Being a Librarian: Metadata and Metadata Specialists in the Twenty-first Century

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Introduction

"Librarianship offers a better field for mental gymnastics than any other profession."[1]

—Horace Kephart, 1890

The plan to create a festschrift for Tom Turner, Cornell's pre-eminent and beloved metadata librarian, was first announced in early 2003 at a celebration of the eighth anniversary of the Dublin Core Metadata Initiative. Among other events, the program featured the East Coast premiere of "Being a Librarian," a humorous one-act play by Dennis Stephens of the University of Alaska Fairbanks.[2] The play is an adaptation of an article by Horace Kephart, Cornell's first cataloger, who was hired in 1882.[3]

A deeper look into the 1890 *Library Journal* (LJ) issue containing Kephart's article reveals that Kephart's "Being a Librarian" was the last in a series of articles of that name published that year in the July through November issues. As is revealed in the series as well as in Kephart's comic treatment of the subject, the professional librarian of the day needed perseverance; an excellent education and an intelligent, open mind; a wide knowledge of languages, literatures and cultures; the ability to provide both public and technical services; business savvy and a knowledge of the book trade; facility with many aspects of library operations; and management skills.

A further perusal of the *LJ* issues for 1890 reveals much in common with today's worries that without guidance, information-seekers often fail to discover the most

reliable, current, and accurate resources. For example, to Charles Henry Hull, then assistant librarian at Cornell, a well-made, current bibliography was superior to the catalog for getting materials "of recognized merit" into the hands of readers. In an article comparing catalogs with bibliographies, Hull quipped, "It is doubtful whether the subject catalogue does as much good as it does harm. The average student uses it without discrimination. He wants a treatise on electricity; the catalogue offers him a choice of a hundred titles, and he copies one of them absolutely at random."[4] Hull's criticism of the catalog—which was then evolving, sounds surprisingly similar to today's librarians' criticisms of Internet search engines.

Then and now, "there are few professions which contribute so much to the saving of time and to the progress of science" as librarianship.[5] Librarians have perhaps taken the most pride in their role as intermediaries, whether as reference librarians personally connecting users to the information they need, or as the creators of tools, like bibliographies or reference guides, library catalogs, specialized indexes or finding aids, that facilitate those connections. However, in the increasingly interconnected world of the Web, information seekers behave more and more self-sufficiently, choosing simple but powerful search services like Google (http://www.google.com), and moving well beyond library collections in their pursuit of information.[5.5] How can librarians continue to contribute to saving time and advancing the state of knowledge in this kind of world?

In this chapter, I take the following trends as starting points for defining what being a librarian will be like in the twenty-first century:

- Technology-driven research, teaching, and learning environments;

- Disintermediation (i.e., a decrease in guided access to content);

- A global infosphere (e.g., an academic library user's "infosphere" is made up of the open Web, published content, special collections, and institutional content); and[6]

- An accelerating shift in information-seekers' preferences for Web-based information and multimedia formats.

My particular purpose is to forecast the role of metadata and metadata specialists in libraries in five to ten years. The forecast is drawn from the larger context of relationships between the global infosphere, information-seeking behavior, and changing roles for librarians and library collections.

The Larger Context: Knowledge Management

"Knowledge creation is everyone's concern, and not the responsibility of a specialized few."[7]

—Chun Wei Choo, 2002

I have used the work of Chun Wei Choo, professor of Information Studies at the University of Toronto and the author of several books on information and knowledge management, as a way to organize this section's observations about the changing context for being a librarian. Dr. Choo characterizes organizations as "knowing communities" that "interpret information about the environment in order to construct meaning … create new knowledge by converting and combining the expertise of know-how of their members … [and] analyze information in order to select and commit to appropriate courses of action."[8]

If we assume that the university is a knowing community that observes and makes sense

of the world, creates new knowledge, and seeks information to support decision-making,

then the role of an information service such as a library comes into focus: to participate in

the generation and processing of information for the university. Choo further defines a

proactive role, rather than reactive: "In the knowing organization, information systems

and services go beyond simply *what* people want to know, to *why* and *how* they will use

the information."[9] Figure 1 is an adaptation of Choo's illustration of a highly

collaborative model for knowledge creation and organizational growth. Speaking about

this figure, Choo says "The intelligent organization breaks away from functional

fragmentation. It forges new partnerships between "domain experts, information experts,

and information technology experts" to bring together the organization's capabilities.[10]

