First Update Supplement

Encyclopedia of Library and Information Science

SECOND EDITION

Edited by

Miriam A. Drake

Encyclopedia of Library and Information Science

Second Edition

First Update Supplement

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Miriam A. Drake

Georgia Institute of Technology, Atlanta, Georgia, U.S.A.

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Preface

The second edition of the *Encyclopedia of Library and Information Science* represents a dynamic database aimed at describing both history and the state of the art in libraries, library science, information science, and applications of information technology. The print edition appeared in four volumes in 2003. It quickly became established as a respected and valuable reference resource. This supplement contains articles added since 2003 and includes new material as well as updated entries.

The material contained in this volume includes many elements relating to library operations, information access and processing, information literacy, and information science. New processes, new developments, and new ways of disseminating, accessing, and analyzing information create the exciting and transformational aspects of the field. This supplement provides valuable resources for people in the field as well as people wanting to learn about the field.

This supplement contains articles on libraries in Canada, Eastern Europe, Germany, and Japan as well as the British Library. Articles of special importance to the field today are: ''Digital Object Identifier (DOI®)'' by Norman Paskin; ''CrossRef'' by Amy E. Brand; ''Institutional Repositories'' by Joseph Branin; ''SFX'' by Jenny Walker; and ''Video on Demand—The Prospect and Promise for Libraries'' by Grace Agnew.

I thank the Editorial Advisory Board for their help in refereeing entries, recommending topics, and recommending authors. I appreciate Susan Lee, a valuable colleague who contributes to the *Encyclopedia of Library and Information Science* in many ways, making it a superior resource.

Miriam A. Drake
Editor

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Academic Libraries in Canada

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INTRODUCTION

Canadian academic libraries developed within the operational contexts of their parent colleges and universities. They contain rich historical collections dating from 1632, collections related to native peoples, and developing digital collections. Responsibility for higher education rests with the provinces and territories of Canada to form a distributed system of education libraries. Academic libraries collaborate through national and regional associations.

Canadian libraries have made substantial investments in information technology and actively participate in a national system of electronic information delivery.

ACADEMIC LIBRARIES IN CANADA—ACADEMIC AND RESEARCH LIBRARIES

The article on research libraries in the first edition of this encyclopedia notes that ''the term research, applied to a library, describes the function of the library more than the source of its support—university, college, or public (municipal) funds... The function of a research library is to collect and make available for use all the material[s] on a given subject or range of subjects.''[1]

Academic libraries may or may not be great research libraries but they are university libraries, supporting the education of students and the research and teaching needs of the faculty on a particular campus. A number of Canadian academic libraries are also great research libraries by international standards; the terms ''academic'' and ''research'' in relation to libraries tend to be used interchangeably in describing university libraries of status. For example, the organizations the Canadian Association of Research Libraries (CARL) and the Association of Research Libraries consist of academic libraries.

HISTORICAL DEVELOPMENT OF CANADIAN UNIVERSITIES AND COLLEGES—THE FIRST LIBRARIES

Academic libraries in Canada developed historically within the context of the universities and colleges they supported. In the course of their development, these libraries frequently incorporated collections and traditions older than the university itself. For example, the Library of Université Laval contains items from the Bibliothèque de la Mission Canadienne des Jésuites, 1632. Laval University, established in 1852, has its origin from an earlier institution, the Séminaire du Québec.

Therefore among the oldest major universities and housing libraries with rich historical traditions and collections are the University of Toronto (Ontario)[a] and McGill University (Montreal) Quebec.[b] The University of Toronto, with the most extensive library in Canada, was founded in 1827 as the Anglican King's College of York. It was secularized and its name was changed to the University of Toronto in 1849. Montreal businessman and philanthropist, James McGill, bequeathed support to found the Royal Institution for the Advancement of Learning in 1813, but political and litigious controversies of the time delayed its establishment. It was only by engrafting the Montreal Medical Institution as the first faculty of McGill that the university became incorporated in 1821. Therefore it might be argued that the first university library in Canada was a medical library.

Canada's Maritime provinces (Newfoundland, Nova Scotia, New Brunswick, and Prince Edward Island) are the home of a variety of institutions of higher learning—with two major universities: Dalhousie and Memorial. Dalhousie University (Halifax), Nova Scotia, the oldest university in the Maritimes, was founded in 1818 by the Ninth Earl of Dalhousie, but did not begin to function as a university until 1863. A number of smaller academic institutions in the Maritimes began later in the 19th century: Acadia University, founded as Queen's College in 1898; the Université de Moncton (Moncton), New Brunswick, a francophone university, traces its origins to the Collège Saint-Joseph, 1864; and Mount Allison University (Sackville), New Brunswick, was founded in 1843 as Mount Allison Weslyan College. The University of New Brunswick (Fredericton), New Brunswick, originated as the Provincial Academy of Liberal Arts and Sciences in 1785. Memorial University (St. John's),

[a]For a complete history see Ref. [2].
[b]For a complete history see Ref. [3].

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Newfoundland, was founded in 1925 as Canada's most eastern university, located in the last province to join Canada in 1949.

The province of Ontario, Canada's most populous province, includes the University of Toronto as well as other major universities. Other early Ontario universities are Queen's University (Kingston), founded by the Church of Scotland in 1839; the University of Ottawa (Ottawa), founded in 1848 as the College of By-town; the University of Western Ontario (London), founded in 1878 as the Western University of London; and the University of Windsor (Windsor), which originated as Assumption College founded in 1857. The University of Guelph (Guelph) was created out of the Ontario Veterinary and Agricultural College beginning in 1888. Carleton University (Ottawa) originated as Carleton College[c] in 1942. The expansion of the 1960s witnessed two new colleges: Brock University (St. Catharine's) in 1964 and Trent University (Peterborough) 1963. Two largely undergraduate universities in northern Ontario are Laurentian University (Sudbury), created from the University of Sudbury in 1957, and Lakehead University (Sault St. Marie).

In the province of Quebec, the early history of the development of universities is connected to the history of the Catholic Church. Université Laval (Quebec City), Quebec, was founded in 1852. The Université de Montréal (Montréal), founded in 1878 as a branch of Université Laval, received its parliamentary charter in 1920. The Université de Sherbrooke (Sherbrooke), the youngest university in Quebec, began in 1954. In 1963, Quebec created the Québec Commission Royale d'Enquête sur l'Enseignement dans la Province du Quebec.[5] This study, known as Report of the Parent Commission, resulted in the establishment of the l'Université du Québec System in 1968, providing a system of university education across the province (Trois-Rivières, Chicoutimi, Hull, Rimouski) and a consolidation of collections from the Collège Sainte-Marie, Ecole Normale Jacques-Cartier, and the Ecole des Beaux-Arts to form the Library of the Université du Québec à Montréal. The Parent Commission also recommended the incorporation of two Montreal colleges, Loyola and Sir George Williams, to form Concordia University in 1974.

In Western Canada, the University of Alberta (Edmonton), Alberta, was founded in 1906; the University of Calgary (Calgary), Alberta, was established in 1945 as a branch of the University of Alberta, becoming a university in its own right in 1966; Brandon University (Brandon), Manitoba, was established in 1899; the University of Manitoba (Winnipeg), Manitoba, established in 1877 is Western Canada's first university; the University of Saskatchewan (Saskatoon), Saskatchewan, was established in 1907; the University of Regina (Regina), Saskatchewan, founded as a college of the University of Saskatchewan in 1925, became an independent institution in 1974; Simon Fraser University (Burnaby), British Columbia, was founded in 1965; and the University of Victoria (Victoria), British Columbia, has origins going back to 1903 as a college affiliated with McGill University, and became a degree-granting institution in 1963. A provincial university was proposed for British Columbia as early as 1877, but its implementation was delayed because of political rivalry between Vancouver Island and the mainland. In 1899, Vancouver College, also affiliated with McGill University, was established and, in 1906, this became McGill University College of British Columbia, becoming the University of British Columbia in 1908.

This brief review of the evolution of universities in Canada presents the context in which Canadian higher education evolved, and with it the libraries to support these institutions. None of these institutions made elaborate provision for libraries in support of their programs. The University of Alberta is symptomatic of developments across the nation. When the University of Alberta was established in 1909, the provincial Premier at the time, A. C. Rutherford, wrote to request gifts of books from, among others, the premiers of the provinces of Quebec and Manitoba as well as the Canadian High Commissioner in London, Lord Strathcona.[6] First came the university, then, almost as an afterthought, the library. In many ways, the history of academic libraries in Canada has continued to demonstrate the ''rattrapage'' philosophy—during which the library prospers when enrolment increases and research intensifies. Only a handful of academic libraries in this country maintain strong collections that are not linked to current user needs. However, all of these institutions are committed to their heritage collections and maintain archives on the history of the institution and the library.

THE POLITICAL CONTEXT OF CANADIAN ACADEMIC LIBRARIES

The Constitution of Canada (1867) delegates to the provinces of Canada the responsibility for education with a resulting system of autonomous educational institutions across 10 provinces and two territories of Canada. Each province has a Minister of Education and usually a Deputy Minister, but a similar post does not exist at the federal level. Higher education is almost exclusively public. Most universities are increasingly controlled by their provincial governments, which contribute the larger

[c]For a complete history see Ref. [4].

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percentage of financial support to the universities. Student fees (regulated by provincial governments), research grants, and private giving provide the remaining support. Academic services are negotiated between federal and provincial partnerships, and by strong nongovernmental associations such as the Association of Universities and Colleges in Canada.

Canadian academic libraries are colored by these decentralized provincial education policies, and by two other unique aspects of the Canadian heritage—bilingualism and the presence of an aboriginal culture that is making itself felt in political and educational matters, especially in the west. Canada is a bilingual country, and one of its provinces, Quebec, is French-speaking by law. Recognizing the need to provide bilingual library resources, La Bibliothèque de l'Université Laval has developed a ''Répertoire de Vedettes-Matière'' (RVM), a subject thesaurus for cataloguing, which has been adopted as a national standard by the National Library of Canada, the Bibliothèque Nationale du Québec, the Bibliothèque Nationale de France, and the Bibliothèque Nationale de Luxembourg.

Academic libraries in Canada support programs in aboriginal studies and in other areas relevant to the study of native people, such as Canadian studies. Academic libraries in Western Canada are particularly noteworthy in this area. The University of Saskatchewan's Aboriginal Portal provides access to photographs, online documents, and full text of native law cases retrospective to 1763 and includes historic photographs. The University of Alberta Learning Resources, in support of its School of Native Studies, provides full text and links to recommended web sites, and also includes digital versions of Métis Scrip Records. Numerous academic libraries have developed lists of selected references on the Native People of Canada, such as those available at the University of Manitoba Elizabeth Dafoe Library, McGill Libraries, and the University of Regina. A growing interest in this area is the digitization of historic collections relative to Native and Canadian studies programs. In the Government of Canada's Aboriginal Digital Collections project, 30 web sites were created by aboriginal youth, featuring significant Canadian aboriginal materials. The oral tradition of aboriginal culture benefits from the digital era through the use of multimedia in capturing native songs and spoken (oral) histories.

Canadian academic libraries have organized themselves into strong regional associations that cover the map of Canada, from west to east. These are as follows:

- The Council of Prairie and Pacific University Libraries (COPPUL)
- The Ontario Council of University Libraires (OCUL)
- The Conférence des Recteurs et des Principaux des Universités du Québec (CREPUQ)
- The Council of Atlantic University Libraries (CAUL).

The COPPUL is a consortium of 22 university libraries located in the provinces of Manitoba, Saskatchewan, Alberta, and British Columbia. Member libraries ''cooperate to enhance information services through resource sharing, collection purchasing, document delivery, and many other similar activities.''[7]

The Ontario Council of University Libraries (OCUL) is a consortium of 19 university libraries in the province of Ontario. These 19 Ontario libraries, like those of COPPUL, ''cooperate to enhance information services through resource sharing, collection purchasing, document delivery, and many other similar activities.''[8]

The CAUL/Conseil des Bibliothèques Universitaires de l'Atlantique (CBUA) consists of 17 member institutions located in the provinces of Eastern Canada—Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland.[9]

The Quebec university libraries are coordinated through the CREPUQ in a Sous-comité des bibliothèques. In 1969, the rectors of the Quebec universities adopted a plan for the improvement and coordination of the Quebec university libraries and, in 1972, an office of libraries with a full-time coordinator was established under the umbrella of CREPUQ. Membership consists of the 12 directors of university and special libraries in Quebec, the Bibliothèque Nationale du Québec, and the City of Montreal Library. With its history of more than 30 years, the CREPUQ Sous-comité des bibliothèques is the oldest regional academic library collective in Canada.[10]

These four regional consortia have proven most effective in fostering a strong collaborative culture at a regional level, resulting in shared resource acquisition that greatly intensified with electronic site licensing. It should be noted that the existence of these four regional cooperatives preceded the advent of electronic site licensing initiatives, although today much of their activity is focused on licensing agreements.

At a national level, the CARL/L'Association des Bibliothèques de Recherche du Canada (ABRC)[11] was established in 1976 and consists of 27 university libraries plus the National Library of Canada (Ottawa) and the Canada Institute for Scientific and Technical Information (CISTI). CARL/ABRC has three basic goals:

- To provide organized leadership for the Canadian research library community in the development of policies and programs that maintain and improve the cycle of scholarly communication
- To work toward the realization of a national research library resource-sharing network in the areas of collection development, preservation, and access
- To increase the capacity of individual member libraries to provide effective support and encouragement to

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postgraduate study and research at national, regional, and local levels.

The Canadian Association of Research Libraries has played a leadership role in organizing the Canadian academic library community. Priorities include copyright, federal funding of libraries as a component of Canadian research and innovation, and the provision of information resources through collaboration (see the Canadian National Site Licensing Project, CNSLP). Membership in the Canadian Association of Research Libraries is limited to libraries of Canadian universities with doctoral programs in the arts, sciences, and social sciences, or to other research institutions approved by the membership.

THE EVOLUTION OF CANADIAN ACADEMIC LIBRARIES

In their evolution, Canadian academic libraries have been aided by a large number of studies and reports; not all of these reports have enjoyed governmental support and recognition. Those that have been initiated by government or official bodies such as the Association of Universities and Colleges in Canada appear to have created a larger impact in the improvement of academic libraries. As early as 1930, a grant from the Carnegie Corporation provided the financial resources for a comprehensive study of Canadian libraries by the Commission on Libraries, chaired by John Riddington, the Librarian of the University of British Columbia and the President of the newly formed Canadian Library Association.[12]

Included in this comprehensive study was a chapter on university libraries that documented the situation in libraries in the **23** universities of the then Dominion of Canada. Noting their variety, this report documented ''the aristocratic English and the theologically controlled type of French universities...'' (p. 123) as well as the great variation in institutional size. The libraries of these institutions reflected the same wide variation, and noted that ''while there are some Canadian universities that thus recognize the place of the library in higher education, there are others that are far from being fully awakened to this realization.'' (p. 125). The lack of reliable data on academic libraries is also noted. The commission's report is descriptive of those university libraries that bothered to provide data, and concludes with the observation that ''the whole subject is one that would well repay careful study and record...'' (p. 132). If the number of subsequent studies is an indication, this recommendation was certainly taken seriously, although not immediately acted upon.

As Canada became a country with an increasing awareness of its cultural and scholarly role, a number of studies exploring the humanities in Canada were made.[13–16] These studies, perforce, considered library support for scholarship in the humanities, and recommended over and over again that academic libraries needed to be strengthened if Canadian humanities scholarship was to flower. Many studies and consultants' reports at both the provincial and institutional levels were also completed as libraries continued to scrutinize their ability to serve scholarly and research needs on their campuses.

A visionary, yet cautionary, approach to the ways in which the emerging information technologies could be harnessed to provide increased support to humanities scholarship was proved by W. Kay Lamb, Canada's first National Librarian.[17] Dr. Lamb envisioned stronger resource collaboration between academic libraries and the relatively new National Library of Canada. He speculated quite accurately on enhanced scholarly access to the nation's libraries through computer technology. His article still makes interesting reading for his insight as well as foresight; he cautions that access and electronic enhancements do not alone result in scholarship at a higher level: ''one aspect of the forward march of automation worries me. Scholars, especially young scholars, are becoming preoccupied with the mechanical aspects of research. The ease and relative cheapness with which copies can now be made and the speed with which data can be manipulated give them the impression that copying and manipulation in themselves accomplish something. They mistake turning wheels and checking cameras for real research and thought. Ease of copying does not eliminate the need to read, consider, and select; it merely postpones the evil day. I shall feel more cheerful about mechanical and electronic wonders when their existence and use begin to reflect more clearly in a rising standard in the results of research and in scholarly writing'' (Ref. [17], p. 10.).

An extensive study of library resources in Canadian academic and research libraries was prepared under the auspices of the Canadian Association of College and University Libraries, a section of the Canadian Library Association and the Association of Universities and Colleges in Canada and funded by the Canada Council and the Council on Library Resources (Washington, DC). Comprehensive, thorough, and accurate, the Downs Report,[18] as the study came to be known, provided valuable insight into all aspects of academic libraries in Canada at a watershed moment. The full force of information technology had not yet impacted upon libraries, although the potential for automation to improve library services was beginning to be understood. Furthermore, the mechanization of major indices beginning in science and medicine was underway. The 1960s was also a decade of unparalleled growth in Canadian universities—a burgeoning of student enrolment, and a doubling in the number of faculty members with the associated growth in

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research output. The period of the 1960s captured by the Downs Report demonstrates a strong belief in the value of higher education and, at the same time, a commitment to the decidedly Canadian value of universality of access.

Given the period of growth, optimism, and expansion in which the Downs Report was conceived, it is not surprising to find its proposals for action both ambitious and far-reaching. Downs interpreted ''resources'' in the broadest sense to mean collections, professional librarians, library buildings and library instructional programs, and other services. As Robert Downs notes, ''never before in their history have Canadian university libraries received the attention and support which have lately been accorded to them. But utopia for them is still far from being just around the corner'' (Ref. [18], p. 2). Robert Downs' remarks remain true 36 years later. The recommendations in his report address administrative organization in libraries, technical services and collection development, readers' services, physical facilities, personnel, financial support, library automation, interlibrary cooperation, and, most importantly, financial support. In this last group of recommendations, Downs recommended an additional appropriation of Can$150,000,000 for collections over the next decade, and an allocation annually of a minimum of 10% of the general university expenditure for library support. The Downs study took a strong stand regarding the primacy of collection development as the core value of the university library: ''Beautiful buildings, well-trained staffs, and the most modern cataloguing and classification, circulation, and reference systems can compensate only to a limited degree for the absence of strong collections'' (Ref. [18], p. 207.)

Following the appearance of the Downs Report, a conference, convened by the Association of Colleges and Universities in Canada and the Canadian Association of College and University Libraries—the sponsoring associations of Downs' work—met in Montreal to discuss the future of Canadian academic libraries envisioned in the report. Robert Blackburn, Chief Librarian of the University of Toronto, and Basil Stuart-Stubbs, University of British Columbia, prepared discussion papers.[19] A comprehensive and sustained evaluation of the implementation and impact of the recommendations of the Downs Report was not undertaken systematically; given the breadth and scope of the report, this is not surprising. Like other valuable library reviews both earlier and subsequent, the essential value of the report was in the visibility it created for the needs of the library in higher education and the way it illuminated the quite staggering library needs and their costs. It was left to the individual library director to deal with the level of implementation. In the words of Basil Stuart-Stubbs, ''to use a time-worn phrase, we librarians have a selling job to do, and here is where the Downs Report comes in. This document is the cornerstone for all of your individual arguments for the years to come and it will be your responsibility to make the best possible use of it'' (Stubbs, p. 20). The effectiveness of the Downs Report on improving Canadian academic libraries must be evaluated in terms of improvements in collections and services, and real growth did occur in libraries into the 1970s.

Economic conditions, at large, determine the general financial situation in universities, which, in turn, impact on support of the university library. By the 1970s, the development of Canada research libraries was again in jeopardy. Inflation was escalating annually and globally, Canadian academic research libraries purchase over 90% of their resources outside Canada, and the devaluation of the Canadian dollar, especially with respect to U.S. currency, was a serious factor.

A comprehensive academic study of financial restraint in libraries during the decade 1973–1983 was undertaken by Auster.[20] Auster recognized the sustained growth and expansion of academic libraries in the 1960s and early 1970s, and picks up on a period of financial constraint starting in 1973. Using information obtained from a questionnaire sent to libraries and data compiled annually by the Canadian Association of Research Libraries, Auster publishes her ex post facto research (her term) in 1991. The question posed by this work regarding whether library retrenchment is a cyclical phenomenon remains valid, if unanswered. ''How long will the cycle last?'' is the determining variable. The unfortunate consequence for Canadian academic libraries caught in the cycle of growth and retrenchment is the impact on the development of collections of depth and breadth in support of scholarly research.

By the 1990s, the Canadian academic library community had recognized that the combined force of retrenchment and the adoption of information technology in publishing and scholarly communication had brought academic libraries to a watershed. Working with the Association of Colleges and Universities in Canada, the Canadian Association of Research Libraries undertook a broad study on change and the future of academic libraries in the information age.[21] The report, broad in scope, embedded academic libraries within the entire university system, recognizing that libraries and their parent institutions had reached a critical juncture. It addressed a broad array of university sectors—scholars, administrators, librarians, university press directors, students, and learned societies, recognizing that these interest groups held the resources and the authority to ensure that Canadian universities were positioned in the emerging global knowledge network.

The report recommendations called for a response at the institutional and national levels—raising awareness of the issues and the need for change; promulgating best

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practices within small and large university libraries; developing reliable analytical tools based on standard statistical indicators; developing strong electronic communications infrastructure; and building a distributed digital library support for electronic publishing in universities, an appropriate copyright environment for products and users, and a review of the academic reward system. These recommendations were comprehensive, far-reaching, and ambitious.

In the 7 years since the appearance of ''The Changing World of Scholarly Communication,'' many of the developments that were proposed have been taking place at individual institutions and nationally. The recommendations calling for the creation of a distributed digital library, for example, witnessed truly significant advancements in those 7 years. Many university libraries are actually engaged in the creation of digital versions of their unique library collections, and are developing rich scholarly resources in digital form, supported in some cases through government grants at the federal and provincial levels. In this respect, the National Library of Canada/Bibliothèque Nationale du Canada has been formative through its Canadian Initiative on Digital Libraries program (see entry under National Library of Canada).

The recommendations of ''The Changing World of Scholarly Communication'' urged university librarians to work together to build a distributed digital library to provide access to electronic and networked information resources. As a result, academic libraries were positioned to act when the Canadian Foundation for Innovation (CFI) was announced in the Canadian federal budget in 1997, with an initial investment of Can$800 million. The purpose of this program, which continues to the present, is to invest in capital research infrastructure to provide Canadians with the tools needed to conduct high-level research and to stimulate creativity in research, to enhance Canada's role in the global knowledge society. Grants over a 5-year period provided a maximum of 40% of the capital costs of the research infrastructure in the nonprofit sector. An additional 40% was to come from the 10 provincial governments of Canada to support successful CFI applications ratified at the provincial level, thereby maintaining the delicate provincial/federal balance of powers and adequate guarantee for higher education as part of the provincial mandate. The remaining 20% was to come from other partners or agencies, including the institutions themselves and donors from the private sector.

The announcement of the CFI granting program created considerable excitement in the library community. Stressing cooperation and interinstitutional collaboration, the funding program seemed ideally suited to libraries. For decades, libraries had been aggressively collaborating through resource sharing, interlibrary loan, and, more recently, through organizing as consortia to obtain price advantages in licensing electronic information. Thus interinstitutional proposals from libraries seemed naturally suited for consideration under the CFI initiative.

However, initially, libraries were not viewed as eligible for participation. They were not viewed as part of the research and innovation community that the CFI program was targeting. Intensive discussion had to take place between CFI program officers, on one hand, and librarians, on the other hand, to create the necessary conditions for a library submission. These discussions took place both nationally and regionally. The Canadian Association of Research Libraries played a major role in encouraging dialogue and in transforming the situation to the benefit of libraries. A most compelling argument was that the information provided by university research libraries was essential to the research being conducted by universities. Therefore an 'information infrastructure' to support the research and innovation encouraged under CFI grants was ultimately seen as important by CFI granting officers and as acceptable for consideration. In the summer of 1999, the CFI announced the grant of Can$20 million to support the CNSLP.[22] This initiative, in which 64 Canadian universities are participating, licensed electronic versions of scholarly journals in science and technology, medicine, and the environment ,and provided electronic desktop access to the individual user at participating academic institutions.

INFORMATION RESOURCE DEVELOPMENT IN CANADIAN ACADEMIC LIBRARIES

The 29 member libraries of the Canadian Association of Research Libraries contribute data annually, allowing comparison between institutions and an analysis of quantitative developments in research libraries. For the latest year available, 2000–2001,[23] these institutions invested Can$196,181,175 million in library materials. For those libraries able to report their expenditures on electronic journals (23 of 29 libraries), a collective national expenditure of Can$25.3 million was reported (approximately 12% of the library material budgets). Canadian librarians are investing an increasing percentage of library budgets in electronic journals, and the trend toward electronic serials collections is well established.

Total collective volumes held by members of the Canadian Association of Research Libraries is 73,655,113, with a total of 496,759 current journals received. The University of Toronto Library has continued to outdistance all other Canadian research libraries in size and dollars invested in the library by the university. Larger than the National Library of Canada in its volume holdings, the University of Toronto recorded a total volume count of

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9,346,479, approximately 12% of the volumes held in all other research libraries.

Canadian academic libraries are changing the way in which their research collections are developed. Many are moving toward a new philosophy of collections management, as consortium purchasing and the acquisition of the entire output of a publisher replace individual selection of specific titles. The use of book approval plans is growing as well, deemphasizing individual book selection practices, although neither of these developments is replacing the role of the librarian. Rather, the practice of collection development is being extended to include collections management. Information technology has created new paths to providing clients with information that they require. Recent graduates of Canadian schools of library and information studies do not usually possess the in-depth subject skills of librarian subject specialists in collection development, although they are increasingly computer-literate and technologically proficient. The changing nature of the scholarly communication system and the digital revolution are profoundly altering Canadian research collections, and organizational changes in the management of academic libraries are accelerating.

At the same time, the legacy of important print collections and their continued growth has required imaginative answers to housing growing collections. A number of Canadian academic libraries are using offsite storage facilities. One of the most noteworthy developments in the area of storage is the University of Alberta's Book and Record Depository (BARD). This university facility began to serve as a regional resource center in 1995 when the COPPUL announced that BARD would serve as a depository center for other prairie university libraries such as the University of Calgary and the University of Regina.[24]

Information resource development has been challenged by the rising costs of publication. Between 1990 and 1999, the journal budgets of Canadian research libraries (CARL members) increased by a factor of 1.85, whereas the consumer price index increased by a factor of only 1.28. However, the costs of journals rose by a factor of 3.21, with a result that the actual power of Canadian libraries to purchase journals declined by 42% over this period.[25] Canadian academic libraries faced a harsh reality of rising costs of academic journals and were prepared to face this challenge by changes. They rallied to support the Association of Research Libraries Scholarly Publication Alternatives Research Coalition (SPARC) as early supporters, joining in numbers out of proportion to their U.S. counterparts. Their participation provided a firm foundation for the development of SPARC International. The crisis in scholarly communication is obviously not a uniquely Canadian problem and the solution will not be uniquely Canadian, but the Canadian commitment to a global solution is strong. Recognizing that SPARC plays an important role in helping academic libraries to craft new solutions, the Association of Universities and Colleges of Canada endorsed SPARC in 2000.

LIBRARIAN RECRUITMENT IN CANADIAN ACADEMIC LIBRARIES

Canadian library administrators are concerned about a lack of qualified candidates for senior administrative positions in academic libraries. This concern is based on the reality that almost one-half of academic librarians in North America will have reached the age of 60 years by

Rank	Canadian Salaries in $Can	Canadian Salaries (as expressed in $US)	Salaries of all ARL (US & Canadian) in $US)
Director	123,927	81,575	143,582
Associate Director	94,682	62,324	93,739
Branch Head	76,145	50,122	62,680
All positions	67,075	44,152	55,175
Under sup.	42,136	27,736	37,852

Fig. 1 Average Canadian academic librarian salaries in comparison with U.S. counterpart. (From ARL Annual Salary Survey, 2001–2002, Table 21, p. 44; Table 32, p. 59.)

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2015.[26] Attracting and retaining excellent staff is most challenging in Canada where librarians are allowed easy access to the necessary legal documents that permit them to work in libraries in the United States under the North American Free Trade Agreement, which exists between the governments of the United States and Canada. The opportunity to work for higher salaries in the United States attracts Canadian librarians and intensifies a growing recruitment issue in the North American academic library world. Canadian salaries are significantly lower, on the average, than those of their U.S. counterparts, as seen in the following table (Fig. 1).

Canadian librarian education and recruitment issues are influenced by developments throughout North America, but there are significant differences that characterize the Canadian market. More than half of those who graduate from Canada's seven schools of library and information science are 35 years of age or older, creating shorter career spans. Academic libraries are, on the average, older than other professionals, and also older than academic libraries in the United States.[27] Canadian library directors are also facing the question of whether a degree from a graduate program in library studies is an essential requirement for some professional positions in academic libraries. A recent research proposal[28] laments the lack of a substantial Canadian study of librarians' careers and librarian human resource needs in Canada and proposes a national study to address this issue.

COPYRIGHT AND CANADIAN ACADEMIC LIBRARIES

The Canadian librarian and academic communities work together to assure that Canadian intellectual property law reflects a balance of interests between the creator and the user of copyright material. The Canadian Association of Research Libraries has made a sustained effort to provide leadership in this area. Under Phase II revision of the Canadian Copyright Act (Bill C-32) 1967, this balance between owners of copyright works and the rights of those who need to access these works for private study and research was assured through the introduction of limited educational and library exceptions, known generally in Canada as ''fair dealings'' exceptions (28, 29.1, and 29.2 of the Canadian Copyright Act).

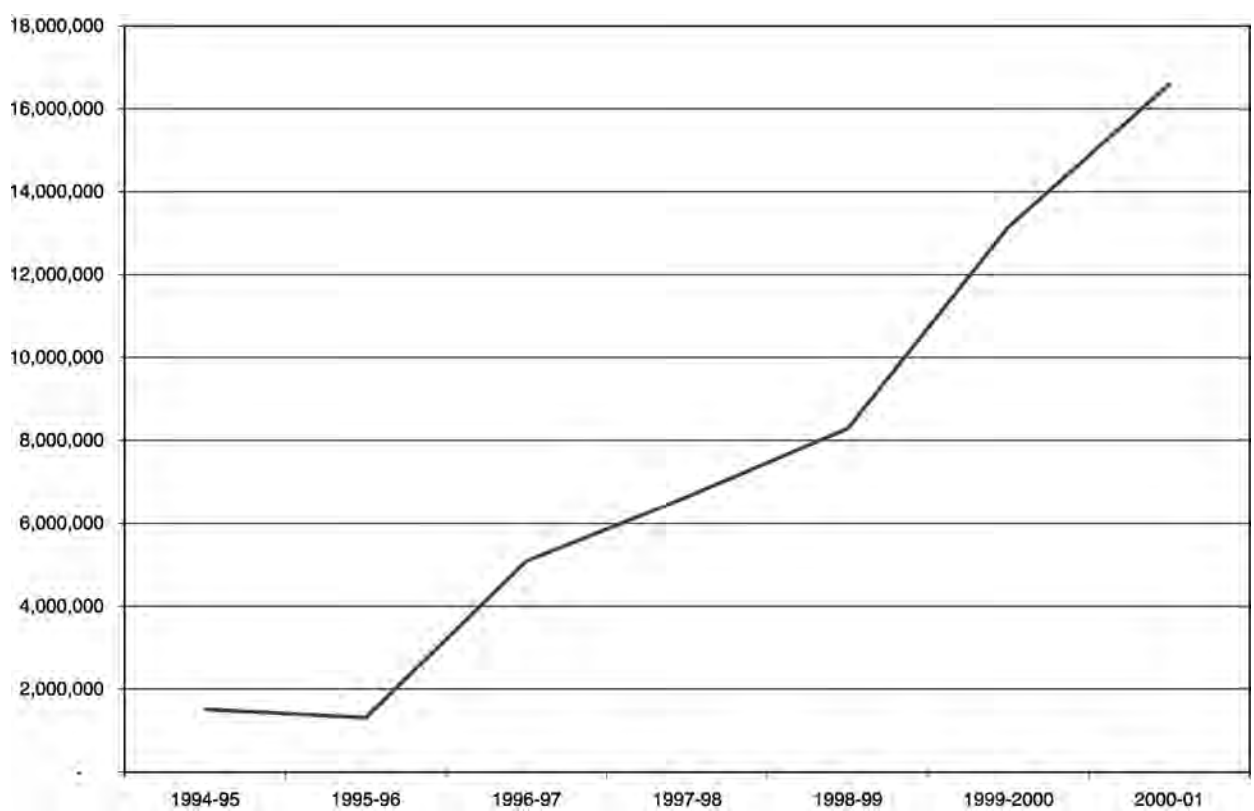

Fig. 2 Total electronic serials expenditures, 1994–2001 ARL libraries. (From Martha Kyrillidou and her staff at the Association of Research Libraries, Washington, DC.)

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As the use of information technology in scholarly communication and publishing proliferated in the past decade, academic librarians acted to protect these limited exceptions, believing that if access were reduced, Canada's research and cultural creativity would suffer. Canada is a signatory to the Treaty of Rome and to the Berne Convention, and is also a member of the World Intellectual Property Organization, and is committed to the extension of copyright protection to digital works. Canadian academic librarians continue to insist, through lobbying and other political activities, that Canadian copyright legislation should continue to include exceptions and limitations to the rights of the property holder. In insisting on the extension of ''fair dealing'' to works produced digitally, academic libraries take the same position that the same law should apply to copyright materials regardless of format.

The Canadian library platform on copyright has much in common with that of the Library Association (Great Britain) and the American scene, as articulated by the position taken by the Association of Research Libraries. The goal is to create ''a robust public domain of information... an essential foundation for an informed and participatory society.''[29] Open access to information created at public expense for all Canadians is a cornerstone of the copyright platform of Canadian academic librarians. An appropriate balance between rights of creators, copyright owners, and the public good remains a guiding principle.

CONCLUSION

The developments in information technology and the reliability of the Internet are revolutionizing research, teaching, and libraries in Canadian academic institutions. The convergence of library resources and teaching programs using information technology is changing the way in which librarians are working and professors are teaching. Some of the best libraries may be entirely online and users may never need to enter the physical space called the library, and the use of open electronic delivery platforms enables 24/7 access to researchers, scholars, and students. In Canadian academic libraries, the role of the librarian and information specialist is being transformed, and these developments are characteristic of libraries throughout the modern world.

Investment by Canadian academic libraries in digital information provides a clear picture of the accelerating speed at which the library is responding to the digital revolution. Using data from the Association of Research Libraries during the past 8 years for which information was collected, an analysis shows that the 13 Canadian academic research libraries which are members of the ARL increased their investment in electronic resources from 3.82% of the materials expenditures in 1993–1994 to 16.7% in 2000–2001.[d]

Collections budgets were growing at a far smaller rate and, clearly, electronic expenses have been underwritten by funds from print collections budgets. This, along with general austerity in library funding, has resulted in less depth of development in book collections. The upward trend in electronic resource development in all ARL members is shown in Fig. 2.

Canadian academic research libraries behave much like their American counterparts, but they are fewer in number and vary more in size, and any change is felt more acutely. As collections development becomes both more costly and complex, the role of the collections librarian is evolving to include many library management issues, including shared financial agreements, document delivery, and the integration of collections and access services.[e]

What is unique to the Canadian scene is the social value system that underscores universality of access to education. The social value of a national system of electronic information delivery has a special significance in a culture that places a high value on universality. Projects such as the Canadian National Site Licensing Initiative, which guarantee to small colleges the same array of scholarly publications that are available to major research universities, support not only improved access to information but also this fundamental social value of universality. However the challenge is the volatility of government support for higher education and the sustainability of library initiatives based on this support. Academic librarians are monitoring carefully global developments in licensing agreements as their responsibility of delivering information to users—especially in science, technology, and medicine—becomes increasingly reliant on costly and private commercial systems of information. At the same time, the history of the development of Canadian academic libraries described earlier in this article left a rich legacy of print collections that needs to be preserved and restored. Canadian academic libraries are at an important point in their evolution and librarians who work in these libraries are creating new services, approaching the future with optimism and confidence.

[d]I would like to express my great appreciation to Martha Kyrillidou and her staff at the Association of Research Libraries for her data analysis of Canadian members of ARL and for the graph that is reproduced in this article.

[e]For a full analysis of these issues, please see Ref. [30].

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Academic Libraries in Eastern Europe

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INTRODUCTION

Academic libraries in the former communist countries of Central and Eastern Europe have experienced a period of rapid and profound change during the last decade, in connection with the transformation in the political and economic structures, changes in territorial and administrative situations, as well as with the rapid development of information and communication technologies.

This article begins by examining the political, economic, social, and technological context within which academic libraries operate, and attempts to provide some insights into the complex and dynamic situation in these countries as well as the main developments and issues academic libraries are facing in Central and Eastern Europe.

This article covers the following candidate countries for membership to the European Union: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia. Some references have also been made to the states of former Yugoslavia and Russia. The term Central and Eastern Europe has been used in this article to refer to these countries.[a]

WHAT IS EASTERN EUROPE?

Several attempts have been made to define Eastern Europe as opposed to Western Europe, but there is yet no consensus on how to delineate the region and its parts. Geographical, political, economic, and social definitions exist, but these are open to interpretation. Concepts are also historically situated and they have a different charge in different historical situations.[1] There is no clear definition in published articles as to what authors mean with the term Eastern Europe. The terms Eastern Europe, East Central Europe, Central Europe, and Southeastern Europe, as well as Central and Eastern Europe, have been interchangeably used.

Some authors see Eastern Europe as synonymous with such terms as the Soviet empire, the Communist Eastern Europe, and the satellite countries. However, the phrase was already used before the establishment of Soviet dominance in the region. The idea of Eastern Europe was already fully crystallized in the interwar era when a whole series of new states appeared on the map as a result of the collapse of the great European empires during World War I and the region of ''independent Eastern Europe'' appeared. As is now common knowledge, prior to the end of the 18th century, Europe was not conceived of as being divided into east and west, but rather into north and south.[1]

Throughout the centuries, the troubled history of Central and Eastern Europe has resulted in different lumping systems. The famous English historian Alan Palmer called Eastern Europe ''the lands between,'' which means the countries between Germany and Russia.[2] However, a state could be filed under several different headings, depending on its current situation. At present, several systems of regional lumping predominate in this region depending on the criteria used: Central Europe, Eastern Europe, Central and Eastern Europe, Baltic countries, and the Balkans.[3] Documents of the European Union refer to associated Central and Eastern European countries (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia), but again, several scholars do not agree with this definition.[4]

However, the distinction between Western Europe and Eastern Europe is becoming less apparent with the majority of countries vying to become members of the European institutions.[5] At the same time, there is a need to recognize that processes of differentiation that have taken place in Europe since 1989 are leading to the formation of new regions. The problems and the points of departure for the individual countries in Europe after the collapse of Soviet domination were different in 1989, and the decisions that the peoples and the politicians of individual countries have made in the course of the past decade or so have produced a wide variety of results, ranging from authoritarian nationalism and civil war to fledgling democracy and prosperity.[6]

[a]The information is based on literature reviews and personal observations.

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ACADEMIC LIBRARIES AT THE PERIOD OF SOVIET DOMINATION

Political, Economic, Social, and Technological Context

This ''new territory'' of the European Union in 2010 is not homogeneous; it is very deeply differentiated in geographical, historical, political, economic, and social dimensions. The decades of Communist rule left their mark on the economics, political culture, and institutions of the region as a whole. In the political dimension, there are differences in the ability to develop the institutions of the state that should be simultaneously strong, small, liberal, and efficient. In the economic dimension, there are differences in the ability to promote the full cycle of economic transformation and to develop the deep roots of the capitalistic economy. In the social dimension, there are deep differences in the mental, educational, and professional structures of the societies and in their capacities to create and absorb innovations.[4]

However, keeping in mind these factors and other elements of differentiation, there are two common denominators that also stress the similarities in the past experiences of these 10 countries and the prospects for their future: first, the common experiences of the 45 years of real socialism; and, second, the common target to join the European Union. There is now a multitude of studies on the 10 accession countries, commissioned and promoted by different units of the European Commission. However, holistic approaches taking into account all valid dimensions and the prospects are still missing.[4]

Academic libraries have always operated as integral parts of the education and research process, taking over the major objectives of the respective universities and higher education institutions to which they belong.[7] In Central and Eastern Europe (CEE), they show, to a certain extent, the same characteristics because of the centralist information environment of the previous socialist rule.

Access to information

Academic libraries formed an important part of the state system of scientific and technological information in the former Soviet bloc countries. In general, they were highly valued institutional properties, both in the scientific and cultural sense, which used to receive financial support from the state.[8] To a large extent, the policies of the communist regimes were concerned with the flow of information and how it could be managed and controlled. A detailed policy dictating the political aims of a library regulated access to foreign literature and information and defined which libraries had and which should not have access to databases and information. The historical tradition, and the geographical and social environment in these countries, also played a role. For example, libraries in Prague, especially when they were situated very near the ruling power, had more easy access and connections to Western databases; Estonia was watched very carefully and suspiciously and more restrictions were made to Western information.[9]

Writers and authors were supported but their writings were published only if positively assessed by the state, i.e., the ruling party.[10] The government also controlled TV, radio, and telephone lines, making important and accurate information available only to intelligence services and the ruling Communist elites. Publicly available information was so intermixed with lies and propaganda that the citizens could hardly distinguish truth from falsehood. As a result, no one trusted public information.[11,12] However, libraries generally had a much better position in these countries as unique institutions of education and they presented one of the most important and prevalent elements of the educational and cultural system in these countries.[10]

Collections of libraries

In the past, the academic library was a rigidly centralized institution, which was responsible for collecting, preserving, and providing access to information and mainly orientated to expanding its collections.[8] They were comparatively well funded, with huge stocks and multiple copies of books including a large number of textbooks ''providing the right education in line with the party.'' However, world literature in general and literature in social sciences in particular were only sporadically present because of severe currency limitations as well as for ideological reasons. To acquire foreign books, hard currency was needed; to obtain the necessary currency, libraries had to fight.[7,9–11,13,14] Therefore the reputation of a library was quite often determined by its stock of foreign books. Because of poor technological infrastructure as well as for political reasons, the access to electronic information was limited. This was especially dramatic in medicine, which appeared in the beginning of the 1990s to be tens of years behind modern developments.[10,12]

Administration of libraries

Under this overall concept of educating the people in line with the aims of the party, academic libraries were administered in a similar way. Library systems were centralized. Centralization was based on legislation and order by the ruling power, not on professional cooperation. The aims and objectives of the administration were formulated in a so-called scientific manner by the ''methodological centers.''[9] Libraries and information services were

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working nearly always directly under the responsibility of the ministries. The on-line access to national and CEE databases as well as the information supply via other electronic means came under the strict control of the respective ministries. For example, in the Soviet Union, major research libraries in all republics, including the Baltic countries, had access via Republican Automated System of Scientific and Technological Information (RASNTI) to on-line databases of Moscow's All-Soviet Institute for Scientific and Technical Information (VINITI), which had access to Western databases via a Center at Vienna. The RASNTIs were parts of the State System of Scientific and Technical Information (GSNTI) of the Soviet Union and operated according to the same principles and uniform standards and regulations as did the Soviet Union. However, the role of the State System of Scientific and Technical Information should not be underestimated. It gave birth to the database and information generation industry; its programs allowed one to introduce the Universal Decimal Classification (UDC) into the practice of scientific–technical information centers and libraries, and to develop the automated system of the Union Catalog of Scientific–Technical Publications, which is still one of the largest functioning information systems in Russia.[14]

The overall feature of the whole system was the absolute lack of any market considerations or principles. Information was not recognized as a commodity and as a marketable service. A book in the previous Soviet bloc countries was a cultural value, not an economic good.[10]

International and technological isolation

During the years of totalitarianism, academic libraries suffered a long period of international isolation and a continuous diminution of their collections from an informative point of view.[7] The financial deficiencies, as well as the lack of professional connections with the international movement of librarianship, kept the academic libraries of CEE generally stuck in the old ways of action, and far from the big changes and modernizations that characterized the transfer of information in Western academic structures.[8,10] This isolation also influenced other activities of the libraries, such as the quality of services and personnel, and the quality of equipments and even the buildings.[7]

In the former Soviet Bloc countries, most information technology was unavailable, unaffordable, or discouraged for a long period.[15] The development of modern technologies was also blocked by the Coordination Committee on Export Control (COCOM), a body consisting of the NATO countries, Japan, and Australia, and whose policy prevented the Eastern bloc from obtaining western technology that could be militarily useful. Political factors also played a role as the military sector was given priority over the civilian sector and society at large. The state governments controlled information to limit freedom, and most of the computing effort was put into mainframe and minicomputer development, the access and use of which could be controlled by the authorities of the state.[12,16]

However, taking into consideration the diverse aspects of the existence of academic libraries in the CEE, we can draw the following conclusions:

- In the period of Soviet domination, there was no coherent and clear strategy for academic libraries.
- There was no policy for collection development in the network of academic libraries capable of reasonably and equally covering all fields of knowledge by using their internal and international sources.
- World literature was only sporadically present because of severe currency limitations, as well as for ideological reasons.
- The equipment of libraries was very poor.
- No unitary outlook was elaborated for the modernization and particularly for the automation of libraries.[7]

ACADEMIC LIBRARIES AT THE PERIOD OF TRANSITION

Political, Economic, Social, and Technological Context

The radical events in the former block countries in the beginning of the 1990s brought down the Iron Curtain and brought huge changes in every field. The countries of CEE changed their political systems from totalitarian to democratic. Going through similar political, economic, and social changes, most of these countries, regardless of their developmental level, have certain similarities:

- New political structures, new functions for state administration, opening of the mass media, and the process of integration into the structures of the European Union.
- Economic reforms, industrial and organizational restructuring, privatization, mass establishment of new private firms, liberalization and internationalization of the economy, and free-market principles that call for more entrepreneurial behavior.
- Extensive creation of new legislation in all spheres of life as a result of the political and economic changes and the need for compliance with and adoption of international standards.
- Development of the telecommunications infrastructure, introduction of the latest information and

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communication technologies (ICTs), and development of the information services industry.
- Adaptation of their education and training systems to the international standards.
- Exposure to the unprecedented availability of printed and electronic information sources and the ever-increasing number of end users who are conversant with the latest ICTs.[17]

However, the new democratic regimes were facing a number of serious challenges of a social, economic, and political nature. These appeared to be rather painful processes with many setbacks—social and political tensions, increased unemployment, decline of production, and unsatisfactory distribution of income.[17] Although there is a great degree of variation among the individual countries in CEE, with countries such as the Czech Republic, Hungary, and Poland fairing far better than Bulgaria or Romania, all of these countries have experienced severe economic decline in the early years of transition.[18]

According to several analysts, the transformation is slower than originally anticipated, and the transformation scene is deeply differentiated at the national, regional, and local levels.[4] However, Leif Pagrotsky, Minister for Trade of Sweden, has noted: ''Some still fail to realize that many of the candidate countries—not least the ones around the Baltic Sea—have rushed through a modernization process that has taken several decades for West Europeans to complete.''[19] It should be said that most of the countries of the region have somehow been able to cope with these challenges thus far, and the process of economic reforms in the region is progressing well.

Influence of Change on Academic Libraries

All these changes resulted in a dramatic shift in these countries, from shortage to abundance in information. It was obvious that improvement of the internal infrastructure was needed to become integral parts of the global information infrastructure. The new political order demanded a basic change of the organizational setup of academic libraries, a reevaluation of their services, and a reorganization of the (national/regional/local) information infrastructure.

The range of external influence on the libraries in general and academic libraries in particular covered political influences (the European Union, regional development, social inclusion, languages, users); economic influences (competition, sponsors, state share, information cost, borderless business, strategic alliances); social influences (aging population, cultural diversity, digital divide, environmental concerns, geographical differences, ubiquitous computing, workplace flexibility); juridical influences (Data Protection Act, copyright, freedom of information, licenses, standards); influences on the changes in the educational and cultural sphere (lifelong learning, professional knowledge, the role of libraries, structural changes).[20]

A row of conflicts and obstacles were pointed out, which negatively affected the main functions of academic libraries by several authors: politicization, the chronic lack of finance, poor information resources and underdeveloped library and information systems and networks, old premises and outdated equipment, expensive telecommunication infrastructure services, contradictions between the publication of literature and the requests of readers, conflict between the growing quantity of documents and the quality of access, and inflexible library work and methods. The lack of possibilities for the necessary continuous upgrading of the professional knowledge and skills also prevented information and library professionals from making bolder steps in pursuing their role. In several countries, the real potential for change has proved to be much smaller than expected.[7,8,13,17,21] The small number of professionally trained librarians and information specialists in several countries managed, with great difficulties, to run, maintain, and develop the complex and demanding information and library systems and networks. Being too few and professionally not strong enough, they could not have been more successful in lobbying and fighting for political, financial, and other necessary support they needed to initiate and carry out projects for improving the information and library sector.[17] However, it should also be noted that there was a great degree of variation among countries, with some countries fairing far better than others.

There are three main factors that have influenced the overall situation of academic libraries in CEE: 1) an ongoing process to restructure and reform the system of higher education; 2) changes in ICTs and information industry; and 3) globalization processes and networking.

Influences of Higher Education on Academic Libraries

Since the 1990s, higher education in CEE has undergone several extensive reforms including:

- Installing democratic principles and processes throughout the universities.
- Establishing a new legal framework providing for institutions of higher education, university autonomy, a new research infrastructure, the framework for quality assurance, and a differentiated higher education system.
- Eliminating previous restrictions in content and pedagogy.

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- Carrying out dramatic shifts in academic programs in response to changing student demand and the economic reality.
- Moving from the narrow Soviet degree structure to an award structure that is not only more flexible but is also consistent with Western models and increasing expectations for common structures across Europe and the world.[22–24]

Many reforms are still in progress and are influenced to a large extent by the aim of integrating into the European Union. The harmonization of higher education in Europe is perhaps the major political challenge for this decade influencing the structures of higher education in CEE. Thirty-one European ministers have signed the Bologna declaration in June 1999 and committed their governments and their countries to create a European Higher Education Area by 2010. The Ministers, including 10 countries of CEE, committed themselves to harmonize within 10 years the structures of their national higher education systems in a two-tier structure (undergraduate–postgraduate; bachelor–master). They have also developed a framework for the reform of their national education systems to create a European area of higher education—with comparable and readable academic degrees, a wider credit system based on European Credit Transfer System (ECTS), mobility of students between European universities, recognition of prior knowledge in a system of lifelong learning, European standards of quality assurance, and European collaboration (joint curricula, mobility schemes of students, and teaching staff). The Bologna Declaration has direct consequences on the profile and structure of the educational programs in CEE.[25]

More recently, we also realized the increase in the number of courses and programs offered on-line by many universities around the world, and an explosive growth in the offer of distance education. The concepts ''virtual university'' or ''e-university,'' as well as transnational alliances and networking between institutions for the purpose of jointly delivering on-line programs, also influence universities in CEE. Several conference presentations indicate that there is a growing interest in distance education in CEE.[26–29]

All these changes in higher education directly impact the growth and tasks of academic libraries, both from the qualitative and quantitative standpoint. The characteristic feature in many countries under CEE is a large increase in the number of students, which also have direct influence on the academic library. New universities have appeared, and existing ones have opened new faculties or colleges and have also developed new specializations in their educational systems. Unfortunately, all this changes has not been followed by a matching development of academic libraries, especially in terms of book storage developments and the number of seats in reading rooms, nor in the professional development of staff members of libraries and the increase in budget allowances provided for those libraries.[13,30] It seems that in all countries in the region, the university system at present attaches too minor an importance to libraries, and in consequence, their informative and formative potential are not properly valued.[17]

Influences of Information and Communication Technologies on Academic Libraries

Library automation

As early as the 1970s, several CEE countries showed serious interest in computerization and began experimenting with automation of information work. The main area was cataloging to avoid duplication of manual work. For example, in Hungary, MicroIsis was inevitably the most widespread system, with librarians paying early attention to conversion of records.[8] In Estonia, the first experimental computer system delivering information about technical inventions was developed in 1971 and the computerized union catalog of foreign books appeared in 1974. In the period 1971–1975, all republics of the Soviet Union, including the Baltic countries, had to develop their computerized systems of scientific and technological information coordinated by the center (in Moscow), and major research libraries had a role in it.[31] In the early 1980s, the computer center at Maribor University started to develop software for the production of bibliographic records. An on-line cataloging system—Cooperative On-line Bibliographic System and Services (COBISS)—emerged from this original software. The original COBISS system linked three Slovenian libraries in 1987 and became accepted as a system for cooperative cataloging between the national and university libraries in the six republics of the former Yugoslavia.[32]

However, the systematic transition to the modern information technology and automation of academic libraries in CEE started in the beginning of the 1990s.[8,20] Developments in libraries and their computer systems in these countries followed different patterns; the level of knowledge and expertise varied and was diverse in the region. Some libraries in certain countries were making rapid strides and were developing great local expertise. Other countries were slower in introducing automation and information technology.[33] In Romania, for example, in the beginning of the 1990s, a few automation experiments were carried out in the central university libraries and only in some of the higher-education libraries.[7]

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Several authors also report problems in automation in Polish academic libraries in this period.[13]

The main issues in the first half of the 1990s were how to choose an automated library system, how to write effective grant proposals, and how to document delivery as traditional print-based journals were gradually supplemented by full-text electronic access. Academic libraries were also concerned about bibliographic standards, without which the full benefits of international cooperation, resource sharing, exchange of bibliographic data, and networking could not be fully exploited. In Slovenia and Lithuania, many standards were translated and librarians were playing a full part in their maintenance and further development. Retrospective conversion was less well advanced in the first half of the 1990s, but innovative work was also happening in this area in the Czech Republic, Slovenia, Croatia, and Russia.[33,34]

Cooperation and networking

Pure cooperation and networking in the mid-1990s is pointed out by several authors.[35] However, in some countries, academic libraries have had coordinated development for several decades.[8,20] Several cooperative automation programs were arising at the level of individual city or region (e.g., Krakow, Lublin, Lodz, and Poznan in Poland)[13] and nationally (e.g., CASLIN in Czech Republic, COBISS in Slovenia, NALIN in Bulgaria, and ELNET in Estonia).[20,33,36–38] The College of the Directors of the Hungarian University Libraries was established by the directors of university libraries that aimed at enhancing the social status of libraries (librarians) by improving the efficiency of academic libraries and the scientific information system.[8] There were also examples of international cooperation between many of the countries in the region (e.g., the Baltic countries, Hungary, and Slovakia). The Hungarian–Slovak Network (HUSLONET) between five higher education libraries in two Hungarian towns and one Slovak town was an initiative implemented in summer 1995. It has an extensive planning phase to select hardware and software and secure finances to network on-line public access catalogs (OPACs) via the Hungarian research network and share CD-ROM's via a common gateway.[8,33]

The primary task of these consortiums was to select, obtain, and implement integrated library software and promote cooperation within and between libraries. The implementation of a common integrated system presupposed cooperation between academic libraries at the highest level and created possibilities for coordinated collections development. It also changed everyday work—there were new tasks and different responsibilities for staff, changes in working routines, and a need for reorganizing all of the library's workflow.[20,39] National priorities for networking were seen to be the creation of national union catalogs, the development of common retrieval interfaces for libraries using different integrated systems, followed by a system for electronic interlibrary document ordering and lending.[8] However, Borgman[35] notes that mounting on-line catalogs was the top priority for many libraries, and little progress was made in automating acquisitions, serials, or circulation.

The programs of Phare, Tempus (programs financed by the European Communities to assist the applicant countries of CEE in their preparations for joining the European Union), and the Andrew Mellon Foundation were instrumental in equipping libraries with hardware and software.[8,13,21,32,33,40] Other programs are from the John D. and Catherine T. MacArthur Foundation and the German Marshall Fund.[11] The work of the Open Society Institute in Budapest was designed to complement the activities of the autonomous national foundations created and funded by George Soros and had an important impact on library automation in CEE countries.[32]

The first International Conference on Library Automation in CEE was organized in April 11–13, 1996, in Budapest, Hungary, where information and innovation was shared among these countries. The section headings—automation, national bibliographies, document delivery, bibliographic standards, retrospective conversion, and cooperation—indicated the most pressing areas of concern in CEE libraries.[33] The participation in international organizations as the International Federation of Library Associations and Institutions (IFLA), Ligue des Bibliotheques Europeénnes Rechereche (LIBER), International Association of Technological University Libraries (IATUL), Arbeirgemeinschaft der Bibliotheken und Dokumentationsstellen der Ost-, Ostmittelund Südeuropaforschung (ABDOS) since 1989 also contributed to the automation as well as development and modernization of academic libraries in CEE.[20]

The second half of the 1990s showed that the number of academic libraries providing on-line bibliographical databases increased with the advancement in library automation. Most university libraries were individually pursuing the introduction of integrated systems and networking, having secured funding from TEMPUS or the private foundations, while the biggest problem was the inadequate budget for primary collection building.[8] Library systems used in CEE were mainly developed in the United States, the United Kingdom, and Israel. For example, systems such as Aleph and Tinlib were used in many academic libraries in the Czech Republic; Dynix, Aleph, Oracle, Voyager, and Tinlib in higher-education libraries in Hungary;[8] Aleph in Latvia and Lithuania; Innopac in Estonia; VTLS and Horizon in Poland; etc.[20,32,39] Slovenia developed a centralized system, COBISS. A good overview about library automation in the states of former Yugoslavia not covered in this article has been given by Močnik.[38]

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Several authors report that enthusiasm, the willingness to work under new circumstances, and increased cooperation with other libraries was apparent in academic libraries in CEE: ''Often the staff came with their own ideas, which were both useful and helpful in the organization of new working routines.''[39] However, experiences from several libraries showed that crucial factors in successfully implementing information technologies in libraries were institutional support, access to technology, a comprehensive information strategy, management, cooperation and networking, and appropriate legal regulations as well as library legislation.

Influences of Globalization on Academic Libraries

Access to the internet

Together with political, economic, and social changes, CEE countries have also been influenced by worldwide globalization processes. In the past two to three decades, globalization has accelerated because of various factors. Technological change is particularly playing a vital role in the globalization process. Internet became an important tool in CEE that enabled academic libraries to participate in global networking, communication, and resource sharing.

The Internet became an essential communication medium for academic and research institutions in CEE in the beginning of the 1990s. Moreover, since 1994, the rapid growth of the Internet hosts in the region can be followed. Some authors have pointed out that the countries of CEE are adopting the Internet technology even faster than Western Europe.[12] In July 1998, Internet hosts per 10,000 inhabitants in Europe were as follows: Finland 859, Iceland 797, Norway 687, Sweden 411, Liechtenstein 396, Denmark 380, Netherlands 341, Switzerland 300, United Kingdom 226, Austria 189, Belgium 177, Israel 174, Luxembourg 159, Germany 156, Estonia 139, Slovenia 110, Hungary 86, France 76, Latvia 39, Poland 29, Lithuania 22, etc.[20] According to International Data Corporation, the IT spending/GDP ratio in Estonia constituted 3.21 (1998), followed by Czech Republic's 2.74 and Hungary's 2.50.[41]

Academic libraries in several countries in CEE were among the first institutions to grasp the possibilities of the Internet.[42] For example, two mailing lists were created in November 1993 for Baltic librarians: Balt-Info (the joint project of Dawn Mann and Eric Johnson, funded by IREX, for communication between Baltic librarians and their counterparts in the United States) and BIBLIO (communication between the Estonian librarians). Lucy Tedd, a British library automation expert, visiting Estonia in 1995, wrote: ''Access to the Internet is quite widespread in Estonia. The National newspapers are available on the Internet, for instance, and about 80 per cent of schools have Internet access.''[43] In 1996 and 1997, visiting the Czech Republic and Slovenia, she also confirmed that the Internet was widely used in libraries in both countries and the Internet was seen as a relevant source of information by ''ordinary'' people.[32]

However, Jankowska[12] notes that in Poland, Hungary, and the Czech and Slovak Republics, the Internet is used ''mainly to communicate with colleagues and other professionals, subscribe to on-line discussion groups, exchange professional information, and access catalog utilities through remote logging. The Internet still is not the first choice for many other activities.'' However, examples from several countries show that academic libraries are actively involved in accessing databases to answer reference questions, obtaining free electronic books, journals, and magazines, searching databases for research and teaching, ordering books and periodicals from publishers and vendors, finding electronic information for patrons, publishing electronic information, presenting virtual resources, and training users.[20]

Access to electronic databases

According to Haavisto,[44] the usage of electronic materials in CEE libraries in the late 2000 and early 2001 were as follows: 100% of academic libraries in Czech Republic, Lithuania, Poland, and Slovenia, 90% in Slovakia and Hungary, 80% in Bulgaria and Latvia, and 40% in Romania used CD-ROM and multimedia works; 100% of academic libraries in Czech Republic, Lithuania, and Poland, 90% in Slovakia, 70% in Slovenia, 60% in Hungary and Latvia, 50% in Bulgaria, and 20% in Romania used electronic full-text journals; 100% of academic libraries in Czech Republic and Poland, 95% in Latvia, 90% in Hungary, Lithuania, and Slovakia, 70% in Slovenia and 50% in Bulgaria and Romania used electronic bibliographic databases. No information was available on Estonia.

Licensing consortia

The access to electronic resources has led to the formation of licensing consortia. The purchase of licensed electronic material began in many cases in individual libraries, which made individual agreements with vendors. The advantage of joining forces soon became obvious and led in many cases to the formation of several small consortia.[44]

The longest tradition of creating consortia is in Slovenia, where national licensing agreements were included in the agenda of the existing consortia COBISS as far back as 1997. For example, the databases available via COBISS are ISI (Web of Science); OCLC (WorldCat, ContentsFirst, ArticleFirst, ProceedingsFirst, PapersFirst, NetFirst, ERIC, and GPO); Bell & Howell, and SwetScan. The government pays for all these resources, and they are open

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to all research libraries in Slovenia. These libraries are also well equipped with the tools for on-line ordering. There is currently another new consortium to acquire Elsevier resources.[44,45]

In Estonia, a consortium of four research libraries provides access to Elsevier Science-Direct, and preliminary negotiations with the Finnish national consortium FinELIB are also under way. Five university libraries in Bulgaria formed the consortium in December 2000 to purchase ISI databases. The participating libraries and EC-funded Tempus project pay the costs. Another consortium of Bulgarian research libraries have also formed the so-called ProQuest Medical Library Collection, funded by the libraries. In the Czech Republic, there are some 15 small consortia funded by the Czech government. The ProQuest and EBSCO consortia are countrywide, open to all research and public libraries. Research libraries have also formed consortia for Springer, Elsevier, and Web of Science materials. In Hungary, there are more than 20 small licensing consortia, covering in most cases several research libraries. Hungarian libraries have also organized trials between vendors. In response to an initiative from libraries and vendors, the Ministry of Education in Hungary recently founded larger research library consortia covering a wide range of subject areas, for which the government would pay the costs.[44]

The first regional Polish consortium for electronic purchasing was founded in Upper Silesia in 1996, as part of a TEMPUS project. It purchases both off-line and on-line electronic resources. Consortia for purchasing databases like CCI, Chemical Abstracts, and Compendex have already existed for some years. Vendors or information providers have initiated some of these. There are as yet no consortia in Lithuania, Romania, and Slovakia (except for the eIFL Direct Program).[44]

The eIFL Direct program (Electronic Information for Libraries) is a project of the Open Society Institution (OSI), which offers a platform for the use of electronic material. The headquarters of OSI in Budapest has negotiated a framework licensing agreement and price level with EBSCO on behalf the 39 countries where OSI is active. The agreement covers access to several databases such as Academic Search Premier, Business Source Premier, Newspaper Source Plus, MasterFILE Premier, Comprehensive MEDLINE Plus Full-Text, and Health Source Plus—all in all, over 5000 journals primarily in the social sciences and humanities. Newspapers, pamphlets, and a small range of full-text reference books are also included. The material can be accessed via the web or in CD-ROM/DVD formats. The practical administration and the payment to EBSCO must be individually carried out in each country. In some countries, the government pays for all the libraries involved; in others, payment is directly collected from the libraries. In most countries, libraries have founded consortia to manage their eIFL resources.[44]

Professional Training of Librarians

All these changes in society and libraries also influenced library and information science (LIS) education. Library and information science education in CEE has gone through a period of rapid change and reorganization as well. Systematic modernization of the curricula of LIS started in the 1990s. Before that time, emphasis was on core knowledge and skills such as cataloging, classification, indexing, and collection development; ICT was hardly included. From the beginning of the 1990s, ICT slowly became a central element in the curriculum, both in terms of content and delivery of teaching. For example, Internet courses were added to the LIS curriculum as early as 1993.[46] To equip students for the range of management roles identified above, several LIS schools developed the management curriculum within LIS.[47] However, many LIS schools in CEE dealt with the problem of how to create relevant curricula including information technology at a time when Western European LIS schools paid more attention to orienting the content of courses more effectively toward learner requirements and creating active and adaptable information professionals able to respond to the needs of a rapidly changing society. It also seemed that, often, the names of courses were quite similar in different LIS schools, but the course content in CEE countries suffered because computer-oriented information technology courses were expensive and considerable investments were needed in equipment, experienced faculty, and software. The main obstacles in developing and implementing necessary curricula in CEE countries in the mid-1990s were the lack of relevant literature, adequate knowledge of foreign languages, lack of qualified lecturers, especially technically competent faculty, and the lack of relevant technological equipment.[48,49] However, close cooperation with several LIS institutions in West Europe as well as membership and participation in several international institutions [European Association for Library and Information Education and Research (EUCLID), Organization of European LIS institutions (BOBCATSSS), IFLA Section of Education and Training, European Association of Distance Teaching Universities (EADTU), etc.] have contributed a lot to the development of modern curricula.[49,51]

THE ACADEMIC LIBRARY IN THE 21ST CENTURY

Academic libraries in CEE today face the same challenges and problems as academic libraries in all Europe. As a result of ICT, library services to users have changed, the management of libraries evolved, and the roles of librarians multiplied.[20] Academic libraries are no longer libraries of an old Soviet type, collecting methodical and

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political literature, but are approaching the European University Library image, enabling the students and the academic community to select the format of information ranging from printed editions and compact disks to databases and Internet searches.[50] The concept of virtual or digital library is rapidly spreading in CEE as well. Library patrons are searching in on-line public access catalogs, requesting interlibrary loan services, and receiving digitized documents from electronic archives without ever stepping into a library.[20] Libraries in CEE also participate in several digital library initiatives (Dieper-Digitized European Periodicals project).[51]

The use of distance learning technologies has an increasing impact on the activities of academic libraries as well. Several libraries have started activities in assisting the course writers in identifying appropriate literature and network resources to support the preparation of the course, providing advice about networked resources, negotiating cost-effective, on-line access for students, and providing physical learning facilities for students. Information literacy is also an emerging issue in academic libraries. However, except for some initial policy statements, some basic curriculum and syllabi formulations, there are yet no substantial training programs mainly because of the shortage of the needed professional input from the information and library sector.[17,20,52,53]

Quality questions appear in academic libraries agenda more and more. Attention is also directed toward hybrid libraries, clumps and preservation of digital objects, the establishment of national agreements enabling all members of higher-education institutions to access a large range of major datasets, based on the all-important ''free at the point of use'' principle, ushered in an era of real resource-sharing and cooperation.

Issues Facing Academic Libraries

If only a few years ago the main stress was laid on technology, now attention is focused more on organizational and legal aspects. Several authors have pointed to conflicting legislation problems as well as issues that should be resolved in connection with access to Internet and electronic resources, e.g., questions of copyright, fair use, universal access, data protection and encryption, or of the reliability, trustworthiness, and quality of freely available information, to name just a few.[10,30,40]

However, a big change has occurred in the copyright legislation of the CEE countries. When the laws of the earlier period were more user-friendly, guaranteeing more user rights without remuneration, the present line is toward a more Western European policy, where the right-owners' position is stronger. For example, in Hungary and Lithuania, the new law was adopted during the year 1999. When in Hungary all kinds of library lending were earlier allowed without permission or remuneration, the new law is recognizing the EU regulations about, e.g., computer programs and databases. In Lithuania, a Public Lending Right system was launched in the new copyright law, the price of which will in one form or another be paid from library budgets. The laws have also grown to be much more detailed than they used to be. They also include more definitions. This is basically an advantage: Earlier laws tended to be very general, and the formulations could be read in several controversial ways. Eight out of ten countries have a clause for library lending right in their copyright law. The most extreme opposite solution is the Slovak copyright law from 1997. It demands that even loaning of books must be licensed by the right-owners. However, in practice, this has not yet been organized. As a part of the membership candidacy process, 10 countries of CEE have to harmonize their copyright legislation with the EU directives.[54]

CONCLUSION

Libraries and information services are operating in a fast-changing environment in CEE. Since 1989, academic libraries have undergone rapid changes toward openness and diversification. Information and communication technology has had an accelerating impact to all these processes in academic libraries. Global communication networks are opening up new opportunities, and information media come in more and more diverse forms. The political and institutional framework has undergone dramatic restructuring. Collection development, resource sharing and automation, including cooperative technology, database building, and access to on-line databases, restructuring of library management, retraining of library staff, and a new emphasis on human resource management policies and practices have been priorities for academic libraries in the last decade of the last century. Libraries in all countries in the region have also struggled financially; the transition to capitalism and losing the legacy of communism is fiscally and socially very costly. Inadequate funding has been a serious obstacle to effective communication, processing, management, dissemination, assessment, and information retrieval.

However, academic libraries have survived and are developing. Librarians are actively and energetically responding to the needs of a developing information market and to a changing administrative structure. The basic automation of libraries is almost completed, and the networking connections and access to different databases, are presently becoming important. Digital library issues are bringing together consortia to discuss common standards, collaborative management, intellectual property rights, electronic publishing, and document delivery. This has implications on a library's acquisition, storage,

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preservation, and service policies. The library and information world in CEE is trying to take the best possible advantages of changes in the world, adapting themselves to new technologies, new demands, and new customers.

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Academic Libraries in Japan

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INTRODUCTION

The history of academic libraries in Japan begins with the establishment by imperial edict of the Imperial University Library in 1886. The library was affiliated to the predecessor of the present-day Tokyo University, the oldest national university, founded in 1877. Keio University, founded in 1858 and the oldest private university, did not establish its library until 1890—four years after the Imperial University Library—because of a lack of financial support.[1]

From such modest beginnings in 1886, by fiscal year 2002 the number of university libraries in Japan had grown to encompass 1245 libraries affiliated to 686 universities. Of these, 298 libraries are affiliated to 99 national universities, 107 are affiliated to 75 local public universities, and 840 are affiliated to 512 private universities (Table 1).[2] There are three types of universities in Japan. National universities and local public universities are established and funded by the national government and local governments, respectively. Private universities exist independently of such governments, although they are controlled and financially supported by the national government. National universities dominate the ranks of the most prominent institutions and only a few private and local public universities enjoy comparable status. While most of these are academic-oriented university libraries, there is also a small number of research libraries, including libraries at interuniversity research institutes.

BACKGROUND

Legislation

All universities are required to have a campus library. Different laws regulate the various types of university library. The laws a library must adhere to depend on the level of the parent institution. Under the National School Act, an ''affiliated'' library is required as an indispensable facility for a national university. The wording of this law is the reason that all of the national university libraries have names such as Tokyo Daigaku Fuzoku Toshokan, for example, which literally means ''library affiliated to Tokyo University.'' The School Education Act requires a library facility at all schools, including private universities, while local public universities are regulated regarding libraries by local government laws.

The revised Guidelines for Universities (1991) provide guidelines for library materials, services, facilities, and library staff.[3]

Organization of Institutions

Usually, each university has more than one physical library. The average number of libraries per university is 1.8. Libraries are distributed according to their subject, affiliated department, and/or physical location. For example, medical libraries are likely to be separated from other campus libraries because of the independence of medical schools from their parent universities, as well as the separate location of university hospitals from the main campus. As Japanese universities are usually spread out across multiple campuses due to a shortage of land, and as each campus must have a library, placing a library on every campus results in multiple libraries at a given university. The United States' model of a single, function-based library, such as an undergraduate library, is not common on the campuses of Japanese universities.

With the merging of campus libraries and computing centers in the early 1990s, and the introduction of computing and multimedia facilities into university libraries, came a change of the term used to describe a library. At several universities, the word ''library'' (toshokan) was set aside in lieu of other terms such as joho senta (information center) or media senta (media center). However, this name shift did not occur at national university libraries, which had to retain the ''old'' term (fuzoku toshokan) because of the regulations mentioned above.

Fig. 1 presents Keio University as an example. It has five ''media centers'' located on five campuses, two of which are subject-specific libraries (i.e., medicine and science and technology). Fig. 2 shows the configuration at Kyushu University, which has a central library, three branch libraries, and six departmental libraries.

Internal Organization and Staff

The top administrator of a university library in Japan is the director. Usually, the director is concurrently appointed as a professor in an academic department.

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Table 1 Number of universities and university libraries in Japan by types of parent institution as of FY2002[a]

	Universities	University libraries
National	99	298
Local public	75	107
Private	512	840
Total	686	1245

[a]Library statistics of colleges and universities 2002–2003. The Ministry of Education, Culture, Sports, Science, and Technology: Tokyo, 2003.

The ratio of library staff members who have shisho, the sole certification for librarians in Japan, is 50% as of 2002.[2] Shisho certification requires 20 credits in addition to a university degree and is issued by the Ministry of Education, Culture, Sports, Science and Technology (MEXT). Only 30% (222 out of 741) of new library staff positions are filled with personnel who have passed the examination given specifically to certify librarians.[4] The positions of library staff are not categorized as either academic or professional. More information concerning education and training for librarians is available in the section ''Librarianship in Japan'' of the *Encyclopedia of Library and Information Science*, 2nd edition.[5]

Financial Support

For the most part, university libraries are funded by the internal finance section at each university. External funding, such as research or education support grants from government agencies, is commonly used for facilities and equipment. Financial support for staff training comes from the library- or university-related associations mentioned in the next section.

Related Institutions and Associations

The National Institute of Informatics (NII), an interuniversity research institute of MEXT, was established in 2000. Although NII focuses more on research and development than services, it does provide information

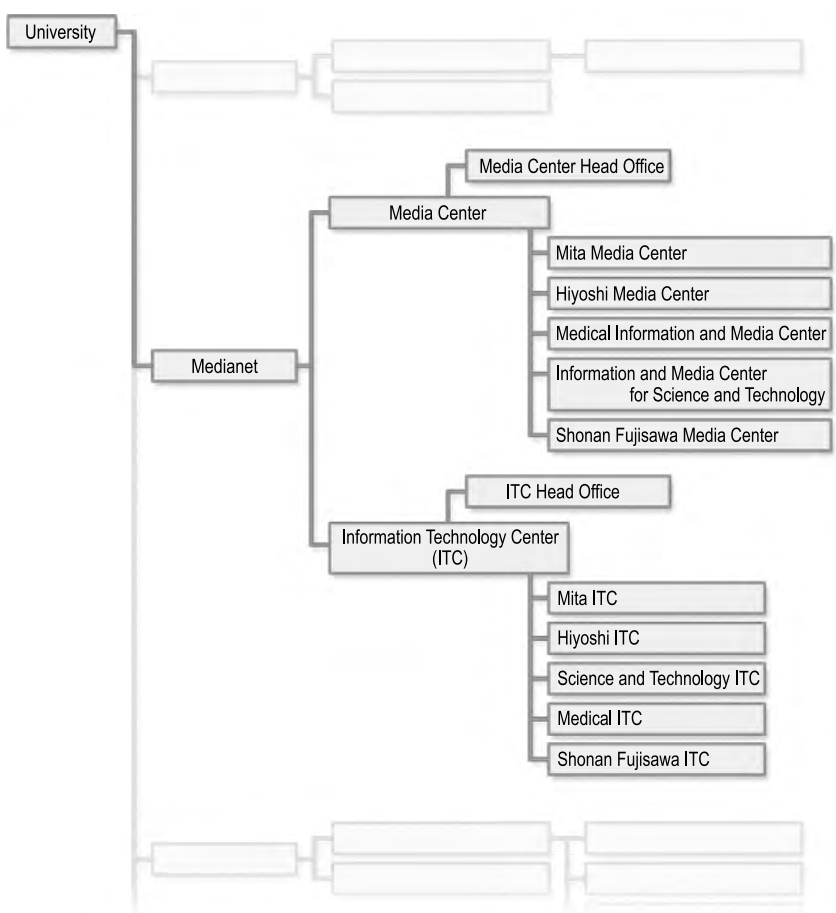

Fig. 1 Organizational chart of Keio University library system (Media Center) and computing center system (Information Technology Center). (Keio University Media Center Head Office: Tokyo, 2002. http://www.lib.keio.ac.jp/en/org/orgchart.html, accessed July 2003). (*View this art in color at www.dekker.com.*)

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Central Library
Medical Library

Branch libraries
Chikushi Branch Library
Ropponmatsu Branch Library

Departmental libraries
Library, Faculty of Letters
Library, Faculty of Education
Law School Library
Library, Faculty of Economics
Library of Engineering and Information Science
Library, Medical Institute of Bioregulation

Fig. 2 Libraries of Kyushu University. (Created using a list at http://www.lib.lib.kyushu-u.ac.jp/english/ref.html, accessed July 2003).

systems for reearchers and libraries [e.g., National Center for Science Information System (NACSIS)-CAT/interlibrary loan (ILL), NACSIS–information retrieval (IR), NACSIS–Electronic Library Service (ELS)] and training programs for library staff. The services provided by NII and its predecessor, NACSIS, have been heavily used by university libraries. These include a bibliographic utility, an ILL system, an information retrieval system, and electronic resources.

Associations related to university libraries are: the University Library Division of the Japan Library Association; the Association of National University Libraries; the Public University Library Association; the Japan Association of Private University Libraries; the Japan Medical Library Association; and the Japan Pharmaceutical Library Association (Table 2). The activities of these associations include publication, research, training programs, and public relations for member libraries. The joint purchase of electronic resources and the formation of consortia have become popular among several of these associations as a result of the academic journal crisis that began in the late 1990s.

Impact of Government Policy on University Libraries

The Information Division of the Research Promotion Bureau of MEXT is responsible for university libraries and related institutions. Although the government does not directly administer private universities, reports and proposals submitted to Japanese government councils have affected the administration and activities of all types of university libraries. For example, a proposal on digital libraries in 1996 has had a large impact on the activities of university libraries, especially at national universities.

National university libraries are now facing drastic changes because of the reorganization and consolidation of national universities planned for FY2004. Libraries will have to become competitive and discover ways to raise funds, as they will receive less financial support from the government. Universities and their libraries are currently reorganizing library and information services in preparation for this change. For example, libraries are launching digital services from internal departments that are not part of the library organization itself, establishing an R&D section for information services, restructuring the library staff training system, and establishing criteria to measure the effectiveness of the library and information services provided.

CURRENT CONDITIONS

The *Library Statistics of Colleges and Universities*, published annually by MEXT, provides information on the

Table 2 Associations related to university libraries in Japan

Name	Year of founding	Types of member	No. of members	URL
Association of National University Libraries	1954	Institutional	101 (Inst)	http://wwwsoc.nii.ac.jp/anul
Public University Library Association	1955	Institutional	76 (Inst)	http://wwwsoc.nii.ac.jp/pula
Japan Association of Private University Libraries	1930	Institutional	446 (Inst)	http://www.jaspul.org
Japan Medical Library Association	1927	Institutional	114 (Inst)	http://wwwsoc.nii.ac.jp/jmla
		Individual	40 (Indiv)	
Japan Pharmaceutical Library Association	1955	Institutional	92 (Inst)	http://wwwsoc.nii.ac.jp/jpla
		Individual	11 (Indiv)	
		Supporting	6	
University Library Division Japan Library Association	1948	Institutional	671 (Inst)	http://www.jla.or.jp/daigaku/index.html
		Individual	802 (Indiv)	
		Student	9 (Stu)	
		Supporting	1	

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status of university libraries in Japan. Much of the following information (except the sections on electronic journals and reference services) is taken from the 2001 edition of the report.[2]

Collections and Acquisitions

In FY2001, library collection sizes averaged 923,354 volumes at national universities, 225,883 at local (non-national) public universities, and 300,412 at private universities. The average number of books acquired in the same year was 17,450 at national, 7624 at public, and 10,211 at private universities.

Book acquisitions by all three sectors have declined since FY1998, by a total of 4.3% from FY2000 to 2001. Journal collections averaged 16,215 titles at national, 3175 at public, and 3599 at private universities. The average number of journal titles acquired in FY2001 was 5422 at national, 1300 at public, and 1706 at private universities. As with books, journal acquisitions have declined since 1998, by a total of 1.7% in all sectors from FY1999 to 2001.

Japanese-language materials typically comprise 66% of Japanese university collections, with materials in major Western languages, particularly English, making up the remaining 34%. Of the three university sectors, national universities have by far the largest collections of both books and journals. This is a reflection of the pattern of higher education in Japan.

Operating and Purchasing Expenditures

Annual operating expenses for university libraries averaged 250 million yen at national universities, 84.6 million yen at public universities, and 135.2 million yen at private universities in FY2001. Operating expenses fell in recent years in all sectors: by 96% at national, 88% at public, and 84% at private universities from FY1998 to 2001.

Expenditures for purchasing library materials averaged 233 million yen at national, 58 million yen at public, and 93 million at private universities in FY2001. These expenditures likewise fell across the board from FY1998 to 2001—by 95% at national, 92% at public, and 88% at private universities.

Electronic Journals

Scholarly journals face the same crisis in Japan as they do in the West. Foreign journal purchases declined from approximately 40,000 titles in the late 1980s to half that—a bit over 20,000 titles—in the late 1990s. Purchases of Japanese journals fell even more sharply over the same period, from 69,000 titles to 28,000. Yet expenditures for purchasing foreign journals rose during this time from 15 billion yen to 25 billion.[6]

These circumstances have prompted the major publishing houses to invest in the publication of electronic journals. As electronic journals gain in prominence, libraries are actively adding them to their collections. However, initial expectations that the growing popularity of electronic journals would bring purchase prices down have not been borne out. Consequently, libraries are struggling to find ways to minimize the cost of purchasing access to electronic journals, while continuing to purchase print journals. One solution is to negotiate fees as a consortium, and libraries are already engaged in a variety of consortium-based activities.

Reference Services

According to a 2002 survey of university libraries by MEXT, 79% of these libraries offer reference services. An average of 2134 reference questions are handled each year, of which nearly half (50%) are bibliographic searches, 15% are fact searches, and 31% are for guidance in library use.

According to a 1999 survey,[7] 17.2% of all universities have separate reference departments. The percentage is 88.6% for large and midsize libraries, but only 10.2% for small libraries (which comprise over half of the total). Libraries employ an average of 0.4 reference specialists and 2.4 staff who handle reference services in addition to other assignments (compared with 0.8 and 2.0, respectively, in 1988). In Japan, reference services are usually handled as one of several responsibilities by public service staff.

Since the 1990s, university libraries have begun augmenting their existing orientation programs with information literacy education programs coordinated with teaching faculty as part of the university curriculum. This trend has accelerated with the issuance in 1998 of guidelines for this purpose by the Japan Library Association (JLA).[8]

Numerous reference materials are available in Japanese. Primary examples of materials provided by public institutions are the NACSIS-WEBCAT catalog of the National Institute of Informatics (NII) and the Japanese Periodicals Index of the National Diet Library (NDL). These are accessible to the public via the World Wide Web and enjoy frequent use. Digitized reference materials by commercial publishers are generally sold in CD-ROM or other media formats. Most digital reference materials are available to users only on terminals in libraries, either in standalone environments or via the Internet.

