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Bibliography versus Auto-Bibliography: Tackling the Transformation of Traditions in the Research Process

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Bibliography versus Auto-Bibliography: Tackling the Transformation of Traditions in the Research Process*

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Ms. Babb reports on a study conducted to determine whether researchers will identify the same works recommended by scholarly bibliographies if their searching is limited to the confines of the library catalog and its subject headings. She explores how the auto-bibliography of the catalog compares to more traditionally compiled bibliographies, and what—if anything—is sacrificed when users rely upon auto-bibliography rather than scholarly bibliography.

¶1 Library research in the twenty-first century presents something of a conundrum. Users still want and need to engage with traditional research sources and to produce traditional outcomes. The purpose and goals of research have not changed. Research methods, however, have expanded beyond their traditional framework, with preference now frequently given to online access to sources. For the library community, the most obvious online presence of a monograph collection is the virtual catalog. But a library's traditional research tools—including reference services such as reader's guides and bibliographies—reside outside of the catalog.

¶2 This article explores one aspect of the conundrum by comparing the intra-catalog resource of subject headings to the extra-catalog resource of bibliography, and highlighting the differences between these two seemingly intimately related resources. The article explores the ways in which the subject headings assigned to materials in the virtual catalog replicate the sources selected via scholarly bibliography, and also whether book lists generated via subject heading searches can indeed be considered comparable to scholarly prepared bibliographies.

Traditional and Transitional Online Research Practices

¶3 Bibliography has long been a bastion of scholarly research, both as end result and as source. The compilation of bibliographies has been a respected part of scholarship, both within individual disciplines and within the library. Scholarly bibliography serves a critical function within a multifaceted research process,

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that of guiding researchers to both the best and the most elusive of sources.[1] In the traditional research paradigm, users might come to the library with preliminary research in hand, armed with bibliographies from other reference materials or other sources. Or they might begin at the library by seeking such references, consulting library research assistive materials, such as bibliographies and pathfinders, or consulting with reference librarians and subject specialists. After these research steps, the library catalog could be consulted to determine library holdings. Individual research preference and practice would of course vary, but from an early educational stage the library and its resources figured prominently in research training. A primary purpose of the library (or union) catalog was to serve as finding aid for known items; the means by which these items became known, however, resided not so much within the catalog as outside of it.

¶4 The online environment has transformed the way that library users perform their research.[2] Recent studies indicate that, rather than beginning in texts or in the library, more and more research now begins on the World Wide Web. The prevalence of Internet use for research has been well documented.[3] Not only has

1. By its most basic definition a "list of books," ROY STOKES, THE FUNCTION OF BIBLIOGRAPHY 1 (2d ed. 1982), bibliography can be divided into many different branches, including not insignificantly the study of books themselves. Blum refines the definition to "a list of publications belonging to a certain category, compiled in order to announce their appearance and describe them." RUDOLF BLUM, BIBLIOGRAPHIA: AN INQUIRY INTO ITS DEFINITION AND DESIGNATIONS 8 (Mathilde V. Rovelstad trans., 1980). Categorization may concern any elements; the terms "enumerative," "scholarly," "reference," and "subject" bibliography are all used to describe lists of books about a particular subject. It is these kinds of bibliography that are most germane to the discussion of general library research practice. The term *subject bibliography* is most indicative of the appropriate context for this investigation. A subject bibliography may be defined as a listing of books and other materials (letting the "biblio" component be broadened to incorporate all research and reference materials, regardless of format) on a given subject. Tennant refines the definition to include "the art of finding, reviewing, selecting, and annotating important information resources on a particular topic." Roy Tennant, *The Art and Science of Digital Bibliography*, LIBR. J., Oct. 15, 1998, at 28, 28. The bibliographies included as works cited in reference materials are another component of such guidance, as they outline the works that supported study of the topic focused upon in the material at hand.
2. Pagel summarizes the situation, noting that "[t]echnological advances have had a significant impact on many of the traditional uses of bibliographic resources and changed the research methodology of many users." Scott B. Pagel, *Introduction* to Symposium, *The Legal Bibliography: Tradition, Transitions and Trends*, LEGAL REFERENCE SERVICES Q., 1989, no. 1–2, at 1, 6–7. Lahiri further notes that automation has "deeply damaged the former card catalog mentality and methodology which served as an instrument for bibliographic access and exposure to library materials for nearly a century." Amar K. Lahiri, *Toward a Bibliographic Common Cause*, 8 CATALOGING & CLASSIFICATION Q. 1987, no. 1, at 65, 65.
3. Carlson reported on the results of Outsell's major study of research behavior for the Digital Library Federation. Researchers in general reported going to online resources prior to print, while students reported first using Internet sources, then consulting a professor or librarian, and going to print resources last. Scott Carlson, *Students and Faculty Members Turn to Online Library Materials Before Printed Ones, Study Finds*, CHRON. HIGHER EDUC., Oct. 3, 2002, at 37. Other commentary on online research trends and practices includes Bradley L. Schaffner, *Electronic Resources: A Wolf in Sheep's Clothing?* 62 C. & RES. LIBR. 239 (2001); Wendy M. Starkweather & Camille Clark Wallin, *Faculty Response to Library Technology: Insights on Attitudes*, 47 LIBR. TRENDS 640 (1999); Deborah J. Grimes & Carl H. Boening, *Worries with the Web: A Look at Student Use of Web Resources*, 62 C. & RES. LIBR. 11 (2001); Susan C. Curtis, *Listening to Generation X*, 38 J. EDUC. MEDIA & LIBR. SCI. 122 (2002); Paula Wilson, *Teaching Library Skills through Technology*, 42 PUB. LIBR. 26 (2003).

the means of research changed, with virtual searching outpacing library searching, but so has the practice; "the average user usually comes to the terminal with vague ideas about searching terms and little or nothing written down."[4] Rather than beginning with assistive resources—a librarian, a bibliography—today's researchers jump right into the process. In the online environment, assistive research aids may not be so serendipitously evident as in the physical library, nor is their benefit necessarily recognized by searchers.[5] In the online environment, the facets of the research process appear to be consolidated into one stop and one step, occurring within a single context. Its progression is iterative rather than faceted. When searching online, users begin their research at Google, Yahoo, or another search engine by typing in keywords to search, then linking to the resulting pages. The unstated expectation of the searcher is that all of the traditional steps can be accomplished online, or that some steps are no longer required in the online environment. Rather than consulting a source, performing a search, and retrieving items—and repeating and refining this process as necessary—the impression for online users is one of simple search and retrieval. The library community has questioned whether the online environment can successfully fulfill traditional research needs. With the appearance of a consolidated process, are some facets left unfilled?

¶5 Search behavior aside, it should be noted that some continuity exists between print and online research materials. Metadata structures and searching exist in both environments, albeit diffused and changed online—and significantly immune to authorization—from library standards. Both Web and library metadata rise from the same sort of information analysis and organization. A more surprising tradition to be found in online manifestation is that of bibliography.

¶6 Within the online environment, the search engines themselves provide a sort of pseudo-bibliography because their results display as lists of resources. Some search engines display results by keyword-hit relevance algorithm, while others enhance results through topical clustering into related categories, a practice intended to let searchers more easily find and navigate sought and related sources.[6] Another example of bibliographic practice is that of incorporating links to further information within Web pages, either as hyperlinks within the text proper or as separate pages of links. Hyperlinks within text may provide links to definitions or additional pages related to the highlighted text, serving a function similar to that

4. Patricia M. Wallace, *How Do Patrons Search the Online Catalog When No One's Looking? Transaction Log Analysis and Implications for Bibliographic Instruction and System Design*, 33 RQ 239, 245 (1993).

5. Jenson notes that "students lack hands-on experience in an actual library and with actual library materials" and that they "have trouble producing good research because they have not been given the foundation necessary for doing so in a world where research of the available literature . . . is now conducted almost exclusively by looking at a computer monitor." Jill D. Jensen, *It's the Information Age, So Where's the Information? Why Our Students Can't Find It and What We Can Do to Help*, 52 C. TEACHING 107, 108 (2004).

6. For description and analysis of Web search engine results clustering, see Lois Mai Chan et al., *Structural and Multilingual Approaches to Subject Access on the Web*, 26 IFLA J. 187 (2000).

of traditional footnotes. Pages of links provide some corollary to traditional bibliography, linking either to reference resources or, more commonly, sites selected as of interest by the author. In both cases, the Web author is acting as a bibliographer, or webliographer, in providing reviewed and often annotated lists of resources for user guidance and reference.[7]

¶7 The ubiquity of hyperlinks and the pseudo-bibliographic nature of Web search results suggest an online corollary to some aspects of the traditional library research environment. They represent an online exhibition of the broader facets of research traditions, whereby online search strategies continue to support traditional practice.[8] The navigation of bibliographic hyperlinks is a skill—along with keyword searching—that Web-oriented users are likely to bring to and employ in the virtual library, as it is increasingly likely that users bring Web search skills into the catalog. Not only is Web searching becoming more and more ubiquitous, but the skills searchers learn on the Web are generally applicable across the Web, in different engines and interfaces. Hsieh-Yee points out that "[a] user's background and experience with computers, the Web, and other information retrieval tools can affect how he or she seeks information."[9] Transmittal of Web strategies to the library's interfaces—including the catalog—seems a logical choice on the part of the searcher.[10]

¶8 To many users, the online library catalog represents a search engine to the library; thus it would be the user's starting point for library searches. Most online catalogs now enable searching by keyword, so the search process as well as the

7. It is not certain that these resources are widely consulted by Web researchers. "[T]he addition of content-based links can sometimes be effective . . . but not for all link types, and not in all situations." Lisa Baron et al., *Labeled, Typed Links as Cues when Reading Hypertext Documents*, 47 J. AM. SOC'Y INFO. SCI. 896, 905 (1996). Hsieh-Yee's study of Web search behavior found that "users relied heavily on hyperlinks to locate documents and did not choose items in the hot list and window history" and that "low link densities presented in list format . . . have the best effects." Ingrid Hsieh-Yee, *Research on Web Search Behavior*, 23 LIBR. & INFO. SCI. RES. 167, 172–74 (2001). Nonetheless, links are widely used by Web authors. Researchers who do use them will often find themselves rewarded, since the majority of links are designed as hyperlinks to other full-text Web resources.