<Insert Figure 1.1 Knowledge Pyramid of the University Community>

All three groups engage in what Choo calls the "information network processes"

of acquiring, creating, organizing, distributing, and using information. No single group

has a monopoly on information processes. Further, to truly understand this model, we

must expand our library-centered notion of "information" beyond documents to include a

wide variety of human sources of information.[11]

Domain experts are those who are personally involved in creating and using

information. At the university, this group would consist largely of professors, graduate

students, researchers, and so on. *Information experts* have the know-how to select,

acquire, and organize information into systems and structures, to enhance the

accessibility and quality of information, to preserve information, and to provide services

to promote learning and awareness. At the university, this group consists of librarians,

records managers, archivists, and others. *Information technology* (IT) *experts* possess

specialized technical expertise to build and maintain information infrastructures. It is

important to note that there is not one generic "university knowing community," but

many communities that are adopting new information technologies and new pedagogical

or research practices at different speeds, in different ways, according to their disciplinary

traditions. Clifford Lynch, Director of the Coalition for Networked Information, argues in

favor of digital library "customization by community" and notes that information and IT

experts will face a trend away from institutionally-based communities toward discipline-

based ones.[12]

In the twentieth century, two conceptualizations of the library have dominated our

thinking: (1) the library as a warehouse and/or (2) the library as a center of experts and

tools that guide users to appropriate library resources. In the twenty-first century, both

concepts are having the effect of restricting librarians to an unnecessarily narrow role in

their communities. Fortunately, there is some evidence of change. A finding of Cornell's

"Models of Academic Support for 2010" project is that information technology is

fundamentally transforming how faculty members teach and conduct research; how

students learn; and how librarians should support those activities.[13] This finding led to

recommendations for librarians to partner more actively with faculty and campus IT

experts; to enhance coordination, integration, and distribution of scholarly work; to

leverage librarians' digital expertise to assist faculty to build and manage university-wide

digital assets; and to offer new services to support innovation in teaching and collaborative learning.

Along these lines, Cornell University Library has recently established Faculty Grants for Digital Library Collections.[14] The grants support the creation of digital content of enduring value to scholars. In 2004, its first year, the program invited projects in the areas of humanities and social sciences. The library's Digital Consulting and Production Services (DCAPS) group, working with other campus service providers such as the Academic Technology Center, helped faculty grant recipients prepare and implement their projects. Thus the grants program embodies a real-life example of a "knowledge pyramid" of a domain expert (a faculty member) creatively collaborating with information experts (DCAPS) and IT experts (the Academic Technology Center).

Another example of the changing context for being a librarian is the National Science Digital Library (NSDL), established by the National Science Foundation (NSF) as an online library of science, technology, engineering and math resources to support teaching and learning for all age groups, preschool to adult. Cornell was one of three "NSDL Core Integration" institutions funded in late 2001 to build the production release of the NSDL.[15] The Cornell component of the Core Integration team includes two librarians, one of whom provides leadership on metadata development and interoperability—quite a challenge considering that the NSDL strives to be the largest and most heterogeneous digital library ever built. First and foremost a collaborative project, the Core Integration team works with subcontractors, many other NSDL-funded projects, the NSF, and numerous other publishers, digital libraries and associations. In terms of Choo's model, the NSDL is a large-scale, long-term, cross-institutional example

of domain experts, information experts, and IT experts striving for a common goal: fueling national improvements in science, technology, engineering, and math education.

Another impressive example of active collaboration of librarians in a knowledge community is the Virtual Life Science Library, VIVO, a Web portal for Cornell's Life Sciences Initiative.[16] Still a work in progress, VIVO unifies access to a large array of life sciences resources and services through a "curated index" of information about library materials, courses, people, departments, programs, majors, research laboratories, and publications—anything related to life sciences at Cornell. It is worth noting that VIVO's objective is to promote collaboration among faculty and research staff who are dispersed across administrative lines and physical locations. VIVO deliberately does not mirror Cornell's traditional administrative organization, but links people, organizations, events, publications, and places based on "ontologies" —structured relationships of data entities— to help people discover and navigate through VIVO's rich content. VIVO is an example of effective knowledge management and an exemplar of twenty-first century librarianship. More detailed information about VIVO is available in Jonathan Corson-Rikert's chapter in this book.