Library Staff

Staff at university libraries, including nonregular staff, averaged 39 at national, 11 at public, and 17 at private universities in FY2001. Of these, full-time staff averaged

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22, 6, and 10, respectively. Libraries tend to hire part-timers whenever possible to reduce payroll expenses. The trend in recent years has been for libraries to outsource more work, and most national, public, and private university libraries do this to some extent. Until recently, cleaning, security, bookbinding, and computer maintenance were the most commonly outsourced tasks. Now, however, some libraries are contracting out cataloging and reference service tasks as well. The number of full-time staff at university libraries is consequently declining.

Shelf Capacity

Average shelf capacity at university libraries was 843,203 volumes at national, 277,596 volumes at local public, and 367,699 volumes at private universities in FY2001. It is worth noting that at the national universities, average collection size exceeds shelf capacity; these libraries are consequently compelled to adopt a variety of strategies to cope with the lack of shelf space. This shortage is a serious and growing problem in most Japanese university libraries. Solutions include a repository of overflow materials at off-campus sites or shared storage of collections among multiple institutions, but for most libraries, these practices remain at the provisional or experimental stage. As yet, there is no consortium established for shared storage. Cooperative efforts toward this objective need to be undertaken in the near future.

Opening Hours

University libraries are open at an average of 255 days out of a single year. National university libraries are open more often, averaging nearly 300 days; 43 national universities, or nearly half the total, keep their libraries open on holidays. However, well over half of the libraries at public and private universities are closed on holidays, hence the low average for all sectors. Most university libraries, regardless of sector, remain open on weeknights 4 or more hours beyond normal business hours (9:00 to 5:00). Additionally, nearly all national university libraries (93%) are open for at least four hours on Saturdays. However, fewer than half of all public and private university libraries stay open outside of university business hours.

Loans and Interlibrary Loans

Book loans do not vary widely among university sectors, the overall average being about 21,000 volumes lent per year, or 83 volumes a day in FY2001. About 80% of all university libraries in Japan participate in interlibrary loans. National universities annually lend an average 237 volumes to other libraries, and borrow at an average rate of 199 per library—approximately three times as many as are lent and borrowed by public and private universities. The same pattern can be seen with interlibrary loans of photocopied materials. National universities receive an average of 3354 copy requests a year—three and four times the respective number received by public and private universities—and issue an average 2538 requests, two and four times the number issued by public and private universities, respectively. These figures are averaged by the number of libraries and thus show that there are many small libraries which contribute little to lending services and ILL services. Many libraries actively participate in these services, as well as offer open access to library materials. There are few borrowing restrictions, other than the number of books that can be borrowed at one time and the due date for returning them.

The most influential union catalog in Japan is operated and maintained by the National Institute of Informatics (NII); this consists of a union catalog of books and a union list of periodicals. Almost all ILL services for journals are based on the NII union list. On the other hand, ILL services for books rely not only on the NII union catalog, but also on the individual OPAC systems of leading university libraries, because the NII catalog is not exhaustive.

Public Access Policies

Some 98% of all universities—national, public, and private—permit public access to their libraries under certain conditions. The most common requirements are a letter of introduction from an affiliated institution, or some form of personal identification. Services offered to nonuniversity visitors are generally limited to reading in the library and photocopying, but some libraries offer other services as well. For example, 48% of all university libraries will lend books out to nonuniversity visitors, and 59% provide them with reference services.

BIBLIOGRAPHIC CONTROL AND RELATED TOPICS

Cataloging Processes

Most academic libraries in Japan maintain local catalog databases, taking advantage of shared cataloging using NACSIS-CAT, the sole bibliographic utility in Japan, which is operated by the National Institute of Informatics (NII). A new trend in current cataloging practices is outsourcing, either hiring contract catalogers or purchasing complete catalog records from outside organizations. This practice is often part of the acquisition process.

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Bibliographic Utilities

NACSIS-CAT began service in 1984 under the management of NII, formerly the National Center for Science Information System (NACSIS). It provides a shared cataloging facility as well as a union catalog. These services are available free of charge. A total of 1013 organizations, mostly academic libraries (75%) and including 26 foreign organizations, participate in the utility, which has almost 7 million bibliographic records as well as 1.3 million authority and 70 million location records. Among universities in Japan, 93% are members.[9]

The Web version of NACSIS-CAT, called Webcat, has been available free of charge since 1999. The database has also been used with NACSIS-ILL, the interlibrary loan system, since 1992. The union catalogs of foreign bibliographic utilities, such as On-line Computer Library Center (OCLC) and Research Libraries Group (RLG), are also frequently used in producing new catalog records and in retrospective conversion.

Bibliographic Record Sources

In contrast to other countries, there are several kinds of MARC products in use in Japan. For domestic publications, Japan MARC, maintained by the National Diet Library (NDL), and TRC MARC, originally created for booksellers by Toshokan Ryutsu Center, are frequently used as a source of bibliographic records for library catalogs. These records are available through NACSIS-CAT, or by purchase from the producers. Bibliographic records are also available from the member libraries of the aforementioned utilities and other domestic MARC record producers.

The advantage of TRC MARC is its immediate availability even before publication, while Japan MARC provides more precise and detailed information. For foreign publications, bibliographic records from other countries are used, particularly those in MARC21 format.

MARC Formats

There are three MARC formats commonly used in Japanese library systems: NC/MARC, Japan MARC, and MARC21. NC/MARC, a format specific to NACSIS-CAT, is a relatively simple format used by most academic libraries because it provides interoperability with NACSIS-CAT. Japan MARC is a more UNIMARC-like format used for domestic publications, while MARC21 is used for foreign publications. TRC MARC records are available in all three formats.

Bibliographic Records

The Nippon Cataloging Rules, maintained by the Committee of Cataloging of the Japan Library Association (JLA), are used by 96% of all university libraries for descriptive cataloging of materials published in Japanese and several Asian languages (e.g., Chinese and Korean). The Anglo–American Cataloging Rules are used at 71% of the libraries for publications in Western languages. The most frequently used classification scheme (at 96% of the libraries) is the Nippon Decimal Classification maintained by JLA. Very few libraries use NDL Classification numbers.[10] Subject information other than classification numbers is rarely used or maintained at academic libraries because of the unavailability of a good subject headings list in Japan. For example, subject headings used in Japan MARC records are rarely used by libraries because of their complexity and unfamiliarity. Another subject headings list, the Basic Subject Headings (BSH) maintained by JLA and used in Toshokan Ryutsu Center (TRC) MARC, is also unpopular at academic libraries because it is not sufficiently comprehensive.

Subject information appearing in foreign MARC records, such as the U.S. Library of Congress Classification symbols, LC Subject Headings, National Library of Medicine Classification numbers, and Medical Subject Headings, are used by a considerable number of libraries. However, few libraries use them as subject access tools because they contain foreign words unfamiliar to most users.

Authority control is rarely undertaken by most libraries (28% for name and 5% for subject authority).[10] Instead, several organizations or systems such as NDL, NACSIS-CAT and TRC produce and maintain authority files.

Recon Projects

Half of all Japanese academic libraries have a more than 50% backlog in their retrospective conversion projects. The primary reason for delays in retrospective conversion is that library automation projects in Japan have focused primarily on circulation systems to benefit patrons, while efforts to enhance the level of bibliographic control have taken second priority because of the difficulties of handling Japanese characters.

Cataloging Electronic Resources

Bibliographic records describing databases and electronic journals are not integrated into on-line catalogs in many academic libraries. Instead, library websites provide an alphabetical list and/or search function for each category.

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Outsourcing

Twenty-four percent of universities have outsourced their cataloging process.[2] Although outsourcing brings benefits to the libraries such as reducing costs and maintaining consistency, it also means that fewer and fewer catalogers are trained at academic libraries, forcing the libraries to rely increasingly on outside contractors.

Global Contributions and Standardization

One ongoing challenge for academic libraries in Japan is the worldwide distribution of bibliographic records of Japanese publications in accordance with global standards. Even with the adoption of Unicode as a solution to the problems associated with the Japanese character set, obstacles remain in the exchange of data and creation of Web-based catalogs such as Webcat. The introduction of Unicode has made the bibliographic records of OPACs relatively accessible, but it is still difficult to use Japan-originated bibliographic records for cataloging in other countries. The barriers are not only the lack of availability of records in other countries' utilities, but also issues of content and its designation because of differences in cataloging practices as well as the characteristics of the Japanese language. Waseda University is the only institution in Japan that has loaded its catalog records of Japanese publications into OCLC-CJK, but these records still reflect the problems mentioned above.

CONSORTIA

A variety of consortia are active in Japan, involving the libraries of national and private universities, as well as medical and pharmaceutical colleges. Currently, their activities focus primarily on fee negotiations. However, interest in forming consortia also extends to such issues as financial assistance, model contracts, statistics on library use, fair price structures, licensing, and archive ownership. Other issues to be addressed include how to access, manage, and maintain digital materials; training of digital resource librarians; and information literacy education.

In FY2000, Japan's national university libraries formed a consortium, which comprises 66 national universities with life science programs, to negotiate access fees for the International Digital Electronic Access Library (IDEAL) service of Academic Press. The Association of National University Libraries (ANUL) subsequently created an electronic journal task force. By negotiating directly with overseas publishers, the task force has begun purchasing journals at lower prices. In FY2002, MEXT budgeted 396.8 million yen for this consortium, which has negotiated new contracts with Elsevier Science's ScienceDirect and several other publishers. ANUL also conducts training sessions for library staff in charge of electronic journal user education, and an initiative is also under way to establish SPARC Japan.

Private universities are following suit. In FY2002, five universities that had contracted with ISI's Web of Science the previous year formed a consortium; by FY2003, the number of participating universities had grown to 12. Negotiations with ISI have been successful in lowering prices. This consortium obtained 450 million yen in funding from the Japanese government for FY2003 through the auspices of the Japan Universities Association for Computer Education.

The Japan Association of Private University Libraries has taken steps to participate in the U.S.-based International Coalition of Library Consortia (ICOLC), of which ANUL is already a member. The Public/Private Universities Library Cooperative Committee, whose members include public, private, and national university libraries, is studying the feasibility of establishing an organization similar to ICOLC in Japan. The JCOLC concept would bring together existing library consortia, establishing a framework for information sharing and cooperation that would transcend the traditional barriers between national, private, and public universities in Japan.

LIBRARY SYSTEMS

University libraries in Japan began developing their own library systems in the 1980s in accordance with the concept proposed by the Science Council in a 1980 report, Plan for Academic Information Systems.[11] The 1990s saw increased standardization of library operations with the establishment of shared cataloging and ILL systems under the auspices of NII, as well as the marketing of various library system packages. These developments substantially eliminated the disparities among library catalog and circulation systems at different universities.

Library package vendors include IBM Japan, NEC, Hitachi, Fujitsu, Ricoh, Maruzen, and Japan Information Processing. Table 3 shows figures on university installation of these various systems. Library systems today are predominantly client–server distributed processing systems. Oracle is the most commonly used database management system (DBMS), but is losing popularity because of its high price. Library packages generally attempt to cover all library operations by offering the following subsystems or modules:

1. Book ordering and acquisition systems
   These systems manage all book ordering and acquisition operations. This was a critical feature of

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Table 3 Library system installation at universities, by vendor (four-year institutions only) (FY2003)

Vendor name	National universities	Public universities	Private universities	Total	Major packages	URL
Braintech	2	7	114	123	JOHOKAN	http://www.braintech.co.jp/
Fujitsu	20	5	59	84	iLiswave	http://software.fujitsu.com/jp/ilis_univ/
Ricoh	18	15	75	108	LIMEDIO	http://www.ricoh.co.jp/limedio/
NEC	14	5	30	49	LICSU/21	http://www.sw.nec.co.jp/educate/uni_prod/licsu21/01.html
JIP	10	5	31	46	LINUS/NC	http://www.jip.co.jp/bs/products/Shohin/11/kihon/kihon.html
Maruzen	1	4	112	117	CALIS.CARIN	http://www.cd.maruzen.co.jp/carin/ls/index.html
Hitachi	4	3	34	41	LOOKS21	http://www.hitachi.co.jp/Prod/comp/app/looks/
NTT Data	25	1	10	36	NALIS	http://www.nttdata.co.jp/services/s090082.html
Itochu Techno-Science	5	0	45	50	NeoCILIUS	http://www.ctc-g.co.jp/~product/category_jp/product_id_128.html
IBM Japan (Kinokuniya)	1	5	41	47	LVZ	http://www-6.ibm.com/jp/gold/edu/download/lvz200111.pdf
Total[a]	100	50	551	701		

[a]Totals do not always match column figures because some universities use more than one package.

library systems until the mid-1990s. Since then, however, many libraries have established links to the ordering and acquisition systems of major booksellers, and now find it sufficient to develop interfaces with these systems without installing their own.

2. Journal ordering and acquisition systems
   These systems manage such operations as ordering, accession, and binding notification. When booksellers serve as agents for libraries in the periodical acquisition process, accession and bibliographic data are provided together with the periodicals.
3. Catalog systems
   These systems are typically designed to handle cataloging operations in coordination with the shared cataloging system operated by NII.
4. On-line Public Access Catalogs (OPACs)
   Web-based OPACs with title and author search functions have become the norm. Many systems include Z39.50 target and Web cross-search functions. Table 4 shows the current state of public access to university library OPACs. The table suggests that the necessary components for off-campus access to

Table 4 Public access to university OPACs

	No. of universities	No. with open OPACs	Percent of total
National universities	97	96	99.00%
Local public universities	75	48	64.00%
Private universities	513	316	61.60%
Total	685	460	67.20%

	Mar. 1997	May 1998	Mar. 1999	Feb. 2000	Mar. 2001	Mar. 2002	Mar. 2003
Universities surveyed	555	602	602	620	650	670	685
Percent of all universities	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
No. with open OPACs	82	173	207	277	348	415	460
Percent of total	14.80%	28.70%	34.40%	44.70%	53.50%	61.90%	67.20%

From Ueda, Shuichi: http://www.slis.keio.ac.jp/~ueda/libwww/libwwwstat.html (2003/03/22).

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catalog information are already in place. Systems have also been developed that offer multilingual OPAC access, cross-searches of catalog information via the Z39.50 protocol, and links to electronic journals.

5. Circulation systems
   These systems manage lent and returned materials, user information, and shelving operations. They are designed to accommodate the variation in the lending requirements of Japanese libraries for different users (faculty, students, etc.) and materials. Most interlibrary loans between university libraries utilize the ILL system of NII. The individual ILL systems of these libraries are therefore configured for compatibility with the client function of the NII system. This system has been expanded to offer overseas ILL services.

That the aforementioned services already exist makes it imperative that the means be quickly developed for more efficient information exchange between domestic and foreign institutions. This will require systems that conform to such international standards as the MARC21 format, the Z39.50 protocol, and ISO-ILL.

Library system packages by different vendors offer a variety of special features, including system linkage with booksellers, outside processing services, bookbinders, and so on; on-line services with user authentication functions; and OPAC access via mobile phone. Table 5 lists the features offered with various packages, and Table 6 lists the packages installed at major university libraries.

Web-Based Service Systems

In many cases, university libraries are not only represented on their institutions' websites, but also provide information services through their own websites. For example, many libraries now offer public access to digitized materials from their collections, particularly rare Japanese and Chinese books. These resources, augmented by bibliographic information and explanatory notes, can be accessed via the library's website or OPAC.

To accommodate the recent proliferation of databases and electronic journals, libraries seek to facilitate the use of these resources by creating descriptions, classifying databases, and developing search portal sites or installing existing products for this purpose. On-line request systems have also been set up to enable users to make ILL or acquisition requests in tandem with searches for materials.

As university libraries begin to offer more extensive information services via the Web, many are enhancing their system information and network environment maintenance capabilities to accommodate anticipated user service demand from outside the library.

Japanese Language Processing

Library systems have substantially contributed to the development of information retrieval practices in Japan, particularly for Kanji (Chinese character) searches. A good example is the method of creating search keywords by dividing Japanese text into separate words. Recent advances in full-text search techniques have increased the use of wild-card searches. This search method has become standard on the Internet, forcing a reevaluation of search methods used by libraries. Since the mid-1990s, environments supporting Unicode have become the norm, hastening resolution of the problems posed by the Japanese language to international exchanges of data. The spread of Unicode has facilitated multilingual processing; however, the full application of multilingual processing technology requires the development not only of character codes, but also of techniques for linguistic processing of the unique characteristics of individual languages.

Japanese has a number of linguistic features, not found in European languages, that complicate the construction of OPACs and other search systems. Three major problems are:

1. Multiple scripts
   In Japanese, a given word can be written in any of four scripts: Kanji (Chinese characters), the Hiragana, and Katakana syllabaries, and the Roman alphabet. For example, the word for Japan (Nihon) can be written 日本,ニホン,にほん or Nihon. This means that any search system must provide four indexes for each word. A problem in the construction of catalog records in MARC format is how to fit these varying scripts into the same field. The complexity of Japanese script also renders problematic the international distribution of the MARC records thus created.
2. Spelling variations
   When Kanji characters are spelled out in one of the other Japanese scripts, the spellings are not always uniform. Taking the word for Japan as an example again, the Kanji 日本 can be romanized as either Nihon or Nippon. Japanese search systems must be able to recognize both spellings. In practice, this problem is resolved by creating correspondence tables and unifying spellings when data is generated.
3. Word separation
   This is the biggest problem posed by Japanese text. Words in Japanese sentences are not normally separated by spaces, and it is frequently impossible to define precisely where one word ends and another begins. For example, nihonkeizaigakunyumon (''introduction to Japanese economics'') could be parsed three ways: nihon/keizai/gaku/nyumon,

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Table 5 Features included in university library packages

	System operations									
Major packages	**Ordering**	**Accession**	**Periodicals**	**Cataloging**	**Circulation**	**ILL**	**Statistics**	**Budgeting**	**Collections**	**User Mgmt.**
JOHOKAN 5.0/AL	○	○	○	○	○	●	○	○	○	○
iLiswave/iLissurf	○	○	○	○	○	○	○	○	●	●
LIMEDIO	○	○	○	○	○	○	○	○	○	○
LICSU/21	○	○	○	○	○	○	●	○	○	
LINUS/NC	○	○	○	○	○	○	●	○	○	○
CALIS,CARIN	○	○	●	○	○	●	○	●	○	○
LOOKS21(LOOKS21/U→UNIPROVE/LS)	○	○	○	○	○	○	○	○	○	○
NALIS	○	○	○	○	○	○	○	○	○	○
NeoCILIUS	○	○	○	○	○	●	●	○	○	○
LVZ	○	○	○	○	○	○	○	●	○	○

○ = Standard.
● = Option.
× = N/A.

nihon/keizaigaku/nyumon, or nihonkeizaigaku/nyumon. Any of these units can be legitimately defined as a discrete word, so this one phrase might be recognized as consisting of four words, or three, or two. Every such unit must be stored in an index so that users can search by whichever word combination they happen to choose. In practice, not all Japanese search systems are so accommodating. At least where OPACs are concerned, however, a number of solutions to this problem have been devised to provide users with comprehensive search results.

Table 6 Packages installed at university libraries

University	Package	Installed
Tokyo University	LICSU-LX	2001.3
Tokyo Inst. of Technology	NALIS[a]	
Kyoto University	iLisminds[b]	1998.1
Hokkaido University	LICS	
Kyushu University	LICS	
Tohoku University	LICS	
Nagoya University	iLiswave	
Osaka University	LICS	
Keio University	CALIS	1998.10
Waseda University	INNOPAC	1998.10
Meiji University	iLiswave	
Rikkyo University	LICS	
Hosei University	iLiswave	
Sophia University	LOOKS	
Ritsumeikan Univ.	CALIS	
Kansai University	LINUS	
Kwansei Gakuin University	iLiswave	2002.4
Doshisha University	iLiswave	

[a]Includes digital library.
[b]iLiswave + digital library.

COOPERATIVE ACTIVITIES

At the 19th U.S.–Japan Conference on Cultural and Educational Interchange (CULCON) held in Okinawa in 1998, a joint statement on ''Libraries and Access to Information'' called for more concrete results in this area. To this end, in 1999 the Association of National University Libraries (ANUL) and the Public/Private Universities Library Cooperative Committee of Japan, together with the National Coordinating Committee for Japanese Library Resources (NCC) of the United States, formed a Roundtable on Improvement of Document Delivery Services between Japan and the United States. This was followed by a successful document delivery service test between Ariel and EPICWIN. Currently, as part of the Global ILL Framework (GIF) project, photocopy and book ILL services have been established via an ISO-ILL protocol link between the On-line Computer Library Center (OCLC) and the National Institute of Informatics (NII).

In 1998, the Japan Association of Private University Libraries formed the Committee for International Library Cooperation, which has initiated the following projects:

1. Donation of materials
   Cooperating universities are notified of materials that are in duplicate or to be discarded. These materials are then donated upon request. From 1995 to March 2002, 52,697 items (50 transactions) were donated to 31 institutions (26 of them universities) in 12 countries. From 1995 to 1997, this project was undertaken as a philanthropic activity of the Japan Culture Corporation, but is currently funded by the Japan Association of Private University Libraries with corporate support.

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Vendor linkage		User services				Protocols, new technologies						
Bookstore orders	Auto check-in	Web-OPAC	I-mode-OPAC	OPAC-EJ links	Online requests	Digital library	NII NewCAT	Z39.50	Multilingual (UCS)/DB	Full-text search	Authenti-cation	IC chip
●	×	●	×	×	●	×	○	Jcross	Oracle	○	●	● (IC card)
●	●	○	●	●	●	●	○	●	○	SearchServer	●	×
●	●	○	●	● (OVID link)	○	●	○	●	○	G-Base	○	×
PLATON	○	○	●	●	○	●	○	×	○	TextNavigator	●	×
●	●	○	×	●	○	●	○	●	○	OpenText	○	×
CHOICE	×	○	×	●	×	●	×	○	Cache	●	×	●
●	●	○	×	●	○	MEDIACENTER	○	○	HiRDB	●	○	×
●	●	○	○	×	○	○	○	○	Oracle	●	○	×
PLATON	○	○	×	×	○	○	○	×	○	Search cluster	○	×
PLATON	ACCESS	○	●	●	○	●	○	○	UDB/DB2	NSEARCH	○	×

2. International symposia
   Prominent American librarians are invited to speak at a symposium held every May to give private university libraries in Japan an opportunity to learn about current developments in university libraries overseas (particularly North America), and apply this knowledge to their own management. Topics at the last four symposia were ''Global Resources Sharing'' (2000), ''Cooperation and Collaboration in the Academic Library Environment'' (2001), ''ARL, SPARC and the Transformation of Scholarly Publishing'' (2002), and ''Research Information Services in a Global, Networked Environment'' (2003).
3. Group visits to overseas libraries
   Visits by library staff are organized to overseas libraries for training to enhance knowledge and skills acquired through the international symposia. From November 4 to 10, 2002, five librarians from five universities trained at OhioLink, OSU, OCLC, and Duke University (TRLN).
4. Overseas training programs
   Librarians at universities affiliated to the Association are sent overseas to participate in established training programs to obtain further work-related knowledge and skills. The Association has contracted to send librarians to train for 6 months with the associates program of the Mortenson Center at the University of Illinois, with the first trainee attending in September 2003.

DIGITIZATION PROJECTS

The extent of digitization in academic libraries in Japan can be determined from the responses by individual libraries to the statement ''At least part of our collection has been digitized'' in the section ''Computer Use at Universities'' of the report Statistics on Libraries in Japan.[12] However, to ascertain the actual state of affairs, one must examine link lists or the websites of individual universities. For example, a link list created and administered by the University of the Ryukyus Library (http://www.lib.u-ryukyu.ac.jp/erwg/denshika.html) provides information on the current extent of digitization efforts at national university libraries.

Most of the materials being digitized are historical documents, photographs, and other materials related to Japan. Examples include Japanese Old Photographs in Bakumatsu-Meiji Period (http://oldphoto.lb.nagasaki-u.ac.jp/univj/) by Nagasaki University Library; Ikeda Family Collection (http://www.lib.okayama-u.ac.jp/www/ikeda/ikeda-e.html) by the Okayama University Library; Digital Collections-Rare Books (http://www.tulips.tsukuba.ac.jp/pub/tree/kichosho.html) by the University of Tsukuba Library; and Nakajo Family Collection (http://www.lib.yamagata-u.ac.jp/rarebooks/nakajo/index.html) by the Yamagata University Library. Kobe University Library has produced a unique digital collection of materials related to the 1995 Hanshin Earthquake, Great Hanshin-Awaji Earthquake Disaster Materials Collection (http://www.lib.kobe-u.ac.jp/eqb/index.html). Keio University Library has digitized materials for the Keio Historical Photograph Database (http://photodb.mita.lib.keio.ac.jp/), while the Keio Digital Content Research and Service Museum (DRM) has digitized the 42-line Keio Gutenberg Bible as well as the medieval Japanese illustrated text Nara Ehon under the auspices of the university's Humanities Media Interface (HUMI) Project. Plans call for the registration of these materials with the Cultural Materials Initiative (CMI) of RLG, to which the Keio University Library has belonged since 1993.

To promote the use of digital materials and maximize the value of their digitization projects, libraries must develop and maintain comprehensive catalogs and search

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tools. However, these tools are still in the developmental stage at most institutions. Easy public access to digital materials also requires the establishment of a standardized system for information distribution. The MEXT Council for Science and Technology has issued a proposal to this end, Strengthening of Systems for Distribution of Science Information.[13]

RESEARCH AND DEVELOPMENT

To date, the National Institute of Informatics (NII) has been responsible for most research and development related to academic library services and operations in Japan. NII has developed cataloging, ILL, information retrieval, and Japanese language-processing systems, all of which have had a dramatic impact on the country's academic libraries. Research and development efforts have also been facilitated by digitization projects targeting national university libraries and funded by MEXT.

Other efforts have been undertaken at a more informal level. For example, the Library System Study Group, whose members include both academic libraries and library system vendors, is engaged in research and development with the aim of standardizing library systems. Efforts currently focus on the use of the Z39.50 protocol as a standard for system interfaces and bibliographic database searches.

INTERNATIONAL CONFERENCES AND SEMINARS

International conferences are frequently held on a variety of occasions. For example, the International Seminar on Library and Information Science was held in 1982 at the Library Center of the Kanazawa Institute of Technology, then annually after that until 1992. Scholars, librarians, and researchers from all over the world spoke on topics that contributed to the advancement of many aspects of library and information science. After an interval of one year, the seminar continued under a new name, the International Roundtable for Library and Information Science. The topics of the Roundtable focus on digital libraries and their impact. One significant change in 2003 is that the seminar was held jointly by the Library Center of the Kanazawa Institute of Technology and the Council on Library and Information Resources of the United States. The University of Library and Information Science also holds frequent conferences on digital libraries. It organized the International Symposium on Digital Libraries (1955 and 1999) and the International Symposium on Research, Development and Practice in Digital Libraries (1997).

Efforts are also under way to host or participate in international conferences on digital libraries that are open to participation not only by researchers but also librarians. For example, the Keio University Library hosted the sixth meeting of the Pacific Rim Digital Library Alliance (PRDLA) in Tokyo on July 11–12, 2002; this was attended by participants from 19 institutions in nine countries.

OTHER INTERNATIONAL ACTIVITIES

Many libraries make a concerted effort to participate in international activities. For example, in October 2002, the Keio University Media Center became the first general member of RLG in Asia and has since intensified its efforts at international cooperation. Other Japanese universities are also contemplating participation in RLG's Cultural Materials Initiative and other global resource sharing activities in the near future.

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Acidic Papers and Preservation Strategies

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INTRODUCTION

Until the 19th century, papermaking remained relatively unchanged from its introduction into Western Europe. Made by hand from durable natural fibers such as cotton, flax, and hemp, handmade papers have a naturally long life of several hundred years. The increasing demand for books forced papermakers to look for alternate raw materials and to increase production. In 1719, Rene de Reamur presented to the European paper-making industry a theory of making paper based on observations of American wasp's fine paper nest. Reamur's observations went ignored until 1800, when English papermaker Mathias Koops published a book conveying the same thesis as Reamur's. This, too, went ignored until 1839, when Frederich Gotliebb Keller discovered how to make paper from wood. Wood is approximately 50% cellulose, 30% lignin, 16% carbohydrates, and 4% protein, resins, and fats. It is the cellulose component in wood that is processed into today's paper.

In 1799, Nicholas Louis Robert invented a machine to make paper. Later, he assigned the rights to Leger Didot and, 2 years later, the English brothers Henry and Sealy Fourdrinier bought the machine. Although the Fourdrinier machine needed improvements, the process of the mechanization of paper was well on its way. By 1867, the first ground wood pulp paper mill had been established in the United States. By the mid to late 19th century, papermaking became increasingly mechanized and wood by-products replaced cotton and hemp as an alternative source for cellulose. Although conversion to a mechanized process addressed the increasing demand for paper, the paper produced in this process was highly acidic and carried with it the seeds of its own destruction.

The problem of acidic papers has shaped the preservation agenda of libraries since the 1970s. In an effort to understand the problem, the library community, conservation and paper scientists, engineers, and the industry have worked together to design and to implement preservation strategies in an attempt to halt the deterioration of acidic papers and to recover from the wholesale loss of millions of volumes. These joint efforts have resulted in reformatting activities such as microfilming, digitization, and facsimile production, and in conservation activities such as lamination, paper splitting, encapsulation, and deacidification. Indeed, a comprehensive preservation program is measured by the degree to which the full range of available preservation techniques is called on to deal with the problem of acidic books and papers.

OVERVIEW

The acidity of the wood pulp paper was recognized as early as 1909 in a U.S. Department of Agriculture Report, *Durability and Economy in Papers for Permanent Records: A Report Submitted by H. W. Wiley, Chief of Bureau of Chemistry, and C. Hart Merriam, Chief of Bureau of Biological Survey, Committee on Paper Departmental Use*, including *Paper Specifications* by F. P. Veitch, Chief Leather and Paper Laboratory, Bureau of Chemistry. Although recognized early into the new century, it was not until the mid 1950s that William J. Barrow would conduct the first systematic scientific testing and publish his findings in *Migration of Impurities in Paper* in 1953 and in his *Permanence/Durability of the Book* in 1963. Although the library community may well have noticed by the 1960s that large portions of printed materials were beginning to crumble on the shelf, it would be another 20 years before the library profession was to feel the impact of the crisis that was before them.

Recognizing that acidic paper was a global problem affecting all paper repositories, in 1984, a group of librarians, university officers, and scholars formed the Commission on Preservation and Access (CPA). The purpose of the commission was to develop and to support collaboration among libraries and affiliated organizations to pursue the preservation of published and documentary records. The commission's most pressing priority was the problem of brittle books. The commission was charged with exploring three possible strategies: help foster microfilming programs, explore deacidification of acidic but not yet brittle materials, and support efforts to persuade publishers to use alkaline paper. By 1985, the National Endowment for the Humanities established the Office of Preservation and Access to provide leadership in this area and an aggressive brittle books program was well underway (www.neh.gov/preservation/index.html). The joint efforts of the commission, the National Endowment for the Humanities (NEH), and preservation librarians

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succeeded in establishing, supporting, and attaining the articulated goals. In 1988, the Association of Research Libraries (ARL), the CPA, and the National Humanities Alliance (NHA) testified before Congress that millions of brittle books in libraries and archives were in danger of being lost forever and that this was a national crisis that presented a permanent threat to the future of scholarship and education in the humanities. Twelve years after it was formed, the commission had successfully completed its original mission and, in 1996, it redefined its scope of concerns and was renamed the Council on Library and Information Resources (CLIR) (http://www. clir.org)

NEUTRALIZATION/ALKALIZATION/ DEACIDIFICATION

Chemically, an acid refers to a material's ability to form hydrogen ions when dissolved in water. However, this process weakens cellulose in paper and eventually breaks down the molecular bonds. Acids may be inherent to the material, or they may be introduced at the time of production, or introduced yet again from external agents such as acid from adjacent materials or from atmospheric pollutants. The level of acidity is expressed in a unit of measure called pH. The scale expresses the level of concentration of hydrogen ions in a solution. The scale ranges from 0 (the highest level of acidity) to 14 (the highest level of alkalinity). Each value represents a 10-fold increase. A pH of 7 is considered neutral, a pH below 7 is acidic, and a pH above 7 is alkaline. Although acidity is a chemical reaction, it results in physical changes. As acidity increases, visible mechanical changes occur in paper that diminish its useful life (e.g., discoloration, loss of physical strength, loss of mechanical properties, etc.). To a certain degree, it is possible to raise the pH of some papers and thus retain a pH closer to neutral and increase the useful life of paper. Items that are acidic, but not yet brittle, retain some physical strength and thus can benefit from alkalization or deacidification. A preservation strategy geared toward neutralizing the acids in paper by raising the pH is called deacidification. Acidic papers that benefit most from deacidification include papers that are alum rosin-sized, ground wood, and papers produced under acidic conditions. Deacidification is considered a preventive preservation strategy and can be used for treating both new and older materials in the collections.

The ability to neutralize paper chemically has been available since the 1940s. The first application of paper deacidification was patented by O. J. Schierholtz, who used it in an aqueous solution of calcium bicarbonate. In 1943, William J. Barrow devised a technique that laminated paper with cellulose acetate while also deacidifying the paper with calcium carbonate. In each of these different techniques, the primary application was an aqueous bath intended for single-sheet material, such as maps, individual leaves, etc. Scientific advances continued to be made in the field of conservation and, by the 1960s, it became possible to add an alkaline buffer that would serve as a reserve from which the paper could eventually draw in the future. Several solutions have been used for deacidification; the most common are calcium carbonate ($CaCO_3$) and calcium hydroxide ($Ca(OH)_2$).

Aqueous deacidification provided a treatment option for individual papers. For a book to benefit from aqueous deacidification, it had to be disbound, each page had to be treated individually and dried, and then every sheet had to be reassembled into a book and bound. A single-sheet process was not an efficient strategy for the millions of volumes at risk. Given the scope of the problem, a mass deacidification process that allows an entire bound book to be treated was needed. The first application of such a process was developed in 1960 by Richard D. Smith. Smith used magnesium methoxide solubilized in a mixture of methanol and Freon compounds for his solution in a nonaqueous process. In 1972, Smith founded Wei T'o (http://www.weito.com) and developed two additional applications methods: a spray application for individual volumes and single sheets, and a chamber application that allowed dozens of volumes to be treated at once. The original formulation of Wei T'o has undergone several changes and improvements since its original introduction to accommodate changes in EPA regulations, as well as to improve product performance. The current formulation of the solution is as an isopropoxy magnesium isopropyl carbonate dissolved in isopropyl and ethyl alcohols.

During the 1970s, the Library of Congress attempted to develop a gaseous application using diethylzinc in the hope of avoiding potential damage to inks and adhesives. Experimentation and testing of the dez process, including a pilot plant at the NASA Goddard Space Flight Center and a commercial venture by Texas Alkyls, part of AKZO Chemicals, Inc., proved promising, but several factors, including the economics of a commercial venture and the high chemical reactivity of dez, resulted in the ending of further development. In 1987, the Lithium Corporation of America (Lithco), a subsidiary of FMC Corporation, developed a nontoxic proprietary chemical called MG-3, a nonpyrophoric magnesium compound soluble in both hydrocarbon and halocarbon solvents for deacidification, buffering, and strengthening of books and paper documents. The process consisted of three stages: preconditioning of materials, impregnating of materials with the active ingredients, and solvent removal. A third process developed by Battelle during this same time used magnesium titanium ethoxide both to deacidify and to strengthen paper. The Battelle pilot plant in Deutsche

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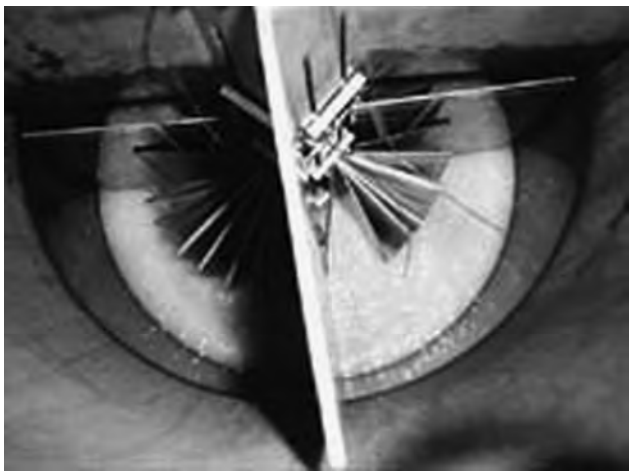

Fig. 1 Bookkeeper deacidification cylinder for books. (Courtesy of Preservation Technologies, 2002.)

Bücherei, Leipzig, began operations in 1994 and is still in operation.

In the 1980s, Richard Spatz of Koppers Company Laboratories developed and patented a deacidification process under the name of Bookkeepers and subsequently founded Preservation Technologies, Inc. (http://www.ptlp.com). Bookkeepers deacidification is a liquid-phase process using magnesium oxide (MgO) particles suspended in an organic solvent. The process requires a book to be strapped to a central cylinder where it is submerged in an alkaline bath of submicron particles of MgO. The particles are dispersed in a perfluorocarbon carrier with the assistance of a surfactant that prevents the particles from aggregating. Books are gently agitated in the solution. During this process, the pages are fanned open and the MgO particles are absorbed by the paper. The actual bath takes only 12–15 min and the entire process takes 2 hr to complete (Fig. 1). Preservation Technologies has also designed a horizontal treatment chamber that allows them to treat large, single-sheet documents as found in archival collections without having to remove papers from their containers (Fig. 2). The deacidification process is effective in raising pH values to between 6.8 and 10.4 and depositing a uniform alkaline reserve without damaging book or paper structure, or adversely affecting color, adhesives, plastic paperclips, ribbons, wax seals, or photosensitive papers. The overreaching success of Preservation Technologies' Bookkeepers mass deacidification process has resulted in the successful integration of this preservation strategy into a large number of U.S. and European libraries.

DUPLICATING AND REFORMATTING

Duplicating and reformatting represent two preservation strategies appropriate for materials that have reached a level of deterioration where physical restoration or conservation is not possible. Although duplication reproduces the original information in the same format, such as photocopying a book, reformatting reproduces the information by transferring it to another format, such as microfilm or electronic or digital format. Each of these strategies qualifies as preservation in so far as there are assurances that the information being preserved is moving from an unstable medium to a more stable one. Such

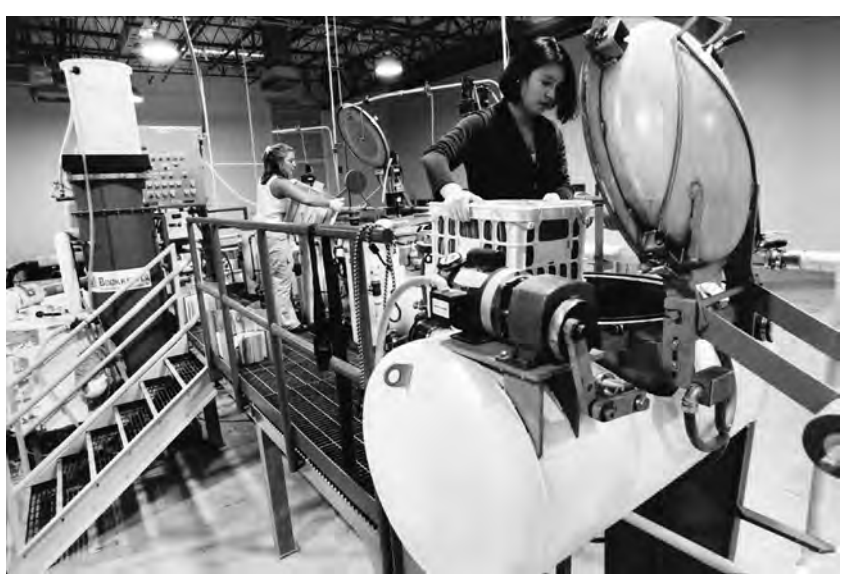

Fig. 2 Bookkeeper deacidification cylinder for archival materials. (Courtesy of Preservation Technologies, 2002.) Foreground shows loading archival materials in the horizontal cylinder while books are being prepared for the vertical book cylinder.

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assurances come from scientists who conduct research and testing to provide evidence of material safety, durability, longevity, and optimal storage conditions. Because duplicating and reformatting strategies are linked to technological developments, preservation librarians must factor in the issue of future accessibility of the reformatted information, before the reformatting strategy can be considered a preservation strategy.

PRESERVATION PHOTOCOPYING

Photocopying machines are regular fixtures in libraries and archives. The advent of acid-free and buffered papers, along with improved photocopying technology, has made it possible to transform ordinary photocopying into preservation photocopying. It is possible to produce high-quality black-and-white and color copies with extreme fidelity to the original. Preservation photocopying is best used for single-sheet collections, such as archival materials, ephemera, pamphlet literature, and performance scores. Preservation photocopying of grayscale material is less satisfactory at the present time. Preservation photocopying does not require significant institutional retooling compared with preservation microfilming and/or digitization, and thus can be relatively easily incorporated into library in house operation or outsourced. An institution is able to take advantage of either favorable operating budget or high staffing levels.

The quality of a preservation photocopy depends largely on the paper used, the quality of the photocopy machine, the skill of the operator, and the quality of the original. Guidelines exist to assist the preservation librarian in producing preservation-quality photocopies. To qualify as a preservation photocopy, the item must be produced on paper meeting ANSI Standard Z39.48 for permanent and durable paper. Like preservation microfilming, image quality is lost in subsequent generations. Prior to digital technology, it was customary to retain a second unbound photocopy to produce future copies, but with scanning technology, it is both possible to produce high-quality paper copies and to archive scanned images for future copies without loss of image quality associated with generational loss.

Photocopiers use a toner to produce permanent images. The image is fused onto the paper. The fusing process must produce a strong and uniform bond of the pigment to the paper to ensure permanence. A tape pull test is typically used to determine the quality of pigment fusing. If the toner has lifted off and the image is visible on the peeled tape, the fusing is not satisfactory. Different papers and different machines produce differences in fusing and, for this reason, machines should be dedicated to this function. The operator must take care to reproduce the item in sequential order, to avoid skewing the image during copying, to register the printed text from both sides of a page, to adjust the contrast settings to achieve best legibility between text/illustrations and background, and to allow adequate gutter margins for binding. Image quality, permanence, and completeness often depend on the skill of the operator and, for this reason, the staff should be well trained and dedicated to this function to understand and monitor the various elements. Preservation photocopies must also contain a page identifying the work as a copy and indicating that the paper complies with ANSI Z39.48 or ISO 9706: 1994.

PRESERVATION MICROFILMING

Preservation microfilming is still considered to be the only accepted preservation reformatting strategy. This degree of reliability and acceptance is due not only to the stability and the longevity of the film base, but also to the full course of standards brought to bear through all stages of prefilming, filming, and postfilming activities. Standards governing preservation microfilming are set by the American National Standards Institute (ANSI; www.ansi.org), the American Institute of Image Management (www.aiim.org), and the Research and Libraries Group (www.rlg.org) *Guidelines for Preservation Microfilming.* Preservation microfilming is usually undertaken either to replace brittle material, to protect the original by creating a surrogate use copy, and/or to replace other deteriorating or defective microforms. Although microfilm technology was originally developed to reproduce the high-contrast black-and-white print text, improvements in lens technology and film emulsion now make it possible to reproduce grayscale information found in printed illustrations with the use of continuous tone microfilm and colored illustrations with extremely high fidelity to the original (Figs. 3a and b).

PREFILMING PREPARATION

Prior to filming, bibliographic search for the title should be conducted in OCLC or Research Libraries Information Network (RLIN) to prevent the duplication of existing microfilms. If no previous film exists, the item is then reviewed for physical and bibliographic completeness; page-by-page collation is conducted; torn pages are repaired; extraneous materials are removed; irregularities in text or physical construction or unique characteristics, such as foldouts and page sequences, are identified and noted in preliminary targets; and prospective cataloging in OCLC or queuing in RLIN is conducted to announce the intent to microfilm. Prior to filming, decisions regarding disbinding must also be considered. Flat materials can usually be placed directly onto the camera bed (Fig. 4).

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Fig. 3 (a) Color microfilm and (b) continuous tone microfilm. (Courtesy of Preservation Resources, 2002.)

Depending on how tightly bound a book is, bound volumes are placed onto a support cradle, thus eliminating in most cases the need to disbind (Fig. 5). If the paper is severely brittle or poorly bound, microfilming-bound materials can cause more damage than disbinding, in addition to compromising the camera operator's ability to capture a quality image.

Bibliographic control is central to preservation microfilming. In the prefilming stages, prospective cataloging on OCLC or queuing in RLIN expresses an institution's intent to microfilm a title. Additionally, complete bibliographic information of the original material is included as a preliminary target in the microfilm itself. Finally, a base set of data elements for USMARC Fields 007 and 533 is entered. These fields record production information such as the number of generations, the emulsion, the final format, the reduction ratio, the date and year filmed, the filming agent, and the institution owning the item (Fig. 6). The National Register of Microfilm Masters (NRMM) is the largest single file of records for microform masters in the United States.Originally printed on paper, the NRMM is now integrated into OCLC and RLIN and includes the master microfilms from the European Register of Microfilm Masters.

Fig. 4 Herrmann and Kraemer 35-mm camera filming of flat scrapbook collection. (Courtesy of Preservation Resources, 2001.)

FILMING PHASE

Standards require that three generations of microfilm be created. Silver halide polyester film is used for the first

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Fig. 5 Herrmann and Kraemer 35-mm camera and book cradle. (Courtesy of Preservation Resources, 2001.)

generation. A film can be either 35 or 105 mm, high contrast, color, or continuous tone, or high contrast/full-frame or color/full-frame continuous tone fiche, respectively. The first generation, called the master negative or camera negative, is made and stored according to standards specified by the ANSI. In addition to the quality of film, standards and best practices specifying the number of splices, density, resolution, targets, reel programming, orientation of image, and many more ensure that the microfilm will both preserve the information and be accessible in the future.