8. A primal difference in the online environment is that the navigational steps are not necessarily readily apparent as in fact separate stages, both in preparation and use. The move from search engine result to Web page to hyperlinked text may be smoother and swifter than the move from print bibliography to library catalog to book-on-shelf to works cited and back to library catalog. Nevertheless, just as many different agents have probably been involved in making the stages manageable, from search engine programmer to Web author to webliographer, and so forth.

9. Hsieh-Yee, *supra* note 7, at 169.

10. As Fritch and Mandernack point out, users unfamiliar with a search environment and overwhelmed by the intricacies of its use are apt to "make a decision based on the choices that are most obvious (though not necessarily the best)." John W. Fritch & Scott B. Mandernack, *The Emerging Reference Paradigm: A Vision of Reference Services in a Complex Information Environment*, 50 LIBR. TRENDS, 286, 293 (2001). Brown further posits that users "use a variety of search services and don't find it worthwhile to learn the rules of each in depth." Frederick L. Brown, *What Users Know and Why They Know It: An Examination of Search Behavior and Search Service Rules*, INTERNET REFERENCE SERVICES Q., 1999, no. 4, at 57, 68. And Payette and Rieger concluded that library users "seem to have an Internet search paradigm that they transferred to the [library] Gateway search." Sandra D. Payette & Oya Y. Rieger, *Supporting Scholarly Inquiry: Incorporating Users in the Design of the Digital Library*, 24 J. ACAD. LIBRARIANSHIP 121, 125 (1998).

interface suggests similarity to Web search engines. The primary difference, of course, is the content that users are in fact searching. While Web search engines index a variety of metadata and full text, library catalogs index only library metadata (i.e., the fields populated by MARC or other encoded bibliographic data). The absence of full text in the traditional library catalog, requiring further research or a stop at the library for access, is obviously one of the primary reasons users rely on the Web for one-step / one-stop research. Users specifically seeking library materials—for example, students who are not allowed to use Web resources for their research—may nonetheless attempt to search for these materials as they search for Web materials. They may not be aware of the differences inherent in library metadata and other online resources. A primary area of ignorance is the more narrow functionality—listing only library holdings—of the library catalog and the need to consult additional resources. Although remote users may seek to research within the library, they likely are in fact limiting their research to the library's catalog. Thus, their research tools are those that can be culled from within the catalog's bibliographic records. Although the library's full Web pages may include subject guides and pathfinders, these resources typically are not incorporated into the catalog, and thus will be missed by those who search only within the catalog.

¶9 The important resource of subject bibliographies may be available on a library's Web site, but they probably are not integrated into the catalog; instead, users encounter subject headings, frequently hyperlinked to facilitate searching by subject. Rather than consulting prepared subject guides and bibliographies, catalog searchers are likely to create their own ad hoc bibliographies via subject searching. If the results of search engines may be considered pseudo-bibliography, the results of subject searching in the library catalog may be more like auto-bibliography. The catalog incorporates the use of authorized headings, and thus the lists produced by searching it are arranged along clearly structured lines. Librarians, too, utilize catalog-generated auto-bibliographies when they employ subject heading searches to produce lists of local holdings and other available literature.

¶10 The challenges of searching subject headings are well documented.[11] A common recommendation for subject searching is to determine appropriate authorized headings by beginning with keyword searching, then moving on to subject-specific searching using the authorized heading found in a single (or several) records.[12] As

11. *See, e.g.*, David H. Thomas, *The Effect of Interface Design on Item Selection in an Online Catalog*, 45 LIBR. RESOURCES & TECHNICAL SERVICES 20 (2001); Patricia M. Wallace, *How Do Patrons Search the Online Catalog When No One's Looking? Transaction Log Analysis and Implications for Bibliographic Instruction and System Design*, 33 RQ 239 (1993); Ronald J. Zboray, *Archival Standards in Documentary Editing*, 42 STUD. BIBLIOGRAPHY 35 (1990).

12. Payette and Rieger describe the process by which searchers move from known items to those of related subject as *forward-chaining*: searchers "submit a keyword search based on the title or author of a publication they knew was related to the topic of interest." Payette & Rieger, *supra* note 10, at 125. Krummel refers to a similar process as *triangulation*: "one useful way to 'get inside' a subject heading system is to identify the headings assigned to a particularly major work in that field, then to look under those headings." D.W. KRUMMEL, BIBLIOGRAPHIES: THEIR AIMS AND METHODS 112 (1984).

a quick example of this process, searching keywords **online** and **searching** in the LC catalog (http://lcweb.loc.gov) results in more than ten thousand bibliographic records. Consulting these records reveals hyperlinked subject headings, such as "online bibliographic searching," which can be clicked to re-initiate the search upon authorized subject headings rather than keywords, producing a far more manageable and one presumes relevant result set of twenty-five bibliographic records. Such search strategy makes use of a traditional library research skill, with a single bibliographic record guiding the user to an authorized subject heading, which in turn guides the user to the library's holdings on the subject. The search process also replicates the Web search strategy of moving from keyword search via search engine to hyperlink navigation on the Web page. The process also illustrates the utility of using a catalog's auto-bibliography, just as Web searchers utilize a search engine's pseudo-bibliography. It furthermore underscores one of the primary purposes of assigning subject headings to materials described within catalog records: that of guiding searchers to items related by subject matter.

¶11 The use of linked subject headings or keyword-to-subject searching within the online catalog may seem like a winning strategy, one in which users can rely upon known Web search strategies to perform traditional library research. One expects that few librarians, however, would suggest replacing bibliographies with subject headings.[13] Schneider summarizes a general consensus and compromise among scholars and librarians alike, stating that:

> Many weighty voices pile up proof, almost beyond question, that catalogs and bibliographies are always somewhat different, and that misconception of this fact, although comprehensible, is very unfortunate. . . . The catalog is a tool of the librarian; the bibliography is primarily a tool of the scholar. The catalog locates an immediately obtainable book. . . . Bibliographies, on the contrary, deal with the whole field of book knowledge. . . . In general, each publication is entered in only one place in catalogs, whereas bibliographies must be freely supplied with references.[14]

¶12 Nonetheless, and despite the best and loftiest intentions, the library catalog in many respects increasingly is called upon to fill in for other research sources.[15] The library catalog may indeed fill the role of comprehensively listing and linking works by given authors or of a given nation; the issue of subject analysis and linkage is more problematic.

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13. *See generally* Raynard Swank, *Subject Catalogs, Classifications, or Bibliographies? A Review of Critical Discussions, 1876–1942*, 16 LIBR. Q. 316 (1944) (summarizing the debate regarding the relative merits of and preferences for scholarly bibliographies and library catalog subject headings as it occurred in the late nineteenth and early twentieth centuries).
14. GEORG SCHNEIDER, THEORY AND HISTORY OF BIBLIOGRAPHY 50–51 (Ralph Robert Shaw trans., 1934). Krummel more pointedly remarks that "it is mischievous nonsense to propose that librarians, information specialists and other generalists who pride themselves in seeing forests rather than trees can come up with lists that, however useful, are anything but incomplete and intellectually flawed." KRUMMEL, *supra* note 12, at 102.
15. East points out that the "functions [of the printed national bibliography] are increasingly supplanted by Internet access to the national library catalogue." John W. East, *Requiem for the National Bibliography? The Implications of Internet Access to National Library Catalogues*, 30 AUSTL. ACAD. & RES. LIBR. 1 (1999).

¶13 There are fundamental differences between bibliography and subject headings. Catalogers do not select subject headings to create bibliographies; indeed, cataloging standards and practices firmly delineate the differences.[16] Subject headings are not designed to produce bibliographies; bibliography is the task of the reference librarian, not the cataloger. Users who enter the catalog without other guidance and rely upon subject headings for bibliographic research and linking are, in fact, relying upon the catalog's auto-bibliography based on the authorized headings, as they may likewise rely upon the pseudo-bibliography produced by search engines, which align results along metadata. One should find that the library catalog is more refined than search engines, since the metadata of the catalog is itself more refined and incorporates authority control.[17] However, auto-bibliography is simply not the same as bibliography. Thus, if bibliography may be considered a facet of research independent or, at the very least, different from subject headings, the user who generates bibliography via subject headings in the library catalog, utilizing auto-bibliography rather than scholarly bibliography, may be missing steps in the research process. Does it matter? Will researchers identify the same works that are recommended in bibliographies if their searching is limited to the confines of the library catalog and its subject headings? How does the auto-bibliography of the catalog compare to more traditionally compiled scholarly bibliographies? What—if anything—is sacrificed when users rely upon auto-bibliography rather than traditional scholarly bibliography?

Bibliographies and Their Subject Headings: A Sample Study and Analysis

¶14 Many studies have examined the relationships between subject headings and bibliography.[18] The majority of works that analyze bibliography in the light of

16. See, for example, the works of Charles Cutter, Lois Chan, or any introductory cataloging textbook.
17. Benefits of the catalog's auto-bibliography over a search engine's pseudo-bibliography include the expertise and objectivity with which subject headings are assigned by catalogers as well as the use of standardized, authorized headings. In addition, topical collocation is an inherent outcome of subject cataloging, while the objectives of Web metadata assignment may be more concerned with hit counts and less with topical relevancy.
18. Fiscella—who notes that "the value of a bibliography lies in its gathering and preliminary screening of information on a subject" as it "combines and organizes the information about materials from diverse resources, and . . . evaluates the materials"—searched in electronic databases to see if selected keywords would find and unite materials on two different bibliographies. John B. Fiscella, *Bibliography as an Interdisciplinary Information Service*, 45 LIBR. TRENDS. 280, 281 (1996). Prior discovered that significant source materials in art history were not united by subject heading within the library catalog—noting that "I was unable to identify a crucial tool despite my library training, intimate knowledge of the OPAC, and background in the field"—and thus explored incorporating bibliography into the OPAC itself. Barbara Q. Prior, *Library Catalog as Reader's Guide? Two Stories and a Problem*, 23 ART DOCUMENTATION, 21, 21 (2004). Several have investigated searching by citation. *E.g.*, Miranda Lee Pao, *Term and Citation Retrieval: A Field Study*, 29 INFO. PROCESSING & MGMT. 95 (1993); Miranda Lee Pao & Dennis B. Worthen, *Retrieval Effectiveness by Semantic and Citation Searching*, 40 J. AM. SOC'Y INFO. SCI. 226 (1989); Rebecca Green, *Locating Sources in Humanities Scholarship: The Efficacy of Following Bibliographic References*, 70 LIBR. Q. 201, 202 (2000) (evaluating the scholarly research practice—cited as preferred by humanist scholars—of "footnote tracing . . . over the formal bibliographic apparatus"). Fiscella and Prior noted some superiority of bibliography, while Pao, Worthen, and Green felt that citation searching increased—if not necessarily improved—search results. Numerous studies have also been done on subject headings and subject searching.

subject headings explore searching by subject within the library catalog, then examine the lists created by subject searching to determine whether they incorporate materials relevant to related bibliographies or reference questions. Another way of examining the relationship between bibliography and subject headings is to begin not with a search by subject but with a bibliography; this is the method selected for this article.