<center>Other Trends to Watch</center>

More Disintermediation

Today's libraries exist in physical and virtual space, so that users interact with libraries both in buildings and on the Web. With respect to library buildings, the "Cornell University Library, Library Building and Services Survey"[17] and "Dimensions and Use of

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the Scholarly Environment," a joint report of the Council on Library and Information Resources (CLIR) and the Digital Library Federation (DLF)[18] offer some guidance. Both studies support the view that while access to print journals and books in library buildings remains of great importance to faculty and graduate students, nearly all library users, regardless of academic discipline, increasingly rely on online information sources, and all groups prefer to work online from their homes and offices, rather than visiting the library. While services like "Ask a Librarian" and virtual reference have offered new methods for connecting users with librarians, the increasing offsite use of library collections and services continues to stoke the disintermediation trend.

The Library as an Information Commons

While disintermediation persists, the library has the opportunity to become an "information commons" that offers an inspiring shared space and common ground for face-to-face collaborations, supported by sophisticated IT equipment.[19] It seems likely that by 2015, the current configuration of users, collections, and staff that inhabit library buildings will shift to a configuration that gives greater preference to a variety of user spaces, public services, and public computing.

The Library as One Subset of the Global Infosphere

The virtual and online dimension of "library use" is as important as use of the library buildings. In the Cornell library's "LibQual+ Spring 2003 Survey," 27% of faculty, graduate student, and undergraduate respondents said they use resources on

library premises daily, and 32% said they access library resources through library Web pages daily. At the same time, demonstrating the importance of the open Web as part of users' global infospheres, 73% of the LibQual respondents said they use Yahoo, Google, or non-library gateways for information daily.[20]

The Power of Google

In 2004, a team at the Cornell University Library researched the possibility of building an integrated framework for the Cornell library's fifty-some digital collections. The research team conducted structured interviews of several dozen library staff members.[21] Interviewees often remarked that the library's discovery systems need to be "much more like Google," in the sense of faster search engines and better indexing to assure relevant, accurate, and consistent query results.

The 2003 LibQual survey revealed a related perspective among Cornell library users: three of the six largest gaps between users' desired and perceived service levels related to the ease of use of the library's access systems.[22] Librarians must introduce easier-to-use discovery systems for bringing together the content of their collections; they need to find an appropriate place and role for the library catalog in the larger infosphere, and they need to build rich digital collections and give users around the world a powerful and easy way to search across them.

Interconnections, Interoperability, and Information Delivery

Librarians need to make their collections and services visible. Their communities need to be more aware of what they have to offer. One barrier to visibility is the diversity

of discovery and access systems for libraries' analog and online collections. Further, information seekers who could benefit from library resources often have their eyes on some other part of the infosphere, not on library Web pages.

Print collections continue to be important, but fewer people come to the library to use them and more of the print collections are being shifted to storage. Another change is the rising importance of Web-based campus learning management systems and university portals.[23] This means the collections need to go where the people are, or more specifically, where their eyes are. Enabling library content to be discovered and pushed out to wherever users want or need it to appear calls for new, much more robust and interconnected discovery and content delivery systems.

Offsite Storage and the Challenge to Browsing

The trends of increasing use of library electronic and digital collections and declining use of the traditional collections of major research libraries are well documented. With print collections continuing to require more space, it seems only a matter of time until larger portions of research library collections must be shifted into storage, where they will be difficult to browse. It may be necessary for librarians to find creative solutions, such as virtual browsing, through which users can discover, select, and request delivery of the materials they want.

Structuring Unstructured Data

As librarians become more involved in knowledge management at the university, they will face a major problem: the organization of unstructured data, which commonly

appear in emails, Web pages, memoranda, reports, etc. Making these resources

conveniently findable is likely to involve developing and/or using new automated tools

for organizing, classifying, and discovering a very large volume of unstructured but

useful data.

Partnerships with IT and Other Information Experts

The missions of other campus organizations that support teaching, research, and

learning are closely related to a library's mission. Due to their common interests, new or

closer partnerships between these organizations are likely to become commonplace,

including some sharing of IT, space, or services.

Library Catalogs, Cataloging, and Catalogers

"Save the time of the reader."—S.R. Ranganathan[24]

S.R. Ranganathan, born in India in 1892, was a complete and systematic thinker

who made immense contributions to librarianship with his "five laws of library

science."[25] The fourth law, "save the time of the reader," is perhaps the one that

transcends and ties together the 120 years of library practice covered by this chapter.