POSTFILMING

The first-generation film is inspected frame by frame to ensure that all information has been faithfully captured, that images are of the highest quality, that no errors have either been reproduced or introduced, and that the film has been processed according to standards. A second-generation print master or print negative, also on silver halide, is then produced from the master negative. From the second generation, the third and all subsequent generations are produced. The third generation, the service copy used by library patrons, can be either a positive or a negative image, on diazo, vesicular, or silver halide film base depending on a library's preference. Although the third generation is not considered a preservation copy, proper care, handling, and storage will ensure long-term use and avoid needless wear on print masters. ANSI/NAPM IT9.Tl-1993 describes the appropriate storage conditions for both master negative and print master to

```
  OCLC:  24839085            Rec stat:    c
  Entered:    19911122       Replaced:    20010411       Used:    19911122
▶ Type:  a     ELvl:  I     Srce:  d     Audn:        Ctrl:        Lang:  eng
  BLvl:  m     Form:  a     Conf:  0     Biog:        MRec:        Ctry:  dcu
               Cont:  b     GPub:        LitF:  0     Indx:  0
  Desc:  a     Ills:        Fest:  0     DtSt:  s     Dates: 1930,     ¶
▶   1  040     IND ‡c IND ‡d OCL ¶
▶   2  007     h ‡b d ‡d a ‡e f ‡f a011 ‡g b ‡h a ‡i c ‡j p ¶
▶   3  007     h ‡b d ‡d b ‡e f ‡f a011 ‡g b ‡h a ‡i b ‡j p ¶
▶   4  007     h ‡b d ‡d b ‡e f ‡f a011 ‡g b ‡h a ‡i a ‡j p ¶
▶   5  037     #92-8333-2 ‡b IND ¶
▶   6  041 0   englat ¶
▶   7  090     ‡b  ¶
▶   8  049     CGPP ¶
▶   9  100 1   Hart, Charles Aloysius, ‡d 1893- ¶
▶  10  245 14  The Thomistic concept of mental faculty ‡h [microform] / ‡c by
Charles Aloysius Hart. ¶
▶  11  260     Washington, D.C. : ‡b Catholic University of America, ‡c c1930. ¶
▶  12  265     CPC/Microtexts Unit, Room 112, Hesburgh Library, University of
Notre Dame, Notre Dame, Ind., 46656. ¶
▶  13  300     142 p. ; ‡c 24 cm. ¶
▶  14  533     Microfilm. ‡b Notre Dame, Ind. : ‡c University Libraries,
University of Notre Dame, ‡d filmed June 1992. ‡e 1 microfilm reel ; 35 mm. ¶
▶  15  539     s ‡b 1992 ‡d inu ‡e n ¶
▶  16  504     Includes bibliographical references (p. 137-142). ¶
▶  17  500     Thesis (Ph. D.)--Catholic University of America, 1930. ¶
▶  18  500     At head of title: The Catholic University of America. ¶
▶  19  500     Vita. ¶
▶  20  600 00  Thomas, ‡c Aquinas, Saint, ‡d 1225?-1274. ¶
▶  21  650  0  Psychology ‡x History. ¶
▶  22  650  0  Mind and body. ¶
▶  23  650  0  Soul. ¶
▶  24  650  0  Metaphysics. ¶
▶  25  740 01  Faculty, The Thomistic concept of mental. ¶
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Fig. 6 The OCLC bibliographic record for preservation microfilming data in 007 and 533 MARC fields. (Courtesy of University of Notre Dame and OCLC, 2002.)

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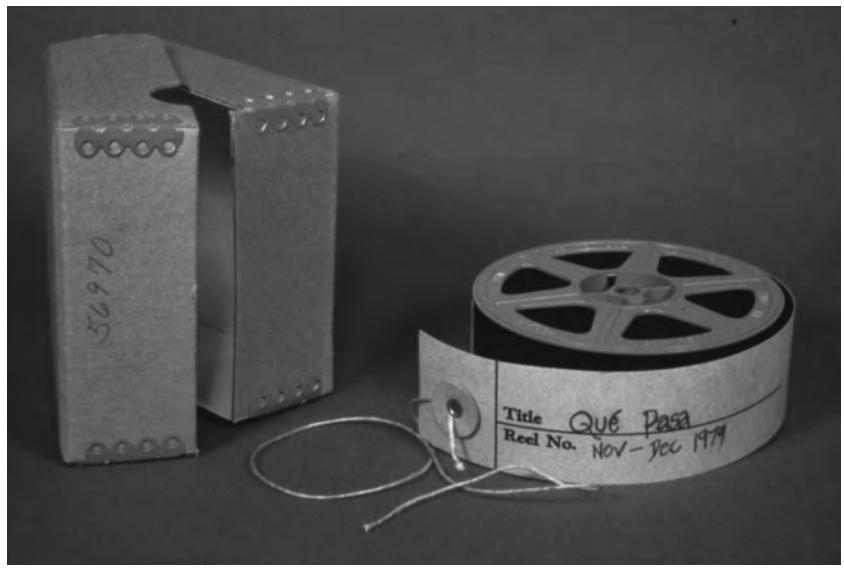

Fig. 7 Appropriate housing for preservation microfilm includes inert reel, button string tie, and archival box. (Courtesy of Sophia K. Jordan, 2001.)

Fig. 8 Microfilm storage cabinets inside a vault in Iron Mountain. (Courtesy of National Underground Storage, Iron Mountain, 2001.)

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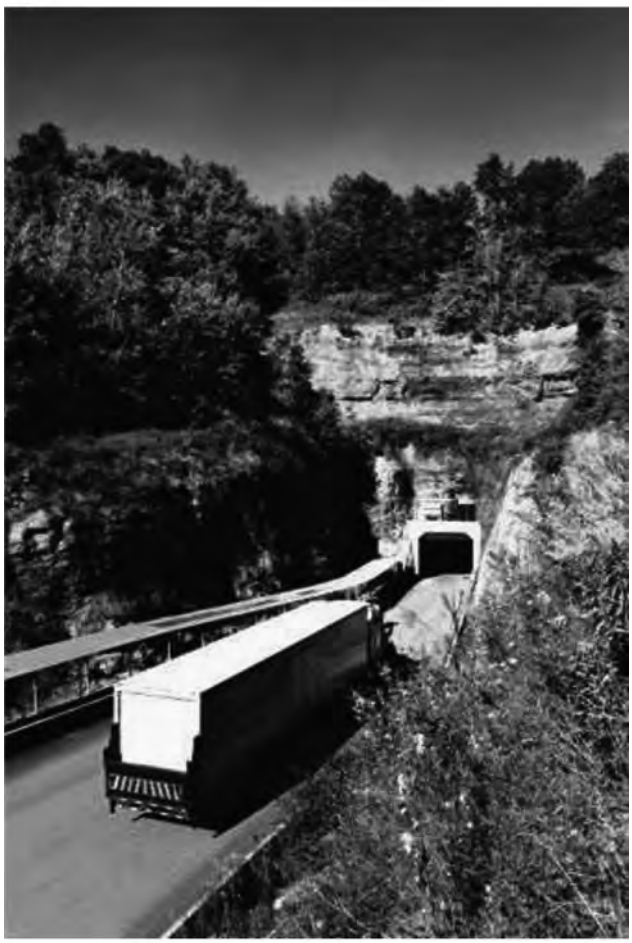
(a)



(b)

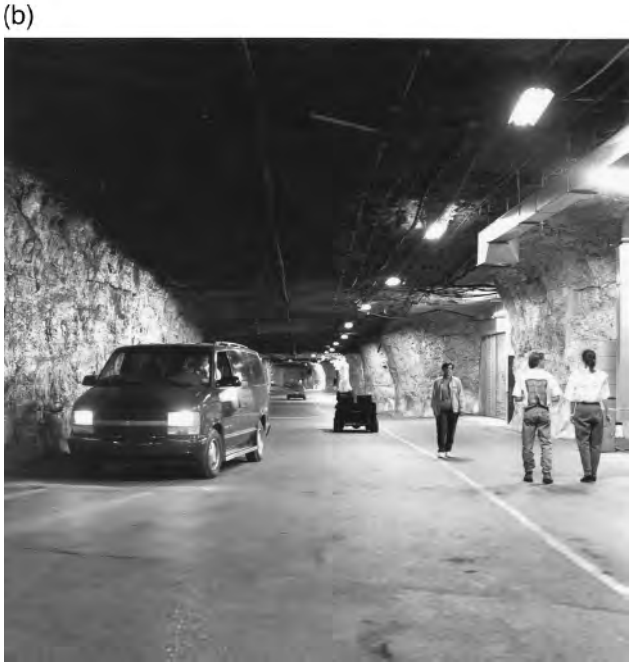


Fig. 9 (a) Entering the Iron Mountain underground storage facility. (b) Inside the roadway of Iron Mountain. (Courtesy of National Underground Storage, Iron Mountain, 2001.)

Fig. 10 Direct duplication of microfilm. (Courtesy of Preservation Resources, 2001.)

ensure longevity. From archival boxes (Fig. 7) and appropriate microfilm cabinets (Fig. 8) to underground document storage facilities meeting strict environmental conditions, preservation microfilming provides assurances that master negatives will continue to preserve information into the distant future (Fig. 9). Print masters are stored in a controlled environment and in a different location than the master negatives. This can be located either at the microfilming agent, or remotely at the home institution. Preservation-quality microfilm has evolved into a sound and well-established preservation strategy.

In the early stages of microfilm technology, material degradation of film base was not well understood. Early microfilms produced on nitrate and cellulose acetate film suffer from their own form of degradation and do not currently satisfy preservation standards. To save the vast microfilm collections that have grown, it is possible to create a preservation microfilm from deteriorating nitrate or acetate-based film by transferring the information to a silver gelatin polyester-based safety film through a process called direct duplication (Fig. 10).

A preventative measure developed in the 1990s was polysulfide treatment. This is recommended for both master negative and print master. The process protects films from damage caused by high temperature, high humidity, and atmospheric pollutants, and can be applied either during the filming processing or afterward.

DIGITIZATION AS A PRESERVATION STRATEGY

From its beginnings, digital technology was seen as a reformatting strategy intended to replace the inconvenience and limits of preservation microfilming. Unlike

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preservation microfilming or photoduplication, digitization offers a degree of accuracy and fidelity without generational loss. Additionally, digitization offers a universal format, regardless of the format of the original, and a level of access to the reformatted information previously unknown. From the preservation agenda, digitization solves many of the limitations of traditional reformatting while also greatly enhancing access. Digital initiatives have been extremely successful access strategies and their role in libraries, historical societies, museums, and educational institutions continues to be explored individually, collaboratively, and globally. The number of web sites devoted to bringing digital collections to users, as well as discussing the place of the digital agenda, is well documented on the Internet (www.diglib.org).

Many of the preservation issues associated with digitization fit into the well-ascribed practices long established in preservation microfilming. These include selection criteria, physical preparations, project management, image quality standards, bibliographic control, equipment management, staff workflow, and long-term storage and retrieval issues. Because preservation departments had successfully addressed these issues, digitization initiatives have been largely absorbed by preservation departments as an adjunct access strategy. However, a successful establishment of managerial and production models for reformatting does not automatically qualify digitization as a preservation strategy. Unlike other reformatting strategies, material and informational longevity, authenticity, and usability of the digital format have not yet been uniformly resolved. Current research indicates that the useful life of digital carriers is somewhere between 5 and 25 years. This cannot compare with the longevity or the durability of microfilm or archival paper. Because preserving digital information is not about preserving the physical format, but about maintaining access over time to the integrity of the information, material longevity is less central, albeit critical to the management of information preservation. The range of preservation issues associated with digital reformatting includes the rapid change in hardware and software, the potential loss of information during migration, space limitations on servers, file naming conventions, and administrative programs for migration information.

Informational authenticity, integrity, and intellectual property rights are of greater concern in the digital arena because of the ease of access and the limited control over reproduction of digital works. Several strategies that are being explored include: technology preservation, which attempts to retain the same hardware and software; technology emulation, which attempts to create simulated operations of older technology on newer technology; and data migration, which proposes a rigorous routine of migrating digital information through successive generations of hardware and software regularly.

Because most digital collections are destined for access on the Internet, access to bibliographic information is key. Digital collections are accessed through metadata—the cataloging of the new millennium. Metadata provide information about the architecture of a digital file to enable intellectual control, description, and access for efficient and effective searching. Metadata structures are based on the 1995 data element scheme known as the Dublin Core. The preservation of metadata on the Internet is of equal concern, and a system of harvesting metadata from global servers is another link in the chain for digital collections.

Digitization offers vastly improved access to preserved materials and, as a result, digitization has become an adjunct activity within the preservation agenda. Standards and best practices are evolving (www.diglib.org/standards.htm) and there is strong evidence to believe that the many issues will be resolved so that digitization will be considered a preservation reformatting strategy. However, until that time, preservationists are taking a hybrid approach to deal with the complexity of issues. The hybrid approach combines the benefits of access associated with digital formats with the archival viability associated with microfilming and/or conservation of the artifact. In this context, digitization can be considered a preservation strategy. Hybrid approaches can take several Mforms and are best worked out in consultation with the curator of the collection, conservator, preservation librarian, and computer systems staff, to find the reformatting combinations that best fit the need of the item, institution, and mission.

PRESERVATION OF DIGITIZATION INFORMATION: PRESERVING THE WEB

Preserving digitally born information presents an even greater challenge than digitization as a reformatting strategy. Toward that end, there has been increased global activity to identify the formal mechanism for the long-term preservation of these resources. Independent working groups, institutions, and agencies have been established to address this issue. There are several important Internet preservation projects that are noteworthy. Pioneer in this area is the 1996 Pandora Project of the National Library of Australia that archived a selection of Australian online publications, including web sites. Additionally, the National Library of Australia has developed a national strategy for their long-term preservation that is being coordinated by the Preserving Access to Digital Information (PADI) Working Group (www.nla.gov.au/dnc/tf2001/padi/padi.html). The Internet Archive, an organization in San Francisco, has been collecting open access HTML pages since 1996. The National Library of Sweden, another pioneer, established its program Kultur-

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arw3 in 1996 with the goal of collecting, preserving, and providing access to Swedish electronic documents published online.

The problem of acidic books and papers has forced the global community to work together to ensure that the collective products of human learning, memory, and culture will endure for generations to come. The process of dealing with the brittle books problem has resulted in a range of activities that has not only come to the rescue of collections, but has also introduced another means of communication, learning, and engagement, with its own preservation challenges. Like the preservation strategies of previous decades, research, development, standards, and professional management are required to ensure that any proposed strategy designed to ensure continued access to information should be an effective and measured preservation response.

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African American Studies Databases

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INTRODUCTION

As an interdisciplinary field, African American studies crosses into a wide number of overlapping subject areas including social studies, humanities, health, law, medicine, and technology. Because information pertinent to African American studies depends on the subject of any given research project, information may be found in a number of databases rather than concentrated in a single tool. As a result, users and librarians alike must know the scope and coverage of a broad range of electronic services. Given the nature of the discipline, the introduction of several commercial databases specific to African American studies since the mid-1990s has been a welcome addition to the plethora of subject databases available commercially and freely on the World Wide Web. However, the multidisciplinary and interdisciplinary nature of African American studies raises many issues concerning content, coverage, and scope of electronic databases. This article explores these issues and highlights significant databases, mostly subscription databases, available to date.

AFRICAN AMERICAN STUDIES COLLECTIONS AND ELECTRONIC RESOURCES: A BRIEF HISTORY

Whether identified as African American studies, Afro-American studies, Africana studies, or black studies, academic departments and programs devoted to research and teaching multidisciplinary or interdisciplinary aspects of the African American experience have been a significant aspect of higher education in the United States for the last three decades.[1] African American studies developed into an academic area of study in the 1970s as a result of the political action of the 1950s and the 1960s and the student demand for black-oriented courses. Over the years, it has emerged as a discipline contributing significantly to traditional fields, such as history, literature, political science, and sociology, and to new fields of inquiry and analysis, such as race, class, and gender studies.[2]

Recognizing and responding to the demand and need for black-related materials, a number of universities also established individual library collections supporting and supplementing the new curriculum. Presently, a number of universities in the United States maintain separate African American library collections, reading rooms, and/or cultural centers. For example, University of California at Santa Barbara, Ohio State University, University of Pittsburgh, Bowdoin College in Maine, and Boston College have separate collections; the African American Studies Department at Syracuse University houses a separate library it jointly administers with the university library; University of Pennsylvania and Princeton University have separate reading rooms; and Indiana University at Bloomington as well as Purdue University both maintain libraries within their respective black cultural centers. Predating many of these efforts are a number of established African American manuscript collections owned by historically black colleges and universities, public libraries, archives, and historical societies, such as the Moorland-Springarn Research Center at Howard University, which contains more than 160 collections containing document pertaining to the African Diaspora, and the New York Public Library's Schomburg Center for Research in Black Culture, which includes more than 450 manuscript collections.

Over the years, the publication of print research and reference resources pertaining to African American studies has flourished. However, when Smiley Bell[3] published her article, ''Electronic Resources for Cultures of the World'' in 1994, African American studies databases did not exist. In 1995, Chadwyk-Healey released two of the first commercial databases specific to African American studies, the *Database of African–American Poetry, 1760–1900* and *Black Studies on Disc*. A recent search of *OCLC WorldCat* using the terms ''African Americans databases'' yielded 92 unique computer and Internet titles relating to African American studies ranging from full-text databases such as *African American Newspapers the 19th Century*, which contains complete texts of major 19th-century African American newspapers, to *The Trans-Atlantic Slave Trade: a Database on CD-ROM*, which contains records of 27,233 trans-Atlantic slave ship voyages made between 1595 and 1866.[4] In addition, a number of free-access electronic resources such as *Black Facts Online* (http://www.blackfacts.com), a searchable database containing facts about African American history, are also cataloged in *WorldCat*. Searchable electronic versions of seminal African American resources such as *The Oxford Companion to African American Literature*

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and the *American Slave Narratives* have also become available. To date, ProQuest Information and Learning, marketed under the brand names Chadwyk-Healey and ProQuest, is the largest publisher of African-American-related databases with six titles: *The African American Biographical Database* (*AABD*); *African–American Poetry, 1760–1900*; *Database of Twentieth-Century African–American Poetry*; *International Index to Black Periodicals Full Text*; *Ethnic NewsWatch*; and *Ethnic NewsWatch: A History*.

The advent of the World Wide Web has made it possible for scholars, students, and other users to access an enormous and rapidly growing body of textual, graphical, and interactive material previously inaccessible. African American studies are well represented on the Web by a myriad of personal and institutional Web sites ranging in information at local, regional, national, and international levels. The overlapping subjects areas of African American studies are a plus given the linking technology of Web-based browsers; but reliance on Web resources has raised some concerns about possible diminishing quality of student research and the reliability of personal and commercial Web pages. As more and more of the *Google* generation comes of age and seeks electronic information for their research, the issues of information literacy and what users consider to be reliable will continue to be explored in the research. In 1999, Thomas Weissinger looked at the relationship among different types of African American home pages, in particular, the idea of scholarly vs. nonscholarly African American Web sites. Weissinger compiled a list of 62 general black studies home pages and used the link command in the *AltaVista* search engine to determine what types of Web pages each particular site was linked. He found that most sites in academic domains link to other sites in academic domains. Likewise, most sites in commercial domains link to other sites in commercial domains; commercial home pages link to personal home pages much more frequently than do academic ones. Weissinger suggested that individuals managing academic sites find personal home pages and commercial ones to a lesser extent lack credibility and trustworthiness. He further suggested that many personal African American Web sites document experiences or issues ignored by sites catering to mainstream audiences lending relevancy and value to their users. This may be an indication that access to materials not available on academic and institutional Web pages may need to be improved and reevaluated.[5]

SELECTED DATABASE OVERVIEWS

Numerous general and specialized databases specific to African American studies are currently available. In this section, selected commercial and free Web databases are described in terms of format, content, and coverage. Periodical indexes are covered separately in a later section. For purposes of this article, the databases included are commercial and/or scholarly sites edited by specialists, sponsored by educational institutions, literary societies, and subject enthusiasts (Fig. 1).

Biographies and Bio-bibliographies

African–American Artists on Disc (CD-ROM) lists more than 8000 African American artists, craft artists, art historians, museum and gallery directors, and curators. Including more than 20,000 bibliographic citations referencing books, book chapters, exhibition catalogs, periodicals, newspapers, dissertations, audiovisuals, and archival materials, much of the material is derived from the seminal print reference *250 Years of Afro-American Art* and supplemental material collected since its publication in 1981. The bibliography is comprehensive and includes both well-known and secondary artists, as well as tertiary artists often not found in other sources.

African American Biographical Database (AABD, on line) produced by ProQuest is a landmark collection of biographical narratives including thousands of biographical accounts assembled from Chadwyk-Healey's *Black Biographical Dictionaries, 1790–1950*, rare biographical dictionaries, newspaper clipping files, obituaries, slave narratives, and Web sites. This work is an excellent resource for finding biographical information on lesser-known African Americans in all walks of life. The database is searchable by name, date of birth, occupation, religion, date of birth or death, gender, and the sources of the biographical information. Users can also search the full text of the resources by any word or phrase, including personal names, appearing in the text. Comprised of digitized complete text of all volumes used as sources, keyword searching provides access to all points in each text where specific subjects or topics are found. This work is an excellent resource for finding biographical information on lesser-known African Americans.

American Slavery: A Composite Autobiography (on line) is the electronic version of a multivolume set of the same name published in 1972. From 1936 to 1938, ex-slaves in the United States told their stories of what it was like to be a slave and what was life like after emancipation. These narratives were collected under the auspices of the Work Projects Administration's Federal Writers' Project that put unemployed workers back to work during the Great Depression. Hired writers traveled around the country and interviewed the last generation of African Americans born into slavery. Searchable by surname, location, age, and alone or combined with subject index heading, the database is an excellent source for historical,

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Title	Access	Time Span	Content
Biographies and Bio-Bibliographies			
African-American Artists on Disc	CD-ROM		Full text, full images
African American Biographical Database (AABD)	Electronic (subscription only)	1790 to 1950	Full text, full images, hyperlinks
American Slavery: A Composite Autobiography	Electronic (subscription only)	1936 to 1938	Full text, hyperlinks
American Slave Narratives: An Online Anthology	http://xroads.virginia.edu/~HYPER/wpa/wpahome.html	1936 to 1938	Some full text and full images
North American Slave Narratives, Beginnings to 1920	http://docsouth.unc.edu/neh/neh.html	17th c. to 1920	Full text, full images
Encyclopedias and Guides			
African American History Links and General Resources	http://www.academicinfo.net/africanam.html	--	Hyperlinks, some full text
The AFRO-American Almanac	http://www.princeton.edu/~mcbrown/display/faces.html		Hyperlinks, full images
Access to African American Studies	Electronic (subscription only)	1972 to date	Full text, full images, hyperlinks
Encarta Africana 2000	CD-ROM	Prehistoric to present	Full text, full images, audio/video clips
Afriana.com	http://www.africana.com	--	Full text, some images, hyperlinks
African American Culture and History	CD-ROM	1619 to date	Full text, images, hyperlinks
African American Experience on File	CD-ROM	1492 to date	Full text, images, hyperlinks
The Civil Rights Movement in the United States: An Interactive Encyclopedia	CD-ROM	--	Full text, images, hyperlinks
The Encyclopedia Britannica Guide to Black History	http://search.eb.com/blackhistory/	--	Full text, full images, hyperlinks, audio/visual clips
Data Sets			
The Trans-Atlantic Slave Trade: A Database on CD-ROM	CD-ROM	1595-1866	Data files
Online Archive: Roll of Emigrants to Liberia, 1820-1843	http://dpls.dacc.wisc.edu/Liberia/	1820-1843	Data files
Liberian Census Data, 1843	http://dpls.dacc.wisc.edu/Liberia/	1843	Data files
Genealogy			
AfriGeneas	http://www.afrigeneas.com/	--	Some full text, hyperlinks, images, searchable databases
Christine's Genealogy Website	http://ccharity.com/	--	Some full text, hyperlinks
Freedmen's Bureau Online	http://freedmensbureau.com/	19th c.	Full text, hyperlinks
Historical Texts and Documents			
Digital Schomburg Images of 19th Century African Americans	http://digital.nypl.org/schomburg/images_aa19/	19th c.	Image database
African American Women Writers of the 19th Century	http://digital.nypl.org/schomburg/writers_aa19/	19th c. to early 20th c.	Full text, textual images, hyperlinks
African-American Women On-line Archival Collections	http://scriptorium.lib.duke.edu/collections/african-american-women.html	--	Some full text, full images, hyperlinks
Library of Congress and National Archives			
The African American Mosaic	http://www.loc.gov/exhibits/african/afam001.html	--	Textual images, images, hyperlinks
African American Odyssey	http://memory.loc.gov/ammem/aaohtml/aohome.html	--	Textual images, images, hyperlinks
African American Sheet Music	http://memory.loc.gov/ammem/award97/rpbhtml/aasmhome.html	1850 to 1920	Textual images, images, hyperlinks
The Church in the Southern Black Community, 1780-1925	http://memory.loc.gov/ammem/award99/ncuhtml/csbchome.html	1780 to 1925	Bibliographic records, images, hyperlinks
U.S. Colored Troops (USCT)	http://www.itd.nps.gov/cwss/	19th c.	

Fig. 1 African American database. (*View this art in color at www.dekker.com.*)

(*Continued*)

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Literature			
Black Drama	Electronic (subscription only)	Mid 1800s to date	Full text
African-American Poetry, 1760-1900	Electronic (subscription only), CD-ROM	1760 to 1900	Full text
Twentieth-Century African American Poetry	Electronic (subscription only), CD-ROM	1900 to 2000	Full text, textual images
Newspapers			
African American Newspapers: The 19th Century	Electronic (subscription only)	1827 to 1862	Full text
Ethnic NewsWatch	Electronic (subscription only)	1992 to date	Full text
Ethnic NewsWatch: A History	Electronic (subscription only)	1960 to1989	Full text
Indexes and Abstracts			
Black Studies Database: Kaiser Index to Black Resources (BSD)	Electronic (subscription only)	1948 to 1986	Bibliographic records
Black Studies on Disc	CD-ROM	1988 to date	Bibliographic records
International Index to Black Periodicals Full Text (IIBP Full Text)	Electronic (subscription only)	1910 to date	Bibliographic records, full text (1998 to date)

Fig. 1 (*Continued*). (*View this art in color at www.dekker.com.*)

genealogical, and sociological research. Samples of some of these 2300 slave narratives are freely available via *American Slave Narratives: An Online Anthology* (http://xroads.virginia.edu/~HYPER/wpa/wpahome.html) including selected photographs, audio from recorded interviews, an annotated index, related readings, and Web sites. Earlier slave narratives are available at *North American Slave Narratives, Beginnings to 1920* (http://docsouth.unc.edu/neh/neh.html), an ongoing project at the University of North Carolina at Chapel Hill. When complete, it will include all the narratives of fugitive and former slaves published in broadsides, pamphlets, or books in English up to 1920 and many of the biographies of fugitive and former slaves published in English before 1920. Links to narratives are accessible through both alphabetical and chronological bibliographies.

Encyclopedias and Guides

African American History Links and General Resources (http://www.academicinfo.net/africanam.html), maintained by Academic Info, is a comprehensive guide to major African American sites of interest to researchers and students. Users can find links to historically black colleges and universities; *The Afro-American Almanac* (http://www.toptags.com/aama/), an on line presentation of African Americans from a historical perspective from slavery to the present; *The Faces of Science: African Americans in the Sciences* (http://www.princeton.edu/~mcbrown/display/faces.html) which profiles men and women who have contributed to science; *The History of Jim Crow* (http://www.jimcrowhistory.org/home.htm) which provides a history of segregation in the United States from the 1870s through the 1950s; and *The Negro League Baseball* (http://www.negroleaguebaseball.com/) which includes teams, players, and related research sources. Overall, *African American History Links and General Resources* is an excellent gateway to digital collections and established Web sites maintained by museums, associations, universities, public libraries, and individuals.

Access to African American Studies (on line), produced by CIS Universe, provides access to major federal legislation regarding race relations from 1792 to the present, complete U.S. Supreme Court decisions on race, reference articles on well-known African Americans, events, and laws pertaining to the African American experience, manuscript material, autobiographies of prominent African Americans, as well as scholarly articles from academic journals and important anthologies. This product is searchable by keyword and subject, and users can also browse a list of topics. Searches can be limited by date and document type. Cross-references are hot-linked throughout entries leading to related documents within the database. A related CIS product is *Access to Primary Sources*, an on-line guide to nonprint archival collections in microform. This guide provides Web-searchable guides for over 127 of the most popular microform collections from CIS, including many of its African American research collection on microform, such as *Black Journals, Black Workers in the Era of the Great Migration, 1916–1929*; *Congress of Racial Equality Papers, 1959–1976*; *Papers of the NAACP*, and *Slavery Source Materials*. *Access to Primary Sources* is useful mainly for libraries that own a number of the microform sets.

Encarta Africana 2000 (CD-ROM) is the second version of the multimedia encyclopedia developed as a joint effort by Dr. Henry Louis Gates, his fellow Harvard professor Dr. Kwame Anthony Appiah, and Microsoft.

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Using audio, video, and the written word, *Encarta Africana 2000* covers the African Diaspora across the globe from Africa to the Americas, Europe, the Caribbean, and Asia, tracing the history and culture of people of African descent from 4 million BC to the present. Originally conceived to fulfill the lifelong dream of famous African American educator W.E.B. DuBois to compose an encyclopedia of African history, *Encarta Africana 2000* includes articles, Web links for additional research, full-color, 360° panoramic tours of famous African sites, and new multimedia sections such as the ''Music Timeline,'' featuring music and rare video clips of legendary musicians such as John Coltrane and Miles Davis, and the ''Civil Rights Chronology,'' which depicts 125 defining moments of the U.S. Civil Rights Movement. *Africana.com* (www.africana.com), produced as a free on-line companion to the CD-ROM, includes articles and daily news stories about African American lifestyles, heritage, art, information on books, music, art, and jobs. Users can join chats and forums to discuss issues of particular interest.

African American Culture and History: An On-line Encyclopedia (CD-ROM), produced by Facts on File Online, combines a number of reference resources as one database. It includes over 2000 timeline entries spanning more than 500 years of black history; approximately 1800 biographies, hypertext entries on topics ranging from cases and legislation to key social movements; historical documents; maps and charts; and an image gallery consisting of 850 historical images. Also included are selected Web links to educational sites. Overall, it is a useful database recommended for school and public libraries. Facts on File also produces *African American Experience on File* (CD-ROM), a smaller database containing many of the same visual and textual materials arranged under chronological headings such as ''Background,'' ''Slavery in the Early Americas (1492–1820),'' and the ''Antebellum Years (1821–1865).''

The Civil Rights Movement in the United States: Interactive Encyclopedia (CD-ROM) published by ABC-CLIO contains more than 500 entries covering individuals, events, primary documents, organizations, and definitions of important terms. Many cross-references hotlink with each entry. This product enables users to connect to a companion Web site containing a ''Teacher's Resources Section'' which offers lesson plans, assignment ideas, links related to organizations, and educational Web sites. The ''Student Resources'' section provides examples for writing biographies and guides for conducting research. Most of the information in this database can easily be found in a good general reference collection and is therefore recommended for public and school libraries.

The Encyclopedia Britannica Guide to Black History (http://search.eb.com/blackhistory/) features 600 articles, historical film clips and audio recordings, as well as hundreds of photographs. The ''Related Internet Links'' and ''Bibliography'' sections provide source material and topics for further study, as does the Study Guide for Students. ''Eras in Black History'' examines five centuries of black heritage through five distinct time periods, from the slave revolts of early America through the successes of the Civil Rights Movement. Each era is further divided by topic/profession, with biographies and photographs of notable people and descriptions and documents of historic events. The newly added ''Timeline of Achievements'' traces the yearly contributions of African Americans in politics, industry, arts, religion, sports, and education. The site can be browsed alphabetically through the expanded ''Articles A to Z'' page, which contains links to every article through two lists, ''Biographies'' and ''Events & Institutions.''

Data Sets

The Trans-Atlantic Slave Trade: a Database on CD-ROM database includes records of 27,233 trans-Atlantic slave ship voyages made between 1595 and 1866, accounting for between two-thirds and three-quarters of all trans-Atlantic slave voyages sailing after 1600. This database consists of data sets compiled by individual researchers, collated voyages that appeared in several different data sets, and added new information from previously unexplored sources. The database covers most of the British trade, the 18th-century French and Dutch trades as well as the Portuguese trades, 17th-century French trades, and 19th-century Spanish, Danish, and North American trades. Each entry in the database consists of a single slaving voyage, for which up to hundreds of pieces of information may be available, including data such as dates at which the ship left from or arrived at various destinations during the voyage; ports of origin, slave purchase, and delivery; number of slaves embarked and disembarked, their demographic composition, and mortality levels; details of ship construction, registration, armament, and crew size; names of captains and owners; the outcome of the voyage; and archival sources. This database requires some level of technical expertise to manipulate the data.[6]

Online Data Archive: Roll of Emigrants to Liberia, 1820–1843 and *Liberian Census Data, 1843* (http://dpls.dacc.wisc.edu/Liberia/) provide downloadable data representing individuals who immigrated to a colony in Liberia through the American Colonization Society. Founded in 1916 to assist free blacks in the United States to Africa, this society's ''charitable'' work was a response to the fear of free blacks in America as a threat to the safety and the quality of life for whites. Variables included in the database are place of origin, place of arrival, literacy level, occupation, mortality dates, and morbidity dates.

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The census variables include age, family size, date of arrival, occupation, education, and health.

Genealogy

AfriGeneas (http://www.afrigeneas.com) is an established site dedicated to African American genealogy. Through cooperation and coordination of genealogical researchers, the site provides and maintains links to specific Web sources, a searchable surname database, a cemetery database, and census schedules. The site continually collects and updates slave data from descendants of slave holding families and from public and private resources. Another established site is *Christine's Genealogy Website* (http://ccharity.com/) which provides news stories about important collections and links to major African American local, state, and regional genealogy sites.

Freedmen's Bureau Online (http://freedmensbureau.com/) contains information about the creation of the United States Bureau of Refugees, Freedmen, and Abandoned Lands, the federal agency that oversaw emancipation in the former slave states after the Civil War. Initially designated to protect the rights of ex-slaves against intrusion by their former owners, many of the records collected and maintained by the agency including population counts, migration information, personal names, and locations of former slaves link to related government and genealogy sites.

Historical Texts and Documents

Numerous research institutions, public libraries, and government agencies have made available to the public some of their African American digital collections. *Digital Schomburg Images of 19th Century African Americans* (http://digital.nypl.org/schomburg/images_aa19/) is part of the *New York Library's Digital Collections* and offers a selection of images of 19th-century African Americans contained in the Photographs and Prints Division of the Schomburg Center as well as other selected units of the Research Libraries of The New York Public Library. The collection is searchable by keywords and accessible by topics including the Civil War, education, Reconstruction, slavery, and social life and customs. Users can also browse portraits of well-known and lesser-known African American men and women, as well as family and group photographs. Another digital collection from the Schomburg Center is *African American Women Writers of the 19th Century* (http://digital.nypl.org/schomburg/writers_aa19/), a digital collection of some 52 published works by 19th-century black women writers. The collection provides access to the thought, perspectives, and creative abilities of black women as captured in books and pamphlets published prior to 1920. A full text database of these 19th- and early 20th-century titles, this digital library is searchable by keyword and title. Another archival digital collection specific to women is Duke University's *African–American Women On-line Archival Collections* (http://scriptorium.lib.duke.edu/collections/african-american-women.html). Users can read selected items from the collection including letters written between Hannah Valentine and Lethe Jackson, two house slaves at Montcalm, the family home of David and Mary Campbell, located in Abingdon, Virginia. Also accessible are original documents pertaining to Elizabeth Johnson Harris, an African American woman who handwrote a memoir of her life (1867–1923) which provides glimpses of her early childhood, of race relations, and of her life as an African American woman.

Library of Congress and National Archives

The Library of Congress currently maintains two major digital resources related to African Americans. *The African American Mosaic* (http://www.loc.gov/exhibits/african/afam001.html) surveys the full range, size, and variety of the Library of Congress' African American collections, including books, periodicals, prints, photographs, music, film, and recorded sound; however, it is not an exhaustive inventory of all the holdings. Rather, the guide covers only four areas—colonization, abolition, the Great Migration, and the Writers' Project Administration. *African American Odyssey* (http://memory.loc.gov/ammem/aaohtml/aohome.html), part of the Library of Congress' American Memory site (http://memory.loc.gov/ammem/amhome.html), consists of several digital collections culled from the library's holdings of rare and unique materials pertaining to African Americans. Included in the digital collection are the following: *African–American Odyssey: A Quest for Full Citizenship*, a special presentation which showcases the library's various African American collections; *The Frederick Douglass Papers at the Library of Congress*; *Jackie Robinson and Other Baseball Highlights, 1860s–1960s* which includes photographs of players and teams, as well as highlights from Robinson's career and civil rights activities; *Born in Slavery: Slave Narratives from the Federal Writers' Project, 1936–1938*; *From Slavery to Freedom: The African–American Pamphlet Collection, 1824–1909* which includes 397 pamphlets, published from 1824 to 1909 by African American authors including Frederick Douglass, Mary Church Terrell, Booker T. Washington, and others who wrote about the African Diaspora in the United States from slavery to Reconstruction; and *Slaves and Courts, 1740–1860*, which contains over 100 pamphlets, books, court documents, accounts, and examinations of cases involving African and African American slaves in the United States and American colonies.

Also part of the Library of Congress's American Memory collection is *African–American Sheet Music,*

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1850–1920 (http://memory.loc.gov/ammem/award97/rpbhtml/ aasmhome.html) and *The Church in the Southern Black Community, 1780–1925* (http://memory.loc.gov/ammem/award99/ncuhtml/csbchome.html). The former consists of 1305 pieces of African American sheet music dating from 1850 to 1920 selected from the collections of Brown University. The collection includes music from the black face minstrelsy in the 1850s and from the abolitionist movement of the same period, Civil War period music including songs about African American soldiers and the plight of the newly emancipated slave, and post-Civil War music. Many of the 20th-century titles feature photographs of African American musical performers. Compiled of printed texts from the University of North Carolina at Chapel Hill, the latter traces the experiences of African Americans and the development of the church in the black community. Through narratives and observations by African American authors, the collection provides a history of how the black community adapted evangelical Christianity for personal survival and freedom.

The National Park Service in partnership with the Civil War Soldiers and Sailors project (http://www.itd.nps.gov/cwss/) has made available a searchable database of Civil War soldiers, regiments, and battles including a designation for U.S. Colored Troops (USCT) which contains over 230,000 names of USCT, 180 histories of USCT units/regiments, and links to significant battles they fought in. Although the *WorldCat* record for this item provides a WWW address that previously linked directly to the USCT portion of the databases, users must actually use the ''State or Origin'' field pull-down menu in the search form and select U.S. Colored Troops. Aside from this caveat, it is still an excellent source for genealogy and documentary history of blacks who fought in the Civil War. The source of the data being entered is the General Index Cards in the Compiled Military Service Records at the National Archives.

Literature

When complete, *Black Drama* (on line) will contain the full text of 1200 plays written from the mid-17th century to the present by more than 100 playwrights from North America, Africa, and the Caribbean. Each entry is extensively indexed, allowing keyword and multifield searching. Accompanying reference materials and images make this database a rich source of information. The database is divided into three sections: section one covers key writings from the Harlem Renaissance, works performed for the Federal Theatre Projects, and plays from significant dramatists of the 1940s including Langston Hughes, Paul Laurence Dunbar, and Zora Neale Hurston; section two covers the Black Arts movement of the 1960s and 1970s and includes works from playwrights such as Amiri Baraka (LeRoi Jones), Ed Bullins, James Baldwin, Rita Dove, Sonia Sanchez, and Joseph Walker; and section three brings together a selection of plays from sub-Saharan Africa, the West Indies, the United Kingdom, and other parts of the world. The database does not contain abstracts or citations.

Database of African–American Poetry, 1760–1900 (on line), produced by Chadwyk-Healey, contains more than 2500 poems written by African American poets in the late 18th and 19th centuries. Searchable by word, line, phrase, and concept, this database includes many of the poets covered by William French's essential reference book *Afro-American Poetry and Drama, 1760–1975: A Guide to Information Sources*. Chadwyk-Healey also publishes *Twentieth-Century African American Poetry* (on line). This source includes complete text of each poem, as well as accompanying images, illustrations, dedications, notes, acknowledgments, prefaces, introductions, and epigraphs.

Newspapers

African American Newspapers: The 19th Century (on line) is an excellent source for primary information about African American life and history during the 1800s. This source comprised of the complete text of major African American newspapers including *The Colored American* and *Freedom's Journal*, two of the first African American newspapers. This database is an excellent source for first-hand reports of major events and issues of the day, including congressional address, world travel, religion, biographies, vital statistics, essays, editorials, poetry, prose, and advertisements. *Ethnic NewsWatch* and *Ethnic NewsWatch: A History* are full-text on-line databases produced by ProQuest. Both of these databases cover newspapers published by and for leading American ethnic groups including African Americans. It provides information on topics not covered by the mainstream press and is an excellent source for ethnic perspectives of topics of national interest that may vary from what is presented in the mainstream press. *Ethnic NewsWatch* covers 1992 to the present, while *Ethnic NewsWatch: A History* covers 1960 to 1989.

AFRICAN AMERICAN JOURNAL LITERATURE: ACCESS THROUGH INDEXING

Currently, there are three electronic-based indexing services related to African American studies: *Black Studies Database: Kaiser Index to Black Resources* (*BSD*), *Black Studies on Disc*, and *International Index to Black Periodicals Full Text* (*IIBP Full Text*). *Black Studies Database* is the electronic counterpart to *Kaiser Index to Black Resources, 1948–1986*. National Information Services Corporation (NISC), which produces *Black Studies Database*, has indicated plans to update article coverage

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into the 1990s. *Black Studies on Disc*, the electronic counterpart to *The Index to Black Periodicals*, provides current coverage as does *IIBP Full Text*.

Published since 1995 by Hall, *Black Studies on Disc* includes not only the *Index to Black Periodicals* for 1988 to the present, but also the *Dictionary Catalog of the Schomburg Center for Research in Black Culture* and its updated annual, *Bibliographic Guide to Black Studies*. These two publications list materials available in the New York Public Library's Schomburg Center for Research in Black Culture, including books, serials, microforms, audiovisual resources, photographs, manuscript collections, artifacts, and ephemera. Burg and Kautzman[7] noted in a review of the CD-ROM version of *BSD* that it unquestionably adds value to African American studies research, while Harner[8] stated in the *Literary Research Guide: Annotated Listing of Reference Sources in English Literary Studies* that the highly selective nature of the work renders it primarily useful for its indexing of a few periodicals excluded from traditional research databases.

IIBP, first published in 1998 by Chadwyk-Healey, is an expanding Web-based database that provides access to 150 periodicals covering Africa, the Caribbean, Latin America, Canada, and the United States. Access to abstracts and bibliographic citations for current records from 1998 onward, bibliographic citations for records from 1910 to 1997, as well as full text coverage for key scholarly journals (1998 onward) make this database the most comprehensive in terms of title coverage and scope.

A few articles addressed indexing inadequacy in African American studies. In a 1999 article, Pillow examined indexing adequacy for 13 core African American research periodicals in 11 electronic indexes including *Black Studies on Disc*. Indexing coverage of these scholarly journals was highly selective, with only 66% of the relevant literature included in the indexes examined. *Black Studies on Disc* covered nine of the titles, but covered only 32.3% of actual citations, ranking ninth in issue coverage. Pillow[9] concluded that indexing for scholarly African American journal literature is erratic and inconsistent among traditional databases and *Black Studies on Disc*. Vega García[10] explored indexing coverage of minority women studies journals focusing on periodical literature by and about African American women and U.S. Latinas. She also concluded that both traditional indexes and those specific to ethnic and race studies did not adequately index the literature. Additional indexing adequacy studies are needed to compare coverage of the field's scholarly literature, general periodicals, creative works, and book reviews by *IIBP Full Text* and *Black Studies on Disc*.

Because gaps exist in the indexing of African American studies periodical literature, it is important for users and librarians to understand that an index specific to African American research may not provide the relevant literature needed for any particular topic. Other general and subject indexes should be considered in addition. For example, an individual conducting a search for journal literary criticism of Zora Neale Hurston's novels should consult available indexes such as *MLA International Bibliography* and *Contemporary Women's Issues* in addition to available African American indexes.

CONCLUSION

The number of commercial and WWW databases pertaining to African American studies has grown over the last decade exponentially. This growth has enabled information providers and users unprecedented access to archives, periodical literature, digital collections, and data pertaining to African American studies across multiple disciplines. The interdisciplinary aspects of the discipline call for researchers to consider a variety of subject resources, many of which may not be particular to African American studies. To date, research on the content, coverage, and usability of African American databases is minimal, and more is needed in the areas of indexing adequacy and usability studies.

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Anthropology Libraries

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INTRODUCTION

The development of anthropology as a distinct scholarly discipline can be traced back to the early 19th century to mid-19th century, with the publication in Europe and the United States of works by such pioneers as Sir Charles Lyell (1797–1875), Lewis Henry Morgan (1818–1881), and E. B. Tylor (1832–1917), along with others such as Armand de Quatrefages (1810–1892), Henry Sumner Maine (1822–1888), Adolf Bastian (1826–1905), John Wesley Powell (1834–1902), Daniel Garrison Brinton (1837–1899), Frederick Ward Putnam (1839–1915), and Thèodore Hamy (1842–1908).[a]

It is no coincidence that the oldest anthropology libraries were established during the same period. The Ethnological Society of London library was established in 1843. Elsewhere in Europe, ethnography museums with libraries were founded in Leiden, Basel, and Oslo in 1837, 1849, and 1857, respectively. The first anthropology library in the United States was that of the Peabody Museum of Archaeology and Ethnology in Cambridge, MA, in 1866, followed in 1869 by the American Museum of Natural History library in New York.

As this brief list suggests, with few exceptions, the significant 19th century anthropology libraries were essential components of ethnographic and natural history museums being established at the time. Education in anthropology in colleges and universities in both the United States and Europe in this period was still rare. As anthropology course offerings began to enter the curriculum at the very end of the 19th century, students fortunate to be studying at colleges and universities with established ties or proximity to anthropology museums, or, in a few cases, with anthropology museums on campus enjoyed the benefits of access to museum artifact and specimen collections and to their still mostly small, but established, anthropology libraries. This article will take a historical look at the development of anthropology libraries and their relationship to ethnography museums and anthropology education, particularly in the 19th century, and will describe some important and unique anthropology library collections in the United States, Europe, and elsewhere today. Applications of new technologies in anthropology libraries will also be discussed.

[a]These include such landmark works such as those in Refs. [1–8].

ANTHROPOLOGY LIBRARIES, ETHNOGRAPHY MUSEUMS, AND ANTHROPOLOGY EDUCATION IN THE 19TH CENTURY

The First Library Collections

The development of anthropology as a distinct scholarly discipline in the 19th century led to the establishment of anthropology libraries, typically within ethnology or natural history museums, or, in some cases, within specialized research institutions and scholarly societies. In the United States, the libraries at the Peabody Museum of Archaeology and Ethnology (Fig. 1) at Harvard University in Cambridge, MA (1866), and at the American Museum of Natural History in New York City (1869) were the first. These were followed by the libraries at the U.S. Bureau of American Ethnology (now part of the Smithsonian Institution) in Washington, DC (1879), the University Museum of Archaeology and Anthropology at the University of Pennsylvania in Philadelphia (1887), the Field Museum of Natural History in Chicago (1893), and the Anthropology Museum at the University of California in Berkeley (1901). Significant, although less comprehensive, early anthropology libraries were also established at the Bernice Pauahi Bishop Museum in Honolulu (1889) and at the Southwest Museum in Los Angeles (1903). In all these cases, libraries were integral parts of museum collections, just as pots, weapons, stone tools, skeletons, and other ethnographic and archaeological specimens were.[b]

Nineteenth-century Europe saw a similar development of encyclopedic ethnography museums, whose missions were to collect objects from all over the world and which recognized the need for libraries to support research on those collections. The library of the Museè d'Ethnographie

[b]In fact, library books were accessioned just like other museum artifacts and specimens were. It was typical for early museum annual reports to record all objects added to the collections, including books, usually distinguishing between donations and purchases.

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Fig. 1 The library of the Peabody Museum of Archaeology and Ethnology in about 1910 (PM 1110). (Courtesy of the President and Fellows of Harvard College, Peabody Museum of Archaeology and Ethnology.)

du Trocadèro in Paris dates back to 1878 (it was renamed Musèe de l'Homme in 1937), whereas the German cities of Munich, Leipzig, Berlin, Dresden, and Hamburg all established important ethnography museums with libraries between 1868 and 1879. The Ethnological Society of London library was established in 1843 and became the library of the Anthropological Institute in 1871. Significantly, it eventually became affiliated with a museum as well, but not until more than a century later in 1976.

In Canada, ancestral institutions to two noteworthy anthropology museums with outstanding libraries, the Royal Ontario Museum (ROM) and the Canadian Museum of Civilization, date back to the 1830s.

Early Education in Anthropology

Historian of anthropology John F. Freeman wrote that ''anthropology seek[s] its childhood in the museum and its maturity in the university.''[9] As this metaphor correctly suggests, the establishment and development of the first ethnography and natural history museums laid the foundation for anthropology to become part of college and university curriculums. In 1866, the year the Peabody Museum of Archaeology Museum of Archaeology and Ethnology at Harvard was founded, the university's president, James Walker, described anthropology, with a certain anticipation, as a ''branch of Science . . . to which many minds in Europe are now eagerly turning, and with which not a few of the philosophical inquiries and theories of the hour are intimately associated. It will grow in interest from year to year.''[10] But growth was slow. Extending our metaphor, anthropology's adolescence, in fact, lasted for several decades. A quarter century after the founding of the Peabody Museum at Harvard, there was still little in the way of formal education in anthropology in the United States. Then, in 1892, University of Pennsylvania Professor of Anthropology Daniel Garrison Brinton[11] made ''an earnest appeal to our seats of advanced learning to establish a branch of Anthropology.'' Brinton was seeking ''the enlightened and liberal citizen ready to found such a department, and endow it with the means necessary to carry out both instruction and research,'' and his vision was about to be realized. In the final decade of the 19th century, there was a surge in anthropology courses offered, although at that time, few were being taught by faculty with anthropology appointments, and fewer still were being offered by what were still rare anthropology departments. Indeed, although the first courses in anthropology were being taught by everyone from anatomists to zoologists, it is also the case that many were being given in partnership with ethnography museums.

Museums as Partners in Anthropology Education

In 1899 and again in 1902, George Grant MacCurdy[12] of Yale surveyed the state of anthropology teaching in the United State and Europe,[13] and his data indicate that ties between anthropology museums and academic

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departments were quite common. As of 1899, students in anthropology departments at Harvard, Yale, and Columbia had access to museum collections at, respectively, the Peabody Museum of Archaeology and Ethnology, the University Museum, and the American Museum of Natural History. In Washington, DC, students enrolled in anthropology courses at the National University and the Columbian University were being taught by National Museum (now the Smithsonian) curators. A Bureau of American Ethnology researcher offered a course at Iowa State University, whereas at Ohio University, an Ohio Archaeological–Historical Society curator taught anthropology. At the University of Pennsylvania, students had access to the Philadelphia Academy of Natural Sciences. In his 1902 report, MacCurdy lists Brown University with its Museum of Anthropology (now the Haffenreffer Museum), and the University of Chicago with ties to the Walker Museum's Anthropological Section, explicitly noting that the students at both institutions enjoyed access to anthropology museum collections.

In Europe and elsewhere, instruction in anthropology was likewise becoming established in many universities, often with ties to museums. MacCurdy notes in his 1899 report that anthropology courses were being taught at Oxford by E. B. Tylor, who was Professor and Reader in Anthropology and Keeper of the University Museum, and by Henry Balfour, Curator of the Pitt-Rivers Museum. The University of Aberdeen in Scotland had recently established a Museum of Anthropology ''so that instruction in anthropology may, in all probability, be given there.''[12,13] In France at the Museum d'Histoire Naturelle, Théodore Hamy occupied the Chair of Anthropology. At the University in St. Petersburg, anthropology was being taught by Professor of Geography and Ethnography E. J. Petdri, who was also Director of the University Geographical Anthropological Cabinet, whereas D. N. Anutchin, Professor of Geography and Ethnography and Director of the University Anthropological Museum, taught courses at Moscow. In Budapest, Professor of Anthropology and Ethnology and Director of the Anthropological Museum Aurel Török taught courses.

The ties between anthropology museums and anthropology education remained strong even as anthropology solidified its position in the college and university curriculum. In 1916, exactly 50 years after the founding of the Peabody Museum at Harvard, a group of eminent anthropologists met to discuss the objectives and methodology of anthropology teaching. Their efforts were formalized the following year when the American Association for the Advancement of Science established a committee on teaching of anthropology, with Franz Boas as chair, and 2 years later, a report was issued describing the aims of professional and nonprofessional training—the former being for students desiring a career in anthropology.[14] The committee's report ends with a brief list of requirements for a department of anthropology, and it is noteworthy that it states unequivocally that undergraduate work should be based on a small teaching collection of museum specimens and artifacts. For graduate work, access to museum collections is indispensable. Replacing actual specimens with illustrations is an unacceptable substitute so far as Boas and his colleagues were concerned.

Thus, within half a century, major anthropology museum and library collections were established; grew with the support of the educational, scientific, and lay communities in which they were located; and became recognized as indispensable to anthropology education for both nonspecializing students and those desiring a career in the field.

NOTEWORTHY ANTHROPOLOGY LIBRARIES

Many important anthropology libraries today are components of ethnographic and natural history museums, and some serve university anthropology departments as well. Still others are governmental, independent, or private. Some of the preeminent collections formed during the 100-year period of the 1830s to the 1920s have been selected for further description in the following due to their historical or otherwise unique collections or institutional histories.

United States

Tozzer Library (Library of the Peabody Museum of Archaeology and Ethnology; Cambridge, MA)

The first library established in the United States with the express goal of supporting research in anthropology was at the Peabody Museum of Archaeology and Ethnology at Harvard University in Cambridge, MA. In 1974, it was renamed the Tozzer Library in memory of Alfred Marsden Tozzer (1877–1954), Professor of Anthropology and second Peabody Museum Librarian who served in that position from 1934 to 1947.

In 1866, George Peabody, a Massachusetts businessman, gave US$150,000 to Harvard for an archaeology and anthropology museum, to be used as both a collection fund and to purchase ''such books and works as may form a good working library.''[15] The museum's library was a modest facility for many decades, with funds for the purchase of books and journals being quite minimal. However, many publications were contributed by their authors, and museum trustees and others made donations of important works as well. By 1880, there were 1000

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Fig. 2 Professor of Anthropology Roland B. Dixon (1875–1934), who served from 1906 to 1934 as first Librarian of the Peabody Museum (PM N32546). (Courtesy of the President and Fellows of Harvard College, Peabody Museum of Archaeology and Ethnology.)

books and pamphlets, and a card catalog had been created.[16] The Peabody Museum's library made major advancements toward becoming the renowned collection it is today with the appointment of Professor Roland B. Dixon (Fig. 2) as the first Librarian in 1906. With a dedicated staff to assist him, Dixon created a classification scheme to organize the collection by subjects and geographic areas, and developed a program to exchange Peabody Museum publications for those of other museums and learned societies throughout the world.[c] In 1917, Assistant Librarian Constance Ashenden, the first staff member with professional training, joined him. By the 1920s, author and subject cards were being added to the library's card catalog for articles in the periodicals subscribed to. This effort continues today in the form of *Anthropological Literature*, an index produced in both printed and electronic format, which analyzes 900 serial titles and many of the edited works acquired by the library. The library moved into a separate building, next door to the Peabody Museum, in 1974 and today holds 235,000 items and subscribes to over 2100 serials. Over 200 foreign institutions send their publications in exchange for Peabody Museum publications or *Anthropological Literature*. In 1963, the importance of the collection for anthropological research was recognized when G. K. Hall commenced the publication of the *Catalogue of the Library of the Peabody Museum of Archaeology and Ethnology, Harvard University*. The initial set of 26 author volumes and 27 subject volumes was subsequently updated by four author and subject supplements appearing between 1970 and 1979 and totaling 31 additional volumes. All printed volumes were superseded in 1988 when a second enlarged edition appeared in microfiche format. Tozzer Library's web site can be found at http://hcl.harvard.edu/tozzer/.

[c]Dixon was not the first anthropology librarian to implement an exchange program. The Smithsonian's library was exchanging works in its series *Smithsonian Contributions to Knowledge* with other institutions as early as 1849.

The Library of the American Museum of Natural History (New York)

Anthropology forms a significant part of the 450,000-volume library[d] of the American Museum of Natural History in New York City, along with physical and natural sciences such as astronomy, paleontology, and zoology. The American Museum was founded as both a museum and a library by the State of New York in 1869, making it the oldest such institution in the United States; its anthropology department was formed 4 years later.

Museum President Henry Fairfield Osborn wrote in 1911 that ''it is a well-recognized fact that a thoroughly equipped library is a necessary adjunct to an institution devoted to scientific research.''[18] Significant early accessions supporting anthropological research included the Library of the American Ethnological Society, which was deposited in the museum's library in 1903, and a collection on voyages and travel—many quite rare—received in 1886. In addition to the print collection, the library houses an extensive collection of photographic materials documenting the museum's ethnographic and archaeological fieldwork.

G. K. Hall published the *Research Catalog of the Library of American Museum of Natural History* in 1977 in 25 volumes, divided into author and subject sections. The latter is based on the library's unique classification scheme; however, extensive conversion to Library of Congress call numbers has been carried out since then. The library's web site is http://library.amnh.org/.

The John Wesley Powell Library of Anthropology at the Smithsonian Institution (Washington, DC)

The foundation for a Smithsonian Institution was laid in 1846 when Congress passed the Smithsonian Act of Organization, utilizing a gift of US$500,000 from Englishman James Smithson (1765–1829), who wished that it be used to create an institution ''for the increase and diffusion of knowledge.''[19] Libraries have been central

[d]The size of collections at the time of writing has been taken from libraries' web sites, or, if not available there, from Ref. [17].

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to that mission from the beginning; by 1855, there were 15,000 volumes in the Smithsonian's library, and, by 1866, it had already expanded to 40,000 volumes, primarily via first Smithsonian Secretary Joseph Henry's establishment of an exchange program with other scientific societies throughout the world. As early as 1847, Henry began planning such a program by contacting international scientific organizations to inquire as to their interest, and by 1849, there were 173 institutions set to receive the first volume of *Smithsonian Contributions to Knowledge*, published in the previous year. Significantly, that first scientific publication was E. G. Squier and E. H. Davis' *Ancient Monuments of the Mississippi Valley*, the selection of which demonstrates the important role played by the Smithsonian Institution in the development of American anthropology.[20]

In 1879, Congress founded the Bureau of American Ethnology as a separate division of the Smithsonian, under the directorship of John Wesley Powell, to perform ethnological and archaeological research on Native American cultures. The bureau's library originated from efforts to prepare for publication the information gathered during Major Powell's geographical survey of the Rocky Mountain region from 1869 to 1872.

The John Wesley Powell Library of Anthropology was created in 1965 by bringing together the library of the Bureau of American Ethnology, by that time numbering over 40,000 volumes,[21] and several collections within the Smithsonian's Division of Anthropology. Today, it is one of 20 branch libraries comprising the Smithsonian Institution Libraries and holds 80,000 volumes and subscribes to over 400 serial titles. Its web site is http://www.sil.si.edu/libraries/anth-hp.htm.

The Library of the University Museum of Archaeology and Anthropology, University of Pennsylvania (Philadelphia)

The University of Pennsylvania made the first anthropology faculty appointment at an American university when it named Daniel Garrison Brinton as Professor of Anthropology in 1886.[22] The University Museum was established in the following year, followed shortly thereafter by the Department of Archaeology and Palaeontology. The department's stated role was to ''provide instruction in Archaeology, Ethnology, and Palaeontology, and to extend scientific inquiry by means of original investigation into the study of these subjects. Among the means employed by it to accomplish these are: first, the establishment of a Museum and Library which shall be open to students and to others seeking information in this direction. . . .''[23]

In 1942, Cynthia Griffin was appointed the museum's first full-time librarian, overseeing a collection numbering 16,000 volumes. When she retired in 1971, rapid growth had expanded the collection of the Museum Library to more than 50,000 volumes, and, in the same year, it moved into its present three-level facility in the museum's new academic wing.[24] The University Museum Library currently holds 120,000 volumes and subscribes to 550 journals. A long-standing exchange program now brings in publications from 300 foreign institutions. The Museum Library's web site is http://www.library.upenn.edu/museum/.

The Library of the Field Museum of Natural History (Chicago)

The Field Museum was incorporated in 1893 under the name Columbian Museum of Chicago, the goal of which was ''the accumulation and dissemination of knowledge and the preservation and exhibition of objects illustrating art, archaeology, science, and history.''[25] The Field Museum was primarily an outgrowth of the World's Columbian Exposition, held in Chicago that same year, whose planners saw an opportunity to use its exhibits to form a permanent museum. Ethnographic displays of Native American culture had occupied a prominent place in the Exposition's Manufactures and Liberal Arts Building, having been created by a team of eminent anthropologists led by Frederic Ward Putnam and which included Franz Boas.

The Field Museum's library was established in March 1894 (1 year after the founding of the museum) and, according to the director's annual report for 1894/1995, it had already entered over 6500 items in its accessions book by October 1894.[26] Some 1400 of these had originated from the Columbian Exposition's Department of Ethnology, gathered by Putnam and his colleagues. Another early addition to the library was an important collection of books on China, bequeathed by Curator of Anthropology Bethold Laufer, who died in 1934.

Today, the Field Museum is one of the world's comprehensive anthropology and natural history museums; the library holds 275,000 volumes and receives over 3000 journals, two-thirds of which are received via exchange agreements for museum publications. Its web site is http://www.fieldmuseum.org/research_collections/library/default.htm.

The Library of the Bernice Pauahi Bishop Museum (Honolulu)

The Bishop Museum was established in 1889 by Charles Reed Bishop to honor the memory of his wife, who had been the sole living member of the Hawaiian royal family before her death in 1884. Princess Bernice Pauahi Bishop left a significant legacy in the form of an

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extensive collection of Hawaiian artifacts and royal family heirlooms, and her husband founded the museum to house it.[27]

The Bishop Museum library, holding 50,000 volumes today, is one of the world's preeminent collections on the anthropology and cultural and natural history of Hawaii specifically, and the Pacific in general. Its importance to scholarship was recognized in 1964 when G. K. Hall and Company published the *Dictionary Catalog of the Library* in nine volumes, with a one-volume supplement 3 years later. The library has a web site at http://www.bishopmuseum.org/research/cultstud/libarch/.

The Ayer Collection, Newberry Library (Chicago)

The Newberry Library, an independent research library, was founded in 1887 in Chicago, and today, its collection of 1.5 million volumes focuses, with obvious breadth and depth, on the history and literature of civilizations of Western Europe and the Americas from the Middle Ages through World War I. Within the larger Newberry collection is the distinctive Ayer Collection, one of the finest in the country on the Indians of North America.

In 1911, Chicago businessman and Newberry Library Trustee Edward E. Ayer (1841–1927) donated his Americana collection of 21,000 books and manuscripts to the Newberry, along with an endowment to support ongoing acquisitions. In a speech given in 1944, Newberry Librarian Stanley Pargellis provides a wonderfully personal view of Edward Ayer's determined book-buying habits. Remarking that a visitor to the Newberry who enters the Ayer Collection might suppose that the library contains nothing but Indians, Pargellis explains that such a perception is due to the fact that ''A lot of them are there; chronologically all the way from those excellent Brazil Indians of the 16th century... to the ones that the Office of Indian Affairs is taking intelligent care of today. The Ayer Indians range in space from Alaska to Tierra del Fuego; and because collectors are fortunately made that way, Mr. Ayer bought also every book he saw which shows how white men have met, described, investigated, treated, and maltreated the Indian. That led him to buying books on voyages, if they were voyages to places where Indians were, to buying charts and maps which showed those places, and books on colonial governments in North and South America which had to do with Indians.''[28]

Today, the Ayer Collection includes over 130,000 volumes, including published works in archaeology, ethnology, art, and language and literature, as well as on the history of contact between Native Americans and Europeans. It also contains extensive manuscript materials, Mesoamerican codices, cartographic works, photographs, and original paintings and drawings by such artists as George Catlin and Karl Bodmer.

In 1961, G. K. Hall and Company, to help bring the riches of the Ayer Collection to the attention of scholars, published the *Dictionary Catalog of the Edward E. Ayer Collection of Americana and American Indians in the Newberry Library* in 16 volumes, followed by seven additional volumes in two supplements in 1970 and 1980. The Ayer Collection has a page on the Newberry Library web site at http://www.newberry.org/nl/collections/L3cover.html.

The George and Mary Foster Anthropology Library, University of California at Berkeley

The Anthropology Museum at the University of California, Berkeley, was founded in 1901, as was the anthropology department. The first department chair was Frederic Ward Putnam, and Alfred L. Kroeber taught its first course.[29][e] There existed a small departmental library in the early years—anthropology instructor Pliny Earle Goddard served as the department's librarian until he departed for an assistant curatorship position at the American Museum of Natural History in 1909.[31] However, unlike at other anthropology museums described here, there was no significant and distinct anthropology library at Berkeley until half a century later when Professor John H. Rowe, frustrated at the difficulty in locating anthropology materials spread throughout numerous Library of Congress classes in the Main Library stacks, established a one-room anthropology library in the department's new, although temporary, quarters known as T-2.[f]

The anthropology library begun by Rowe was designated as a branch of Berkeley's university library in 1956 and moved into its current home in the newly opened Kroeber Hall in 1959, a location shared today with the anthropology museum, which is now named after Phoebe A. Hearst, and the anthropology department. The anthropology library was named in honor of Professor Emeritus of Anthropology George Foster and his anthropologist wife, Mary LeCron Foster, in 1997, and holds 80,000 volumes today. Its web site can be found at http://www.lib.berkeley.edu/ANTH/.

The Braun Research Library, Southwest Museum (Los Angeles)

The Southwest Museum was established in 1903 by journalist, ethnographer, archaeologist, photographer, and

[e]Stadtman presents another brief summary of early anthropology at Berkeley in Ref. [30].

[f]In Ref. [32], John Rowe recounted in detail the half-century-long effort to establish an anthropology library at Berkeley. His speech has been reproduced on the web at http:sunsite.berkeley.edu/Anthro/rowe/bio/rolib.html.

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Fig. 3 Charles Fletcher Lummis (1859–1928), an easterner and Harvard-trained anthropologist, established the Southwest Museum in 1903 to preserve the cultural heritage of the West (PM Pa-IN 10/84). (Courtesy of the President and Fellows of Harvard College, Peabody Museum of Archaeology and Ethnology.) (*View this art in color at www.dekker.com.*)

poet Charles Fletcher Lummis (Fig. 3) and moved into its present building on a hilltop in Los Angeles in 1914. The institution's founding principle declared its purpose as: to ''help the Southwest fulfill the wisest of all the precepts of the Greeks—'Know Thyself'—by unlocking to its children its underground treasure house of knowledge with the master key of modern Anthropology, which is nothing less than the science of Man.''[33]

In 1931, the museum's library held 15,000 volumes in six separate collections, including the expanding Hector Alliot Memorial Library of Archaeology, which began as an 800-volume donation from the Ruskin Art Club in memory of the museum's first curator.[34]

Over the years, the Southwest Museum's mandate has broadened from an early focus on pre-Hispanic, Spanish colonial, Latino, and Western American art and artifacts to cover the entire New World, now representing native cultures from the Arctic to the tip of South America. Today, the museum's Braun Research Library holds 60,000 volumes of books and serials, as well as extensive collections of manuscripts and photographs.

The Native American Collection, Cornell University (Ithaca, NY)

The Native American Collection, relocated from the privately endowed Huntington Free Library and Reading Room, Bronx, to Cornell University in Ithaca, NY, in 2004, was established in 1928 by George G. Heye (1874–1957), Director of the Museum of the American Indian then located in northern Manhattan. The library's nucleus of some 16,000 volumes consisted of the personal libraries of two Museum of the American Indian anthropologists, Frederick W. Hodge and Marshall H. Saville, both collections of which were related to the archaeology, ethnology, and history of the Southwest and Latin America.[g] What was the Museum of the American Indian has become the Smithsonian Institution's National Museum of the American Indian (NMAI), and its extensive collections of ethnographic and archaeological materials moved to Washington, DC. The Native American Collection, consisting of 40,000 volumes, was not part of the negotiations that resulted in the creation of the NMAI and has been transferred to the Cornell University Library.

In 1977, G. K. Hall and Company published the *Dictionary Catalog of the American Indian Collection, Huntington Free Library*, in four volumes, in recognition of the collection's value to scholarship.

The Harold B. Colton Memorial Library, Museum of Northern Arizona (Flagstaff)

Founded in 1928, the Museum of Northern Arizona's traditional research focus was on the archaeology and geology of the Colorado Plateau; today, it is a center for regional natural history research in many subjects.[36]

Archaeologist Katharine Bartlett was in charge of the library in 1953 when the collection was gathered from nine separate locations in the original museum building and consolidated into a wing of the new research center, after which it grew rapidly.[37] Today, the library is named in honor of the museum's founder and first director; it holds 100,000 volumes and subscribes to 60 serial titles. The library has a page on the museum's web site (www.musnaz.org/Research/library.html).

Europe

Anthropology Library of the British Museum Centre for Anthropology (London)

As of mid-2004, the premier anthropology library in Britain is reinventing itself one more time in its more than 160-year history, in the new British Museum Centre for Anthropology, scheduled to open at the British Museum.

In 1871, the library of the Ethnological Society of London, dating from 1843, was joined with that of the Anthropological Society of London to form the Anthropological Institute's library. The Institute became the Royal Anthropological Institute (RAI) when it was granted a Royal Charter in 1907. Various distinguished

[g]The author in Ref. [35] provides a wonderfully evocative description of the early development of the library at the Museum of the American Indian.

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members of the RAI, including V. Gordon Childe (1892–1957), served as librarian on a voluntary basis, and in 1948, Ms. B. J. Kirkpatrick was appointed first professional librarian.

In 1976, the RAI library was brought under control of the Department of Ethnography of the British Museum and merged with the department's library collection, which also dates from the 19th century. Just a few years earlier, in 1970, the Ethnography Department's public programs and exhibits had been moved out of the British Museum and into Burlington Gardens, where they formed the new Museum of Mankind, and so the library became known as the Museum of Mankind Library. With the 1976 RAI acquisition, the museum's library changed from a modest departmental library collection into one containing 110,000 volumes.[38]

In recognition of its commitment to scholarship, in 1963, the RAI began publishing its *Index to Current Periodicals Received in the Library*, with coverage going back to 1957, and indexing continues today in the database *Anthropological Index Online*. In addition, in 1990, the Museum of Mankind Library card catalog was reproduced on 763 microfiches, providing researchers with bibliographic information on its collection of 19th-century and 20th-century publications.

In spring 2004, a new British Museum Centre for Anthropology is to open at a site adjacent to the British Museum in Bloomsbury. The centre's anthropology library, heir to the distinctive ancestral collections described above, will hold more than 120,000 volumes and 4000 journal titles. Not surprisingly, one of its strengths lies in its full runs of 19th-century and early 20th-century periodicals, many acquired via exchange agreements with other learned societies. The RAI's web site includes an announcement of the anticipated new library at the centre (http://www.rai.anthropology.org.uk/MoM/MoM.html).

Le Musée de l'Homme (Paris)

The Musée de l'Homme and its library were founded in 1936 and opened on the occasion of the Universal Exposition in Paris the following year, although the museum was born out of an earlier institution; the Musée d'Ethnographie du Trocadéro had been established in 1878 on the same site.[39] Paul Rivet (1876–1958), physical anthropologist and Americanist, was put in charge of the Musée d'Ethnographie du Trocadéro in 1929, and, in the succeeding years, under his direction, the library was greatly enlarged by the addition of the collections of the Laboratoire d'anthropologie du Musèum national d'histoire naturelle, the Institut français d'anthropologie, the Institut d'ethnologie de l'université de Paris, and others. Today, the Musée de l'Homme serves as France's center for research in ethnology, prehistory, and biological anthropology; the library holds 260,000 volumes and subscribes to 850 periodicals. Its web site is at http://www.mnhn.fr/mnhn/bmh/.

Museo Preistorico–Etnografico Luigi Pigorini (Rome)

The Museo Preistorico–Etnografico Luigi Pigorini was founded in 1876 by royal decree, and a library that has grown today to hold 60,000 volumes was begun shortly thereafter. The institution initially proposed in 1871 by prehistorian Luigi Pigorini, a museum of Italian prehistory and ethnography, was explicitly incomplete in his view until a library of ethnological and paleoethnological publications was made a part of it.[40] The library's web site is http://www.pigorini.arti.beniculturali.it/Museo/Biblioteca/biblioteca.html.

Canada and Mexico

Canada is home to two important anthropology libraries—those at the ROM in Toronto, Ontario, and at the Canadian Museum of Civilization in Hull, Quebec, a suburb of Ottawa.

The ROM was officially created in 1912, although it claims antecedents as far back as 1836 when the Literary and Philosophical Society of York (the earlier name for Toronto) acquired land for a Museum and Institute of Natural History.[41] Today, it comprehensively collects and exhibits the cultural and natural history of Canada and the world.

At ROM, research and teaching in anthropology have, for many years, been carried out in close partnership with the anthropology department at the University of Toronto. The museum was, in fact, a part of the university for many decades and briefly housed its Department of Anthropology beginning after it was founded in 1936. Today, many anthropologists have joint appointments as ROM curators and university faculty, and the anthropology holdings in ROM's library serve as a de facto anthropology library for the university. ROM's library, now numbering over 100,000 volumes, has a web site at www.rom.on.ca/library/general.html.

The Canadian Museum of Civilization likewise grew out of efforts by the York Literary and Philosophical Society, which in 1832 sought funding to investigate the geology, mineralogy, and natural history of the province of Upper Canada. This led to the founding of the Geological Survey of Canada (GSC) in 1842, and the following year, a museum was opened in Montreal to house its growing collection of geological and archaeological specimens. The year 1907 saw the establishment of

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an anthropology division within the GSC with linguist Edward Sapir (1884–1939) as its first chief ethnologist. As Canada's national museum of human history, the Canadian Museum of Civilization, as it was named in 1986, today offers a Canadian perspective on the archaeology, ethnology, and folklore of all cultural groups in Canada's past and present. The museum's library dates back to the 19th century and today numbers 100,000 volumes plus substantial collections in other formats. Its web site is www.civilization.ca/cmc/biblio/index-e.html.

The Biblioteca Nacional de Antropología e Historia ''Dr. Eusebio Dávalos Hurtado'' in Mexico City was founded in 1888 and holds 60,000 volumes; its primary clientele are the staff at the Instituto Nacional de Antropología e Historia (INAH). In 1972, in recognition of the value of the collection to scholars, G. K. Hall published *Catálogos de la Biblioteca Nacional de Antropología e Historia* in 10 volumes. The library is on the web at www.arts-history.mx/biblioteca/intro.html.

ANTHROPOLOGY LIBRARIES ESTABLISHED AFTER WORLD WAR II

The postwar era brought forth various social and political forces, particularly in non-Western countries, that encouraged the establishment of new ethnography museums and anthropology research centers, and we will now turn our attention to some of the newer anthropology library collections founded since the mid-20th century. This period, marked by the end of colonialism and the beginning of human and civil rights movements in indigenous communities, has witnessed a return of control over cultural patrimony and its interpretation, often including library resources such as photographic and archival materials, to some social and ethnic groups. As noted by one anthropologist and museologist, ''museums as social institutions have [now] been adopted by new nations and reshaped to their own purposes.''[42] To illustrate this trend, we need to only compare the seventh edition of the directory *Museums of the World*, published in 2000, which lists approximately 900 ethnography museums, with the 10th edition published 3 years later in 2003, which lists 1200 ethnography museums, an increase of 25%. A few institutions founded in the second half of the 20th century include the Ethnographic Museum in Addis Ababa, Ethiopia (1963), the Museu Nacional de Antropologia in Luanda, Angola (1976), the Ethnological Museum in Chittagong, Bangladesh (1973), and the Soloman Island National Museum and Cultural Centre in Honiara (1969). Although many museums like these are too small and/or underfunded to support libraries, there are significant exceptions. A few are noted below, and there are no doubt many more.

One of the most successful new anthropology libraries is part of the Mashantucket Pequot Museum and Research Center in Connecticut, which was founded in 1998. Owing its existence in large part to the success of revenue-generating gaming casinos on Indian reservations in the United States, it already holds 40,000 volumes and 800 serial titles on the histories and cultures of the indigenous peoples of North American north of Mexico. The library's web site is www.pequotmuseum.org/Home/LibrariesArchives/RESEARCHLIBRARY/GeneralInformation/htm.

The Seneca Nation of Indians, in New York, chose to cede some control over their library to obtain needed resources from the New York State Education Department. The libraries of the Seneca Nation opened in 1979, with the Cattaraugus Branch located in the village of Irving and the Allegany Branch in the village of Salamanca. Rather than locate them inside their museum, the Seneca Nation chose instead to take advantage of municipal funding for public libraries and made the libraries affiliates of the regional public library system. Today, the Irving branch holds an impressive 18,000 volumes on Seneca culture and related subjects.

In Kathmandu, Nepal, the Social Science Baha was established in 2002 to take a lead role in encouraging and facilitating the study of the social sciences by the region's scholarly community, and their stated major priority is developing a well-stocked and efficiently managed social science library, including cultural anthropology. Their web site is www.himalassociation.org/baha/, through which they actively seek outside support to continue to grow the library.

One final postwar anthropology library will be noted, although unlike those just described, it has, from its founding, had significant support. The Robert Goldwater Library serves today as the library of the Department of the Arts of Africa, Oceania, and the Americas at New York's Metropolitan Museum of Art. It was founded in 1957 as the Museum of Primitive Art Library, charged with documenting the arts of Africa, the Pacific Islands, and native and Precolumbian America.

Allan Chapman, the library's founder and first librarian, guided its move to the Metropolitan Museum of Art in 1975, maintaining throughout this period its policy to acquire all current publications in the field of primitive art as well as selective retrospective material. Today, the Robert Goldwater Library holds more than 30,000 volumes and maintains 150 periodical subscriptions. Its importance for research was recognized by G. K. Hall and Company in 1982 with the publication of the *Catalog of the Robert Goldwater Library, the Metropolitan Museum of Art* in four volumes. The Goldwater

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Library does not have a separate page on the Metropolitan Museum of Art's web site.

ANTHROPOLOGY LIBRARIES IN THE DIGITAL AGE

The Internet, particularly the capabilities of the World Wide Web, offers anthropology libraries and archives unprecedented opportunities to make their resources available beyond their physical location. Historical, rare, photographic, and archival materials in anthropology library collections make worthwhile candidates for digitizing and mounting on web sites, and librarians are working with faculty members, curators, and other scholars to create these digital anthropology libraries. The web is also valuable for providing access to up-to-date anthropology library catalogs, indexes and bibliographies, and publishers' catalogs, as well as digitized finding aids for archival collections.

A premier repository of anthropology materials and one that has made use of new technologies for extending its reach beyond the onsite researcher is the National Anthropological Archives, part of the Department of Anthropology of the National Museum of Natural History, Smithsonian Institution, in Washington, DC. Its web site (http://www.nmnh.si.edu/naa/) serves as an electronic gateway to an array of unique resources, at the core of which is the *Guide to Collections of the National Anthropological Archives*, a comprehensive, alphabetically arranged guide to more than 650 manuscript and photograph collections.

Two more noteworthy anthropology resources available on the World Wide Web are *Ethnologue*, a bibliography of 12,500 references to books, journal articles, book chapters, dissertations, and other academic papers about languages and cultures (www.ethnologue.com/bibliography.asp) and *Bibliografía Mesoamericana*, which indexes the anthropology of Mesoamerica, including archaeology, ethnography, ethnohistory, art history, linguistics, physical anthropology, and other related disciplines (www.famsi/org/research/bibliography/htm). Although comprehensive online indexes to the literature of anthropology, such as *Anthropological Index Online* and *Anthropological Literature*, and specialized indexes, such as *Bibliography of Native North America*, are available via subscription only, *Ethnologue* and *Bibliografía Mesoamericana* are free.

CONCLUSION

Challenges for the 21st Century

The oldest of the highlighted libraries of the bricks-and-mortar variety has been collecting, organizing, and providing access to the literature of anthropology for over 160 years; the youngest for barely 2 years. Whether serving museums, universities, independent constituencies, or the public at large, all these libraries face challenges in their continuing efforts to effectively perform these functions today. All are committed to collecting comprehensively within their defined scopes, whereas the various types of materials being collected have multiplied beyond books, manuscripts, maps, and photographs to include CD-ROMs, videos, and electronic publications accessed via the World Wide Web. Each of these libraries hopes to maintain its own presence on the web accurately and attractively. Furthermore, each should also catalogue its often unique holdings according to the highest standards and, ideally, enter those records into the bibliographic utilities for access by scholars and other librarians.

Where traditional, ''19th-century'' practices still remain in place; they are, by necessity, being reexamined. For example, long-standing exchange agreements that are extremely labor-intensive and often bring in out-of-scope materials might better be replaced by limited firm ordering through reliable vendors. Continued use of unique classification systems that were developed in the pre-Library of Congress era might also be reconsidered for the sake of standardization. Nevertheless, regardless of whether old classification schemes are frozen or not, older materials in these collections may never be retrospectively converted to Library of Congress call numbers and subject headings, and likewise may never appear in online catalogs; hence the importance of published catalogs such as those produced by G. K. Hall for many of the anthropology libraries described here. Use of efficiency tools such as approval plans would serve to streamline workflow, yet remain problematical because of the multidisciplinary, encyclopedic nature of anthropology. The difficulties connected with identifying and acquiring important gray literature also remain, whether these are reports of contract archaeology projects or of research being done by brand new ethnographic or natural history museums in countries only recently able to support such work by their own scientists. Finally, because the anthropology of a country is more than likely being published in the language (or languages) of that country today, the resulting wide range of different languages represented in an anthropology library creates challenges for staff to be able to identify, order, and catalog publications in them.

Anthropology has been defined as ''the discipline that encompasses no less than the study of all of humankind, and in which nothing is alien.''[43] As such, it will continue to fascinate and arouse curiosity in most who come in contact with it, be they scholars, students, members of the public, or, certainly no less than these, the anthropology librarians challenged to continue building and providing access to these extraordinary collections. It

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is the discipline itself that creates the larger and most important challenge, and that makes anthropology libraries so very interesting for librarians and their users.

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Book and Journal Publishing

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INTRODUCTION

This article is intended to focus on the place of the ''trade'' in the transmission and dissemination of knowledge, literature, and information in the society. The term the ''trade'' has long been the shorthand referent to book and journal publishers, book wholesalers, journal agents, retail bookstores, specialist booksellers to libraries, and out-of-print (OP) dealers. Various elements of the trade are integral partners with libraries as the originators and/or suppliers of books, periodicals, and related services. Book and journal publishers are the key players in the trade as they first produce the books and journals, which come to rest on the shelves or in the computers of libraries. As the originators of the knowledge/literature/information packages stored and circulated by libraries publishers stand at the beginning of the process, which results in the dissemination of the material embodiments of ideas, bodies of knowledge, and research findings. (Some may argue, and in substantial measure correctly, that authors stand at the beginning of this creative process, but such commentators fail to understand the role that publishers play in not simply providing the means for authors to make their work available in the marketplace of ideas but in seeking out, stimulating, encouraging, assisting in the writing, and editing their work to get it to and make it most useful to readers.) By virtue of this role of origination in the intellectual and creative process of knowledge and information formation, the present standing and condition of publishing is of substantial interest to librarians and information specialists. This article does not have as its burden an explanation of the processes and practices of the publishing trade. Rather, its intention is to inform readers of the present trends and problems faced by publishers internationally and how the present state of publishing may affect libraries.

Any effort to provide a statistical portrait of the trade is so marred by inaccuracies as to make such a representation virtually meaningless. The wide differences in the numbers provided by various agencies for a specific year in a specific country not only befuddle veterans of the trade but also simply confuse outside observers. It is a matter of some irony that a trade dedicated to the origination and dissemination of knowledge and information possesses so little information about itself. Probably the most reliable source of statistical information about the U.S. book trade is the Book Industry Study Group. They estimate the total dollar sales of books in the United States is $26,000,000,000. The reader will quickly note that the individual sales of any number of large corporations exceed the total of sales of all classes of books published by all publishers in the United States. To use a boxing metaphor: ''The trade punches above its weight'' in terms of setting the cultural agenda of the United States.

THE MAJOR PRESENT TRENDS MARKING PUBLISHING

Several worldwide trends mark, and have marked, the book and journal publishing trade in recent decades. The first is the continuing increase in the number of new titles issued. This trend is really only a continuation of the trend, which began with the invention of printing and has continued ever since, save for the occasional short periods of leveling off attributable to major wars. However, since World War II the rate of increase virtually the globe around has accelerated to an incrementally higher annual rate. In earlier centuries, this secular growth in new book titles could be attributed to the roughly parallel increases in literacy—first in Europe and North America and subsequently in the other major regions of the world. Indeed, increases in literacy quite closely track increased economic well-being across entire countries and regions. Economic well-being, in turn, generally correlates with not only increased personal income beyond sheer creature needs and increased leisure but job markets depending upon ever larger percentages of more highly skilled jobs. All these consequences, of course, contribute to the desire and need to allocate increased percentages of wealth to reading for increased comprehension, augmenting skills, and filling leisure time in a satisfying way.

Inextricably linked to this growth in book readership is the second observable major trend. That is the globalization of reading interests. This is to say that some titles come to enjoy a near-global readership. This concentrating of readers' taste is served not only through the sale by the original publisher of coeditions to publishers in other countries employing the same language or through the

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sale of translation rights, but also by the globalization of publishing firms. Although the sale of coeditions and translation rights is a universal practice, and the numbers of titles involved is rapidly growing, the largest fraction of such transactions involve titles published by English-language publishers.

In parallel with this widespread interest in writings originating in English-language countries, the English language has become the principal language of scientific, technical, and medical (STM) writing/publishing, as well as the language of much other scholarly writing/publishing, throughout the world. STM publishing represents about 10% of total book sales in the advanced countries but markedly less in developing countries.

Globalization of reading taste and subject interest based in significant measure on English language writings coupled with the near-universal use of the English language in STM publications and, to a lesser degree, in other scholarly writing/publishing, has led to the third major trend in international publishing. That is the economic concentration of the publishing trade, particularly in the advanced countries. The need to be able to successfully market a substantial fraction of any publisher's list to copublishers, translation partners, and in the case of STM and scholarly books to readers/users worldwide virtually dictates that publishers establish a presence in those countries that constitute their major markets, usually by means of acquiring existing publishers in those countries. The firms involved must possess the financial resources necessary to maintain staffs of a size consistent with the nature of such markets; the management skills to operate such geographically dispersed organizations successfully; and the financial integrity to assure partners of their capacity to fulfill the various agreements into which they enter—almost exclusively on trust, for international contracts and agreements are but at best scarcely enforceable in any way other than moral integrity. Furthermore, such firms typically seek a presence in the countries that represent their major markets, not only in terms of the sale of the bulk of their titles but in terms of the editorial content and list-building by the acquisition of titles from writers in the countries in which they are domiciled.

The almost inevitable outcome of this concentration produces the fourth major trend, again most marked in the advanced countries where the consequences of increased economic complexity are most clearly being played out. That is the almost exponential growth of small publishers publishing exclusively in narrowly defined subject matter fields and serving fairly readily defined reader audiences. In the United States alone over 50,000 small publishing firms have been formed as documented by R.R. Bowker and *Publishers Weekly*. Such publishers are often styled ''niche publishers'' reflecting the quite definite outlines of subject matter and audience that they have rigorously focused on. The large, economically concentrated publishers, compelled to support a large and highly specialized staff, must necessarily seek out ''big-name'' authors, whether writers of fiction or writers of dense scholarly syntheses and every kind of book between these extremes. The large publishers are no longer in a position to gamble heavily on unknown authors or run many of the risks incident to the new, and often novel, hypotheses and syntheses continually being advanced in the various realms of scholarship by young scholars. Therefore, the niche publishers, often founded by editors exiting the world of the large concentrated houses, have identified a multitude of subject matter/audience interests/markets in which they can make genuine cultural contributions as well as reasonable livelihoods. Audiences are typically reached by specialized marketing programs designed to apprise niche audiences of the availability of books devoted to their subject-matter interests. To reach beyond their domestic market for their titles, they typically develop a network of other niche or small publishers in the other major markets for books suited to the specialized subject matter involved. Much trading of coeditions and translation rights is ultimately conducted within these networks. By carefully developing and employing these networks, the niche publisher can reach virtually the entire universe of authors and readers concerned with the subject matter or writings defining such niche networks.

It should be clearly articulated here that the titles classified as ''trade'' books and marketed by and large through the ''trade'' channels of retail bookstores constitute not only the most highly visible aspect of the book trade but roughly one-fourth of total book sales. The book-reviewing media and the associated publicity and ''smart'' talk in literary circles fundamentally turn on trade books. The world of trade books is almost entirely dominated by a handful of large, publishing conglomerates, which are usually international in scale. The same observation can be made of the small contingent of STM book and journal publishers, save only that STM books are not marketed through retail bookstores in any significant numbers. STM marketing more closely resembles that pursued by niche publishers. It bears repeating that the trade book world, which is what the general public construes as the entire world of books, constitutes but roughly 25% of the total sales of books in most countries. (Of this 25% about one quarter are children's books.) The remaining 75% will be dealt with below.

The fifth major trend is still largely confined to the publishing trades of the advanced countries. That is the leveling off of the sale of units of books. This is to say that the total number of books purchased in the advanced countries has become virtually flat, in year-on-year comparisons, since the last few years of the last century.

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Given that the total number of titles continues to increase while the number of book units purchased has largely flattened out, the obvious consequence is that the sales of most titles has been declining over the past decade. The book trade economist, Fritz Machlup, first identified this trend in the late 1978.[1] In a major review of book publishing *The Economist* noted, ''. . . the overall amount of money that the public spends on books is no longer rising''.[2] As this trend continues, the consequences thereof, in terms of book prices, publisher economic viability, etc. have only been ameliorated by the appearance of short-run printing and print-on-demand technologies. The most likely explanation for this phenomenon is, first, that the increasing affluence of the citizens of the advanced countries has led to the formation and articulation of a markedly increased number of more narrowly and selective personal interests.

Second, as Curtis Benjamin pointed out some years ago, virtually all scholarly fields have in recent decades demonstrated what he styled a ''twigging effect.'' This is to say that what were in the early 20th century fairly coherent bodies of knowledge, the content of which most of the scholars in those fields were presumed to have mastered and about which they were in a position to teach both the general public and new recruits to the field, have divided and redivided into increasingly narrow subfields. As the apparent pace of discovery quickened, such generalists became fewer while the numbers of ''specialists'' who were on the cutting edges of the newly defined subfields increased. In short, these specialties ''twigged'' off the trunk of the general field. These specialists spent much of their professional lives increasingly narrowly focused on narrow and specialized subfields. As they did so, entirely new subdisciplines arose bringing in their stead specialized books and journals. These specialists, in turn, concentrated most of their attention on these specialized publications to the exclusion of those in other specialties. Thus, while the number of new titles published in the general field increased the specialists mostly purchased titles in their field, thereby increasing the number of titles associated with each general field. They outcome, of course, was fewer copies of most titles sold despite the increase in the numbers of titles published.

A third factor also contributed to this outcome. Libraries have long formed a dependable and major market for books—the public libraries for ''trade'' books, the school libraries for supplementary ''textbooks,'' and the university and research libraries for scholarly books. But demands on library budgets to offer an ever wider array of materials/services, most notably periodical literature; electronic products, and Internet access have increased very rapidly. The costs of traditional purchases plus this increased demand for other products/services have outstripped available funding. The inevitable outcome, of course, is that library book purchases have been held steady or reduced and so contributed to the reduction in numbers of copies sold of a larger number of titles being published.

Substantial increases in the purchasing of books remain to be realized in second and, more notably, in third world countries. Realization of these increases will depend on both economic development and the retreat of governmental command-and-control authorities from the publishing trade—just as had to occur earlier in the development of the advanced countries to free the public square for open debate occasioned by the increasing complexity of advancing societies.