¶15 To determine the nature and relevance of the differences between the auto-bibliography of lists generated by subject heading lists and true bibliography created by scholars, one can analyze the subject headings assigned to works gathered in such bibliographies. The goal of this study was to determine the degree to which the auto-bibliography that would be produced by the subject headings assigned to works appearing in a scholarly bibliography actually replicates that scholarly bibliography. Similarities between auto-bibliography, generated by subject headings within the bibliographic records, and bibliography, produced by scholarly endeavor, would be evidenced by thematic relationships in the subject headings within each bibliography. If the full bibliographic records of the items united by scholarly bibliography are examined, one can determine whether or not the auto-bibliography of subject searching would likewise unite them.

¶16 Three bibliographies were selected from legal journals to serve as the basis for the study: "A Bibliography on Christian Faith and the Law"[19] (Bibliography 1); "Other Suggested Reading: An Essential Bibliography on Drug Law and Policy"[20] (Bibliography 2); and "Animal Rights: An Interdisciplinary, Selective Bibliography"[21] (Bibliography 3). Law was chosen as general topical area because of the scholarly traditions of legal research, continuing respect for legal bibliography,[22] and the frequently multidisciplinary approach of the research. The tendency and tradition of legal research to branch into several fields helps to ensure that subject headings should not be assigned too narrowly, for example, simply "law." Legal research traditions and the vintage of the articles (published in 1956, 1986, 1990) also would help to ensure that the bibliographies were less influenced by library subject headings, as may be the case in bibliographies prepared by librarians for library Web sites.

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19. *A Bibliography on Christian Faith and the Law*, 10 VAND. L. REV. 967 (1957).
20. *Other Suggested Reading: An Essential Bibliography on Drug Law and Policy*, 11 NOVA L. REV. 1051 (1987).
21. Marcelle P. Chase, *Animal Rights: An Interdisciplinary, Selective Bibliography*, 82 LAW. LIBR. J. 359 (1990).
22. Legal bibliography is addressed in Symposium, *The Legal Bibliography: Tradition, Transitions and Trends*, *supra* note 2. Although library technology has changed since the symposium was published, its statements about legal research and the particular importance of bibliography to this research remain germane today.

¶17 Because library catalogs typically do not incorporate bibliographic entries for journal articles, journal article references were removed from the bibliographies for the purpose of study. The remaining references on the bibliographies—primarily monographs—were then searched in the Library of Congress (LC) online catalog. Searching was limited to one catalog to help ensure some consistency of subject heading assignment and treatment. Items not found in the LC catalog were removed. The end result was a database for each bibliography in which the bibliographic information from the LC catalog—including subject headings, classification, and notes—were appended to the original bibliographic data from the bibliography. The collective subject headings, classification, and keywords for each bibliography were then analyzed to determine commonality among the materials united by bibliography.

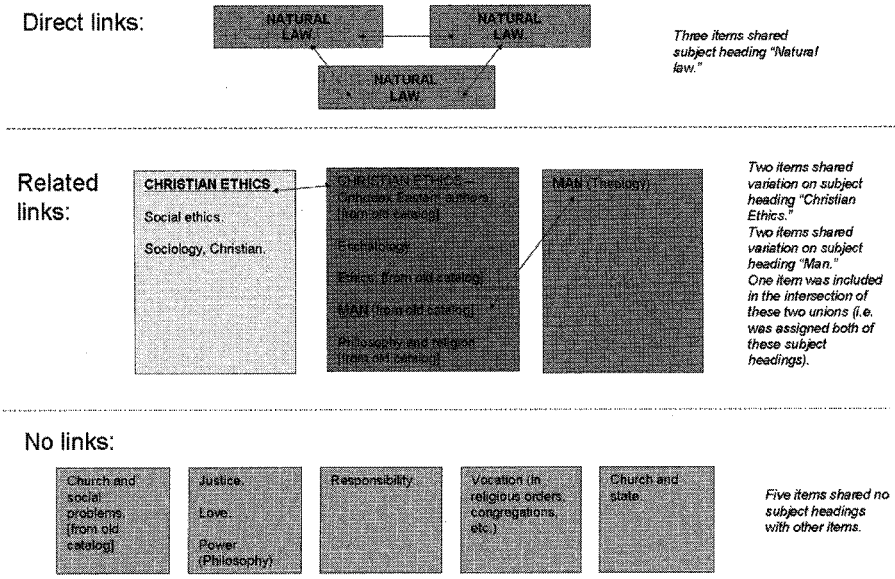
Bibliography 1: Subject Headings

¶18 "A Bibliography on Christian Faith and the Law" included thirteen bibliographical references; two of these were not in the LC catalog, leaving eleven for the purposes of study. The greatest number of subject headings assigned to any one item was five; the majority (eight) had only one subject heading assigned. Two other items had three subject headings assigned. Only one subject heading was assigned to more than one item: "Natural law," which was assigned to three of the records. Two other subject headings were assigned to more than one record (two each) but in differing forms: "Christian ethics," which was assigned to one record and with the subdivision "Orthodox Eastern authors [from old catalog]" to another; and "Man [from old catalog]" which was assigned to one record and with qualifier "(Theology)" to another. The twelve other subject headings were all uniquely assigned and did not appear in more than one bibliographic record.

¶19 Only three of the records, therefore, were directly linked by subject heading. Two sets of two other records were linked by the intersection of shared subject headings in a single record (see figure 1). Rather than replicating the scholarly bibliography, the catalog's subject headings produced, at best, three small subsets of bibliography: a list of three books on "Natural law," a list of two books on "Christian ethics," and a list of two books on "Man," with the latter intersecting. Whereas scholarly bibliography linked eleven works, subject headings linked a maximum of three.

Figure 1

Subject heading linkages for "A Bibliography on Christian Faith"



Bibliography 2: Subject Headings

¶20 "Other Suggested Reading: An Essential Bibliography on Drug Law and Policy" included eighteen bibliographical references; two of these were not in the LC catalog, leaving sixteen for the purposes of study. A total of fifty-three subject headings were assigned throughout the sixteen records examined. Three items were assigned five subject headings, three were assigned four, six were assigned three, and the remaining four were assigned two. Five different subject headings were assigned to more than one record: "Cocaine" (assigned to three), "Drug abuse—United States" (assigned to three), "Cocaine—Physiological effect" (assigned to two), "Cocaine habit" (assigned to two), and "Narcotics, Control of—United States" (assigned to two). Additional linkages can be seen in added subdivisions:

- "Cocaine habit" appeared without subdivision in two records and with different subdivisions in two others ("—history" in one and "—treatment—United States" and "—United States" in another), for a total of four related subject headings in four separate records.
- "Narcotics, Control of—United States" appeared in two records, with the further subdivision "—History" in another and a different geographic subdivision "—New York (State)—New York" in another, for a total of four related subject headings in four separate records.
- "Heroin" appeared without subdivision in one record and with two different subdivisions ("—Prices—New York (State)—New York" and "—Therapeutic use")

in another, for a total of three related subject headings in two separate records.

- "Marijuana" appeared without subdivision in one record and with two different subdivisions ("—Physiological effect" and "—Therapeutic use") in another, for a total of three related subject headings in two separate records.

¶21 Twenty other subject headings were all uniquely assigned and did not appear in more than one bibliographic record. Seven of these unique headings were assigned in records that did not include other linked subject headings, for a total of three bibliographic records without any linkages to other records in the bibliography.

¶22 Figures 2 and 3 display the linkages of subject headings among the records in this bibliography. The records link along two distinct paths. The first path (see figure 2) shows direct linkage between subject headings "Drug abuse—United States" (assigned in three records) and "Narcotics, Control of" (assigned in four records), as they are linked via a single record assigned both headings. Linkage for "Narcotics, Control of" is possible only if subdivisions are not considered. More specific subject headings "Marijuana" and "Heroin" are additionally linked via related records (i.e., the assignment of linking subject headings "Drug abuse" and/or "Narcotics, Control of" along with these headings), for a total of eight records linked by related subject headings. The second path (see figure 3) displays the linkages related to "Cocaine" and its subdivisions (assigned to five records).