"Save the time of the reader" gets at the underlying purpose of mediating tools like

indexes, taxonomies, classifications, library catalogs, and metadata.

At the time Kephart's "Being a Librarian" article appeared in *LJ* in 1890, the

modern catalog was just beginning to flourish. By the late 1960s, when the Online

Computer Library Center (OCLC) was founded and the first MAchine Readable

Cataloging (MARC) records distributed by the Library of Congress were loaded into the OCLC database, cooperative cataloging was transformed, providing libraries with a new plane on which to build resource sharing, reference, and local library systems.

By 2000, the Library of Congress was leading the development of cataloging and associated standards, and the OCLC and Research Libraries Group (RLG) cooperative cataloging databases contained millions of MARC records from all over the world. While producing MARC catalog records is arguably among the most expensive tasks in the library (an oft-quoted number is fifty dollars per full original record), the shared cataloging databases drive the costs of cataloging to affordable levels for countless libraries (a few dollars per record). Online cooperative cataloging has been a successful and valuable service for libraries and their users.

As helpful as the cooperative cataloging model is, it is becoming less affordable. The growth of Web resources, and other digital objects valuable to the university community, dwarfs the growth rate of books and printed serials. As the authors of *LC21: A Digital Strategy for the Library of Congress* put it, "sheer size presents considerable challenges to the economics of traditional library cataloging."[26] There are other ways in which the present model of library cataloging does not scale to twenty-first century demands. In general, library cataloging is descriptive metadata. Many other types of metadata—rights, technical, structural, administrative, evaluative, preservation, and linking metadata—are needed for the array of information objects in which libraries now have an interest. Further, library cataloging practices, and to a great extent, library information systems, target one level (or unit) of description—for monographs, the edition; and for serials, the title. Traditional library and indexing practices are, or at least

were, aligned reasonably well with the current scholarly communications system, which in the sciences is largely based on serial publications.

Reacting to a growing dissatisfaction with the current scholarly communications system, Herbert Van de Sompel, team leader of the Digital Library Research & Prototyping Team at the Research Library of the Los Alamos National Laboratory, and others recently proposed revising the notion of a scholarly "unit of communication" (1) to include a range of other non-textual materials and "compound objects" that combine media types, and (2) to facilitate the early registration of all units in a future, more flexible scholarly communication system.[27] If such a system were created, traditional cataloging practice (and the lengthy process associated with changing it), would be inadequate. In addition, traditional cataloging practice is problematic because many communities outside librarianship use metadata—metadata that can and should be reused. The Internet facilitates interactions among formerly separate communities, making interoperability of library cataloging with other communities' metadata of crucial importance.

The *LC21* chapter on metadata concludes that metadata is a strategic issue for libraries and notes "it will be a tremendous challenge to change the [library's] base model for metadata … however, it is certain that library-type metadata practices will at some point need to be re-examined in the light of a changed world … [and] it is not productive to ignore the fact that changes are inevitable and will be dramatic."[28] Affordability and scalability are not the only challenges facing cataloging as it has been traditionally practiced in the twentieth century. Table 1 provides more information about affordability and scalability but also summarizes five more significant challenges.

<Insert Table 1.1 Challenges Facing Traditional Library Cataloging>

Despite these challenges, catalog librarians have the potential to use their expertise to make enormous contributions to university communities and to future information retrieval and dissemination systems. Doing so will require that they focus on the needs that catalog librarians meet, rather than the methods they use. When catalog librarians identify what they contribute to their communities with their methods (the cataloging rules, etc.) and with the product they provide (the catalog), they face the danger of "marketing myopia." Marketing myopia is a term used in the business literature to describe a nearsighted view that focuses on the products and services that a firm provides, rather than the needs those products and services are intended to address. Business texts often illustrate marketing myopia with reference to the decline of the American railroads, which faded not because the need to transport people and freight went away, but because the railroad owners defined the business they were in too narrowly. If owners had defined their business as "transportation" instead of "railroading" they might now have truck, airline, and bus divisions and still be a major economic and social force in America.

Implications for Metadata and Metadata Specialists

"Instead of being a hoarder of containers, the library must become the facilitator of retrieval and dissemination."