The sixth major and worldwide trend affecting publishing is the explosion of electronic products and the extension of the Internet to public access, not simply in the United States but worldwide. Much has been made in recent decades of the repeatedly prophesized demise of the printed codex and the replacement of the book by first one and then another electronic product whether as stand-alone devices or some kind of Internet download. A steady stream of fiascoes and exploded hopes and the loss of quite substantial sums of money have failed to diminish widespread enthusiasm for such notions; several celebrity figures in the world of publishing have kept up the drumbeat for such alternatives.

Outcomes such as those associated with the attempted mechanization of the codex have not attended all efforts to provide electronic access to formerly printed material. A brief glance at these successful ventures and the character thereof will, in all likelihood, identify the nature of the kinds of intellectual material that can satisfactorily transit to electronic means of transmission. The most obvious and successful kind of electronic presentation of formerly printed material has proved to be the ''encyclopedia'' and similar ''reference'' materials. In short, the electronic transmission and presentation of information (think discrete bits and pieces of data) seems to work quite well for a number of users and uses. Related thereto is the still emerging electronic transmission of more complex forms of information in the shape of research reports and journal articles communicating new discoveries of discrete data. (Many libraries now prefer to receive journal subscriptions in electronic form.) What has become thoroughly evident in the last three to four decades is that information/data transits relatively readily to electronic forms.

Electronic technology has proved, on the other hand, a major boon to book publishers in the ''backroom'' functions of the publishing cycle. The typical journey of a writing from author to a printed book is now conducted almost entirely electronically. Writing, editing, peer-reviewing, designing, preparing electronic input for the printer, and control of the presses in the printers shop is now largely done on computers. Additionally, all

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warehousing billing, shipping, accounting, etc. within the publishing house is computer controlled.

Thus, book publishers are well acquainted with electronic procedures and practices. However, their repeated efforts to replace, or offer an electronic alternative to, the printed book have proved fruitless. A brief look at the nature of the book provides the obvious answer to these repeated fizzles. The difference between the miscellany of any assemblage of information/data (think encyclopedias, dictionaries, law reports, an issue of a journal, etc.) and the coherent body of knowledge or the sustained discourse of a fiction writing is a matter of human epistemology and the quite different purposes mental processes served by each. A book of knowledge or a fiction depend for their meaning and use on an extended discourse or narrative—readers must be presented with an often extensive body of evidence or the development of a story, all configured in a logical and coherent way to acquire, in at least some measure, the sense the author intended. Information gathering, by way of contrast, commonly involves simply finding a datum to serve a particular purpose defined by the immediate needs of a mental process engaged by the seeker (think a telephone number or a dictionary word or a brief chronology of the development of the computer or a library catalog entry, etc.). The discursive discourses demanded by the exposition of a knowledge concept, an ethical precept or the telling of a story are not well handled in terms of human epistemological requirements by digital devices. An entirely different epistemological process is involved in the acquisition of a datum or a body of data than is called for in the following of the line(s) of thinking involved in the transfer of knowledge concepts and precepts or the development of a story line inherent to the construction of fiction.

To cast this profound intellectual difference in an entirely other way: a base of knowledge is an absolute prerequisite not only for intelligently seeking information but is equally necessary to the rational understanding of whatever data bits are located. By way of example: imagine an intelligent person who is utterly unacquainted with financial markets. Seat this person before three networked computer screens displaying real-time financial data. The ignorant subject of this thought experiment placed in this situation will prove utterly unable to make any sense of these masses of data, despite the fact that financial data is probably the most complete and accurate body of information/data presently in existence. Only a broad and deep knowledge of financial markets and the economics underlying them will permit a viewer to decipher this information and put it into understandable and usable form. The same thought experiment could be employed with any body of data resulting in precisely the same outcome of incomprehensibility for the unknowledgeable. In short, the epistemological realities of the human mind must needs deal with knowledge and information in quite different ways. Therefore, the successful migration of information books to electronic forms is perfectly consistent with the functioning of the human mind. The operation of the human mind equally well explains the repeated failures to adapt books of knowledge and fiction to electronic forms.

An exception to this general formulation may occur when a reader requires but a limited portion—a chapter or several pages—of a longer discursive writing. In such cases, electronic access may prove as useful as access to the printed form of the text.

The seventh major trend in publishing again relates to another player in the wider world of books, in this case booksellers. Again this trend has been most clearly played out in the advanced countries enjoying maximum retailing freedom. This retailing trend is being played out in two forms. Both forms take as their base operational objective the immediate supply of the widest possible range of titles. This trend first became evident in the form of the ''super bookstore'' chains. The huge bookstore stocking 150,000 to 250,000 discrete titles has been the occasional feature of a limited number of major cities for some years. However, such stores were not readily accessible to a large fraction of the population of any country. (This fact also explains the dramatic growth of direct-mail book clubs of all descriptions in the 1930s to the 1940s—they offered most of the citizenry both some information on current publishing output and the opportunity to easily purchase titles of interest.) The radical change in bookselling, which the chain superstores inaugurated, was to place well-stocked stores (75,000 to 200,000 individual titles) in all manner of market locations—even some in which small-scale, ''mom and pop'' bookstores had failed. The opportunities offered the reader to personally examine hands-on a broad range of books for suitability and immediately acquire any of interest were almost overnight geometrically increased. The advent of the chain superstores has provided a much larger number of readers with a service well beyond that previously available. And not surprisingly, the committed independent booksellers undertook to match the competition created by the chain superstores in virtually every aspect, from increasing the number of titles immediately in stock to providing seating and other amenities for browsers—which has, in turn, benefited readers.

The emergence of the bookstore chains has led to some quite unsustainable conclusions about their impact on publishing. Probable the most common is that the chains have furthered the purported homogenization of taste and interest among readers and, thereby, narrowed the range of subject matters open to authors and publishers and/or lowered the levels of sophistication to which books have

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to be tailored. Either one or both of two lines of argument are advanced to support this cluster of related conclusions. The first, and most egregious, is that the buyers/management of the large chains exercise greater or lesser control over the publishing programs of the trade publishers. The fact of the matter is that the opinion of chain bookstore staff is occasionally solicited, e.g., when a publisher harbors some concerns with respect to the size of print run to order or again, as approximations of the quantity of a title that might be purchased when advertising and promotion budgets are being formulated. However, such inquiries are light-years apart from editorial control.

The other common causative factor advanced in support of the notion of the progressive homogenization of public taste and interest attributable to the chain bookstores is that the centralized buying employed fails to offer the full range of subject matters and writings that are available. The obvious assumption is that the chain booksellers are appealing to only the lowest common denominator and thereby lowering and narrowing the literary and cultural horizons of the reading public. The general taste and interest of the reading interests of the vast numbers of readers as documented over the centuries apparently is insufficient evidence of the fact that the chain booksellers, in step with the stocking practices of the independent booksellers, is to stock books that seem to have the potential for enjoying a reasonable sale. In short, the chain buyers are simply doing what they insist they are doing—stocking those titles that in their opinion will find a reasonable audience, even one numbering but one or two copies in most of the chain's stores.

In every age litterateurs, authors, and some publishers have found fault with the taste and interests of the general book-buying public. Thus, it is hardly surprising that the same players are leveling identical complaints but falsely attributing them to the emergence of a class of retail bookseller they instinctively dislike.

This new means of providing rapid access to a stupendous range of books in large numbers of physical locations created by the chain superstores and their independent competitors was then translated to Internet bookselling. So, it is now possible for the readers to learn of and then order books of interest from the precincts of their own home and expect, in most cases, to have the books delivered to the front door three or four days later. The databases of book titles now maintained by the largest of the Internet booksellers are, for all practical purposes, identical to the books in print of one or several countries. These large Internet booksellers have now gone a step beyond the provision of in-print titles to conducting out-of-print searches in cooperation with hundreds of out-of-print book dealers. So, the acquisition of an out-of-print title has now become nearly as routine as the acquisition of an in-print title. Additionally, universities and other vendors have digitized a large number of out-of-print titles, most of which can be downloaded and printed out. The world of hard-to-find titles has been radically reduced.

The eighth major trend, which has emerged only in the last few years, is the extensive reprinting of titles using print-on-demand technology (POD). The POD grew out of the joining of the photocopying and computer technologies. Like all such new technologies, POD migrated through about a 20-year period of rapid, successive marginal improvements paralleled by a widening body of buyers thereby progressively reducing costs. The technology is now so effective and cheap that it can successfully compete with conventional presswork for editions of up to about 500 copies. However, perhaps more importantly, it can be economically employed for editions of 10 or so copies, assuming the original text exists in a suitable digital format. As the POD technology has been progressively improved, it has become virtually impossible to distinguish a POD volume from a printed volume. The obvious consequence is that publishers are now in a position to keep much larger and increasing fractions of their backlist in print and within the bounds of an acceptable list price. Some of the more farsighted publishers—largely niche and STM firms—are now producing a significant number of their new titles employing POD. By so doing they cannot only print quantities from digitized manuscripts more closely approximating estimated short-term forward sales but reprint in very small quantities, from the same digital format, as demand dictates.

The second largest single class of books in terms of sales is that of textbooks—typically representing 25% of total book sales in advanced countries and larger percentages in developing countries. Textbooks have a history almost as long as that of the book, whether in scroll or codex form. Indeed, Albert Kapr, presently regarded as the leading authority on Gutenberg, opines that the first book printed from movable type was the standard Latin grammar and dictionary textbook used throughout the Middle Ages and early Renaissance for instruction in the universal language of that period, the 27-line Aelius Donatus *Ars Minor* printed in Strasbourg.[3] Since that day textbooks became an increasingly important and profitable element in almost every publisher's list. Neither the growth of literacy or learning is comprehensible save in the context of an appreciation of the central role the textbook has played in the evolution and present prominence of the culture of the West. The textbook and related supplementary readings continue today to be the principal educational tools in the shaping of the minds of the young and their induction into the mainstream of their culture, now throughout the world.

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The textbook, despite its critical role in education, has for much of its history been the lightning rod of cultural conflict, thanks to this very criticality of its role—both within the West and between the West and the balance of the world. As a consequence, the publishing of textbooks is far from the static, seemingly benign activity it is commonly thought to be. The textbook has always been the target of all manner of special interest groups seeking to impose their various agendas on education—and thereby, on the shaping of the minds of the oncoming generations. While these conflicts over the contents of textbooks erupt on occasion into the view of the larger society—one thinks, e.g., of the contests over the control of schools and textbooks, in the centuries following the Reformation—they are usually confined to the immediate and, in many ways, inbred circle of the educationists. Textbook publishers have long since seen themselves and been considered by other segments of the educational establishment as members in good standing thereof. The textbook publishers, therefore, have chosen, by and large, to accommodate these differences by steering a middle course between contending special interest groups, which often results in a quite bland editorial substance, which in turn proves of questionable educative value.

Textbook publishers, particularly those publishing college and university-level textbooks have turned to alternative forms of publishing over the past two or three decades. The first radical departure from the standard textbook was the ''course pack.'' The course pack is a collection of chapters from two or more textbooks all focused on a usually narrower subset of the topics typically treated in a textbook, but also commonly derived from the fashion in which professors wish to structure their instructional approach. In the most recent and radical departures from the traditional print textbook, entire textbooks and course packs are now being offered for sale in digital form as CD-ROMs or for downloading from publishers' Internet sites.

Whatever the periodic lapses by some textbook publishers from contemporaneous best standards of knowledge content, the textbook and its publishers are so central to the passing along and maintenance of the received cultural heritage that they will continue to represent a significant and critical element in the world of publishing.

The next largest class of publishers is the STM publishers. As the name implies their editorial foci are oriented to related worlds of pure and applied science. The STM publishers range in size from international conglomerates publishing widely across the spectrum of the sciences and their applied practices to highly specialized niche publishers. Many also devote a considerable amount of capital and editorial effort to the publishing of journals in some or all of the specialties in which they publish.

Related to STM publishing, and often conducted by STM publishers, is the publishing of professional literature. As the name implies, this publishing sector serves the needs of the growing army of professionals—lawyers, accountants, and the like—and the even faster growing battalions of ''experts'' of all kinds, both private and public. The political, economic, and social structures and practices of modern society, and particularly that of the advanced countries, have become so complex that all manner of specialized knowledge is now required to negotiate the tortuous corridors often imposed on the citizen by this complexity. Of necessity, the citizenry has been compelled to turn such experts for help whenever compelled to navigate these uncertain waters. So, the professional publishing sector has arisen and expanded in parallel with this growth of experts. One of the most obvious of these specialized fields is that of management to which a multitude of books are now oriented every year. At a somewhat lower and more common level are the numerous books aimed at serving those seeking entrée to and subsequently maintaining currency in one or another of the numerous skilled vocations that have accompanied the increased complexity incident to the modernization project.

The last major class of books published is that serving a religious orientation. These range from the texts of the sacred texts of the world's religions to devotional tracts. This class represents about 10% of total book sales in the developed countries and probably larger percentages in some regions of strong religious belief elsewhere in the world. Religious publishing, while remarkably difficult to track and quantify, seems from several accounts to be enjoying a significant upsurge in numbers of publications and in terms of sales at the present writing.

In addition to the major categories of books dealt with above, there is a large and generally unquantified body of publishing conducted across the globe every year. This transient body of publishing is commonly referred to as ''ephemeral literature.'' The publishing of ephemera serves a multitude of purposes usually confined to the narrow, self-contained objectives of a vast array of small, special interest groups. These groups appear to be endemic to every region of the world, save the poorest and/or most remote portions thereof, and are particularly committed to the use of publication to articulate, advance, and sustain their particular interests.

PRESENT PROBLEMS

Although a shallow backwater in financial terms the publishing trade exerts political, economic, social, scientific, and, more broadly, a cultural impact of the first rank—an influence greatly in excess of its fiscal stature.

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This disproportionate importance in cultural consequence imposes on the trade in general, and publishers and editors in particular, an enormous professional cultural responsibility. Shabby publishing inevitably and invariably leads to shabby long-term cultural outcomes, as has been agonizingly evident and with alarming frequency in past centuries. It is all too easy for publishers and editors to seek short-term financial relief or wealth by trolling for the lowest common denominator. At least as culpable is the knowing publication of books that advance untrue or ethically impoverished propositions. Such resorts to the dissemination of populist or dubious goods are not simply contemptible in terms of the critical role that the finest publishing tradition fulfills but culturally corrosive.

Perhaps the gravest problem presented by present publishing trends, second to the continuing extent of shabby publishing, is a fundamental cultural epistemological problem. It arises out of the growing imbalance between the increasing volumes of raw data/information published in journal or electronic form and the comparatively slighter fraction thereof being synthesized/reduced to knowledge concepts published in coherent book form. Random bits and pieces of data/information are of no intrinsic intellectual value save as they can be integrated/synthesized by savants into knowledge concepts. Individual bits of data are absolutely essential and of the utmost importance to the prepared mind, but they possess no meaning and, hence, value to a mind not well stocked with knowledge concepts or working hypotheses into which they can be fitted to support or refute a knowledge hypothesis. There are in a number of subject-matter fields of genuine importance imbalances between the numbers of research people digging out/discovering new data/information and the numbers of people involved in synthesizing these data into hypotheses, thereby weaving some form of coherent knowledge concept out of these data and integrating these concepts/hypotheses into existing bodies of knowledge. Authentic book publishers can play an enormously useful cultural role, as they have in the past, by closely and continually monitoring these imbalances and then identifying and seeking out potential synthesizers and to then encourage them to imbed their works of synthesis into a book for broad circulation—and possible falsification.

In all likelihood, the next most serious problem faced by book publishers is the continuing attrition of library budgets. Two significant deleterious consequences arise from these budgetary constraints. First, libraries are able to acquire a constantly declining percentage of the print output resulting from the still increasing output flowing from research and synthesis. These progressively diminishing budgets are additionally being expected to acquire a far wider range of materials, most notably but not confined to electronic forms. The outcome is that libraries are acquiring a diminishing fraction of an increasing intellectual output—both print and electronic. Consequently, publishers are being increasingly constrained in the performance of their cultural function. Second, libraries have traditionally been not only an indispensable support of serious publishing but a necessary and useful partner in the larger cultural ''peer-review process.'' In the latter role, they have long been looked to endeavor to not only weed out the culturally mediocre but to promote the dissemination of the culturally sound. Both the preservation of the good and weeding out of the mediocre are at the very best very difficult and subject to real abuse. Obviously, the acquisition of a declining proportion of the books and journals published in both print and electronic form limits to a greater or lesser degree the effective discharge of both of these two vital cultural functions. Possibly as great a harmful consequence of the throttling of library material budgets and the resulting reduced capacity to bring books into library holdings is either increased book prices for all buyers or, in the more acute cases, the choking off of book manuscripts in publishers' offices induced by uncertainties about viable markets.

A continuing publishing problem remains that of copyright protection—intellectual property protection. This problem is most acute in the case of STM books and textbooks. While the problem is worldwide, it is especially acute in the underdeveloped regions of the world. The books involved are most commonly those published in the English language. Although Western publishers have over the years made all manner of concessionary exceptions for the underdeveloped countries, the problem continues to evade solution. However, this problem is not confined to underdeveloped countries; the unauthorized use of the intellectual and literary efforts of others is widespread in developed countries. Since the widespread acceptance of the Internet, an increasing volume of piracy in the form of downloading intellectual property has developed in this channel as well. The consequence of these alternative methods of acquiring intellectual property yields the unintended consequences of higher prices for all books and journals for the ethical users as well as a proportional reduction in the property owner's income.

Another of the seemingly intractable international publishing problems is the matter of publishing in languages of limited usage. The common remedy invoked to solve the publishers' problem is to look for government subsidies to publishers. This, as any reader of John Milton's *Areopagitica* knows, is a dangerous game at best. The continuing history of governmental intervention in the publishers' workshop since Milton's time simply confirms the wisdom codified by him and provides a continuing sorry account of the unintended consequences resulting from this rent-seeking solution of government

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subventions. A far better solution to not only this problem but opening a far larger perspective to the citizenry of such minor-language countries as well would seem to be intensive and sustained instruction in one of the world's major languages. The economic benefits resulting from such an educational investment would likely recover the costs involved many times over.

THE FUTURE

Turning from the disconcerting matter of the problems confronting the publishing trade to the equally dangerous enterprise of trying to make some sense of the present trends in the world of culture, knowledge maintenance and formation, and authentic publishing some of the following observations may be useful in orienting the planning exercises of librarians and information specialists.

In all likelihood the most important trend that will greatly impact the future of publishing is the continuing increase in the financial support of research, both private and public. One of the major conclusions that can be drawn from the history of the scholarship of the last half century is that the extent of our ignorance not just of our world and our natures but of the history that landed us on the shores we presently occupy is dauntingly large. While the totality of our knowledge is impressive indeed, it still falls short of that level of understanding with which all can feel intellectually and ethically relatively comfortable. This realization has driven the continued increases in support and the inevitable increased publication, as it has in the past. It seems almost certain, therefore, that the number of new book titles being published can only increase. This increase is the inescapable consequence of not simply the synthesizing of new knowledge concepts and the integration of these new concepts into the bodies of existing knowledge. It will also follow from the necessary and continuing falsifying of older, unsupportable knowledge hypotheses in light of the new knowledge hypotheses that emerge or the contradictions that appear as these new hypotheses find their place in existing bodies of knowledge. Book publishers and editors will play a crucial role in this knowledge-building process.

Preceding the falsifying of unsustainable hypotheses and the synthesizing of new hypotheses in books containing coherent bodies of knowledge is the discovery/uncovering of data/information resulting from this continued vigorous support of research. The third likely future outcome is quite how these research results will likely enter into the larger public square of discourse and debate. On present trends, this process of dissemination seems a highly uncertain matter. Traditionally, research results have been made public in the form of journal articles and research reports. The rapidly emerging technology of electronic transmission has radically altered the likely future channels of dissemination.

To come to grips with this seeming conundrum some of the leading characteristics of the uses of the journal and of the nature of the thing in itself at the opening of the new century must be noted. First, as is well understood the cutting edge of research in virtually every subject-area field is dominated by a tiny handful of key players. These key players seldom look to the journal literature for cognitive purposes for they know most of the other members of their respective invisible college as well as the avenues of research/discovery/hypothesis formation being pursued or advanced by their peers. This elite rather employs the journal for several other purposes. First, journals are used to establish priorities of discovery in the highly competitive environment of work at research frontiers. Second, the elite uses journal papers to signal to others in the invisible college the marking off of future research avenues in an effort to foreclose competition. And lastly, of course, these movers and shakers still intend to communicate their results to the vast bulk of others in the subject field who use these results to maintain currency for the discharge of their pedagogical responsibilities.

These latter preponderant pedagogical members use the journal for quite other purposes. As noted above they use journals to maintain subject currency for instructional purposes. They are, however, also faced with the ''publish or perish'' employment mandate. Consequently, they tend to publish that 75% to 80% of the papers that make no contribution to the information base of their particular subject area field or are essentially meaningless. This is also the group that uses the journal literature maintaining currency in the intellectual content of their field and for verification purposes.

Turning to the journal itself the principal observation to be made is that it is, and always has been, a miscellaneous gathering of papers. As such any specific issue possesses no substantial coherence for any particular reader. Thus, the vast percentage of papers contained therein is remote from the intellectual interests of most readers. (Notable exceptions are such high-status, general-purpose journals, such as *Science* and *Nature*.)

The second, major characteristic of the journal is that it remains, in essence, a print product and as such is conceived in terms of an issue and for commercial purposes as a subscription for all the issues published within a defined period, usually a year—this for historic reason that the first journals were published as a member benefit by learned societies and so, tied to yearly dues. Thus, the present thinking remains tied to yearly subscriptions to a specific journal title. (Historically, reports are spin-offs, for they did and do not fit the journal format

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well.) However, the retention of this association with a yearly subscription cycle is becoming increasingly dysfunctional for the publication of research results and that of related forms of information/data as the volume of the latter continues its recent increase.

It seems probable, in light of the recent development of massive computer capacity and the escalating sophistication of management software for enormous databases, that information/data will increasingly be made available by highly defined systems, akin to the approval plan system for books and tailored to the specific needs of individual users. The ongoing operational costs of such a system will prove sufficiently small that such individual profiles can be maintained and serviced directly to subscribers' desktop computers at a very reasonable cost to the individual subscribers.

If this trend is realized an entirely new journal/report infrastructure must be created. Subscribers to such a system will probably be served by newly formed organizations serving as middlemen between publishers and users. Libraries will continue to have a role in information/data dissemination as the middleman between publishers and occasional users, i.e., those users whose information/data needs do not warrant signing up for a sustained service.

It also seems likely that libraries, operating as stakeholders in some kind of consortium arrangement, will be responsible for warehousing/archiving these vast bodies of raw information/data until various chunks of it are reduced to knowledge concepts by library scholars. The latter are scholars devoted not to uncovering new information/data working in a research setting, but scholars working in libraries on the already discovered information/data literature to reduce it to some kind of comprehensible form—knowledge concepts and ethical precepts—which can be incorporated into existing bodies of knowledge

The latter role of knowledge concept and ethical precept formulation/synthesis will become increasingly important as the society more fully recognizes the unsustainable disparity between information/data discovery and knowledge formation/synthesis. Consequently, librarians will be called on to play an increasingly critical role as partners in marshalling of information/data for the utilization of the library scholars who will be virtual habitués of libraries.

All of this intellectual work of synthesizing new knowledge concepts and integrating them into existing bodies of knowledge will, of course, be disseminated to the broader public in the form of sustained discourses. Manifestly, so doing will result in a marked increase in the number of books published.

All of which brings us back to library as the cultural warehouse of the culture or the memory of the species—all those seemingly old-fashioned and presently disdained descriptions of the cultural place and function of the library. It brings us back, as well, to where this article began. The number of book titles published yearly will continue to grow as humankind seeks to better come to grips with the true and the good.

CONCLUSION

Substantial clouds of uncertainty surround publishing at this writing. The principal cloud is economic resulting from the flattening of sales and the other problems noted above. All of this uncertainty is further complicated by the yet unknown consequences of the digital revolution. Publishers have, however, had to perform their cultural role through all manner of difficulties and uncertainties. So, at the end of the day they will continue to originate books and journals as the cultural need for knowledge, literature, and information is not likely to disappear.

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The British Library

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INTRODUCTION

The British Library holds one of the most comprehensive collections of the world's knowledge. The collection is at the heart of the unparalleled range of services that are provided to national and international users in reading rooms and exhibition galleries and through document supply and bibliographic services. The Library is active in its use of electronic services and digitization to provide effective and ever-wider access to its holdings. One of its main tasks is to collect, preserve, and provide access to the United Kingdom's National Published Archive; extending this remit into the digital domain is a critical responsibility going forward.

HISTORY, FOUNDATION, AND FUNDING

The British Library is the national library of the United Kingdom. It was founded in 1973, the first time that the United Kingdom as a whole had had an official national library. The creation of this new body combined the national resources for reference, bibliographic services, and interlending into a single administrative unit. The British Library brought together many organizations, in particular, the library of the British Museum,[1] which had histories and collections[2] stretching back many years, and included the National Reference Library of Science and Invention. Added to these were the National Lending Library for Science and Technology, the National Central Library, and the British National Bibliography Ltd. In 1982, the India Office Library and Records joined the Library, followed by the National Sound Archive in 1983. The recent history of the Library from its foundation, and thus from the first edition of this encyclopedia, to the present has been characterized by an ever-closer fusion of the constituent parts, developed through a number of different structures, each of which has moved the Library forward.

This progress toward integration was dramatically demonstrated by the opening of the Library's purpose built premises at St. Pancras by Her Majesty Queen Elizabeth II in June 1998 (Fig. 1). In its new headquarters, designed by Sir Colin St. John Wilson, the Library was able to consolidate services from 18 different buildings around London. Of particular note was the move from the historic Round Reading Room at the British Museum, bringing humanities researchers to join their peers from the scientific disciplines in 11 new reading rooms covering all fields of research. At present, the exceptions to this consolidation remain the Newspaper collections, still situated in North London, and the conservation studios which remain on the British Museum site but for which plans are underway to construct accommodation to the north of the new building. The Library's site in Boston Spa, Yorkshire, is the operational center for document supply and bibliographic services and promises to be the site of future expansion because it offers both space and relatively cheaper building costs.

The Library's funding comes mainly from government, through the Department for Culture, Media, and Sport. The grant-in-aid in 2003 was £88 million, supplemented by the Library's trading income, primarily from document supply services, of £28 million and a further £3 million from donations and similar forms of support.

STRATEGY AND USER COMMUNITIES

Once established at St. Pancras, the Library redefined its strategy in consultation with its major stakeholders and user groups in 2001. The consultation confirmed the Library's core responsibilities for acquiring, preserving, and providing access to U.K. publications—the National Published Archive—and gave a mandate for extending this to digital publications, including the Web domain. Users also confirmed the value of centralized document supply services and the extensive purchase of international publications, in both print and digital formats, for the benefit of the U.K. research community. Support was also manifest for the Library's program to widen outreach, in both digital terms and in the provision of exhibitions, events, and activities in its new headquarters that would engage broader sections of the community.

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Fig. 1 The British Library's headquarters in St. Pancras, London, is a sleek, modern complement to the Victorian Gothic station alongside. *(Go to www.dekker.com to view this figure in color.)*

The consultation enabled the Library to focus on, and map the differing needs and expectations of, its primary constituencies, thus giving definition to the shaping of service and collection development in the medium term. Priorities have been set out for each primary audience.

For the researcher

- The Library aims to support world-class research and remain in the premier league of global research libraries by continuing to build breadth and depth in both print and electronic collections and by providing excellent navigation and access to external collections.
- The Library will continue to focus on providing electronic access to collections, particularly for the scientific community, and use its unique expertise to develop services for the humanities and social science researchers.

For the business user

- The Library aims to support innovation, competitiveness, and growth by being a trusted, first-choice provider of content.
- It will develop value-added products and services in conjunction with key customers for both Web and physical delivery. For example, the Library plans to open a drop-in Innovation Centre to support the entrepreneur or small company, backed up by access to on-line information and expert knowledge.
- It will develop a digital offering that integrates information services, document supply, and access to experts.

For the U.K. library and information network

- The Library will provide support through offering:
  - reliable guidance
  - expertise and leadership relating to library and information service provision
  - high-quality bibliographic services
  - world-class collections
  - nationally cost-effective services
- Strengthening partnerships with public libraries as a key means of improving accessibility to the national collection and reaching out to the citizen.
- Developing and building on current relationships in the higher education library sector will be key in terms of providing support for research and creating a shared information environment.

For education

The Library aims to be a center of excellence in source-based investigative learning and a leading provider of such learning.

- It will provide high-quality onsite experiences with professionals and promote the value of research.
- It will:
  - market to teachers, creating products for learners
  - focus on schools within a context of lifelong learning
  - promote untapped resources (for example, the unique visual material in the collections)
  - address social inclusion through ''cultural inclusion''

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For the general public

- The Library aims to secure public support and convince a broad, popular audience of its cultural value and relevance to future generations.
- It will focus on raising public awareness and engaging groups with which it has had no previous contact.
- Ways in which the Library can do this include:
  - establishing alliances with companies with public reach and recognition, such as the British Broadcasting Corporation (BBC) or a major retailer
  - delivering a strong Events Program around a variety of themes of public interest
  - ensuring coverage of its galleries in leading U.K. and London guidebooks
  - identifying communications channels through which the Library can engage with minorities, for example, through the BBC's Asia programming

The compelling common factor underpinning the roles the Library plays for these diverse audiences is articulated in its mission: to help people advance knowledge to enrich lives. This mission manifests itself most clearly in the outcomes users derive from the Library. Recent examples include the delivery of a specialist article on blast injuries urgently needed by a Melbourne hospital treating victims of the Bali bombing; making critical international research available to gene therapists at the Great Ormond Street Hospital to enable a breakthrough in the treatment of a previously fatal bone marrow condition; and working with the historian Dr. David Starkey on a TV program which shared new insights into the political maneuverings behind the marriage of Henry VIII to his fourth wife, Anne of Cleves.

To fulfill its mission, the Library is strengthening links with bodies representing its key audiences in the research and library and information world. There has been a long and close history of collaboration and interaction between the British Library and higher education in the United Kingdom in support of research. In 2002, the Library agreed a statement of strategic alliance with England's Higher Education Funding Council (HEFCE) to promote specific collaborations and undertake special projects in support of common purposes; to ensure that strategies are mutually informed by relevant developments in both bodies and respective networks; and to develop mutually beneficial information exchange and expertise sharing. In the same year, it agreed a concordat with the Arts and Humanities Research Board to identify shared strategic priorities in the support, promotion, and dissemination of research and postgraduate study in arts and humanities and to set up frameworks for the development of intellectual infrastructure and training of postgraduate researchers.

Recent years have provided numerous good examples of practical collaboration. The Library has participated in some 15 projects funded by the Research Support Libraries Programme (RSLP) and co-funded many others through its Cooperation and Partnership Programme (CPP). It has worked with the lead body in higher education information services, the Joint Information Services Committee (JISC), and RSLP to fund and manage studies on national union catalogues, leading to the development of the union catalogue of serials—SUNCAT. Joint Information Services Committee has also supported the free provision of the Library's Electronic Table of Contents service to all U.K. academic institutions.

The Library is collaborating on collection development and management through RSLP and CPP projects and through a number of multilateral programs, for example, the Consortium of University and Research Libraries Russian and East European initiative. Bilateral projects are underway with the School of Oriental and African Studies, with the University College London on Scandinavian and Dutch language materials, with the Institute of Advanced Legal Studies on foreign legal materials, and with the London School of Economics on overseas official publications.

In addition, there has been a long history of scholarly cooperation between staff of the British Library and academic departments in universities, as well as with individual scholars. Formal agreements on scholarly collaboration exist at present with, for example, University of Sheffield and Royal Holloway, University of London, and with several central institutes of the University of London.

The Library was one of the cosponsors of the Research Support Libraries Group, together with the United Kingdom's four Higher Education Funding Councils and the national libraries of Scotland and Wales. The British Library Board has welcomed the group's conclusion that there is a need for a U.K.-wide strategic framework and the development of coordinated delivery mechanisms for research information provision. It has endorsed, in principle, the recommendation that the United Kingdom should create a new body, the Research Libraries Network, to lead and coordinate the provision of research information in the United Kingdom. The Library will be participating fully in the creation of the network and the furthering of its program.

COLLECTIONS AND SERVICES

The British Library is unique among national libraries for both the breadth of its historic collections and for the size and international reach of its document supply business. This latter facet confers the additional distinction that no other national library earns such a high proportion of its annual spend.

The breadth of the collection is reflected in a continuing wide remit with regard to current acquisitions upon which services depend.

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Based on entries in catalogues, the Library's collection[3] is calculated as tabulated below:

Monographs	9,767,009
Serial titles	702,340
Newspaper titles	54,972
Manuscripts	310,148
India Office Records	260,000
Philatelic items	8,191,508
Cartographic items	4,265,471
Music scores	1,583,885
Sound disks	1,209,625
Sound tape items	205,901
Videograms	22,077
Prints and drawings	32,371
Photographs	212,086
Patents	49,591,370
Reports in microform	4,505,019
Theses	645,458

The Library spent about £14 million in the year 2002–2003 but recognizes that, merely to maintain the present level of acquisition, it would have to increase expenditure by about another £1 million a year to keep pace with inflation in the price of publications. The significant strain this places upon a single organization has been, in part, the stimulus to forging collaboration with the research sector at a strategic level, as outlined above, to explore whether a national view can be taken with respect to the provision of the national research resource.

For some years now, the Library has aimed to manage its holdings as a single collection for the provision of both reading room and document supply services, the main exception to this being U.K. published material. The London-based legal deposit collection, with very few exceptions, is not used for document supply, which is served by the purchase of duplicate copies.

The impact of the advent of electronic collections on the Library, in general, and on services, in particular, can only be sketched at this time (2003). Taking forward its responsibility for preserving an archive of the published output of the nation, the Library is promoting a bill currently going through parliament to extend the legal deposit legislation to electronic and Web-based material. Since 2000, a voluntary agreement has been in place between U.K. publishing bodies and the copyright libraries for the deposit of certain classes of electronic material: the bill seeks to formalize and extend this agreement. The Library is addressing the challenges associated with long-term preservation, storage, and access to digital material through its leading role in the U.K. Digital Preservation Coalition, a community of interest groups which includes national and government archives, libraries, museums, higher education, the Research Councils, and bodies representing the publishing and information technology communities. The coalition is defining a national strategy and collaborating on a program to build knowledge and share best practice.

The collection of reference materials, spanning four millennia and covering every written language, is one of the richest and the most comprehensive available to scholars. It is housed primarily in St. Pancras and serves the 11 reading rooms there (Fig. 2). Two other reading rooms are located in Boston Spa and in the Newspaper collections building in North London. Over 5.5 million documents were consulted in the year 2001–2002 in the St. Pancras reading rooms. Access is free, although researchers must qualify for a Reader's Pass, currently held by over 150,000 readers. While the reading rooms in St. Pancras are essentially interdisciplinary, they are broadly grouped into humanities on the one hand and science, technology, and business on the other. In addition, certain types of material—Manuscripts, Maps, Rare Books and Music, and Oriental and India Office Collections (Fig. 3), each have a dedicated reading room.

The document supply collection is housed mainly in Boston Spa and is used by all U.K. university and public libraries, together with almost all of the top 100 research

Fig. 2 Humanities Reading Room, St. Pancras. *(Go to www.dekker.com to view this figure in color.)*

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companies in the United Kingdom and a significant number of smaller companies (Fig. 4). In 2001–2002, the Library supplied 3,320,800 items, 36% of which were delivered to overseas organizations. In recent years, the majority of document requests have been met by photocopies, but increasingly, researchers are being given instant access to articles and papers in electronic form as the Library develops relationships with the publishers. Furthermore, new partnerships with Relais and Adobe are enabling the Library to supply secured electronic copies from almost all printed and microform material in the document supply collection, and, in the future, this facility will be extended to the reference collections.

The provision of these services is vitally dependent on the catalogues that describe the contents of the institution. The Library is in the process of acquiring and implementing an integrated library system to underpin its offering to researchers. For the first time, a complete package will be acquired and implemented without modification. However, at the same time, the requesting systems that support document delivery are also being modernized through investment in IT and new business processes. The vision underpinning these developments is of a single collection displayed and made available through a single interface, with issues of where and how to view the items needed for research seen as second-order questions.

For the general public, the Library's new building provides modern facilities and galleries (Fig. 5). The centerpiece of the public space is the King's Library, housed in a magnificent glass and bronze tower (Fig. 6). The 65,000 volumes of King George III's collection were presented to the nation by George IV in 1823 and continue to be used by researchers every day. The Library also has three exhibition galleries of very different character. The John Ritblat Gallery of Treasures of the British Library displays the jewels of the collection. These include historic documents such as Magna Carta, icons of English literature including the Beowulf manuscript and the notebooks of the Brontës, and the sacred texts of the world's great religions. Imaginative access to a number of these, including the Lindisfarne Gospels, the Golden Haggadah, the Diamond Sutra, and Sultan Baybars' Qu'ran, is provided by Turning the Pages, a touch-screen system developed by the Library to give visitors the opportunity to turn the pages of digital facsimiles, explore them in magnified detail, and hear or read about their production and meaning.

Fig. 3 Oriental and India Office Reading Room, St. Pancras. *(Go to www.dekker.com to view this figure in color.)*

Fig. 4 The British Library site at Boston Spa, Yorkshire, is the operational center for international document supply and bibliographic services. *(Go to www.dekker.com to view this figure in color.)*

The Workshop Gallery provides didactic space that demonstrates the transmission of text through the ages and in different media (from illuminated manuscripts to sound and computer typesetting). Finally, the Pearson Gallery provides a flexible space for a series of changing exhibitions that are focusing on major strengths of the Library's collection. Recent exhibitions include a focus on the rich history of the trade and cultural exchange between Britain and Southeast Asia, a display of the best contemporary illustrators of children's books, and an examination of the political and cultural impetus behind a thousand years of map making. Themes that will inform future exhibition programming include a focus on the great English writers, whose lives and work are so well documented in the Library's collections, and an exploration of world faiths.

In addition, displays are mounted in the other public spaces of the building which throw light on topical events and anniversaries. A recent popular example was the

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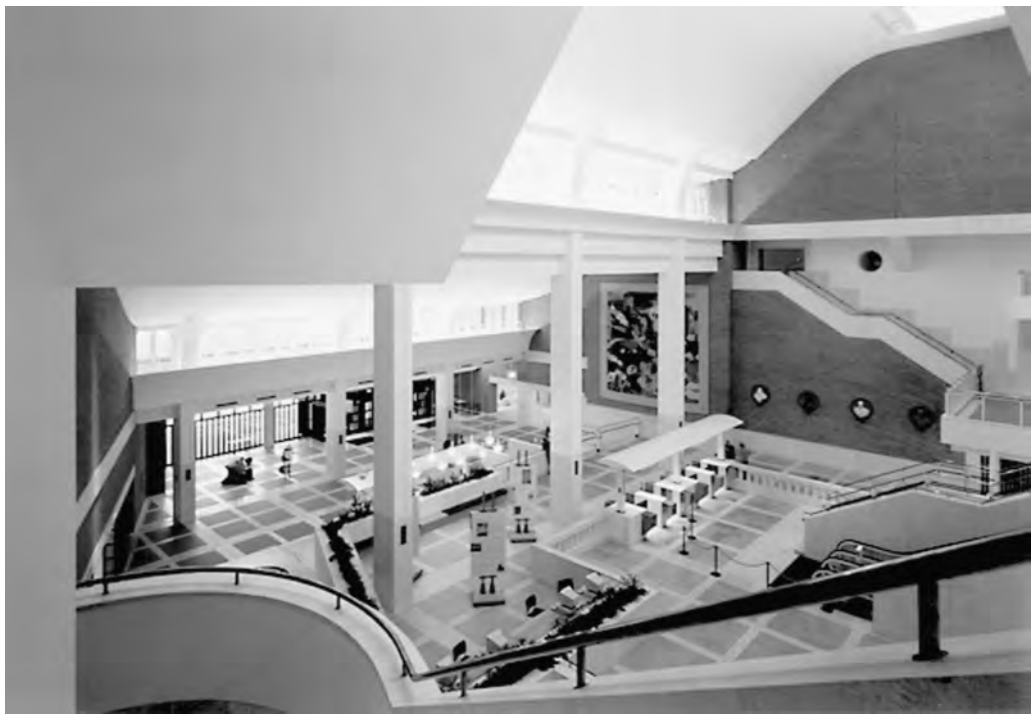

Fig. 5 The entrance hall of the Library's St. Pancras building. *(Go to www.dekker.com to view this figure in color.)*

Sound Archive's display, 50 Years of Number Ones, which tracked half a century of the pop music charts. Sound points gave visitors the chance to search the database of 900 hits and hear their favorites again. Other public spaces include the Piazza, with sculptures by Sir Eduardo Paolozzi and Antony Gormley, and the Conference Centre's auditorium and meeting rooms which give the Library flexible space to mount events, conferences, and activities for a wide range of audiences.

An imaginative program for schools is also offered in the new building, which has facilities to accommodate limited numbers of school groups. The school audience is particularly well served by the extensive learning areas of the Library's web site, which provide interpretation and structured explorations of themed materials from the collection in support of the United Kingdom's National Curriculum. Citizenship, for example, a recent addition to the curriculum, is supported by an innovative web space, 21st Century Citizen. Themed presentations of primary source materials provide a platform for structured learning and student investigations, backed by teachers' area with lesson plans and other classroom resources.

Digitization has enabled significant numbers of collection items to be made available for a range of audiences—scholarly, school-based, commercial, or the wider public—by varying the routes into the material and the levels of interpretation provided. The Library's digitization programs, developed through a mixed approach of public and private sector funding, include major collaborations such as the International Dunhuang Project (IDP). This project is bringing together on the Web a collection of thousands of Chinese manuscripts and early printed material that was dispersed a century ago from caves on the Silk Road trading route. The image bank, catalogue, and other resources promote in-depth study and establish a new paradigm for the fostering of knowledge in the digital environment by linking the collections and expertise of the British Library to those of the National Library of China, the Bibliothèque nationale de France, the Institute of Oriental Studies, St. Petersburg, the National Museum, New Delhi, and the Staatsbibliothek, Berlin.

The Library has developed digitization projects based around regional U.K. material such as maps, topographical drawings, dialect, and folk song to complement the holdings of local museums and archives and also plans to digitize complete runs of 19th century U.K. newspapers. Supported by search software that can locate exact words, dates, names, and places mentioned in articles, irrespective of font or type size, the project promises to be a significant resource for academic researchers, family and local historians, teachers, and school students.

The Library's catalogues are freely available on its web site. The British Library Public Catalogue gives seamless access to the reference and document supply collections of over 10 million items, and searches are currently running at over 8 million a year. Document supply customers can

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Fig. 6 The tower of the King's Library, St. Pancras. *(Go to www.dekker.com to view this figure in color.)*

order material directly from the catalogue and from the Library's Inside database, a subscription service which since 1993 has recorded article and paper details from the 20,000 most heavily used international research journals and all academic conferences. Other databases provided by the Library include the Sound Archive, Manuscripts and Newspaper catalogues, and the subscription-based British National Bibliography, the record of all new and forthcoming monograph and serial titles published or distributed in the United Kingdom since 1950.

The Library's publishing program has expanded steadily and 50 titles are now published each year. The focus is on two main areas: first, illustrated books and multimedia CD-ROMs that give access to primary source material in the historic collections, aimed at a general audience; second, scholarly reference books in bibliography and the history of books and manuscripts. The popular series of Writers' Lives, for example, has included Austen, Wordsworth, Byron, and Keats, while the recent Encyclopedia of Paper Making and Bookbinding offers step-by-step guidance to practitioners and beginners. For the scholar, a leading current title is the two-volume Maps in the Atlases of the British Library: A Descriptive Catalogue c. 850–1800.

STRUCTURE

Library policy is set by the British Library Board, currently comprising 12 members, under a part-time chairman. The chief executive and director of Finance and Corporate Resources are members of the board.

The Library is currently structured on the basis of six directorates: Scholarship and Collections, Operations and Services, Strategic Marketing and Communications, Electronic Strategy and Information Systems (eIS), Finance and Corporate Resources, and Human Resources. The directors, together with the chief executive, form the Exec Team of the Library, with responsibility for its day-to-day running.

Scholarship and Collections

Scholarship and Collections is responsible for nurturing in-depth expertise and understanding of the collections and for developing policy for and managing the areas of collection development, description, and conservation.

The collection grows by a mixture of purchase and donation and also by legal deposit. In the financial year 2001–2002, the collection grew by 2,389,571 items. The British Library is one of six libraries entitled to receive copies of all U.K. publications under legal deposit legislation. The others are the National Library of Scotland, the National Library of Wales, Bodleian Library, University of Oxford, Cambridge University Library, and Trinity College Library, Dublin.

The structure of Scholarship and Collections divides the collection for administrative purposes into British; Europe and the Americas; and Asia, Pacific, and African collections; and the functions appropriate to them: Collection Development, Collection Acquisition and Description, and Collection Care.

Operations and Services

The Operations and Services directorate is responsible for the services derived from the Library's collections; it also provides the focus for science provision. It is responsible for those services however they are delivered, whether in reading rooms or remotely through document supply.

The Library's recognition that licensing of access to content complements the acquisition of physical material in an increasingly electronic age is reflected in the recently created unit of Publisher Licensing. This sits within the directorate beside Sales, Operations (including Document

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Supply and the London Copy Service), Reader and Visitor Services, and Science, Technology, and Industry.

Strategic Marketing and Communications

The directorate is responsible for the public profile of the Library, in its widest sense, and comprises the press office, public relations, exhibitions, publishing, and events. Senior staff head the marketing and communications activity to each of the Library's key audiences—researchers, business users, the library and information network, education, and the general public. The directorate also leads the Library's collaborative and partnership activity with U.K. public and university libraries, including the funding of collaborative projects through the Cooperation and Partnership Programme. Alongside these sits the Development Office which will capitalize on the increased profile of the Library in the wider community to increase the financial support from private and public sources to supplement the grant-in-aid received from the government.

The directorate is also responsible for taking the lead with respect to broadening the Library's audience through the management and development of the web site and for furthering the digitization of collections in line with user needs.

Electronic Strategy and Information Systems

The Electronic Strategy and Information Systems directorate is charged with ensuring that the Library is equipped to deliver services in both traditional and electronic media. It provides a focus for awareness of the latest developments in communications technology and the expertise with respect to the systems the Library needs to run its business. It also leads the Library's representation in collaborations to develop international standards and practices in the digital arena.

Human Resources

The HR directorate is responsible not only for the delivery of efficient procedures for handling one of the most important resources available to the Library, its staff, but also for the culture change needed to work in a dynamic and fast-changing technological environment.

Finance and Corporate Resources

This directorate is responsible for not only the estates strategy of the Library (current annual expenditure in the region of £20 million), but also the financial control of an annual spend, comprising both grant-in-aid and earned income, in the region of £120 million per annum. The directorate also provides a core of project management expertise to the other directorates and is the central focus for the planning of the Library's future activity.

CONCLUSION

The British Library, in terms of its collections and the range of services that are derived from them, is the world's greatest research library. The digital information revolution has posed new challenges to the library profession, and offered new opportunities. The British Library is responding confidently to the new imperatives:

- to collect contemporary electronic information formats
- to use digitization to aid conservation and access
- to use electronic networks to deliver the knowledge it holds

In so doing, the Library will not compromise its core activities. Electronic formats will complement the printed and manuscript sources on which the Library's reputation is founded, just as Internet access by wider national and international audiences will extend and enhance the research that takes place in the reading rooms.

Thirty years ago the founders sought to create a national library to serve the world. The Library is now achieving this in ways that its founders may not have envisaged, but must certainly welcome.

FURTHER INFORMATION

The Library's web site, www.bl.uk, gives details of services and collections and provides access to a wide range of digital resources.

The British Library can be contacted at 96, Euston Road, London, NW1 2DB, United Kingdom.

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Canadian Association of Research Libraries

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INTRODUCTION

The Canadian Association of Research Libraries/Association des bibliothèques de recherche du Canada (CARL) is the national leadership organization for Canada's major research libraries. CARL comprises 27 university libraries, the Library and Archives Canada, and the Canada Institute for Scientific and Technical Information (CISTI). http://www.carl-abrc.ca/about/factsh-e.htm.

CARL members are the backbone of Canada's intellectual holdings in all disciplines, with an annual expenditure of over half a billion dollars, monograph holdings of over 75 million items, and nearly half a million journals subscriptions. The responsibility individually and collectively is to acquire, to provide access, and to preserve these holdings for the benefit of the research community.

Recent advances, especially in the fields of information and telecommunications technologies, are radically changing the patterns of international scholarly communication and scholarly publishing. Research libraries must take maximum advantage of these developments. This realization prompted the first set of CARL Strategic Directions (2000–2003). A new set of Strategic Directions (2004–2006) has been adopted (Strategic Directions 2004–2006; Building the National Information Network—Leadership, Scholarship, Stewardship).

MEMBERSHIP

CARL was established in 1976. Its membership is institutional and is primarily open to the libraries of Canadian universities with doctoral graduates in both the arts and the sciences.

The current members are shown in Fig. 1.

MISSION AND GOALS

CARL provides leadership to the Canadian academic and research library community by working to enhance scholarly communication. This is done in collaboration with the broader academic community, through long-term programs in three areas: Information Policy, Resource Sharing, and Scholarly Communication.

The goals of these programs are to:

Provide organized leadership for the Canadian research library community in the development of policies and programs that maintain and improve the cycle of scholarly communication.

Work toward the realization of a national research library resource-sharing network in the areas of collection development, preservation, and access.

Increase the capacity of individual member libraries to provide effective support and encouragement to postgraduate study and research at national, regional, and local levels (http://www.carl-abrc.ca/about/about-e. htm).

STRATEGIC DIRECTIONS

The Board of Directors determines the Strategic Directions of the Association in consultation with the membership. The first 3-year set of Strategic Directions was approved in 2000.

Strategic Directions 2004–2006; Building the National Information Network—Leadership, Scholarship, Stewardship.

http://www.carl-abrc.ca/about/2004-sd-e.pdf. The following excerpts describe the context of each.

Leadership

CARL represents the country's major libraries, with the most valuable collections and greatest human and financial resources. CARL will provide leadership and work with partners on issues of concern to the Canadian research library community. CARL is a national association representing the interests of Canada's research libraries to federal legislators and policy makers. If libraries are to have their issues on the national agenda, CARL must do this with our partners and allies.

Scholarship

Research libraries represent a major component of the current system of scholarly communication. The system is

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University of Alberta	Université de Montréal
University of British Columbia	University of New Brunswick
University of Calgary	University of Ottawa
Carleton University	Université du Québec à Montréal
Canada Institute for Scientific and Technical Information	Queen's University
	University of Regina
Concordia University	University of Saskatchewan
Dalhousie University	Université de Sherbrooke
University of Guelph	Simon Fraser University
Université Laval	University of Toronto
Library and Archives of Canada	University of Victoria
University of Manitoba	University of Waterloo
McGill University	University of Western Ontario
McMaster University	University of Windsor
Memorial University	York University

Fig. 1 Table of CARL members.

under stress and faces many pressures to change. Research libraries have a major role to play in ensuring that changes are in the best interests of our institutions and our clientele. We can act as a catalyst to promote positive changes, while resisting those that we consider to be against the interests of our stakeholders.

Information literacy is a key component of CARL's mandate. Library users are obtaining information from many sources, much of it outside traditional library channels. The academic library can play a significant educational role in helping members of the academic community retrieve, obtain, assess, and organize information relevant to their needs—vital skills in today's information society. CARL can help focus efforts on the national scene and coordinate local initiatives.

Fig. 2 Joyce Garnett, CARL President (2003–2005). (*View this art in color at www.dekker.com.*)

Stewardship

Research libraries are rapidly changing, thanks to the digital revolution. More and more material, formerly collected in print form, is being digitally obtained. It is increasingly obtainable at the time and place of the user's choosing. At the same time, high-speed networked access is increasingly pervasive throughout the Canadian society. Today's student and researcher can access unprecedented amounts of information from their home or office. The advent of ubiquitous wireless connectivity will herald almost universal access to information resources. These transitions raise many new issues, while assigning new importance to a number of older ones.

GOVERNANCE

The Bylaws, and the Association's Structures and Procedures, may be found in the Members' Handbook (http://www.carl-abrc.ca/about/handbook/handbook-e.PDF).

The Board of Directors consists of the President, Vice President/President-Elect and representatives from the four principal regions of Canada—the West, Ontario, Quebec, and the Atlantic Provinces.

The President of CARL (2003–2005) is Ms. Joyce C. Garnett (Fig. 2), University Librarian, The University of Western Ontario, London.

The Vice President/President-Elect is Mr. John Teskey (Fig. 3), Director of Libraries, University of New Brunswick. He will serve as President from 2005 to 2007.

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Fig. 3 John Teskey, President-Elect (2005–2007). (*View this art in color at www.dekker.com.*)

COMMITTEES

Issues and initiatives of importance are frequently identified and pursued through the Committee structure. General policy direction and financial guidelines are provided by the CARL Board.

Standing Committee on Copyright

Mandate:

Monitor copyright issues and developments.
Develop and articulate positions and policies with respect to copyright issues.
Initiate or recommend appropriate programs or activities to encourage current knowledge and awareness of copyright issues among the membership.
Initiate and maintain linkages with other organizations and individuals having common interest in copyright matters (http://www.carl-abrc.ca/projects/copyright/copyrightforum_e.pdf).
Regularly report to the Board of Directors and to the membership at general meetings.
Advise the Board of Directors annually on the probable financial and resource needs of the Committee.

CARL has developed a ''Statement of Principles for the Management of Copyright in the Digital Environment.'' The intent is to further the debate on copyright law reform in Canada and to build consensus within the library and higher education communities on the critical need for Canadian intellectual property law to recognize and reflect new issues that have arisen with the use of copyrighted works in the digital environment. To date, some 160 organizations have added their support to the Principles (http://www.carl-abrc.ca/projects/copyright/copyright_princ-e.htm).

CARL submits briefs on copyright issues and copyright legislation to the Canadian government. CARL also lobbies in support of its positions.

Standing Committee on Effectiveness Measures and Statistics

Mandate:

Review current efforts in the area of performance indicators, benchmarking, and effective resource allocation as they apply to research libraries.
Raise the awareness of CARL members of developments relating to these matters in research libraries.
Facilitate discussion of these matters among the CARL membership.
Draft documents, policies, and recommendations as appropriate.
Liaison with other national and international committees having similar mandates.

CARL conducts an annual Statistical Survey of Canadian University Libraries to collect information on expenditures, establishment and collection size, and salaries. There are further questionnaires on supplementary statistics, emerging services, data services, and document delivery.

Sample tables may be found on the CARL Interactive Statistics Database (http://137.122.27.38/data/data_home/carl_data.htm). The annual CARL Statistics-Statistiques de l'ABRC are available for purchase.

Government Policies and Legislation Committee

Mandate:

Anticipate and monitor activities of legislative, regulatory, and government agencies and related organizations in Canada, the United States, and abroad that impact Canadian research libraries.
Anticipate, analyze, respond to, and influence information, funding, intellectual property, and telecommunications issues and policies that affect Canadian research libraries.
Promote funding for Canadian agencies and national institutions that advance CARL positions reflecting member interests on these issues and policies.

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Initiate and maintain linkages and partnerships with other Canadian organizations and individuals having a common interest in matters within the scope of the Committee's mandate.

Recent activities have included submissions to the government of Canada on the national Innovation Strategy (http://www.carl-abrc.ca/projects/innovstrat/index.htm), the future of the federal Depository Services Program (http://dsp-psd.communication.gc.ca/) and reimbursement for the Indirect Costs of Research (http://www.carl-abrc.ca/projects/indirectcosts/index-e.htm).

CARL provides an annual Brief to the House of Commons Standing Committee on Finance (http://www.carl-abrc.ca/projects/finance/brief_2003-e.htm) as part of its prebudget hearings.

In many cases, the association has been invited to appear as a witness at parliamentary and other hearings.

The committee is financially supported through the ARL joint federal relations initiative.

Committee on Scholarly Communication

Mandate:

Monitor scholarly communication issues and developments.
Identify, research, and promulgate positions and policies with respect to scholarly communication issues.
Initiate or recommend appropriate programs or activities to encourage current knowledge and awareness of scholarly communication among the membership.
Initiate and maintain linkages with other organizations and individuals having common interest in scholarly communication issues.
Regularly report to the Board and to the membership.

In November 2002, CARL hosted *Research Innovation and Scholarship: The Role of Open Access Publishing* (http://www.carl-abrc.ca/meetings/other/recap-e.htm). This international conference served as a springboard for a number of current initiatives including those described below.

OTHER PROJECTS

Institutional Repositories Project

Institutional repositories (IRs) centralize, preserve, and make accessible the knowledge generated by academic institutions. They also form part of a larger global system of repositories, which are indexed in a standardized way, and searchable using one interface. This could provide the foundation for a new model of scholarly publishing. CARL members are starting to implement institutional repositories as a coordinated strategy to aggregate the digital research output of their academic institutions. The pilot project facilitates discussions of lessons learned, and explores best practices (http://www.carl-abrc.ca/projects/ir/index.htm).

Optimizing the Transition of Knowledge Dissemination: Toward a Canadian Research Strategy

The creation, dissemination, and application of new knowledge is fundamental to the advancement of research, the development of an informed citizenry, and a healthy national economy.

A 3-year study jointly funded through an award from the Social Sciences and Humanities Research Council (SSHRC) and by CARL to consider the issues involved began in Fall 2002. Through innovative methodology, it will examine how scholarly knowledge can best be disseminated as communication models change. The findings may well uncover a wide-ranging research agenda to explore the future of scholarly communication in Canada. The Principal Investigator of the project is Dr. William Birdsall. It is expected that the group will release its results in January 2005 (http://www.kdstudy.ca).

Canadian National Site Licensing Project

CARL is proud to have spearheaded the national effort by the academic library community to transform research patterns through digital licensing with major publishers. This was advanced through a $20-million award from the Canada Foundation for Innovation, announced in 2000. With matching funds provided by the participating universities, this amounted to $50 million. CARL's members have been closely associated with the CNSLP's subsequent successes, which include to provide to the information needs of some 650,000 researchers across 64 institutions, as well as the move to incorporation (http://www.cnslp.ca).

STAFF

Staffing consists of two full-time staff members: the Executive Director and the Executive Assistant. CARL also employs freelance Research Associates.

OFFICIAL STATUS

CARL is a federally incorporated nonprofit corporation (since 1981) and a registered charity (since 1984). It is an affiliate member of the Association of Universities and

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	Total Materials Expenditure (Includes Binding)	Total Staffing Expenditure (Includes Fringe Benefits)	Operating Expenditure	Totals	Percentage		
					Material	Salaries	Operating
Question	**4.7 + 4.8**	**5.4 + 5.5**	**5.6**	**4.7+4.8+5.4+5.5**			
British Columbia	13 932 914	18 858 286	4 760 681	37 551 881	37.10	50.22	12.68
Simon Fraser	6 737 467	6 505 918	1 224 876	14 468 261	46.57	44.97	8.47
Victoria	4 789 344	6 803 565	1 019 298	12 612 207	37.97	53.94	8.08
Provincial average	**$8 486 575**	**$10 722 590**	**$2 334 952**	**$21 544 116**	**39.39%**	**49.77%**	**10.84%**
Alberta	13 448 977	15 485 892	2 029 335	30 964 204	43.43	50.01	6.55
Calgary	7 947 329	10 856 108	1 378 746	20 182 183	39.38	53.79	6.83
Manitoba	6 430 488	9 630 096	1 335 506	17 396 090	36.97	55.36	7.68
Regina [i]	3 031 407	2 914 486	804 695	6 750 588	44.91	43.17	11.92
Saskatchewan	5 910 939	6 968 462	1 082 662	13 962 063	42.34	49.91	7.75
Regional average	**$7 353 828**	**$9 171 009**	**$1 326 189**	**$17 851 026**	**41.20%**	**51.38%**	**7.43%**
Carleton	3 616 017	6 951 406	1 166 172	11 733 595	30.82	59.24	9.94
Guelph	4 107 365	6 283 968	815 213	11 206 546	36.65	56.07	7.27
McMaster	7 339 845	7 130 431	894 522	15 364 798	47.77	46.41	5.82
Ottawa	5 931 904	8 262 764	1 654 731	15 849 399	37.43	52.13	10.44
Queen's	7 784 547	8 059 702	1 407 495	17 251 744	45.12	46.72	8.16
Toronto	24 569 788	37 216 383	7 902 673	69 688 844	35.26	53.40	11.34
Waterloo	6 106 531	7 405 063	1 174 814	14 686 408	41.58	50.42	8.00
Western Ontario	9 407 945	8 818 866	489 716	18 716 527	50.27	47.12	2.62
Windsor	3 944 173	4 650 419	499 088	9 093 680	43.37	51.14	5.49
York	8 011 257	10 972 215	1 448 288	20 431 760	39.21	53.70	7.09
Provincial average	**$8 081 937**	**$10 575 122**	**$1 745 271**	**$20 402 330**	**39.61%**	**51.83%**	**8.55%**
Concordia	4 047 975	6 690 064	990 720	11 728 759	34.51	57.04	8.45
Laval	8 996 711	11 522 105	570 527	21 089 343	42.66	54.63	2.71
McGill	12 708 585	12 521 738	2 691 565	27 921 888	45.51	44.85	9.64
Montréal	8 313 476	12 692 117	1 065 315	22 070 908	37.67	57.51	4.83
Québec	3 129 679	7 867 734	269 621	11 267 034	27.78	69.83	2.39
Sherbrooke	3 801 540	4 030 274	274 911	8 106 725	46.89	49.72	3.39
Provincial average	**$6 832 994**	**$9 220 672**	**$977 110**	**$17 030 776**	**40.12%**	**54.14%**	**5.74%**
Dalhousie	4 653 175	5 203 554	870 073	10 726 802	43.38	48.51	8.11
Memorial	5 646 896	7 408 294	1 000 172	14 055 362	40.18	52.71	7.12
New Brunswick	2 067 494	3 771 555	434 699	6 273 748	32.95	60.12	6.93
Regional average	**$4 122 522**	**$5 461 134**	**$768 315**	**$10 351 971**	**39.82%**	**52.75%**	**7.42%**
CISTI	12 620 251	15 452 912	14 361 837	42 435 000	29.74	36.42	33.84
National Library	2 146 361	28 981 067	14 180 126	45 307 554	4.74	63.97	31.30
National average	**$7 282 082**	**$10 341 912**	**$2 337 865**	**$19 961 859**	**36.48%**	**51.81%**	**11.71%**
National total	**$211 180 380**	**$299 915 444**	**$67 798 077**	**$578 893 901**			

U/A = Unavailable N/A = Not applicable N/P = Nonpertinent N/R = Did not reply

[i] Fringe benefits not included.

Fig. 4 Table VI—Summary of library expenditures.

Colleges of Canada (AUCC) and is incorporated as a nonprofit organization under the Canada Corporations Act. The Executive Director is a registered lobbyist under the Lobbyists Registration Act. CARL regularly lobbies the Canadian Government on behalf of its members on issues such as copyright and intellectual property legislation, financial support for libraries, government information policy, and international trade issues, among other things.

REPRESENTATION ON EXTERNAL COMMITTEES

The association is represented on the following:

The Canadian Committee on Cataloguing
Canadian Consortium for Research
Depository Services Program Library Advisory Committee

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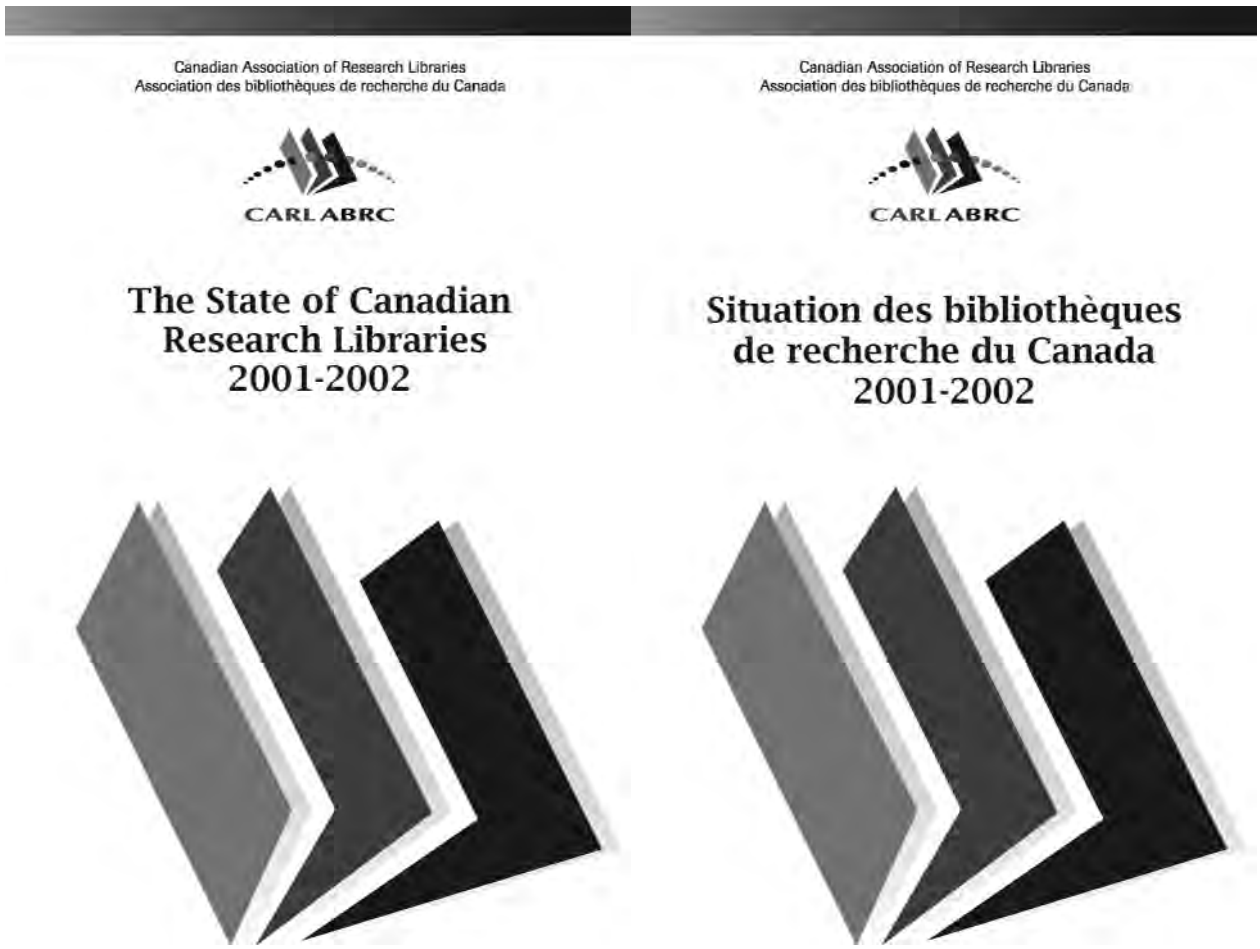

Fig. 5 (1) The State of Canadian Research Libraries 2001–2002. (2) Situation des bibliothèques de recherché du Canada 2001–2002. (*View this art in color at www.dekker.com.*)

National Core Library Statistics Committee
National Library of Canada Theses Advisory Committee

PUBLICATIONS

Annual Publications

CARL Statistics/Statistiques de l'ABRC (http://www.carl-abrc.ca/projects/stats/statistics-e.htm). The CARL Statistics/Statistiques de l'ABRC is a comprehensive report of tables and figures collected from CARL member institutions (Fig. 4). The publication also includes a commentary on trends and items of note within the document. Ordering information is available on the website (http://www.carl-abrc.ca).

The State of Canadian Research Libraries (Fig. 5): This publication examines some of the major activities of Canadian research libraries in terms of their contribution to the Canadian research community and the broader knowledge-based society (http://www.carl-abrc.ca/projects/state/index-e.htm).

Occasional Publications

Backgrounder series (http://www.carl-abrc.ca/projects/index.htm):

These publications provide information on new trends in services, technologies, and the management of research libraries.

Current titles (2003):

The Preservation of Digital Resources: Primary focus on national strategies, emerging standards, and best practices.

Statistics and Performance Measures for Research Libraries—Recent Research and New Developments.

The Open Archives Initiative—Developing an Interoperability Framework for Scholarly Publishing.

Create Change describes the state of scholarly communication in Canada and its economics. It also offers suggestions on how the system may be changed for the better. A second edition is due to be released in February 2004 (http://www.carl-abrc.ca/projects/createchange/create_change.htm).

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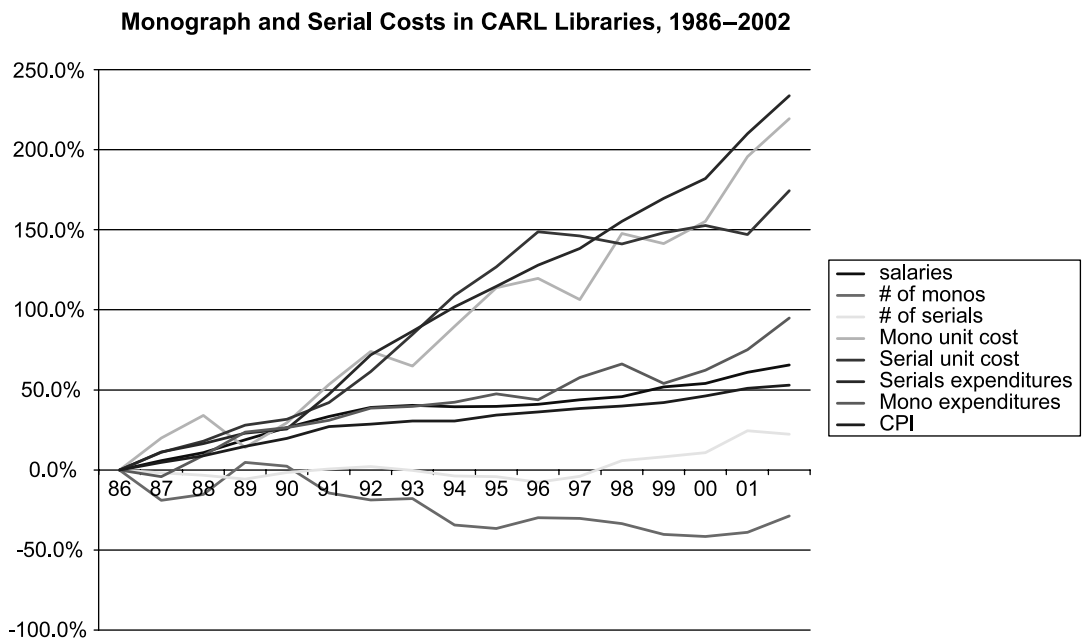

Fig. 6 Monograph and serial costs in CARL Libraries, 1986–2002. (*View this art in color at www.dekker.com.*)

The rising costs of serials in Canadian research libraries are shown in Fig. 6.

AWARDS

CARL Award for Distinguished Service to Research Librarianship

Presented annually to an individual at a CARL member institution who has made a substantial local, national, and/or international contribution to research librarianship. The person may have planned and implemented an exemplary library program, actively promoted research libraries and/or librarianship, or otherwise served the profession with marked distinction. Micromedia ProQuest is the generous sponsor of this award.

Winners

1998	Graham R. Hill
2000	Charles Humphrey
2001	Bernard Dumouchel
2002	Michel Fournier
2003	Alan MacDonald

CARL Award of Merit

Presented from time to time as appropriate to a Canadian individual as recognition for an outstanding contribution to research librarianship, where not otherwise recognized; No monetary award accompanies it. The award is made by resolution of the CARL Board.

Winners

2002	Deb deBruijn

INTERNATIONAL LINKS

Scholarly communication is international in its nature and scope. CARL works with peer organizations, especially in the United States, the United Kingdom, and Australia to share information and to develop positions, policies, and practices. These ties are augmented through personal contacts between members.

FURTHER READING

1. http://www.carl-abrc.ca/index.htm.

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CENDI

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INTRODUCTION

CENDI is an interagency group composed of the Scientific and Technical Information (STI) managers from 11 federal agencies that are engaged in scientific and technical research and development (R&D). For over 20 years, CENDI has been working formally and informally to improve the scientific and technical information systems in the federal government. Over these years, its accomplishments range from impacting federal information policy to educating a broad spectrum of stakeholders on all aspects of federal STI systems, including its value to research and the taxpayer to operational improvements in agency and interagency STI operations. Today, CENDI is viewed by senior officials, as well as the information industry, as a lead organization for federal STI management. This article discusses the history, organization, and operations of CENDI and gives examples of the tools, policies, and technologies it has improved along the way. The name CENDI originally derived from the initial four members: *C*ommerce, *E*nergy, *N*ASA, and *D*efense *I*nformation Programs. As of 2004, the agencies represent over 93% of the federal research and development (R&D) budget and support the management, dissemination, and preservation of the R&D output required through both the Executive and Legislative branches of the government.

CENDI executives have the responsibility of managing the intellectual capital resulting from federal R&D investment. They help to provide access to the worldwide scientific and technical knowledge base in their mission areas and they develop information infrastructures to support users in cost-effective access to this information. These STI managers have common interests and program interrelationships in their operations, technology developments, management, and policies. Historically, these agency managers have had close working relationships to share resources, avoid duplication of effort, and improve the effectiveness of each agency's mission.

OVERVIEW

Research and development increasingly crosses institutional, agency, national, and international boundaries. Indeed, considerable technical research in the federal government is funded through interagency programs or with more than one agency having part of the overall program responsibility. Because information is both the input and output of this scientific process, programs such as CENDI, which increase resource sharing and avoid unnecessary duplication of effort, are increasingly important. Equally desirable is a coordinated effort to ensure that federal policy and standards are developed with the best information available and that they are consistently and efficiently implemented. In today's increasingly networked environment, it is ever more critical for organizations with connected content to be interoperable to create the next-generation STI systems for the nation.

An important by-product of CENDI cooperative activities is the educational process from which all participating staff members benefit. By sharing information and working together, staff gain training on new ways of doing things. By studying other systems, they learn more about how their jobs and systems impact and are impacted by processes and procedures of other groups and by changes in the external environment.

External Recognition

Although the importance of interagency cooperation is well recognized in general, it has recently been elevated to higher visibility as a result of the enabling impacts of advancing information technologies in the STI area. The fact that CENDI is a forum for 11 federal agencies to discuss issues within a common context has proven very valuable to federal policymakers, information technologists, the library community, and the information industry, among others. For example, the staff who were drafting the E-Government Act of 2002 and the Office of Management and Budget (OMB) offices who are implementing its provisions have had a series of interactions with CENDI to gain technical insights and expertise for their work. Studies have highlighted the need for better interagency cooperation and, since CENDI's beginnings, studies have pointed to CENDI as an ongoing effort worthy of recognition. Examples of studies are: *Federal Scientific and Technical Information: Opportunities and Challenges of Electronic Dissemination* (Office of

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Technology Assessment, July 1989) and *Foreign Technologies: Federal Agencies Efforts to Track Developments* (Government Accounting Office, June 1989). Over the last half-century, a number of other major information studies and projects have focused on federal information management, and CENDI has enriched those efforts. In the 1990s, CENDI worked with Congress on adding content to the development of the National Research and Education Network (NREN, the precursor to the Internet). This effort substantially contributed to the development of digital libraries. In issuing and reviewing the impact of information policy on STI, CENDI worked with the OMB to assess the impact of Circular A-130 on the management of STI. Since the turn of the century, CENDI has been actively working with the International Council for Scientific and Technical Information (ICSTI) to address the issue of digital archiving of scientific and technical information in an increasingly electronic environment. In 1999, CENDI cosponsored the report ''Digital Electronic Archiving: The State of the Art and the State of the Practice,''[1] which summarized the state of the practice in digital archiving. A new version of the report was issued in 2004[2] and shows both the progress that has been made and the major issues and work that is yet to be done. CENDI was recently cited as a key contributor to the deliberations of the National Commission on Libraries and Information Science (NCLIS) in its assessment for Congress on the proposed closing of the National Technical Information Service (NTIS).[3] During these deliberations, CENDI prepared a paper on the impacts of this proposal for the White House. Other areas addressed by CENDI as well as its accomplishments are found in publications and operational activities cited later in this article.

With rapidly changing technologies, tight budgets, limited personnel resources, and increasing cross-cutting programs in research and development, the need to leverage resources and avoid duplication has proven to be a necessity. Interagency cooperation and resource sharing have been instrumental in inducing STI managers to extend their ability to maintain quality operations, develop new technologies, and better serve their user communities.

HISTORICAL HIGHLIGHTS

The roots of CENDI go back to the days of the Committee on Scientific and Technical Information (COSATI), Federal Council on Science and Technology, which was established in the early 1960s to bring order out of chaos in the handling of technical report literature and the new volume of scientific output resulting from World War II.[2] The STI managers of the major R&D agencies (predecessors of present CENDI participants from NASA, DOE, DTIC, and NTIS) worked with COSATI to establish standard guidelines for the cataloging and indexing of technical reports. The purpose was to capture all elements unique to this type of literature, print announcement tools through use of automation, and share records with each other quickly and in the most economical way. In the late 1960s, COSATI was transferred from the White House Science Office to the National Science Foundation. As funding was gradually withdrawn, COSATI was allowed to expire.

Need for Updating

The agencies that had worked with COSATI to develop the standards continued to use them. However, as new rules were required and others needed amending, the agencies began to make decisions individually or with some of the other agencies. Thus differences in standards began to emerge. At the same time, these agencies continued to exchange records on magnetic tape.

The need to contain costs of database preparation, the need for timely announcement of scientific and technical reports, and the difficulty of merging even slightly differing records made it increasingly apparent that cooperative action was needed to try to eliminate differences in cataloging procedures. Both technology and content standards such as subject translation among thesauri were significant challenges.

During the 1970s and early 1980s, the managers of agency STI programs from NASA, DOE, DOD, and NTIS began to periodically meet together to discuss topics of mutual interest and stimulate more effective cooperation. The meetings proved fruitful, but it was recognized that a more systematic approach was needed to achieve some of their mutual objectives. Mutual objectives included not only improving interrelationships in their operations, but also addressing agency and national policy issues that had an impact on the R&D and STI communities. Meetings began to be held more regularly in the early 1980s. The senior managers were joined in regular discussions by their key planners because much of the CENDI focus was on planning issues.

CENDI Formed

In 1986, a formal *Memorandum of Understanding* (MOU) was signed by each of the original four participating agencies: Commerce (National Technical Information Service), Energy (Office of Scientific and Technical Information), NASA (HQ/STI Division), and Defense (Defense Technical Information Center) Information Managers. In an Addendum to the MOU dated February 1987, the National Library of Medicine joined as a participant. In 1993, the National Air Intelligence Center

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(NAIC) joined CENDI, representing the intelligence community within the Department of Defense. In 1995, the National Biological Service (reorganized into the Biological Resources Discipline, U.S. Geological Survey/ Department of Interior in 1998) joined, and, in 1998, the National Library of Education and the National Agricultural Library became CENDI members. Early 1999 brought the addition of the Environmental Protection Agency, bringing the membership in 2000 to a perfect total of 10 organizations in nine federal agencies. As a result of the changes in priorities, NAIC had to withdraw its membership in 2001. In 2003, the Government Printing Office became the first Legislative Branch agency to join CENDI. The long-standing focus on the Executive Branch was broadened by policy in recognition of the electronic interoperability and the changing information roles that this has brought with it. Similarly, as a result of this increasingly cradle-to-grave electronic world and the special focus CENDI has had on long-term access to digital information, the National Records and Archives Administration (NARA) also joined in 2003. It was as a result of the increasing number and alphabet of new members as well as an understanding that ''CENDI'' had achieved sufficient recognition that, in 2003, the CENDI name was changed to remain just its acronym, irrespective of member agencies. The development of CENDI is shown in Fig. 1.

History of the CENDI Secretariat and Chairmanship

From 1982 until 1987, the responsibilities for leading and maintaining CENDI rotated among the agencies for periodic, but increasingly more regular meetings. A principal representative from each agency (generally the STI program head) chaired the meeting and was assisted by a ''planner'' or ''alternate'' in dealing with the meeting agenda, logistics, and documentation. As areas of cooperation increased, the need to provide better continuity in operations was recognized. In 1987, CENDI established the position of Executive Director. It was initially set up as a full-time federal position, but, because of a changing skill mix requirement, the secretariat functions were put under contract in 1988. At the same time, the CENDI chair became an elected position with a defined tenure.

Establishment of Operational Working Groups

As areas of mutual interest and potential cooperation emerged, CENDI appointed working groups (WGs) to carry out activities. Each WG had representatives from each agency. Some became standing committees. Others were set up as special task teams. The first WG was organized in 1983 to address Cataloging Standards. It continues until today as part of the Content and Management Access WG. Through the years, CENDI has managed the WGs to reflect changing needs in technical requirements and in working styles, with emphasis in recent years on project-oriented task teams.

CENDI OPERATIONS

CENDI's Vision and Mission

The CENDI vision is to provide an infrastructure so that ''Federal STI agencies will have a cooperative enterprise where capabilities are shared and challenges are faced together so that the sum of accomplishments is greater than each individual agency can achieve on its own.''

CENDI's mission is to ''help improve the productivity of federal science- and technology-based programs through effective scientific, technical, and related information support systems. In fulfilling its mission, CENDI agencies play an important role in addressing science- and technology-based national priorities and strengthening U.S. competitiveness.''

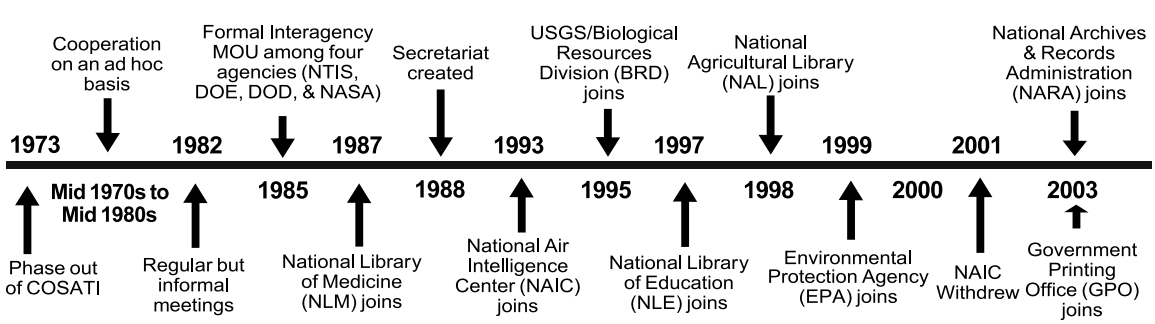

Fig. 1 CENDI timeline. (*View this art in color at www.dekker.com.*)

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Goals and Objectives

Each year, CENDI holds an annual planning meeting to review its activities and plan the activities for future years. Each planning meeting has a theme that reflects the context for the planning. Figure 2 shows the themes for the last decade of the twentieth century.

Goals, Objectives, and Specific Activities

CENDI goals have remained stable over the years. They are stated today as:

1. Coordination and Leadership: provide coordination and leadership for information exchange on important STI policy issues.
2. STI Life Cycle Management: promote the development of improved STI systems through the productive interrelationship of content and technology.
3. Education: promote an understanding of STI and STI management and its value to the R&D enterprise.

Under each goal, CENDI identifies objectives that attempt to be concrete, measurable, and accomplishable within 12–24 months. Under objectives, a list of activities is developed from which the yearly program plan is determined. The Program Plan is a living document that gives direction to CENDI activities. There is always the flexibility to respond to changes in the environment. CENDI Goals, Objectives, and Activities for each year can be found on the CENDI website (www.dtic.mil/cendi).

Cost of Participation

The cost to each agency of its participation in CENDI is directly proportional to the level of agreed-upon activity. The principals and their alternates meet on a regular basis (six times per year) and then, as needed, on a task-specific basis. This requires a time-and-travel commitment. Working groups and special project teams composed of agency staff meet on an ''as required'' basis and contribute time to exchanging information and conducting projects. In addition, CENDI members fund the CENDI secretariat and other contractor assistance as needed. The level of secretariat funding is established at the annual management planning session.

CENDI Organization

Figure 3 illustrates the CENDI operating units and organization structure for Fiscal Year 2004.

Principals and Alternates

The Principals Group, composed of one person from each member agency, guides and directs the activities of CENDI. The principals are generally the senior program executives who have the ability to commit agency resources and set program direction. They bring their ideas and issues to the CENDI agenda and provide oversight of the operation of the secretariat. As membership has increased, the role of the CENDI chair has taken increasing responsibility to act on behalf of the members in this regard.

The CENDI chair is elected at each April meeting for a one-year term. The timing is such that the chair presides at the June meeting and helps to set the agenda for the annual planning meeting (usually in August), where planning for the next official year commences.

In addition to the principal, an alternate from each agency supports the overall direction of CENDI. The alternates attend the regular meetings, assist in coordinating

1990	The Value of Cooperation: Positioning for the 1990's
1991	Building Strategic Alliances
1992	Critical Connections: Cooperation to Enhance Information Value and Use
1993	Navigating in a Networked World
1994	Building a Digital Information Network
1995	Changing Missions – Changing Technologies
1996	Opportunity in Change
1997	Changing STI Management in a Networked Environment
1998	Enterprise Networking and STI Futures
1999	The Virtual STI Enterprise: Completing the Connections
2020	Visions – 2000 Realities
2001	Designing an STI Architecture: Where Content and Technology Meet
2002	Striking Balances: STI Requirements and Response
2003	New Strategies and Operating Models for Government STI Managers: E-Government and E-Science

Fig. 2 CENDI planning themes.

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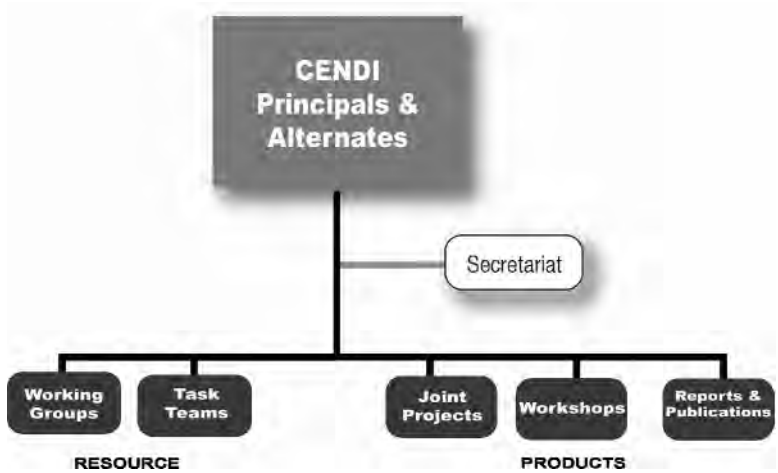

Fig. 3 CENDI organization structure for 2004. (*View this art in color at www.dekker.com.*)

their agency participation, and occasionally perform specific assignments.

Secretariat

The secretariat provides the day-to-day operations as well as planning support to CENDI. This support includes technical expertise, interaction with the technical community, and knowledge of the operational requirements, such as documentation of deliberations and decisions of the group and its subgroups. The secretariat prepares the agendas, logistics, and documentation of the principals' meetings; assists in developing white papers; maintains CENDI central files and outreach tools; and undertakes other special projects, as required. The secretariat similarly supports the activities of the WGs.

The secretariat is expected to take a proactive role in developing opportunities for interagency cooperation and for undertaking initiatives that can advance the goals of CENDI. This is carried out through technical and professional liaison activities as well as special projects and programs.

Working Groups and Project/Task Teams

CENDI working groups are established to undertake cooperative projects and programs where representation from multiple CENDI agencies is desired. Most of CENDI operational cooperation is handled through WGs. The WGs are chartered by CENDI principals and are based on the requirements of the undertaking. Groups may have a continuing nature or may be set up with a defined task and completion date (called Task Teams). In general, projects with specific objectives and finite life spans are preferred. A changing emphasis to this and away from standing committees has become the modus operandi since 1993. Participation in a WG is voluntary on the part of agencies, so not all WGs have participation from all agencies. Non-CENDI agencies and outside organizations may be invited to participate in specific working groups if it helps to promote the WG objectives. The WG and Task Teams in 2004 are:

1. Content Management and Access Working Group
2. Persistent Identification Task Group
3. Metrics and Evaluation Task Group
4. Distribution Markings Task Group
5. Digital Preservation Task Group
6. Information Technology (IT) Security and Privacy Working Group
7. Copyright Working Group
8. STI Policy Working Group

The chair of a working group, who is appointed by the principals, has overall responsibility for the group's activities and results. The secretariat provides support at the request of the WG chair.

In addition to working groups, which generally organize workshops and conferences, do studies and analyses, write publications, and provide advice, CENDI takes on interagency operating projects.

In 2001, in response to the April 2001 workshop on ''Strengthening the Public Information Infrastructure for Science'' and taking into consideration a request from Firstgov to develop specialized topical portals, CENDI formed an alliance to develop an interagency website for access to STI. This website, called Science.gov (www.science.gov), is a one-stop source of STI including both selected, authoritative government websites as well

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as deep web databases of technical reports, journal articles, conference proceedings, and other published materials. The science-attentive citizen whether a practicing scientist, policymaker, journalist, educator, or business person can search for scientific information without regard to the federal agency structure that might generate it. Through the volunteer efforts of members and involving over 100 staff, content and architecture is developed for the site. The Science.gov website is hosted by the Department of Energy (DOE) Office of Scientific and Technical Information (OSTI), which also supplies the site's ''deep Web cross-database search'' capability. The database used by the browse tree with the ability to ''explore by subject'' selected federal scientific and technical websites is maintained by the National Technical Information Service (NTIS). The web page search function is provided by the U.S. Geological Survey (USGS). CENDI, through its secretariat, provides the administrative support and coordination for Science.gov. The site was formally launched in December 2002 and demonstrated for the technical community at the American Association for the Advancement of Science (AAAS) meeting in February 2003. Science.gov has received excellent reviews from the press. Today, it is recognized by Firstgov as the government portal for science. Dr. John H. Marburger, The President's Science Advisor, said of Science.gov, ''The site is a great example of e-government in action.''

Cooperating Organizations and Guests

Guests may be invited to attend CENDI meetings to make presentations and/or take part in discussion. In addition, the secretariat keeps a list of cooperating organizations, which are kept informed of CENDI activities and extended a general invitation to attend CENDI open meetings. Cooperating organizations include nonmember federal agencies, interorganizational groups, such as library or trade associations, and other groups with mutually reinforcing activities. In these cases, a quid pro quo is established to keep each other informed of activities. Examples of groups with which CENDI maintains regular liaison include the National Research Council's US National Committee to CODATA (Committee on Data), the Federal Library and Information Center Committee (FLICC), the Coalition for Networked Information (CNI), the International Council for Scientific and Technical Information (ICSTI), the National Federation for Abstracting and Information Services (NFAIS), and the Association for Research Libraries (ARL).

Membership

New members from other federal R&D information organizations may be admitted by unanimous agreement of the members. However, it is the intent of the group that membership in CENDI should remain small and focus on organizations with STI or supporting responsibilities.

Outreach

Consistent with CENDI goals of providing leadership and educational opportunities for the federal STI community, CENDI has an active outreach program. The program includes invitations to participate in meetings, open conferences and workshops, and an active public website. As part of the CENDI website, the STI Manager has been developed to provide an evaluated, linked index to sites and issues of interest to the STI management community. Finally, the secretariat responds to public requests for information about CENDI or for CENDI material. Today, CENDI reports and other information are made available on the website.

Through the combined efforts of cooperating organization initiatives and outreach, CENDI works with a wide variety of organizations each year from many sectors of the economy and with many technical orientations. Figure 4 provides a sample of the categories and numbers of organizations with which CENDI has cooperated in a typical year.

Products and Services

During the course of a year, CENDI produces many special products, including workshops and conferences, presentations, testimony, white papers, review of comments to laws, regulations, and proposed policies, briefing books, surveys, working group reports, and guidelines, among others. CENDI products are primarily produced through one of three ways:

1. *Principal or alternate*. A product such as a presentation, testimony, or a paper is requested and a CENDI member receives input from the group and creates the product. Often, the chair has responsibility. Secretariat assistance is provided as requested.
2. *Working groups*. Special products come from the working groups. Authority for their development is generally given by direction from the principals or by recommendation from the group in an action plan with concurrence of the principals. Secretariat assistance is provided as requested.
3. *Secretariat*. Policy guidance is given to the secretariat, which then develops the background research, technical analysis, and data collection, including input from CENDI members and their appropriate staff, on selected issues.

Documents created by CENDI working groups, special project task teams, or joint projects may be formally

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Sample types of organizations with which CENDI interacts in a given year

- ► 1 Legal and policy agencies
- ► 29 Executive mission agencies
- ► 5 Interagency
- ► 3 Other government entities
- ► 3 Legislative branch agencies
- ► 9 Academic organizations
- ► 12 Other, Not for Profit organizations
- ► 18 Private sector entities
- ► 4 International organizations

Total: 84 different organizations from all sectors of the information industry

Fig. 4 Cooperating organizations from FY00.