Figure 2

Subject heading linkages for "Other Suggested Reading: An Essential Bibliography on Drug Law and Policy"—set 1: "Drug abuse" and "Narcotics, Control of"

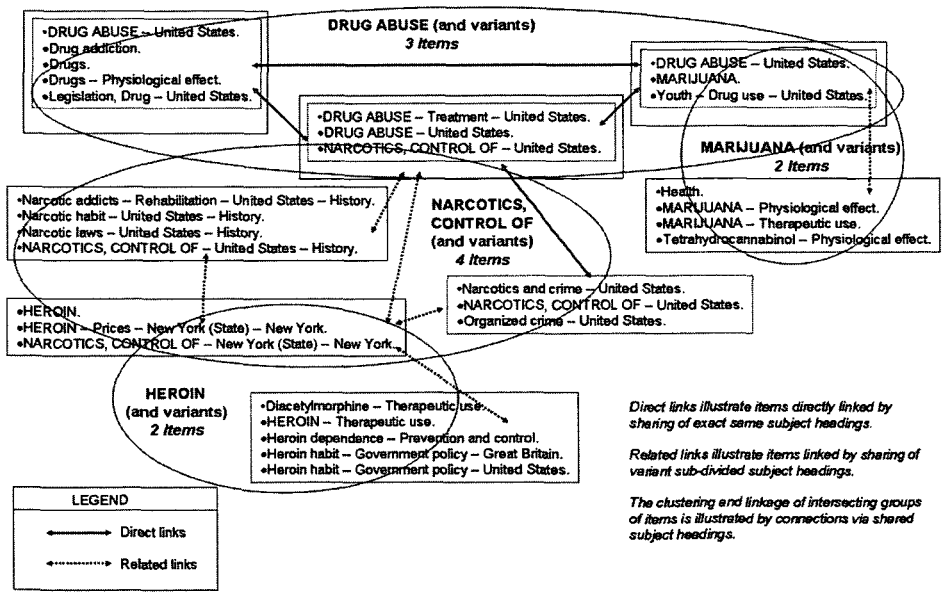
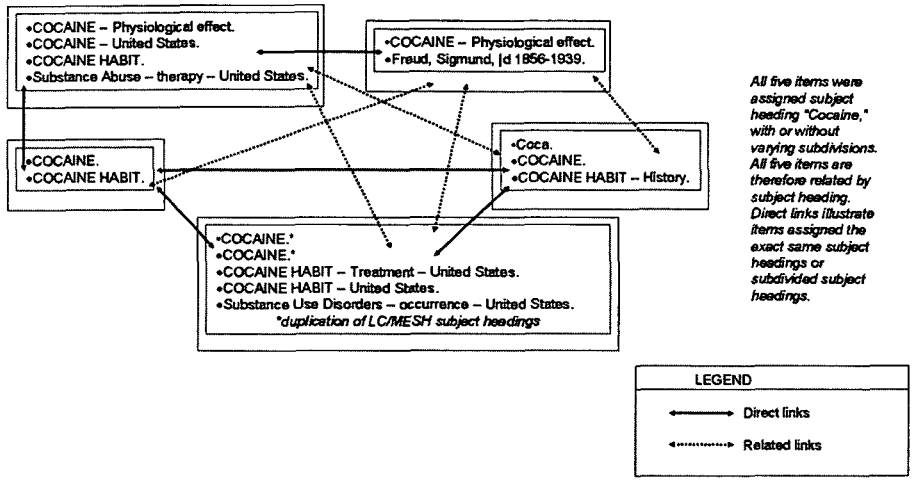


Figure 3

Subject heading linkages for "Other Suggested Reading: An Essential Bibliography on Drug Law and Policy"—set 2: "Cocaine" and subdivisions



¶23 As in the case of Bibliography 1, several smaller subsets are produced: auto-bibliographies on "Drug abuse—United States," "Narcotics, Control of," "Marijuana," "Heroin," and "Cocaine." The subsets can be expanded by including different subdivided headings, and can be intersected through connections of records that share different subject headings.

¶24 The subject headings assigned to works in "Other Suggested Reading: An Essential Bibliography on Drug Law and Policy" illuminate and underscore one of the primary challenges of keyword searching, especially within the context of the controlled vocabulary of subject headings. Although the bibliography deals with "drug law," explicitly legal subject headings were assigned to only two records: "Narcotic laws" to one and "Legislation, Drug" to another. The term "laws" appeared in only one subject heading ("Narcotic laws"), assigned to only one item. Keyword searching for "drug" and "laws" within the assigned subject headings would produce no hits.

¶25 The scholarly bibliography linked sixteen works. The maximum number of records directly linked via subject heading is five, and the maximum number indirectly linked via intersection of assigned headings is eight.

Bibliography 3: Subject Headings

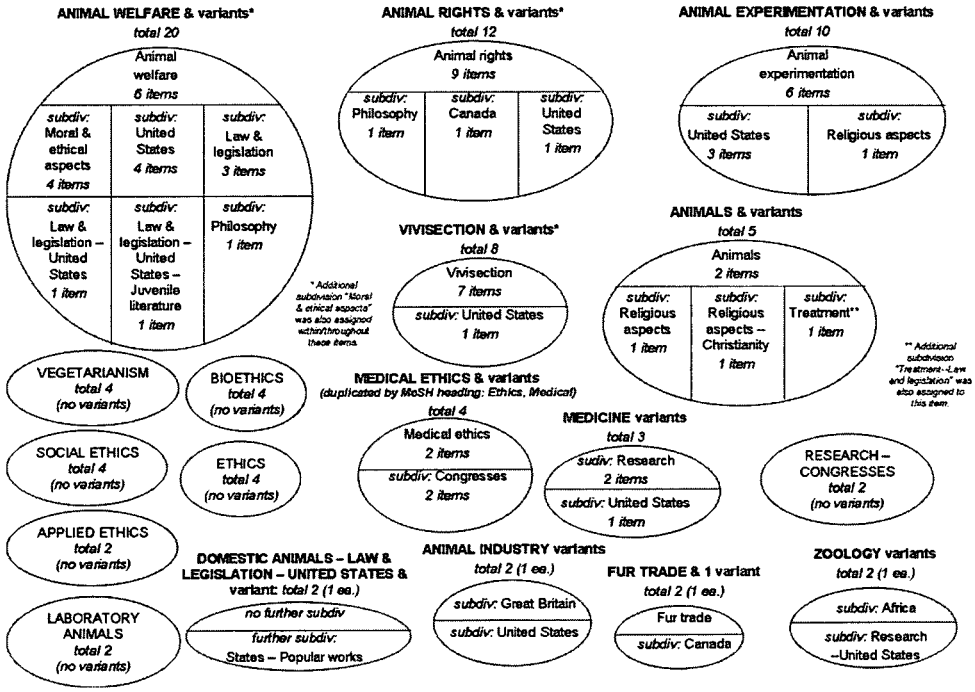
¶26 "Animal Rights: An Interdisciplinary, Selective Bibliography" included sixty-two bibliographical references for monographs; one reference was included twice, and four of the sixty-one unique titles were not in the LC catalog, leaving fifty-seven for the purposes of study.

¶27 A total of 145 subject headings were assigned throughout the fifty-seven records examined. Two items were assigned seven subject headings, one was assigned six, one was assigned five, ten were assigned four, twelve were assigned three, thirteen were assigned two, and the remaining eighteen were assigned only one.

¶28 Eighteen different subject headings were assigned to more than one record. These headings and the number of records in which they were assigned are illustrated in figure 4.

Figure 4

Subject heading linkages for "Animal Rights: An Interdisciplinary Selective Bibliography"



¶29 The maximum number of records directly linked by subject heading was nine ("Animal rights"). The maximum number of records linked by subject heading including variant subdivided subject headings was twenty ("Animal welfare," assigned without subdivision to six items and with various subdivisions to fourteen others).

¶30 Forty-one other subject headings were all uniquely assigned and did not appear in more than one bibliographic record. Seven of the unique subject headings were assigned among four records that did not contain any linking subject headings. Three were assigned between the two records linked only to each other

via the subject heading "Applied ethics," which did not contain further subject heading linkages to any other records.

¶31 In addition to the subject heading linkages exhibited in figure 4, the records could be further clustered via the linkage of shared subject headings in different records. For example, an item assigned only the single subject heading "Vegetarianism" can be clustered with an item assigned only the single subject heading "Animal rights" via shared linkage to an item assigned both subject headings. A full fifty-one of the fifty-seven records studied can be clustered in this manner, although the linkages are in some cases very tenuous. The subject headings "Fur trade" and "Animal industry," for example, have been assigned in only two records each, and can be included in the larger clustering of subject headings due to the assignment of more common subject headings ("Animal welfare," "Animal rights," or both) in one record each.

¶32 Once again, a pattern of subsets and intersections is illuminated. The subject headings listed in figure 4 all represent smaller auto-bibliographies produced by searching on those subject headings. The figure includes subdivided and non-subdivided headings. The scholarly bibliography brought together fifty-seven works; subject headings united the smaller subsets. If these subsets are considered in light of the clustering of additionally assigned and co-assigned subject headings, fifty-one records may be considered linked. Representing 89% of the works in the bibliography, this collection of intersecting linkages does strongly approach and match the content of the bibliography.

¶33 The subject headings assigned to items in "Animal Rights: An Interdisciplinary, Selective Bibliography" exhibit both the strengths and weaknesses of keyword access. On the positive side, the assignment of subdivisions such as "Law and legislation" and "Moral and ethical aspects" makes access via keyword to these specific aspects more likely, as users may narrow a search for keyword "animals" by adding the concepts of "law," "legislation," "moral," or "ethical." Moreover, keyword-within-subject-heading search results may be easier to navigate than long browse lists of complex subject heading strings, particularly as it unites subdivided subject headings, such as free-floating subdivisions like "History" and chronological and geographical subdivisions.

¶34 However, a less overtly positive element is that among all headings assigned are those from four different controlled vocabularies: Library of Congress Subject Headings (LCSH), LC subject headings for children's literature (AC), Medical Subject Headings (MeSH), and Répertoire de vedettes-matière (RVM). The use of more than one list of authorized subject headings is most obvious in those records in which near-synonymous headings from different lists have been assigned within single records, as, for example, the assignment of headings "Medical ethics" (LC) and "Ethics, Medical" (MeSH). It also accounts for the duplication of the subject heading "Bioethics" in one record (one heading coded for LC and the other for MeSH). This inversion of LC and MeSH subject heading terminology also illustrates another benefit of keyword search-

ing within subject headings, since such searching would retrieve both headings. The utilization of additional lists is of great assistance to those familiar with the lists, such as researchers seeking more scientifically oriented publications, presumably cataloged with MeSH terms. One may also expect it to be helpful to those wishing either to expand specialized searches to more general ones or to narrow general searches to more specialized ones. Libraries that utilize more than one subject heading list generally include means within the catalog to focus searches exclusively upon these lists. Searchers who are less informed about the different lists may be confused and possibly misled by the differing headings they encounter while browsing, especially if they focus upon more specialized terms at the exclusion of more general, and vice versa. Searching for RVM terms in LC catalogs would obviously produce very few hits and might misinform catalog users as to the true nature of the library's holdings, in which English-language subject headings are typically assigned to foreign language materials.