—William A. Wulf, 2003[29]

Wulf's quote appeared in the report of the "Tucson retreat"—a session hosted by the University of Arizona library to address how research libraries might deal creatively and effectively with continuing fiscal challenges.[30] The notion of "containers" applies to what has been the focus of libraries for thousands of years—books. Wulf, Professor of Engineering and Applied Science at the University of Virginia, maintains that information technology makes it possible to shift the focus away from the containers of information in favor of what users are attempting to learn from them.

The Tucson retreat participants articulated a list of assumptions about the future of higher education and libraries, and then used the lists to develop both transitional and transformative models for academic libraries. In the transformed library, librarians:

- Stop putting the majority of resources into preserving and maintaining current library collections;

- "Serve the mission of the higher education institution rather than a specific job description"[31];

- Develop robust information partnerships; and

- Manage a broad range of information objects in traditional and nontraditional formats—many previously outside the library's purview, such as learning objects, data sets, and institutional data.

The authors of the report predict that, as we transform ourselves in these ways, "individual libraries will still maintain unique and wonderful special collections, but our primary investments for the future will be in access systems."[32] If this prediction plays out, it is excellent news for metadata specialists, because just as catalogers played the

central role in creating nineteenth and twentieth century tools—the card and online catalogs—metadata specialists will be needed to help build these new kinds of access systems. Table 2 elaborates on the prediction related to libraries' renewed investments in access systems. In addition, the table summarizes the implications of four other trends: librarians' closer involvement with the university knowledge community; technology-driven research, teaching and learning; increasing user self-sufficiency; and the dominance of the global infosphere.

<Insert Table 1.2 Forecasts and Implications for Metadata Specialists>

Conclusions

"Research libraries, as organizations, have great difficulty in developing the technical skills and implementing the revolutionary changes that are needed for automated digital libraries."—William Y. Arms, 2000[33]

Our technology-driven environment, disintermediation, global infosphere, and other trends are placing pressure on our assumptions about libraries and what it means to be a librarian. Throughout the twentieth century, being a librarian increasingly meant being a specialist of some kind—a bibliographer, curator, or collection development specialist; an acquisitions, cataloging, or reference librarian; an information technologist; and so on. These specializations reflected the relatively stable conditions that university research libraries enjoyed throughout the second half of the century. Information seekers have been well served by librarians' current specializations. The conditions facing libraries are now changing, calling for a reassessment of the usefulness over the long

term of our current specializations. In fact, because the boundaries between types of librarians have been drawn so clearly, the current division of labor in academic libraries may actually be making it more difficult to conceive of appropriate strategies for the future.

At the very least, adapting successfully to current demands will require new competencies for librarians, and I have made the case elsewhere that librarians must move beyond basic computer literacy to "IT fluency"—that is, an understanding of the concepts of information technology, especially applying problem solving and critical thinking skills to using information technology.[34] Raising the bar of IT fluency will be even more critical for metadata specialists, as they shift away from a focus on metadata production to approaches based on IT tools and techniques on the one hand, and on consulting and teamwork on the other. As a result of the increasing need for IT fluency among metadata specialists, they may become more closely allied with technical support groups in campus computing centers. The chief challenges for metadata specialists will be getting out of library back rooms, becoming familiar with the larger world of university knowledge communities, and developing primary contacts with the appropriate domain experts and IT specialists.

If as Choo suggests with his notion of a "knowledge pyramid," being a librarian will require more active participation in the university's knowledge communities, librarians will also need to have a deeper understanding of where scholars turn for information. In their article on knowledge creation and social networks, Cross, assistant professor at University of Virginia's McIntire School of Commerce, and others note that "improving efficiency and effectiveness in knowledge-intensive work demands more

than sophisticated technologies—it requires attending to the often idiosyncratic ways that people seek out knowledge, learn from and solve problems with other people in organizations."[35] Their research into social networks builds further evidence that working relationships and personal contacts are enormously important to the ways people obtain information and learn. Cross and his team found four features that promote effective knowledge sharing: (1) knowing "who knows what" and thus who to seek out for information; (2) having timely access to those individuals; (3) the willingness of those sought out to actively engage with information seekers; and (4) enough trust in working relationships to facilitate creativity and learning.[36]