published in paper, on the Web, or in other appropriate media. The request to formally publish a report may be made, based on the value of the information to others outside the CENDI agencies, by the working group, task team, or by the CENDI members. If the output is to be formally published, a CENDI report number is assigned. Publicly available CENDI reports are mounted on the CENDI website and are provided to NTIS for inclusion in its database for public distribution. Report copies are also provided to the CENDI agencies, where it is determined

DOCUMENT NUMBER	DOCUMENT TITLE
2001-3	License Agreements for Electronic Products and Services: Frequently Asked Questions
2001-2	Evaluating our Web Presence: Challenges, Metrics, Results
2000-3	Frequently Asked Questions About Copyright and Intellectual Property
2000-2	Web Metrics and Evaluation: Current Site of Implementation Among the CENDI Agencies, Phase 1
2000-1	CENDI Guidelines for Privacy of Customer Information
1999-1	Digital Electronic Archiving Report (co-sponsored with ICSTI)
1998-4	CENDI Digital Library Initiatives: Toward a Digital Future
1998-3	CENDI Metadata Initiatives: Beyond the Bibliographic Record
1997-3	CENDI Cost Study: The Changing R&D Information Economy in the Digital Age
1997-2	Impact of the Internet on Customer Service and Product Development Among the CENDI Agencies
1997-1	The Imaging of Legacy Collections Among the CENDI Agencies
DOE/OSTI--11686	Scientific and Technical Information Policy Implementation Under OMB Circular A-130
N/A	Public Access to Government Electronic Information: A Policy Framework
N/A	CENDI Retrieval Tools Report (December 1994)
N/A	Symbol Verbalization Survey (February 1993)
N/A	Briefing Book on Federal Scientific and Technical Information (March 1993)
CENDI-2	A Guide to Distribution Statements and Markings Used by DoD, DOE, and NASA (October 1997) *Currently under revision with expected publication date of 2004*

Fig. 5 CENDI publications.

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- XML in STI Management
- Persistent Identification Using HANDLES®
- Open Archival Information System Reference Model
- PKI and Digital Signatures
- Web Metrics and Results
- Systems Architecture and Modernization
- Helpdesk Management and Systems
- Machine Translation
- Impact of the Internet on Customer Service and on Product Development
- Future of Bibliographic Standards in a Networked Information Environment
- Metadata 101: Beyond Traditional Cataloging
- Reference/Citation Linking: The Federal Perspective
- Controlled Vocabulary and the Internet
- CENDI Enterprise Network Development (Task Group Roundtable)
- GovTechNet '99 -- Integrated Knowledge Management Products in Defense, Intelligence, and Open Source Science and Technology
- GovTechNet '99 -- National Libraries and Information Infrastructures: Developments in Managing Federal Scientific and Technical Information
- Federated Repositories/Digital Object Identifiers

Fig. 6 Examples of CENDI workshops and conferences.

whether the document is appropriate for inclusion in their databases. Sample recent CENDI publications are listed in Fig. 5.

CENDI workshops and conferences are of two types: 1) members only, which focus in depth on agency issues and recommendations for joint action, and 2) open sessions where the broader STI community is invited to attend. Some of the workshops are cosponsored by cooperating organizations such as the Federal Library and Information Center Committee. Some examples of the topics of CENDI workshops are given in Fig. 6.

STI Information Management Issues

As reflected in CENDI's task groups, conference topics, and publications, CENDI members stay involved in major information management issues. Some of the policy accomplishments were noted previously. In recent years, management issues of CENDI interest have included metadata standards and guidelines, potential uses for controlled vocabularies in an Internet environment, long-term archiving and preservation of digital objects, copyright and database protection, the roles of the public and private sector in dissemination of federal government information, developing new concepts of metrics and statistical indicators for the impact of STI products and services, and persistent identifiers for referencing and locating government information, both in the context of links and as cited references in government documents, e-government, and information security and privacy. Issue-related discussions and activities have provided opportunities for continuing cooperation between CENDI and other public and private organizations, including FLICC, NFAIS, ICSTI, and CODATA of the International Council of Science (ICSU). The results of CENDI focus on topics such as these have included input to legislation and regulations, changes in a given agency's operations, joint development projects, and awareness raising for strategic planning by agency management.

CONCLUSION

In today's environment where information technologies are changing the way science and technology are created, disseminated, and used, the STI programs' functional responsibilities, operational systems, and technological development have much in common and, increasingly, are interrelated. It is important to keep lines of communication regular and open. Stovepipe systems simply do not serve the increasingly multidisciplinary requirements of science and technology or the individual user. Moreover, it makes sense to leverage investments in technology assessments, standards developments, and procurements. For some executives, it is very important to have a collegial forum to exchange ideas, concerns, and plans for

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the future. Addressing these requirements has made CENDI a useful cooperative resource in a progressively more complex environment. For more information on CENDI and to access its publications and news, visit its web site at www.dtic.mil/cendi.

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Consortia, Library Buying

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INTRODUCTION

Library consortia are a new expression of an old experience—that the quality of library service is improved when librarians cooperate. The traditional expression of library cooperation has been through interlibrary loan, which has provided a route to noncore content outside a library's collecting policy. This and other forms of library cooperation have rarely made an impact on a library's core services. The formation of consortia for the purchase of core content at the heart of a library's collecting policy has brought library cooperation into the mainstream of library services. The pressure to form consortia has come from a realization that even the wealthiest library cannot keep pace with the needs of its users in an era of expanding publication and inflationary price increases. How to meet user needs when even a growing library budget is inadequate is a question librarians across the world have had to address. Banding together to purchase collectively a broader range of content has proven to be a partially successful answer to the question. Consortia have also provided librarians with negotiating muscle in an era when vendors have become increasingly aggressive in pricing and licensing. Consortia are the librarians' response to the mergers in the publishing industry, which have given certain publishers control of a greater number of important journal titles.

CONSORTIAL STRUCTURES

There is no such thing as an identikit consortium. Consortia grow from the economic, political, social, and historical environments in a particular region or country, and librarians discover the best structure to suit that environment. Each consortium is unique and only broad characteristics can be described for consortia worldwide. The structure of library consortia can be analyzed from several aspects: the geographical area covered, the roles of the consortia, and their internal structure. Some consortia are international in nature, others are national, and yet others cover a particular part of a country. Some have a very strong purchasing role whereas others have more general roles in library cooperation. Some have a very ''tight'' internal structure whereas others allow member libraries to opt in or out of particular purchasing deals or other collaboration. The analysis below is of the 156 consortia in membership of the International Coalition of Library Consortia (ICOLC; http://www.library.yale.edu/consortia/) in 2003, and—although not all characteristics of these 156 consortia can be defined with precision—the ICOLC membership illustrates the broad features of consortial structure worldwide.

''Regional'' Consortia

Three out of every four ICOLC members are consortia of libraries within a particular area or region within in a country. (To call these consortia ''local'' would give them a false image because many have more libraries in membership than some national consortia.) Most of these ''regional'' consortia are associated with particular states in the United States or provinces in Canada. This may be due partly to the origin of ICOLC as a group of North American consortia, but it also reflects the natural cohesiveness of libraries in the same geographical area. Many of these consortia share services in addition to purchasing, and these services—such as access for users to all libraries in the consortium—work best within a distinct geographical area. Perhaps it is of no coincidence that some of these ''regional'' consortia—such as OhioLink (www.ohiolink.edu)—have the tightest internal structures, carrying their geographical cohesiveness into their structures.

National Consortia

One of every eight consortia in membership of ICOLC is a national consortium. These consortia are in countries outside North America, mainly in Europe but also in some parts of Africa, Asia, and Australasia. The national consortia vary in internal structure, from a ''loose'' consortium such as the JISC (www.jisc.ac.uk) in the UK (where individual universities can choose whether or not to opt in to deals offered to them) to a consortium such as the FinELib (www.lib.helsinki.fi/finelib/), which has a strong internal structure linked to national information provision.

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International Consortia

Very few consortia are international in geographical scope. This may reflect the difficulty in negotiating cooperative arrangements across national boundaries, using different legal and financial systems. This situation is being faced by the most successful of the international consortia, eIFL (www.eifl.net), which was set up by the Open Society Institute to assist libraries in ''countries in transition.'' This consortium now supplies electronic content to libraries in over 40 countries on four continents and, as it moves to an independent legal structure, is taking on the very real challenges of a purchasing program based on international cooperation. Other examples of international cooperation have been restricted to purchasing deals agreed between one country and another on an ''ad hoc'' basis.

Special Interest Consortia

The remaining consortia in membership of ICOLC link libraries with a special interest that they have in common. They are usually libraries within one country but, because they only include in membership libraries with a particular interest, they cannot be described as national consortia. An example from Europe is the Consortium of University Research Libraries (www.curl.ac.uk), which has in membership around 20 of the major research libraries in the UK. The ''special interest'' that links the CURL members is the need to design cooperative arrangements—including a few purchasing deals—that meet the needs of large, historically important libraries. Thus long-term preservation issues are more important to this group than to some other UK libraries. An example of a ''special interest'' consortium from the United States is ALICE, the Adventist Library Information Cooperative (http://www.asdal.org/alice.html), which negotiates the purchase of electronic content for the Adventist educational institutions. These ''special interest'' consortia will have much in common with the general consortia in negotiating the purchase of academic content—and support the standards and principles agreed by ICOLC—but they will have particular issues to raise with content providers, which may not be of concern to all consortia.

The Importance of Structure

Experience has shown that the internal structure of a consortium can influence its effectiveness in purchasing electronic content. The key factor in securing worthwhile discounts from vendors is the commitment to purchase from as many institutions as possible. A ''loose'' consortium in which libraries do not commit to purchase all content negotiated by the consortium is in a weaker negotiating position than a consortium in which all libraries agree to purchase. Deals beneficial to libraries can be negotiated by consortia in which libraries opt in or out of particular purchases, but such deals take longer to negotiate as consortia leaders go back and forth between member libraries and vendors to secure commitment. Many purchasing deals contain discount levels graded according to the number of participating libraries, and a deal that is close to completion may be made more beneficial to libraries by the inclusion of a library that had previously been unwilling to commit. A ''tight'' consortium in which commitment is known before negotiation commences does not face this complication in the negotiating procedure.

Worthwhile Loss of Independence?

The structure of a consortium also has a relationship to the independence of member libraries. Joining a consortium involves any library in some loss of independence, even if the consortium has good procedures in place to ensure that it acts according to the wishes of its members. If the consortium is to purchase content on behalf of its members with prior commitment, the members will have to earmark some funds for the consortium, possibly substantial funds if major databases are to be purchased. If the consortium is managed well, the members will gain greater benefit from the commitment of funds to the consortium than they would have gained by using the same funds outside the consortium. As the proportion of content purchased through a consortium grows in comparison to the content purchased by a library acting alone, the issue of loss of independence may become more critical. Visionary leadership in consortia and in individual libraries will be required to handle the delicate relationships between consortial managers and the members of the consortium.

THE INTERNATIONAL COALITION OF LIBRARY CONSORTIA

The factors that have led to the development of library consortia in many countries have also led to the formation of the ICOLC (http://www.library.yale.edu/consortia/). As librarians have faced the challenge of making available an ever-increasing quantity of electronic information at prices that are affordable, and have discovered consortia to be invaluable in meeting that challenge, so they have realized that cooperation with librarians in other consortia adds experience and strength to their own efforts. The easy exchange of information across the Internet, which has benefited communication within a

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particular consortium, has also benefited communication between consortia.

The ICOLC first met informally as the Consortium of Consortia (COC) in 1997, providing an opportunity for leaders of North American consortia to receive presentations and ask questions of the vendors with which many of them had been negotiating individually. The COC did not set out to negotiate deals on behalf of consortia but to provide a forum in which information common to many consortia could be received from vendors and discussed. Vendors welcomed the opportunity to present at COC meetings because the attendees represented much of the North American library purchasing power, and presenting information about their products at a COC meeting was a very effective use of their marketing resources. Most vendors accepted with good grace the hard questioning to which they were subjected by the consortia leaders. So successful was this formula that when European and Australian consortia learned of the COC approach, they began to attend the COC meetings and COC was turned into ICOLC, with the emphasis on the ''I'' for ''international.'' The coalition continues to be an informal, self-organized group comprising library consortia from around the world, meeting two or three times a year in North America and in Europe.

The coalition has also taken a lead in drafting documents that set standards for the delivery of electronic information from vendors to libraries. These documents can be read at the ICOLC web site (http://www.library.yale.edu/consortia/) and cover the following topics: ''Statement of Current Perspective and Preferred Practices for the Selection and Purchase of Electronic Information,'' ''Guidelines for Statistical Measures of Usage of Web-Based Information Resources,'' ''Endorsement of the Bath Profile,'' and ''Privacy Guidelines for Electronic Resources Vendors.'' Each of these documents has been welcomed by vendors who have wished to understand the needs of the library community worldwide and have attempted—with varying degrees of success—to make their products ''ICOLC-compliant.'' In several instances (e.g., on measures of usage), the general statements in an ICOLC document have inspired more detailed works by publishers and librarians working in collaboration in other fora.

CONSORTIAL BENEFITS

Because modern library consortia are primarily concerned with the purchase of electronic journals, there is a tendency to measure their strength by the financial savings that they are able to achieve for their members. Financial savings are important, but the strength of consortia brings many other benefits. The advantages that consortia bring that are not financial in nature may be very important to the libraries and librarians involved. Working within consortia is providing librarians with a better future than if consortia did not exist. By and large, consortia are well respected. Consortia are providing funding authorities with better value for money from library budgets. Consortia are gradually changing publishers' pricing and licensing policies. As a result of the way in which consortia are using their strength, users of libraries are receiving better service than they would if consortia did not exist.

Forming a consortium can create an internal strength within the libraries of the consortium and give the libraries a higher political profile. Bulk purchase of electronic content can bring financial savings but equally important is the strength a consortium has in negotiating license terms, in coordinating the supply and delivery of electronic content, and in resolving problems as they arise. The benefits described below can be achieved by both large and small consortia. A consortium may only consist of a few libraries, but if those few libraries are the most important libraries in that country or region, they have the same strength as a consortium of hundreds of libraries in a much larger country. Likewise, the level of expenditure represented by the libraries in one consortium may appear small compared with the level of expenditure in another consortium, but the key factor is the proportion of national or regional expenditure that the consortium represents. The benefits to librarians and to library users through the formation of a consortium can be achieved in any country, irrespective of national wealth or political structure.

Support: Individuals and Institutions Benefit in Facing Common Situations

New ways of coping with the increasing cost and complexity of electronic information provision are opened up for librarians through collaboration in a consortium. The best type of consortium involves its members in solving the problems. Library consortia cannot be described as democratic structures because strong leadership is often required to unite a disparate collection of organizations. However, a consortium will not be effective if it acts as a central authority, solving all the problems while individual librarians are left out of the picture. A consortium should work like a commune, with everybody playing a part. Working within a consortium can provide individuals with a sense of belonging and a feeling of support as they face the challenges of electronic information provision. The formation of a consortium can have the same beneficial effect on institutions. Academic organizations are often struggling to provide information

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to students within a restricted budget. Often universities are only able to provide a limited range of journal titles. Belonging to a consortium can increase dramatically the number of titles available to students and staff of an institution with limited funds.

Politics: A Consortium Brings Respect for the Library Community

The feeling of strength within a consortium can lead to greater political strength. Political authorities see collaboration between libraries as a way of reducing costs and increasing access to libraries. Forming a consortium is perceived to be a progressive action and will often earn praise from politicians. Such actions help to raise the profile of librarians and libraries and give them a better image. A library that is perceived to be cooperating with other libraries will be looked on more favorably than one that is perceived to be inward-looking in its attitude. This benefit of belonging to a consortium is reinforced if the consortium is part of the governmental structure in a country or region. Some consortia may benefit from being based at a national library, which integrates the consortium into the political structure of the country. Access through a consortium into political structures will not enable a library to get all that its users need, but access into power structures in any country is certainly easier for a consortium of libraries than it is for a library acting alone. Users of libraries benefit when membership of a consortium leads to a higher political status for libraries and to higher grants.

Purchasing: Discounts Through Bulk Purchase

Likewise, a consortium of libraries has greater power than any library acting alone in purchasing books and journals from publishers and other vendors. This point was evident in the days of paper publications, when a purchasing consortium would be able to make a deal with a bookseller or agent to supply a group of libraries with books or journals at a discounted price. For the bulk purchase of electronic publications, a consortium may be negotiating with a publisher directly—with the agent's role confined to subscription management or delivery of the content—or the consortium may be negotiating with an agent as an aggregator of content. Publishers benefit from dealing with a consortium in that they save the cost of marketing to individual libraries, and their products are seen by more users than if individual libraries purchased their own journals. Forming a consortium will not bring lower prices automatically, but a consortium has greater opportunity than an individual library to adopt a firm policy in refusing to accept offers from publishers that do not give the consortium sufficient advantage over purchasing by individual libraries. It is the willingness to walk away from a bad deal that will gain the consortium an advantage. Users of libraries also gain as the library obtains better value for money from its purchase of journals and datasets.

Licensing: The Strength of a Common Approach

Consortia have been very successful in using their strength to secure good licensing terms. The statement of licensing principles drafted by the ICOLC in 1998 has been a major influence on publishers' licenses for electronic journals. At the local level, individual libraries have benefited greatly from the advice available to them through consortia. When librarians are faced with a legal document that is long and difficult to read, they need advice, and consortia have often had access to legal advice, which an individual library could not afford. Consortia can also use their strength to ask for licensing terms that may be important at a local level. The ICOLC licensing principles are applicable in many countries, but there may be local requirements that a local consortium can negotiate with publishers on behalf of libraries within a particular country. A local consortium will have greater opportunity for such negotiation than a library acting alone. Users of libraries benefit when a consortium license enables them to use electronic journals and databases without unnecessary restrictions imposed by the publisher.

Providing: Coordination of Supply and Delivery

Consortia can also help to establish a coordinated policy for the provision of electronic journals and books within a region or country. Collection development is a much more powerful tool if it is used through a consortium, which is able to cover some of the gaps in purchasing. Fragmentation of purchasing policy often leads to the same basic content being purchased by all libraries, with much valuable material not purchased. A consortium can plan collection development much more effectively. Users gain from access to more content than can be provided by one library acting independently, as has been demonstrated by statistics from the US OhioLink consortium (see a 1999 press release at http://www.scienceserver.com/ohl-millionarticle.htm). The benefits of common collection development are even greater if the route into the content is the same for all members of the consortium. As an example of the work of a consortium in this respect, the ATHENS authentication system developed by the JISC in the UK has enabled staff and students

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of UK universities to use the same individual password to gain access to all contents purchased through the JISC. Other national consortia have developed different arrangements to make access to electronic information easier for users.

Problem Solving: Finding Answers to Common Problems

If a dispute arises between a publisher and a library, the librarian can argue the case more effectively if the library is a member of a consortium. The problem may well be affecting other libraries in the consortium, and time is saved by acting collectively. Likewise, an internal problem may arise; for example, if a library has to cancel many journals because of a budget cut. This situation can be handled constructively through a consortium by looking at the holdings of all the libraries in the country or region. One library may cancel one title, and another an alternative title, for example. Technical problems also arise, such as system failure. Membership of a consortium often entitles users to go to another library when such a problem arises, and if no common access policy exists, a consortium provides a forum for the discussion of such issues.

CONCLUSION

Consortia are now a well-established feature of the international library landscape. This has been a remarkable development given the short timescale of consortial development. Although some ICOLC members have been in existence for many decades, it was only in the early 1990s that they began to explore cooperative purchasing, and it was the widespread availability of electronic publications in the late 1990s that created the environment in which consortia could flourish. Consortia have had a major impact on the terms under which electronic publications are purchased and an equally major impact on wider access to the increasing number of publications available. Participating in a consortium has also helped many librarians to be confident in facing the challenges of modern library development. Opportunities for progress have been seen and seized in collaboration with others. Involvement in consortia has also helped librarians to participate in international discussions about the future role of libraries (e.g., in relating the publishers' wish to license rather than sell to institutional decisions about holdings versus access). This broader picture has to be taken into account in estimating the success or failure of library consortia. Consortia have helped to stabilize the journal price rise spiral, they have helped to improve licensing terms, and they have helped to increase access to published content; but the long-term benefit from consortia will be in empowering the library profession to face the challenges of the electronic future.

FURTHER READING

For such a recent development, consortia have received big coverage in the library literature, reflecting the interest among information professionals. One new journal title was published specifically to cater for this interest, *Library Consortium Management*, published by MCB University Press for 2 years, 1999–2000. This journal faced strong competition from existing librarianship journals devoting considerable space to the consortia movement. A very useful series of descriptions of particular consortia across the world was undertaken by *Information Technology and Libraries* (published by the Library and Information Technology Association, a division of the American Library Association) in three special issues: volume 17, number 1, March 1998; volume 18, number 3, September 1999; and volume 19, number 2, March 2000. The title of an article written by Barbara McFadden Allen neatly illustrates one of the tensions in consortial development: ''Consortia and collections: achieving a balance between local action and collaborative interest.'' The article was published in *Journal of Library Administration* (vol. 28, no. 4, 2000, pp. 85–90).

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Copyright Clearance Center

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INTRODUCTION

Copyright Clearance Center, Inc. was established in 1978 to facilitate compliance with U.S. copyright law. A not-for-profit corporation in Danvers, Massachusetts, Copyright Clearance Center serves as a bridge between copyright holders and those who seek to reproduce copyrighted works. It helps ensure the free flow of information and ideas while safeguarding the rights of publishers, authors, and other creators and, in the process, helps fulfill the constitutional purpose of copyright: to foster progress in science and the arts.

The world's largest licenser of text reproduction rights, Copyright Clearance Center represents 1.75 million titles. Its repertory of works includes textual materials of all types, from scientific journals to books, newspapers, and magazines. Copyright Clearance Center's customers include more than 10,000 U.S. corporations, plus thousands of government agencies, law firms, document suppliers, libraries, academic institutions, copy shops, and bookstores. Its licensing systems cover electronic and print reproductions within the United States and abroad.

A SYNOPSIS OF U.S. COPYRIGHT LAW

The Role of the Constitution

U.S. copyright legislation traces its roots to England and the Statute of Anne (1710), but has long since been ''Americanized.'' After some difficulties with state legislation under the Articles of Confederation, the Constitution made copyright (together with patent law) primarily, although not until 1978 exclusively, a federal matter for the new national government. It assigned to Congress the ''Power to Promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.''[1]

The First Congress wrote the Copyright Act of 1790, which maintained the focus of the Statute of Anne primarily on textual materials and on a limited duration of copyright—two 14-year terms. Through the 19th century and up until the Copyright Act of 1909, as citizens litigated their rights and developed new technologies and new ways of expressing themselves, Congress steadily expanded the creative works protected by copyright (maps, charts, prints, music, dramatic compositions, photographs) and extended the terms of protection until they reached two 28-year terms and covered foreign citizens as well as Americans. The 20th century saw protection expanded to yet newer technologies, including sound recordings, broadcasts, software, and other embodiments for creative works.

Modernizing Copyright Law

The most extensive revision of U.S. copyright law was the Copyright Act of 1976, which finally provided exclusive jurisdiction to the federal government and attempted to modernize copyright law and address new technology issues on a more generic basis than before. The 1976 Act also brought the United States into conformity with world practice by extending copyright terms to ''life of the author plus fifty years.''

During the 18 years that the 1976 Act was in development, many new technologies were reviewed to determine how they should be addressed by the new Act. Invented in the 1950s and widely available in libraries and businesses within its first 10 years, the photocopy machine had a distinct effect on the rights of authors and publishers of text-based materials. The easy and inexpensive copying abilities of these machines led Congress to recommend copyright holders and content users develop a clearinghouse to provide individuals, businesses, and organizations with a centralized resource for legal access to photocopying copyrighted works. As a result, shortly after President Ford signed the new Copyright Act, Copyright Clearance Center was established.

The Copyright Act of 1976 was by no means Congress's last word on the subject. Since that time, a host of amendments have been debated and a number have been enacted. They include the following: U.S. accession to the international Berne Convention, which did away with mandatory copyright formalities in the United States; clarification of sound-recording rights; furthering of term extensions to meet new foreign rules; and implementation of the Digital Millennium Copyright Act for protecting

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copyrighted works in the digital environment. Few of these steps were taken without objection from users and others, and litigation has been prevalent over the years. What is certain is that Copyright legislation has changed and always will change to meet the needs of a society that aspires to ensure the constitutional ''Progress of Science and the useful Arts.''

THE HISTORY OF COPYRIGHT CLEARANCE CENTER

Copyright Clearance Center opened its doors on January 1, 1978, the same day that the Copyright Act of 1976 took effect. Created at the suggestion of Congress, the not-for-profit organization was established by representatives of publishers, authors, and information users. Their goal was to provide a single clearinghouse through which copyright holders could voluntarily offer centralized permissions to use text-based copyrighted works. Copyright holders would register their works with Copyright Clearance Center, and the organization would grant permissions on their behalf and collect and distribute royalties. To ensure that Copyright Clearance Center would serve as a trusted intermediary for copyright holders and users alike, from the beginning its Board of Directors has included representatives of the publishing, author, and user communities.

The first service provided by Copyright Clearance Center allowed copyright holders and users to exchange permissions and royalties for photocopying uses on a case-by-case basis. Over the years, that basic transactional service has been augmented by a full complement of licensing offerings, designed to meet the growing needs of users and copyright holders. Copyright Clearance Center's mission and services also have evolved with changing times and now reflect today's digital environment and global economy.

Copyright Clearance Center's Mission

Copyright Clearance Center's mission is threefold:

1. To act as an agent for domestic/foreign authors and publishers by providing them with the efficiencies of collective services through equitable collection and distribution of royalties for photocopying and electronic uses of their copyrighted works.
2. To provide all types of users with an efficient single source for licensed access to as broad a repertory of copyrighted works as possible.
3. To continue development of collective licensing systems that meet the challenges of emerging information technologies.

Copyright Clearance Center fulfills this mission with a complete range of licensing solutions that meet the needs of corporate and academic audiences for print and electronic uses. Today, users can still request and obtain permissions on a case-by-case basis on-line at Copyright Clearance Center's web site, www.copyright.com. They also can opt for annual licensing rights that give all members of their organization access to rights to use content from an extensive repertory of works.

The world's largest text reproduction rights organization, Copyright Clearance Center represents 1.75 million titles. In fiscal year 2002, Copyright Clearance Center distributed more than $68 million to copyright holders. The organization provides licensing services to more than 10,000 businesses and thousands of academic institutions, libraries, document suppliers, government agencies, law firms, copy shops, and bookstores.

Copyright Clearance Center is one of more than 30 national reproduction rights organizations worldwide. Through agreements with a majority of these organizations, and through its participation in the International Federation of Reproduction Rights Organizations, Copyright Clearance Center links copyright holders and users to their foreign counterparts, enabling them to tap the potential of global information markets and resources.

COMPREHENSIVE SERVICES FOR USERS AND COPYRIGHT HOLDERS

Copyright Clearance Center makes it convenient to quickly obtain the necessary legal permission to reproduce portions of copyrighted works. By offering a centralized source for copying rights, Copyright Clearance Center encourages information users to comply with copyright law and helps ensure that copyright holders receive fair compensation.

Copyright Clearance Center offers a comprehensive array of services that balance the needs of copyright holders and users, fosters an ongoing dialogue between these two constituencies, and educates users about copyright law and its role in promoting the progress of science and art by protecting intellectual property. Theses services were developed specifically to meet the varying licensing requirements of a broad spectrum of content users, from librarians and college professors to information professionals, government agencies, and corporate marketing and communications staff.

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LICENSING SOLUTIONS

Services for the Business World

Content users can obtain rights through Copyright Clearance Center's licensing and permissions services to cover reproduction and distribution of copyrighted materials within the users' organizations and externally. Rights can be obtained on a case-by-case basis through Copyright Clearance Center's on-line permissions services or they can be obtained ''in bulk'' through annual repertory licenses.

To use Copyright Clearance Center's on-line permissions services, content users simply go to the organization's web site, www.copyright.com, to order rights to photocopy, e-mail, and post on Internet, intranet, and extranet sites, excerpts of copyrighted materials. In instances when a particular work is not included in Copyright Clearance Center's extensive repertory of titles, the organization will solicit special permission for the customer from the copyright holder.

A second group of service options from Copyright Clearance Center are forms of annual licensing. Customers pay an annual fee in exchange for the right to photocopy portions of any works in the Copyright Clearance Center repertory throughout the year for in-house distribution. A similar annual licensing service, introduced in 2000, covers digital uses of copyrighted works. Fees are based on the size and industry of the user organization and are set by a representative group of copyright holders who serve on Copyright Clearance Center's Board of Directors. Because they streamline the licensing process, these services are highly convenient for copyright holders and users alike. As an added benefit to licensees, upon their first renewal of an annual license from Copyright Clearance Center, registered publishers agree to waive any prior unasserted infringement claims that fall within the scope of the rights granted under the applicable license. Currently, Copyright Clearance Center's annual licenses cover more than 14 million U.S. employees of thousands of corporations, professional service organizations, government agencies, and not-for-profit institutions.

Other services address the needs of U.S. companies that have employees working in other countries. Through Copyright Clearance Center, these corporations can purchase an annual license that extends their photocopying and/or digital-use privileges to employees in 160 countries outside the United States, allowing them to reproduce portions of newspapers, magazines, journals, and other registered copyrighted works for internal use. The multinational photocopy license covers thousands of English-language titles published in the United States, United Kingdom, Canada, New Zealand, and Australia, while the multinational digital-use license reflects substantially the same repertory as the similar domestic license.

Services for Colleges and Universities

Academic content users can take advantage of several services that address the unique needs of educational institutions. Among the most popular services are those that simplify the permissions process for coursepack materials. In fact, Copyright Clearance Center is now the largest licensor of rights for academic coursepacks in the United States. Publishers and other copyright holders set the prices at which their works are licensed. Academic customers benefit from the convenience of using a single permissions source, especially since coursepacks typically include works from several authors and publishers. Customers simply go to Copyright Clearance Center's web site, www.copyright.com, to obtain permissions on a case-by-case basis. Customers use these services to obtain rights to copy and distribute copyrighted material in physical and electronic coursepacks, electronic reserves, interlibrary loans, and distance learning.

Copyright Clearance Center also provides a solution that enables publishers to provide their customers with an easy way to secure instant permissions and obtain paper and electronic reprints directly from their on-line publications. Known as Rightslink®, the service allows users to request permission by clicking a link provided beside the information they want to use. At the same time, it allows publishers to set the prices and terms for use, ensuring they maintain decision making over how their content is reused. Major publishers including Dow Jones & Company, The New York Times Company, The Washington Post Company, Knight-Ridder Digital, MSNBC, and Euromoney Institutional Investor use Rightslink.

Educating Users and Copyright Holders

Copyright Clearance Center believes the most effective way to promote copyright compliance is to educate users about copyright law and motivate them to comply by providing user-friendly licensing solutions. To support and encourage compliance, Copyright Clearance Center is engaged in ongoing efforts to advise users on resolving compliance challenges posed by the evolving ways people use and share information. Copyright Clearance Center representatives visit corporate and academic customers and prospects on a regular basis providing compliance education seminars, and speak at conferences throughout the year on the importance of copyright compliance and issues regarding digital content usage. They also meet with copyright holders to underscore the importance of

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leveraging new technologies that can boost compliance by making it easier for content users to obtain copying rights. Equally important, Copyright Clearance Center brings users and copyright holders together, in work groups and seminars, to share their different perspectives and address licensing problems.

CONCLUSION

Since its founding in 1978, Copyright Clearance Center has been instrumental in educating users and copyright holders about copyright law and providing licensing solutions that meet their changing needs. Launched at the recommendation of Congress, through the voluntary efforts of publishers, authors, and content users, Copyright Clearance Center has consistently used consensus to develop new services and address the needs of new markets. As a result, it has emerged as the world's largest licensing agent for text reproduction rights and the foremost provider of copyright licensing solutions.

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United States Copyright Office. http://www.copyright.gov.

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CrossRef

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INTRODUCTION

This article provides an overview of CrossRef, a cross-publisher linking network and platform for other collaborative technologies. It discusses CrossRef's mission and history, as well as how the system works, and the impact it has had to date on various segments of the information industry. A final section looks at system enhancements in process. The article concludes by situating CrossRef as part of a larger trend in resource discovery toward virtual integration of distributed resources.

CROSSREF'S MISSION

CrossRef is a nonprofit membership association, founded and directed by publishers. Its mission is to improve access to published scholarship through collaborative technologies. CrossRef serves two additional purposes as an organization: it operates a cross-publisher citation linking system, and it is an official digital object identifier (DOI) registration agency, appointed by the International DOI Foundation (IDF).[1] A look at the history of CrossRef helps explain these three core functions.

CROSSREF'S HISTORY

CrossRef was incorporated in January of 2000 as a cooperative venture among 12 of the world's leading scholarly publishers, both commercial and not-for-profit, with a mandate to provide cross-publisher reference linking throughout the on-line journal literature. The founding members were Academic Press, the American Association for the Advancement of Science (publisher of Science), the American Institute of Physics, the Association for Computing Machinery, Blackwell Science, Elsevier Science, the Institute of Electrical and Electronics Engineers, Kluwer Academic Publishers, Nature Publishing Group, Oxford University Press, Springer-Verlag, and John Wiley & Sons. Start-up funds for CrossRef were provided as loans from eight of the original publishers.

When the CrossRef service went live in June of 2000, it supported reference links in roughly 1100 journals from a member base of 33 publishers, using a beta system called the ''DOI-X prototype.''[2] CrossRef became an official DOI registration agency in October of 2000 and was the first such agency authorized by the IDF to allocate DOI prefixes and register DOIs. To date, CrossRef is the most robust implementation of the DOI model.

Although CrossRef got underway with a specific focus on linking electronic journal articles in the scientific, technical, and medical (STM) arena, it has since branched out to cover DOI-based linking of all authoritative (peer-reviewed) scholarly and professional literature on-line, regardless of genre or discipline, with a broader mission of improving ''deep web'' resource discovery through shared technologies.

The Importance of Cross-Publisher Linking

Among the visitors to the Frankfurt Book Fair in October of 1999 who witnessed a demonstration of the DOI-X project were several representatives from STM publishing. Recognizing that a DOI-based lookup system for citations could enable a cross-publisher article-level linking system for serials, they took the unprecedented step of joining together in an independent association.

Linking at the article level benefits both scholars and publishers. References are how authors make explicit the links between their work and previously published scholarship. Making a citation immediately actionable, so that it links to the cited document in a matter of a click or two, is a powerful enhancement to efficiency and functionality in on-line research, but not if it is bounded by digital collections defined by publisher. From the researcher perspective, neither the publisher's identity, nor even that of the journal in many instances, is considered a significant identifying feature of the published work, as opposed to who wrote it and when.

Hence, automated linking is mainly useful from a research perspective if it works across publications, across publishers, and is truly comprehensive. The usefulness of the system is directly proportional to the robustness of its coverage, and CrossRef paves the way for a truly robust, comprehensive network of connected publications.

Citation linking of this kind also offers advantages to serials publishers, because it drives readers to their publications and their web sites. By allowing readers to connect to their content from outside resources and

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locations, they not only serve their subscribed user base better, but at the same time they create opportunities for article- or chapter-based sales, whether through document delivery services, hosting intermediaries, or their own pay-per-view mechanisms.

CROSSREF TODAY

Let us look at how far the CrossRef initiative has progressed in just under 3 years. As of October 2003, the network includes 250 publishers, 8500 journals, over 9 million DOIs, including several hundred thousand DOIs for nonjournal content such as books and conference proceedings, at varying levels of granularity. The CrossRef system is adding between 2 and 3 million new DOI records per year. Many of these DOIs point to backfile, historical content, as publishers digitize archival material, several of them as far back as volume 1, issue 1. Another source for the steep growth is the addition of new content genres. Publishers who have been registering journal content for some time are beginning to register DOIs for other content types, and new members who may not publish journals at all are joining to register books and proceedings.

To realize the vision of a linking backbone for all scholarly and professional literature on-line, the DOI directory will eventually have to include patents, technical reports, government documents, learning objects, datasets, images, and so on. This will involve the cooperation of several DOI registration agencies, of which there are a growing number to cover different regions of the world, different media, and different applications.

The state of the CrossRef endeavor can also be measured by its impact on the research experience. Researchers are currently using the system at a rate of about 3 million DOI clicks per month. Roughly 2 million DOIs per month are retrieved from the system, which gives some indication of the number of DOI-based links being created. In addition to the 250 publishers who participate as members, there are roughly 200 other participating organizations, including libraries, database publishers, full-text aggregators, software vendors, and journal hosting/linking platforms. These ''affiliates'' access the CrossRef database of DOIs and metadata on a regular basis to facilitate linking through their own products.

THE DIGITAL OBJECT IDENTIFIER

The DOI syntax is a National Information Standards Organization (NISO) standard.[2,3] A DOI is an alphanumeric name for a digital content entity, such as a book, journal article, chapter, image, etc. The DOI is paired with the object's electronic address, or URL, in a central directory that can be readily updated, and is published in place of the URL to prevent links from breaking, while allowing the content to move as needed. The CrossRef system makes updating the URL in the central DOI directory very easy. Because CrossRef publishers have been updating their records reliably so far, reports of nonworking DOIs are rare, even with millions of DOIs being resolved each month.

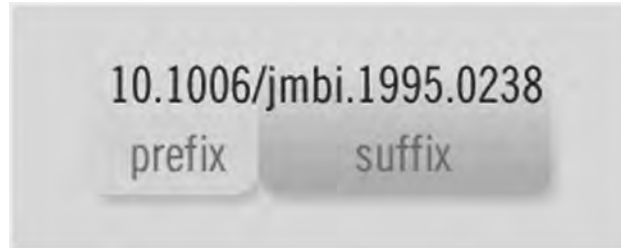

Fig. 1 Sample DOI, illustrating prefix and suffix. *(Go to www.dekker.com to view this figure in color.)*

Let us take a closer look at a DOI, in Fig. 1. The DOI is made up of two components, a prefix and a suffix, separated by a forward slash. The prefix is assigned to the content owner by a DOI registration agency like CrossRef. All DOI prefixes begin with ''10'' (to distinguish the DOI from other implementations of the Handle System®),[a] followed by a four-digit string. The prefix in this example is ''10.1006.'' The suffix has a very flexible syntax and is composed by the publisher according to their internal content management needs, with the main restriction being that the suffix must be unique within a prefix.

Once a DOI is assigned to a digital entity, it continues to identify that entity regardless of ownership. While publishers assign DOIs using their own prefix(es), control of individual DOIs can be readily transferred. For example, if ownership of a journal passes from Publisher X to Publisher Y, control over the DOIs for articles in that journal will be given to Publisher Y, who can then update the metadata and URLs for those DOIs. Publisher X will continue to assign DOIs using their existing prefix. Therefore, the prefix of a DOI does not reliably identify the publisher. At the same time, because the DOI never changes in these cases, it means that all the links to that content that have already been published still function. Hence, one key insight of the DOI system is persistence;

[a]The Handle System is a distributed computer system for naming digital objects and storing the names and the information needed to locate and access the objects via the Internet. It is managed by the Corporation of National Research Initiatives on behalf of the IDF.[5]

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the other is ''actionability.'' Like the URL itself, one click on a properly implemented DOI gets the user to the location of the content they want.

The DOI remains unique and persistent throughout changes in ownership and location of the content, but it need not be transparently meaningful or descriptive. Rather, descriptive information belongs in the metadata associated with each DOI when it is registered in the CrossRef system. Actionable, persistent identifiers like the DOI add value to publications because they enable new functionality and work reliably in the Web environment. The identifier strings themselves can be opaque if they are associated with descriptive metadata in the registration process and, in any event, mainly being interpreted and processed by computers. At the same time, registering an identifier along with descriptive metadata lays the groundwork for constructing other automated services around the content being identified.

HOW CROSSREF WORKS

Publishers use automated (i.e., batch) processes to deposit metadata records into the CrossRef metadata database (MDDB). Each deposited record must include minimal bibliographic information, a DOI, and a current URL. The

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<journal>
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Fig. 2 Abbreviated example of journal-level and article-level metadata record in CrossRef.

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descriptive metadata includes journal title, ISSN, first author, year, volume, issue, and page number. Depositing metadata with CrossRef involves creating an XML file formatted according to a schema. A sample CrossRef metadata record with both journal-level and article-level metadata and identifiers is shown in Fig. 2.

When publishers deposit records, they automatically enable others to link to their content, because other publishers, librarians, and intermediaries can then retrieve from CrossRef the DOIs that link to that content. After a metadata record is deposited, CrossRef registers each DOI–URL pair in the central DOI directory, an implementation of the Handle System. Thus, when a user clicks on the DOI, it is resolved through the Handle System and not the CrossRef system.

In a separate process, the publisher submits the citations contained in each registered work to the Reference Resolver, the front-end component of the MDDB that allows for the retrieval of DOIs. This way, the publisher can, as part of its electronic production process, add outbound hyperlinks to any of an article's citations that point to entities already registered in the CrossRef system. The Reference Resolver can also accept DOIs as input and return metadata as output. Fig. 3 provides an overview of the workflow for reference linking.

When metadata and DOIs are deposited with CrossRef, publishers must have active response pages in place so that they can accept incoming links. As soon as a given deposit goes through, other users of the system will be able to retrieve the DOI in question and create links using that DOI. A minimal response page consists of a full bibliographic citation and some mechanism via which the user can gain access to the full text. Access to proprietary content is controlled by the publisher; most publishers take users to an abstract page and permit authenticated users to go directly to the full text. If the full text is available at no charge, all users can view it immediately. Many publishers also present unauthenticated users with pay-per-view options.

Fig. 4 shows a user clicking on a CrossRef DOI in Journal 1 and connecting to a response page at the web site of Journal 2.

In sum, CrossRef provides a database of DOIs and metadata that supports DOI lookup, not unlike a telephone book and directory assistance. If you know the DOI for a piece of content, that is all you need to know to locate it persistently. If a publisher changes the location of the content, it need only update the URL in one place.

CROSSREF'S IMPACT

Let us look now to how CrossRef impacts the various communities in the information arena.

Impact on Publishers

The current system of Internet addressing made widespread linking possible several years ago. Yet

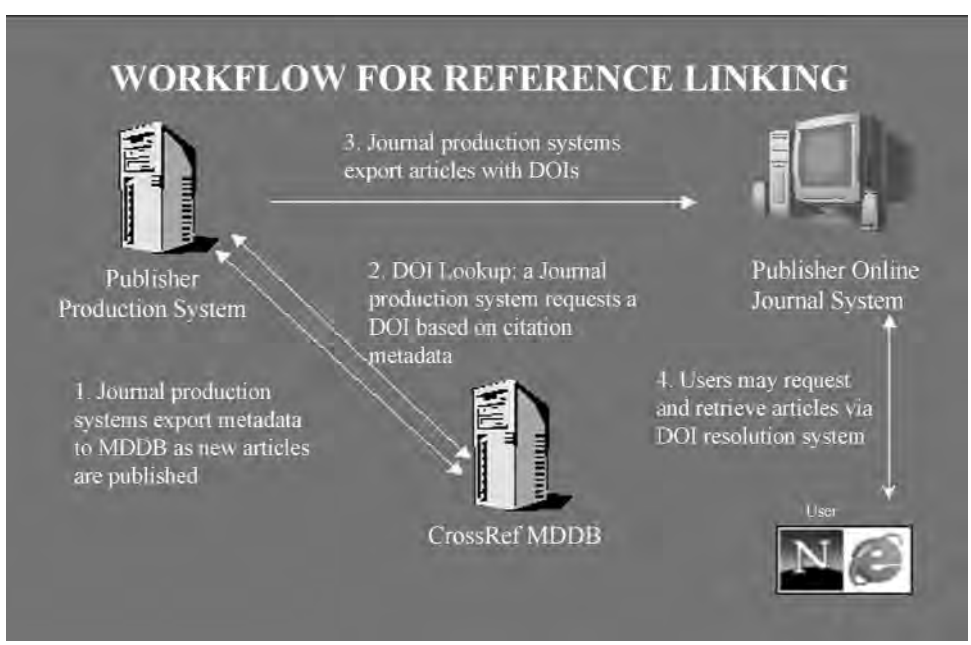

Fig. 3 Workflow for reference linking. *(Go to www.dekker.com to view this figure in color.)*

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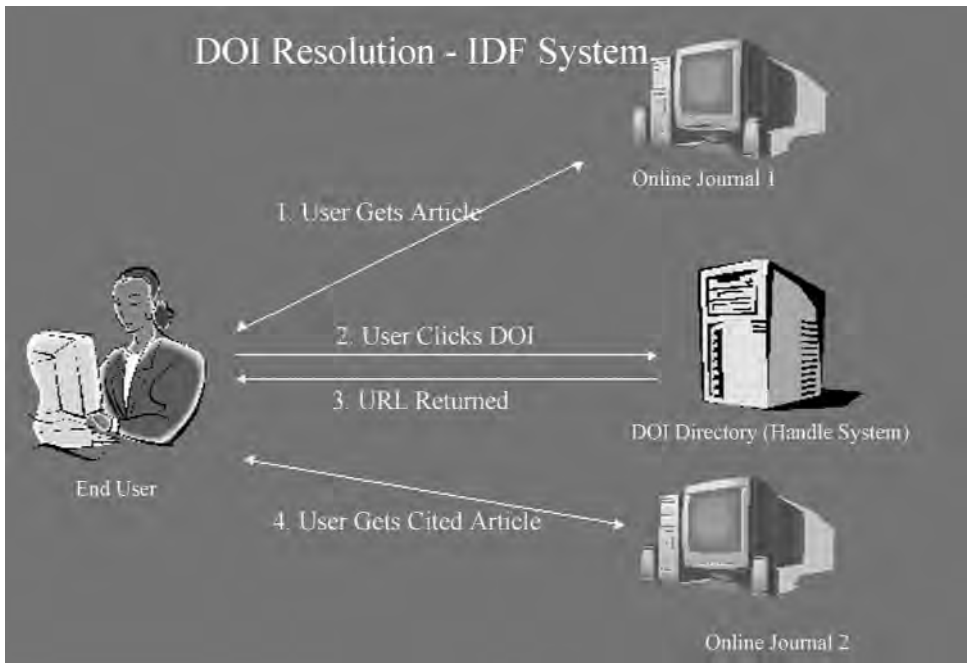

Fig. 4 DOI resolution from the end user perspective. *(Go to www.dekker.com to view this figure in color.)*

cross-publisher linking remained a largely onerous and error-prone endeavor for scholarly publishers until CrossRef was formed. Before CrossRef, in order to link with one another, publishers had to enter into numerous bilateral agreements and stay on top of several publisher-specific, algorithmic linking schemes. Any change in the on-line location of a piece of linked content meant that previously published links to that content became obsolete.

With CrossRef, publishers have both a technology and a business infrastructure for persistent linking. On the business side, the publisher (or other interested party) signs one agreement with CrossRef and gains the right to link to all other participating publishers. With membership at 250 publishers, nearly 20,000 bilateral agreements $[1/2N(N-1)]$ would have otherwise been needed to enable the same network of connections. Hence, a linking network on this scale could never have arisen without an organizational infrastructure like CrossRef. Publishers also benefit from being part of a collaborative platform for ongoing development of shared technologies while maintaining complete control over their own business practices and how their content is accessed.

On the technology side, CrossRef addresses the error-proneness of links by use of the DOI, as described above. CrossRef is the only DOI registration agency with a DOI look-up and retrieval service. For a publisher with content registered in the CrossRef database, this means that over 450 participating organizations—other publishers, Abstracting and Indexing (A&I) databases, aggregators, and libraries—will be able to link automatically to their response pages. For electronic books such as reference works, CrossRef facilitates internal linking of components and references, as well as providing durable hyperlinks from citations to any other participating publishers material. Assigning DOIs to book chapters gives publishers a head start in repurposing content for course packs, for derivative works requiring a subset or reordering of the original components, and for e-commerce at the chapter level.

Impact on Libraries

With CrossRef functioning as intended, DOIs will be widely distributed by publishers as a standard part of bibliographic metadata. Libraries and their patrons will then simply encounter DOIs in the primary and secondary publications that they access. DOIs are good for libraries in the same way that they are good for the research process. Namely, they make linking reliable at any level of granularity possible. In the same way that links drive readers to publisher content, libraries may also see increased usage of acquired electronic resources as an additional benefit.

Most researchers access content through the institutions with which they are affiliated. One shortcoming in the CrossRef model is that it does not take the researcher's

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or institution's access rights into account. Because DOI assignment is a publisher-regulated process, DOIs default to resources designated by the publisher. For the user working in an institutional context, it is not always appropriate to be directed to a publisher's on-line version of a research article. For instance, the institution may not subscribe directly to the e-journal but may still be able to offer the user access to the desired article through an aggregated database or through print holdings. In addition, the library may wish to provide a range of navigational options beyond what is available at the publisher's web site.

In order for information providers to equip their products for optimal integration with library linking systems, they are being asked to implement the OpenURL. This has caused some confusion concerning primary and secondary publishers who use the CrossRef/DOI system for cross-publisher links to full text, because of the mistaken perception that the OpenURL and the DOI are competing technologies. They are not.

The *OpenURL* is a mechanism for transporting metadata and identifiers describing a publication, for the purpose of context-sensitive linking. The OpenURL standard is currently on the path to NISO accreditation.[6]

A *link resolver* is a system for linking within an institutional context that can interpret incoming OpenURLs, take the local holdings and access privileges of that institution into account, and display links to appropriate resources. A link resolver allows the library to provide a range of library-configured links and services, including links to the full text, a local catalogue to check print holdings, document delivery or ILL services, databases, search engines, etc.

The DOI and the OpenURL work together in several ways. First, the DOI directory itself, where link resolution occurs in the CrossRef platform, is OpenURL enabled. This means that it can recognize a user with access to a local resolver. When such a user clicks on a DOI, the CrossRef system redirects that DOI back to the user's local resolver, and it allows the DOI to be used as a key to pull metadata out of the CrossRef database, metadata that is needed to create the OpenURL targeting the local resolver. As a result, the institutional user clicking on a DOI is directed to appropriate resources.

By using the CrossRef DOI system to identify their content, publishers in effect make their products OpenURL aware. Since DOIs facilitate linking and data management processes for publishers, many publishers are beginning to require that the DOI be used as the primary linking mechanism to full text. Link resolvers can use the CrossRef system to retrieve the DOI, if the DOI is not already available from the source (i.e., citing rpar; document.

As we have seen, static URLs are not a persistent linking mechanism. If a URL is published as a link and the content it points to is moved, then that link will no longer function. DOIs address this problem. An OpenURL link that contains a DOI is similarly persistent. OpenURLs without DOIs can function persistently only if the relevant metadata is updated within the institution's link resolver. This process is greatly streamlined via access to the CrossRef system, because CrossRef provides a single source for linking reliably to a multitude of publishers without the need to track varied metadata-based linking schemes. In short, link resolvers benefit from using the DOI when linking to publisher-designated resources is appropriate, and as a way to obtain needed metadata.

Impact on Intermediaries

CrossRef encourages its publisher members to distribute DOIs as part of the standard bibliographic metadata that they provide to database publishers, aggregators, vendors, and other intermediaries. These intermediaries can also come directly to CrossRef for a way to identify, acquire, and capture DOIs for records that do not currently contain DOIs as provided directly by the primary publisher.

Like primary publishers, intermediaries join CrossRef to create links to all CrossRef member publishers without signing bilateral linking agreements or having to track publishers' individual linking schemes. They can then also offer their customers links to the full-text content of some primary publishers who do not authorize any other type of linking relationship. In addition to the efficiencies of centralized linking agreements and the enhanced utility of indexes that link reliably to full-text resources, some intermediaries offer CrossRef implementation as part of their journal hosting services, and others integrate their own software into the CrossRef system.

Impact on Researchers

Clearly, researchers want the content that they read on-line to be linked. It is much more efficient to navigate a body of research at the citation, or ''idea,'' level. When the researcher takes on the author role, linking can be viewed as a way of garnering additional exposure. Including outbound hyperlinks adds valuable functionality to on-line publications, and inbound linking may increase readership and citations.

The CrossRef linking infrastructure is intended to be invisible to the end user. There is no charge associated with clicking on a DOI link because the costs of the system are borne by publishers. These links are labeled by publishers in a variety of ways; sometimes they are branded but often not. Without full-text citation linking, the user who discovers a desired resource while reading

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usually has to switch to a different search interface to locate and ultimately access that resource. With CrossRef, it takes a click or two to get to the full text, either as an authenticated user or through pay-per-view services, regardless of the journal or publisher.

BEYOND CITATION LINKING

The CrossRef network is currently expanding not only in content coverage—to different genres and levels of granularity—but also in functionality. Some of the key developments on the near horizon are described here.

Forward linking refers to tracking with which other publications cite a given publication. With cross-publisher forward linking currently under development at CrossRef, the user will soon have access to complete citation pathways and be able to link to content that cites, as well as is cited by, a given content item.

Parameter passing refers to using OpenURL syntax to send a key or some encoded text along with the DOI. Because the DOI is simply a string that redirects the user to a URL pointer to the publisher's site, the targeted publisher can tell very little about where the user is coming from and what terms of access should be granted. Parameter passing would enable extra functionality that will benefit both publishers and end users.

The parameter could be information about the source entity (i.e., the entity containing the reference the user clicked on). In this case, the publisher receiving the link would know the exact title and publisher the user came from. Each publisher could track the links that arrive at its own site, and would thus know which publications were linking to its own. Parameter passing will also impact the end user experience by allowing branded response pages, return buttons (links back to the original site), customized messaging or error handling, and special trading rules, such as allowing immediate full-text access to users coming from certain locations.

Multiple resolution entails the association of multiple elements with a DOI, so that a user clicking on a single link is presented with a menu of publisher-supplied options. These will include the option to go to alternative sites for the same content or different physical manifestations of a work; to view related resources; to drill up or drill down within the publication; to access associated metadata; to get more information about the author; and to purchase or acquire rights to the content. Fig. 5 highlights a multiple-resolution demo on the CrossRef web site.

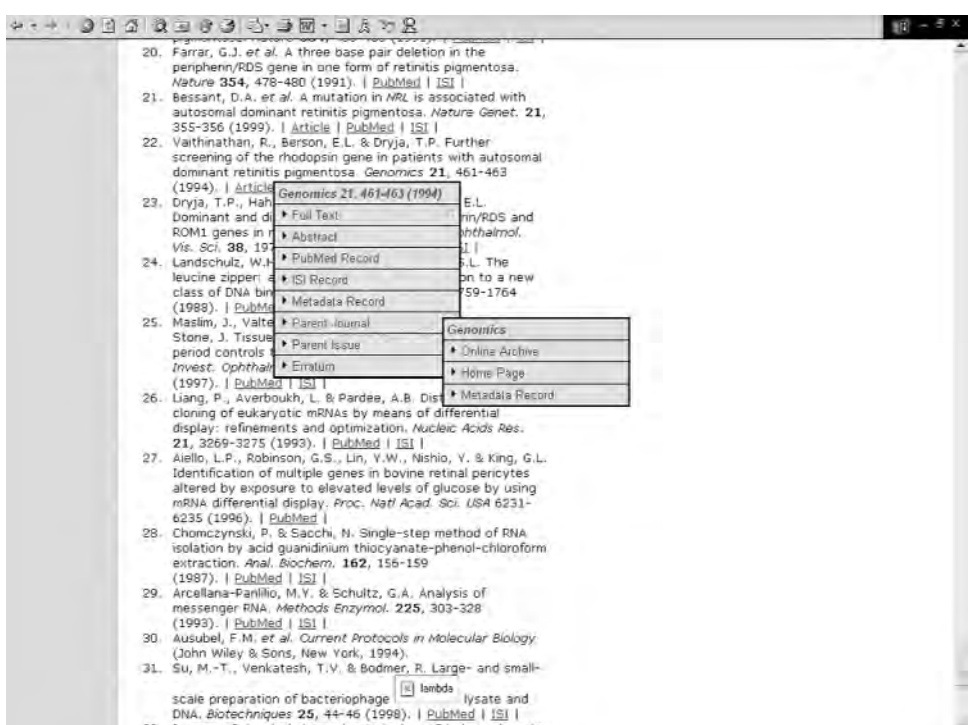

Fig. 5 Screenshot from the multiple-resolution demo on the CrossRef web site. (From Ref. [7].) *(Go to www.dekker.com to view this figure in color.)*

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CONCLUSION

CrossRef is about reducing friction in the means of discovering and accessing scholarly content on-line. Perhaps the key insight of the CrossRef initiative is that it allows publishers to create collectively the experience of integrated electronic resources for the scholarly community, without in fact requiring aggregation of anything but the most minimal metadata. The fact that CrossRef does not aggregate proprietary full text or even abstracts is a large part of why the model has appealed to so many primary publishers.

CrossRef is representative of a trend toward ''distributed integration''[8] of information resources that will continue to progress as publishers take advantage of yet other ways, such as the Open Archives Initiative,[9] to expose metadata about their information products on the web for harvesting, search, and e-commerce applications. From the end user perspective, the outcome is a more highly integrated body of research literature, even if such integration is merely virtual. As the automated tools for exposing and harvesting metadata, classifying content, and performing intelligent search continue to be refined/improved, this trend will no doubt advance.

Interlinking of resources across publisher platforms, as in CrossRef, is a prime example of distributed integration in electronic publishing. Both content providers and content consumers benefit from initiatives that use metadata and identifier registration to enable virtual integration of scholarly literature on-line.

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Digital Object Identifier (DOI®)

Norman Paskin
International DOI Foundation, Oxford, United Kingdom

INTRODUCTION

The Digital Object Identifier (DOI®) is a managed system for persistent identification of content on digital networks. The DOI system builds on existing or developing standards, notably the Handle System® for resolution of names to data on the Internet and the indecs™ (interoperability of data in e-commerce systems) framework for precise specification of an identified entity's attributes (metadata). DOIs may be used to identify physical, digital, or abstract entities, at any level of granularity. DOIs conform to functional specifications for persistent identifiers on the Internet such as URI and URN and offer substantially better functionality than any other existing or proposed implementation. Through multiple resolution, a DOI may be associated with multiple pieces of data, each of which may be dynamically updated. Once assigned, a DOI can be used to locate an entity or service irrespective of changes in location, ownership, or other attributes. The DOI system has been developed and implemented in a range of publishing applications over the past 3 years: Several million DOIs have been assigned, and the number is growing.

The DOI system is being further developed to build a rich framework for interoperability of persistent identifiers and metadata, treating each piece of content as an object in its own right, with a defined name (identifier) and attributes.

The DOI has been developed to meet the needs of the intellectual property communities in carrying out any transaction (free or paid). Identifiers (unique labels for entities) and metadata (structured relationships between identified entities) are prerequisites for management of content, such as digital rights management. The term ''identifier'' can mean a label, numbering scheme, specification, or fully implemented identifier system in a specific infrastructure. Implementations require a social infrastructure. In an automated environment the entity being managed must be structurally defined by means of attributes. Managed entities will often be abstractions, and the choice of which possible entities to distinguish as separable is not absolute but dependent on function and context. Interoperability requires a persistent means of identification and structured description. Persistent identification can be aided by use of Internet technologies, which allow indirection, separating names from attributes. Structured description requires an ontology framework, such as the indecs framework, which can support mappings using a managed data dictionary.

THE DIGITAL OBJECT IDENTIFIER

The Digital Object Identifier (DOI) is a system for persistent identification and interoperable exchange of intellectual property on digital networks, which provides an extensible framework for managing intellectual content in any form, at any level of granularity, and in any digital environment. The DOI system builds on the existing standards infrastructure. DOIs may be used to identify any intellectual property entity (e.g., books, music, images, database records, product descriptions) and at any level of ''granularity'' (e.g., individual chapters, songs, articles, product components). The International DOI Foundation, a nonprofit organization, manages development, policy, and implementation of the DOI system through DOI registration agencies. Introduced in 1998, the DOI system has been developed and implemented in a range of applications; in August 2003, the number of DOIs assigned exceeded 10 million and the number is growing. A DOI references an entity as a first-class object rather than via some attribute of an object (such as an address); it may then resolve to a location or other service.

A DOI can be thought of as the on-line equivalent of the physical barcode, and on the Internet it currently functions as a kind of ''super-URL,'' linking users to services such as where they can buy the item, learn more about it, find related items, access related services, contact the publisher, etc. (Fig. 1). Thus it facilitates on-line transactions of all kinds, including e-commerce, rights management, and digital distribution.

OVERVIEW

The complete specification of the DOI system may be found in the DOI Handbook[1] maintained on-line by the International DOI Foundation. The Foundation is an

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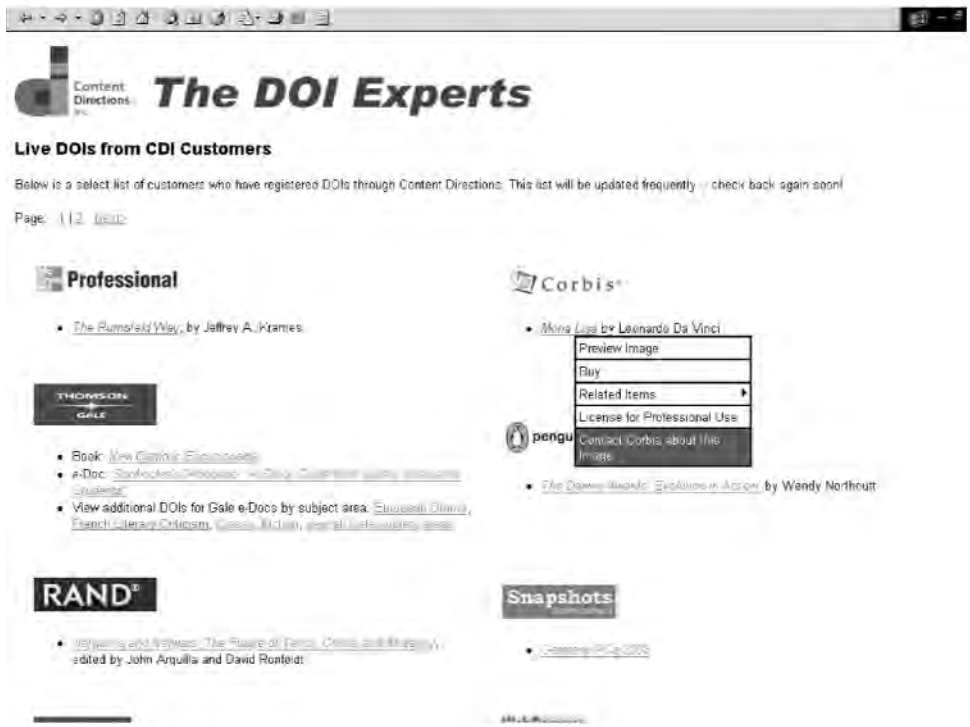

Fig. 1 Examples of commercial implementations of the DOI system from the website of Content Directions Inc., a DOI Registration Agency. The example for Corbis (the Mona Lisa by Leonardo de Vinci) shows here the pop-up menu that appears when the link is highlighted. The business options offered (''buy'' etc.) are conveyed by multiple resolution options in the underlying DOI. (From ''demonstrations of DOIs in use provided by DOI Registration Agencies'' at http://www.doi.org/demos.html.) (*View this art in color at www.dekker.com.*)

open-membership organization, initially financed by its members (drawn from the publishing, technology, and information communities) and migrating toward a self-financing system where the costs of maintaining the DOI system are met by those assigning DOIs. Any organization may assign DOIs, on condition that it implements a consistent agreed policy and contributes to the costs of running the system.

The DOI system has four components, based on existing or collaboratively developed published standards; DOI is unique in bringing together all the components in a fully implemented and managed system.

1. Numbering syntax: Assigning an alphanumeric string (a number or name) to the intellectual property entity that the DOI identifies. The numbering mechanism is a standard (ANSI/NISO Z39.84-2000).[2] The DOI syntax is a standard that specifies two components, the prefix and the suffix, which together form the DOI, e.g., DOI:10.1234/5678. There is no limitation on the length of a DOI. DOIs are not case-sensitive. A DOI may be assigned to any item of intellectual property, which must be precisely defined by means of structured metadata.

A prefix is assigned by a Registration Agency to an organization that wishes to register DOIs; any organization may choose to have multiple prefixes. Following the prefix (separated by the forward slash) is a suffix (unique to a given prefix) to identify the entity assigned by the Registrant. The combination of a prefix for the Registrant and unique suffix provided by the Registrant avoids any necessity for the centralized allocation of DOI numbers. Optionally, an existing identification system number may be incorporated into a DOI, by using this as the suffix. The DOI itself remains persistent through ownership changes.

2. Metadata system: Precise description of the entity that has been identified with a DOI, through associated metadata based on the indecs (interoperability of data in e-commerce systems) framework. The metadata specifying an entity may be derived from any existing metadata scheme; the DOI metadata system enables mappings between application areas to be made consistently. Some metadata is likely to be common to all applications and essential for initial recognition, and is compulsory for every DOI. The additional metadata elements needed in a particular transaction depends on the nature of the transaction and are specified in extended Application Profiles (specific to a group of DOIs); these are interoperable (so that DOIs and services can be mixed and used from various sources) through common controlled

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definitions in a structured data dictionary that enables mapping of metadata schemes. Initial DOI applications used only the features of the resolution system; later, applications also build on the metadata feature.

3. Resolution: The DOI system resolves the DOI to a current associated value such as a URL; users of DOIs need not be aware of changes to URLs to use the system. The DOI Resolution System is the Handle System, an open-standard scalable architecture. Resolution may be to multiple pieces of data. The DOI system is one implementation of the Handle System. The DOI system conforms to the functional requirements of URI and URN specifications.

4. Policies: The rules that govern the operation of the system in a social infrastructure that defines the funding and ongoing operational requirements of the system as well as its day-to-day support and management by means of a number of Registration Agencies that operate under the same rules in an operational federation.

The DOI system is the integrated system—comprising numbering, description, resolution, and policy—managed by the International DOI Foundation (IDF), providing an implemented system of names (identifiers) through a numbering scheme in an infrastructure using a specification. The remainder of this article will discuss the components of the DOI system in detail.

A summary overview of the progress, applications, and prospects for further development of the DOI system may be found in the DOI Progress Report 2003.[3] Examples of DOIs may be seen at the DOI website. A discussion of the fundamental issues of identification and numbering, which refers to the DOI and related technologies, is also available.[4]

DOI NUMBERING

The formal specification of the syntax for creating the DOI identifier string is the standard ''ANSI/NISO Z39.84-2000 Syntax for the Digital Object Identifier.'' Note that the term identifier has multiple nested meanings in library and information science, including:

1. An unambiguous string or ''label'' that references a specific single *entity* (e.g., ISBN 0-19-853737-9).
2. A numbering scheme formal standard, an industry convention, or an arbitrary internal system providing a consistent syntax for generating individual labels or *identifiers (1)* denoting and distinguishing separate members of a class of entities (e.g., ISBN, or DOI Syntax NISO Z39.84).
3. An infrastructure specification: A syntax by which any *identifier (1)* can be expressed in a form suitable for use with a specific infrastructure, without necessarily specifying a working mechanism (e.g., URI).
4. A system for implementing labels [*identifier (1)*] through a numbering scheme [*identifier (2)*] in an infrastructure using a specification [*identifier (3)*] and management policies.

The DOI system is an example of the last, but ''DOI'' may also be used in reference to any of the lesser specific uses, e.g., in sense:[1] ''the Z39.84 specification defines how to construct an identifier''; ''this DOI identifies...''; or in sense:[3] ''a DOI is a URI, and hence the DOI system implements the URI specification.''

The DOI system provides an *actionable* identifier; that is, in the context of a particular piece of digital network infrastructure, the identifier can be readily used to perform some action, e.g., in an Internet Web browser, it can be ''clicked on'' and some action takes place.

The term Digital Object Identifier should not be solely read as ''an Identifier of a Digital Object (a data structure whose principal components are digital material, or data, plus a unique identifier for this material). A DOI may be an identifier of such objects, but is not solely an identifier of such objects as it may also identify other *entities* and *creations*. Therefore DOI should be interpreted as ''a digital identifier of objects.''

DOI METADATA

A single item of metadata is a relationship that someone claims to exist between two entities, each of which may have an identifier (an unambiguous string denoting an entity) and must, in an automated environment: a piece of data comprising the two entities and the relationship between them. In the plural form, metadata refers to a set of these relationships (data) having one entity in common, and thus forming data about that entity, often summarized as ''data about data.'' Precise specification of metadata about the identified entity is essential to the consistent application of identifiers, including DOI.

The DOI approach to metadata adopted the indecs principles[5] derived from the collaborative indecs project and subsequently developed into the indecs Data Dictionary:

- Unique identification: Every entity needs to be uniquely identified within an identified namespace.
- Functional granularity: It should be possible to identify an entity when there is a reason to distinguish it.
- Designated authority: The author of metadata must be securely identified.
- Appropriate access: Everyone requires access to the metadata on which they depend, and privacy and

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confidentiality for their own metadata from those who are not dependent on it.

Well-formed metadata elements and schemes, which adhere to the *indecs principles*, can be understood outside a particular metadata scheme by the process of mapping through an ontology, an explicit formal specification of how to represent the objects, concepts, and other entities that are assumed to exist in some area of interest and the relationships that hold among them. The *indecs ontology* derives from the basic concept of a context: The circumstances in which an act occurs, encompassing the entities of time, place, agent, and resource. The indecs ontology has been further developed both in the DOI system and elsewhere and forms the basis of the DOI Metadata System (DMS), three components that provide well-formed and interoperable metadata to support the use of DOIs: the Kernel Metadata Declaration; indecs Data Dictionary; and Resource Metadata Declaration.

The Kernel Metadata Declaration is a publicly stated compulsory small standardized set of metadata elements for every DOI; this kernel is common to every associated Application Profile with associated metadata (i.e., all but those in the Zero-AP). Each resource identified with a DOI must have a supporting Kernel Metadata declaration. As the initial focus of DOI is on Creations, the initial kernel has been devised for Creations. Other types of resource are identified by DOIs only if involved in intellectual property transactions, or in internal DOI administration for the identification and management of Application Profiles and Services. When DOIs are applied to such other entities, the appropriate kernel will be defined.

The indecs Data Dictionary (iDD) is a structured ontology, developed from the indecs Framework, containing all terms used in DOI Application Profile metadata Declarations, ONIX messages, and other schemes commonly used for intellectual property and formal mappings of the relationships between them.

An Application Profile is a grouping mechanism for DOIs, a set of DOIs that share some common characteristics. Formally, a DOI Application Profile (DOI-AP) is the functional specification of an application (or set of applications) of the DOI system to a class of intellectual property entities that share a common set of attributes. It includes the kernel metadata (compulsory for all DOIs) and additional information applicable only to that particular sort of object. Each DOI is associated with one or more Application Profiles. Special cases of Application Profiles are:

- The Zero Application Profile (Zero-AP): A special case of an Application Profile in which the metadata set is empty. Only limited functionality is possible with DOIs registered in the Zero-AP.
- The Base Application Profile (Base-AP): A special case of an Application Profile in which the metadata set is identical to the *kernel*.
- Restricted Application Profiles (Restricted-APs): Special cases of an Application Profile in which the metadata set is not available to all users, appropriate for nonpublic uses of DOI.

The Resource Metadata Declaration (RMD) provides a nonmandatory model with comprehensive semantics and an XML schema for declaring resource metadata of any complexity, based on indecs. Therefore it is a tool to extend DOI metadata declarations to any desired level of specification while ensuring these are interoperable with kernel metadata and other Application Profile metadata declarations.

The DOI Metadata system seems at first glance rather complex. However, it is essentially simple as it follows logical principles. Furthermore, it can readily be used to answer practical question, for example, if I identify entity A with a DOI, and then I adapt it in some way to create entity B, should I assign a new DOI to entity B? The indecs approach shows that there can be no general rule that applies to all cases and each must be treated in context; if a DOI Registrant finds it useful to do so, they may. However, the rules of Application Profiles, and business rules of Registration Agencies, will help in deciding for DOIs registered in Application Profiles. The key point is that one must precisely specify what A is and what B is, because two digital entities are never the same in any absolute sense and can be considered copies of each other only in the context of some defined purpose.[6]

DOI RESOLUTION

Resolution is the process in which an identifier is the input (a request) to a network service to receive in return a specific output of one or more pieces of current information (*state data*) related to the identified entity, e.g., a location (such as URL) where the object can be found. Resolution provides a level of managed indirection between an identifier and the output. In the case of the DOI system, the DOI *Resolver* is the Handle System technology.[7–10] The Handle System provides a resolution capability that can operate throughout the internet; that is, ''the global information system that is logically linked together by a globally unique address space based on the Internet Protocol (IP) or its subsequent extensions; is able to support communications using the Transmission Control Protocol/Internet Protocol (TCP/IP) suite or its subsequent extensions/follow-ons, and/or other IP-compatible protocols; and provides, uses, or makes accessible, either publicly or privately, high-level services layered on the communications and related infrastructure described herein.''[11]

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In the DOI system, resolution is from a DOI to one or more pieces of typed data; that is, the pieces of data are of a defined family, e.g., URLs representing instances of the object, or services, or one or more items of metadata. A *DOI record* is the set of data (resolution values and administrative data) held in the DOI system as current state data associated with a specific DOI and returned in response to a resolution request. Conceptually, two cases are distinguished that are of significance in the DOI system: single resolution and multiple resolution.

Single resolution is resolution returning a specific output of one piece of state data related to the DOI-identified entity, specifically a URL. Single resolution was the basis of early applications of the DOI system, and of DOI persistent identification through naming because single resolution provides the redirection necessary to implement persistence when a location changes: The URL associated with the DOI changes, while the DOI itself remains unchanged; once a single change to the DOI record, all DOIs (wherever recorded or encountered) will resolve to the updated URL and so the user is transparently redirected to the new location (Fig. 2). The *Primary URL* is the default URL value that is provided from a DOI single resolution, and also provided as one value in the case of DOI multiple resolution and specifically denoted as such in the DOI record. The default URL may represent an instance of the identified entity, or some relevant metadata.

Multiple resolution is resolution returning a specific output of several pieces of state data related to the DOI-identified entity, specifically at least one URL plus defined data structures representing Application Profile and/or Service information. Multiple resolution goes hand-in-hand with managing the object and its available services through structured metadata.

The Handle System, the resolution component of the DOI system, is a general-purpose distributed information system designed to provide an efficient, extensible, and secured global name service for use on networks such as the Internet. The Handle System includes an open set of protocols, a namespace, and a reference implementation of the protocols. The DOI system is one implementation of the Handle System; hence a DOI is a *Handle*. DOIs are distinguished from other handles by additional features and functionality, specifically *metadata* and *policy* forming the totality of the DOI system. The Handle System is made up of multiple local handle services. A local handle service is made up of one or more sites, and a site is made up of one or more handle servers (Fig. 3). Handle servers store handles. One local handle service is unique, the

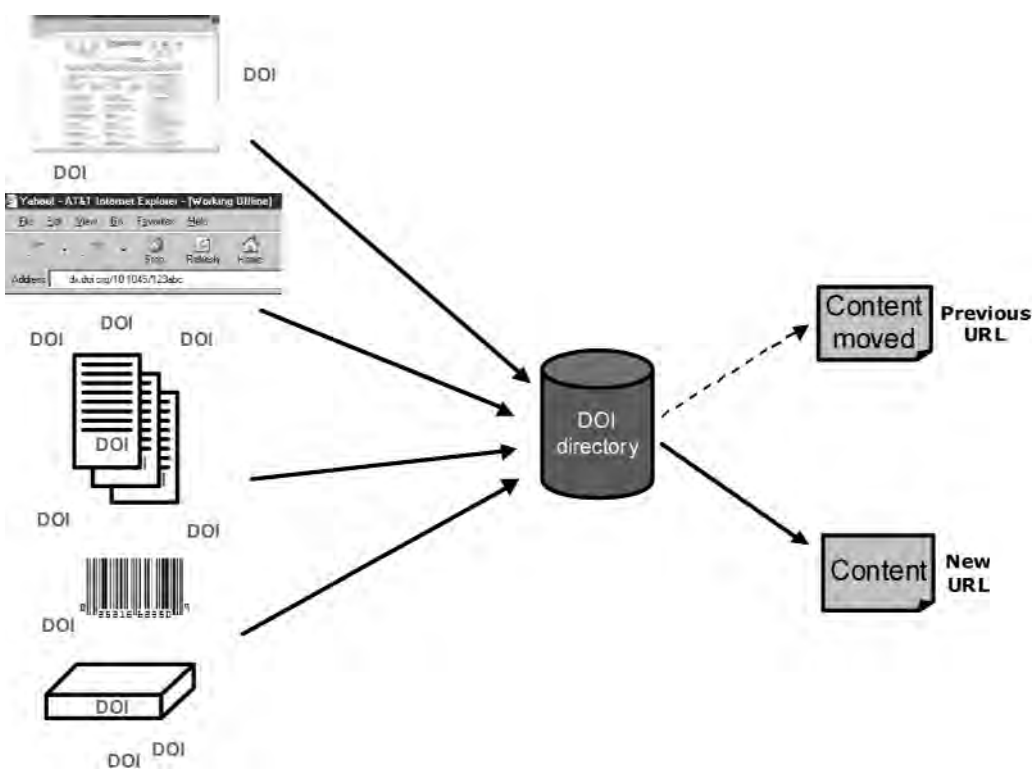

Fig. 2 The role of DOI in providing a persistent identifier. Content originally at one URL has been moved to a new URL. Through a single change in the DOI directory, all instances of the DOI identifying that content, even if already recorded in print, as bookmarks, etc., will automatically resolve to the new URL, without the user having to take any action. (©International DOI Foundation.) (*View this art in color at www.dekker.com.*)

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Global Handle Registry®, a unique *local handle service* that stores naming authority handles. A query to the Global Handle Registry reveals which local handle services store which handles. ''Local'' implies simply that the particular service may be physically or logically confined to storing some administratively convenient subset of Handles, such as all DOIs. Local handle services may also be implemented by a DOI Registration Agency for their DOIs, for convenience.

The process of resolution of a DOI is accomplished by either of two pieces of software: the *native resolver* or a *proxy server*.

- The native resolver is a freely available resolver plug-in that extends a Web browser's functionality so that it understands the Handle protocol. It will recognize a DOI in the form doi:10.123/456, and resolve it to a URL or other file type the browser recognizes. The user simply ''clicks'' on the DOI (or types the DOI into the address line in their browser) and the DOI is resolved directly. It has significant advantages (performance, functionality, nonreliance on other capabilities) when compared with the use of the proxy server and an unextended browser, the more common user interface to the DOI today. The development of additional services that depend on utilizing the full multiple resolution potential of the DOI will necessitate the user being able to manage DOI resolution directly.
- The proxy server is a gateway between the Handle System and HTTP that enables resolution of a DOI in the URL http://syntax (e.g., doi:10.123/456 would be resolved from the address: http://dx.doi.org/10.123/456). Any standard browser encountering a DOI in

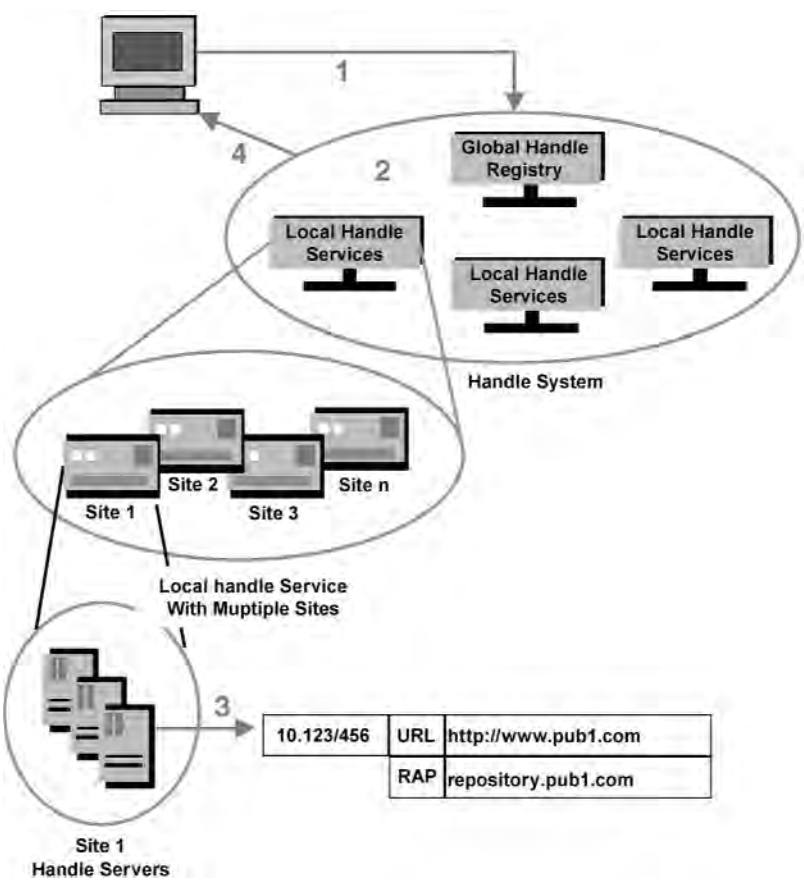

Fig. 3 Architecture of the Handle System. (1) A client such as a web browser sends the handle to the Handle System for resolution. (2) The Handle System consists of a collection of handle services. One service, the Global Handle Registry, is responsible for knowing the locations and name space responsibilities of all of the public Local Services. Each of these Local Services knows how to access the Global Handle Registry. This allows a resolution query to enter the Handle System at any point and to be routed to the specific service and server that knows the answer. (3,4) Each handle can be associated with one or more pieces of typed data. In this example, the handle 10.123/456 is associated with, and so resolves to, both a URL and a protocol called RAP. This is the information that is returned to the client. Note that it would also be possible to associate multiple instances of the same data type, e.g., multiple URLs, with a single handle. (From Handle System Overview, Laurence Lannom; Corporation for National Research Initiatives.) (*View this art in color at www.dekker.com.*)

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this form will be able to resolve it without the need to extend the Web browser's capability, unlike the use of the native resolver. The use of the proxy server and an unextended browser provides the more common user interface to the DOI today. The core DOI resolution service is used by the proxy but is not constrained by the proxy. DOIs used through a HTTP proxy server (in the ''http://dx.doi.org'' formulation as a URL) will continue to be persistent.

A DOI *A*pplication Programming Interface (API) has been developed as a tool used in managing DOIs in relation to underlying technologies. It provides a description of functionality in a modular conceptual layer above the technology that provides the functionality; in the case of DOI, the API provides specifications for using the Handle System but avoids the need for users to address the Handle System directly and in depth. The API ensures the portability of any code written to address DOI services and applications. The API provides a mechanism for relating Application Profiles to DOI records.

Several *DOI Tools* have been developed to facilitate the use of DOIs. These include a Handle plug-in extension to Acrobat and Acrobat Reader that looks for an embedded DOI identifying a PDF file as that file is being opened, and, if it finds one, resolves it and uses the resulting information to customize the reader icons, or pop-up windows, to offer services specific to the document being opened. Examples such as automatically alerting to the availability of a new version of the document have been demonstrated.

DOI POLICIES

DOI Policies are the rules determined by the International DOI Foundation for the operation of the DOI system in a consistent, predictable, and controlled manner to ensure longevity of the system as infrastructure. The policies focus on the relationship and obligations of the various parties involved in the system:

- The International DOI Foundation (IDF): The organization established to develop and manage the DOI system.
- Each Registration Agency (RA): An organization that participates in the DOI system by offering services to Registrants by agreement with the International DOI Foundation, including prefix allocation, registration of DOIs, and maintenance of sufficient infrastructure to allow Registrants to declare and maintain DOI metadata and state data, and optionally may offer additional services based on any business model.
- Each Registrant: An organization that registers DOIs through a DOI Registration Agency; usually, but not necessarily, the Registrant will have some commercial or legal rights or obligations in the material identified.

The DOI system's policy is designed to implement, in a managed, scalable, efficient, self-financing system, a unique set of functionality:

- Persistence—The consistent availability over time of useful information about a specified entity: Ultimately guaranteed by social infrastructure (through policy) and assisted by technology such as managed metadata and indirection through resolution that allows reference to a first-class entity to be maintained in the face of legitimate, desirable, and unavoidable changes in associated data such as organization names, domain names, URLs, etc. DOIs resolve to information (metadata) about an identified object in a manner intended to persist over changes in location, ownership, description methods, and other changeable attributes. If the object ceases to be available, the DOI at minimum indicates a valid but now defunct identifier.
- Interoperability—rich interlinking with related content, so as to increase the content's usefulness and visibility.
- Extensibility—the ability to later add new features and services.
- Efficiency—Through single management of data for multiple output formats (platform independence) and class management of applications and services, efficiency is gained.
- Dynamic updating—Metadata, applications and services need to be quickly and easily updated through managed state data.

The functionality is delivered through the provision of *DOI Services*. A DOI Service is a defined result from a defined action, i.e., do X and the result will be Y. DOI Services perform specific functions when presented with data from DOI Application Profiles. This may involve specific servers on the network or abstract notions such as a defined method for comparing dates in documents with dates in DOI records. DOI Service is used in the same generic sense as Web Services and the Grid Service architecture, but is not restricted to either of those models. Like Application Profiles, Services are separately managed as classes; DOIs, APs, and Services have many-to-many relationships.

The benefits of this functionality, because it is essentially generic and so rather abstract, need to be translated into specific illustrations that make sense for a particular community. For example, DOIs in enterprise content management convey the benefits of knowing what

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you have and being able to find and use it efficiently,[12,13] and convey these benefits into the supply chain.[14] DOIs for publishers provide improved discoverability, longer shelf life for access, and linking to related offerings. DOIs for citations (Fig. 4) improve the ability to create cross-links in the publishing production process,[15,16] etc. DOIs offer the necessary prerequisites of persistent identification, structured metadata, and scalable resolution necessary for digital preservation[17] and digital rights management.[18–20] The IDF has been instrumental in the development of several scenarios, white papers, and illustrative examples that may be found on the DOI website.

The DOI system has the specific policy aim of identifying any ''intellectual property entity.'' The primary focus of DOI applications is *Creations*: entities that are products of human imagination and/or endeavor in which intellectual property rights exist; resources made by human beings, rather than other types of resource (natural objects, people, places, events, etc). These may be manifested as Digital Objects, Physical Packages, Spatio-temporal Performances, or Abstract Works. They correspond to intellectual property as defined by the World Intellectual Property Organization: ''creations of the mind: inventions, literary and artistic works, and symbols, names, images, and designs used in commerce.'' Other types of resource are identified by DOIs only if involved in intellectual property transactions (or in internal DOI administration), and may be identified by DOIs where appropriate.

Implications of DOI Policy

There is a widespread recognition of the advantages of assigning identifiers as well as a widespread misconception that an abstract-free specification (like a URN or URI) actually delivers a working system rather than a namespace that still needs to be populated and managed. URLs, for example, have a clear technical infrastructure (standards for how they are made) but a very loose social infrastructure (anyone can create them once a domain name has been obtained, with the result that they are unreliable: They have no guarantee of stability, let alone associated structured metadata). Product barcodes, Visa numbers, and DOIs have tighter social (business) infrastructures, with rules and regulations, costs of maintaining and policing data, and corresponding benefits of quality and reliability. From this need for management stems some misconceptions about the DOI funding and business model. The most common myths are:

- The myth that DOI is for, run by, or only to the benefit of, commercial publishers. The publishing community was the first to see the benefits of persistent identification and to attempt to build an open system (rather than a system for, e.g., a library or a campus); several publishers have not only joined the IDF but provided initial loan funding, and the initial CrossRef application is in the publishing sector. However, there is nothing to prevent any other application or any nonpublisher involvement.

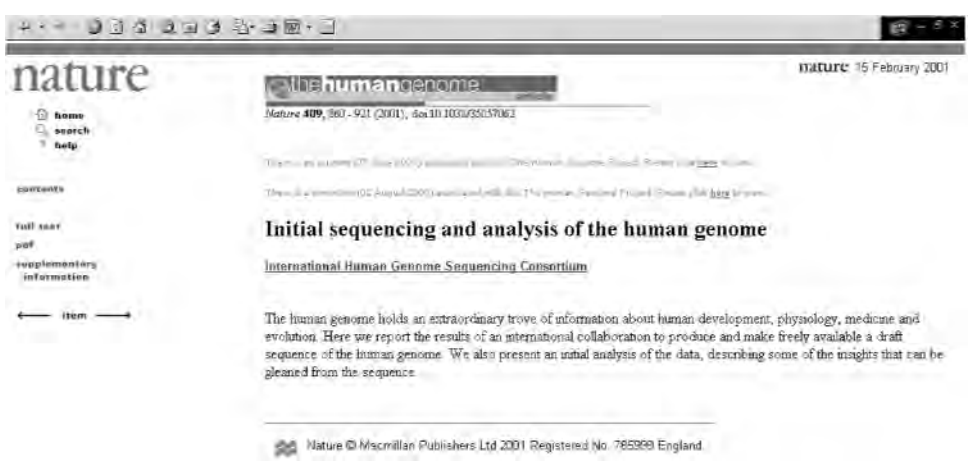

Fig. 4 Example of DOI used in journal cross-linking in the CrossRef system. A citation in an article is matched to the appropriate DOI by the CrossRef database of bibliographic data and associated DOIs; this can then be used to populate a commercial service with active, persistent links. The original citation is: ''Initial sequencing and analysis of the human genome,'' International Human Genome Sequencing Consortium, *Nature* 409, 860_921 (2001); doi:10.1038/35057062. Resolving (clicking on) the DOI for that reference produces the screen shown here. Note the explicit DOI in the citation at the top of the screen, and also the use of DOIs to link to related items such as errata and correction. (From ''demonstrations of DOIs in use provided by DOI Registration Agencies'' at http://www.doi.org/demos.html.) (*View this art in color at www.dekker.com.*)

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- The myth that DOI is ''a commercial packaging of something that is available for free elsewhere.'' The practical implementation offered by DOI is more than a collection of the underlying technical specifications.
- The myth that DOI is ''only for rights management.'' While that was the initial impetus, because rights management requires an extensible system, it is in fact applicable for any use.
- The myth that DOI is ''untested.'' All of the components are proven in other contexts, and there are millions of working DOIs. DOI builds on Handle and <indecs>, and so it inherits the strengths and real-world testing of these: For example, the <indecs> approach has been validated by rigorous analysis in the MPEG 21 framework development. These underlying technologies (rather than DOI per se) are often appropriate to answer the question of ''how the DOI relates to X.''
- The myth that DOI implementation ''allows only one business model'' (seeing a swan and claiming that all birds are white and swim). As more applications are developed, the flexibility of a system that deliberately allows any business model will be appreciated.

DOI HISTORICAL DEVELOPMENT

The DOI was launched in 1998, initiated by a collaborative effort of several trade associations (one in the United States, two international in scope) in the text publishing sector, to provide an extensible infrastructure for digital management of content—initially as a tool for naming digital content for publishers, although from the outset designed as a generic tool. The impetus for its creation was the recognition of the need for an equivalent in the digital world to highly successful identifier schemes such as ISBN for books and physical barcodes for consumer goods,[21] rather than reliance solely on unmanaged systems such as URLs. Almost immediately after the introduction of the first popular Web browser in 1993, the side effects on information management of disappearing links (changed URLs) became apparent. (Examples are commonplace: in their 1999 report on ''Digital Archaeology: Rescuing Neglected and Damaged Data Resources'', Ross and Gow[22] used 199 online references. In 2003, perhaps ironically less than 32% of these resources remain accessible.) The recognition of this problem led, in 1995, to the first major effort to make resource discovery easier: the Dublin Core initiative. The <indecs> activity of 1998–2000 considered interoperable data across all e-commerce media, for all purposes, not just resource discovery; it has been widely recognized as influential and developed into a key tool. An earlier but related activity, which soon became key to DOI, was discussed in the paper by Kahn and Wilensky[23] on digital objects, where they examined the concept of identifiers (handles) and reconceptualizing the Net from the movement of data packets to the management of information. The Kahn–Wilensky paper, in turn, resulted from the earlier work by Kahn et al. at the Corporation for National Research Initiatives on the basic digital object idea, which led to the development of the Handle System.

The DOI system is deployed via Registration Agencies (RAs) who are empowered to assign DOIs for a community under the aegis of the IDF. Growing numbers of RAs have been appointed, in the United States, Australasia, and Europe. They include a variety of organizations, both commercial and not-for profit, and include both startup companies building offerings around DOI and existing businesses who simply wish to add DOI as one tool in their service offerings.

The number of DOIs assigned is now over 10 million, from over 300 organizations, and growing quickly. The initial CrossRef implementation remains the largest user, but there is growing interest elsewhere, and applications will be stimulated by the availability of full application tools. As each RA comes on board, it brings a whole community into DOI usage.

The DOI is both a deployment and a development activity: The deployment of an initial implementation of persistent actionable identifiers (a DOI as a name for a piece of content, solving the broken link problem), and a development of a full implementation (using multiple resolution and interoperable metadata) as a common infrastructure for distributed content management at the level of ''meaning'' rather than ''bits.''

DOI IN RELATION TO OTHER TECHNOLOGIES

It is useful to consider how DOIs relate to some other standards and technologies with which there is often confusion.

Standards Bodies

The IDF has placed a strong emphasis on communicating with, and participating in, a wide range of related standards and consortia activities, and on building the DOI system from existing standards or collaborating with others where new standards are needed. The DOI is not a single technical standard, as it is not a ''pure'' technical standard but one with specific implementation requirements and policies (analogies are with existing successful identification implementations such as Visa, EAN/UPC

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codes, ISBN, etc. each of which build on standards). The IDF is not a standards development organization, but uses existing best of breed standards to develop a business implementation. A standardization route is followed where appropriate, e.g., the DOI syntax was an early formalized standard. The Handle System is an Internet RFC. The indecs framework was a multiple partner open collaboration.

Persistent URLs (PURLs)

A PURL[24] is a Persistent Uniform Resource Locator. Functionally, a PURL is a URL. However, instead of directly pointing to the location of an Internet resource, a PURL points to an intermediate resolution service. The PURL resolution service associates the PURL with the actual URL and returns that URL to the client as a standard HTTP redirect. The OCLC PURL Service has been strongly influenced by the active participation of OCLC's Office of Research in the Internet Engineering Task Force Uniform Resource Identifier working groups.

PURLs are all http and inherit both the strength and weakness of that approach. PURLS provide one level of indirection, just like a single value DOI handle, but all contained within a single server and that single server is permanently attached to a specific domain name. PURL servers do not know about each other. The redirection is functionally equivalent to the way DOI uses a Handle proxy, dx.doi.org, which reinterprets DOI Handle queries into http. PURL is equivalent to a local DOI that never goes beyond the proxy server approach and never makes use of the multiple resolutions and data types, metadata approach, and enforced common policy. The DOI system also provides a centrally managed redirection service rather than local PURL server management.

Open URL

The DOI system for resolution of identifiers to global services can be used with complementary technologies such as Open URL, allowing the contextualization of requests to those services to local requirements.[25] The Open URL framework, a generic means for bundling contextualized identifier/metadata packages designed to be extensible to new application domains and new transport methods, is already used with DOI to deal with the ''appropriate copy problem'' (resolution is sometimes required not to any generic instance of a piece of data, but to a particular copy that may have certain access rights as a locally held library copy). As Herbert Van de Sompel, Creator of Open URL/SFX, stated: ''When you don't have decent metadata, it's hard to provide decent services. That's why I am an enormous fan of unique identifiers for objects, and systems that allow you to obtain well-structured metadata by using those identifiers. For me the big deal of the DOI/CrossRef framework is not necessarily the links they provide, because that might be done in other ways. The crucial importance of that work is in the mere fact that objects are being identified, and that identifiers can lead to metadata about objects. That changes the whole game.''[26] The Open URL/DOI combination has proved very successful and is now in practical use with DOIs assigned via CrossRef[27] through several commercial services like EBSCO's LinkSource, Serials Solutions' Article Linker, Ovid's LinkSolver, and others; these allow end users to access all of a library's digital resources, regardless of whether they reside locally or remotely.

Uniform Resource Identifier/Uniform Resource Name (URI/URN)

The DOI meets the functional requirements of the two main approaches that have been proposed for dealing with first-class objects on the internet: the URN and the URI. Broadly, the URN approach is favored by IETF and the URI approach by W3C, although there is considerable room for discussion and, crucially, widespread practical implementations of object naming do not exist (both URI and RN are specifications, not full-working implementations). The DOI is de facto such an implementation. A detailed discussion of the technical implications of these approaches may be found in the DOI Handbook.

There is currently considerable debate in the Internet communities on the wider issue of naming standards. DOI is capable of being used in any specification that may finally be endorsed. Until a clear consensus is reached in the Internet communities on which approach is to be preferred, DOI remains ''agnostic.''