Analysis of Findings Related to Subject Headings

¶35 Does the auto-bibliography produced by subject heading searches of library catalogs replicate a subject bibliography? Based upon analysis of the direct subject linkages found in the three bibliographies chosen for study, the short answer is *no*. This negative response, however, is not a criticism of subject headings, nor of cataloging or catalogs. While some studies rightfully fault cataloging errors as barriers to subject access,[23] even the most ideal cataloging by its nature differs from the intellectual activity of scholarly subject bibliography. As Tanselle states, "[T]he distinction beween catalogues and bibliographies is an elementary one; yet it is not always kept clearly in mind by those engaged in bibliographic activity."[24] Subject headings work as they are designed to work: to align materials within the framework of specific structured headings. Drabenstott, Simcox, and Williams outline some of the basic purposes of subject headings: "[to] sum up the subject contents of the items . . . [, to] give catalog searchers hooks for matching the terms in their queries with the subject of library materials . . . [, to] index the subject contents of a library's collection . . . [, and to] standardize the subject terminology. . . . Furthermore . . . subject headings form part of a complex system of cross-references that suggest related terminology to catalog users for an encyclopedic array of subjects."[25]

¶36 For online searching, subject headings broaden keyword access by adding subject-related terminology to descriptive information (data elements such as title and notes which may or may not include appropriate subject clues)

23. *See, e.g.*, DAVID BADE, THE CREATION AND PERSISTENCE OF MISINFORMATION IN SHARED LIBRARY CATALOGS: LANGUAGE AND SUBJECT KNOWLEDGE IN A TECHNOLOGICAL ERA (Univ. of Ill. Graduate School of Library & Info. Science Occasional Papers No. 211, 2002).
24. G. Thomas Tanselle, *Descriptive Bibliography and Library Cataloguing*, 30 STUD. BIBLIOGRAPHY 2, 4 (1977).
25. Karen M. Drabenstott, Schelle Simcox & Marie Williams, *Do Librarians Understand the Subject Headings in Library Catalogs?* 38 REFERENCE & USER SERVICES Q. 369, 385 (1999).

within the important context of relating the keyword to the "aboutness" rather than other description of the work. The strength of subject headings within the catalog record is their ability to identify and enable access by topic to works within a structured framework. The framework is specifically designed to enable navigation between related headings, as authority control both guides users from unused to used headings ("see" references) and suggests additional headings ("see also" references). It is neither practical nor recommended to move outside of the framework; to do so negates the functionality of authority control. While the function of subject headings may approach, in some respects, bibliography (i.e., creating lists of works), in essence it differs radically from the overall purpose of subject bibliography in which the scholarly judgment and human interpretation of the bibliographer move beyond structured framework. The discrepancies between subject headings and bibliographies should not be interpreted as a weakness of subject headings but as a strength of bibliography. Assigned headings in the catalog record do, indeed, identify the subjects of works; it is bibliography that unites them.

¶37 Bibliographies are produced by subject specialists and are designed to bring out intricate interconnections of research and reference materials.[26] Subject headings, on the other hand, are assigned by catalogers who, even if they are specialists within the library collection, are by career choice more generalists. Some catalogers may indeed be experts within a given discipline and thus also capable of fine bibliography, but such is not the nature of subject heading assignment. Subject headings themselves are designed to be more general, to describe most concisely the comprehensive topic of an entire book.[27]

¶38 Chan summarizes LC practice in assigning subject headings as follows:

- Assign a specific heading that represents precisely the content of the work. . . .
- Assign separate headings to a work covering two or three topics when there is no single heading that precisely represents its contents.
- Assign a broad or generic heading that encompasses all the topics treated in a

26. As Krummel puts it, "[C]ompilers enjoy the advantages of perspective and of a finite universe." KRUMMEL, *supra* note 12, at 27. And Jolley notes that "the writers [of bibliographies] have a specialized knowledge of the subject and have more space at their disposal, to give a much more precise indication of the subject of the books and the method of treatment than any subject catalogue can provide." L. JOLLEY, THE PRINCIPLES OF CATALOGUING 101 (1961).

27. Buchel and Coleman interpret Taylor's description of subject analysis as follows: "In library cataloging, subject analysis has typically been carried out on the summarization level that is finding the one overall subject concept that encompasses or can represent what the whole item is about. Alternatively, the 20% rule is invoked where 20% of the document is about the subject." Olha Buchel & Anita Coleman, *How Can Classificatory Structures Be Used to Improve Science Education?* 47 LIBR. RESOURCES & TECHNICAL SERVICES 4, 7 (2003) (citing ARLENE G. TAYLOR, THE ORGANIZATION OF INFORMATION (1999)). They point out that "subjects are much broader than concepts or facets." *Id.* at 8. And, indeed, Jolley notes that "often it is not possible to do more with a book than indicate the broad subject with which it deals or even the class of writing to which it belongs." JOLLEY, *supra* note 26, at 99–100. Finally, Miksa notes that "subject heading work has become primarily the activity of naming the entire topical contents of books." FRANCIS MIKSA, THE SUBJECT IN THE DICTIONARY CATALOG FROM CUTTER TO THE PRESENT 395 (1983).

> work covering four or more topics, even if the generic heading covers other topics not included in the work.[28]

¶39 Bibliographers, on the other hand, may disregard, as appropriate, the overall topic of a book, including an item in the bibliography based on a detailed analytics of chapter content and theme, thus bringing in specific elements largely excluded from subject headings. In delineating the access advantages of subject bibliographies over subject headings, Krummel points out that "[w]ritings with casual mention of the subject require an extensive search and usually luck as well, but are what can make a list particularly valuable. . . . The general rule is to err always on the side of inclusion. . . . Calling attention to the obscure, offbeat, distant or unsuspected is exactly what makes many a bibliography invaluable."[29] Moreover, general subject headings are designed to be assigned with the greatest specificity possible; works that might otherwise be united by general subject heading will be divided by the assignment of narrower subject headings or subdivisions, as appropriate.[30] Bibliographers can exploit this complexity to most fully represent different aspects of research. The overall theme of a bibliography, in contrast to subject headings, may be as broad and inclusive as desired by its creator. Given the same topics, subject headings and bibliographies will be necessarily and by their nature different. Krummel points out that bibliographies will always enhance the catalog.

> As our library catalogues grow older, larger and perhaps more refined, they also become more cumbersome, more limited in their coverage and more subject to varying interpretations of their rules. Older writings are rarely re-catalogued to meet new needs, while detailed subject analysis of contents was long ago deferred to other bibliographical enterprises, among them enumerative bibliographies.[31]

¶40 In their manual for Library of Congress bibliographers, McCrum and Jones highlight the ability of bibliographers to incorporate new terminology, as "subject headings used throughout large card catalogs cannot reflect constantly changing fashions in the use of terms . . . [,] the necessary relationships must be made, therefore . . . by means of the bibliographer's own addition to his file of pertinent cross references."[32] They also suggest that the relationship between subject headings and bibliographies is best inverted from that supposed by the typical search strategy of encountering bibliography via subject headings. Rather, one should encounter

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28. LOIS MAI CHAN, LIBRARY OF CONGRESS SUBJECT HEADINGS: PRINCIPLES AND PRACTICE 182 (2d ed. 1986).
29. KRUMMEL, *supra* note 12, at 31–32.
30. Jolley notes the complexity of assigning subject headings because "[n]o subject exists as a completely separate entity. All subjects contain other subjects and are parts of larger subjects. . . . All books deal with several subjects. . . . Many books deal with several subjects or with the relations of several subjects." JOLLEY, *supra* note 26, at 99.
31. KRUMMEL, *supra* note 12, at 6.
32. BLANCHE PRICHARD MCCRUM & HELEN DUDENBOSTEL JONES, BIBLIOGRAPHICAL PROCEDURES & STYLE: A MANUAL FOR BIBLIOGRAPHERS IN THE LIBRARY OF CONGRESS 12 (1954).

subject headings via bibliography, since "knowledge of terminology that has been gained during the preparation of the bibliography provides the necessary technical background for selecting the subject headings and subheadings useful for characterizing the items included in the compilation . . . formal subject headings used in lists and catalogs should not be followed slavishly."[33]

¶41 The bibliographies selected for analysis in this study neatly exhibit these differences. All three bibliographies take as their focus broad interdisciplinary themes: Christianity and law, drugs and law, and animal rights and law. Subject headings assigned to the works included in each bibliography are for the most part narrower than the bibliography's theme, denoting the specificity of focus of the particular work. The subject headings are specific enough that works are not comprehensively united throughout the entire bibliography. Certain patterns, however, do emerge.

¶42 Subject headings can be related, with subdivided subject headings connecting records. It is significant to note, however, that these connections may not be apparent during the search process. If searching is narrowed to specific terms, more general items may be missed. Browsing subject lists during the search process enables navigation of subject headings, but may also contribute to missed hits if the entire list of subdivisions is not explored. User knowledge of subject heading structure—browsing the full list of headings, seeking related terms, narrowing or broadening terminology as needed—is crucial to enabling these connections.

¶43 Records may be further related by bridges between different subject headings, connecting to different records. Conceptually, this represents an interesting parallel between bibliography and subject headings. Although the subject headings do not comprehensively link to reproduce the bibliographies, they do cluster into arrangements of related records, and these clusters are then linked via assignment of common subject headings. Such clustering and linkage displays in the assignment of subject headings something like the theoretical work of the bibliographer as different elements are united. Figure 5 displays the total number of works analyzed from the three bibliographies, and the numbers and percentages of subject heading linkages, direct and intersecting. Consideration of linkage via intersecting subject headings comes closer to more comprehensively matching the content of the bibliography; although not significant in the smallest bibliography, it incorporates 50% of the second and a full 89% of the largest bibliography, an average that approaches 75%. The clustering of intersecting subject headings that is revealed in the analysis of catalog records is precisely what bibliographies can provide in a most straightforward fashion. Unfortunately, exploration of such intersecting linkages in the search process is not simple. For practical searching in the library catalog, the thorough navigation of subject heading clusters may represent a chain of activity too time-consuming and theoretical to be of great or common use to many searchers, since the connections may be drawn in so many

33. *Id.* at 108.

different directions, through so many different records, some of which may be of quite limited relevance.