It is easy to see the value of metadata specialists' becoming more involved in the university's knowledge communities; of all people, they know how to acquire and organize information into systems and structures and to enhance the accessibility and quality of information. As portals like the NSDL and VIVO become more commonplace, it will become more important for metadata specialists to apply their expertise beyond documents or information objects to codifying the expertise of the university community itself. This will require new developments in metadata. Along these lines, one field in which metadata specialists might become more involved in the future is mapping knowledge domains, with the goal of revealing the structure of a discipline or research network.[37]

The dominance of the Internet and astounding progress in information technologies have led to serious competition for the attention of the university's information seekers, some of whom feel they no longer need libraries, library collections, or librarians. So long as we continue to define ourselves by our specializations (e.g.,

reader services vs. the "back room"), and to focus internally on library collections and buildings, we risk being marginalized at about the speed with which information seekers' preferences continue shifting from traditional library collections to online, more dynamic, and collaborative information environments.

Being a librarian must change as the nature of information-seeking changes. Now, at the beginning of the twenty-first century, the hardships that libraries are experiencing may be viewed as opportunity costs wrought by the Internet, widespread personal computer use, and online information industry competitors (like Amazon.com and Google) that were able to take advantage of new means to meet the needs of information seekers. What is happening is a natural evolution, in accordance with the forces of a free market, in which information seekers gravitate to the offerings that best meet their needs and expectations.

It is true that university research libraries face an enormous challenge positioning themselves in the online information market. At the same time any library can differentiate itself from its online information industry competitors, provided it clearly identifies the needs of its communities, provides services valued by those communities, and makes its staff and services visible. Metadata is key to empowering information seekers and to building scholarly information access systems that are easy to use. Metadata expertise is a sustainable strategic advantage that libraries can and should embrace and promote to faculty and other members of the university community. Metadata specialists are well positioned to make worthwhile contributions to the university communities they serve, provided they seize opportunities to contribute their

expertise to the larger information network processes of the university—that of

transforming mere "information" into knowledge, insight, and action.

Notes

1. Horace Kephart, "Being a librarian," *Library Journal* 16, no. 11 (November

1890): 330.

2. Dennis Stephens, *Being a Librarian: Multi-tasking at the Reference Desk, ca.

1890*, a multimedia play for voices in one act, based on Horace Kephart's article.

http://www.faculty.uaf.edu/ffdjs1/being18_integ.html (September 25, 2004)

3. Kephart had a distinguished library career before moving on to even greater

fame as an author, woodsman, and advocate for the establishment of the Great Smoky

Mountains National Park.

4. Charles Henry Hull, "Subject catalogues in college libraries," *Library Journal*

15, no. 6 (June 1890): 167.

5. Ernest C. Richardson and W.F. Poole, "Being a librarian," *Library Journal* 15,

no. 7 (July 1890): 202.

6. *The 2003 OCLC Environmental Scan: Pattern Recognition* (Dublin, OH:

OCLC Online Computer Library Center, 2004), 101-2.

7. Chun Wei Choo, *Information Management for the Intelligent Organization: the

Art of Scanning the Environment*, 3rd ed. (Medford, NJ: Information Today, 2002), 224.

8. Chun Wei Choo, *The Knowing Organization: How Organizations Use

Information to Construct Meaning, Create Knowledge, and Make Decisions* (New York:

Oxford University Press, 1998), xii.

9. Choo, *The Knowing Organization*, xiii.

10. Choo, *Information Management for the Intelligent Organization*, 238.

11. Choo, *Information Management for the Intelligent Organization*, 158.

12. Cliff Lynch, "Colliding with the real world: heresies and unexplored questions about audience, economics, and control of digital libraries," in *Digital Library Use: Social Practice in Design and Evaluation* (Cambridge, MA: MIT Press, 2003), 196.

13. In 2002/03, I was part of a Cornell library team that engaged in more than a dozen data-collection initiatives and produced a report on "Models for Academic Support" (MAS2010) for the Mellon Foundation. In general, the purpose of the project was to explore restructuring of information services in higher education to better fit the needs of the twenty-first century university. "MAS2010: Models for Academic Support" Final Report to the Mellon Foundation, Part I, November 24 2003, Cornell University Library, http://www.library.cornell.edu/MAS/MAS2010%20Final%20Report.pdf (September 26, 2004).