The DOI, as an identifier, stands on its own. When used in a Web context, such as in a Web browser plug-in or http-to-handle proxy, it can be put in the form of a URI with a scheme doi: In this sense, it is no different than a telephone number.

A ''doi'' URI may serve as a pure name or may be dereferenced by a network service. When used as a name, a doi-based URI is independent of any service protocol and accordingly is not network dereferenceable. When used within a network reference (e.g., within a hyperlink), a DOI identifier does not have a native resolution system, but is instead transported using a network protocol to a specific service (e.g., the Handle System or an HTTP request to a proxy), which may also include supplemental query components specific to that service. Note that in current practice, all DOIs are Handles, registered in and resolvable through the Handle System.

The URN/URI distinction is clear at the implementation level. URIs are not intended to rely on any additional

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network services. A software client either knows what to do with, e.g., ftp, or it does not. The URN architecture assumes an additional network service that would allow a client to deal with a previously unknown URN type, e.g., urn:doi. Specifically, a DNS-based middle layer (RDS) is used to find the specific service appropriate to the given URN scheme. URN resolutions are then delegated to that scheme-specific resolution service. However, no such implementations are currently in use.

Domain Name System (DNS)

DOI resolution in native resolver form does not require the use of the DNS, although does of course when used with the proxy resolver. The Handle System is more appropriate for large numbers of digital objects than DNS, and the DNS administrative model argues against using it as a general-purpose name system (DNS administration typically requires a network administrator, and has no provision for administration per name by anyone other than a network administrator). DNS also has well-recognized problems of security and updating,[28] which suggest that it will not be sufficient to assume that existing DNS technology should be adapted to deal with new requirements, rather than inventing something new: Peer-to-peer networks already presage this.[29]

URLs are grouped by domain name and then by some sort of hierarchical structure, originally based on file trees, now possibly unconnected from that but still a hierarchy. DOIs offer a more finely grained approach to naming where each name stands on its own, unconnected to any DNS or other hierarchy. This offers beneficial flexibility, especially over time, as the document origins reflected in that hierarchy lose meaning, such as a change in ownership that is reflected in DNS. A DOI, DOI Application Profile, and DOI services are layers of abstraction that allow more flexible management of sets of DOIs, in a more useful way than as a fixed subdomain.

CONCLUSION

The Digital Object Identifier system provides a system for the identification and hence, management of information (''content'') on digital networks, with the aim of providing persistence and interoperability. The DOI system is not designed as a single application, but to provide a generic framework of identification, resolution, metadata, and policy that can be applied to all entities in a network environment.

The DOI system is a full implementation of fundamental principles of identification, resulting in a practical implementation already widely adopted in technical publishing and extending to other sectors. It provides both underlying technical standards and practical policies for a cost recovery, self-supporting network of implementation, including both automated processes and necessary human intervention.

The DOI system uses existing standards while also collaborating with leading work in naming and metadata to develop proposals for further evolving appropriate agreed standards. The system is developed and managed by the nonprofit International DOI Foundation, which aims to work with existing standards and partner organizations to facilitate wide uptake of the DOI.

The landscape of identification and naming is a complex one; however, with over 10 million DOIs currently (August 2003) assigned, the DOI system is a notable exception to many other proposals in being a proven success and has demonstrated that the system is resilient and scalable and able to support production-scale applications. Support from the publishing industry is now extending to other sectors.

The International DOI Foundation is now articulating further aspects of the system, both technically (with the development of multiple resolution and application profiles) and organizationally (reaching out to numerous communities to demonstrate that DOI can facilitate both autonomy and interoperability).

A system such as DOI is needed to bring a practical implementation of what has long been recognized as a fundamental lack in Internet technologies: The ability to treat content entities as first-class objects.

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Digital Reference

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INTRODUCTION

Digital reference refers to a network of expertise, intermediation, and resources put at the disposal of a person seeking answers in an on-line environment. Also known as virtual reference (and sometimes chat reference, or real-time reference), it takes many forms including e-mail, web forms, chat, and instant messaging. Advanced digital reference software can incorporate video conferencing, shared web browsing, and even allows a remote librarian to take control of a patron's computer. Yet all of these technologies serve the same fundamental purpose: to provide human intermediation to a patron on-line.

OVERVIEW

There are many terms used to described the study and practice of digital reference (e.g., virtual reference, real-time reference, chat reference, real-time chat reference, live reference) but all share a central concept: the use of software and the Internet to facilitate human intermediation at a distance. While the practice of digital reference varies from librarians on-line chatting instantly with patrons, to a pooled networks of experts using e-mail to route question across the country, to web applications linking libraries of all types internationally, all of these services are seen as having a common set of issues and needs. These issues range from policy (protecting personal information in a digital environment), to technology (interoperating with partners and consortia in answering reference questions on-line), to staffing (how does one train reference staff to work on-line).

The years between 1997 and 2003 have seen the emergence of a digital reference community. While digital reference in some form has existed for decades in these years, the practice of providing human intermediation on-line has exploded to libraries of all types, and these libraries have banded together as a common community to identify and solve problems. They have created mailing lists,[1] conferences,[2] and large-scale consortia efforts.[3] There have also been efforts to create quality standards,[4] technical standards,[5] and a research agenda.[6]

DIGITAL REFERENCE BACKGROUND

The digital reference field has two progenitors. The first is in traditional library and information science (LIS), particularly LIS practice. The second major contributor to digital reference is the category of Internet services known as AskA services, or expert question/answer sites.

Library Reference

Digital reference as an examination of the librarian's role in a digital environment began with e-mail reference efforts. These efforts extended the traditional core reference function of the library past the reference desk to the desktop. Users were able to ask reference questions and consult with trained librarians through e-mail. Still and Campbell[7] provides an excellent example of early e-mail reference studies. This thread of digital reference concerns issues such as the role of the librarian in cyberspace, the impact of distance service on the traditional reference interview, evaluation,[8] and new skills needed by the information professional.[9]

AskA Services

The second progenitor to the current digital reference arena is that of AskA services.[10] AskA services (so-called because services tend to take on names such as Ask-A-Scientist, Ask-A-Teacher, and so on) are expert-based question-and-answer services. They use networked communities of experts to answer questions via the Internet. AskA services have been extremely popular on the Internet, and have given rise to a separate set of issues concerning system development and scalability.

CURRENT ISSUES IN DIGITAL REFERENCE

As with any rapidly evolving field, the issues, problems, and opportunities in digital reference constantly change. However, several issues have emerged as particularly cogent:

- Selecting the best mode of interacting with the patron: There are a variety of means of interacting with the patron in digital reference. Many have divided these

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modes into two classes: real-time, in which the patron and librarian interact simultaneously, and asynchronous, where patrons ask questions through e-mail or the web and wait for a reply. While there is some debate on how different these two forms are, it is nonetheless reality that in today's digital reference market libraries must choose software often built to support only one of these paradigms. There is a growing amount of research and development into merging these forms of interactions, and identify when a patron needs an immediate consultation with a librarian or when the question can be given more time to chose the appropriate answer.

- Developing policy for digital reference: There is little debate that digital reference is simply a particular case of reference service. However, there are challenges present in the digital environment that are not present at the traditional reference desk. The most notable difference is the creation of reference artifacts (e.g., transcripts, e-mails, knowledge bases). In face-to-face and phone reference, little in the way of patron questions or information is captured. In the digital environment, a great deal of personal and identity information is captured with reference questions. E-mail addresses, backgrounds, and the default capturing of identifying information require new policies and methods for ensuring patron privacy, adherence to copyright, and compliance to the use of licensed resources. Furthermore, with the widespread adoption of transcripts for evaluation, new reference policies are needed to outline staff rights of privacy, intellectual property, and the use of transcripts in personnel evaluation.
- Staffing the virtual reference desk: Is staffing a virtual reference desk (a digital reference services) equivalent to staffing the traditional reference desk? In some respects, the same core librarian skills of the reference interview, knowledge of sources, and an ability to find information are identical. However, managing the software of digital reference, communicating in a primarily text environment, pushing pages, and designing interfaces are new skills. Library administrators must wrestle with how to impart these new skills to a staff. Additionally, they must determine how to deal with staff who are reticent to move to a digital environment. They must determine where to put digital reference librarians (on desk, or answer from their offices). Increasingly, librarians must also coordinate their staffing activities with other libraries in consortia.
- Integrating digital reference into the larger library enterprise: As with most innovations, digital reference began with a small group of pioneering individuals doing the task on their own time. As digital reference moves into the mainstream of library operations, there must be a conscious attempt to link digital reference policies and objectives to those of the library as a whole. Digital reference cost must be evaluated in terms of the whole library's service population and priorities.
- Software and standards to facilitate digital reference: Digital reference, by its very nature, is dependent on software. Two perennial issues in digital reference relate to the features of software (what are they, how do you evaluate them in purchasing decisions, or how do you create them in in-house development efforts) and their ability to interoperate. Whether a library chooses to buy or build software, it is an important, and often a resource-intensive decision. Libraries are increasingly becoming concerned with the long-range impact of these decisions as they seek to work with other libraries. One means of ensuring long-range interoperability is to seek software conforming to open standards. One issue is what standards apply to digital reference, what standards need to be developed in this arena, and how can these standards be incorporated into software.
- Evaluating the costs and benefits of digital reference: Evaluation is one area where digital reference has actually been in front of the development curve. However, digital reference suffers from the same ambiguities of traditional reference service. So, where there has been little agreement in determining costs of reference, so too there is an issue in costing digital reference. The primary advantage in the digital setting is the production of clearer records (transcripts, list of recommended links, e-mails) that can be used for more thorough evaluation and data mining.

While this is not a comprehensive list of issues, they represent ongoing work in the field.

DIGITAL REFERENCE PROJECTS

Digital reference issues, as in the digital library community, are not being considered in the absence of development. There are many digital reference projects underway. Studies by Janes[8] have estimated that nearly 44.7% of academic libraries had a digital reference service in 1999. While the numbers were smaller in the public library sector, the numbers were still significant. There are also large-scale projects underway as well.

LARGE-SCALE DIGITAL REFERENCE PROJECTS

Each of the following projects represents different aspects of the digital reference community (although the populations involved tend to overlap).

- The Virtual Reference Desk—A project of the National Library of Education, this service has created a

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network of over 20 organizations, mostly from the AskA community. This project utilizes human intermediation in both answer formulation and triage of questions. http://www.vrd.org.

- QuestionPoint—Spearheaded by the Library of Congress, this service is still in testing stages. However, it already involves over 60 libraries of different scales and missions. This service is asynchronous, and relies on the use of site profiles and service level agreements to automate routing of questions through the network. http://www.questionpoint.org.
- 24/7—A network based in California, but linking libraries and subject experts across the world to answer questions. http://www.247ref.org.

These are just the major examples of digital reference systems. Others include AskERIC, the Internet Public Library, and the MAD Scientist Network.

CONCLUSION

Digital reference is a growing and evolving field. It constitutes a set of issues and practices that are driving a reevaluation of reference as a whole. Reference librarians are quickly taking to a new medium of providing services on-line. A growing market of software options is leading to new issues in policy, training, and standards. Ultimately, digital reference is a growing community of professionals dedicated to not only putting reference librarians on-line, but reevaluating and improving reference as a whole.

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Domain Analysis in Information Science

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INTRODUCTION

Information science (IS) is a field that aims at providing better library, documentation, and information services to various groups of people. It has been very much driven by technologies developed outside IS itself. However, IS is not the same as computer science, but is a field in its own right. Historically, IS developed out of special librarianship and documentation. People in the field were originally subject specialists who worked to improve scientific and scholarly communication in their respective fields, or in general. In schools of IS, many attempts have been made to construe a theoretical framework for practical-oriented information activities.

In the beginning and the middle of the 20th century, subject knowledge played an important role in information science, as indicated, for example, by the inclusion of entries on different domains in *Encyclopedia of Library and Information Science*. It has subsequently been ousted by views that have implicitly denied the importance of content and social context. From about 1975 to 1990, the cognitive view was probably the most influential theoretical framework in IS, although it is difficult to outline any coherent view in the mixture of different approaches in the field. Mostly new ideas are coming and going without leaving any permanent improvement in the theoretical and conceptual structure of IS. The general impression is that the field badly lacks theoretical guidance.

Domain analysis (DA) is a view that claim to be in accordance with the history of information science and at the same time to be able to provide a satisfactory and coherent theoretical view of all the phenomena in the field as well as to integrate various subdisciplines such as bibliometrics, document representation, document retrieval, information seeking, etc. Although DA was clearly formulated as an alternative to the cognitive view, nobody has so far tried to seriously argue with it. It is rather the case that some adherences of the cognitive view have modified their views to avoid the criticism implied by DA. This makes it difficult to identify any clear alternatives to DA in IS today, although much research in the field implicitly built on universalistic assumptions that are contrary to DA.

SUBJECT KNOWLEDGE IN INFORMATION WORK

Major research libraries and information services used to and still tend to use subject specialists for selecting documents, organizing documents, help users search for information, and similar core information functions. There are often separate departments for descriptive cataloging (performed by general librarians) and subject cataloging (performed by subject bibliographers). Subject specialists may be educated in a subject, e.g., chemistry, law, music, or psychology. They are mainly hired on their subject-specific education, but are mostly given additional training in information science. Subject specialists have domain knowledge that is relevant in, for example, indexing documents in that particular domain. They often feel that they work in their subject field and need to know more about this (and perhaps know more about computers), while they may not articulate a need for knowledge in IS. Nobody denies the need for subject knowledge in information work, but one can ask whether most of what subject specialists have learned is necessary for information tasks, and one can ask whether it is sufficient for such tasks. Anybody who claim to be an information scientist should be able to provide good arguments for the nature and necessity of IS in relation to such tasks; that is, to formulate *general* theoretical principles about such tasks.

The domain analytic point of view (cf. Refs. [1,2]) is that subject specialists are not per se information specialists. They may have much tacit knowledge that enables them to index book, search information, and so on. Typically, they can do this in their field of expertise and from this point they can broaden their competencies in a bottom–up manner, while information specialists have general competencies about information sources and from this point may specialize in a top–down fashion. Subject specialists still need knowledge about, for example, the meaning of relevance, criteria for the quality of indexing, as well as theories about all other aspects of IS.

Traditionally, IS was founded by subject specialists, but remained unclear as to the role of subject knowledge. The founders of Knowledge Organization such as Cutter,

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Richardson, Sayers, and Bliss recognized the need for subject knowledge. For example, Ernest Cushing Richardson and Henry Bliss wrote:

> ''Again from the standpoint of the higher education of librarians, the teaching of systems of classification...would be perhaps better conducted by including courses in the systematic encyclopedia and methodology of all the sciences, that is to say, outlines which try to summarize the most recent results in the relation to one another in which they are now studied together, ...'' (from Ref. [3], quoted from Ref. [4], p. 2)

Subject knowledge was and is still taught in many major schools of LIS, but this component has generally declined and has had difficulties in formulating the theoretical implications for general IS. Especially after 1975, IS has tended to ignore the important differences between domains, such as, for example, the sciences and the humanities. When the first edition of *Encyclopedia of Library and Information Science* 1968–[5] was published, the study of subject literatures played a more important role than it does today. This encyclopedia contains articles such as:

- Biological literature
- Business literature
- Economics literature and periodicals
- Geographical literature
- Historical literature
- Humanities and its literature
- Mathematics literature
- Medical literature

Today it is more difficult to find experts in disciplinary literatures in IS.[a] Some important research on different domains is being performed by bibliometric researchers. Broader research in specific domains are also performed, such as the program in chemoinformatics in Sheffield,[7] which can be interpreted as an exception from the general tendency toward a weakening of subject-specific approaches in schools of library and information science and generally within IS.[b] However, at no time, IS has developed a satisfactory theoretical frame and much research in the field implicitly or explicitly built on universalistic assumptions that are opposed to the basic assumptions in DA.

Until the formulation of DA in IS circa 1993, the fundamental issue about the role of subject knowledge has not, to my knowledge, been seriously addressed in the field. There have been some important empirical studies about the role of domain-specific knowledge[8] without any clear conclusions and without any overall theoretical frame. It has more been the case that two ideologies have been fighting each other than it has been a serious attempt to build a science and profession on a basis that contains a clarified attitude toward the issues related to subject expertise and the nature of knowledge.

The domain analytic view implies that an information scientist should study knowledge domains either singly or comparatively. To be an information specialist with a given specialty is not to be a subject specialist in the ordinary sense, but rather to be an expert in information resources in that field. Information scientists should be trained using bibliometric and other methods *specific* to information science.[9] Subject knowledge is recognized as being of immense importance for information science and should not be underestimated. However, it should be approached with a clear IS perspective. Most subject specialists have a training providing much knowledge of lesser importance in information work just as they need knowledge that has an explicit focus on informational problems.

Apart from IS, may domains be studied from many different perspectives, e.g., anthropological, historical, linguist, philosophical, or sociological perspectives. All these fields belong to the field of metascience, the science of science (although, as mentioned, it is broader than just science[c]). It is important for information research to provide a unique perspective within metascience.

> The specific focus of library and information science on a given domain is the providing of library and information services, such as selecting documents, facilitating the retrieving of documents, design classification systems, index documents for the community belonging to the domain *as well as the ideal purposes which the domain is meant to serve in society*.

Information scientists should know about the system of communication in different domains, the kinds of documents produced, their genres, special languages, specific

[a]Those articles also appear in the second edition.[6]

[b]An anonymous referee on this article stated: ''actually, a lot (possibly most) of ''digital library'' development is domain-specific: bioinformatics, law information systems, music digital libraries, etc. Bibliographies are commonly, usually, even, domain-based.'' My question is, however, if such knowledge is represented within the research community of LIS or if such systems are just developed ad hoc, without guidance from or dialog with researchers in LIS? Are valuable experiences in developing systems based on domain-specific knowledge being interpreted and communicated to the LIS community?

[c]The term ''cognitive science'' (or ''cognitive studies'') in a way covers this broader perspective better compared to the term metascience. However, the cognitive research program tends to ignore the cultural and social context in the theory of cognition. It is often putting things upside down.

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functions, etc. Information scientists should know who the knowledge producers are, who the intermediate actors are, who the users are, and how all these agents, institutions, and services are connected in social systems. They should know about relevance criteria/quality criteria for selecting documents, for indexing documents, and for retrieving documents. Such relevance criteria can be either the user's subjective relevance criteria, or it could be criteria that a public library can use as arguments for its basic policy (e.g., functions of enlightenment, of improving peoples health, etc). Information scientists should also know how the field is structured (or rather should be structured). Such structures of the field are important to classify the literature as well as to other purposes such as providing a differentiated policy toward different subdomains. Of interest to IS theory is also the different nature of domains and the different kind of users served. Are there important differences between science and the humanities? Between ''professionals,'' ''amateurs,'' ''hobbyists?'' How is the study of everyday life related to domains in IS?

WHAT IS A DOMAIN?

Ontological, Epistemological, and Sociological Dimensions

A domain may be a scientific discipline or a scholarly field. It may also be a discourse community connected to a political party, a religion, a trade, or a hobby.

A scientific discipline is normally defined by its object, e.g., botany by plants, zoology by animals, psychology by minds and behaviors, history by the past, theology by God, etc. A theory of what objects exist in the world is called *an ontological theory*. Domains are normally defined by ontological theories (at least implicitly).

Knowledge development is not just the adding of new elements into a pre-established classification. As knowledge develops, so does the view of structure of the world and the relations between different concepts. Parts of the world that were previously regarded as unconnected may suddenly turn out to be strongly related. In this way, our ontological theories are changed, and by implication also our conceptual structures and social structures (e.g., by the development of new interdisciplinary fields). It is an old rationalist dream to uncover the structure of the world as well as the structure of our knowledge a priori, once and for all. This is related to the dream of a perfect language and perfect systems of knowledge organization. Few people today regard this dream as based on solid grounds.[10]

Epistemological concepts are concepts about how we know existing things (e.g., empiricism: knowledge is obtained through the senses; or rationalism: knowledge is obtained through rational analysis, e.g., mathematical analysis). All human knowledge is influenced more by some epistemological ideals compared to others: They are more or less influenced by different ''paradigms.'' (This is, by the way, not just true about science, but also about everyday cognition). There are mutual dependencies between ontological and epistemological theories. If you believe, for example, that science should stick to what can be observed, you tend to reduce reality, e.g., reduce social ontology to individual behavior.

It follows that a given domain may have different definitions caused by different theoretical views or different interests associated with it. When this is the case, a given definition is reflecting a particular view or interest. Domain analysis should be based on the accumulated knowledge in ontology and epistemology. It may be easy to just do some kind of classification of a domain. If it is not based on the knowledge of various views of that domain, it will probably turn out to be a naïve solution that is unsatisfactory for advanced users. It is important to know the basic ontological and epistemological views (or ''paradigms'') on the domain and their implications for classifying that domain.

Sociological concepts are concepts about groups of people studying knowledge fields (e.g., scientists, professionals, or people with a hobby). The sociological dimension is central in domain analysis, as revealed in the formulation in Ref. [2], p. 400: ''[Domain analysis] states that the most fruitful horizon for IS is to study the knowledge domains as thought or discourse communities, which are parts of society's division of labor.'' The structure of social domains is explored by Mattei Dogan, who finds that few researchers today master a whole discipline while the important units are the specialties, which are very often cross-disciplinary: ''There is more communication between specialties belonging to different disciplines than between specialties within the same discipline.'' (Ref. [11], p. 14852). He also states that specialties are constructed ''along substantive, epistemological, methodological, theoretical, and ideological lines . . . The division of disciplines into specialties should be distinguished from their fragmentation into schools and sects. The term ''school'' refers to a group of scholars who stress a particular aspect.'' Ref. [11], p. 14852).

The dynamics of specialties and disciplines is addressed by Tengström, (Ref. [12], p. 12) who emphasizes that cross-disciplinary research is a process, not a state or structure. He differentiates three levels of ambition regarding cross-disciplinary research:

1. The ''Pluridisciplinarity'' or ''multidisciplinarity'' level.
2. The genuine cross-disciplinary level: ''interdisciplinarity.''
3. The discipline-forming level ''transdisciplinarity.''

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What is described here is a view of social fields as dynamic and changing. Library and information science, for example, can be viewed as a field that started as a multidisciplinary field based on literature, psychology, sociology, management, computer science, etc., which is developing toward a discipline in its own right.

Ontological, *epistemological*, and *sociological theories* and concepts are interacting in complicated ways. The realist philosophy regards ontological entities as influencing human language and thinking and subsequently organizing groups of people studying those entities. For further arguments for this realist view, see Ref. [13]. However, the opposite theory is influential today. That is, the social constructivist view that the social organization is the primary determinant and that the ontological entities are not discovered by science, just made up. Different disciplines and other forms of social organizations and power relations *construe* their own objects. This position does not recognize the existence of a mind-independent reality: It is antirealist. Thus we have two very different and conflicting views of what constitutes a domain: the realist and the antirealist view. This conflict is more or less visible in all fields, including the so-called hard sciences. The problem of realism vs. antirealism is not just ''an academic question.'' It is a question of central importance to information science because a realist view implies a focus on the objective pole, while an antirealist view implies a focus on the subjective pole. The increasing neglect of subject knowledge in information science and the focusing on users and their cognition may thus be seen as a development from a more realist position to a more antirealist position and this will probably turn out to be a blind alley.

All three dimensions are important in domain analysis. Domain analysis explores ontological relations, e.g., generic relations in thesauri and classification systems. It also studies social groups such as scientists, professionals, students, or children. Finally, it studies epistemologies, paradigms, traditions, and theories, which is important because people tend to organize themselves according to their views. For example, Hjørland[14] demonstrated that scientists's relevance criteria are closely connected to their epistemological views. The interaction of these basic concepts is complicated but it is important for IS to uncover more precisely how they interact in the forming of domains.

APPROACHES TO DOMAIN ANALYSIS

In Ref. [9] I have suggested 11 specific ways to study domains in IS, which together define the specific competencies of information scientists and information professionals:

1. Producing literature guides.
2. Producing special classifications.
3. Research on indexing and retrieving specialties.
4. Empirical studies of users in different fields.
5. Bibliometrical studies.
6. Historical studies of information exchange.
7. Document and genre studies.
8. Epistemological and critical studies.
9. Terminological studies, LSP, discourse studies.
10. Studies of structures and institutions in scientific communication.
11. Domain analysis in professional cognition and artificial intelligence.

In this article, we cannot go into detail about these approaches. However, in Ref. [9] I have provided a state-of-the-art review concerning the application of those approaches and also given some hints about their mutual relationships. While these 11 approaches may be used separately (and some of them are often used and taught in a ''general'' way), the application of more than one to the same domain may provide a deeper understanding of underlying dynamics. The approaches need to be tested on specific fields. It is a real mistake to believe that one is better off if one knows nothing about information systems in any particular domain.

Example: If we take a given domain, say art, a domain study can map the different actors, institutions, and communication processes in that domain, e.g., the artists, the art reviewers, the museums, the art historians, the scholarly literature, the libraries, the databases, and so on. The UNISIST model is fruitful in this process.[15]

However, such a mapping is depending on a view of what is (good) art. In a given society, there are majority and minority views about what is (good) art, why an epistemological study of the art domain is also necessary. Ørom[16] has pointed out that art has been influenced by different ''paradigms'' such as ''the iconographic paradigm'' and ''the stylistic paradigm.'' These paradigms have influenced the way art exhibitions have been designed, the way art literature is written, and the way library classifications are designed. Based on such an analysis, he is able to analyze dominant views in, for example, classifications such as *Library of Congress* (LC) and *Universal Decimal Classification* (UDC). It should not be difficult to expand this analysis to all other information science areas such as bibliometrics, IR, relevance assessments, etc. One may, for example, study bibliometrical patterns in scholarly art literature and study the relative influence of different paradigms. If one is going to construe a guide to information sources about art,

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> then both this epistemological study and the study of actors, institutions, etc. would be a precondition if one want to base such a guide on well-argued criteria.
>
> A basic argument is that any work of art, any text on art, and any information system on art is always based on a certain view of art. This is inescapable, why it must be considered in information system design and management. Domain analysis is a research program in information science that provides general methodological principles for such tasks.

Domain analysis does not imply that information science should dissolve into separate studies of various domains. There are general methods and principles by which domains should be explored in IS (c.f. the UNISIST model presented in Ref. [15]).

Information science should be organized both in relation to different domains and to different processes, levels, approaches, kinds of systems, etc. The comparative perspective: The examination of how knowledge domains differ on some points and are similar on other points is important to construct *a general information science* that is not just an empty abstraction.

THE SOCIOCOGNITIVE VIEW

Even if domain analysis has the domain as its primary focus (and thus not the individual), it nevertheless also has a view on individual cognitive processes. This view is termed *the sociocognitive view* and is related to both American pragmatism and to Russian historical–cultural psychology. Important names in these traditions are John Dewey and L.S. Vygotsky, respectively.

A basic assumption in this view is that small children's cognition is mainly determined by biological principles. When children learn language, symbols, etc., the cognitive processes are increasingly mediated by signs, meaning, and symbols, which are internalized in the individual and then reprogrammed the way cognitive processes work. Such systems of signs and symbols are first developed externally. They are culture specific and partly social and domain specific.

People's use of information may be partly biologically determined. Some people like music much more than others and therefore they use more information about music. Some people have a flair for mathematics; others try to avoid it. However, when we speak of people's relevance criteria in relation to IR, they are mainly determined by cultural factors. They may, for example, be determined by theories or ''paradigms'' in knowledge domains, as demonstrated by Ref. [14].

When searching for literature about a topic, say schizophrenia, the relevance criteria are implied by the theory, tradition, or ''paradigm'' to which the searcher subscribes or belongs. Psychoanalysts prefer psychoanalytical papers, cognitivists prefer cognitivistic papers, etc. Relevance criteria are socialized into the individual from the academic tradition in which the individual has been raised (and to which the individual may add, modify, or change relevance criteria).

What is the difference between the sociocognitive view and traditional cognitive views? Peter Gärdenfors[17] wrote:

> ''The role of culture and society in cognition was marginalized in early cognitive science. These were regarded as problem areas to be addressed when an understanding of individual cognition had been achieved...
>
> However, when the focus of cognitive theories shifted away from symbolic representations, semantic, and pragmatic research reappeared on the agenda...
>
> ...a second tradition turns the study program upside down: actions are seen as the most basic entities ...''[17]

Thus the sociocognitive view turns the traditional cognitive program upside down. It emphasizes the internalization of culturally produced signs and symbols and the way cognitive processes are mediated by culturally, historically, and socially constructed meanings. Less priority is given to ''hardware'' whether in brains or computers.

Domain analysis consequently does not conceive users in general, but sees them as belonging to different cultures, to different social structures, and to different domains of knowledge. Information producers, intermediaries, and users are more or less connected in communities that share common languages, genres, and other typified communication practices. There are different *semantic distances* between the agents.

PRAGMATIC REALISM

In Ref. [13] it is argued that information science and DA should be based on a view that is termed ''pragmatic realism.'' The basic realist claim is that a mind-independent reality exists. That for example, the mountains existed before mankind and that they exist independent of what the human mind thinks about them. This does not imply that we know reality, that our knowledge is true, or that science is necessarily approximating reality. It is important to look with skepticism on all knowledge claims and not to confuse claims with truth. Nonetheless, it is the realist view that a mind-dependent reality exists, and that this has important consequences

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for how research should be carried out in both information science and all other sciences.

Pragmatic realism differs from other kinds of realism. It is not a naïve realism that is based on some kind of fundamentalism, such as empiricism or rationalism. Thomas Kuhn may be interpreted as pragmatic realist. While Kuhn emphasized how our ontologies are implied by our theories and paradigms, he nevertheless emphasized that we cannot freely invent arbitrary structures: ''nature cannot be forced into an arbitrary set of conceptual boxes. On the contrary ... the history of the developed sciences shows that nature will not indefinitely be confined in any set which scientists have constructed so far.'' (Ref. [18], p. 263), The world provides ''resistance'' to our conceptualizations in the form of anomalies; that is, situations in which it becomes clear that something is wrong with the structures given to the world by our concepts. In this way, Kuhn's view may be interpreted as (pragmatic) realist, although he is often interpreted as antirealist.[19] Such a view is contrasted by, for example, empiricism, rationalism, positivism, and social constructivism. However, I would hasten to add that some important and interesting recent writings in information science is provided under the banner of social constructivism and the research approach known as discourse analysis.[20,21] Social constructivism shares with pragmatic realism a historical as well as a social and a political perspective that is absent in traditional epistemologies.[22]

What are the implications of pragmatic realism for information science? Basically, the implication is that it becomes important to carefully distinguish between objective and subjective knowledge.

When users seek information, they always do so on the basis of their subjective knowledge. They may or may not be familiar with the objective possibilities for searching. For example, users may not know about citation indexes and they may thus miss an important search opportunity that objectively exists.[23] When studying users' information-seeking behavior (which is, of course, based on the users' subjective knowledge of information sources), information scientists need to base such studies on knowledge about the objective possibilities. One can say that nobody knows the objective possibilities, but the argument is that information scientists should know them better than the users that they are investigating. Information scientists, more than the users, should know about possibilities and limitations in search engines, citation indexes, thesauri, controlled vocabularies, etc. They should advice the users on how to exploit those possibilities. Consequently, when studying users' behavior, this should be interpreted on the basis of some kind of model of the objective possibilities. Such a model is based on the information scientists' subjective view (and could possibly be wrong). However, such models must be introduced, discussed, and refined in the scientific literature if IS is to make progress. This way, given knowledge is always subjective, but it is supposed that some answers are more correct than others, and the only way to find out is to consider the arguments that supports a given view.

Pragmatic realism is also important to understand relevance in information science. Whether or not a certain substance is relevant as a cure for cancer is ultimately decided in medical research, not by asking patients or users of medical services. (It is of course always legitimate to be skeptical about a knowledge claim. This will lead into a discussion about the basis for that claim and ultimately to epistemological discussions. Such discussions are, by principle, part of the discourse on a given subject). A thing is relevant for a given purpose if it contributes to reaching the goal—whether or not the user thinks so. In a similar way is the validity—and thus the relevance—of a document claiming that a certain substance is relevant as a cure for cancer also ultimately decided in medical research, not by asking users of information services.[d,e] Thus, we have a central realist claim: A given document may be relevant to a given purpose, whether or not the user believes this to be so.[f]

[d]The experts may, of course, be wrong, as we have already discussed. However, this is no argument why nonexperts should be right. They might be. The only way to settle disputes between different views is to examine the basis for the arguments raised in favor of them, as this is performed in, for example, courts, scientific experiments, and epistemological arguments. To find the relevance criteria by empirical studies of users and their needs or by considering experimental studies in cognitive science are simply misplaced.

[e]In some domains, e.g., rock music, there may be a lack of researchers. Musicology seems to neglect nonclassical music. In such cases, the users may be ''experts,'' at least until this field is properly represented in musicology. In other fields, such as child psychology, experienced mothers may have adequate competencies for which a degree in developmental psychology cannot be a substitute. This last example is related to different epistemologies, i.e., to different views of how to obtain knowledge. Developmental psychology has mainly been dominated by a ''positivist'' epistemology, while other epistemologies give a higher status to the kind of experiences that motherhood represents. In both cases, the realist view applies: A given document may or may not be relevant to a given purpose, whether or not the user believes this to be so.

[f]Of course, a document is not relevant in a situation if the user cannot understand it. In higher education, it is normally attempted to provide students with the knowledge necessary to study the documents that are deemed to be relevant. In the sciences, one learns mathematics and in theology one learns Greek, Latin, and Hebrew. The underlying philosophy is that the relevant texts presuppose these kinds of learning. Again, different opinions may exist. Different views of what is relevant may exist as different ''paradigms'' in all subjects.

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CONCLUSION

If information science is to be taken seriously as a field of study, it is important that basic theories are formulated and examined in the field. Domain analysis is one serious attempt to consider the basic problems in IS. Anybody working the field should care about the arguments that have been or might be raised for or against this view.

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Electronic Records Management

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INTRODUCTION

Records management is a common human activity. Each day, we process information and decide whether we need to preserve it or not. It might be a letter we receive, a phone message, or even whether we need to remember a phone number. Without this selective information destruction, we would soon drown in information, unable to locate useful, needed information among all the unneeded material.

Records management is described as ''The systematic control of all organizational records during the various stages of their lifecycle: from their creation or receipt, through their processing, distribution, maintenance and use, to their ultimate disposition. The purpose of records management is to promote economies and efficiencies of record keeping, to assure that useless records are systematically destroyed while valuable information is protected and maintained in a manner that facilitates its access and use.''[1]

Since the invention of writing, humans have been examining their written records and making a determination of whether they need to be retained. Whether it was Sumerians smashing clay tablets, Egyptian scribes scraping ink off old papyrus, or a parent deleting old E-mail messages off their home PC, records management is a common human activity. It was only with the development of the National Archives that the concept of a formal records management program evolved. Archivists needed a process of pre-reviewing records to determine what information was worthy of being preserved for future generations. As a profession, records managers are a fairly new group existing only in the past 60 years.

In the pre-digital world, records management was a back-office activity. While records managers would preach correspondence and reports management, their main thrust was in the management of semi-active and inactive records. Once records ceased to be active in the office, they were transferred to records management which was responsible for managing them until they were eligible for destruction or transfer to the archives. The efficacy of such programs was shown through the reduction in filing equipment and floor space devoted to semi-active and inactive records storage. Many times, records management was made part of the facilities management function of the organization because of this space management function.

From a records management standpoint, a record is treated the same no matter what media is used for storage. A contract is retained for the same amount of time whether it is on paper, carved in stone, or is an electronic file found on a network drive.

Electronic records present specific problems dealing with access over time, proliferation of multiple copies and duplicates, and preservation. Unlike paper records, which can be segregated into centralized file areas, electronic records are decentralized into many different network servers and individual PCs, distributed easily by E-mail and file sharing, and allow for many different versions to coexist throughout an organization.

Electronic records management strives to manage these records according to basic records management principles, but this requires adopting new techniques and strategies to effectively manage these records. It becomes especially difficult while organizations are in transitional phase between analog and digital records. Establishing the integrity of files and providing access and managing retention are complicated many folds when the records exist in both paper and electronic form.

The purpose of this article is to present the basics of electronic records management and to provide some idea of the future impact of managing electronic records on organizations. This article is a general discussion of managing electronic records. The author understands that there are some differences in how this is performed in the private and public sectors. Where applicable, how these tow sectors diverge will be covered. The encyclopedia entry on electronic records management written by Philip Bantin examines this topic from an archival standpoint. These two articles should be viewed as companion pieces rather than contrary or competing topics.[a]

THE BASICS OF RECORDS MANAGEMENT

The definition in ''Introduction'' states that records management is the systematic control of organizational records across their lifecycle. The lifecycle is expressed using a retention schedule that lays out the records series

[a]This article was published in the 2000 edition of the *Encyclopedia of Library and Information Science*.

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(a group of like records such as correspondence or contracts) and assigns the amount of time they are required to be retained by the organization. This retention period is based on four factors:

1. The organizations' business need for the records.
2. Federal or state laws mandating specific retention.
3. Fiscal requirements, i.e., needed for audit.
4. Historical value of the record—usually, a small percentage of all records.

Retention periods are expressed as a unit of time, conditional on a specific action taking place, or a combination of the two. A retention period may be 3 years as long as administratively necessary or 6 years after audit. Retention periods are neither a minimum nor a maximum amount of time; they are the exact length of time a record should be held to protect an organization's rights, but not so long that it can be a burden to the organization. The only exceptions are if the condition placed on a record has not been met or if the record is required for the purpose of litigation or additional audits.

Records destroyed too soon and are then required for litigation or discovery purposes may be seen as destruction of evidence. Records retained long after their retention period has expired are still subject to discovery and, in government organizations, subject to Freedom of Information (FOIA) requests. Maintaining the additional records increases expenses to meet these requirements and may expose the organization to further litigation. One needs only to look to the recent Arthur Anderson, Enron, and Microsoft cases to see examples of improper records retention practices.

Organizations need to make records management a part of the daily business process if it is to be successful. This is performed by developing policies and procedures which detail the records management process and define responsibility for managing and carrying out the program. The policy has to be seen as coming from the top with top-level management showing that they support and implement records management in their own activities. The policy should also make clear the penalties for failing to follow procedures. The procedures will include information on retention schedules, process for destroying records, clear line of responsibility, and who is responsible for the implementation of the program.

HOW RECORDS MANAGEMENT FUNCTIONS IN AN ORGANIZATION

Historically, records management has been a paper-based process and therefore was seen as a back-office activity. While the records are active, they remain under the responsibility of the records creator who would identify, file, and organize the paper records. The active records may have been maintained in centralized file areas, in secretarial areas, or in the personal files of the creator. When the activity was completed or no longer active, it was relegated to the records managers. The records creator would box the files, fill out paperwork identifying the contents, and send the box to storage in low-cost records centers. The records managers would maintain the records, provide retrievals as required, notify the records creator when the retention period had expired, and arrange for the appropriate destruction of the records. The cost benefits for records management were space savings and the reuse of filing equipment; for this reason, records management was often bureaucratically placed within facility management. As long as records managers were able to show financial benefits through cost avoidance, the programs continued.

In some cases, records managers operated centralized records areas for active areas. These central files allowed the movement of files among multiple users to be centrally tracked. These central file rooms worked most effectively in legal and engineering situations, although they existed in other industries as well.

THE RISE OF ELECTRONIC RECORDS

The development of the personal computer, collaborative work tools, E-mail, and networks changed the records management equation. Instead of a few paper copies of any document in existence, there were multiple copies extant in various local networks. The lack of centralization also results in a lack of control of the various documents maintained in an organization. In a centralized environment, everyone knows where the required documentation is located. In the decentralized electronic world, a needed document may exist in many places or none.

One result of a decentralized world is that records became more difficult to locate. Required information may be located in an E-mail that is resident on eight PCs but cannot be found because the subject line is *miscellaneous items*. There are 17 copies of a contract or report on my PC but all are different versions—which is the final version? The more records dispersed across multiple machines, the harder it became to differentiate the copies from the record copy. Who is responsible for preserving the record copy? Can you tell which one is the record copy? In various postings on listservs, it has been estimated that almost all of the historical electronic records created in the late 1980s and early 1990s are lost because they were not managed with an eye to the future.

Electronic records management can no longer be an afterthought in terms of managing the electronic records

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of an enterprise. In order to be effective, the electronic records management has to be inserted into the active business processes of the organization. It becomes necessary to manage electronic records while they are active instead of waiting until the record becomes inactive. The sooner the control is gained over these records, the better it is to be able to organize, categorize, and protect electronic records. Gaining control of these records early in the process provides an opportunity to distinguish nonrecords with minimal or no retention requirements from those that require preservation for an extended period of time.

THE ROLE OF INFORMATION TECHNOLOGY

Managing electronic records while they are active requires that electronic records managers work closely with the enterprise's information technology group. Traditionally, records managers have allied themselves with either the legal or financial departments because these groups recognized the need to protect records. While these two groups still have the same concerns about records, information technology will have to implement the electronic records management protocols.

The electronic records manager will have to work with the information technology staff on several important issues:

1. Training information technology staff to recognize that electronic information can be considered a record and has to be appropriately managed and safeguarded. This often arises when electronic information is deleted, E-mail for example, to free up disk space without consideration given to the possible destruction of electronic records.
2. Provide technical support for the purchase and/or development of tools for managing electronic records.
3. Include records management in the development and/or purchase of new record-creating systems to allow for the inclusion, in the information architecture, of record-keeping processes.
4. As business processes are being reengineered and new systems are developed, the ability to capture, index, attach a retention value, and preserve electronic records has to be included. Including records management processes within existing business processes insures that the appropriate records are preserved and reduces waste from preserving duplicates and unnecessary records.

There are several stumbling blocks with records managers and information technologists working together. First is the lack of a common language. A simple term such as record has very different meanings to each group. For the records manager, a record is ''recorded information no matter what the media,''[1] while the information technologist views it as a ''collection of data items arranged for processing.''[2] An information technologist will archive a file when it is put into storage; a records manager places historical documents into an archive for preservation. There are many more terms that have different meanings depending on who is using them. Failing to agree on a common vocabulary raises the frustration level of both groups.

Second, each group values the information in their care differently. The records manager sees all records as having a definite lifecycle and, at the end of the retention period, expects that the records will be destroyed. Records retained too long become a liability to the organization particularly if litigation is involved. The information technologist views the records as a resource to be used in many different ways. Rather than disposing of information, they desire to aggregate it and use sophisticated data mining tools to discern trends and patterns from the data.

Finally, both groups are feeling corporate pressure and are competing for scarce resources and access to the corporate hierarchy. Fulfilling the records management's requests for additional software, add-ons to the existing software, and increased server capacity for electronic records storage reduces the funds available for information technology to complete their missions. This is where the records management's traditional allies in fiscal and legal can assist in making sure that sufficient funds are available for both groups to complete their missions.

Tools of the Electronic Records Manager

The electronic records manager can draw upon a steadily growing arsenal of tools to begin managing electronic records. These tools allow the records manager to begin managing the electronic records, although not as easy as was possible with paper records. These tools are still in the stages of development and are gradually becoming more powerful and flexible.

The first tool is the electronic document management system (EDMS). An EDMS functions as a means of circulating and routing work within an organization. It manages records that are created using digital, word processing documents for example, or analog documents that have been converted using scanning systems. It allows a wide variety of digital elements to be connected and organized within a single file. An insurance claim file may contain a report of the damage suffered to a car, digital photos of the damages, an electronic copy of the repair estimates, an audio file of the injured party being

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interviewed by an adjuster, a record of the electronic payments to the repair shop, and, finally, a letter from the car owner thanking the insurance company.

This electronic file takes the place of the bulky paper files that were previously used by the insurance company. The completion of the repair work might be held up because of a part of the file being missing or a needed form not filled out. The process may have been further hampered by an adjuster being out ill and their work piling up on their desk.

An EDMS performs several important functions in the management of electronic records while they are in their active state:

1. It provides an electronic repository for electronic records as various users access them. The document resides in a repository and must be checked in or out as it is used.
2. Each time a document is worked on and returned into the repository, a version number is attached so that the most current copy of the document is always known.
3. Metadata is attached to each document so it can be located using a search function.
4. The manner in which the document flows through the work process can be controlled and modified in real time. Using the example of the insurance claim, if one of the adjusters is out for a lengthy illness, the adjuster's work can be electronically routed to other adjusters to insure that the work is not being bottlenecked. Additionally, managers can track productivity using the workflow feature.
5. An EDMS also allows work to be performed collaboratively with users connected in the same system although they may be in geographically diverse locations. It also allows work to be performed concurrently rather than linearly. Work no longer has to be performed linearly.
6. Approvals and authorizations can be performed electronically rather than requiring a wet ink signature.

The second tool available to the electronic records manager is an electronic records management system (ERM). The ERM takes over when the electronic record has ceased to be a draft or an in-progress work and is considered completed. An ERM can be used either as a standalone system or connected to an EDMS. When connected to an EDMS, the ERM achieves a seamless integration and allows the process of preserving only records to proceed smoothly. An electronic records management system has the following characteristics:

1. It can be used exclusively for electronic records or it can manage both paper and electronic records.
2. It provides a trusted repository for records and retains them in their original form.
3. It allows for the reuse of documents and other material but preserves the integrity of the records by not allowing changed or modified documents to be returned to the repository. Changed or modified documents have to be renamed when placed in the repository.
4. It links each record to a retention period and will identify those records whose retention periods have expired.
5. It maintains an audit trail of records users and those records that were removed for destruction.
6. It provides a method for indexing records for ease of retrieval.

The third tool relates to the storage of electronic records. Currently, there are a number of storage options that the records manager can choose from depending on the types of records or application.

The most common form of electronic record storage is the CD-ROM. These disks provide the ability to store large quantities of information in their native format. CD-ROM drives are becoming a commonplace and will replace diskettes as the storage or information transfer medium. Recently, Dell computer announced it was not going to include 3.5-in. diskette drives on their computers until specifically requested.

The current form of 3.5-in. diskette can hold a maximum of 1.44 MB, while a CD-ROM can hold up to 500 MB of information. The next step up on the horizon is the DVD-ROM which will be able to hold 4.7 GB of information.[3] To give you an idea of the relative size differential, a CD-ROM can hold about 10,000 text pages while the DVD-ROM can hold close to 500,000 text pages.[b] In 2003, several manufacturers announced that they were developing DVD-ROMs that would hold 1 TB or 1000 GB of information.

The primary issue with CD-ROMs or DVD-ROM is that while the physical medium may survive for many years, the data written to those CDs may not be accessible because of hardware or software changes. Further information on hardware and software obsolescence will be discussed in the section on migration.

If the material you wish to store is historically valuable or requires an especially long retention period, you may consider having an electronic form to use for rapid retrieval with a microfilm backup to preserve the record and provide a stable source for longer storage. There are scanners which allow either scanned images to be written to microfilm or vice versa. The benefit to a microfilm

[b]Found on the Xanatek web page at http://xanatek.com/.

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backup is that microfilm is a stable medium that, if stored properly, can be usable for several hundred years. An added benefit is that it is human-readable and, with good eyesight and a light source, it can be examined without computer intervention.

A third option involves the use of networks of hard drives to provide access to large volumes of information while still providing security by backing up the data. The redundant array of independent disks[4] and storage area networks[5] harness multiple, redundant groups of hard drives to store and back up large quantities of electronic data or records. Using these forms of storage increases response time and reduces possibility of records loss. These two applications are used in high-volume situations and were originally developed for large data networks. If your organization has high volumes of scanned images, video, or other forms of large-sized records, these provide an excellent opportunity to both access and preserve your electronic records.

The rapidly changing technology of electronic records storage requires records managers to work closely with their information technology counterparts to keep current in this area and to make the best, most appropriate choices in the storage of electronic records. It is another example of the need for a partnership between records managers and information technologists. The choice of storage effects not only the current issue of how do I maintain access to these records, but also how the storage choice will effect retention and destruction in the future.

Special Records Issues

Within the field of electronic records management, there are several topics which merit a more detailed closer look at the issues surrounding them.

E-mail

Is E-mail a record? E-mail is a tool used for electronic communication; its recordness is determined by the content of the communication and the sender or recipient rather than by the form of communication. Deciding that E-mail is a records series is the equivalent of declaring that envelopes are records.

E-mail was originally a quick form of communication, used to send short messages across limited networks. The rapid rise of the World Wide Web (WWW) and E-mail utilities has made it a preferred form for delivering information either across the hall or across the world. The ability to attach files, photographs, and audio and video files to E-mails has changed its very nature. E-mail can now be a form of correspondence, a transmittal slip, an approval mechanism, and an annoyance.

The determination of an E-mail's recordness is a combination of the content of the message and the sender/receiver of the E-mail. Thus an E-mail about the awarding of a contract from the head of the library has a different retention value than an E-mail about an upcoming staff luncheon sent out by the head of circulation. Both are forms of correspondence but the contract award would be held much longer than a staff luncheon.

The recipient of the E-mail will have to determine the retention period based on the records retention schedules in use by the organization. By any objective standard, most of the E-mails created or received by an organization tend to have little or no value as records. They are convenience communications, personal communications, or unwanted spam. The goal is to be able to retain the small percentage of records from the larger quantity of nonrecord E-mail.

Another E-mail issue is where the E-mail will be stored and how it will be located when needed. E-mail is managed through the use of a dedicated server, which has a minimum amount of storage space. Information technology will limit the time and the amount of E-mail that may be retained on this central server. This is performed without differentiating E-mail records from nonrecords, and this places responsibility for the preservation and organization of E-mail with the creators and receivers.

Most E-mail programs allow users to create subject folders on their E-mail page. The user can use this to create dated subject files, resident on their PC, and file their E-mails into these folders. The folders can be destroyed according their retention periods. In case of litigation or FOIA requests (for government entities), the appropriate E-mails can be located and provided rapidly. The users also have to have enough discipline to first organize their E-mails, then dispose of nonrecord E-mails, and, finally, continue to manage E-mails for the long term.

The short-term solution is to create policies and procedures which delineate the proper methods for managing E-mail, establishing responsibility and providing training that reinforces the policies. These policies need to include appropriate use guidelines for E-mail. Using organizational E-mail systems to send around inappropriate jokes, photographs, and files not only clogs the network, but also exposes the organization to possible sexual harassment charges. Additionally, employees need to be aware that the contents of the E-mail system belong to the organization and not the private communication of the employee. The E-mail is subject to both FOIA request in a public institution or discovery in the case of litigation.

The organization then has to decide if they wish to make the financial commitment necessary to implement an electronic record management program to manage

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E-mails on an enterprise level. There is no doubt that many E-mails are records; organizations have to recognize this and take appropriate action to preserve access to these records.

Web Pages

The World Wide Web (WWW) is an information medium. Originally, the web was merely another means to disseminate already published material. The web is now the first place where many materials are published and, in many cases, is the sole means of disseminating and publishing. The web is also being used for transactions such as registrations, licensing, or purchasing. All of these activities produce electronic records having various retention periods. The act of viewing or using a web page creates logs and activity files. All of these activities create records showing who used the site, when it was used, if something was purchased, credit and delivery information for purchases, and lists of what information was accessed. In addition to legal and financial implications of these records, the information also has privacy and security implications that can affect how these electronic records have to be preserved.

Web sites as a record are just beginning to come to the forefront of issues for record managers.[c] Often, there are analog copies of the information on the page, and financial transactions are passed through to specialized databases once the transaction has been completed. Each record manager will have to examine the web site material created by their organization and determine what parts of it are or create records and manage them accordingly.

Unlike an analog publication, a web site is not used linearly. Depending on the viewers' interests or requirements, different pages will be accessed. Links may take the viewer from the original web site to another web site and back again in a seamless fashion. This nonlinear functionality is useful to the viewer but makes the records manager's life considerably more difficult.

Public organizations will also have to determine whether the web site has historical connotations. A number of states have begun to capture the web sites of governors and cabinet officers as historical records. At the end of the Clinton Administration, the National Archives and Records Administration (NARA) directed all agencies to take a snapshot of their web site prior to the end of the administration and send the snapshot to NARA.[d]

The preservation of web sites presents particular difficulties because of the underlying structure of a web site. Each site is composed of multiple files of information, graphics, and other material. This material is coded using a variant of HTML code. The program running the web site determines what material to pull from what file to present to the viewer. When trying to preserve the web site, the records manager has to determine what view of the web site to save and the best program to use to preserve the functionality of the page. As with other electronic records, long-term preservation will require considerable work over time to insure the availability and usability of the information. The very nature of a web site, its nonlinearness prevents the printing out of this material while still preserving the usefulness of the web site.

New Forms of Electronic Records

The records manager has to be aware of additional new formats of electronic records. Many older forms of electronic records have analog formats. A word-processed document is the same whether it is electronic or printed out. A spreadsheet looks the same in electronic or hard copy. The primary difference is functionality. An electronic spreadsheet changes as new data are added; a paper has to be recalculated and printed out.

The increasing functionality of the web and personal computers is resulting in the creation of additional forms of electronic records. Instant messaging has gone from being a communication tool for teenagers to being used in corporations as a supplement to E-mail. Unlike E-mail, although the same suite of management, tools do not exist to manage instant messages. This does not mean that they do not have the characteristics of records and those that qualify, as records have to be preserved.

Digital photos and videos are increasingly used to document business activities, insurance adjusters for example, or to provide information. They are being included in electronic compound documents and reports. For example, in the state of Virginia, the governor's photographer uses only a digital camera; the state archives will be responsible for preserving those electronic images for as long as the other records of the governor.

Collaborative work tools, video conferencing internet meeting tools, and electronic white boards are all tools used by current organizations as a way to communicate and work remotely. All of these tools have the capabilities of producing electronic records that will have to be managed and retained. The records manager will have to remain vigilant of what new tools are being developed and implement strategies to manage the records created as a result of their use.

[c]For a fuller discussion of web sites as records or an archival item see Ref. [6].

[d]For additional information see the ''Federal Web Site Snapshot Information'' found at http://archives.gov/records_management/web_site_snapshot/snapshot.html.

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Preservation

Acid-free paper will last for several hundred years; properly stored microfilm will last for 500 years; how long will a CD-ROM last? The CD-ROM maker will tell you that the CD-ROM will last 100 years, but in 100 years, where will you find a CD-ROM player to extract the data? The 5.25-in. floppy drives have disappeared from computers and soon 3.5-in. drives will be non-existent.[7] Electronic records are plagued with both software and hardware obsolescence rendering the information stored unobtainable. How is the records manager supposed to deal with this situation?

Unfortunately, there is no easy answer to this question. At the current time, there are four ways to deal with the problem of maintaining electronic records throughout their life span.

1. Print the records onto paper—This solution works in situations where there are hybrid paper/electronic files where the user prints out electronic records and integrates it into the paper file. In most situations, converting electronic files to paper is not a solution. Paper records do not have the functionality of electronic records and suggesting it can make you appear a Luddite. The print to paper solution works for small self-contained files or to preserve documents found on web sites.
2. Digital archeology—This process involves saving one or more examples of every hardware and software combination used in your organization to create electronic records. This presumes that the hardware and software will always run and not suffer from mechanical breakdowns. Even more to the point is whether anyone will remember how to use the equipment 10 to 20 years down the line. What are the chances that someone, in 2025, will be able to troubleshoot a 66-MHz PC running Windows 3.11 to retrieve a document written in WordStar? This process may work in the short time, but as a long-term solution, it is not a good option.
3. Emulation—Jeff Rothenberg of the Rand Corporation is the prime proponent of this concept.[8] It involves the development of a software package that will emulate older software on existing hardware. Any current computer running this emulator would be able to read and make available electronic records written in obsolete software packages. In a similar vein, the National Archives and Records Administration is seeking to develop a software wrapper to allow electronic records to be encapsulated by an XML wrapper and allow access to the material.
4. Migration—In the short term, this is the one process that can be performed and uses existing technology. The negative is that it involves developing an internal structure to carry out this process and fund it year in and year out. Migration involves converting older electronic records to current software and hardware. For example, a document created in version 3 of a word processing software would be converted to the current version 5.2 of the same software, or electronic records written to CD-ROMs would be converted to DVD_ROMs when CD-ROM writer and readers are being phased out and will no longer be available.

While this is the most practical solution, it is not the easiest. Implementing requires documenting the software and hardware requirements for all of your electronic records, monitoring when the software and hardware become obsolete, copying the material to the newest combination, documenting it, and testing the media that the electronic records are written to. In the end, this requires a steady stream of funding and a dedicated group of technicians to carry out this process. The ultimate question is whether a document remains the same as the original after being transformed several times by writing to new software versions and storage media.[9]

There is no one answer to the best method of preserving electronic records throughout their life span. When one considers that a historical electronic record will have to survive for hundreds of years, the problem can be overwhelming. This problem has to be dealt incrementally. The records manager will have to insure that the electronic records are available currently and look 5–10 years ahead with regards to preservation. The issue of longer-term preservation will take place on a national level by the institutions with the need and financial resources to fund this research.

ACCESS

It is not enough to preserve electronic records as merely artifacts. They are resources that contain information and work products that belong to the entire enterprise. The concept of knowledge management[e] is designed to insure that the intellectual capital of an enterprise is preserved and made available to others who can use the same information. Previous work functions as the foundation that new ideas and work are built upon.

In the paper world, the records manager dealt with the physical storage of records. They managed the boxes, insured that they were stored efficiently and at minimal cost. The user was responsible for knowing which boxes to retrieve. Effectively, the knowledge of the organization

[e]For a discussion of knowledge management see Ref. [10].

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was locked up in warehouses and only a few people knew the contents.

Electronic records, not having a physical presence or organization, require a control regime to be imposed upon them to insure that they are retrievable and manageable. Graphical user interfaces provide a paper metaphor of folders and hierarchy to allow users to store electronic records in a form they were familiar with. Unfortunately, each individual tends to use names and letter combinations that work for them but may not be as obvious to others. Therefore the records manager has to work to develop uniform naming conventions to provide guidance to users so that information will be locatable in the future for someone other than the creator.

Records stored on centralized servers require the development of hierarchical filing structures that allow users to easily find relevant documents and files located on that server. These filing structures are the electronic version of the paper filing plans that records managers created for centralized file rooms. These plans have to be consistently updated to reflect current work and need to be documented so that future users can find needed records.

A benefit of an electronic records management program is that it requires each ''archived'' document to be identified with at least a minimum amount of metadata that describes each document or file. Records creators also have the capability to add additional keywords to provide additional access points to these records. The search capability of these electronic records management programs is that they also provide search capabilities to identify required records from all that are stored in the system.

The need to provide access to electronic records requires records managers to add to their skills to make this happen. They will need to look to other professions such as librarianship to become familiar with such tools as controlled vocabularies and taxonomies to provide access to the material under their control.

Summing Up

Electronic records have been in existence for over 50 years. It is only in the past 10 years with the rise of personal computers and networks that electronic records have become a serious records issue. Records managers face the daunting task of not only dealing with existing electronic records, but also having to stay one step ahead of the technological train and deal with newer forms of electronic records as they become available.

Records management, as a profession, will have to expand its knowledge base and look to other professions for the skills and knowledge they need to deal with electronic records. Electronic records are a difficult challenge but are also an opportunity for records managers to have an impact on their organizations.

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Environmental Information

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INTRODUCTION

Dosa[1] provided a multipart definition of environmental information, stating that it was a process reflecting:

- The interdisciplinary nature of research and profession work
- The differences in how people perceive problems, propose solutions, and assign priorities
- The peaks and valleys in public policy attention to these problems, resulting in uneven funding of research, information services, and collection development
- The dispersion of literature in many sources: indexing and abstracting services, directories, bibliographies, government documents, and statistical sources
- The user's need to learn how to interact with information resources and systems to determine the most useful search terms and definitions
- The ongoing proliferation of new information services and systems, which mandate sound techniques for searching and evaluation.

Those characteristics were written in 1978 in the sadly out-of-print book, *Library Searching: Resources and Strategies with Examples from the Environmental Sciences* (Morris and Elkins,[2] Jeffrey Norton Publishers). Nearly a quarter of century has passed since Professor Dosa wrote that definition, yet it is still an accurate assessment of environmental information.

Humans have been describing their relationships with their physical surrounding for tens of thousands of years. Drawings on caves, pottery fragments in tombs, and burial sites from ancient graves all represent attempts by humans to record information about the physical conditions and surroundings, the environment in which they lived. Ancient cultures developed an intuitive sense about their relationship with their surroundings, whether they are agrarian or hunting. Greek philosophers postulated the living nature of the Earth and its resources, even defining a goddess for the Earth, Gaia, who in the 20th century received resurgence when James Lovelock proposed a ''Gaia hypothesis''—that the Earth behaves much like a living organism.

AN APPRECIATION OF NATURE

In the last millennia, there were three major factors contributing to the generation of environmental information. The first factor was represented by extensive writings and illustrations of early scientists and naturalists whose chronicles provide an initial information base describing our environment and the natural resources found in it. These works are highlighted by individuals such as Georgius Agricola, who identified and classified a large inventory of minerals in his 12-volume treatise, *De Re Metallica* (1556). Carolus Linnaeus (Carl von Linne), a Swedish botanist and physician, developed a systematic way to classify plants and animals by providing scientific or genus and species names to organisms (e.g., *Homo sapiens* for humans, *Salmo trutta* for brown trout, and *Salmo salar* for the Atlantic salmon), which was introduced in 1735 in *Systema Naturae* (the 10th edition in 1758 contained classifications of more than 4000 animals). *Genera Plantarum* (1737) and *Species Planetarium* (1753) provided descriptive classifications for a large variety of plant life. Constantine Samuel Rafinesque wrote extensively about his observation of plant and animal life in the United States, choosing to publish his findings in a number of special articles during the early to mid 1800s in a variety of widely read travel, nature, and popular literary magazines. John James Audubon published 435 vivid and colorful renderings of nearly 1000 birds in paintings published in a seven-volume *Birds of America* series (1827–1838, a smaller version in 1840–1844) and contributed visual images of the elements of nature and the environment.

President Thomas Jefferson (himself a noted naturalist) called Captain Meriweather Lewis and Lieutenant William Clark to gather a team of scientists to chronicle the natural resources in the newly acquired territories of the Louisiana Purchase. Their 1804–1806 adventure would take them from St. Louis, Missouri, to the Pacific Ocean at the mouth of the Columbia River on now Oregon's Pacific Coast. Their journal recorded a comprehensive inventory of the biological and land riches of this previously unexplored region of the northern and northwestern regions of the United States. The result of this expedition was one of the first information

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records of a national inventory of the country's biological resources.

On a more global scale, noted biologist Charles Darwin set out on a circumnavigational voyage to gather information about the natural histories and physical environments encountered. A 5-year expedition on *HMS Beagle* provided Darwin the opportunity to collect and describe countless plant and animal species in South America and the Pacific Islands. Among Darwin's prolific writings of this adventure are *The Voyage of the Beagle* (1839), *Journal of Researches into the Geology and Natural History of the Various Countries Visited by the HMS Beagle* (1839), and *Zoology of the HMS Beagle* (1839–1843). Additional works were to include *Structure and Distribution of Coral Reefs* (1842) and *Geological Observations on Volcanic Islands* (1844). These chronologies and observations based on this 1831–1836 adventure were one of the most detailed descriptions of flora and fauna written and were widely accepted among his scientific peers. Darwin used this opportunity to lay the foundation of his best known and one of the most controversial books ever written, *The Origins of Species by Means of Natural Selection, or the Preservation of Favoured Races in the Struggle of Life* (1859).

Darwin's theories were not unanimously accepted in scientific circles and general public. However, religious circles were the most unaccepting of the concepts of evolution and declared his ideas as sacrilegious, setting off one of the longest and most controversial scientific debates of all times with scholars challenging the scientific basic and religious aspects of Darwin's theory into the 21st century. Subsequent works by Darwin, most notable being *The Descent of Man, and the Relation to Sex* (1871) and *The Expression of Emotions in Man and Animals* (1872), refined some of his evolutionary theories.

The development and implementation of data-gathering activities of the International Geophysical Year (IGY) in 1956–1957 created the World Data Centers (WDCs) as international data and information-collecting centers and archives for the resulting monitoring data. The IGY served as a continuance of the two previous International Polar Years, 1882–1883 and 1932–1933, where coordinated scientific studies were conducted to understand our planet's natural processes and cycles. The International Council of Scientific Unions (ICSU)[3] was the body with oversight for the IGY, with U.S. participation coordinated by a U.S. National Committee (USNC) appointed in 1953 by the National Academy of Science. Today, the WDCs remain viable sources of Earth system data and information in the broadly defined areas of geochemical dynamics. It is hoped that by the end of 2002, WDCs devoted to ecological data will be created within the WDC-United States, perhaps under the auspices of the Department of Interior (DOI)'s National Biological Information Infrastructure.

The continued academic pursuit of the descriptive narrative in explaining the dynamic relationships among the various biotic and aboitic components of our physical surrounding may well have been seeds planted to yield the harvest of the entire disciplines of what we now know as ecology and evolutionary biology (or simply evolution). Continuing into the early years of the 21st century, efforts are underway to refine and to increase the resolution of our understanding of the descriptive processes of taking inventory of our environment, such as the DOI's efforts in support of the National Biological Information Infrastructure (www.nbii.gov), the multiagency commitments to increase our understanding of the complex dynamics of our climate through the U.S. Global Change Data and Information Systems (GCDIS; globalchange.gov), and provision of access to and analysis of environmental data and information through new technologies and disciplines such as environmental geographic information systems (E-GIS).

THE NEED FOR CONSERVATION

The second source of environmental information results from an interaction of the tremendous growth of human populations and their consumption of natural resources, primarily in the 19th and 20th centuries. As populations grew, so did their demands for the natural resources from metals, minerals, fossil fuels, forests, and wildlife. Thomas Robert Malthus published his essay on the *Principle of Population* (1798) as a mathematical treatment of an exponential growth of human population that would eventually place demands on the amounts of cultivated land and food production, leading to famine, such as that in Ireland in the 1840s. The application of information resources on improved agricultural practices, use of fertilizers, development of irrigation systems, and use of pesticides averted a worldwide Malthusian catastrophe. However, the pressures a rapidly growing population exerted on the environment were evident in the deforestation of vast regions of England by the mid-19th century. Coupled with the increased industrialization and demands on natural resources was the accumulation of capital investment and wealth primarily in Western Europe and the United States, and usually at the expense of poor, economically and politically weaker nations.

The loss of natural resources, beginning with the loss of forested land and the habitats they represented, served as a stimulus for a growth of a conservation-minded intellect and a biocentric philosophy in the later half of the 19th century. The designation of Yellowstone National Park in 1872 (a National Park Service would

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not be established until 1916) set into motion a new conservation ethic to preserve the esthetic beauty of the nation's natural scenic places and reserves of wild flora and fauna. The value of nature, the environment, was also expressed most strongly in the United States in the concept of transcendentalism in the writings of Ralph Waldo Emerson, who published ''The Method of Nature'' in the *Complete Works: vol. 1. Nature, Addresses, and Lectures* (1893), and Henry David Thoreau, in his classic *Walden* (1854). These concepts are best reflected by Scotsman, John Muir (who founded the Sierra Club in 1892), who postulated a love of nature and a need for the conservation of natural resources for future generations. These were the seeds planted that would contribute to the thoughts and actions of countless others caught up in the social maelstrom of the 1950s–1970s: civil rights, the protest of the War in Vietnam, the feminist movement, and environmental activism.

While the German forester, Dietrich Brandis, was working with the British Government to manage the vast forest reserves of the Indian Subcontinent, fellow countryman, Bernhard Fernow, became the first Chief Forester in the Department of Agriculture and established a forestry school at Cornell University in 1898. President Theodore Roosevelt, an avid outdoorsman and adventurer, would be noted for his policies of progressive conservation establishing national forests, national monuments, national parks, and wilderness areas. Under Roosevelt, the U.S. Forest Service was created in 1905, tasked with management of public lands and controversial relationships among changing political climates, logging industries, and conservationists who remain with us until today. The popularity of the automobile provided the public at large direct access to many of the nation's most visually attractive wilderness areas, and helped to expand this proconservation ideology into the 1920s and 1930s with growing need to preserve the scenic beauty and natural wonders found in these vast wilderness areas.

Aldo Leopold was among the first scientists to embrace a land ethic and a scientific approach to wildlife management. His acclaimed book, *A Sand County Almanac and Sketches Here and There*, helped develop the rhetoric and actions that would eventually lead to the passage of the Wilderness Act of 1964. Involvement of the public in matters related to conserving natural resources and scenic vistas would prove invaluable for the celebration of the first Earth Day on April 22, 1970, and what is recognized as the birth of the Modern Environmental Era of the United States and a subsequent explosion of environmental information.

The United Nations gathered the nations of the world to the first global Conference on the Human Environment held in Stockholm in 1972. The goal of this event was to establish a framework for international policy making on matters related to the environment, especially those related to the transboundary transport of pollutants. Among the outcomes of this meeting was the call for improving the exchange of critical environmental data and information and the creation of the United Nations Environment Programme (UNEP). The UNEP developed INFOTERRA as a global environmental information resources sharing network, including directories of organizational and human expertise, and information analysis functions and services. Countries participating in INFOTERRA designate a central institutional focal point, such as the U.S. EPA, to prepare resources for inclusion in the network. The Global Environmental Monitoring System (GEMS) was also established in 1975 from this conference, and initiated a comprehensive data-coordinating program to more broadly share and provide standard information formats for the collection of environmental data related to environmental problems such as global environmental change (e.g., climate change and ozone depletion), biodiversity, soil conditions, water quality, plant and animal health, and the environmental impact and consequences of human activities. The 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) was approved in 1975 as yet another outcome of the Stockholm Conference. The goal of this initiative is to prevent the trade of endangered and threatened species of plants and animals.

A 20-year follow-up conference, the United Nations Conference on Environment and Development (UNCED) and more widely known as the 1992 Earth Summit in Rio de Janeiro, Brazil, drew more than 35,000 environmental activists and advocates from academia, government agencies, business and industry, and a wide variety of public interest and special interest organizations. The agendas for the largest environmental gathering were many, but concentrated on a number of pressing global environmental problems and issues: biodiversity, climate change, deforestation, environmental health and quality of life, marine resources, toxic and hazardous wastes, and the crises of urban environments. Most notable for the 1992 Earth Summit was the emergence of sustainable development (a concept borne from a 1987 UNEP commission report addressing the disparity of environmental problems between the rich and poor, *Our Common Future*, chaired by Norwegian Prime Minister Gro Harlem Bruntdland, as a central theme linking environmental and ecological problems to economic and social systems).

ENVIRONMENTAL QUALITY

The third root of the tree of information—and perhaps the more important of the influences for the origins of our

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contemporary understanding of the environment—comes from the research and observations related to increased pollution of the air and water primarily in the 18th and 19th centuries and the Industrial Revolution, and as a direct result of the concentration of populations in larger cities and their exposure to unsanitary and toxic by-products of their daily lives. It is from these roots that the branches of the chemical, medical, and biological sciences would evolve into the disciplines of occupational medicine and safety, environmental medicine, and public health.

King Edward I established in 1285 what may have been the first environmental agency, in appointing a commission to investigate the burning of coal in medieval England and the episodes of deadly air pollution events (now called smog events) in London. The 1960s–1990s saw tremendous concerns in Europe and North America related to what was commonly called acid rain (a term first appearing in the scientific literature in 1870s), resulting from the ecological impacts from the acidification of rain and other forms of precipitation and dry deposition, which is caused largely by the burning of fossil fuels, including coal and oil. The common thread lacing between seven centuries of observations is the need for data and information linking cause, effect, and solution. *English Reports on Smoke Prevention, 1843–69*, published in 1881, is one of the earliest government reports addressing air pollution issues in London. It is the second report from the Select Committee on Smoke Prevention (including the appendix and index of the 1843 and 1845 printings) to report ''upon the means of obviating the evils arising from the smoke occasioned by factories and other works situated in large towns, and to take actions ''to abate the nuisance arising from the smoke of furnaces in the metropolis and from steam vessels above London Bridge,'' including a history of the Smoke Nuisance Abatement (Metropolis) Act, 1853.

It is not surprising that the aspects of medicine and biology, in particular, lead to the development of a greater understanding of water pollution resulting from toxic chemicals and the disposal (or not) of human waste (and wastes from humans). Outbreaks of waterborne diseases caused considerable havoc in larger population centers and, over time, a body of knowledge related to the gathering of outbreak statistics, investigations of the causes and effects of such outbreaks, and eventually to research and applications for the prevention of waterborne diseases and epidemics began to grow. In the 19th century, cholera epidemics (cause by bacteria of the genus *Vibrio* introduced perhaps to England and the United States from India) caused substantial damage to cities whose populations were exposed to the bacterium, killing tens of thousands of people. Dr. John Snow published a now-famous booklet, *On the Mode of Communication of Cholera* (1849), that includes an analysis of the location of households affected by the disease and their proximity to public water wells. His theories were tested in the outbreak of 1854 in London when the handles of pumps at contaminated wells were removed (forcing people to other sources of drinking water) and the epidemic stopped. Snow's work is considered to be the first public health application of what we know today as a geographic information system (GIS).

In modern times, major sources of environmental information are research, monitoring, and other data-acquiring activities of the U.S. Federal Government. The number of various departments, agencies, bureaus, and divisions of our governmental structure dealing with ecological and environmental issues is enormous.

The National Environmental Policy Act was the first significant new environmental legislation of the modern environmental era. Among a broad array of activities mandated by NEPA was the creation of the Council on Environmental Quality (CEQ; www.whitehouse.gov), which develops and recommends to the President national policies and priorities to ensure the quality of the environment and to develop strategies to further environmental quality. The CEQ is required to review and evaluate federal environmental programs to determine their impact to the environment (requires the preparation of environmental impact statements, gathering information to establish cause-and-effect relationships impacting the environment by human activities). The CEQ also assists the President in preparation of the annual report to Congress, *Environmental Quality: Annual Report to Congress*. In addition to serving as the official report on the state of environmental quality in the United States, *Environmental Quality* presents extensive tabulated trends data related to indicators of environmental quality and environmental change. The most recent issue of *Environmental Quality* was published in 1997.

The Environmental Protection Agency (EPA; www.epa.gov) was established in 1970 as an independent agency as a result of a large-scale reorganization of the U.S. Federal Government by President Richard M. Nixon. The EPA coordinates environmental activities for the federal government and is the primary agency for identifying and controlling threats to the environment and for establishing and enforcing environmental laws, regulations, and guidelines. The EPA maintains 10 Regional Offices. The EPA's National Library Network is a coordinated network of information resource centers (formerly called libraries), which facilitates access to its own collections of books, reports, journals, and other information resources. The information resource centers assist in maintaining special information clearinghouses, information dockets, information hotlines, and publication distribution. Activities of the information resource

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centers are administrated under the EPA's Office of Environmental Information.

The National Oceanic and Atmospheric Administration (NOAA; www.noaa.gov) was established also in 1970 as a result of President Nixon's government reorganization efforts. The NOAA is one of the programs of the U.S. Department of Commerce that provides research and data and information related to the Earth's oceans, atmosphere, and coastal regions, and protects marine and other national resources with warnings and forecasts related to weather and climate. The National Environmental Data Referral Service provides access to publicly available nonbibliographic environmental information (e.g., numeric data, environmental mental monitoring data, and remote sensing data). The National Sea Grant Program provides additional information support and outreach services through its extension services located at 29 colleges and universities in 30 U.S. states with marine or freshwater coastlines in the Great Lakes.

The U.S. Department of Energy (DOE; www.energy.gov or www.doe.gov) deals with issues related to providing delivery of energy resources, which includes extensive programs in the areas of ecology and environmental health and science. The DOE's Environmental Management Division attends to issues related to the impact and cleanup of chemical and radioactive wastes at DOE facilities. The Office of Energy manages the basic and applied activities in the areas of environmental and ecological research, including the support of five National Laboratories (Argonne, Brookhaven, Ernest Orlando Lawrence Berkeley, Lawrence Livermore, Los Alamos, Oak Ridge, Sandia). The Office of Scientific and Technical Information (OSTI; www.doe.gov/osti) in Oak Ridge, Tennessee, serves as the central repository for energy-related and environmental-related information from DOE operations, the general open scientific and technical literatures, and the DOE Energy Science and Technology Database, parts of which are made available from several publicly available services such as the DOE Information Bridge and DOE Energy Files. The DOE OpenNet initiative was undertaken at the direction of DOE Administrator Hazel O'Leary in the mid-1990s to provide public access to more than 275,000 declassified documents on DOE research, including that dealing with human radiation experiments during and after the development of atomic weapons by the Manhattan Project.

The DOI (www.doi.gov) is responsible for the nation's natural resources (mineral, land, and biological resources). The Fish and Wildlife Service is responsible for the protection of fish and wildlife and their habitats and supports basic research along these mandates. The U.S. Geological Survey (USGS; www.usgs.gov) provides comprehensive geographic and cartographic services, including those to support the environment. Within the USGS is the Biological Research Division, which is developing the National Biological Information Infrastructure as a major effort to compile information and data inventories in support of the biological resources of the United States. A number of states within the United States provide inventories of their natural resources as part of the USGS Biological Resources Division's National GAP Analysis Program. This environmental information initiative provides baseline descriptions of the geographic distribution of native animal and plant species, their habitats, status of related land use activities, and conservation practices. These data are analyzed with geographic information services to determine gaps in the patterns of natural distribution of native species of plants and animals.

The U.S. Department of Agriculture (USDA; www.usda.gov) is one of the largest departments within the U.S. Government, which exerts considerable efforts toward the generation of ecological and environmental information. Such activities are related to food safety and inspection, the study of the efficacy and impacts of pesticides, agricultural impacts to ecology, and management of U.S. forest preserves. The National Agricultural Library (NAL; www.nal.usda.gov) is the world's largest repository of broadly defined information resources. The AGRICOLA (**AGRIC**ultural **O**n**L**ine **A**ccess) began as the *Bibliography of Agriculture* in 1942. It is now a database of millions of bibliographic records of journal articles, technical reports, theses, patents, and audiovisual resources. Free public access is provided from the NAL web site. Additional information services are provided by the USDA's network of county cooperative extensions administrated through more than 630 individual state land grant universities, veterinary colleges, other university and college programs (food safety, nutrition, forestry, agrochemistry, biotechnology, etc.), and state and county extension service offices.

The Laboratory of Hygiene was established in 1887 and today is known as the National Institutes of Health (NIH; www.nih.gov). The NIH is one of eight health services agencies within the U.S. Public Health Service in the U.S. Department of Health and Human Services. Twenty-four separate institutes comprise NIH, with the most notable for their dedication to the environment being the National Institute for Environmental Health Sciences, the National Cancer Institute, and the National Library of Medicine (NLM). The NIEHS sports more than 20 national Environmental Health Science Centers (EHSCs) at medical schools and universities in the United States. Community Outreach and Education Programs in each EHSC provide a variety of education and training, information, and communication services and programs for the local or regional communities in which these