Figure 5

Analysis of Subject Heading Linkages for Three Selected Bibliographies

	# works	direct SH linkages		intersecting SH linkages	
		#	% of total	#	% of total
A Bibliography on Christian Faith and the Law	11	3	27%	3	27%
Other Suggested Reading: An Essential Bibliography on Drug Law and Policy	16	5	31%	8	50%
Animal Rights: An Interdisciplinary, Selective Bibliography	57	20	35%	51	89%
	# works	direct SH linkages		intersecting SH linkages	
		#	% of total	#	% of total
totals:	84	28	33%	62	73%
averages:	28	9	32%	20	73%

¶44 An additional caveat to the use of subject headings is confusion regarding their terminology.[34] Although keyword searching and generation of subject searching via links within the bibliographic record may be most intuitive to users and thus commonly used, this strategy may not be the best route toward the most effective understanding and use of subject headings by searchers. Mann states that "[b]rowse displays of precoordinated strings are the *only* mechanism that we have for providing vocabulary control of free-floating elements,"[35] and he further warns that "Boolean searches alone in fact make it much easier for searchers to entirely miss the most appropriate resources."[36]

34. In their study of subject headings in library catalogs, Drabenstott, Simcox, and Fenton reported that even "professional librarians . . . did not agree on the meaning of subdivided subject headings" and that "the most successful users [of subject headings] are those without subject expertise but with knowledge of the structure and content of the catalog." Moreover, they found that "end users did best . . . [at assigning meanings] to subject headings in alphabetical browsing lists, and they did worst . . . [at assigning meanings] to subject headings in bibliographic records." Although the study found that "the difference was not [statistically] significant," it nonetheless points out the contextual benefit of browse lists of subject headings over keyword access to subject headings and related auto-bibliographic lists. Karen M. Drabenstott, Schelle Simcox & Eileen G. Fenton, *End-User Understanding of Subject Headings in Library Catalogs*, 43 LIBR. RESOURCES & TECHNICAL SERVICES 140, 142, 150 (1999).

35. Thomas Mann, *Why LC Subject Headings Are More Important than Ever*, AM. LIBR., Oct. 2003, at 52, 53.

36. *Id.* at 54.

Additional Links to the Subject in the Bibliographic Record: Classification

¶45 Another guide to topics within the library catalog and collection is the assignment of classification numbers. Unlike subject headings, which describe the work itself, classification is designed to place the work within the framework of the library's physical shelves.[37]

Bibliography 1: Classification

¶46 All of the eleven works studied in "A Bibliography on Christian Faith and the Law" were classified by the Library of Congress.[38] One item was assigned the generic class "LAW <General Law>," while the other ten were assigned LC classification. Items were classified in B: General Philosophy (one item); BJ: Ethics (three items); BT: Doctrinal Theology (one item); BV: Practical Theology (three items); BX: Christian Denominations (one item); and K: Law in General, Comparative and Uniform Law, Jurisprudence (one item). As in the case of the subject headings, the works are clustered by classification, with three items each within BJ: Ethics and BV: Practical Theology. Even within this clustering, however, there is subclustering, with two items under the classification of Religious Ethics and one under Special Topics, and two under Practical Religion, The Christian Life—Moral Theology and one under Ecclesiastical Theology—Special Aspects of Church Institutions. The strength of classification clustering in uniting items will depend upon the number of items included in any given category. In a library or catalog with few items classified in the Bs, Philosophy and Theology would be relatively unified for quick browsing. If many items are so classified, however, the distance between B and BV—with almost a full alphabet of categories in between—is lengthy, indeed.

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37. The significance of the physical classification of works within the library as it enables users to quickly hone their searching by consulting the indexes within works in a given section is explored by Thomas Mann, who states that "[c]lassified shelving enables us to do, in effect, full-text searches of our most important knowledge records, our retrospective book collections, down to the page level and, indeed, even to the level of an individual word." Thomas Mann, *The Importance of Books, Free Access, and Libraries as Places—and the Dangerous Inadequacy of the Information Science Paradigm*, 27 J. ACAD. LIBRARIANSHIP 268, 276 (2001). Although Mann specifically excludes "the classified arrangement of surrogate computerized catalog records searchable in call number order," *id.* at 275, since the text access resides within the works and not within the surrogates, classification nonetheless does attempt to provide subject-oriented assembly of works and may thus be considered. Budd suggests "classification as a retrieval tool" to enhance subject access; "once it is determined that a subject search results in a set of relevant items, the call numbers assigned to those relevant works might be used as a tool to navigate through the library's collection to locate additional relevant books. John M. Budd, *The Complexity of Information Retrieval: A Hypothetical Example*, 22 J. ACAD. LIBRARIANSHIP 111, 114 (1996).

38. MARC field 050, second indicator 0. One might presume that LC classification would be assigned more authoritatively by the Library of Congress than by other institutions; many libraries use LC cataloging records and classification "as is" within their own catalogs, editing to accommodate local practice. In reality, of course, LC cataloging and classification may reflect unique elements of LC practice—with some seemingly legal items assigned political science classification rather than law—and other institutions may produce outstanding cataloging and classification.

¶47 Seven of the eleven works were also assigned Dewey Decimal Classification; two were assigned by LC[39] while the other five were not identified.[40] Once again, clustering is evident, within the subcategory of "Philosophy" (three items classified in Dewey division 170: Ethics) and the broader category of "Reli-gion" (three items classified in three different Dewey subdivisions of Christianity).

¶48 The classification assigned to the items in this bibliography did not unite a greater number of items than the subject headings did. The maximum united by class was only three of eleven, the same number as united by subject heading. This corollary between class and subject heading is not surprising, since classification is assigned based on or in relation to subject heading. And since only a single classification number is typically assigned to any one item, intersection of classes is not possible, unlike subject headings which may be assigned in multiples.

Bibliography 2: Classification

¶49 Each of the sixteen works studied in "Other Suggested Reading: An Essential Bibliography on Drug Law and Policy" was assigned LC classification by the Library of Congress. Items were classified in BF: Psychology (one item); HV: Social Pathology, Social and Public Welfare, Criminology (ten items); KF: Law of the United States (one item); QP: Physiology (three items); and RC: Internal Medicine (one item). Clustering and connections within the assigned classification is very evident for these works, as ten works clustered within Subclass HV all fall under the broad rubric of "Drug habits. Drug abuse" and include the assignment of the exact same classification for three (HV5810), three (HV5822), and four (HV5825) works.

¶50 Two works were also assigned National Library of Medicine call numbers,[41] QV: Pharmacology and WM: Psychiatry.

¶51 Sixteen of the works were also assigned Dewey Decimal Classification by LC. Eleven works were classed within Dewey division 360: Social Problems & Services, and five were classed within Dewey division 610: Medicine & Health. The pattern of clustering for Dewey classification is quite strong within Social Problems & Services.

¶52 Five items were also assigned Superintendent of Documents Classification System (SuDoc) numbers.[42] Two of the items were identified as HE: Public Health, Human Services, Food/Drug Regulations, Children, Aging, Medicine, Nutrition; one was identified as Pr: Presidential Studies; and two were classed as Y3: Independent Agencies. It should be noted that SuDoc numbers are assigned only to government documents and their arrangement is indicative of topic primarily because of the orientation of the issuing agency. Thus, SuDoc numbers are not

39. MARC field 082, second indicator 0.
40. MARC field 082, second indicator blank.
41. MARC field 060.
42. MARC field 086, first indicator 0.

of great usefulness in generating bibliography beyond the government publication parameters. Nonetheless, their clustering may contribute to uniting like materials.

¶53 The general classification of the items in Bibliography 2 suggests, superficially, a stronger unification than subject headings provided, with a maximum of ten items united by LC class and a maximum of eleven items united by Dewey, compared to a maximum of five directly and eight indirectly united by subject headings. The breadth of works included in the general classes is therefore important to consider, with the eight items classed in the Dewey 362.2 subdivisions displaying strongest and most relevant association.

Bibliography 3: Classification

¶54 All of the fifty-seven works studied in "Animal Rights: An Interdisciplinary, Selective Bibliography" were classified by the Library of Congress. Ten of the items were assigned classification within class B: Philosophy, with more specific assignment in B: General Philosophy (one item); BD: Speculative Philosophy (one item); BJ: Ethics (six items); BL: Religions, Mythology, Rationalism (one item); and BT: Doctrinal Theology (one item). One item was assigned to class GF: Human Ecology, Anthropogeography. Twenty-five of the items were assigned classification with class H: Social Science, with more specific assignment within HD: Industries, Land Use, Labor (one item); HM: General Sociology (three items); and HV: Social Pathology, Social and Public Welfare, Criminology (twenty-one items). Four items were assigned classification within K: Law, with more specific assignment in K: Law in General, Comparative and Uniform Law, Jurisprudence (one item) and KF: Law of the United States (three items). Six items were assigned Q: Science, with more specific assignment in QH: Natural History, General (one item) and QL: Zoology (five items). Six items were assigned R: Medicine, with more specific assignment within R: General Medicine (five items) and RA: Public Aspects of Medicine (one item). Two items were classed within SF: Animal Culture, and three were classed within TX: Home Economics.

¶55 If considered in the broadest terms, the clustering is very strong in HV, as twenty-five of the fifty-seven have been classed specifically in the "Protection, assistance and relief" [of animals] area of this class. Although not a full majority of the bibliography, it does represent a strong trend that is most indicative of the stated nature (animal rights) of the bibliography.

¶56 One item was also assigned two call numbers by the National Library of Canada.[43] Both numbers were the same (HV4708: Protection, Assistance and Relief—Protection of Animals, Animal Rights, Animal Welfare), although the "LC-based" included cuttering.

¶57 Seven works were also assigned National Library of Medicine call numbers. One was classed within HV: Social Welfare, Criminology; one was classed

43. MARC field 055. One item had an LC-based call number assigned by NLC (second indicator 0) and one had a complete LC class number assigned by NLC (second indicator 1).

within QY: Clinical Pathology; and five were classed within W: Health Professions. Of the five classed in W, two were classed as generic W1: Serials, Periodicals, and the other three were more topically classed in W50: Medical Ethics.