14. Cornell University Library, "Faculty Grants for Digital Library Collections: Advancing E-Scholarship" http://dcaps.library.cornell.edu/facultygrants/ (October 10, 2004)

15. William Y. Arms, Diane Hillmann, Carl Lagoze, Dean Krafft, Richard Marisa, John Saylor, and Carol Terrizzi, and Herbert Van de Sompel, "A spectrum of interoperability: the Site for Science prototype for the NSDL," D-Lib Magazine 8, no.1 (January 2002). http://www.dlib.org/dlib/january02/arms/01arms.html (October 10, 2004)

16. Cornell University, "VIVO: Virtual Life Sciences Library" http://vivo.library.cornell.edu/ (September 26, 2004)

17. "Convenient Business Hours Study" (internal report, Cornell University Library, 2003) http://www.library.cornell.edu/iris/hours/databook/ (October 10, 2004)

18. Amy Friedlander, *Dimensions and Use of the Scholarly Information Environment: Introduction to a Data Set Assembled by the Digital Library Federation and Outsell, Inc.* (Washington DC: Digital Library Federation and Council on Library and Information Resources, 2002). http://www.clir.org/pubs/reports/pub110/contents.html (October 10, 2004)

19. For a recent survey of library practices with respect to information commons, see Leslie Haas and Jan Robertson, "The information commons," *ARL SPEC Kit* 281 (July 2004)

20. *LibQUAL+ Spring 2003 Survey: Institution Results: Cornell University* (Washington DC: Association of Research Libraries/Texas A&M University, 2003), 27.

21. "An Integrated Framework for Cornell University Library Digital Collections: High-Level Requirements and Internal Implementation Issues" (internal report, Cornell University Library, 2004).

22. Li*bQual+ Spring 2003 Survey*, 22.

23. Some well-known examples of learning managements systems are Blackboard, called "CourseInfo" at Cornell (http://www.blackboard.com/), and WebCT (http://www.webct.com/).

24. S.R. Ranganathan, *The Five Laws of Library Science* (Madras, Madras Library Association, 1931).

25. ibid

26. "Organizing intellectual access to digital information: from cataloging to metadata," chapter 5 in *LC21: A Digital Strategy for the Library of Congress* (Washington DC: National Academy Press, 2000), 6.

27. Herbert Van de Sompel, Sandy Payette, John Erickson, Carl Lagoze, Simeon Warner, "Rethinking scholarly communication: building the system that scholars deserve," *D-Lib Magazine* 10, no. 9 (September 2004). http://www.dlib.org/dlib/september04/vandesompel/09vandesompel.html (October 10, 2004)

28. *LC21,* chapter 5, 15.

29. William A. Wulf, "Higher education alert: the information railroad is coming," *EDUCAUSE Review* 38, no. 1 (January/February 2003): 16. http://www.educause.net/ir/library/pdf/erm0310.pdf (September 27, 2004)

30. Joseph M. Brewer, Sheril J. Hook, Janice Simmons-Welburn, and Karen Williams, "Libraries dealing with the future now," *ARL Bimonthly Report* 234 (June 2004), 7. http://www.arl.org/newsltr/234/dealing.html (September 27, 2004)

31. Brewer et al., 4.

32. Brewer et al., 7.

33. William Y. Arms, "Automated digital libraries: how effectively can computers be used for the skilled tasks of professional librarianship?" *D-Lib Magazine* 6, no. 7/8 (July/August 2000), 9. http://www.dlib.org/dlib/july00/arms/07arms.html (October 10, 2004)

34. Karen Calhoun, "Technology, Productivity and Change in Library Technical Services " (paper presented at the annual meeting of the Potomac Technical Processing

Librarians, Johns Hopkins University, October 4, 2002), Slide 8, speaker notes.

http://www.lib.virginia.edu/ptpl/Calhoun_files/frame.htm (September 26, 2004)

35. Rob Cross, Andrew Parker, Laurence Prusak and Stephen P. Borgatti, "Knowing what we know: supporting knowledge creation and sharing in social networks," *Organizational Dynamics* 30, no. 2 (November 2001), 101.

36. Cross et al., 102.

37. See for example Howard D. White, Xia Lin, Jan. W. Buzydlowski, and Chaomei Chen, "User-controlled mapping of significant literatures" (paper presented at the Arthur M. Sackler Colloquium of the National Academy of Sciences, "Mapping Knowledge Domains," Irvine, CA, May 2003). *Proceedings of the National Academy of Sciences* 101, suppl. 1 (April 2004).