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centers are located. The NIEHS Library (library.niehs.nih.gov) serves as a central repository for scientific, technical, and medical information resources and is used by researchers, educators, and students alike. The NCI was established under the National Cancer Act of 1937 (broadened by the National Cancer Act of 1971) and serves as a world-renowned resource for data and information related to cancer, including its environmental causes. The NCI supports the compilation and management of the CancerNet bibliographic database. The NLM (www.nlm.nih.gov) is one of the world's largest medical library collections. In addition to the library's collections on its Bethesda, Maryland campus, are the data and information support and management services it provides. Most notable is its support of the *Index Medicus* and MEDLARS (**MED**ical **L**iterature **A**nd **R**etrieval **S**ystem), the print and online information systems, respectively, which include the MEDLINE, TOXLINE/TOXNET, Hazardous Substances Data Bank (HSDB), and other bibliographic and nonbibliographic databases.

In addition to the monumental environmental legislation under NEPA, several other major pieces of environmental legislation are responsible for the generation of large environmental information programs, services, and repositories.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, 40 CFR 300-374) is more commonly known as the ''Superfund Act,'' and was passed in the wake of the public outcry over the impacts of chemical waste storage practices to the environment and, in particular, the impacts to communities, neighborhoods, and individual residents living in or near such chemical waste sites. The Superfund Act forced the cleanup of chemical waste disposal sites, some of which had been abandoned for decades. This legislation required the identification of ''responsible parties'' to pay for the cleanup of these chemical landfills and dumpsites.

The Agency for Toxic Substances and Disease Registry (ATSDR) was created under provisions of the Superfund Act. As an agency under the Department of Health and Human Services, the ATSDR reports on preventive measures to reduce or eliminate exposure to chemical hazards and toxic substances from chemical landfill sites, toxic dumps, and other intentional and planned releases of harmful chemicals into the environment. The ATSDR is also responsible for reporting on the adverse human health effects of chemicals from these sites and provides substantial information resources to carry out its mandate, issuing public health assessments of chemical waste sites, health consultations for specific chemicals or classes of chemicals (and derivative public health summaries, e.g., *Fact Sheets on Hazardous Substances*), health surveillance and registries, and response actions for emergency releases of hazardous chemicals. The ATSDR also supports applied research directed toward public health assessments for chemical hazards and toxic substances. The ATSDR's HazDat database (www.astdr.cdc.gov/hazdat.html) is a scientific and technical database providing access to the release of chemical hazards and toxic substances from Superfund sites or emergency events. The education and training of medical and health care providers is another function of ATSDR. The ATSDR works closely with an allied program in the Department of Health and Human Services, the Centers for Disease Control and Prevention (CDC; www.cdc.gov), whose mission is to safeguard the nation's public health through 11 major operating components, including the National Center for Environmental Health and the National Institute for Occupational Safety and Health.

A major factor contributing to the confusion of federal, state, and local officials, environmental activists, researchers, and lawmakers with issues concerning toxic and hazardous chemicals in the environment was not a lack of chemical, physical, and biological data, but the fact that these data were widely scattered in the scientific literature.

A direct result of the increased public awareness about the harmful effects of chemical wastes, the dispersion of relevant data and information, and government calls for action was a surge in the publication of compendia, handbooks, and databases reporting the physical and chemical properties, biological activities, and other important data for chemicals and classes of chemicals with environmental significance or importance. Most notable of these compendia are the *Handbook of Environmental Fate and Exposure Data for Organic Chemicals: Vol. 1. Large Production and Priority Pollutants; Vol. 2. Solvents; Vol. 3. Pesticides; Vol. 4. Solvents; Vol. 5, Solvents* (Philip H. Howard, Lewis Publishers, Boca Raton, FL); *Handbook of Physical Properties of Organic Chemicals* (Philip H. Howard and William M. Meylan, Lewis Publishers, Boca Raton, FL); and the *Handbook of Environmental Data on Organic Chemicals* (Karl Verschueren, Van Nostrand-Reinhold, New York).

The Toxic Chemical Release Inventory (or the Toxic Release Inventory, TRI) was mandated by the Emergency Planning and Community Right-to-Know Act Title III (313) of the Superfund Amendments Reauthorization Act of 1986 (40 CFR 300-374). It requires the annual reporting to the EPA by specified industries of releases of specified chemicals or classes of chemicals into the environment. These data files provided the public access to critical information about the release of chemicals into the air, water, and land [disposal or spills and underground injection (disposal)], and since 1991, information on source reduction and recycling information. Sections

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311 and 312 of the Superfund amendments require annual reporting of the storage and quantities of chemicals at site-specific locations for emergency planning actions and general community right-to-know purposes. These publicly available data are perhaps the most important environmental information databases ever created. They provide emergency planners, local officials, county and municipal governments, community groups and neighborhood coalitions, and concerned citizens with ready access to easily obtained and understood data on the storage and release of chemicals into the environment. In addition to these direct information-providing benefits resulting from TRI and related data compilations are the large-scale reductions of chemical releases into the environment (for instance, Eastman Kodak in Rochester, Monroe County, New York, has reduced its emissions of the suspected carcinogen, methylene chloride, which is used in the manufacturing of photographic films, by more than 75% since the first TRI data were made public in July 1989). Access to these data is found from several locations, such as the EPA's TRI Office (www.epa.gov), the RTKNet (Right-to-Know Network, www.rtknet.org), Mapcruzin (www.mapcruzin.com), and Environmental Defense's chemical Scorecard interactive chemical storage and release database (www.scorecard.org).

The GCDIS (www.gcdis.gov) is the primary information and data component of the U.S. Global Change Research Program. The GCDIS coordinates the data and information activities of more than a dozen federal government departments and agencies and provides a variety of gateway services to the data and information resources broadly related to global environmental change. The Global Change Master Directory is the primary search engine developed by NASA to manage the various data and information resources available to researchers, policy makers, officials, managers, activists, educators, and students.

MANAGING THE INFORMATION BASE

The journal literature representing the primary information base for the results of environmental research also reflects the history of the disciplines related to or derived from the quest for answers to questions related to our relationships with dynamic components of the world in which we live.

Among the oldest scientific and technical journals devoted specifically to the environment are: *Advances in Ecological Research* (1962), *Adverse Drug Reaction Bulletin* (1964), *Ambio* (1972), the *American Industrial Hygiene Association Journal* (1940), *American Midland Naturalist* (1909), *American Naturalist* (1897), *Annals of Occupational Hygiene* (1958), *Annual Review of Ecology and Systematics* (1970), *Annual Review of Pharmacology and Toxicology* (1961), *Archives of Environmental Health* (1960), *Archives of Toxicology* (1930), *Atmospheric Environment* (1967), *Biological Conservation* (1969), *Bulletin of the Ecological Society of America* (1917), *Bulletin of Environmental Contamination and Toxicology* (1966), *Canadian Field Naturalist* (1919), *Chemico-Biological Interactions* (1965), *Critical Reviews in Environmental Science and Technology* (1970), *Critical Reviews in Toxicology* (1971), *Ecological Monographs* (1931), *Ecological Studies: Analysis and Synthesis* (1970), *Ecology* (1920), *Environmental Health Perspectives* (1972), *Environmental Research* (1967), *Environmental Science and Technology* (1967), *Experimental and Toxicologic Pathology* (1967), *Food and Chemical Toxicology* (1963), *Food and Drug Law Journal* (1946), *Health Physics* (1958), *Industrial Health* (1963), *International Archives of Occupational and Environmental Health* (1930), *International Journal of Radiation Biology* (1959), *Journal of the Air and Waste Management Association* (1955), *Journal of Animal Ecology* (1932), *Journal of Applied Ecology* (1964), *Journal of Ecology* (1913), *Journal of Experimental Marine Biology and Ecology* (1967), *Journal of Wildlife Management* (1937), *Journal of the Association of Food and Drug Officials* (1937), *Journal of Environmental Health* (1938), *Journal of Environmental Quality* (1972), *Journal of Occupational and Environmental Medicine* (1959), *Journal of Radiation Research* (1960), *Journal of Toxicology: Clinical Toxicology* (1968), *Mutation Research* (1964), *Occupational and Environmental Medicine* (1944), *Occupational Medicine* (1951), *Oecologia* (1968), *Oikos* (1948), *Pesticide Science* (1970), *Pharmacology and Toxicology* (1945), *Radiation and Environmental Biophysics* (1963), *Radiation Research* (1954), *Reviews of Environmental Contamination and Toxicology* (1962), *Reviews in Environmental Health* (1972), *Science of the Total Environment* (1972), *Teratology* (1968), *Toxicologic Pathology* (1972), *Toxicological and Environmental Chemistry* (1972), *Toxicology and Applied Pharmacology* (1959), *Toxicon* (1962), *Water, Air and Soil Pollution* (1971), *Water Environment Research* (1931), *Wildlife Monographs* (1957), and *Xenobiotica* (1971).

In 1969, Heldref Publication began one of the first interdisciplinary journals, *Environment*, as a means to provide authoritative reviews and evaluations of important and current environmental issues. The articles were not of the traditional peer-reviewed academic technical nature, but rather were analytical articles written to synthesize the issue representing the current scientific and technical thoughts on the issue, and impacts from social or cultural perspectives, policy, as well as environmental

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implications. This journal still provides such analytical reviews written for a broad audience of readers including researchers, educators, students, and policy makers.

There are numerous periodicals addressing environmental, pollution, conservation, and natural resources issues and concerns. They are published by various federal and state agencies, nonprofit environmental and conservation organizations, and public interest groups (see the National Wildlife Federation's Annual *Conservation Directory* (2002, Island Press for individual agency and organization publications). Other periodicals representing general and popular interests related to the environment include: *Audubon* (1899), *E—The Environmental Magazine* (1990), *International Wildlife* (1971), *National Geographic* (1888), *National Wildlife* (1962), *Orion* (1982), *Sierra* (1893), *Whole Earth* (1968), and *Wilderness* (1935). Christopher Dodge provided the first compilation of more than 160 environmental periodicals produced and published by the alternative press in an article, ''Green Zines: A List of Alternative Environmental Periodicals'' (*Green Library Journal*, 1(3):20–32, 1992). The review journal, *Counterpoise* (CRISES Press, Gainesville, FL) provides reviews of periodicals, books, and other information resources published or produced by small, regional, independent, alternative, and progressive presses. Regular features and reviews concerning the environment and ecology are provided in *Counterpoise*.

A wide range of environmental issues have served as a stimulus for piquing the interests of consumers, interested citizens, environmental advocates, and consumers. These have included environmental catastrophes such as chemical waste contamination of homes in Love Canal, New York, and Times Beach, Missouri; release of a lethal cloud of toxic gas over the city of Bhopal, India, resulting in the deaths of hundreds; radiological episodes at nuclear power plants at Three Mile Island, Pennsylvania, and Chernobyl, Russia; the massive oil spills of supertankers from the Torrey Canyon in 1969 off the coast of California to the Exxon Valdez along the rocky coasts of Prince William Sound off the Alaska coastline; and the outbreak in the 1990s of waterborne diseases and food poisonings in major U.S. and Canadian cities. Other headline-grabbing incidents are not site-specific and demonstrate that some of today's most serious environmental problems and issues have no respect for political boundaries: acid rain, climate change and global warming, endangered species, overfishing and exploitation of ocean fisheries, and thinning of the ozone layer.

The 1962 publication of Rachel Carson's monumental book, *Silent Spring* (Houghton Mifflin, Boston) reported the environmentally devastating impacts of the unrestricted use of pesticides to a public audience and NOT the ''scientific community.'' The publication of this book is also attributed to starting the environmental movement of the 1970s. It also ushered in an era for the publication of a new genera of environmental information, general interest, and popular works—books written not for scientists but for the general public.

Several compendia have been published to guide librarians in the identification and selection of the general interest and popular literature related to the environment: *Beacham's Guide to Environmental Issues and Sources* (1993, Beacham Publishing, Washington, DC), *Earth Works: Recommended Fiction and Nonfiction About Nature and the Environment for Adults and Young Adults* (1997, Neal Schuman Publishers, New York), *The Environmental Source Book* (1992, Lyons and Buford, New York), and *Reading About the Environmental: An Introductory Guide* (1993, Libraries Unlimited).

Field guides are a genre of environmental literature considered unique for their appeal to hobbyists and professional and amateur naturalists. These guides are filled with descriptive information for the identification a plants, animals, minerals, and other natural resources. Dianne Schmidt provided two outstanding comprehensive compilations of this literature type in *A Guide to Field Guides: Identifying the Natural History of North America* (1999, Libraries Unlimited, Englewood, CO) and *International Field Guides* (1999, University of Illinois, Urbana, IL).

Bibliographic control of environmental information has its roots in several major scientific, technical, and medical indexing and abstracting services: *Biological Abstracts* (1927), *Chemical Abstracts* (1907), *Engineering Index* (1898), *Excerpta Medica* (1947), *GeoRef* (1933), *Index Medicus* (1880, as *Index—Catalogue of the Library of the Surgeon-General's Office*), *Monthly Catalog of United States Government Publications* (1895), *Science Abstracts* (1898, now *Physics Abstracts*), *Science Citation Index* (1961), and *Zoological Record* (1864). It was not until the 1970s that we saw the emergence of subject-specific abstracting and indexing services related solely to ecology and the environment with *Ecological Abstracts* (1974), *Ecology Abstracts* (1975), *Environment Abstracts* (1970), *Environmental Periodicals Bibliography* (1972), and *Pollution Abstracts* (1970). In 1992, Paula Hane, Editor of *Database* (Online, Inc.), compiled a series of *Database* articles written in the early 1990s into a collection entitled, *Environment Online: The Greening of the Database*, which was one of the first comprehensive and multidisciplinary treatments of the online industry's coverage of the environment in the sciences, social sciences, and humanities.

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INTERNET ARGUS, MERLOT, WWW VIRTUAL LIBRARY

Libraries and Their Roles

The United Nations' 1972 Stockholm Conference served as the single greatest stimulus to libraries and librarians for actions related to the access and sharing of environmental information. Mary Anglemyer and Signe Ottersen prepared a detailed summary of the Stockholm Conference and its potential for libraries in an article, ''Beyond Stockholm,'' which appeared in the September 1972 issue of the professional journal, *Special Libraries* (vol. 63, pp. 407–410). This was one of the first calls to action directed specifically to librarians to address not only the growing information needs about the environment, but to become aware of the roles they play in managing the flow of environmental information from its identification and acquisition to its dissemination and use.

If not the catalyst for action, the 1972 Stockholm Conference was conveniently placed in a pivotal year for librarians to react to the forces generating a rapidly growing body of information. More important perhaps was the sudden awareness that librarians had to address the growing appetites for the consumption of environmental information by users representing many disciplines and crossing many perspectives and lines of work.

The June 1972 63rd Annual Meeting of the Special Libraries Association (SLA) in Boston, Massachusetts, produced three major bibliographies for a continuing education seminar, ''The Environmental and Ecological Literature—Where Does It All Come From?: Environmental Information Sources, Engineering and Industrial Applications, A Selected Annotated Bibliography'' (Carole Schildhauer); ''Environmental Services Bibliography'' (Bernadine Hoduski); and ''Environmental Legal Problems, A Selective Bibliography.'' It was at this meeting that the idea of creating a new environmental division within SLA was born (see below).

In September 1972, the EPA held a large Information Symposium in Cincinnati, Ohio, where several thousand participants spent the large portion of 2 days discussing the sources of environmental information. This EPA symposium provided a national forum (there may have never been a national discussion on environmental information attracting more participants than this 1972 gathering in Cincinnati) to describe the services, information and data products, and publications of various information and data centers, document delivery services, reference and referral services, and the most rudimentary of environmental information management activities to coordinate the scientific and technical information base with related legal, regulatory, policy, socio-economic, and planning information. The establishment of a national EPA Library Network was one of the outcomes of this monumental environmental information symposium.

Professor Marta Dosa presented a paper at the Annual Meeting of the American Society for Information Science entitled, ''An Integrating Approach to Environmental Information'' (ASIS Annual Meeting, October 1972, Washington, DC), describing a seminar conducted in the School of Library Science at Syracuse University that investigated the information issues and problems encountered in the emerging field of environmental studies. This seminar became the basis for an ongoing graduate library reference class, Environmental Information, which was taught by Professor Dosa at Syracuse University for more than 20 years until her retirement.

Environmental Information Resources was the theme of the November 1972 18th Annual Allerton Park Institute, which was cosponsored by the University of Illinois Champaign-Urbana's Graduate School of Library Science and the Illinois Institute for Environmental Quality. Its proceedings were published the following year as *Information Resources in the Environmental Sciences*. This conference addressed the proliferation of information and the sources of information related to the environment. This conference focused around the theme of the role of the librarian as an environmental activist and the need for librarians to actively promote the sharing and use of environmental information, which at the time was undergoing rapid changes, growth, and importance. A total of 15 presentations was given, which, in many cases, consolidated into one source the management of information resources related to the environment by government agencies, institutions of higher education and research, and private organizations (including publishers and database vendors). The need for the development and improvement of environmental information collections in various types of library settings (academic, school, public, government agency, and other special libraries) was emphasized. While nearly 30 years have passed since this conference was held, it is uncanny how these papers still echo their relevance, calling for dedicated services, collections, and resource sharing networks related to a large, growing, and dynamic body of environmental information.

Library Organizations

The Environment and Resource Management Division (ERMD; www.sla.org/division/derm/index.htm) of the Special Libraries Association was established in 1989 as a result of the merging of the Environmental Division (initiated in 1972 and established with provisional status in 1974 and division status in 1976) and the Natural

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Resources Division (established in 1968). The ERMD supports special interest groups for forestry, state environmental and natural resources agencies, and toxicology and environmental health. A quarterly newsletter, the *ERMD Newsletter*, publishes not only news about ERMD, but provides reviews or books, technical reports, new journals, Internet and WWW resources, and profiles of notable environmental information programs and organizational efforts promoting data and information management practices. Its programs at the SLA Annual Meetings focus on the topics of importance to the environmental information community and address a variety of issues and concerns.

In addition to the ERMD, the SLA supports a Natural History Caucus (www.lib.washington.edu/sla/), which was created in 1991 to integrate the subjects of anthropology and archaeology, botany, zoology, paleontology, geology, meteorology, and astronomy. The caucus provides a list of natural history museums and libraries worldwide.

The American Library Association (ALA) Task Force on the Environment (TFOE; www.ala.org/alaorg/rtables/srrt/tfoe/) was established in 1989 in the spirit of the upcoming 20th anniversary of Earth Day in 1990. The TFOE is one of seven task forces comprising the Social Responsibilities Round Table, which is administratively linked to the ALA's Office of Outreach and Literacy Services. The primary function of TFOE is to promote awareness for environmental issues for ALA, its members, and other librarians, and to facilitate networking among peers and professional associates. The TFOE and its members took an active role in implementation and now serves as the steward for the web site created by the joint ALA–Global Learning, Inc. Libraries Build Sustainable Communities project (1999–2001, funded by the U.S. Agency for International Development; see www/ala.org/sustainablecommunities). The TFOE was also involved in the production of the various editions of the Libraries for the Future's *The Environmentalist's Guide to the Public Library* (www.lff.org/services/envgui.html).

The Natural Resources Information Council (NRIC; www.quinneylibrary.usu.edu/NRIC/Index.htm) was conceived in 1991 at the first North American Fish and Game Special Librarians' Conference in Boise, Idaho. The NRIC was formerly founded in 1993 and has held annual meetings and developed a network to facilitate the exchange of resources and ideas among librarians and information providers whose work includes natural resources libraries and collection. The NRIC maintains one of the most comprehensive directories of natural resources libraries, information centers, and clearinghouses.

Environmental information, along with other forms of information, exploded on the Internet and the World Wide Web. Don Ritter authored one of the first comprehensive books, *Ecolinking: Everyone's Guide to Online Environmental Information* (1991, Peachpit Press, Berkeley, CA). Toni Murphy and Carol Briggs-Erickson authored *A Guide to Environmental Resources on the Internet*, the first environmental resource guide to the Internet. Growing from a library reference class assignment, the environmental guide was contributed to the Clearinghouse for Subject-Oriented Resource Guides. Their effort is now published as the *Environmental Guide to the Internet*, 4th Ed. (1998, Government Institutes, Rockville, MD). The Clearinghouse is continued on today as the Argus Clearinghouse (www.clearinghouse.net), which is an authoritative and selective collection of subject guides, created by subject specialists. There are a large number of peer-reviewed and ranked guides related to ecology, biodiversity, the environment, and related fields. The *Internet Public Library*, which, like the Clearinghouse, grew out of a 1995 graduate seminar in the School of Information and Library Studies at the University of Michigan, is another major gateway to environmental information resources on the WWW. Another major gateway site is the *WWW Virtual Library—Environment* (earthsystems.org/virtuallibrary/vlhome.html). MERLOT (www.merlot.org) provides links to online learning materials (reference resources, tutorials, web collections, and simulations), each provided with annotations, peer review comments and rankings, and class assignments from middle school levels to college-level instruction.

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Everyday Life Information Seeking

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INTRODUCTION

Information seeking may be analyzed in two major contexts: job-related and nonwork. The present article concentrates on nonwork information seeking, more properly called *everyday life information seeking* (ELIS). Typically, ELIS studies discuss the ways in which people use various information sources to meet information needs in areas such as health, consumption, and leisure.

Due to space restrictions, the present review focuses on ELIS research conducted in the field of information studies or library and information science since the 1990s. First, for this reason, certain types of studies relevant to ELIS will not be discussed. These studies include marketing and consumer research, communication studies (e.g., audience research), and public library use studies. Second, specific questions of ELIS such as general public search strategies during interactions with Internet search engines or online public access catalogs will not be considered in the present review.

The review is structured as follows. In Section 2, the concept of ELIS will be clarified. Section 3 discusses the ways in which various sources and channels are used in ELIS. The major conceptual models of ELIS are discussed in Section 4. Section 5 concludes the review.

THE CONCEPT OF ELIS

Thus far, a rich variety of themes have been explored in ELIS studies. They have focused on people belonging to diverse groups such as the following:

- Adolescents making career decisions[1,2]
- Children[3]
- Parents with children under the age of 5 years[4]
- Abused or battered women[5–7]
- Women with breast cancer[8]
- Hospital patients[9]
- Users of digital health kiosks[10,11]
- Homeless parents[12]
- Lesbians[13]
- Inner city gatekeepers[14]
- People interested in paranormal issues[15]
- Those having reading-for-pleasure as a hobby[16]
- Blind and visually impaired citizens[17]
- People browsing newspapers.[18]

As the above examples suggest, the phenomena of ELIS can be approached from a number of viewpoints, for example, by concentrating on people's specific roles such as consumers or hospital patients. ELIS can also be approached by focusing on the demographic features of information seekers, for example, by investigating information needs and seeking of elderly people.

Particularly in the early years of ELIS research, concepts such as *citizen information needs and seeking* were utilized to denote information seeking taking place outside work tasks (e.g., Ref. [19]). Even though the above concept is illuminating in itself, it is rather narrow because it primarily refers to people's rights and obligations toward social institutions as voters or participants in activities of civil society. Alternative concepts such as *nonwork information seeking* are problematic due to its residual nature and negative connotations: nonwork information seeking is implied to be less significant because it deals with something that is not associated with daily work.[20] The definition problem is further aggravated by the fact that issues of job-related and nonwork information seeking tend to overlap and they may be interwoven in everyday settings.[21] For example, seeking information about computer courses may serve both professional ends and hobbies.

Terminological problems originating from the false dichotomy of work-related and ''nonwork'' information seeking may be avoided by taking the concept of ELIS as starting point.[20] The key word is *everyday life*, which refers to a set of attributes characterizing relatively stable and recurrent qualities of both work and free time activities. The most central attributes of everyday life are familiar, ordinary, and routine, and they qualify the structural conditions of action (e.g., the recurrent ''rhythms'' of work and leisure hours). The above characteristics of familiar, ordinary, and routine become real only in the process in which they are reproduced, day after day.

From this perspective, information seeking may occur in both work-related and leisure-related contexts of everyday life. Because the field of work-related information

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seeking is relatively well defined and the term *work-related information seeking* is self-explanatory, usually there is no need to use the more specific expression of ''work-related information seeking in the context of everyday life.'' Thus the concept of ELIS may be reserved to denote information acquisition taking place in less clearly specified contexts and activities such as hobbies and household care. These activities and contexts are seen as important in their own right, and not only as residuals of work-related phenomena. Hence, the positive term *ELIS* indicates that ELIS is not inferior to work-related information seeking.

Generally defined, the concept of ELIS refers to the acquisition of various informational (both cognitive and expressive) elements, which people employ to orient themselves in daily life or to solve problems not directly connected with the performance of professional tasks or full-time study.[20] Like work-related information seeking, ELIS may have two modes. On one hand, it may refer to seeking of *problem-specific information* (e.g., finding a fact). On the other hand, ELIS may manifest itself as seeking for *orienting information* (i.e., monitoring of everyday events by using various sources and channels).

EVERYDAY INFORMATION NEEDS AND THE USE OF INFORMATION SOURCES IN THE CONTEXT OF ELIS

A considerable number of ELIS studies focus on the ways in which information sources are used to meet various information needs. The specificity of research settings varies from general-level surveys of source usage to studies on ELIS focusing, for example, on health issues.[22,23] However, due to space restrictions, the present review concentrates on general-level studies.

Strictly defined, the tradition of ELIS research dates back to the early 1970s, when extensive surveys were launched in the United States to investigate ordinary people's information needs and seeking. At the same time, the first attempts were made to develop conceptual and methodological tools for ELIS studies. Perhaps the most prominent figure in this field is Brenda Dervin—a communication scholar who created innovative approaches to enrich traditional survey research settings. Douglas Zweizig also contributed significantly to methodological issues, primarily in the field of public library use studies (Ref. [24]; cf. Ref. [25]).

One of the pioneering surveys of ELIS was based on interviews with about 1000 people in Baltimore in 1972. The informants represented various demographic groups. This massive study revealed almost 9000 everyday life questions or problems reported by the interviewees. These problems were categorized into problem areas indicating daily information needs as follows:[26]

- Neighborhood
- Consumer habits
- Housing and household maintenance
- Crime and safety
- Education
- Employment
- Transportation
- Health
- Recreation
- Discrimination
- Financial matters
- Legal problems
- Public assistance.

Later surveys have demonstrated that these need areas are largely also valid today. For example, Hersberger[12] used the above categories when exploring the information needs of homeless parents.

Extensive surveys conducted since the 1970s have specified the picture of people's everyday information needs. These surveys have also revealed the most popular information sources and channels used to meet these needs. For example, Chen and Hernon[27] reported the findings of an extensive telephone survey conducted in New England, United States 1979. The informants identified about 3500 daily problems situations—both work-related and nonwork—leading to information seeking. The individual's own experience appeared to be most frequently used because 74% of respondents reported that they had drawn on this source in problem solving. In addition, friends, neighbors, and relatives also appeared to be popular sources. The findings indicate the key role of informal sources that are easily accessible. In ELIS, people tend to favor familiar sources that have functioned reliably in earlier use contexts. Thus ELIS seems to be characterized by a conservative attitude: people tend to draw on familiar information sources that are often used almost routinely.

In the 1990s, interest in general ELIS surveys was revived, particularly in the UK. One of the motivating factors was the growing importance of the Internet in information seeking. The most notable example of the recent surveys giving a general picture of the most popular information sources is provided by Marcella and Baxter;[28] they have reported the findings of a nationwide project on citizenship information conducted in Great Britain in 1997 (for the related ELIS surveys conducted in the UK, refer to Refs. [29–32]).

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According to the nationwide survey, the most frequently mentioned areas of information needs were the following:[28]

- Education (e.g., information to assist with coursework)
- Leisure and recreation (e.g., hobbies and tourism)
- Health care
- Welfare benefits
- Legal information
- Employment and job opportunities
- Financial matters
- Consumer and credit issues
- Housing
- Business information.

Broadly taken, the above main areas resemble those identified in earlier surveys (e.g., Chen and Hernon).[27] Thus it seems that the major information need areas are relatively stable, and the variation between (Western) countries is rather insignificant.

The Role of the Internet in ELIS

Since the late 1990s, particularly e-mail and Word Wide Web (WWW) have been widely accepted as new tools for communication and information seeking. The surveys indicate that people use the networked services for various purposes (e.g., keeping in contact with others by e-mail, seeking information from web pages, buying products and services, and participating in online discussions).[33,34] However, so far, the number of studies focusing on ELIS has remained low (however, refer to Refs. [34] and [35]).

Savolainen[36,37] explored the significance of the Internet in seeking for problem-specific and orienting information in Finland. E-mail and WWW appeared to be the most frequently used services in information seeking, but discussion groups and the Internet Relay Chat (IRC) were also utilized to some extent. The same study revealed that network services were used to seek both orienting and problem-specific information for nonwork purposes. Most often, information seeking was based on the browsing of web pages. Mailing lists and discussion groups were also mentioned in this context. In general, the seeking of orienting information, to keep up-to-date or to monitor daily events, was somewhat more frequent than searches for problem-specific information. Similar findings were received also in a study conducted in Sweden.[38] The study demonstrated that in the late 1990s, the Internet had already gained a fairly significant place in the informants' communication and information-seeking practices, providing a wide variety of sources for different purposes of use.[38] The Internet was also found to be useful as a source of market information (e.g., flight schedules, car rentals, objects for sale, and job opportunities).[38]

Thus far, these findings also suggest that the Internet has not been able to replace other media such as the telephone, television, radio, and newspaper in ELIS.[39] On the contrary, the network services complement them both in job-related and nonwork contexts. However, empirical evidence of the ways in which the Internet is able to challenge other sources in ELIS is still quite patchy, and there is a need for more detailed studies that also make use of qualitative research settings.[40]

THEORIES AND MODELS OF ELIS

Compared to job-related information seeking, the number of theoretical frameworks and models of ELIS is still relatively low. This is partly due to the relatively short tradition of this subfield and the smaller number of researchers who are active in ELIS issues.

The Sense-Making Approach (Dervin)

Brenda Dervin can be counted among the most influential researchers of ELIS since the early 1970s. Her early studies focused on the communication practices of urban poor people.[41,42] In the early 1970s, Dervin began to develop the Sense-Making approach as a methodology focusing on human communication and the design of communication-based systems and activities. Since then, the theoretical and methodological bases of the Sense-Making approach have been transformed and refined, and it has been applied in numerous contexts to explore information needs and seeking of specific groups of people (refer to Refs. [43–47]).

Dervin employs the metaphors of *situation*, *gaps*, and *uses* to depict information seeking and use them as a sense-making process. Metaphorically, the situation stands for the time–space context, where the individual becomes aware of the insufficiency of one's earlier definition of a situation. Gaps refer to questions or information needs elicited in situations of this kind. Uses stand for the ways in which information being sought or received from various sources helps to bridge the gap and to create a new sense. Examples of use include getting ideas and understanding, being able to plan ahead, deciding what to do, and getting out of a bad situation.[43]

Although the Sense-Making approach draws heavily on metaphorical formulations, it has gained empirical support, which strengthens the hypothesis that information seeking is a constructive process based on the utilization of categories of situation, gaps, and uses. For example, a

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study focused on blood donors who were asked to describe the process of donating:[48] What happened first in the donating situation? What are the questions they themselves posed? How did they hope the answers to their questions would help them? Other Sense-Making studies have focused, for example, on the information needs and seeking of cancer patients,[49] Hispanic populations,[50] users of ''plain old telephone services,''[51] and pregnant, drug-addicted women.[52] The Sense-Making theory has inspired, for example, the study of Kari,[15] which focuses on the information needs, seeking, and use of people interested in paranormal issues; the investigation of Julien,[2] which discusses barriers to adolescents' information seeking for career decision making; and the study of Pettigrew,[53] which concentrates on the ways in which people use public library–community network systems.

In sum, the Sense-Making approach has contributed significantly to the conceptual and methodological development of ELIS research. By emphasizing the role of individuals trying to bridge gaps in everyday situations and the nature of information as a situation-bound human construct, sense making has advocated the user-based approach, as opposed to the traditional information system-centered viewpoint. Thus Dervin has not only introduced a new viewpoint to ELIS studies, but has also more broadly contributed to the theoretical and methodological breakthrough of the user-centered approach to information-seeking studies (cf. Ref. [54]).

Interest–Concern–Caring (Wilson)

One of the generic models of ELIS was developed by Wilson.[55] Wilson proposes a tripartite conception of interest–concern–caring to make understandable the intensity and focus of ELIS in various phases of solving everyday problems. In general, the model is based on the assumption that people want to have some control or influence over things that happen in the world.

The category of *interest* refers to a general-level orientation toward some issues. Interest may manifest itself simply as wanting to know how things are in some areas. It is characteristic of interest that it does not necessarily imply one's readiness to engage in action to change or control the objects of interest. Interest may be passive or active. In the former case, information is received if it happens to become available. If interest is active, a person is inclined to find out more about a topic. For example, the issues of diabetes can be approached on the level of interest. The person may be interested in this topic and, occasionally, may read a newspaper article discussing the growing number of diabetes among obese people and the ways in which diabetes may be prevented by changing one's eating habits. However, because this problem is not seen to be of personal concern, the person may or may not make further attempts to seek information about diabetes.

However, if it happens later on that the same person develops typical symptoms of diabetes, the interest turns into *concern*. Concern implies one's readiness to act, exert control, or influence. Similar to an interest, a concern may be passive, or, as Wilson[55] says, ''closed''—not necessarily causing a person to seek information. In the case of active concern, a person tries to find more information to make sense of the situation or to solve a problem. For example, the person starts to seek information more systematically to learn more about the long-term risks of this chronic disease, and may consider calling the doctor. If, in fact, diabetes is diagnosed, the concern turns to *caring*. The person engages in action to change or control the worrisome things. One tries to acquire information systematically about the required diet and other issues relevant to coping with diabetes. The process may also go to a reverse direction. With the help of proper medication, the health problems may no longer seem as life-threatening, and caring may gradually turn into concern or interest. At the same time, the role of seeking orienting information occupies a more central position compared to acquiring problem-specific information.

ELIS in the Context of Small World (Chatman)

Elfreda Chatman is one of the most prominent figures in ELIS studies since the 1980s. Chatman's highly original research project focuses on information-seeking behavior of people living in the margins of society. Her research project is characterized by an attempt to develop a genuine social scientific theory, which describes ELIS in the context of ''small world.'' This concept refers to local and often small-scale communities in which activities are routine and fairly predictable. In a small world, everyday information seeking and sharing are oriented by generally recognized norms and role expectations based on beliefs shared by members of the community.

In a series of ethnographic studies conducted in the 1980s and 1990s, Chatman applied ethnographic methods to study the ways in which poor people seek, use, and communicate information within the context of their everyday settings. In a study characterizing the information world of low-skilled workers, Chatman[56] examined the information needs and seeking behavior of female janitors at a university (refer also to Ref. [57]). It appeared that they had a narrow, concrete, and local view of the world restricted to the most familiar social milieu. Thus information originating outside of this ''small world'' was not of great interest to them. The repertoire of information sources appeared to be narrow. Much daily information

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came from television. To some extent, information was also sought in newspapers. Most informants felt that personal experience was the most reliable source of information. They favored ''first-level information'' received through personal experiences or hearsay from someone who is accepted as having knowledge of the matters to be discussed. In contrast, the value of ''second-level'' information received from outsiders is suspected and often ignored because this type information is not compatible with the common sense reality of the small world.

The specific features characteristic of information seeking in the small world were also studied among elderly women residing in a retirement complex.[58,59] Ethnographic analysis was conducted to ascertain their information and recreational needs, and to explore the most popular information sources. The informants appeared to be active users of mass media. In contrast to the janitor study, the informants of this study favored quality TV programs, and they read books and magazines quite frequently, but were not active users of public library.

Based on the above studies, Chatman[60] concluded that everyday information seeking of small world people is affected by four major factors forming the basis of the theory of information poverty: risk taking, secrecy, deception, and situational relevance. For example, the women of the retirement community avoided risk taking by not telling anyone about declining health concerns, thus giving up to seeking information or gaining emotional support (Ref. [61]; cf. Ref. [60]). The notion of secrecy is closely related to risk taking in that the elderly women concealed physical and mental ailments. Third, deception represents a deliberative attempt to act out a false social reality.[61] In this way, one engages in activities in which personal reality is consciously and forcefully distorted, and the individual tries to appear better than one really is. Finally, situational relevance is instrumental in explaining information poverty. Potentially useful information will be not used because people living in a small world do not see a generalized value of sources provided by outsiders intended to respond to their situation. The source is ignored because it is not legitimized by ''contextual others.''[61]

Later, Chatman[62] developed ''a theory in the round'' to elaborate the lifestyle and information-seeking practices of female prisoners. The concept of ''life in the round'' refers to a dynamic world based largely on approximation.[62] It is a world where imprecision is largely accepted and inexactitude is tolerated, and where ''members move in and out of the round depending on their need for more systematic, precise, and defined information.''[63] Understanding life in the round results when information is clear enough to give sensible meaning to things. The most important consequence of this construct for the practice of ELIS is that life in the round adversely affects information seeking in day-to-day situations; people will not search for information if there is no need to do so. Small world inhabitants ignore information if they perceive that their world is working without it (i.e., they have enough certainty, comfort, and situational predictability so that the need to seek information is negated).[63] Individuals will cross information boundaries only if: 1) information is perceived as critical; 2) there is a collective expectation that the information is relevant; and 3) a perception exists that the life lived in the round is no longer functioning.[62]

Chatman[64] summarized theoretical developments in a theory of ''normative behavior.'' The theory may be seen as an elaboration and extension of the theory of life in the round. In brief, the normative theory of behavior suggests that ELIS is affected by the norms and role expectations of specific communities. Ultimately, norms and roles determine what kind of information sources will be preferred, accepted, and used.

Chatman's research project on the information-seeking practices of marginalized people inspired other projects (e.g., the study of Hersberger[12] focusing on the ways in which homeless parents living in family shelters seek for everyday information). The research line opened by Chatman is promising both theoretically and methodologically. Importantly, Chatman's research project exemplifies the genuine need to utilize the repertoire of social scientific theories and ethnographic approaches to enhance our understanding of information seeking as an integral part of everyday action in social contexts.

The Ecological Model of ELIS (Williamson)

By drawing on the findings of an empirical study in which some 200 older adults were interviewed in Australia in 1992–1994, Williamson[65,66] developed an ecological model of information seeking and use. It can be called ecological because it sets information seeking, acquisition, and use in the context of social and cultural factors, which may have an influence on the ways of selecting and using information sources and channels. The model suggests that, although people purposefully seek information in response to perceived needs, they also monitor their world and receive information incidentally. The ways in which they monitor the everyday world is mediated by social–cultural backgrounds and values, physical environments, and personal characteristics (e.g., their states of health), as well as their socio-economic situations and lifestyles.

The model suggests that in purposeful and incidental information seeking, information sources of various types are given differing importance. The intimate personal networks (family and friends) are closest to the user and

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are probably also perceived by the user as most easily accessible. The other source types are located farther in the ''ecology of sources'' [i.e., wider personal networks (clubs, churches, and voluntary organizations) and the mass media (newspapers, television, radio, and magazines)]. Institutional sources such as professionals, government departments, and other organizations are perceived to be even more remote in this sense.

ELIS in the Context of Way of Life (Savolainen)

''Way of life'' is a social scientific concept, which provides a broad context to investigate individual and social factors affecting ELIS. Savolainen[20] defined the concept of way of life as ''order of things,'' which is based on the choices that individuals make. ''Things'' stand for various activities taking place in the daily life world, including not only jobs but also necessary reproductive tasks such as household care and voluntary activities (hobbies); ''order'' refers to preferences given to these activities. Because, in most cases, the order of things is a relatively well-established constellation of work and nonwork activities taking place in a day or a week, this constellation is easily taken to be the most natural or normal way of organizing one's everyday life. Correspondingly, people have a ''cognitive order'' indicating their perceptions of how things are when they are ''normal.'' Through their choices, individuals have practically engaged in a certain order of things, and it is in their own interest to adhere to that order as long as they find it meaningful. Thus at least implicitly, most people seek for an internal coherence in everyday matters because it gives them better chances to plan their choices and act meaningfully.

The most central issues of way of life manifest themselves in the *structure of the time budget*, described as a relation between working and leisure time, *models of consumption of goods and services*, and *nature of hobbies*.[20] The structure of the time budget reveals the proportions of time spent on work, necessary activities outside work such as household care, and, finally, the time devoted to recreational activities such as hobbies. By analyzing the models of consumption, one may draw a picture that indicates the share of money spent on the acquisition of various goods or services (e.g., books). The analysis of hobbies sheds light on the substance of way of life because the nature of hobbies informs us of the things that people find most pleasant; the analysis also reveals the role of informational interests (for instance, newspaper reading) in leisure time.

Because the meaningful order of things may not reproduce itself automatically, individuals are required to take active care of it. This caring activity can be defined as *mastery of life*, implying the importance of the coherence of the life project at large. The nature of these projects may vary. As aptly specified by Hektor,[38] some life projects may be generic in that that they are common to most people (e.g., household care). Other projects are specific because they originate from an individual's life situation (e.g., child rearing or one's specific interests, i.e., hobbies).

Mastery of life serving one's life projects may be either passive or active. It is passive when people are satisfied with seeing that everything is going on as expected, at least on the whole.[20] Active mastery of life is associated with pragmatic problem solving in cases where the order of things has been shaken or threatened. Mastery of life is a general preparedness to approach everyday problems in certain ways in accordance with one's values. Information seeking is an integral component of mastery of life, which aims at the elimination of continual dissonance between perceptions of ''how things are at this moment'' and ''how they should be.'' If there is no dissonance, mastery of life goes on quite routinely and the information seeking attached to it can be characterized as a rather *passive monitoring* of everyday life events. In other cases, mastery of life may grow into active problem solving aimed at restoring the disturbed order, usually requiring *active seeking of practically effective information*.

Savolainen[20] utilized the above model in an empirical study conducted in Finland. The study focused on two groups: that is, teachers and industrial workers. The empirical study strengthened the assumption that way of life directs information seeking in a significant way. Teachers were more eager to seek factual information from various media, and they took a more critical stand toward the supply of light entertainment from radio, television, newspapers, and magazines. The interviews revealed that personal interest and current life situation also affect media use. There appeared to be teachers not particularly interested in the culture or politics sections of newspapers; similarly, some workers preferred documentaries and other serious programs and took a critical view of entertainment.

Information Practices (McKenzie)

One of the newest models of ELIS is proposed by McKenzie.[67] The model was developed in the context of health information seeking by pregnant women. McKenzie specifies a two-dimensional model of context-bound information practices. The model describes four modes: that is, active seeking, active scanning, nondirected monitoring, and obtaining information by proxy. When seeking information, the modes may appear in varying order, depending on the information need at hand and the situational factors. The modes can take place in two phases: first, at times of connecting information sources; and, second, interacting with them. Thus the second phase implies the use of the information source to which one has

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been connected. The indications of use are, for example, reading a text or actively asking specifying questions when consulting a doctor.

By drawing on the above model, the process of health information seeking maybe described as follows.[67] *Active seeking* can be defined as the most directed mode of information practice. Consulting a previously identified source (e.g., a family physician), rereading an article in an encyclopedia, or conducting a systematic known-item search in a medical database exemplifies active seeking. *Active scanning* refers to semidirected browsing or scanning in likely locations (e.g., medical books in a bookstore, or web pages discussing diabetes). *Nondirected scanning* involves serendipitous encounter with, and recognizing, a source (e.g., incidentally getting a useful idea from a TV program on how to reduce smoking). Finally, *obtaining information by proxy* may take place when interacting with information sources through the initiative of another agent: either the information source or some other gatekeeper or intermediaries. For example, a colleague interested in the stopping of smoking may refer to new web pages related to this topic, recommending the information seeker to visit them. Alternatively, the colleague may have bought a new book on this topic and lends it to the information seeker.

McKenzie's model exemplifies the major tenets of recent studies on information seeking. Information seeking is seen as a highly dynamic and context-dependent activity, drawing on a number of modes that may appear in various orders. The model also exemplifies the growing complexity of ELIS processes (e.g., the ways in which various information resources perceived to be accessible afford ELIS to meet the needs of orienting and problem-specific information).

CONCLUSION

The ELIS studies conducted since the 1970s indicate that everyday life information needs and seeking are affected by a number of cognitive, emotional, cultural, and situational factors. Most frequently, everyday life information needs are related to health issues, consumer problems, housing, and various kinds of hobbies. To meet these needs, people tend to favor a limited number of easily accessible sources, which have been found useful in previous use contexts. This seems to confirm the assumption that ELIS is largely oriented by the principle of the ''least effort.'' It also seems that daily information-seeking habits change quite slowly.

One of the recurrent findings of ELIS research is people's tendency to favor human sources due to easy access to and the opportunity to get immediate feedback. However, source preferences may vary in differing information need situations; depending on their requirements, for example, printed encyclopedias may be preferred over human sources.[68] Since the 1990s, the Internet has increasingly affected ELIS practices by providing easily accessible sources. Even though the popularity of the networked sources has grown rapidly, it seems that they will complement, rather than replace, more traditional sources and channels.

As the daily mediascape becomes more complex and information seeking is affected by an increasing number of contextual factors, there is a need to elaborate the research settings of ELIS. The major challenge is to study contextually the dynamic (situation-bound, sometimes nonlinear and cyclical) processes of ELIS as related to the recurrent patterns of information seeking. One indication of the progress made in this respect is the elaboration of the theoretical and methodological bases, as exemplified by Dervin's Sense-Making approach and Chatman's project to develop a social scientific theory of ELIS. The empirical research settings have also become more sophisticated; ELIS research is no longer restricted to general surveys, but attempts have been made to use both quantitative and qualitative research and to combine data gathered by interviews, diaries, participant observation, and other ethnographic methods. More reflective attention is being devoted to the ways in which the researchers gain access to the everyday life settings of the informants.[35,69–71] Obviously, the increasing sensitivity to contextual issues will be one of the challenges for future ELIS research. This will be necessary as the phenomena of ELIS grow more complex and dynamic.

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Firewalls

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INTRODUCTION

What Are Firewalls?

Historically, firewalls were solid brick or masonry walls between adjoining or adjacent structures. Their purpose was to prevent fire in a wooden-framed building from burning through the typical wooden interior or exterior walls of the day and spreading to another structure. And they were effective to the point that insurance companies usually would discount the insurance premiums for buildings or offices that were protected by such firewalls.

In these days of computers and advanced technology, the term ''firewall'' usually refers to a hardware- or software-based device that performs a function somewhat similar to the firewalls of old—it prevents danger in one area from spreading into other areas. More specifically, today's technological firewall prevents the admittance of hackers, cyber attackers, and other intruders, via the Internet or another network, into your organization's network, into your servers, or into your desktop computer(s). This is accomplished by a system of user-managed access-control rules and policies.

Firewalls serve as a kind of doorman or security guard for outgoing data as well as for incoming data traffic. The purpose of a firewall is to put a break (the firewall itself) between your internal network and any external networks. For example, a firewall may let only certain users access your network (or the Internet); it may allow only certain protocols to be used [e.g., hypertext transfer protocol (HTTP), file transfer protocol (FTP), Telnet] while denying others; it may close specific ports (e.g., 21, 23, 137, 445), and it may block certain well-known kinds of attacks on your network (e.g., Distributed Denial of Services attacks, Port scans). Because they stand between external networks and your internal network, firewalls are your first and best defense.

While firewalls are powerful and critical tools, there are certain security-oriented tasks that they normally cannot perform. These tasks include scanning for Trojans, attack scripts, and viruses in e-mailed or downloaded files; dealing with social engineering ploys; detecting and correcting weak user passwords; dealing with internal attacks, and correcting the use of poor organization security practices and procedures.

TYPES OF FIREWALLS

Firewalls can be categorized by a number of models: by their Basis of Operation, by their Protection Scope, or by their Function. The Basis of Operation model consists of three categories: 1) proprietary hardware-based firewalls (e.g., NetScreen, Cisco PIX, etc.); 2) software-based (or server-based) firewalls (e.g., Check Point Firewall-1, ZoneAlarm, BlackIce Defender, etc.); and 3) virtual firewalls [e.g., outsourcing critical functions and services, such as an organization's web servers or e-mail services, to reliable commercial/third-party firms specializing in hosting such services; or using hidden internet protocol (IP) address manipulation techniques such as Network Address Translation (NAT).

The Protection Scope model divides firewalls into two major categories—enterprise and desktop. Enterprise firewalls are tasked with protecting the organization's Internet connection, its servers, and access to its network(s) as a whole. While enterprise-class firewalls can be either proprietary hardware-based or software/server-based, the former is preferred unless the firewall software is running on a secured proprietary operating system (the security leaks and holes of all standard operating systems are too prevalent and too well known to trust to the hosting of firewall software). Desktop firewalls protect individual desktop computers; they should be considered as the second line of defense to the enterprise firewall(s), and they are almost always software-based.

The Function model divides firewalls into three major categories, based on the procedures they use as their primary defensive methodology: 1) packet filtering (both static and dynamic); 2) stateful packet inspection; and 3) what are commonly referred to as application filtering/proxy servers. Static packet filtering firewalls inspect the IP header section of each data packet going through the firewall (in either direction) and, based on the firewall's default or programmed rule base [usually a combination of IP addresses and transmission control protocol (TCP)/IP, and/or user datagram protocol (UDP) ports], determines whether that packet should be passed through the firewall. Dynamic packet filtering firewalls take static filtering further by maintaining an internal table of connections and connection states. This ensures that an inbound data packet is actually a response to a legitimate

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outbound request. Static packet filtering is the bare minimum function that even the least expensive firewall should perform, but it is not sufficient protection in and of itself.

Stateful packet inspection filtering is the highest level of firewall technology and operates at the application level. It keeps track of outbound requests and their initiator, and allows inbound answers only if it is destined for the system that initiated that request. Stateful packet inspection examines the entire data packet and allows only certain protocols or protocol functions (e.g., all Telnet commands, or just the FTP PUT/GET commands) to enter the network or to leave it, depending on how the firewall has been configured.

A proxy server is not strictly a firewall in and of itself. While a firewall acts as a ''break'' between your internal network and external networks, a proxy server acts as a ''go-between'' between your internal network and external networks. In essence, an internal user queries the proxy server, which then issues its own query to the external network. The external network's response is to the proxy server, which then reissues this response to the internal user.

It should be noted that proxy servers are application-specific; if you intend to use a proxy server, you must be certain that it supports all of the applications you wish to use—now and in the future. The use of a proxy server also means that the appropriate protocols on the client software used by your organization (e.g., HTTP, FTP, Telnet, etc.) will have to be reconfigured to recognize and permit the use of the proxy server; this must be carried out for each desktop computer. A proxy server usually performs additional functions as well (e.g., content caching, site or content blocking, authentication logins). While proxy servers usually mask the internal user's IP address (by using Network Address Translation or IP address masking), the security value of this is a coincidental one to their primary purpose.

For the further purposes of this paper, firewalls will be discussed vis-a-vis the Protection Scope model—as enterprise firewalls and as desktop firewalls.

ENTERPRISE FIREWALLS

Enterprise-class firewalls are designed to protect an organization's Internet connection, its servers, and its internal network(s). They truly are the first line of defense that an outside intruder encounters. Enterprise firewalls can be virtual in nature; they can be built into an organization's Internet router; they can be a separate proprietary device, they can be a server-based software package, or they can be a secondary function of an ancillary piece of hardware (e.g., managed Ethernet switches).

Virtual firewalls are those that consist of locating organizational services and functions off-site or those that use hidden IP address manipulation techniques such as Network Address Translation (see below). Locating your web and/or e-mail servers at a reliable and secure third-party site (e.g., your ISP, a higher-level operation within your organizational hierarchy, or a company specializing in such services) ensures that your web and e-mail server IP addresses do not reflect the IP address location of the rest of your network. Any attacks or intrusion attempts against your web or mail servers will not be synonymous with an attack against the core of your network or against your Internet connection.

Most modern Internet routers have a certain number of firewall capabilities built into them. Many, if not most, of these routers are owned by an organization's ISP and not by the organization itself. Therefore it is likely that the organization may not know the particulars of the firewall security enabled within their router and may even be prohibited from viewing or, especially, changing any firewall and security settings. However, communication with the owner of the router usually will elicit a statement of security measures, and they should be responsive to any requests to change (i.e., strengthen) those measures.

Organizations should have at least one separate enterprise firewall protecting their network (Fig. 1). While these devices can range in cost from several hundred to several thousand dollars, the cost differentials can reflect real-world differences. Usually, higher-cost firewall devices will have a number of advantages over lower-cost devices: higher-data throughput, more extensive encryption and security algorithms, the ability to handle higher loads without significant data slowdown, additional functionality (e.g., stateful packet inspection vs. only dynamic filtering), and additional capabilities [e.g., one or more demilitarized zone (DMZ) ports, Virtual Private Network (VPN) capabilities, etc.].

Specific ancillary pieces of hardware can also contain certain firewall features. This hardware usually consists of items such as managed Ethernet hubs or intelligent switches. These devices should never be used as the sole firewall security within any organization.

Examples of proprietary hardware firewall devices include Cisco PIX, NetScreen, and SonicWALL Pro. Examples of software-/server-based enterprise firewalls include Check Point 2000NT, WebGuard Firewall Solaris, and Raptor Firewall for NT. It should be remembered that: 1) usually, a software-/server-based firewall should be considered potentially less secure than a proprietary hardware-based one because it is usually run from a known ''standard'' operating system (e.g., Solaris, Windows NT, etc.); 2) a software-/server-based firewall, if used, must be run on a computer with a proprietary and highly secured operating system; and 3) any software-/

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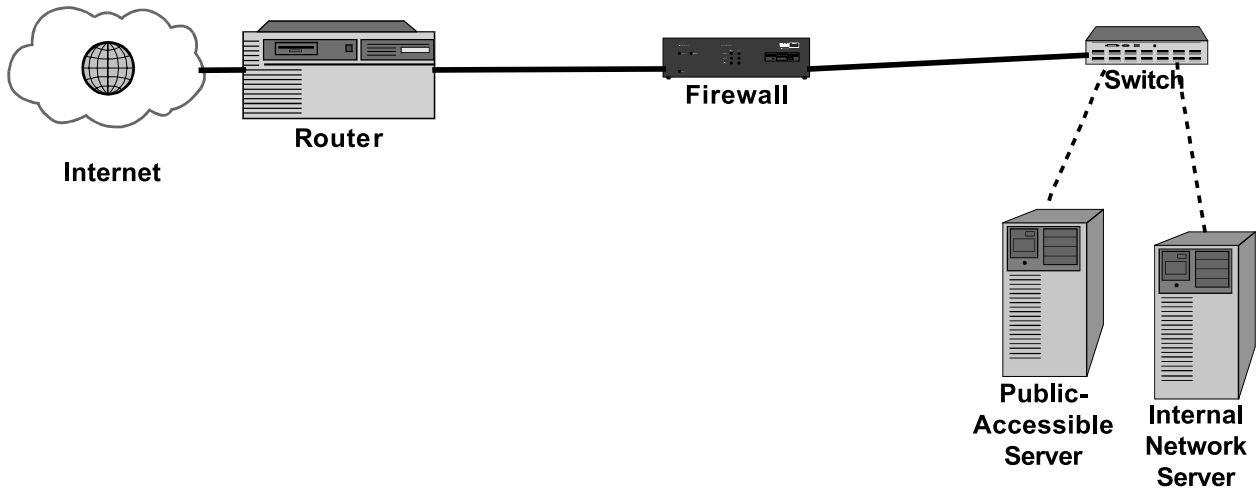

Fig. 1 Generalized network with enterprise firewall.

server-based firewall must be run on a separate computer from any other organizational functions (e.g., a listserv machine, file and print server, etc.).

The best overall firewall security is obtained by a combination of the above types of enterprise firewalls. For example, an organization might outsource its web server and its e-mail services to a third party while maintaining a tightly configured Internet router, a separate proprietary firewall hardware device, and also run its internal computer connections through one or more properly configured intelligent Ethernet 100 Mb switches. In effect, this provides this organization with a multilayered enterprise firewall security system—virtual, router, firewall device, and intelligent switches. While this multiplicity does not ensure absolute security, it does increase it exponentially.

It is extremely important to note that the security capability of any firewall-enabled device is only as good as its proper configuration and administration (including the regular updating of any software, firmware, or settings). It also should be noted that firewalls usually come with one of these two default settings—''admit all'' or ''deny all.''

The ''admit all'' default setting allows all inbound and outbound traffic between your network and the Internet—unless you configure it otherwise. This can be both a time-consuming and complicated process. The ''deny all'' setting default prohibits any inbound or outbound traffic between your network and the Internet — unless you configure it otherwise. This default is much easier to configure for an organization's use because the number of ''openings'' in the firewall will be both known (e.g., outbound HTTP, outbound Telnet, etc.) and will be relatively small in number.

High-end firewall devices will also include the capability to establish Virtual Private Networks (VPNs). These can be thought of as special TCP/IP ''tunnels'' allowing secure, encrypted, and authenticated communication between your organization's network and an external user (something that standard web or dial-in access via an ISP does not provide). However, the use of such communications via a VPN-enabled firewall requires that the particular client computer (e.g., your Director's home computer, the CFO's laptop, etc.) be specifically and carefully configured to use a VPN. Moreover, most VPN-enabled firewalls limit the number of simultaneous VPNs (a factor usually based on the firewall's model, price, and/or its inherent capabilities).

DESKTOP FIREWALLS

Usually, desktop firewalls are software-based and are designed to protect only the computer on which they are installed. These firewalls should never be used as a substitute for an enterprise-level firewall, but should be used to complement your enterprise-class firewall. Examples of good desktop firewalls include ZoneAlarm and BlackIce Defender. Before selecting a desktop firewall, be certain that it monitors outgoing transmission requests as well as incoming ones. Trojan programs, spyware, and adware-infested software perform their functions through the use of outgoing data transmissions; you should install a desktop firewall that will alert you to these hidden transmission attempts.

As with enterprise firewalls, the proper installation, configuration, and updating can make the difference between a false sense of security and a real-world functioning desktop firewall. It also should be noted that it is quite possible, and even desirable, to run multiple

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desktop firewalls on a single computer—different firewall publishers and vendors will use different methods and algorithms for implementing their particular firewall software design.

DEMILITARIZED ZONE

It is sometimes desirable, or necessary, to have one or more servers/computers outside the organization's enterprise firewall (or between two enterprise firewalls). One example of such a need would be if an organization wished to maintain its mail server, list server, and web server in-house, but still wished to protect the rest of their network. In this situation, these public-accessible servers could be located in what is called a demilitarized zone (DMZ)—accessible to external users but not representing a potential ''hole'' into the organization's internal network (Fig. 2). Servers within a DMZ are not allowed to pass traffic into the internal network.

A DMZ can be a separate port on the Internet router, a separate Ethernet switch placed between the Internet router and the enterprise firewall, or specially configured ports on an enterprise firewall itself. No matter what its physical design, its purpose remains the same—to allow needed public or external access to one or more firewall-protected computers while keeping the rest of the organization's network(s) safe behind your internal network's firewall.

Placing your DMZ between your Internet router and your internal network's enables certain firewall protection for the externally accessible computer(s) while maintaining a stricter, more highly secure, environment for the rest of the organization's network (on the other side of the second enterprise firewall). In essence, authorized external users must go through a firewall to access the publicly available machine(s), but any unauthorized attempt to continue on to the organization's network will be thwarted by a second, more tightly configured, enterprise firewall.

NETWORK ADDRESS TRANSLATION

The use of Network Address Translation (NAT) on your network means that only one (1) machine/device on your network needs to have a valid public routable IP address on its external network adapter. The rest of your networked computers can use as many private nonroutable IP addresses (these are not globally unique addresses, but are unique only within your own network/organization) as you want or need. Thus only that one NAT-capable public address device (usually a router or a separate proprietary firewall device) will be visible to the outside world.

The hardware device (router, firewall, etc.) determines your network's NAT capability; the device either will have the capability to handle Network Address Translations, or it will not. Any firewall device that is not NAT-capable should be avoided.

You do not need the coordination or approval of any Internet registry authority in order to use these private IP addresses. Private IP addresses are not routable over the Internet and cannot be accessed via the Internet. This means that many organizations can be using the same block of private IP addresses simultaneously. The IP registry organizations have set aside certain blocks of IP addresses that can be used only on these private networks. These private nonroutable IP address blocks are:

10.0.0.0–10.255.255.255
169.254.00–169.254.255.255
172.16.0.0–172.31.255.255
192.168.0.0–192.168.255.255

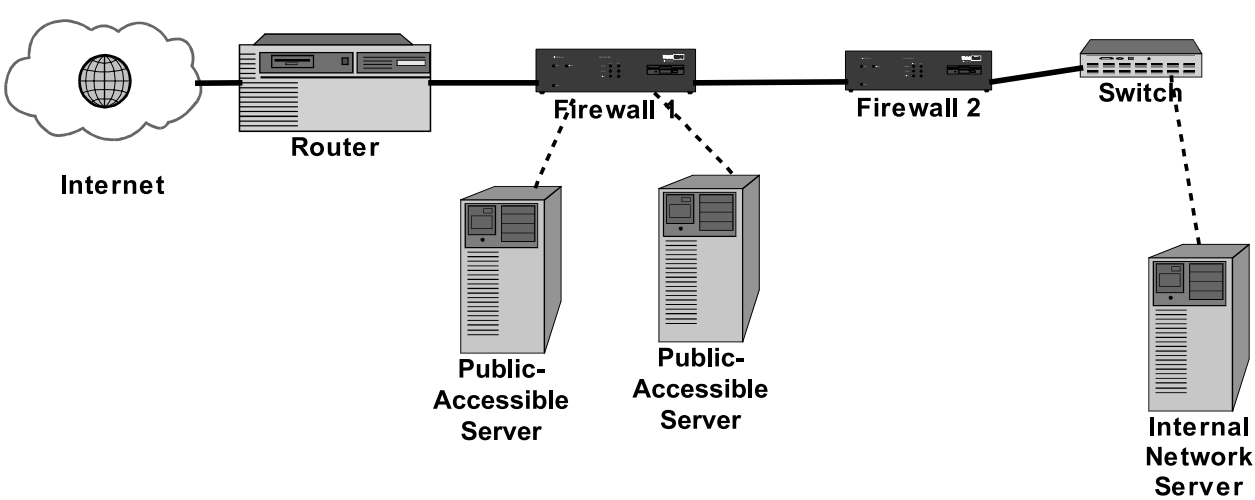

Fig. 2 Generalized network with DMZ (firewall 1) and internal network firewall (firewall 2).

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For example, you could use the private IP addresses of 172.27.1.1–172.27.1.255, 192.168.111.1–192.168.-111.255, or 10.1.2.1–10.1.2.255, and you would have an entire block of 255 private IP addresses available for your own internal use. Your Internet-connectivity device (e.g., firewall) would have to have a legitimate public, routable, IP address (e.g., 123.234.56.67); but, with NAT capabilities operationalized, it would do the Network Address Translation transparently and automatically between the Internet and your organization's internal private IP address network (and vice versa).

All requests from computers on your private network will have their true source private IP address replaced with the NAT device's single public IP address. Your NAT device transparently performs all of the private-to-public and public-to-private IP address translations in the background and adds the proper private IP address information to each outgoing data packet—in an encrypted format—so that it can send data transmitted from the Internet back to the proper desktop computer or server. The NAT device also maintains an internal table of associations for actual user addresses and port numbers (both public IP and private IP).

Because the use of NAT is not, by itself, an absolute guarantee of high security, it is recommended that your network's NAT device (i.e., a piece of hardware that is running the Network Address Translation protocols) be a secure router or a dedicated firewall device (e.g., NAT running on a properly configured Cisco router, or NAT running on NetScreen firewall hardware). This is important because the NAT device's public IP address will be visible to the Internet and, hence, can become a target for hackers, crackers, attackers, and cyber terrorists.

Besides Network Address Translation (NAT), you should be certain that your router or firewall can perform Port Address Translation (PAT). When port address translation is in use, the NAT-capable device also ''hides'' the TCP/IP port of information transmitted back to your network in response to any kind of request or query. For example, a web page request from your network to an Internet web server will go out through your firewall/router on the standard HTTP port—port 80. But, when the response to that web page request comes back to your firewall/router, it will be ''translated'' to a random ephemeral high TCP/IP port—e.g., port 31267—and sent on to the internal network computer making that request. The port address translation information is stored, in encrypted format, in the header of each outgoing data packet.

PLANNING FOR YOUR FIREWALL

Before you start reading reviews and doing searches on the Internet, there is some bare-bones planning that needs to be performed by your organization before one or more firewalls are purchased, and properly configured and managed. These planning points are, in brief:

- Evaluate the potential security threats to your particular organization—with regard to your extant network configuration(s).
- Evaluate your user needs (staff and nonstaff alike) with regard to unilateral or bilateral access to your server(s) and to the Internet.
- Identify all of the appropriate security layers and levels within your particular organization (e.g., desktop computers, servers, router, Ethernet switches, etc.).
- Write a Security Policy for your organization. It need not be lengthy or complex, but it should address: the ethical/legitimate uses of an organization's computers and Internet access; the assignment of responsibilities for maintaining a secure networking and computing environment—for the administration, IT staff, and for every end user; the incident response procedures; and the consequences of computer or network misuse or abuse.
- Update every server and desktop operating system and application program, and keep them updated. Make sure that all of the most recent service packs, bug fixes, and security patches have been applied.
- Determine whether or not Network Address Translation (NAT) or the use of a demilitarized zone (DMZ) is to be used with your firewall(s) and plan accordingly.
- Be sure that you have the appropriate staff (in-house or outsourced) with the appropriate expertise, and time to manage and administer your firewall/network security procedures and scheme. Those staff and those procedures must have the full backing of the organizational administration at the highest levels.

TESTING YOUR FIREWALL

You should look at your computer security in terms of a burglar trying to break into your system—how would they do it, where is that open window or that weak door, and what would they/you try first? Even if you are certain that your enterprise and/or desktop firewall has been configured tightly and correctly, it is wise to test its integrity on a regular basis. Fortunately, there are a number of free online services that can perform various kinds of these tests:

Symantec Security and Virus Check—http://www.symantec.com/securitycheck/
Steve Gibson's ShieldsUp—https://grc.com/
Steve Gibson's LeakTest—http://grc.com/lt/leaktest.htm
DSLreports Shield Probe—http://www.dslreports.com/scan/

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Finjan Software Security Testing Center—http://www.finjan.com/mcrc/sec_test.cfm
HackerWhacker—http://www.hackerwhacker.com/
CyberCop Scanner Trail—http://www.mycio.com/content/cybercop_asap/default.asp
PC Flank—http://www.pcflank.com/index.htm
SecurityMetrics—http://www.securitymetrics.com/portscan.adp
Test Your Firewall—http://www.hackerwatch.org/probe/

You can also (and should) use any of a number of readily available free or shareware port scanner programs to check your own computer, server, and network (this scanning process should be performed from a computer external to your own network).

DANGERS OF FIREWALLS

The use of enterprise and/or desktop firewalls carries with it certain dangers, and these dangers are threefold. The first of these dangers lies in not keeping the firewall updated regularly. Updates come out relatively frequently for software-based firewalls (enterprise or desktop), and even proprietary hardware-based firewalls will need to have their firmware programming updated from time to time.

The second danger lies in the poor or improper configuration and administration of any firewall. All unnecessary TCP/IP ports and applications must be blocked, and these settings need to be checked and reconfirmed on a regular basis. The highest possible security level must be maintained at all times.

The last danger can be the most insidious. No matter how many firewalls are operational at the enterprise and desktop levels, and no matter how frequently they are updated, and no matter how tightly they are configured and administered, never become complacent in your feeling of security and do not become overdependent on firewalls alone for your organization's computer and network security.

OTHER SECURITY MEASURES CONCURRENT WITH THE USE OF FIREWALLS

It never should be assumed that an organization is protected against all attacks and intrusions; even if highly secure multiple enterprise and desktop firewalls are in place and are properly configured and administered. While firewalls indeed should be viewed as the first and best line of defense (i.e., if you do not have them, you are seriously lacking in network security), they are not the only line of defense that an organization should establish.

These other defenses need to be implemented because, while firewalls can be very good at what they do, they can only do certain things. The other defensive measures that should be undertaken by any organization include:

- A good, thorough, and enforced organizational security policy;
- The use of regular, required, and tested data backups at the server and, if necessary, at the individual desktop computer levels (this includes keeping a recent copy of the backup media off-site);
- The regular and required updating of all server and desktop computer operating systems and application software packages;
- Installation of antivirus software on every server and desktop computer; with the enforcement of regular and frequent updates to it;
- Installation of Trojan-scanning and-cleaning programs on every server and desktop computer; with the enforcement of regular and frequent updates to them;
- Installation of antiattack script programs installed on every server and desktop computer; with the enforcement of regular and frequent updates to them;
- The enforced use of strong passwords for local area network (LAN) access, e-mail use, etc.—preferably passwords that are alphanumeric–symbolic with mixed case; and that are changed on a regular basis;
- The strong enforcement of local area network login and volume/directory/folder access and use rights;
- An ongoing user awareness (at all organization levels) of current security issues; and an ongoing user adherence to all of the security measures noted above.

CONCLUSION

Firewalls are indeed your first and best defense. But they need to be selected carefully; installed, configured, updated, and administered properly; and made part of a larger set of organizational security measures. Every desktop should be running at least one properly configured and updated firewall; every enterprise should be protected by at least one properly configured and administered firewall.

Good security is a dynamic interrelated and interlocking system of hardware, software, policies, procedures, and educated and aware users. It is not something that can be performed piecemeal; nor can it be carried out once and then forgotten. Firewalls are indeed the first and best line of defense for your network, but they never should be the only defense or the last defense.

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FIREWALL PRODUCTS

A listing of independently certified enterprise-class firewalls (hardware and software) can be found at:

http://www.icsalabs.com/html/communities/firewalls/certification/rxvendors/index.shtml

Desktop software firewall products can be found at the sites listed below (these are listed in no particular order). Note that the presence of a product or vendor in this list is not necessarily an endorsement of that product or vendor; nor is a product or vendor's absence from this list to be construed as a criticism of that product or vendor. Firewalls must be selected for an individual organization's particular and specific security needs.

McAfee Firewall 4.0—http://www.mcafee.com/myapps/fw4/default.asp
BlackIce PC Protection—http://blackice.iss.net/product_pc_protection.php
Norton Personal Firewall—http://blackice.iss.net/product_pc_protection.php
ZoneAlarm— http://www.zonelabs.com/
Tiny Personal Firewall—http://www.tinysoftware. com/home/tiny2?la=EN
SurfinGuard Pro—http://www.tinysoftware.com/home/tiny2?la=EN

The references listed below are only a small fraction of those available, and should be considered only as good starting points.

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11. How Firewalls Work http://www.howstuffworks.com/ firewall.htm.
12. Firewalls and Internet Security: Repelling the Wily Hacker http://www.wilyhacker.com/.
13. Guidelines on Firewall and Firewall Policy http://www.securityfocus.com/library/3682.
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15. Internet Firewalls — Resources http://www.cerias.purdue.edu/coast/firewalls/fw-body.html.
16. Firewalls and Internet Security http://secinf.net/info/fw/steph/.
17. How To Disable a Proxy Server http://www.peacefire.org/bypass/Proxy/.
18. Home PC Firewall Guide http://www.firewallguide.com/.
19. Internet Firewall FAQs http://www.interhack.net/pubs/fwfaq.
20. Staff Access Through the Library Firewall http://www.libraries.wright.edu/staff/central/auto/firewall.html.
21. What Is A Firewall? http://www.kcfishnet.com/ResourceCenter/Library/definition.asp.
22. The Firewall Lab http://www.thefirewalllab.com/.
23. Network Security Information: Firewalls http://secinf.net/ifwe.html.
24. Proxy Web Servers in Libraries http://www.pandc.org/proxy/.
25. Firewall Text Library http://www.hideaway.net/Server_Security/Library/Firewalls/firewalls.html.
26. Index of firewall-wizards http://lists.insecure.org/firewall-wizards/.

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Fundraising on the Internet: On-Line Strategies for Nonprofit Organizations

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INTRODUCTION

Fundraising can be defined as the part of a nonprofit organization's resource procurement through which resources—cash, donations in kind, and volunteer work—are obtained without any market-based material return. Before appearing on the public stage, nonprofit organizations must carry out a thorough and comprehensive analysis of the conditions of supply and demand prevailing in their particular area of activity. Therefore systematic marketing is an integral part of the overall business planning of nonprofit organizations and forms the basis for their fundraising.

The Internet has brought about fundamental changes to the communications structures of the economy and society. The Internet is playing an increasingly important role in everyday life. On-line communication means not only applying the instruments of conventional marketing to on-line media but also developing new techniques and concepts for working with clients whose communications are increasingly based on on-line media. Nonprofit organizations can benefit significantly from their implementation, particularly in the area of fundraising.

Nonprofit organizations have been struggling to keep their established donors while pursuing new ones, but the costs of these pursuits using traditional fundraising channels can be significant. The Internet enables entirely new opportunities for turning traditional fundraising into comprehensive relationship management, ideally resulting in building and maintenance of long-lasting donor relationships. We will discuss current issues, trends, and debates regarding these developments.

NONPROFITS ON THE WEB: THE AUDIENCE

Allen et al.[1] showed that nonprofit organizations can reach a totally new audience through the Internet: ''With the incredible growth of the Internet, there are more people coming on-line who will change the current demographic image of a younger, highly educated, upper income white male to one with a better gender balance and more ethnic socio-economic diversity.''

The rapid development of the Internet has created a pool of potential on-line donors and activists that is at least as large as the pool of people currently being reached by direct mail. Johnson[2] investigated the phenomenon of the ''dying donors'' and described the tremendous potential of the Internet to reach a new generation: ''Nonprofit organizations cannot afford to ignore the Internet. If they are to remain viable and continue to attract supporters, the Internet must become an important part of their communications mix.''

The Mellman Group conducted a series of focus groups and a survey among individuals with Internet access who are engaged as donors and/or volunteer activists on social issues. They found them to be a younger, more ideologically diverse group than the traditional direct mail donor population; 85% of socially engaged Internet users were under the age of 60 years, and the average age of this group was 42 years.

This group of socially engaged Internet users is more demanding than their direct mail counterparts[3] when it comes to organizations demonstrating progress and being accountable to donors. In exchange for their loyalty, this group expects nonprofit organizations to be accountable and to demonstrate progress toward their goal. Particularly in the United States where nonprofit organizations are generally perceived to have an obligation to create value for society by using their resources effectively, overhead spending is a widespread concern for charitable donors.

Advances in encryption technology have enabled immediate on-line credit card donations to nonprofit organizations on a large scale. Johnson[2] investigated the issues Internet users identify as being of concern when asked to make such an on-line donation. In his survey, Johnson found that most visitors to nonprofit web sites are willing to make an on-line donation, provided that concerns about security and privacy are answered to their satisfaction. Their numbers are still growing.

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FUNDRAISING ON THE INTERNET: A BRIEF OVERVIEW

Internet-based donations have increased dramatically over the past few years.[4] A prime example is the American Red Cross, which triggered record on-line donations in response to the September 11 attacks. By September 30, 2001, the Red Cross had raised over US$200 million, 30% of which came from on-line gifts. By comparison, the total of on-line gifts during 1999 was only US$2.5 million. The movement toward on-line giving was so massive that, for the first time, on-line gifts to the Red Cross outnumbered donations made by telephone.

Another prime example is the World Wide Fund for Nature (WWF), which maintains a global network of interconnected sites with localized content in a multitude of languages. Its central site is http://www.panda.org/, which offers several options for on-line giving. Visitors can sign up for customized e-mail messages on the topics of their choice, surveys, and action alerts based on their preferences and type of involvement. ''Act Now'' icons encourage visitors to become involved and take immediate action.

Panda Passport is WWF's virtual campaigning and fundraising tool. Passport holders receive occasional e-mail alerts and updates on environmental emergencies, enabling them to respond and act immediately. Taking different actions results in different types of stamps in the Passport, and additional status for the holder. Passport allows WWF to directly communicate with its constituents, track their behavior and preferences, and encourage participation and donations.

The integration of on-line donation facilities in nonprofit web sites is an obvious choice. They can be found at many nonprofit web sites. It is important to create a clear argumentative connection between the opportunities for on-line giving and the actual causes or projects for which funds are being raised.[5] However, there are other hybrid solutions available.

FUNDRAISING PORTALS

Fundraising portals equally function as a common source of information on a wide range of different nonprofit organizations and as a gateway to their respective sites. Portals provide a set of tools and resources to help nonprofits integrate the power of the Internet into their operations, establish their own on-line presence, and receive donations. A portal targets citizens and nonprofit organizations alike, as it aggregates content and resources in one convenient location.

A well-known example is NetworkforGood.org (http://www.networkforgood.org/), itself an independent nonprofit organization. Founded by the media giants AOL, Cisco Systems, and Yahoo!, it collaborates with several nonprofit organizations, including the American Red Cross, the Benton Foundation, GuideStar, TechSoup and the W. K. Kellogg Foundation. Its aim is to foster the informed use of the Internet for civic participation and philanthropy by engaging citizens to participate in social causes and nonprofit organizations.

SPONSORING: CLICK-AND-DONATE WEB SITES

Click-and-donate web sites represent an entirely new business model for sponsoring good causes. The Hunger Site, the first of its kind and arguably the most prominent example, began its operations in 1999. The concept of the Hunger Site comprises the synergy between benefit sponsoring and on-line giving. It focuses the power of the Internet on a specific humanitarian need: eradication of world hunger. Site sponsors pay for food funded by the Hunger Site; funds are split between charitable organizations to relieve hunger in over 74 countries. On average, over 220,000 unique visitors click its ''give free food'' button, thus helping to feed the hungry each day. The concept of the Hunger Site is unique in a sense that by using the Internet, it brings together partners that may not have otherwise interacted with each other. Numerous other web sites have copied its click-and-donate concept.

ON-LINE EVENTS: LOTTERIES AND AUCTIONS

On-line events, such as web-based lotteries, prize games, and auctions, can create additional means of fundraising for nonprofit organizations. Possible regulatory and legal hindrances aside, the Internet enables any mission-driven organization to hold these events on their own web sites. Well-known on-line auction houses such as eBay offer such facilities for nonprofit organizations as well. Established lottery organizations, which have existed for some 500 years, have also discovered the Internet as a medium for charity lotteries. An example of such an organization is Novamedia, a European charity lottery with an annual turnover of € 670,840,098 in the year 2000, which launched its purely web-based subsidiary GoodLot.com in 2002.

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ACCOUNTABILITY ON THE INTERNET: PRACTICE AND PERFORMANCE

The question arises as to whether the Internet can indeed live up to its promise of uncomplicated on-line donation transactions and increased transparency and accountability. Information on nonprofit financial performance is becoming increasingly important for individual donors and corporate sponsors alike. Donors evaluate and compare charities, monitor their performance, and generally require effective operating practices. They demand greater accountability to make a balanced decision as to where their money should go to, and to be able to give with greater confidence. An interesting discussion of donor transactions and relationships is the ''e-Donor Bill of Rights'' by the Association of Fundraising Professionals (http://www.nsfre.org/tier3_cd.cfm?content_item_id=1075&folder_id=898).

GuideStar (http://www.guidestar.org) is the most comprehensive resource for detailed financial information on nonprofit organizations in the United States. The GuideStar database contains detailed reports on over 850,000 nonprofit organizations. These reports include information about the organization's mission, current and planned programs, and staff. In many cases, GuideStar also has detailed financial return forms and balance sheets on file for charities that are required to file with the Internal Revenue Service (IRS). Participating in GuideStar enables nonprofit organizations to streamline their grant application process, publish information on-line, and post classified ads for contributions, donations, staff, and volunteers.

BUILDING RELATIONSHIPS ON THE INTERNET

Ideally, the process of on-line fundraising consists of four stages:[5] information gathering, decision making, donation (transaction), and postdonation (relationship building). Bhagat[4] takes a similar approach. Bhagat identifies donor acquisition, donor retention, speed of response, administrative efficiency, and periodicity of income as key areas of impact. These developments have profound consequences for nonprofit strategy. Day[6] made an important point when he suggested that nonprofits should construct their organizational structure around the needs of their constituents rather than their own organizational processes.

Hoffman and Novak[7] were among the first to recognize the tremendous potential of the Internet for decision making and developing relationships. They argued that the interactive structure of the Internet would end the traditional passive role of individuals as receivers of communications. Peppers and Rogers[8,9] went a step further by claiming that the Internet represents a total transformation of the marketing paradigm, which is a shift away from mass marketing and its predominantly one-way broadcast model toward unique, interactive, and personalized one-to-one relationships.

Customer relationship management (CRM) is a set of technologies designed to automate these front office tasks. CRM has been around for many years in the form of separate functions such as sales force automation, marketing automation, and help desk software. Only recently have these applications been integrated to share information throughout the organization. Nonprofits should rise to the challenge of applying technology to facilitate this dialogue.

One of the key concepts inherent in CRM is the notion of the ''learning relationship.'' With every interaction, something new can be learned about the person or organization involved in a transaction in terms of their needs, preferences, or customs.[9] When processed and used properly, this information may influence the next interaction, potentially adding ''value'' for the customer by making the next experience easier, faster, or more rewarding.

Eventually, this information will enable a unique selling proposition toward the customer and a significant competitive advantage over any competing organization. This ability to uniquely identify and segment users makes CRM a viable option as a platform for donor interaction and for on-line fundraising. As the Internet matures to an all-encompassing communication and transaction platform, this data-gathering approach becomes a necessity.

The concept of permission marketing by Godin[10] could well be one of the first steps to be made toward a successful CRM strategy. Permission marketing revolves around the concept of individuals giving their permission to organizations to collect information about them in return for the benefits of a personalized dialogue and treatment. Unfortunately, many nonprofits have not yet implemented CRM practices in any significant way.[11]

One-to-one marketing, a term coined by Peppers and Rogers,[8] essentially means treating different constituents differently. The idea behind is to establish relationships with constituents on an individual basis, and to use the gathered information about them to create a unique, personalized experience. According to this theory, the exchange between an individual and an organization becomes mutually beneficial, as one give personal information in return for personalized service that meets their individual needs.

The convenience of quick transactions and e-mail notifications, along with a reduced overhead, appears to

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be the most compelling reason for individuals to contribute on-line. A consistent e-mail strategy for nonprofits makes sense; resources spent on e-mail strategies tend to be more cost-effective than the same resources spent on web strategies alone. The benefits of e-mail as a relationship-building tool are well documented:[12] People visit fewer web sites than they get e-mail messages. E-mail is a personal and effective way of communication that stimulates action. It combines the power of personal communication with economies of scale.

However, recent research reveals[12] that most nonprofits have not yet fully taken advantage of the benefits of e-mail as a relationship-building tool. Although the majority of surveyed nonprofit organizations do have their own web site, many of these do not systematically collect e-mail addresses on their site, nor do they have a complete record of their constituents' e-mail addresses on file. A majority of surveyed organizations admitted to being unable to survey their stakeholders on-line, and the vast majority of the surveyed nonprofit organizations do not have a declared e-mail strategy.

Still, many nonprofits feel that these concepts are relevant to their organization, and appear receptive to learning more. Moreover, CRM implementation does not necessarily involve a comprehensive, all-or-nothing technological operation: It can be integrated in existing information systems in a series of incremental projects. Yet, there is still a large gap between theory and practice. Most nonprofits have not yet implemented the concepts of CRM and one-to-one marketing into their organizations in any significant way, as Sexton[11] found: Nonprofits ''have always focused on contributor relationships, but their strategies have been one-by-one, rather than one-to-one.''

APPLICATION SERVICE PROVIDING AND OUTSOURCING

Application service providers (ASPs) are a relatively new breed of Internet service providers that deliver application-hosting services to their customers. Applications are treated as a network service rather than a stand-alone or client-server application. Both software and data reside with the ASPs rather than on personal computers (PCs) or local servers, accessed via network connections. Typically, they are paid for on a subscription or per-use basis. In essence, the ASP concept is very similar to the pre-PC era concept of mainframe computing and timesharing, which was generally considered cutting-edge technology in the 1960s and 1970s.

ASPs deliver and manage applications and computer services from remote data centers to multiple users via the Internet or a private network. Obtaining these applications from an outside supplier can be a cost-effective solution to the demands of systems ownership, such as upfront capital expenses, implementation challenges, and a continuing need for maintenance, upgrades, and customization. An ASP may be a commercial entity or a not-for-profit or government organization supporting end users. Commercial ASPs offer leasing arrangements to customers, whereas nonprofit or government organizations may provide services free of charge.

The advantage of this approach for nonprofit organizations is that it enables access to a technology infrastructure that was previously out of reach for smaller organizations. Nonprofits can—partly—outsource the hardware, software, and maintenance such applications require, and focus on activities that are central to their mission. However, at this time, it is unclear if the particular needs of nonprofit organizations will be fully met by the market. Their needs in terms of computing infrastructure and services are diverse and currently not well researched.

Because ASPs tend to focus on business customers and nonprofits are generally underfunded, these specific needs may not be fully met. Still, application service providing may well live up to its promise of enabling a network of supporting organizations, resources, and activities, offering a productive new approach to sharing technology infrastructure while overcoming the inherent small-scale limitations of most community-focused organizations.[13]

The outsourcing market is growing rapidly. Research has shown that many for-profit companies intend to increase their levels of outsourcing within the next few years.[14] Unsurprisingly, the benefits of outsourcing have not gone by unnoticed in the nonprofit world. Many nonprofits feel that these concepts are increasingly relevant to their organizations. Even those who were previously skeptical or ignorant about the benefits of outsourcing are rapidly changing their minds.

The benefits of information technology (IT) and business process outsourcing (BPO) are, indeed, impressive. Outsourcing enables organizations to improve the quality of IT services and support, along with better control of IT, business processes and their related costs. Levels of outsourcing in the nonprofit sector are likely to increase further within the next 2 years. Indeed, a growing number of nonprofit chief executive officers (CEOs) and chief investment officers (CIOs) indicate that these outsourcing concepts are increasingly relevant to their organizations.

Predominant objectives for outsourcing nonmission critical organizational processes are, first of all, improving IT services and support, closely followed by the desire to better concentrate on the organization's core business and cost control. The most frequently mentioned

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general strategic priorities are reduction of the overall budget, and improvement of organizational flexibility and responsiveness while improving accountability of, and control over, IT spending. Outsourcing contributes to a better control of these costs.

A more open view toward the unique opportunities of outsourcing is bound to contribute to improved efficiency and economies of scale. Outsourcing enables a significant reduction in system complexity as less expertise is required to run these systems—a major argument for nonprofit organizations with limited resources. It can be expected that a broader availability of outsourcing services and subsequent market competition enable strategic outsourcing of organizational processes at increasingly attractive price/performance levels.

Outsourcing is a change enabler. IT and BPO are going to change, in remarkable and profound ways, many of the relationships between nonprofit organizations and their constituents, as well as their respective business models. Organizations that are able to unlock these assets and apply them profitably to their specific problems and opportunities will be able to increase their market shares while creating new opportunities for dynamic growth.

CONCLUSION

Whether small grassroots organizations or well-known global brands, regardless of their size, nonprofit organizations all over the world are essentially facing the same challenges—carrying out their mission with limited resources, communicating the issues they advocate to their stakeholders and to the media, and raising the funds that they require to do so. The Internet offers new tools and promising opportunities for mastering these challenges. It plays a critical role as the information infrastructure for creating and supporting positive changes in society.

Mission-driven organizations can gain new insights by drawing on current media and marketing research, and will benefit from adapting the Internet strategies as they are practiced by for-profit organizations and by an increasing number of their peers. In return, for-profit organizations can learn from the innovative community-building and collaboration strategies as they are successfully practiced by the nonprofits.[15] Although uncritical technology worship should be avoided, the Internet offers a versatile platform for creatively sharing ideas.