¶58 Fifty-five of the works were also assigned Dewey Decimal Classification by LC. Thirty-six of the items were classed under different Dewey subdivisions of Philosophy & Psychology, with one in 120: Epistemology, one in 150: Psychology, and thirty-four in 170: Ethics. Six of the items classed as Ethics were assigned the general 170 classification, while others were more narrowly classed as 172: Political Ethics (two items), 174: Occupational Ethics (four items), and 179: Other Ethical Norms (twenty-two items). Other Dewey subdivisions assigned included 200: Religion (with one item classed under 241: Christian Ethics and one under 291: Other Religions—Unassigned); 300: Social Sciences (with one item classed under 390: Economics—Production, four items classed under different subdivisions of 340: Law, and one item under 363: Social Problems & Services—Other Social Problems & Services); 500: Science (two items under different subdivisions); and 600: Technology (five items under different subdivisions of 610: Medicine & Health, one item under 630: Agriculture, and one under 640: Home & Family Management).

Conclusions about Classification

¶59 The classification assigned to works in the bibliographies seems to follow a pattern similar to that of the subject headings. Rather than producing single comprehensive bibliographies, subsets are identified within the bibliographies. Within the physical library, searchers would be well advised to explore the shelves on which the materials they seek are located, thus discovering related works that might have different subject headings assigned and therefore might have been missed in the search by subject heading. Moreover, consultation of the works themselves should be richly rewarding, with chapter headings, footnotes, appendixes, and indexes all providing sources for additional searching. Although such in-depth shelf-browsing and work-in-hand consultation is not precisely replicated in the online environment, nor even feasible within current library catalogs, the uniting of works by classification can provide additional contextual framework and some surrogate of simple shelf browsing to the user. Search by keyword might, for example, be effectively limited to call number ranges. Limiting to "K" class (Law) would add to the legal element of searching more general keywords. It should be noted, however, that part of the reason for greater clustering within classification is the relative broadness of the categories being considered. Such broad scope may or may not be helpful in the search process.[44] The descriptors of the classification assigned also underscores, again,

44. Tanselle comments that "the act of classifying a subject in terms of a larger framework ought to help clarify the nature of that subject . . . [although] there are exceptions." G. Thomas Tanselle, *Bibliography and Science*, 27 STUD. BIBLIOGRAPHY 59, 88 (1974).

the assistance in finding potentially elusive items provided by the bibliographer, as a researcher seeking "Epistemology" is perhaps less than likely to search within "Home & Family Management."

Additional Links to the Subject in the Bibliographic Record: Keywords

¶60 Keyword searching is one means by which users can discover subject headings in the catalog. Keyword searching can also be used—and, indeed, is most commonly used as search strategy—to enable access to records related to topical terms that may not be part of authorized subject headings.[45] Keyword also seems to be the search strategy of choice.[46] It should be worthwhile to ask whether full keyword searching can more fully and comprehensively replicate the contents of a bibliography than subject heading searching alone. Presumably, keyword searching should enable inclusion of records that contain topical or related terms that are broader than subject heading terminology.

¶61 The three bibliographies were analyzed for keyword content. Keywords were extracted from the bibliographic records analyzed for subject headings. The following fields were included: author (MARC 1XX and 7XX), title (MARC 24X), series (MARC 4XX/8XX), some notes (selected MARC 5XX), and subject (MARC 6XX). "Notes" fields included were MARC 500 (general), 505 (contents), and 520 (summary); MARC 504 (bibliography) was excluded since its content is generic (i.e., "includes bibliographical references and index") and not indicative of the topical content of the work. For each record, the words in each field were collected and sorted to produce a list of keywords for the record. Duplicate words were deleted to produce unique keywords for each record. Articles, conjunctions, numerals, dates, and initials were deleted as common stopwords that are not indicative of topical content and thus not helpful to subject-oriented searching. The records associated with each bibliography were then collected and sorted to produce a list of keywords associated with the bibliography; the results were counted to determine the number of times each keyword appeared throughout the bibliography.

Bibliography 1: Keywords

¶62 "A Bibliography on Christian Faith and the Law" included 143 unique keywords. The majority (115) appeared only once throughout the records, and thus

45. Bade defines title keyword searching as "still subject searches . . . [that] simply replace searches in the subject index, which did not lead to the desired materials." BADE, *supra* note 23, at 21–22.

46. Wallace writes that "given the choice between keyword searching and descriptor searching, users not only are more inclined to use the keyword approach, they frequently conduct an equally successful search." Wallace, *supra* note 11, at 241. And D'Angelo notes "the usefulness of tables of contents, indexes, and abstracts for finding keywords, synonyms, and concepts to use to build or refine search statements." Barbara J. D'Angelo, *Integrating and Assessing Information Competencies in a Gateway Course*, 29 REFERENCE SERVICES REV. 282, 287 (2001).

would not facilitate any matching of records. Twenty keywords appeared twice (i.e., in two records), four appeared three times (three records), and three appeared four times (four records). One keyword, "Christian," appeared five times (in five records). Keyword matching thus had better results than subject heading linkages for this bibliography, enabling linkage of five records of eleven rather than only three of eleven, as linked by subject headings. It is interesting to note that the most matched term, "Christian," appeared both in subject headings ("Christian ethics" and "Sociology, Christian") and elsewhere in the records. Thus, keyword searching the additional fields of title and notes broadened and improved subject access. The keywords that appeared three times were also related to subject headings; those that appeared four times, however, were all related to descriptive bibliography rather than topical.

Bibliography 2: Keywords

¶63 "Other Suggested Reading: An Essential Bibliography on Drug Law and Policy" included 195 unique keywords. The majority (149) appeared only once throughout the records and thus would not facilitate any matching of records. Twenty-six appeared twice, eight appeared three times, six appeared five times, one each appeared six and seven times, two appeared nine times, and one each appeared twelve and thirteen times. The highest occurrences (thirteen for "states" and twelve for "united") are reflective of both geographically subdivided subject headings and corporate bodies for government publications. The next highest occurrences (nine each for "abuse" and "drug" and seven for "habit") are terms that appear both in subject headings and elsewhere in the record, and exhibit the ability for keyword searching to unite separate but related subject headings (such as "Drug addiction," "Drug abuse," and "Drug use," likewise "Heroin habit" and "Cocaine habit") as well as keywords in title and notes.

¶64 Keyword searching again slightly increased the number of linked records over that of subject heading alone, where only five records were directly linked and eight indirectly. However, the keywords that produced the maximum linkage ("united" and "states") illustrate the challenge of relevance in keyword searching.

Bibliography 3: Keywords

¶65 "Animal Rights: An Interdisciplinary, Selective Bibliography" included 572 unique keywords. The majority (446) appeared only once throughout the records and thus would not facilitate any matching of records. Sixty-eight appeared twice; eighteen appeared three times; six, four times; eight, five times; five, six times; two each, seven, eight, and nine times; three each, ten and twelve times; two, fourteen times; and one each, eighteen, twenty, twenty-one, twenty-two, twenty-three, twenty-six, and thirty-nine times. The results are similar to those encountered with the other two bibliographies, with the greater number of records involved naturally increasing the number and frequency of keywords. One interesting aspect for this bibliography is that the two most frequently occurring keywords

are variants: "animal" (with thirty-nine occurrences) and "animals" (with twenty-six occurrences). This suggests the benefit of wildcard and truncation in keyword searching, within the context of both subject headings and other fields within the records. Either "animal" or "animals" appeared as keyword in forty-four records, an increase over either term alone.

Conclusions about Keywords

¶66 This limited analysis suggests that keyword searching may be useful in extending subject heading searching to more closely approximate the comprehensive and inclusive nature of bibliography. A caveat is to be found in the vast number of keywords that appear in single records, despite their seeming relevance to the topic of the bibliography. The success of keyword searching depends upon the terminology used and the topic sought; keyword searching within the context of subject heading may prove to produce most relevant hits, although it also introduces, again, the difficulty of selecting authorized terminology within the search process.

Overall Conclusions and Discussion

¶67 The literature is rich with suggestions for the improvement of research within the online environment, with routes both within and beyond the catalog toward improved subject access explored.[47] Improvements toward subject access often focus on enhancements to the online catalog, including annotations and additional keywords,[48] increased subject heading assignment,[49] linkage to bibliographies,[50] enhanced interface design,[51] and incorporation of online bookstore-type linkages and services.[52] Others focus on the continued, indeed increased importance of user education and instruction, particularly in helping transform online search skills to more effective research practice.[53] Still others advocate for improved search heuristics, somewhat replicating in the online environment the aids so obvious in the

47. For a summary and bibliography of suggested enhancements, see Stephanie A. Wittenback, *Enhanced Bibliographic Access*, 8 LIBR. HI TECH BIBLIOGRAPHY 57 (1993).
48. Tennant, *supra* note 1, at 28.
49. *See, e.g.*, Mann, *supra* note 37, at 276–77; WILLIAM E. STUDWELL, LIBRARY OF CONGRESS SUBJECT HEADINGS: PHILOSOPHY, PRACTICE, AND PROSPECTS 81 (1990).
50. *See, e.g.*, Prior, *supra* note 18, at 21–25; Stephen Abram, *Is the Bibliography Dead? Hell No!* INFO. OUTLOOK, Nov. 2003, at 28.
51. Wendi Arant & Leila Payne, *The Common User Interface in Academic Libraries: Myth or Reality?* 19 LIBR. HI TECH 63 (2001).
52. Mary K. Van Allen & Carol Anne Germain, *Business As Usual: Amazon.com and the Academic Library*, 28 J. ACAD. LIBRARIANSHIP 319 (2002).
53. *See, e.g.*, Bill Katz, *Long Live Old Reference Services and New Technologies*, 50 LIBR. TRENDS 263 (2001); Jacqueline De Ruiter, *Aspects of Dealing with Digital Information: "Mature" Novices on the Internet*, 51 LIBR. TRENDS 199 (2002); Curtis, *supra* note 3; Fritch & Mandernack, *supra* note 10; Judith M. Pask & E. Stewart Saunders, *Differentiating Information Skills and Computer Skills: A Factor Analytic Approach*, 4 PORTAL: LIBR. & THE ACAD. 61 (2004); D'Angelo, *supra* note 46.

ideal physical library.[54] All of these ideas explore admirably some promising ways of enhancing online research, addressing the conundrums of millennial research practice, balancing the traditional with the transitional in a quest toward what is coming next.