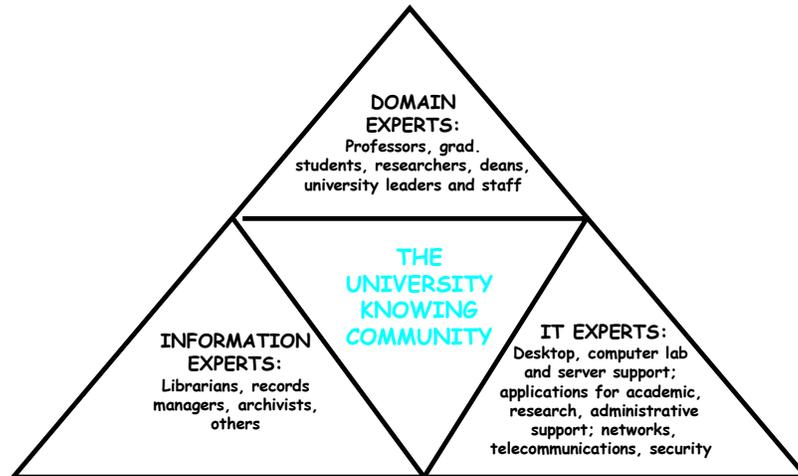**Figure 1. Knowledge Pyramid of the University Community**

DOMAIN
EXPERTS:
Professors, grad.
students, researchers, deans,
university leaders and staff

THE
UNIVERSITY
KNOWING
COMMUNITY

INFORMATION
EXPERTS:
Librarians, records
managers, archivists,
others

IT EXPERTS:
Desktop, computer lab
and server support;
applications for academic,
research, administrative
support; networks,
telecommunications, security

Table 1. Challenges Facing Traditional Library Cataloging

Challenge	Remarks
Affordability and Scalability	- Catalog records characterized by great precision, detail, professional intervention (expensive) - Rapid growth of Web resources and digital objects of value to university community - Need more than descriptive metadata—rights, technical, administrative, linking, etc. - Interoperability issues
Competition for Resources to Develop New Library Services	- Shrinking technical services departments - Streamlining technical services workflows; restructuring of technical services operations - Increasing use of external sources of data (e.g., from vendors); automated cataloging methods
Changes in Information-Seeking Behavior	- Preference for online information - Reliance on simple keyword searching - Decline of subject searching - Expectation of seamless linking (from one information object to another)
Availability of Catalog Librarians	- LIS schools not teaching cataloging - LIS graduates not choosing cataloging - Graying of the library profession (demographics)
Significance of the Catalog	Catalog is one part of larger infosphere
Future of Individual Library Catalogs	- Less emphasis on one catalog per library - Shift toward multiple catalogs appearing as one catalog; catalogs shared across institutional boundaries; catalogs interwoven into the Web (e.g., Open WorldCat, RedLightGreen)

Table 2. Information Forecasts and Implications for Metadata Specialists

Forecast	Implications for Metadata Specialists
Increasing investment by libraries in access systems	Help build new kinds of systems for information retrieval and dissemination; many new kinds of metadata; increasing emphasis on metadata re-use, interconnections, interoperability. Continued rise in automated cataloging using vendor/publisher-supplied data.
Being a librarian means active participation in the university knowledge community	Blurring of lines between what is library "technical service" and what is public service, collection development, or IT; project and team-based work environment; increasing outreach by metadata specialists; involvement in wide array of projects on and off campus; more metadata consulting work and less production work; may become more closely allied with technical support groups in campus computing centers; continued decrease in library/information science professionals with traditional cataloging duties
Technology-driven research, teaching, and learning	Need for "information fluency" among information seekers and "IT fluency" among librarians, especially metadata specialists. Increasing involvement in large-scale digital library research and development projects
Disintermediation and user self-sufficiency	Catalog librarians have always served those who wish to work autonomously; metadata specialists will enhance ease of use of information systems through similar but expanded means—expertise in indexing, data organization and management, access vocabulary, taxonomies, ontologies, etc. Rising need for understanding of visualization and other techniques to support browsing. Increasing use of metadata to enable linking of wide variety of information objects
Global infosphere, Web-based information, and multimedia	Metadata specialists will develop/lobby for standards and best practices, but proliferation of systems and object types will continue; greater need for integrating frameworks and interoperability tools