¶68 These movements toward adapting traditional standards of research excellence to online practice do not fully address, however, the issue of those traditional elements which may remain hidden from view in the online environment. The contrast and analysis of bibliography and subject headings suggest that the traditional resource of bibliography continues to merit attention as a tool offering unique perspective and value to the research process. Many writers and library researchers do continue to advocate for the continued production of scholarly bibliographies and subject guides, independent of library catalog subject headings,[55] while others note that scholars in many fields continue to rely upon bibliographies and citation tracing as primary research methodology.[56] And rather than focusing on catalog enhancements, Jacso explores the feasibility of enhancing bibliographies themselves by incorporating links to full-text documents within Web-mounted bibliographies.[57] In his comparison of bibliography and library cataloging, Buckland describes library cataloging as "a special case of bibliography,"[58] noting that "bibliographies should be seen . . . as a dramatic enrichment of the access function far greater than can be provided by catalogs";[59] he further suggests that bibliographies might be linked to library holdings.[60]

¶69 When viewed in a certain context—that of providing a list of materials within a specified category—library cataloging is, indeed, a form of bibliography. In this view, subject headings serve the purpose of categorization, and other bibliographic elements—such as classification and the keywords included in note fields—serve to refine the categories. The current status of cooperative cataloging and open access to international cataloging utilities might be seen to be coming increasingly closer to the classical lofty goal of universal bibliography.[61] Indeed, one might find and in some way intelligibly unite all the world's published—and

54. *See, e.g.*, Kushal Khan & Craig Locatis, *Searching through Cyberspace: The Effects of Link Cues and Correspondence on Information Retrieval from Hypertext on the World Wide Web*, 49 J. AM. SOC'Y INFO. SCI. 1248 (1998); Luisa Sabin-Kildiss et al., *Accessing the Functionality of Web-Based Versions of Traditional Search Engines*, ONLINE, Mar./Apr. 2001, at 18.

55. *See, e.g.*, Brenda Reeb & Susan Gibbons, *Students, Librarians, and Subject Guides: Improving a Poor Rate of Return*, 4 PORTAL: LIBR. & THE ACAD. 123 (2004); Jody Condit Fagan, *Use of an Academic Library Web Site Search Engine*, 41 REFERENCE & USER SERVICES Q. 244 (2002).

56. *See, e.g.*, Payette & Rieger, *supra* note 10; Roberto Delgadillo & Beverly P. Lynch, *Future Historians: Their Quest for Information*, 60 C. & RES. LIBR. 245 (1999).

57. Peter Jasco, *Create Digitally Enhanced Bibliographies with Public Domain Databases*, COMPUTERS IN LIBR., June 2003, at 52.

58. Michael K. Buckland, *Bibliography, Library Records, and the Redefinition of the Library Catalog*, 32 LIBR. RESOURCES & TECHNICAL SERVICES 299, 302 (1988).

59. *Id.* at 308.

60. *Id.* at 308–09.

61. Shaw describes as "Gesner's dream . . . the complete listing of the scholarly publications of the world." Ralph R. Shaw, *Machines and the Bibliographic Problems of the Twentieth Century*, in LOUIS N. RIDENOUR ET AL., BIBLIOGRAPHY IN AN AGE OF SCIENCE 37, 38 (1951).

in some cases unpublished—scholarly productions into a convincingly comprehensive listing, even more convincing if article indexes are incorporated. What remains a crucial distinction, however, is the innate philosophy behind the intended intelligible unification.

¶70 The compilers of bibliographies make connections between materials; they also provide significant culling. In the most pragmatic terms, when equating subject bibliography with subject headings, the simple selectivity of subject bibliography must be considered. The exhaustivity of searching a single subject heading or even a selected combination of several in a universal catalog produces a list daunting to contemplate. Perhaps this is not a negative result for an exhaustive researcher (although the relevance of broad and basic results may be an issue), but it is cause for a serious pause when research on online search behavior has revealed user disinclination to scan beyond a limited number of search results, whether in search engines or the online catalog. Moreover, and more cogent to the discussion, is the simple philosophical difference between bibliography compilation and subject heading analysis. Catalogers begin with a single work in hand; they do not compile but rather analyze individual items. Thus, subject headings are assigned without considering the lists produced. Bibliographers, on the other hand, begin with the topic and select works to fit the list. Both approaches have wisdom and utility. Ideally, the catalog should, for many purposes, be essentially timeless; subject headings will always unite the same materials. Bibliography, however, may constantly shift, with a single item appearing in endless variation.

¶71 The comparison of bibliography and auto-bibliography suggests ways in which scholarly bibliography can enhance the search for materials. Many scholars have noted in particular the importance of bibliographers to interdisciplinary research.[62] The clustering of subject headings and linkages within bibliographies underscores this importance, as it reveals how well the art can navigate both among multiple disciplines and through the intricacies of more seemingly singular topics. But the searcher may be united with materials through a variety of methods. Another significant consideration is the pleasure of reading and the joy of shared and extensive scholarship that bibliography brings to the overall research process. Ultimately, traditional scholarly bibliography represents a facet of scholarly communication and community with implication far beyond its utilization as a facet of the search process. Krummel makes a distinction between "canonic" bibliography, with value added by the compiler, designed to be read rather than merely consulted, and the "dynamic" bibliography of book lists, including the library catalog.[63] He further notes the most singular aspect of bibliography—its compiler's whim:

> One recalls with pleasure the gratuitous information often found in a bibliography—the odd facts that perhaps do not really belong there, the miniature essay that compilers felt

62. For one such study, see Fiscella, *supra* note 18.

63. D. W. Krummel, *The Dialectics of Enumerative Bibliography: Observations on the Historical Study of the Practices of Citation and Compilation*, 58 LIBR. Q. 238, 244 (1988).

> impelled to insert merely because it struck them as potentially useful to some readers. One associates these aberrations with the learned and eccentric compilers of the Victorian era, and prays that they may not entirely disappear in an age of standards.[64]

¶72 What begins with the question of search behavior may be expanded to the examination of a different question—who will write the bibliographies? The act of compilation—of learning how to make the sort of innovative and sagacious connections that the best bibliographers do—is of great value. The incorporation of webliographies and lists of links into online documents and other materials suggests that online publishing is not ignorant of this value; the art of bibliography may indeed flourish in the environment of creative review and sharing of resources which the focus of many blogs and similar sites represents.[65] Compilation should also prove of equal merit to others, as an analysis of the composition of bibliographies truly offers enlightening perspective on the broad array of research methodology and synthesis.

¶73 Auto-bibliography is not bibliography, but it can be an effective tool in support of the research process and, not insignificantly, the continued advancement of scholarship, including the production of scholarly bibliography. Librarians and other research professionals may support the furtherance of both research and scholarship by encouraging understanding of traditional and transitional resources. Some guidelines for such education may be inferred from the analysis of linked and clustered subject headings described in this study, an abbreviated example of which is illustrated in figure 6. Beginning with the function of subject headings in the library catalog and their utility in generating auto-bibliography, moving on to the effective and productive navigation of auto-bibliographic paths: this should ultimately result in users honing critical judgment skills, as they seek and cull their own unique lists of resources. The judgment by which searchers select or discard resources for further investigation provides practice in the critical selectivity that is an inherent attribute of bibliography production.

¶74 As auto-bibliography supports bibliography, so may bibliography in turn support auto-bibliography. Works cited in scholarly bibliographies may provide a starting point for searching within the library catalog, with the catalog record for the selected item providing suggestions for subject heading, classification, and keyword searching. Bibliographers may also incorporate suggested search strategies into their documents. Some legal scholars, for example, enhance their topical bibliographies by highlighting suggestions for further searching within Westlaw and LexisNexis, identifying appropriate syntax and search terminology, key numbers, key cites, citations, and so on.[66]

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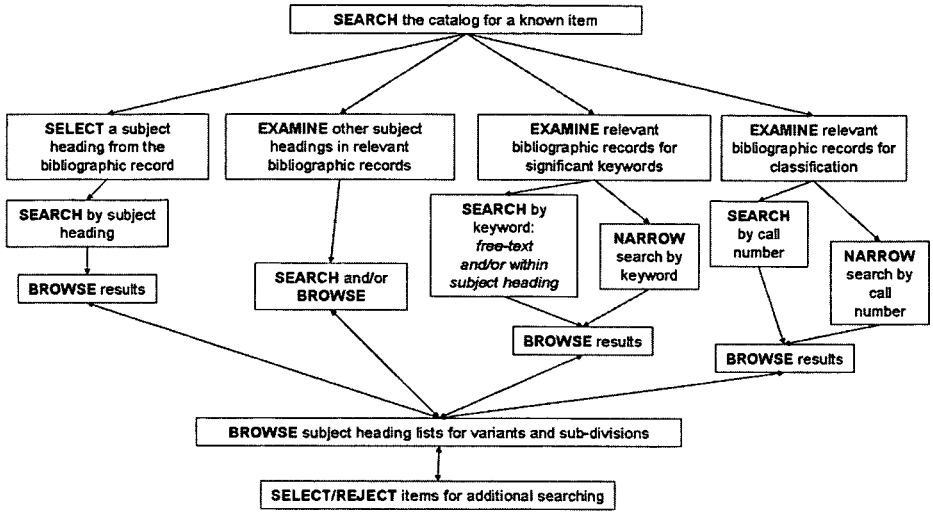
64. *Id.* at 250.
65. Rosen remarks upon the value of compiling bibliographies for librarians in particular, as "their creation also contributes both to the development of the area studies and the knowledge of the author." Nathan Aaron Rosen, *A Duty and a Joy: The Publication of Bibliographies by Librarians*, LEGAL REFERENCE SERVICES Q., 1989, no. 1–2, at 179, 180.
66. For one example of a topical legal bibliography enhanced with Westlaw and LexisNexis search suggestions, see Joe Gerken, *Elder Law Resources*, LEGAL REFERENCE SERVICES Q., 2004, no. 1, at 67.

Figure 6

The Generation and Navigation of Auto-bibliography



¶75 With the differences between auto-bibliography and bibliography firmly understood, one can conclude that they are ultimately complementary resources, each orbiting and supporting the other. Traditional and transitional resources and practices may indeed provide for harmonious movement through the world of research. Thus may the case of bibliography versus auto-bibliography be settled amicably through the mediation of education.