Open source software and the emergence of an open, extensible mark-up language (XML)-based standard for data exchange offer new opportunities and important synergies to community-serving organizations. Because collecting and sharing of information across organizations are essential for achieving missions, research, discussion, and support, further research on the use of these technologies as a means rather than an end, their relationship-building potential, and the purposes to which the information has been put would be useful.

Further initiatives to promote nonprofit relationship and capacity building, collaboration, and technology transfer to increase organizational effectiveness in the sector are needed. More research is needed to establish ''best practice'' resources that provide relevant how-to information and case studies of successful projects by innovative early adopters to the community. Promising first attempts have been made in this direction despite the technology gap experienced by many nonprofits. Considering the rapid pace of development in the field, regular follow-up and updates on the challenges and opportunities related to e-philanthropy are imperative.

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German Academic Libraries

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INTRODUCTION

According to the German Constitution (*Grundgesetz*), cultural affairs and education, also including the institutions of higher education and their libraries, belong under the authority of the *Länder* (single states) not to the federal government. A federal law, the *Hochschulrahmengesetz—HRG* (Higher Education Framework Act), provides guidelines for the universities, but which can be integrated into the state university laws in different ways. Generally, the German institutions of higher education can be characterized in the following ways:

- The universities are financed fully by the single states or they receive a considerable subsidy. That applies also to universities run as foundations. In addition, there are a few private universities. For these, which are limited to special subjects, often economics, the number of teaching staff and of students generally does not play an important role. The universities run by the Catholic or Protestant Church make up a special type of institution of higher education. They offer by no means only theological degree programs, but also a broad spectrum of various degree programs. Institutionally, they belong to the churches, but are financed by the states as well.
- During the last several years, attempts have been made to strengthen the competition among the institutions of higher education by means of ranking procedures. A differentiation of the universities in research-oriented and teaching-oriented universities is officially not planned. There are no entrance examinations except for artistic study programs, but there is a tendency to allow universities to select students on the basis of their performance. Student fees are forbidden by law, but have been repeatedly demanded at the political level. For most of the subject degree programs (for instance, for architecture, management, biology, medicine, pharmacy, psychology, law), for which the number of applicants is far greater than the number of places for students at the universities in these fields, applicants are allocated to a specific place of study by a central administrative office (*Zentralstelle für die Vergabe von Studienplätzen—ZVS*—Central Office for Allocation of Student Place to Study). Part of this system—which is more indicative of a centrally managed economy than of a competitively oriented one—is that budgets of academic libraries are not correlated with the accomplishments of the university in research and teaching nor with library accomplishments. Rather, the budget amount is politically decided upon as a result of budget negotiations.
- Nevertheless, universities are constantly more dependent on obtaining financing from outside sources for research projects. By far, the most important source of outside funding is the German Research Foundation (*Deutsche Forschungsgemeinschaft—DFG*), which is financed through public tax incomes, but it gives its funding—independent of any state authorities—to universities and to other research institutions. The allocation of outside funding (in 2001 the total funding was 1.2 billion Euro) through the DFG has resulted in a strong influence on research in Germany. Even the development of university libraries as infrastructure for science is directed through the allocations of the DFG to a considerable degree (e.g., partial financing of the special subject collections, digitalization of older imprints, development of WWW portals for scientific resources, etc.).
- In addition to the DFG, the German Science Council (*Wissenschaftsrat—WR*) has had a substantial impact on the development of universities and academic libraries. The WR is an advisory body to the federal government and the state governments. Its function is to draw up recommendations on the development of higher education institutions, science, and the research sector as regards, content and structure, as well as on the construction of new universities and academic libraries. For example, in 2001 the WR recommended that the academic libraries intensify their efforts to educate the researchers about electronic publications and to advise them, build up information literacy and competencies, and to give the library staff continuing education on the development and updating of media competencies.[1]
- Two areas can be distinguished in the German universities:
  - Some 160 scientific institutions of higher education (*Wissenschaftliche Hochschulen*), among

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them approximately 80 universities, furthermore technical universities, medical universities, sports education universities, institutions for higher education in art and music, teachers' colleges, church colleges. They have the right of awarding a doctoral title and most of them also the post-doctoral ''Habilitation'' (qualification for lecturing at a university). Their focus is traditionally more on research than on teaching, but a change seems to appear at many universities. The degree programs generally last four and a half or five years (Magister, *Diplom*, Master's degrees). Bachelor degree programs, which have just started to be introduced in Germany in the 1900s are shorter.

- About 170 universities of applied science (*Fachochschulen*): They do not award doctoral degrees. The degree programs generally last three and a half to four years (*Diplom*, Bachelor's degrees) and are oriented more to the professional practice than the scientific institutions of higher education. Most of the universities of applied science have a limited spectrum of subject areas in contrast to most of the universities; according to demand, they offer primarily business and technical subjects. Subjects such as medicine and law are not offered at universities of applied science. However, Master's degrees are sometimes possible. The number of professors and students at an average university of applied science in Germany is considerably smaller than at an average university (several thousand instead of over 10,000 students at a university).

With this background, university libraries (*Universitätsbibliotheken*) on the one hand and libraries of universities of applied sciences (*Fachhochschulbibliotheken)*, conservatories and art colleges on the other hand differ considerably. In Germany, the libraries of universities of applied sciences are defined as a specific type of library distinguished from university libraries.

OVERVIEW

The Position of the Academic Library in the German Library Landscape

University libraries (Fig. 1) and the libraries of the universities of applied sciences (Fig. 2) have the responsibility first of all to make available literature and information for research, teaching, and study at their university. Most academic libraries have additional responsibilities:

- Academic libraries are usually open to users who do not belong to the university. On an average, a German university library has 21,000 registered users and 29% of them do not belong to the immediate university community, but, of course, they may belong to another institution of higher education located in the same city. At libraries of universities of applied science (with an average of 4000 users), the percentage of external users is 26%. In some university libraries, even more than 50% of the users are external users (Erfurt, Oldenburg, Brunswick, Dortmund, Freiburg, and the University of the Federal Armed Forces in Hamburg).
- Some academic libraries, such as the Bremen State and University Library, have the express task to provide members of other institutions of higher education in the same city with literature and information.
- Twelve of the approximately 80 university libraries are simultaneously ''regional libraries.'' That means that by virtue of law, they receive obligatory deposit copies of all newly published works in that particular state. In addition to this, they also collect literature about that particular state regardless of the scientific value of these publications. This combination of state and university library can usually be traced back to historical specialties, such as in Muenster and in Bremen, where older libraries formed the basic collection for the libraries of universities founded in the 20th century.
- As distinct from these libraries there are regional libraries which are not simultaneously university libraries (and that is the greater majority of the regional libraries), and the state libraries which are also involved in the literature and information provision for the academic teaching and research—partially through interlibrary loan and partially through use by students in addition to using their academic libraries.
- About 18 German university libraries take part in the charged document delivery ''Subito,''[2] which has resulted from an initiative headed by the German Ministry for Education and Research and the German states to accelerate the provision of literature. Today, Subito is the document delivery service of international libraries. It is a quick and easy-to-use cooperative delivery service on a nonprofit basis which supplies the user directly with copies of articles from serials or parts of books, and can make books available to the user on a loan basis. The document delivery service allows online searching, as well as ordering and direct delivery of literature to the user's desktop.

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City	Name	Combined with regional library	Active users incl, external users	external users	Opening hours per week	Total holdings	Printed books holdings and dissertations (volumes)	Acquisitions (volumes)	Journal subscriptions incl. electronic journals	Electronic journal subscriptions	Text book collections (volumes)	manuscripts and rare books	% collections in storage areas
1. Aachen	Bibliothek der Rheinisch Westfälischen Technischen Hochschule Aachen	No	29,139	3,718	80	6,953,416	1,166,815	21,239	5,522	2,588	60,971	1,519	70
2. Augsburg	Universitäts-bibliothek Augsburg	No	21,028	7,717	75	2,412,745	1,953,635	25,675	6,039	3,150	43,336	12,888	52
3. Bamberg	Universitäts-bibliothek Bamberg	No	15,855	7,064	69	1,547,473	1,470,156	35,677	5,528	-	22,414	0	70
4. Bayreuth	Universitäts-bibliothek Bayreuth	No	15,298	5,602	64	1,457,331	1,428,272	50,272	4,179	-	17,871	131	43
5. Berlin	Medizinische Bibliothek Charité	No	3,797	-	59	306,285	302,703	6,535	1,390	-	8,485	0	-
6. Berlin	Universitäts-bibliothek der Freien Uni-versität Berlin	No	27,280	11,804	50	2,418,522	2,167,177	18,339	5,699	2,460	40,302	4,210	65
7. Berlin	Universitäts-bibliothek der Humboldt-Universität zu Berlin	No	69,703	8,992	64	6,320,189	5,707,480	68,401	9,922	2,413	50,473	34,166	99
8. Berlin	Universitäts-bibliothek der Technischen Universität Berlin	No	28,178	7,389	69	2,236,478	1,966,661	25,415	6,426	1,441	77,403	74,401	25
9. Berlin	Universitäts-bibliothek der Universität der Künste	No	9,362	-	40	746,322	280,987	4,064	656	-	-	126,124	-
10. Bielefeld	Universiäts-bibliothek Bielefeld	No	20,958	6,480	111	3,121,671	2,014,864	34,632	7,366	949	-	3,902	-
11. Bochum	Universitäts-bibliothek Bochum	No	18,577	3,205	59	2,012,468	1,570,690	15,679	3,080	-	26,120	76	34
12. Bonn	Universitäts-und Landes-bibliothek Bonn	Yes	25,941	5,142	63	2,301,511	2,148,200	33,324	9,569	1,437	63,997	16,525	70
13. Braun-schweig	Universitäts-bibliothek Braunschweig	No	30,204	15,813	54	1,203,134	1,154,428	57,302	3,378	674	29,132	11	64
14. Bremen	Staats- und Universitäts-bibliothek Bremen	Yes	28,285	6,400	72	3,299,615	2,970,268	48,281	12,928	1,743	-	18,740	60
15. Chemnitz	Universitäts-bibliothek Chemnitz	No	16,024	6,789	60	12,091,536	1,142,623	23,423	2,999	-	-	1873	46
16. Clausthal-Zellerfeld	Universitäts-bibliothek Clausthal	No	2,751	132	52	468,504	455,700	6,987	834	-	23,292	-	85
17. Cottbus	Universitäts-bibliothek Cottbus	No	8,280	3,089	69	751,070	471,592	27,878	3,194	1,357	12,114	2,442	26
18. Darmstadt	Hessische Landes- und Hochschul-bibliothek Darmstadt	Yes	13,120	2,582	74	10,188,905	1,579,787	23,793	6,099	2,057	32,426	17,655	95
19. Dortmund	Universitäts-bibliothek Dortmund	No	24,652	12,665	62	23,257,818	1,661,059	37,346	4,482	3,200	47,630	3,774	1
20. Dresden	Sächsische Landes-bibliothek – Staats- und Universiäts-bibliothek Dresden	Yes	62,689	13,764	68	6,143,454	4,268,271	81,347	13,463	2,012	127,391	580,587	85
21. Duisburg	Universitäts--bibliothek Duisburg	No	12,167	3,303	68	1,355,149	1,073,676	24,398	6,333	2,343	-	-	11
22. Düsseldorf	Universitäts-und Landes-bibliothek Düsseldorf	Yes	24,384	7,694	59	2,604,779	2,425,694	36,873	7,437	3,471	77,223	7,938	50
23. Eichstätt	Universitäts-bibliothek Eichstätt	No	7,240	2,101	64	2,240,253	1,701,658	40,785	7,168	2,675	15,463	107,322	72
24. Erfurt	Universitäts-und Forschungs-bibliothek Erfurt/Gotha	No	12,642	9,217	86	1,532,893	1,213,788	38,607	2,085	290	26,567	21,075	48
25. Erlangen	Universitäts-bibliothek Erlangen-Nürnberg	No	24,033	7,167	64	2,862,171	2,768,857	43,382	8,032	1,654	35,598	48,323	96
26. Essen	Universitäts-bibliothek Essen	No	20,283	6,387	64	1,447,029	1,426,269	27,202	3,872	-	-	0	17

Fig. 1 German University Libraries (2001).

(*continued*)

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27. Flensburg	Zentrale Hochschul-bibliothek Flensburg	No	5,950	1,785	41	233,685	232,276	5,384	675	6	-	0	10
28. Frankfurt/Main	Senckenber-gische Bibliothek	No	38,142	12,808	69	1,215,104	1,214,643	13,185	7,021	1	10,179	249	50
29. Frankfurt/Main	Stadt- und Universitäts-bibliothek Frankfurt am Main	No	38,142	12,808	69	4,468,067	3,323,521	45,504	7,789	1,004	32,519	301,878	85
30. Frankfurt/Oder	Universitäts-bibliothek der Europa-Universität Viadrina Frankfurt (Oder)	No	4,476	372	76	564,931	420,447	27,580	1,874	147	10,958	56	9
31. Freiberg	Universitäts-bibliothek „Greorgius Agricola“	No	7,592	1,898	71	777,473	685,256	15,818	1,854	609	36,883	5,008	70
32. Freiburg	Universitäts-bibliothek Freiburg im Breisgau	No	36,225	18,625	78	3,402,823	2,734,084	46,792	5,598	-	94,455	14,417	81
33. Gießen	Universitäts-bibliothek der Justus-Liebig Universität Gießen	No	25,639	4,399	67	1,664,734	1,568,319	14,918	3,618	183	39,990	3,608	61
34. Göttingen	Nieder-sächsische Staats- und Universitäts-bibliothek Göttingen	Yes	46,251	23,327	72	5,671,830	4,075,277	76,393	23,176	3,208	40,056	31,826	35
35. Greifswald	Universitäts-bibliothek Greifswald	No	13,359	3,551	74	3,017,873	2,644,058	31,281	4,823	711	29,532	6,291	72
36. Hagen	Universitäts-bibliothek der FernUniversität Hagen	No	9,125	2,224	51	716,221	716,219	22,772	3,016	-	-	2	3
37. Halle/Saale	Universitäts- und Landes-bibliothek Sachsen-Anhalt	Yes	22,231	8,067	99	5,231,902	4,601,930	64,518	8,120	1,435	51,495	127,197	75
38. Hamburg	Staats- und Universitätsbibliothek Hamburg	Yes	55,072	8,151	63	3,997,803	3,024,255	51,771	7,982	-	47,739	122,898	86
39. Hamburg	Universitäts-bibliothek der Technischen Universität Hamburg-Harburg	No	8,694	3,967	64	982,506	731,796	9,043	1,012	536	40,501	-	78
40. Hamburg	Universitäts-bibliothek der Bundeswehr Hamburg	No	7,880	5,318	57	717,495	498,860	19,953	5,408	2,269	49,526	7	6
41. Hannover	Technische Informations-bibliothek / Universitäts-bibliothek Hannover	No	44,244	-	58	1,635,971	1,568,919	21,829	-	-	-	-	90
42. Heidelberg	Universitäts-bibliothek Heidelberg	No	29,234	8,037	78	3,664,020	3,046,510	43,632	6,111	529	123,467	138,626	80
43. Hildesheim	Universitäts-bibliothek Hildesheim	No	9,179	4,297	56	528,093	417,076	8,214	2,157	918	0	597	50
44. Ilmenau	Universitäts-bibliothek Ilmenau	No	10,754	3,283	67	693,160	566,471	20,999	1,587	11	26,897	0	36
45. Jena	Thüringer Universitäts- und Landesbi-bliothek	Yes	23,625	6,420	71	3,878,146	3,491,909	72,168	8,649	2,331	41,809	10,740	60
46. Kaisers-lautern	Universitäts-bibliothek Kaiserslautern	No	24,695	6,897	50	934,646	844,115	19,458	2,663	640	64,302	0	21
47. Karlsruhe	Universitäts-bibliothek der Universität Karlsruhe	No	20,980	-	54	991,259	910,628	17,451	2,583	1	64,382	0	84
48. Kassel	Universitäts-bibliothek Kassel	Yes	36,131	-	74	22,565,530	1,640,852	29,199	7,187	2,315	0	31,053	14
49. Kiel	Universitäts-bibliothek Kiel	No	20,000	-	73	2,171,039	1,977,911	29,741	4,025	37	60,059	4,883	30
50. Koblenz	Universitäts-bibliothek Koblenz	No	5,941	-	49	247,320	246,960	7,012	765	-	-	-	40
51. Cologne	Universitäts- und Stadtbibliothek Cologne	No	40,474	8,301	62	32,306,460	3,008,703	37,240	10,531	76	71,171	5,721	0
52. Konstanz	Bibliothek der Universität Konstanz	No	13,259	5,668	136	2,007,887	1,989,121	39,613	5,644	877	53,160	18,766	1
53. Landau	Bibliothek der Universität Koblenz-Landau	No	-	-	49	399,550	397,366	19,155	1,323	-	-	-	10
54. Leipzig	Universitäts-bibliothek Leipzig	No	37,317	2,592	68	5,287,396	4,895,379	67,938	7,809	81	48,755	185,672	55
55. Lübeck	Zentrale Hochschul-bibliothek Lübeck	No	6,155	294	54	420,903	331,239	7,814	697	1	29,273	0	50
56. Lüneburg	Universitäts-bibliothek Lüneburg	No	12,647	4,420	55	430,604	361,070	10,922	1,279	41	3,486	0	11
57. Magdeburg	Universitäts-bibliothek Magdeburg	No	19,223	5,374	52	1,867,719	1,024,483	42,284	3,685	803	73,987	15	-
58. Mainz	Universitäts-bibliothek Mainz	No	25,463	6,217	78	2,278,270	2,212,667	26,924	2,873	0	62,094	852	55
59. Mannheim	Universitäts-bibliothek Mannheim	No	-	-	60	2,141,018	1,902,767	39,460	6,294	639	42,160	219	35
60. Marburg	Universitäts-bibliothek Marburg	No	28,211	2,391	83	2,198,772	1,905,644	21,706	3,500	-	37,946	10,159	91
61. Munich	Universitäts-bibliothek der Ludwig-Maximiliams-Universität Munic	No	21,569	3,800	68	2,996,037	2,629,415	40,832	8,464	2,866	41,457	24,136	97
62. Munich	Universitäts-bibliothek der Technischen Universität Munic	No	19,527	5,140	69	1,868,105	1,132,022	46,399	5,805	1,797	77,227	0	88
63. Munich	Universitäts-bibliothek der Universität der Bundeswehr Munic	No	11,722	4,757	56	1,072,718	959,461	21,359	3,068	591	65,960	1,900	50

Fig. 1 German University Libraries (2001). (*Continued*)

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64. Münster	Universitäts- und Landes-bibliothek Münster	Yes	35,980	2,967	73	2,590,204	2,275,000	49,030	10,498	2,518	93,685	5,796	50
65. Oldenburg	Universitäts-bibliothek Oldenburg	No	19,644	10,702	83	1,992,802	1,224,335	47,156	3,658	897	0	16,360	1
66. Osnabrück	Universitäts-bibliothek Osnabrück	No	10,500	3,100	72	1,339,231	1,309,856	27,807	5,500	-	-	11	25
67. Paderborn	Universitäts-bibliothek Paderborn	No	14,357	4,726	99	1,432,945	1,251,656	24,278	2,815	-	0	0	10
68. Passau	Universitäts-bibliothek Passau	No	9,376	1,390	72	1,867,645	1,502,036	37,056	5,223	-	19,498	0	50
69. Potsdam	Universitäts-bibliothek Potsdam	No	22,191	3,182	60	1,081,389	1,037,632	35,544	5,575	1,736	-	0	-
70. Regensburg	Universitäts-bibliothek Regensburg	No	27,784	8,131	79	3,302,318	3,023,613	63,978	13,432	3,238	27,273	23,535	55
71. Rostock	Universitäts-bibliothek Rostock	No	19,285	5,114	59	6,580,972	2,245,772	44,452	3,286	0	-	6,724	80
72. Saarbrücken	Saarländische Universitäts- und Landes-bibliothek	Yes	39,286	-	74	2,058,155	1,898,255	27,438	7,382	2	15,455	1,275	96
73. Siegen	Universitäts-bibliothek Siegen	No	11,162	2,835	75	1,160,472	1,157,696	32,874	4,117	-	-	2	10
74. Stuttgart	Universitäts-bibliothek Stuttgart	No	19,610	8,454	62	1,462,568	1,174,311	25,378	3,681	669	114,152	1,067	69
75. Stuttgart	Universitäts-bibliothek Stuttgart-Hohenheim	No	16,358	7,084	79	525,534	525,534	15,495	2,268	0	28,950	0	14
76. Trier	Universitäts-bibliothek Trier	No	12,626	2,395	80	1,536,180	1,395,556	20,613	5,161	3	29,746	625	1
77. Tübingen	Universitäts-bibliothek Tübingen	No	25,938	8,706	62	3,469,178	3,143,638	47,303	7,600	350	107,268	86,934	92
78. Ulm	Universitäts-bibliothek Ulm	No	6,175	1,207	77	1,027,237	877,063	14,501	2,993	1,039	27,801	2	40
79. Weimar	Universitäts-bibliothek Weimar	No	8,284	1,889	71	556,682	428,581	13,093	1,061	26	34,251	-	60
80. Wuppertal	Universitäts-bibliothek Wuppertal	No	14,195	4,411	59	1,348,656	1,112,811	24,257	4,525	2	41,965	2	18
81. Würzburg	Universitäts-bibliothek Würzburg	No	17,865	5,439	74	1,593,180	1,281,611	17,748	3,640	3,159	36,204	64,743	50
82. Average			**21,286**	**6,072**	**68**	**3,227,8176**	**1,694,912**	**31,619**	**5,234,5**	**1,197**	**43,725**	**31,588**	**50**

Source: http://www.bibliotheksstatistik.de/

Fig. 1 (*Continued*).

Everyone in Germany, Austria, and Switzerland looking for literature can access Subito regardless of where they are and if they are a member of a university or not. In other countries, all libraries, which are financed by public funds and take part on interlibrary loan (ILL), can use the Subito Library Service, but not the end users because of copyright negotiations between Subito Society and publishers.

- Many university libraries are special subject collection libraries as part of the system of supraregional literature supply in Germany.[3] Supraregional literature provision is a joint project of numerous excellent libraries throughout Germany (not only university libraries), supported by the DFG. In combination with *Die Deutsche Bibliothek* (The German Library) and the *Sammlung Deutscher Drucke* (Collection of German Imprints), this system of supraregional literature provision can be seen as the equivalent of a national library. This system guarantees on the one hand excellent and rapid access to international scientific information, realizes this goal on the other hand through a regional division of labor among many libraries and thereby corresponds to the prevailing philosophy in Germany after the Second World War which gave more preference to strengthening federated structures over centralistic structures. In other words, the university libraries that participate in this system comprehensively collect (nearly) all published

Number of branches	Active users incl. external users	external users	Opening hours per week	Total holdings	Acquisitions (volumes)	Journal subscriptions incl. electronic journals	Electronic journal subscriptions	Text book collections (volumes)	% collections in storage areas
2	3,821	995	42,6	152,390	4,176	651	253	7,684	21

Source: http://www.bibliotheksstatistik.de/

Fig. 2 Libraries of the Universities of Applied Sciences including institutions for higher education in art and music (averages for 2001).

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scientific information in their field independent of the question whether that subject area is represented in the teaching and research at that university. The following libraries offer a special document delivery service for publications in their special subject collections (*Sondersammelgebiets-Schnelldienst—SSG-S*), which is more expensive, but even faster than normal document delivery by Subito:

- Saxon State and University Library Dresden: SSG-S for Contemporary Art, including photography, industrial, and graphical design
- Erlangen-Nuremberg University Library: SSG-S for Philosophy and Education
- Senckenberg Library, Frankfurt/Main: SSG-S for Biology, Botany, and Zoology
- Goettingen State and University Library: SSG-S for General English Philology; Great Britain and Ireland; Celtic Studies; North America; Australia; New Zealand; Mathematics; Astronomy, Astrophysics, Cosmology; Geophysics; Geography; and Forestry
- Halle University and Regional Library: Document Delivery Services Near East Direct (*Dokumentlieferdienst Vorderer Orient Direkt*) for publications in the collection ''The Middle East, including Northern Africa''
- Heidelberg University Library: SSG-S for Egyptology; Classical Archaeology; Art (in general); Medieval and Modern Art until 1945
- Kiel University Library: SSG-S for Scandinavistic
- Saarland University and State Library, Saarbruecken: SSG-S for Psychology
- Tuebingen University Library: Document Delivery for Theology, General and Comparative Religious Studies; Ancient Near East, South Asia

- Two university libraries are organizationally combined with central subject libraries (*Zentrale Fachbibliotheken*):
  - The German National Library of Medicine (*Zentralbibliothek für Medizin*) in Cologne, combined with the Medical Department of the Cologne University and City Library. Its task is the acquisition and provision of all German and international literature on human medicine and its basic subfields. This library has international significance and has an astonishingly strong individual document supply service.
  - The German National Library of Science and Technology (*Technische Informationsbibliothek/Universitätsbibliothek—TIB/UB*) in Hanover—joint with the Hanover University Library—is the German national library for all areas of engineering and its basic sciences, in particular chemistry, information technology, mathematics, and physics. The affiliated Patent Information Center enables users to browse patent documents acquired from around the world. The TIB's task is to comprehensively acquire and archive literature from around the world pertaining to engineering and the natural sciences. On the basis of their superb holdings, the TIB today ranks as one of the world's largest special libraries and is one of the most efficient document suppliers in their subject areas.

These two libraries place a particular emphasis on acquiring gray literature of their subject areas which is difficult to acquire and not available via the book trade.

The particularity of the central subject libraries in the German library landscape lies in the direct funding jointly by the federal government and the states (*Länder*). Both the federal government and the states take for some little time great pains to keep their responsibilities separate, but at the same time they finance a series of federal tasks together, among others, the three central subject libraries. The third central subject library (the German National Library of Economics in Kiel—*Deutsche Zentralbibliothek für Wirtschaftswissenschaften/Bibliothek des Instituts für Weltwirtschaft*) is not connected with a university library.

- Two university libraries take part in the Collection of German Imprints (*Sammlung Deutscher Drucke*). The goal of this project initiated by the Anglistic Professor Bernhard Fabian of Muenster and initially supported by the Volkswagen Foundation is a distributed national library. In this way, the continual activities of a national library are to be distributed in Germany among several libraries to acquire a complete collection of all national publications which in other countries is usually more or less achieved by the continual activities of a national library. The background for this is the late founding of a German national State (1871) and the still later founding of a German National Library (1912). A total of six libraries, the collections of which represent an area of emphasis in a specific historical epoch, take part in the project Collection of German Imprints in that they acquire any German publications from that particular epoch in antiquarian or at least as microfilm which are not otherwise available in these libraries.
  - For the years of publication 1450–1600: Bavarian State Library in Munich
  - 1601–1700: Herzog August Library in Wolfenbuettel
  - 1707–1800: Goettingen State and University Library

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- 1801–1870: Frankfurt/Main City and University Library
- 1871–1912: Berlin State Library–Prussian Cultural Heritage (*Staatsbibliothek zu Berlin-Preußischer Kulturbesitz*)
- From 1913 onwards: Die Deutsche Bibliothek with its three locations in Frankfurt/Main, Leipzig, and Berlin

- In two cases, small libraries of universities of applied sciences are spatially or organizationally joined with a public library (*Stadt- und Hochschulbibliothek Lingen*—City and University Library of Lingen; and *Hochschul- und Kreisbibliothek Bonn-Rein-Sieg in Sankt-Augustin*—University and County Library of Saint Augustine). In one case the library of a university of applied sciences is an academic and a regional library (Hochschul- und Landesbibliothek Fulda—Fulda University and Regional Library).

In conclusion, one can say that the German academic libraries have an extraordinarily powerful position in the German library landscape and take on responsibilities that go far beyond the provision of their own higher education institutions with literature and information. They are also substantially involved in preserving the cultural heritage of Germany. Less powerful seems to be their weight in the single university systems where still strong hierarchical structures separate the professors from the rest of the staff.

Collection Development

The considerable differences in the collections of university libraries result from their historical development. Many university libraries have their origins in the 14th and 15th century and could pursue their collection continually over the centuries, even integrating previously held, comprehensive collections into their collections (i.e., the university libraries in Heidelberg, Leipzig, Rostock, Freiburg, Tuebingen-in order of their year of founding). Some go back to the time of the Reformation and the Counter-Reformation (Marburg, Wuerzburg). A number of university libraries of today have been founded in the time of the Enlightenment (Fig. 3) or during political reforms of the 19th century. Most of the libraries of universities founded in the 20th century (most of which were founded between 1960 and 1980 when the politicians in the first years after the end of the Reconstruction era after the Second World War recognized that the potential of scientifically qualified labor force had to be expanded) began their collections at the bottom zero line, but through antiquarian acquisitions—sometimes of complete collections—have achieved similarly extensive collections. After the German Reunification in 1990, the academic libraries in former East Germany, which during the time of the GDR were only able to purchase literature from the West in insufficient numbers, received substantial supplementary acquisitions funds to augment the collection by supplying the missing works.

Fig. 3 Goettingen State and University Library, historical building, a former church (Paulinerkirche), in a drawing from the 19th century. This library was the first German library which since the 18th century realized the concept of a modern research library with systematically acquired literature from around the world. (Source: Goettingen State and University Library.) (*View this art in color at www.dekker.com.*)

Typical for German university libraries in view of this background are the thematic, universal collections with substantial integration of parts of historic collections. In general, only multiple copies were discarded.

On the average, the book collection at German university libraries amounts to 1.7 million volumes (Fig. 1). The following university libraries have the largest collections: Berlin (Humboldt University with 5.7 million volumes), Leipzig (with 4.9 million volumes), Halle (with 4.6 million volumes), Dresden (with 4.3 million volumes), Goettingen (with 4.1 million volumes), Jena (with 3.5 million volumes), Frankfurt/Main (with 3.3 million volumes), Tuebingen (with 3.1 million volumes), Heidelberg, Hamburg, Regensburg, and Cologne (all with approximately 3 million volumes).

The number of journal subscriptions usually lies between 5000 and 6000 titles, of which approximately 1200 are in electronic form (2001). The number of electronic journals is rapidly rising in these libraries. On the average, 32,000 new acquisitions are added per year—although as a result of the financial crisis of public funding this is now in a receding tendency so that the chasm between scientific publication figures and that of the works available in the libraries is widening. According

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to figures collected at the beginning of the 1990s from bibliographies,[4] the library of a university that offers degree programs in all subject areas ought to acquire 54,000 monographs and 12,000 journal subscriptions per year.

In view of the background of the ever-widening chasm between the actual acquisitions budget and the budgetary needs, a budget model[5] for the Federal State of Bavaria was developed in 2001 in which the less frequently needed literature, especially journals, would only be acquired in a few libraries or only in one library at all. Access to literature for the user is then only possible for these areas through automated interlibrary loan and document delivery services (a paradigm change). The Bavarian State Library in Munich then functions as a last resort library to compensate with any items not held in the Bavarian university libraries.

Many university libraries have significant historical collections, often including manuscripts and rare books. Such special collections are first of all found in Augsburg, Bonn, Dresden, Erlangen, Frankfurt/Main (including the Senckenberg Library, Germany's largest special collection for the natural sciences), Freiburg, Goettingen (Fig. 4), Halle, Heidelberg, Jena, Marburg, Leipzig, Muenster, Rostock, and Tuebingen.

The following university libraries possess extraordinarily comprehensive film collections, primarily on video, but in part also on other media forms, such as 35-mm films and photos: Berlin (University of the Arts), Bielefeld, Dresden, Freiburg, Hamburg, Heidelberg, Kiel, Lueneburg, Munich, Oldenburg, Potsdam (University for Film and Television), Regensburg, Stuttgart (University of Applied Sciences for Media).

Fig. 4 Goettingen State and University Library, historical building with the research library for historical holdings. (Source: Goettingen State and University Library.) (*View this art in color at www.dekker.com.*)

Approximately half of the German university libraries have a large collection of musical works for research and teaching, mostly in connection with musical scores and musicologically scientific collections. One of the most prominent collections can be found in the Saxon State and University Library (*Sächsische Landesbibliothek-Staats- und Universitätsbibliothek)* in Dresden.

In most German states, the acquisitions budget is determined by the state budget by the parliaments of the single states (*Landtag*). However, more and more universities are being supplied with global budgets, that is to say, the state parliament decides on a total budget for the university without determining the details of the actual allocations. As a result of this, the academic library is often in competition with other units of the university in the internal university decision-making groups for the level of the library budget.

Textbook collections are important for the students. These often represent a separate department of the university library. The textbook collection usually comprises an average of 44,000 available volumes in smaller textbook collections, 20,000 up to 30,000 volumes (not titles!); in the largest universities, over 100,000 volumes. The differences are less due to the number of students or registered users (correlation-coefficient for users of university libraries and the comprehensiveness of the textbook collection = 0.4), but rather to the thematic profile of the university (in the technical or predominately natural sciences degree programs, also in law and medicine, textbooks play a greater role than in the humanities and social sciences degree programs), and to considerable differences in the level of service. At some universities, there are also ''student libraries'' (*Studentenbibliotheken*) the collections of which are made up of nonfiction, belles letters, how-to-do-it books, and serve the general education of the students in the sense of *studium generale*, and are also supposed to include information for the students' everyday life (e.g., at the universities in Bamberg, Bonn, Freiburg, Goettingen, Heidelberg, Karlsruhe, Cologne, Regensburg). An original idea was realized in the Central Library for the Sciences of the Humboldt University of Berlin in 2003: The natural sciences professors were asked to name their favorite books for the textbook collection. The spectrum extended from comics up to Umberto Eco's *The Name of the Rose*.

Written acquisitions profiles were still the exception at German universities in the 1990s. However, now the opinion prevails that acquisitions profiles should be developed and documented, and in the course of time, more and more university libraries are presenting their written acquisitions profiles.[6] According to a quasi-

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official recommendation[7] the acquisitions profile should above all express statements about the university profile of requirements, i.e., the profile of the teaching and research and the student numbers, external responsibilities (e.g., for a regional library), financial requirements, acquisition levels. The acquisition levels defined here for German university libraries are formulated according to the Conspectus method, although they do not follow these exactly either in their formulations or in the content, as they must be thought of completely in the context of the libraries of the German higher education system. Furthermore, the distinction of collection depth indicators is not planned for in the German model.

The collections of the universities of applied sciences (Fig. 2) can be distinguished in two aspects from those of the university libraries:

- They are not more or less universal in scope, but rather more thematic and very narrowly oriented to the subjects offered at the respective university of applied science. An exception to this is the collections of the library of the Stuttgart University of Applied Sciences for Media as the courses of study there in library and information science also include a sort of *studium generale*.
- They are considerably smaller than the collections of university libraries (on the average with 152,000 volumes and 4200 new acquisitions per year). However, there are some libraries of universities of applied sciences with collections of over 1 million volumes (such as at the universities of applied sciences in Jena, Leipzig, and the University for Film and Television in Potsdam), and a number of libraries at smaller universities of applied sciences where only a few subject areas are taught with collections of under 10,000 volumes. For the students enrolled at these universities of applied sciences, textbooks often play a more important role than a comprehensive collection. At some libraries of universities of applied sciences, the holdings consist of textbooks to one fourth or more in a steep gradation (for instance, the libraries of the universities of applied sciences in Brandenburg, Ingolstadt, Isny, Munich, Muenster). The number of journal subscriptions is on the average 650, although ranging from 50 to over 11,000 and on an average 250 electronic journal subscriptions (2001).

Collection building for monographs (books) is generally based on the selection of individual titles by the library staff at libraries of German institutions of higher education. However, the division of labor for collection development between research and teaching personnel and the library staff differs greatly from university to university. At the universities of applied sciences the selection decision lies more often with the professors than with library staff members. Procedures such as blanket orders or approval plans are rarely used. For decisions on acquiring journal subscriptions, the journal impact factors are increasingly being used for judgment purposes. The journal subscriptions usually take up far beyond 50% of the entire acquisitions budget of university libraries, sometimes over 90%.

User Services

In-house use and lending

University libraries usually have 50% of their collection in open stacks, whereas in libraries of universities of applied sciences it is 79%. The storage areas are often open to users. The collections in storage areas are arranged according to running acquisitions numbers (*numerus currens*), the open access areas and reading room collections are usually arranged by a classification system. Approximately one third of German academic libraries use an individually developed classification system. A number of classification systems that were developed in Germany for academic libraries are used in a more or less limited number of academic libraries. The ''*Regensburger Verbundklassification—RVK*.''[8] (Regensburg Union Classification) is by far the widest applied classification system, named after the Regensburg University Library where it was originally developed; it is used in more than one third of all university libraries in Germany and is increasingly finding more users. Up until now, the Dewey Decimal Classification (DDC) has only found isolated usage in Germany. But it seems quite sure that Die Deutsche Bibliothek (The German Library) will be using the unabridged DDC in a very few years for the production of the German National Bibliography (until now only the divisions have been used).[9] Whether the academic libraries will then change the arrangement of their open access collections to DDC is not very likely.

Lending and circulation remains a central service at all academic libraries (Fig. 5). A university library usually records an average of over 500,000 loans per year, a library of a university of applied sciences over 85,000 loans. Nine university libraries record over 1 million loans per year.

At all academic libraries, users have access to reading rooms and working spaces (Fig. 6), at many larger university libraries various reading rooms for manuscripts, cartographic materials, etc., are available. Generally, a more or less large number of PC-work places with Internet connections and network outlets are available for laptops.

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Fig. 5 Freiburg University Library, entrance hall with central communication functions and OPACs. (Source: Freiburg University Library.) (*View this art in color at www.dekker.com.*)

At a growing number of academic libraries, wireless network access is available; the users can borrow a wireless network card for their laptop and create a cableless Internet connection. Generally, there is an organizational separation between the university library and the computer center; for this reason, the PC pool operated by the university computer center is most often still separate from the reading rooms but there are trendsetting exceptions (Fig. 7).

A CD-ROM network, operated by the academic library, and accessible from all PCs on campus including the PCs in the reading rooms of the academic library and in the PC pool, is a standard service today. Furthermore, the electronic publications held by the library are available via the Internet with password authentication for university members.

Fig. 6 Saxon State and University Library Dresden, central reading room. (Source: Saxon State and University Library/ Deutsche Fotothek.) (*View this art in color at www.dekker.com.*)

Fig. 7 Humboldt University Berlin, Central Library for the Sciences from 2003. Library and computer center are here installed in the same building and work closely together to manage the access to digital information. But in general the academic library and the computer center are separate organizations in Germany. (Source: Humboldt University Berlin.) (*View this art in color at www.dekker.com.*)

Further important user services that are usually offered by university libraries include:

- Reference services. The conventional reference service is often connected with the supervision of the reading room. In general, there is no special reference librarian, but rather the library staff from all departments (collection development, cataloguing, document delivery, marketing, etc.) are involved in providing reference services. It might be that also the conventional Reference service gains a greater esteem as electronic Reference service begins to establish.
- All academic libraries take part in interlibrary loan. Through the document delivery services, the significance of interlibrary loan has declined. Nevertheless, a total of more than 3 million interlibrary loan requests are processed per year, 77% of which are processed at university libraries.

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- Photo center. The photo center takes orders from users for readable hard copies of microforms and to a lesser degree of nonlending materials.

Hybrid libraries

In countless projects, the academic libraries have entered the path to the hybrid library and offered comprehensive virtual services. In addition to the academic libraries, state and regional libraries are also involved in such projects. A few examples are noted here:

- In 1996, the Karlsruhe University Library developed the ''*Karlsruher Virtueller Katalog—KVK*''[10] (Karlsruhe Virtual Catalog; Fig. 8). This metasearch interface for library catalogs in the Internet sends the search query to all libraries in the German regional networks and also to important libraries such as the national libraries of the United States, Great Britain, France, Spain, Italy, and Germany, and displays the respective hit lists.
- On the homepages of all academic libraries there are useful links to thematically relevant content. The Duesseldorf University Library has compiled a comprehensive, ordered, and annotated collection of selected and constantly checked Internet resources in all scientific subject areas (Duesseldorf Digital Library—*Düsseldorfer Digitale Bibliothek*).[11] The goal of this project is to provide the best possible answer to the highest possible number of questions. While search engines, databases, and (print and electronic) bibliographies include more or less everything that they find, the quality of the resource plays an important role for inclusion in the Duesseldorf Digital Library.
- The Digital Library ''*DigiBib*''[12] of the University Library Center of the State of North Rhine-Westphalia (*Digitale Bibliothek DigiBib des Hochschulbibliothekszentrums Nordrhein-Westfalen—HBZ*)[13] offers a unified user interface for a number of diverse information resources: library catalogs and bibliographic databases from the whole world, as well as online documents, and to a lesser degree, links to online or CD-ROM databases arranged according to subject area (i.e., lexica, factual databases) and qualitatively high-value free websites. Using this unified interface, one can determine the availability of a resulting text—if it is available online, via document delivery, if it is held in a library, or can be obtained from an online bookshop. With this service, every participating library offers its users a cost-free and simple access service to the freely available resources and to

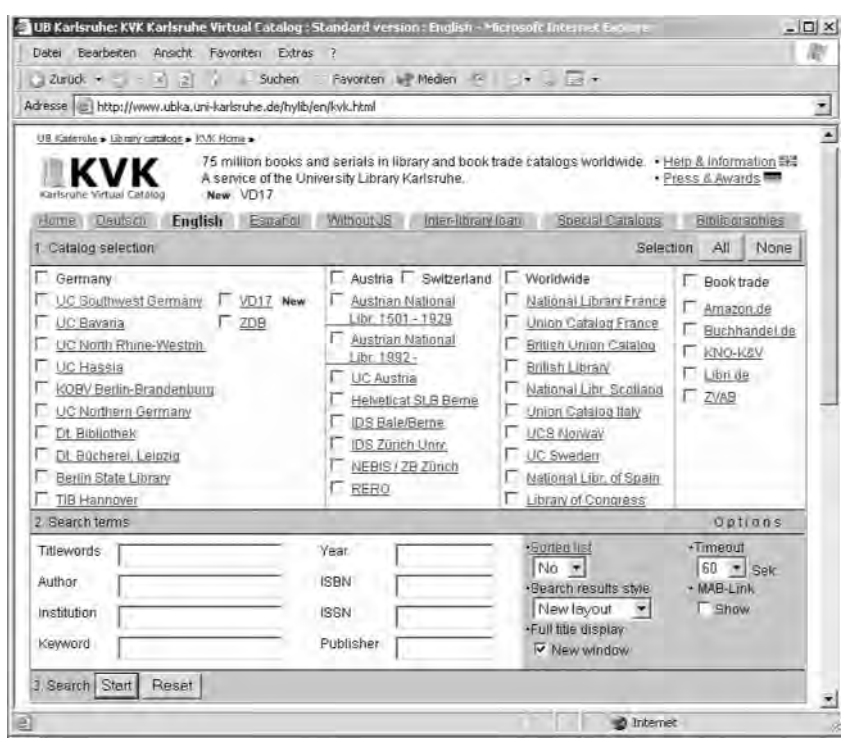

Fig. 8 Homepage of the Karlsruhe Virtual Catalog, a service of the Karlsruhe University Library. (*View this art in color at www.dekker.com.*)

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resources licensed by that particular library. Guest users have access to the freely accessible offerings.

- Many university libraries participate in the DFG program for developing the distributed digital research library (*Verteilte Digitale Forschungsbibliothek—VDF*).[14] In this context, university libraries built virtual subject portals and other electronic services for numerous scientific disciplines, for instance:
  - Virtual Specialized Libraries (*Virtuelle Fachbibliotheken*)[15] for each scientific discipline, e.g., for ethnology (Library of the Humboldt University in Berlin), French language and literature (Bonn University and Regional Library), pharmacy (Brunswick University Library).
  - Digitization of historical collections in order to make them available via the Internet, e.g., digitized historical children's books (University of Oldenburg),[16] digitized historical travel literature on the Middle East (Halle University and Regional Library).[17]
  - Joint Historical Subject Information Service (*Gemeinsamer Geschichtswissenschaftlicher Fachinformationsdienst*) of the special subject collection libraries Bavarian State Library and Goettingen State and University Library.[18]
  - Vascoda[19] (Figs. 9 and 10), led by the German National Library of Science and Technology Hanover—an Internet portal which offers a central access point to a wide array of scientific and scholarly information, especially to the invisible Web. Vascoda incorporates more than 20 virtual libraries, 4 scientific networks, and the Electronic Journals Library EZB.
  - Further development of the search engine ''German Harvest Automated Retrieval and Directory'' (GERHARD),[20] with which documents are automatically evaluated according to document type and categorized according to content (Oldenburg University Library).[21]
  - Development of an extended multimedia online publication system for digital libraries (Stuttgart University Library).[22]
- In order to support the DFG programs to build a German digital research library and coordinate national efforts toward standardization in various fields (e.g., digital conversion, online access, bibliographic description), the Goettingen Center for Retrospective Digitization (*Göttinger Digitalisierungszentrum—GDZ*)[23] at the Goettingen State and University Library was established in 1997.
- The project digital theses and dissertations[24] is a joint project of the computer centers and the university library of the Humboldt University in Berlin. The purpose of this prototypical development of a digital

Fig. 9 Homepage of Vascoda, an Internet portal that offers a central access point to a wide array of scientific and scholarly information. (*View this art in color at www.dekker.com.*)

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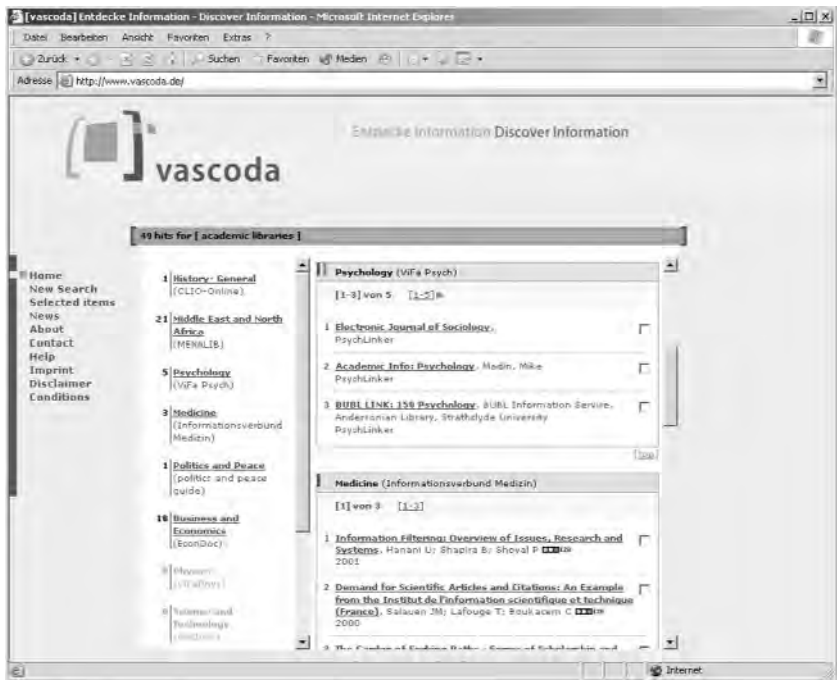

Fig. 10 Search results for ''academic libraries'' in Vascoda. (*View this art in color at www.dekker.com.*)

library (certified document server) for theses and dissertations (*Hochschulschriften*) is, above all, to ensure that dissertations will be processed in electronic form and will be archived. The project provides the document server with a security concept for the archiving of digital documents and supports potential authors in processing their publications for the Internet by means of a workflow for treating electronic documents within the university library. Similar projects can also be found at many other university libraries.

- Reference services via e-mail is possible everywhere, because the university libraries can all be reached by e-mail. A number of university libraries have established expressly e-mail-based reference services in that they provide a specific Web template for this purpose and advertise this on their homepage. Several university libraries offer a virtual reference desk by using a Web customer support software.[25] The most well-known are currently the services of the University Library in Dortmund,[26] Oldenburg,[27] Trier,[28] and the Library of the Technical University of Hamburg-Harburg.[29]

Despite numerous projects, in which the catalog entries have been digitized, there are still collections in certain amounts in many university libraries of which the catalogs have not yet been digitized, especially those from the 19th century and partially also from the first half of the 20th century.

More or less all of the academic libraries also offer electronic journals to their users. For the license agreements with publishers, the university libraries (also many state and special libraries) have joined together in regional consortia (customer associations) on the basis of continuing print subscriptions.[30] Not so much the more reasonable price is seen as one of the advantages of consortial agreements but the cross access. However, the disadvantages are, of course, highly controversial:[31] An obligation for subscribing to a long list of electronic journals is submitted to the consortium and the individual participating libraries in the consortium have only very limited possibilities of canceling journals no longer needed. The question is not clarified everywhere whether access to older volumes of electronic journals no longer subscribed to is still available to the individual libraries. Academic libraries normally tend to continue to subscribe to the print edition parallel to the electronic edition wherever it is available.

Access to electronic journals via the Electronic Journals Library (*Elektronische Zeitschriftenbibliothek—EZB*; Fig. 11) has become standard at academic libraries. The EZB is managed by the Regensburg University Library.[32] The EZB contains links for all users to the

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Fig. 11 Homepage of the Electronic Journals Library, access to over 14,000 electronic journals worldwide. (*View this art in color at www.dekker.com.*)

over 14,000 electronic journals of all participating libraries, sorted according to subject areas, titles, publishers. Depending on the licenses which the individual participating academic libraries have contracted with the publishers, access to the individual titles will be opened. Among the 200 participants are also state, regional, and special libraries.

A complete overview of all initiatives, projects, and programs supported by numerous financial backers concerning digital libraries including the activities of academic libraries can be found on the website of the Digital Library Forum.[33] Its main focus is on the funding activities of the German Federal Ministry of Education and Research, the DFG, the single German states, and other research institutions.

Information literacy

In the year 2001, the German Federal Ministry of Education and Research commissioned a study of the state of information literacy at German institutions of higher education. The report[34] (nicknamed the *SteFi-Studie-Studieren mit elektronischer Fachinformation*—Report on studying with electronic specialist information) came to the conclusion that information literacy with regard to electronic scientific information is very selective and not systematically taught to many higher education instructors and students. The necessary integration of instructing information literacy competencies in the regular subject courses was hindered by the programmatical separation of information literacy from subject content being taught. The report recommended first of all the following measures:

- Cooperation between subject information centers, university libraries, departmental libraries, and instructors to further information literacy.
- Available offerings in courses on information literacy should be packaged together and networked (placed online).

At the same time, broad discussion[35] began in Germany on the Information Literacy Competency Standards for Higher Education of the American Association of College and Research Libraries ACRL. In 2001, the German Science Council[1] recommended that the libraries of institutions of higher education increase efforts to

- qualify and advise scientists as online-authors,
- teach information literacy,
- provide continuing education for library staff for development and updating their media competencies.

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With this basis, countless initiatives for improved teaching of information literacy at academic libraries were strategically planned, intensified, and increased. Programs for user instruction have a tradition at the academic libraries since the 1970s, but are often limited to a short introduction and a broad spectrum of hand-outs with explanations for individual services such as the OPAC, document delivery services, database use, etc. Since the 1990s, many academic libraries offer a virtual tour via the Internet. Because in the new Bachelor's degree program a certain portion of the interdisciplinary content is required, many academic libraries take this opportunity to actively pursue instruction in information literacy. In the meantime at many universities, corresponding modules are offered as parts of courses for introduction to scientific methods or are offered additionally, but only in rare cases belong to the mandatory courses students are required to take.[36] Many academic libraries develop their own multimedia learning programs for information literacy. Several excellent examples are worth mentioning:

- Courses in information literacy, for example at the academic libraries of Brunswick,[37] Bremen, Dortmund,[38] Freiburg im Breisgau,[39,40] Kassel,[41] Konstanz und Wuerzburg,[42] at the Technical University of Hamburg-Harburg,[43] and the University of Applied Sciences of Ingolstadt,[44] which are partially integrated into the official course of study at this University,
- The so-called road shows at the Freiburg University Library,[45] i.e., promotional activities outside the library in classrooms showing the OPAC, electronic journals, and database searches on the Internet,
- Online tutorials at the university libraries of Heidelberg,[46–48] Lueneburg,[49] and Kassel.[50]
- Virtual Tour of the University Library of Trier.[51]

Organization, Management

Library staff

In German public service, four qualification levels are distinguished according to the educational and professional degrees. Correspondingly, library staff at libraries of institutions of higher education are recruited according to these four qualification levels (Table 1).

In addition, a considerable number of student assistants are employed, especially for work at the circulation desk and in supervising the reading rooms and departmental libraries. Voluntary employment of students is rare.

Continued professional education for library staff is well developed. The professional associations, universities, and infrastructural institutions of librarianship offer a myriad of continuing professional education events including distance learning-based studies and courses.

Table 1 Library staff at libraries of institutions of higher education

Professional level	Special training	Typical jobs	Percentage of total library staff at academic libraries
Academic librarians (always in university libraries, not in all libraries of the universities of applied sciences)	University degree in any subject area plus two-year additional study program in library and information science	Collection development, upper management, reference services, subject cataloging, database searches, public relations and exhibitions	15%
Certified librarians	Three and a half to four-year-degree program in library and information science at a university of applied sciences	Cataloging, middle management, reference services, acquisitions, database searches, interlibrary loan, public relations	39%
Specialist staff for media and information services (former professional designation: library assistant or assistant at libraries)	Three-year dual training program, i.e., in combination with education at a vocational school	Acquisitions, technical media processing, lower management	44%
Semiskilled staff	None	Media orders, process, technical advisory concerning media, circulation	2%

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Isolated occurrences of teleworking have been established.

Management and marketing

At the libraries of universities which were founded in the 1960s, the so-called one-track library system was established. Its characteristics are:

- The departmental libraries (branch libraries, partial libraries) are organizationally responsible to the central university library. Or the collections are organized decentrally and placed near the corresponding teaching areas for specific subjects, but there are no independent departmental libraries.
- Cataloguing and classification in the central and in the departmental libraries follow the same standards. All collections are available in the OPAC.
- Collection development is regulated by standard principles.

Older university libraries were often two-track systems and most of them are even today. Their characteristics include:

- In addition to the central university library, a more or less large number of institutes and faculty-libraries existed which were organizationally placed under the institutes and the professional staff (faculties). They have their own budget.
- Originally, most of these libraries did not have a librarian-trained director and they catalogued their holdings according to their own principles—completely separated from the central university library. In the meantime, almost all of these libraries have a professionally trained director and participate in the respective union catalog of the university.
- For collection development, agreements were made concerning the roles and division of labor (acquisitions agreements).

These two-track systems develop gradually into one-track systems, but with serious differences between universities.

In Eastern Germany during the time of the former GDR, the existing two-track library systems at universities were reorganized into one-track library systems and as a result of this, after the German Reunification in 1990, the library systems of even the older universities in Eastern Germany are one-track library systems.

The libraries at universities of applied sciences are always one-track library systems, even if the university of applied sciences is distributed in several locations each with a library (branch libraries).

The university libraries are headed by a director who has completed a university degree and a two-year additional course of study in library and information science as part of the civil service training. An advisory board of professors and other representatives of the university is available for consultation and advice and has a considerable impact especially in one-track libraries. In contrast, the libraries at the universities of applied science have a professor in many cases as the head of the library and the library staff is responsible for the day-to-day operation of the library.

Most academic libraries have been structured according to the model of the line-of-command organizational model, which is typical for the entire area of civil service in Germany. However, in addition to this, since the 1990s forms of matrix organization and project organization have established themselves in many libraries of institutions of higher education. A few libraries of institutions of higher education, with the Dortmund University Library and the Library of the University of Applied Sciences in Muenster in the lead, have continued to develop their organizations so that one can refer to them as models of learning organizations. A trend to merge university libraries with the universities' computer centers seems to arise.

Most academic libraries have organized their processes according to the traditional departmental model. New acquisitions are processed in the departments of Acquisitioning, Cataloguing, Subject Cataloging and Classification, Bookbinder. A slowly increasing number of academic libraries are now changing to the model of integrated processing. Instead of the specialized departments, smaller teams come together to select the new materials for their special areas, order them, and process them completely. The integrated processing model has produced an acceleration of the processing time, in addition to the greater flexibility for project tasks and innovation in management, information technology, and communications technology. The first university library to introduce integrated book processing was the Constance University Library in 1985.[52]

For decades, academic libraries have carried out user surveys in order to design services to better accommodate the needs of their patrons. Since the 1990s, user studies have become a widespread instrument. Notable for their methodology, questions, and results are the latest surveys at the university libraries of Augsburg,[53] Dortmund,[54] Freiburg,[55] Cologne,[56] Constance,[57,58] Magdeburg,[59] Muenster,[60] and above all the questionnaire of over 12,000 users of all university libraries in the State of North Rhine-Westphalia in 2001.[61] This questionnaire made it possible for the first time for university libraries in Germany to compare correlations between service quality and user satisfaction on an

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average of the university libraries with the individual library correlations so that the necessary measures that could be taken could be better justified. (Such an approach for public libraries had already been carried out several years earlier.)[62]

Especially since the 1990s, academic libraries have developed and implemented advanced management and marketing methods. The basis for this is often projects which have been funded by the DFG. Several of them deserve mention here:

- The University and Regional Library of Muenster developed a model for cost management for university libraries.[63]
- At the university libraries of Muenster and Bremen, and at the Bavarian State Library in Munich, a model for organizational control was developed using performance indicators which are coordinated with each other (balanced scorecard).[64]
- The university libraries of Dortmund and Magdeburg[59] developed a package of controlling instruments and used advanced management techniques for the first time in German university libraries, among others, the conjoint analysis, the complexity index analysis, and the service center concepts. Large-scale controlling was introduced at the Technical University of Munich which also included the Munich University Library.
- A project of the Bertelsmann Foundation, which has been substantially involved in modernizing public administration in Germany, has developed an instrument based on performance indicators for national performance comparison of academic and research libraries, beginning with the university libraries (*Bibliotheksindex für wissenschaftliche Bibliotheken—BIX-WB*). Participating in this project are the university libraries of Augsburg, Goettingen, Muenster, Stuttgart-Hohenheim, and the library at the Wuerzburg-Schweinfurt University of Applied Sciences. A similar instrument for public libraries was already developed in 1999 by the Bertelsmann Foundation.[65]

The Infrastructure Units of Academic Libraries

All academic libraries use integrated library automation systems for administration, cataloguing, and circulation and make their OPAC available via the WWW.[66] A German particularity is the regional library networks which began in the 1970s as regional union catalogs. The managing units of the networks[67] are state institutions of the *Länder*. In the meantime, these have developed more or less into comprehensive service centers. As an example, the most important services of the University Library Service Center of North Rhine-Westphalia (*Hochschulbibliothekszentrum Nordrhein-Westfalen—HBZ*) in Cologne[68] and those of the Library Service Center of Baden-Wuerttemberg (*Bibliotheksservice-Zentrum Baden-Württemberg—BSZ*; Fig. 12) in Constance[69] are listed here:

- Bibliographical union database for the region
- Data services for participating libraries
- Automation of interlibrary loan
- Support for the introduction and operation of local systems
- Digital libraries (Fig. 13),[70] i.e., access via the WWW with a uniform user interface to the various resources such as databases, digital full texts, and multimedia objects on distributed servers (virtual media servers). Electronic course reserves are also made available. However, the philosophy of the regional networks is no longer adequate, and the future will show whether the regional networks can exist in competition with digital portals which have no regional orientation.
- With their competitive without a.
- Website hosting for smaller libraries.

Not only academic libraries participate in the library networks, but also regional and state libraries, as well as special libraries of the corresponding geographical region. Some of the regional library service centers also offer their services to museums and archives. (The public libraries play a minimal role in the regional networks, but most public libraries can access the OPACs of the library networks and order items via interlibrary loan. The reason for the minimal participation of public libraries in the regional library networks is the vertical administrative authority in Germany: The states are responsible for the libraries of higher educational institutions, the municipalities are responsible for the public libraries). The library network regions correspond partially to the geographic boundaries of the states, but in some cases, a regional network comprises several states. The most comprehensive library network is the Common Library Network (*Gemeinsamer Bibliotheksverbund—GBV*) comprising 7 of the 16 German states.

Library Buildings

In the commercially prosperous German Empire extending up to World War I, there was an active building period for university libraries (among others the university libraries of Erlangen, Greifswald, Heidelberg, Marburg, Tuebingen, and Halle, where one of the earliest freely supported poured iron storage shelving units has been in use up to today, as well as Berlin—the Technical

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Fig. 12 Homepage of the Library Service Center Baden-Wuerttemberg. (*View this art in color at www.dekker.com.*)

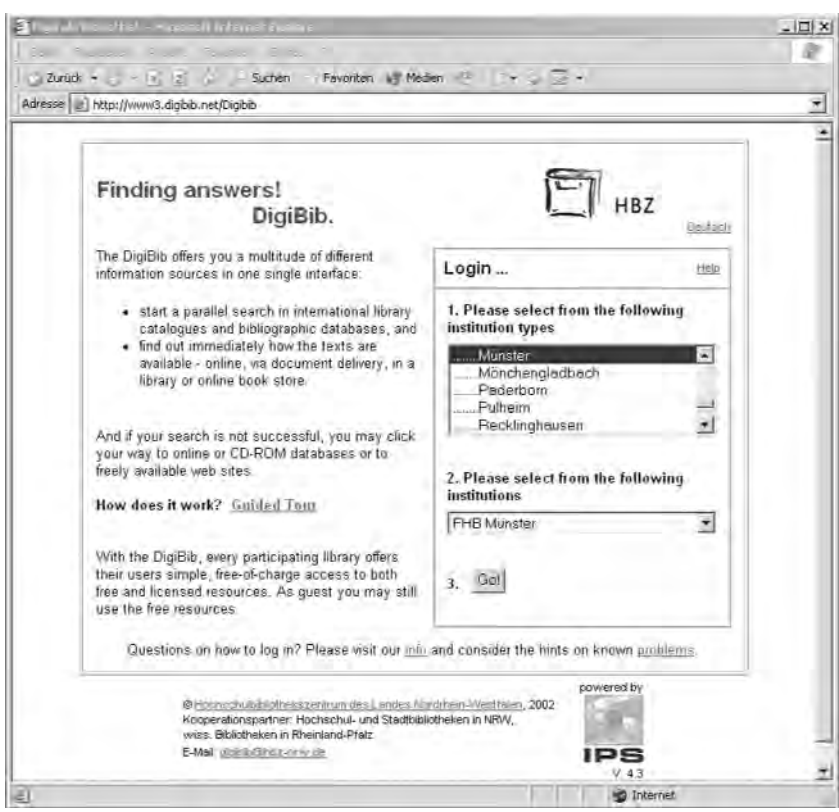

Fig. 13 Digital library of the University Library Service Center North Rhine-Westphalia. (*View this art in color at www.dekker.com.*)

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University).[71] Only after the Second World War were a larger number of new libraries of institutions of higher education built, especially in connection with the newly founded universities in the 1960s and 1970s. These libraries usually have considerably more space than the older library buildings, which includes more space for both the collections and staff, as well as more space for the users. In this phase, most of the new libraries were built in a plain but functional style, e.g., the university libraries in Augsburg, Bielefeld, Bochum, Bonn, Duesseldorf, Frankfurt/Main, Muenster, Stuttgart, and Wuerzburg. Many older universities built significant extension buildings for their libraries in addition to continuing to use the older buildings (i.e., Erlangen, Heidelberg, Tuebingen). Whereas in the 1970s, open stacks, a large number of user work spaces, and flexible, fully air-conditioned buildings were preferred (i.e., the new buildings for the university libraries of Duisburg, Essen, Paderborn, Passau, and Trier), which were thus very expensive to build and had high operational costs, in the 1980s, the concepts of library architecture reverted to more differentiated book arrangement according to frequency of use (textbook collection, open stacks for most used items, and compact storage for others) according to the model of the University Library of Freiburg, newly built in 1978 (Fig. 14).

The most significant newly built university library of the 1990s is the new building of the Goettingen State and University Library (Fig. 15) with its spacious architecture looking toward the city (German universities often lie in the middle of the cities), it has an equal measure of high aesthetic qualities and user-friendly work spaces in the middle of an extended open stacks area and with underground storage areas. The offices (which are no longer large, multiperson offices) are not air-conditioned. It was a model for a number of new library buildings built after this time (in Erfurt, Greifswald, and Jena; Fig. 16). Since the turn of the century, many new buildings for academic libraries comply with the new demands of conveying information literacy as a prime function and of the transition to a hybrid library.[72] Instead of the reading room there are multiple offerings of various user work spaces with PCs located at different areas in the open stacks (silent single work spaces, as well as spaces for two- and four-person work group, etc.; Figs. 17 and 18). In planning the PC-user work spaces, attention was given from the very beginning to the ergonomic standards (size of the table, lighting, and cabling). Notable examples

Fig. 15 Goettingen State and University Library, new building from 1993. This building is a model for many library buildings in Germany since it was planned. (Source: Ronald Schmidt—AFWK.) (*View this art in color at www.dekker.com.*)

Fig. 14 Freiburg University Library, a typical building of the late 1970s. (Source: Freiburg University Library.) (*View this art in color at www.dekker.com.*)

Fig. 16 Thueringen University and State Library at Jena, new building from 2002, an excellent example for the considerable number of new library buildings erected in eastern Germany, the former GDR, after the German Reunification in 1990. German universities and their libraries often lie in the middle of the cities. (Source: Jena University and State Library.) (*View this art in color at www.dekker.com.*)

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Fig. 17 Tuebingen University Library, extension building from 2003. Many German university libraries develop more and more into learning centers. (Source: Tuebingen University Library.) (*View this art in color at www.dekker.com.*)

include the university libraries in Kiel, Greifswald, Ulm, Coblence-Landau, the departmental library for the sciences in Goettingen, and the departmental libraries for the Technical University of Munich.

The libraries of the universities of applied sciences are more often smaller than the university libraries. Therefore, in contrast to the university libraries, the libraries of universities of applied sciences often do not have their own buildings, but rather only have their place as part of one of the university of applied sciences buildings. But even here there are new buildings which have achieved the greatness and complexity of a university library (e.g., the engineering sciences center of the University of Applied Sciences of Cologne and the central library of the University of Applied Sciences of Munich). Other buildings for libraries of the universities of applied sciences have gained their charm precisely because they are visible at a glance and have a particularly attractive interior decoration with modern user work spaces in aesthetically pleasing surroundings, e.g., in Potsdam (the University for Film and Television), Rottenburg, Schmalkalden, Schweinfurt, and Zwickau.

In Eastern Germany, academic buildings up to 1990, i.e., in the period of the GDR up to the German Reunification, were mostly inadequately housed in old buildings that were only insufficiently maintained. Almost no new buildings for university libraries were erected in the GDR. Parts of the collections were stored in provisional buildings often with leaky roofs and totally inadequate for use as a library building. Only after the Reunification was there an active reconstruction of the deteriorated buildings (most notably, for example, the university libraries in Halle and Leipzig) or the erection of new library buildings (i.e., in Dresden, Greifswald, Jena, Magdeburg, and Weimar), where especially previously separated departmental and institute libraries could be combined. In several cases, older buildings used for something else were rebuilt to accommodate a university library or a departmental library (notably, for example, in Frankfurt/Oder or in Rostock).

International Cooperation

Naturally, libraries from German institutions of higher education take part in conferences abroad and are involved in the international work of the IFLA and other associations and in specialized international subject-oriented organizations. For example, the IFLA guidelines on performance measurement in academic libraries were created with significant involvement of German librarians,[73] or librarians from German university libraries[74] cooperated in the EQUINOX-Project[75] of the European Commission in which performance indicators for electronic services were developed. In the following, some of the countless, international cooperation activities and

Fig. 18 Tuebingen University Library, extension building from 2003. In many newly built German university libraries since the late 1990s the former reading room is replaced by multiple offerings of various user work spaces with PCs located at different areas in the open stacks, e.g., silent single work spaces, as well as spaces for two- and four-person work group. (Source: Tuebingen University Library.) (*View this art in color at www.dekker.com.*)

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projects will be mentioned which German university libraries also take part in as institutions. Naturally, the projects of the European Commission form a major area of emphasis.

- German libraries, among them primarily university libraries, but also regional library networks, deliver cataloguing data to international databases or participate in international cataloging projects, including
  - Worldcat[76]
  - CERL (Consortium of European Research Libraries)[77]
  - EROMM (European Register of Microform Master)[78]
  - EUCAT (A Pan-European Index of Union Catalogues)[79]
  - OAI (Open Archives Initiative)[80]
  - OCLC[81]
  - RLIN (Research Libraries Information Network)[82]
  - SIGLE (System for Information on Grey Literature in Europe)[83]
  - *Verzeichnis der im deutschen Sprachraum erschienenen Drucke des 16. Jahrhunderts* (*VD 16*) (Index of Imprints of the 16th Century Published in German-Language Areas)[84]
- Goettingen State and University Library participates in the OCLC CORC (Cooperative Online Resource Catalog) Project which has developed and tests standards for cataloging of electronic resources. The results have been integrated into the OCLC Cataloging Service OCLC Connexion.[85]
- In addition, the Goettingen State and University Library participates in the Renardus Project of the European Commission (=Academic Subject Gateway Service Europe)[86] with libraries and other institutions from seven countries of the European Commission. The purpose of this project is to make distributed collections of high-quality Internet resources in Europe accessible via a single interface.[87]
- Also a project of the European Commission with participants from several countries is PRIDE (People and Resources Identification for Distributed Environments).[88] The University Library of Magdeburg works in this Project. PRIDE offers registered users a uniform entry point to information on libraries and their services.
- The university libraries in Austria, Switzerland, and Germany have joined together on a regional level into consortia (customer associations) to gain a stronger position against the publishers in negotiating licenses for electronic journals. Thus the association of the consortia of these three countries (GASCO)[89] is important.
- The Library of Congress (LOC), Washington, D.C. (USA), joined the Electronic Journals Library (*Elektronische Zeitschriftenbibliothek—EZB*), managed by the Regensburg University Library. In this way, the LOC can offer its users improved and comprehensive access to electronic journals and at the same time, the EZB has been augmented with a substantial number of titles. The EZB is thus the largest collection of electronic journals in the world.
- A German–American cooperative project is the *Reference Reviews Europe Annual*[90] a review journal about European reference works for the U.S. market. The reviews are written by librarians from Germany and the United States.
- In the context of the U.S. program ''German Research Projects''[91] contact partnerships are created through which special subject collection libraries in Germany are connected with a correspondingly suitable partner library in the United States.
- After sporadic discussion in the German-language area for years on the substitution of the AACR2 instead of the German cataloging rules, *Regeln für die alphabetische Katalogisierung—RAK* (which is generally used in all German-language countries), a standardization committee[92] has now appealed for changing to the international cataloging rules and data format (AACR2 and MARC21 instead of the data format MAB2 used in the German-language area which was originally made to fit the RAK). The standardization committee is a cooperative combination of larger university and state libraries as well as the regional consortia from Austria, Switzerland, and Germany whose recommendation is necessary for standardization in these countries; it is also present in international organizations that deal with standardization. The leading role for this committee, naturally, was not given to the university libraries, but to Die Deutsche Bibliothek. But characteristic for German librarianship is that this significant decision is not made by the national library alone, but rather with substantial participation of the university libraries. One of the studies funded by the DFG, the completion of which is scheduled for the end of 2003, should clarify the structural and financial consequences as well as the time plan for the transition from RAK and MAB2 to AACR2 and MARC21.

In contrast to other European countries, Germany has the highest number of OAI-compatible digital archives.[93] These are for the greater part the document servers of university libraries of Berlin (Humboldt University), Bremen, Chemnitz, Dortmund, Duisburg, Dresden, Muenster, and the server of the Library Service Center of Baden-Wuerttemberg with access to the digital documents

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of the entire library network, partially also the subject-oriented repositories such as PhysDoc[94] or library catalogs like that of the University of Oldenburg.[95]

CONCLUSION

German academic libraries have an excellent position in the informational logistics of the entire society.

- First, against the background of a strong federated tradition in Germany, they form a well-balanced system of individual elements, continuously developed since more than a hundred years, which function in a true division of labor and work more as a whole for the universities' profit than individually. A definite disadvantage of this federated tradition is, however, the development of the historical collections due to the previous political structures and events, so that today, thematically or historically related collections often must be searched for in several university or regional libraries. Participating in the division of labor for the literature and information provision for teaching, studying, and research are also the state and regional libraries. On the other hand, university libraries participate substantially in programs at the national level for developing extensive special and historical collections, as well as for document delivery services. This intelligent division of labor was established before the digital revolution and can now best unfold its advantages in cooperative projects on the basis of the WWW.
- Second, several university libraries also take on responsibilities of a regional library.
- Third, the academic libraries in Germany are not only open to the members of the university community, but also to all citizens and thus they are used to a considerable degree as scientific libraries for general use.

In numerous projects, academic libraries in Germany are advancing with giant steps on their way to becoming hybrid libraries and are involved especially in this capacity in international cooperative activities.

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Herbert Hoover Library

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INTRODUCTION

The Herbert Hoover Presidential Library–Museum was dedicated to the American people on August 10, 1962, President Hoover's 88th birthday. Joining Mr. Hoover at the dedication were a host of dignitaries including former President Harry S. Truman. Since that dedication, the Library–Museum has welcomed over 3 million visitors and has served over 3000 scholars. It has acquired and made available for research over 8 million documents, 35,000 photographs, and 7000 museum objects. It also has produced hundreds of exhibits, educational programs, publications, and outreach activities, all in an effort to increase the public understanding of the American experience, in general, and the life and times of Mr. Hoover, in particular.

In carrying out its mission over the past 40 years, the Hoover Library–Museum has undergone several periods of expansion and renovation. The current version of the Hoover Library was completed in 1992 and rededicated on August 10 of that year. Former President Ronald Reagan paid homage to Mr. Hoover and his library at that rededication. Since 1992, more than 750,000 individuals have toured the new galleries, making the Hoover Library one of the most popular historical museums in the state of Iowa.

Hoover Library has served and continues to serve a wide variety of constituents. Scholars, school children, tourists, conference participants, seniors, and civic organizations are just a few of the many users who have streamed through the doors of the Hoover Library over the past 40 years. Yet, in spite of this experience, responding to so many different users has never been easy. Each group has different needs and makes different uses of these libraries. The task for the Hoover Library staff is to accommodate all of these users in an era of declining government resources.

HISTORY

The history of the Hoover Presidential Library–Museum is modest, indeed. Although Franklin D. Roosevelt dedicated his own presidential library in 1941, no effort was made at that time to build such a library for his predecessor. This was no slight of the former president because he himself had dedicated the Hoover Institution on War Revolution and Peace in that same year on the campus of his alma mater, Stanford University. Mr. Hoover's personal and presidential papers were stored at the Hoover Institution and access to the papers was by permission from Mr. Hoover himself. In many ways, the Hoover Institution was intended to function not only as a research library for scholars, but also as a ''think tank'' in opposition to the interventionist policies of the New Deal.

The status of the Hoover Institution did not change much for the next decade. But throughout the 1950s—particularly after the passage of the Presidential Libraries Act in 1955 and the opening of the Harry S. Truman Library in 1957—local leaders in Mr. Hoover's hometown of West Branch petitioned the former president to allow the establishment of a presidential library. Led by William B. Anderson, the committee convinced the former president to allow his friends to build a small presidential museum in his honor in a park that included the former president's birthplace cottage. As allowed by law, the 5000-ft^2 museum was to be called a ''presidential museum'' and administered by the National Archives and Records Service, then a unit of the U.S. General Services Administration.

The cornerstone for the building was laid in 1960, and soon after, the plans changed quickly and dramatically. First, Mr. Hoover made the decision to transfer the papers from his years as secretary of commerce, president, and former president from the Hoover Institution to the new building in West Branch. This decision necessitated an expansion of the building to 7000 ft^2 and a change in name to the ''Herbert Hoover Presidential Library–Museum.'' This was the basic structure that was dedicated on August 10, 1962.

But the building was far from complete on dedication day. Even before dedication, a new addition was in the works, which would include a 180-seat auditorium and more exhibit space, as well as more office and work areas; this work was completed in 1964. Another addition was completed in 1971, providing still more space for exhibits, for researchers using the papers, and a dark room to develop photographs. Yet another addition came in 1974

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and included a conference room and an expanded reading room for researchers. Twelve years after the original dedication, the Hoover Presidential Library–Museum had grown from 7000 ft^2 to nearly 35,000 ft^2, a fivefold increase. But even with these expansions, the facility at West Branch was the smallest—and continues to be the smallest—of the nation's presidential libraries.

The most recent renovation of the Hoover Library began in 1989, the result of several years of planning. Several parts of the original building—roof, heating, and air conditioning—were in need of replacement. At the same time, Senators Mark O. Hatfield of Oregon and Charles Grassley of Iowa urged their colleagues to show more respect and appreciation for the nation's 31st president. The result of their persuasive powers was a U.S. $5 million appropriation to renovate and expand the entire building. The roof and mechanical systems were replaced; the exhibit galleries were more than doubled in size; a lobby, gift shop, and rotunda were added; and new work areas complemented the public spaces. Although the building expansion was modest (12,000 ft^2), the result was dramatic because space was reapportioned in a more efficient manner. On Rededication Day—30 years to the day after the original dedication—the Hoover Library was born anew (Fig. 1).

MUSEUM PROGRAMS

The rejuvenation of the Hoover Library began with the museum program. Although presidential libraries were established first as centers for scholarly research, they have since become venues for both education and entertainment. Over the past 40 years, more than 3 million individuals have visited the Hoover Museum galleries, but only 3000 researchers have used the research collections. This does not make the museum more important than the archives, but it does point out the substantial audience for history within the museum context. Furthermore, it suggests how great is the potential, first, to educate the general public about archival holdings and, second, to engender financial support from that public for scholarly and archival activities that might otherwise languish.

Therefore the sheer size of the audience dictated that museum programs should rank among the highest of the Hoover Library's institutional priorities—not only because they were important in a historically illiterate era, but also because it was a necessary means of generating popular enthusiasm for history among the general public. Such programs, carefully designed to fit within a broader plan of institutional development, educated large numbers for whom the archives standing alone

Fig. 1 Established in West Branch, Iowa, in 1962, the Herbert Hoover Presidential Library–Museum was renovated extensively in 1992 and rededicated on August 10, Hoover's birthday.

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would otherwise appear to be little more than an intellectual warehouse.

For the general public, a visit to the Hoover Library means a tour of the exhibit galleries. In expanding, renovating, and reinterpreting the lives of Herbert and Lou Henry Hoover, the staff employed imaginative designers and fabricators and worked with them to tell the extraordinary story of the ''Great Humanitarian'' from West Branch and his event-filled life of 90 years (Fig. 2).

Six different galleries, each with its own theme, transport visitors to many lands. They first encounter Western Australia, where Hoover began his mining career surrounded by ''red dust, black flies, and white heat.'' They travel on to China in 1899, where a recreated Hoover living room shows the effects of shelling by Chinese nationalists during the Boxer Rebellion. Both make up part of the ''Years of Adventure'' gallery.

Visitors then enter the Humanitarian Gallery and find themselves inside a World War I food relief warehouse that tells the story of Hoover's work to save mankind from the ravages of hunger. This gallery is complete with video stories of some of the actual survivors who, as children, were fed by Herbert Hoover.

The ''Roaring Twenties'' are recreated in the Enterprise Gallery. Visitors experience a montage of the sights and the sounds of that decade just before they come upon a large three-dimensional diorama of Hoover's accomplishments as secretary of commerce during those years. Fire safety codes, standards for building materials, and highway and airline safety regulations all crossed his desk.

The next gallery focuses on the Hoover presidency. Here visitors stand on an inaugural platform on March 4, 1929, and see a multiscreen video presentation on America before the Depression. Hoover tells of what he hopes to accomplish during his presidency. Then comes Wall Street and an extensive treatment of the Great Depression. Visitors have the opportunity to register their opinion—good or bad—of how Hoover handled the events of 1929–1933. After voting, visitors see a video presenting the opposite point of view. The Hoover presidency was

Fig. 2 The success of the Hoover Museum program is the result of a collaboration of archivists and educators as well as museum professionals. The staff mounts three major exhibits each year.

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complicated and the staff wants the visitor to appreciate just how complicated it is.

After the Presidency Gallery, visitors meet Lou Henry Hoover in a special gallery that features the recreation of a cabin that she designed for her conservationist husband. Visitors are able to peek inside the cabin windows and see authentic home movies of the period taken by Mrs. Hoover. The cases facing the cabin tell the story of the many sides of Mrs. Hoover—amateur architect, president of the Girl Scouts, White House historian, artist, and photographer of some renown.

Hoover's long postpresidential career is recounted in a gallery entitled ''Years of Struggle and Accomplishment.'' The highlight of this area is a recreation of two rooms from Hoover's suite at New York's Waldorf Towers. There for all to see is Mr. Hoover's living room, where he wrote more than 40 books, directed worldwide food relief efforts, and reorganized the federal government at the request of President Truman. This gallery ends with a bucolic, life-size diorama of an elderly former president doing what he loved best—fishing. As Hoover said, fishing is a lesson in democracy, for all men are created equal before fish.

The six Hoover galleries make up a museum that stands ready for this new century. These exhibits involve visitors in interactive displays where history becomes participatory. Visitors travel through the entire life of an Iowa orphan whose actions made an extraordinary difference to the welfare of countless people around the world. His life—as reflected in these galleries—continues to inspire Americans across the state and the nation.

Our commitment to our visitors also is reflected in the way we plan and fabricate attractive and accurate temporary exhibits that provide access to primary sources and historical objects in an educational and entertaining manner. We do this by thinking broadly about exhibit topics and exhibit planning, and by expanding efforts to make the public aware of our exhibits using all forms of the media.

As has been the practice at the Hoover Library for the past 14 years, the exhibit staff planned and mounted three outstanding exhibits in 2001–2002. The major temporary exhibit in 2001 was ''The Eagle and the Dragon: U.S. Relations with China,'' which ran from April 21 through November 3 of that year. Opening as it did only 2 weeks after the famous Hainan Island incident, the exhibit could not have been timelier. The items in the exhibit included an exquisite display of memorabilia reflecting the 2000 years of Chinese culture. And for the first time in many years, the Hoover Library displayed all of its famed blue and white porcelains at one time. However, what pleased us most were the words of praise that we received from the Asian community; we were praised for the sensitive way we treated the topic. The exhibit lives on in cyberspace on the Hoover Library's web site.

The ''Eagle and the Dragon'' was followed by two exhibits on American cultural themes. The first was a holiday exhibit entitled the ''Treasures of Christmas,'' which celebrated some of this nation's valued traditions. As part of this exhibit, the Hoover Library featured an extraordinary collection of memorabilia from entertainer Bob Hope about his annual USO tours to the troops overseas. An exhibit entitled ''Let's Play! The Pastimes of Past Times'' followed the ''Treasures of Christmas'' and told the story of how children expressed themselves at the turn of the 20th century.

In 2002, the Hoover Library mounted ''Revolutionary America, 1763–1789,'' a spectacular exhibit that told the dramatic story of how 13 disorganized colonies bound themselves together to throw off the tyranny of the British Empire and forge a new nation. Among the items in the exhibit were tea leaves from the Boston Tea Party, bullets fired at the Boston Massacre, the sand shaker used on the Declaration of Independence to blot and dry the wet ink on that great document, and the epaulettes that George Washington wore at the Siege at Yorktown. These and hundreds of other items brought the American Spirit alive for tens of thousands of visitors to the Hoover Library in 2002.

Many other exhibits are in the planning stage. In 2003, the Hoover Library will mount ''Hollywood Cowboys,'' an exhibit of memorabilia from the great stars of the western movies. That exhibit will be followed by ''Old Man River: History Along the Mississippi,'' ''Christmas Around the World,'' and many others. Our goal is to provide our visitors—particularly the repeat visitors from eastern Iowa—with a unique perspective on the American experience without requiring them to travel to the Smithsonian Institution in Washington.

SCHOLARLY PROGRAMS

In addition to refurbishing its museum programs, the Hoover Library also conducted an in-depth study of its research-related programs. The issues addressed were both serious and straightforward—issues that cut to the heart of the Hoover Library's role as a scholarly institution. Every archival institution must look to the future if it is to effectively preserve the past. No institution needed to do this more than did the Hoover Library.

Beginning in the mid-1960s and over the next two decades, the archivists at the Hoover Library devoted their time and attention to processing the papers of Herbert Hoover and his associates. Over 120 collections were solicited, accessioned, processed, and made available for research during those years—a remarkable achievement especially when you consider the fact that the Hoover Library did not open until 30 years after President Hoover left office. The staff was rightfully

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proud of their accomplishments, but unwilling to rest on their achievements.

In an effort to expand the Hoover Library's archival programs, the staff reevaluated the institution's scholarly mission statement in 1988. The result was a conclusion that the Hoover Library should continue to acquire collections in certain subject areas—the very subjects that were already reflected in the papers of Herbert Hoover and his associates.

A few examples are in order. The Hoover Library actively solicits the papers of agricultural economists and famine relief administrators because of Mr. Hoover's extensive work in this area over the course of 50 years. The Hoover Library also seeks the papers of individuals who contributed to the development of the nuclear energy industry to supplement the papers of Lewis Strauss and other similar collections in its holdings. The early days of aviation are another Hoover strength and the Hoover Library has been fortunate to add two important collections in this area in recent years.

The archival staff also continues to pursue some more visible and interrelated subject areas. The Hoover Library has exceptional collections on conservative political thought from 1933 to the present, and it continues to solicit and acquire new collections in this area. Related to this area, the Hoover Library recently accessioned the papers of a number of conservative publishers and journalists who formed the ''loyal opposition'' to the growth of big government after World War II.

Big government interests the Hoover Library because of Herbert Hoover's efforts to tame the executive branch of government with his two Hoover Commissions in the 1950s. Therefore, the Hoover Library also seeks the papers of public administrators who have worked to bring efficiency to government at the federal level. Finally, because Herbert Hoover was a world statesman, the Hoover Library continues to seek the papers of Foreign Service officers and diplomats who have helped to shape American foreign policy since 1945. Many of these new collections are interrelated and researchers tend to use parts of several of them when they visit.

But acquiring new collections is only one part of the effort to expand the Hoover Library's scholarly programs. The Hoover Library is also in the process of filling in the ''holes'' in its collections. When the Hoover papers were divided between the Hoover Library in West Branch and the Hoover Institution at Stanford University in the early 1960s, the division was not precise, resulting in many of the Hoover Library's series being incomplete. A recent survey indicated that over 30 Hoover Institution collections include materials that relate directly with the holdings in West Branch. A similar problem is the result of the fact that the National Archives did not exist when President Hoover left office and the division between federal records and presidential records was unclear. In truth, there is as much Hoover-related archival material in Washington as there is in West Branch. This is evident in the simple fact that the Hoover Library staff has identified over 100 record series in the National Archives that contain significant amounts of Hoover materials.

In response, the Hoover Library established a program to target and selectively copy the vital archival documentation that supplements the Hoover Library's holdings. Each year, archivists travel west to the Hoover Institution and east to the National Archives. Their efforts have led to an extended copying project that will continue indefinitely.

Identifying, soliciting, processing, and preserving these collections are all important activities, but they would mean little without an expanded effort to reach out to new researchers. More than 3000 researchers from all 50 states and more than a dozen foreign countries have found their way to West Branch over the past 35 years, but the Hoover Library staff is not satisfied. Archival collections can and should be used by students, teachers, and administrators (even the merely curious), as well as by scholars.

Accordingly, Hoover Library archivists have been working to expand the circle of potential researchers in the Hoover Library's collections. The most visible evidence of this effort comes in the form of grants given annually to researchers through the Hoover Library's support group, the Hoover Presidential Library Association. Scholarship will always have a bright future at the Hoover Library.

The Hoover Library and the Library Association also herald outstanding scholarship through an annual Herbert Hoover Book Award that is given to an exceptional work on any aspect of American history during Mr. Hoover's long and momentous public life from 1914 to 1964.

But perhaps the greatest assistance we provide to scholars is the least visible. Interested researchers need not travel to West Branch to learn of the holdings of the Hoover Library. In fact, a great volume of information is just a computer database away. Substantive information on more than 150 collections in the Hoover Library is available on the Hoover Library's web site (www.hoover.archives.gov). Click on the ''Research'' icon and follow the links to ''Search the Collections.'' This search engine allows researchers to locate relevant folders on their topic from the Hoover Library's collections and order the contents of those folders. Even at 50 cents a page, copying selected documents is a lot less expensive than a trip to West Branch.

CONFERENCES AND PUBLICATIONS

The conference and publication programs also are built on the foundation of the Hoover Library's archival holdings. Over the past 15 years, the Hoover Library has averaged

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at least one conference per year, covering a wide range of topics such as the preservation of photographs, careers in public history, the life and times of Lou Henry Hoover, and the world of Laura Ingalls Wilder, among others.

Three of the Hoover Library's most successful conferences were held in 1989, 1995, and 1999. At the first of these conferences, former President Gerald R. Ford, Librarian of Congress Emeritus Daniel J. Boorstin, and a host of prominent historians and journalists came together to discuss the role of former presidents in American public life. At the second conference, former Vice President Dan Quayle and Harvard scholar Richard Neustadt, along with a different group of historians and journalists, discussed the peculiar nature of the vice presidential power and influence. The third conference focused on the lives of Herbert and Lou Henry Hoover, the first such assessment in over 20 years. These conferences focused attention on these important subjects and highlighted the substantial holdings of each of the Hoover Libraries on these subjects. The resulting conference volumes further carried the word of Hoover holdings beyond the confines of the conference.

Two recent conference volumes deserve special mention. First is a volume entitled *Laura Ingalls Wilder and the American Frontier: Five Perspectives*, a selection of articles first presented at a popular Hoover Library conference in 1998. Second is a volume entitled *Uncommon Americans: The Lives and Legacies of Herbert and Lou Henry Hoover*, the first overall assessment of these two extraordinary Americans in more than 20 years.

Conference proceedings are important publications, but the Hoover Library had even more to offer between hard covers. In the past 14 years, for example, the Hoover Library has compiled or published a wide variety of books. Some have been popular reprints of Hoover volumes such as *On Growing Up* and *Fishing for Fun*. Still others have been based on temporary exhibits or guides to the permanent exhibit galleries.

Of more permanent value are the scholarly publications sponsored by the Hoover Library and the Library Association. Since 1975, both organizations have supported the research, writings, and publication of a definitive scholarly biography of Herbert Hoover. Three volumes have appeared to date, with several more on the way.

Both organizations also support the publication of insightful collections of documents. In 1992, for example, they issued *Herbert Hoover and Harry S. Truman: A Documentary History*, a volume that brought together for the first time some 180 documents that tell the story of a remarkable and productive friendship between two unusual men. The second volume in that series was *Herbert Hoover and Franklin D. Roosevelt: A Documentary History*, a volume that highlights the partnership and then conflict between these two very different presidents. The Hoover Library was gratified that these new books have filled a niche in the world of scholarship.

EDUCATION PROGRAMS

There is no more important group of visitors to the Hoover Library than school children. In fact, school children constitute the largest single group of visitors to the Hoover Library each year. For this reason, therefore, the Hoover Library devotes a considerable amount of time and resources into building bridges between the classroom and the presidential library (Fig. 3).

The Hoover Library's education staff works closely with area educators to prepare teachers and their students for their forthcoming visits. Each spring, the Hoover Library holds a special preview for teachers to introduce them to the new exhibits and distribute educational materials that tie the classroom to the exhibit. Just as important, teachers get an opportunity to meet with the docents who will be giving the tours. Over 150 area teachers attend the preview each spring.

Just as important as preparing students to visit the museum galleries are efforts to prepare students to understand the joy of using primary source materials. For example, the education staff has fifth and sixth graders read from the letters of Laura Ingalls Wilder and her daughter, Rose Wilder Lane, in the Hoover collection to help these students understand how mother and daughter wrote their ''Little House on the Prairie'' books. The students use specially prepared booklets that provide for maximum understanding of the letters without

Fig. 3 Each year, a corps of dedicated docents and staff members provides hundreds of tours to tens of thousands of school children eager to learn more about the life and times of Iowa's only president.

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threatening fragile documents. A special feature of these exercises is to allow students to see (but not touch) a selection of Little House documents.

The education staff also works with high school teachers and their students to give them brief but substantive experiences using primary source materials. Each summer, the Hoover Library conducts one or more ''history camps'' for students and teachers from selected area high schools. Each camp is designed and taught by a team of teachers and Hoover Library staff members. The students use a special Presidential Documents Collection that is part of the Hoover Library's holdings and is duplicated at many other presidential libraries across the country. The collection includes a selection of documents focused on important issues covering all the presidential administrations from Herbert Hoover through Jimmy Carter.

Although each camp has its own dynamics, most of the activities focus on an exploration of these primary sources to identify five significant events that occurred during each administration. Students use critical thinking skills as they pursue this assignment. The students are not without support in this task. They all digest a range of background reading before they arrive at the Hoover Library. In addition, they start their camp with a 2-hr introduction on research methodologies and historical perspective. The rest of the first day is spent getting organized, discussing work dynamics, and asking questions.

The real work begins on the second day. The students are divided into three groups, with each group of students receiving guidance and direction from one of the members of the teaching team. Each group focuses on different aspects of the presidency—foreign crises, domestic problems, and civil rights are three examples.

Throughout their week-long camp, each group of students reads, analyzes, and disputes hundreds of documents related to their topics. They question presidential decision making and, by the end of the camp, have a new perspective on the leader of the most powerful nation on earth.

The aim of these history camps is clear. The Hoover Library has the resources to engage students in doing history for themselves. Gaining a sense of how historical knowledge is obtained and how historical narratives are constructed is one result. Learning how historians think and evaluate evidence is another. These exercises allow students to gain a greater understanding of history and use their critical thinking skills long after they have left the Hoover Library.

The Hoover Library's focus on education takes in teachers as well as students. The staff conducts annual workshops to discuss new teaching methods that utilize primary source materials. Each summer, the Hoover Library sponsors one or more teachers in the preparation of curriculum guides to our collections. On occasions, the Hoover Library also serves as a place of respite for teachers and administrators participating in the National Endowment for the Humanities (NEH)-funded programs of independent study in the humanities.

As is the case at many presidential libraries, the Hoover Library also conducts a variety of programs aimed at adult learners. In addition to the conferences mentioned above, the Hoover Library also conducts 1-day workshops as part of programs sponsored by the University of Iowa. In conjunction with the Hoover Presidential Library Association, the Hoover Library sponsors series of Saturday Seminars that will focus on writing memoirs, preserving family papers, and researching genealogy, as well as Sunday afternoon programs of education and entertainment aimed at adults.

The Hoover Library also has programs that take historical materials out to nursing homes, senior centers, and other public facilities. For example, the staff developed the ''Hoover Scrapbook,'' a slide program that introduces the elderly to the world of Herbert and Lou Hoover. Currently in production is a series of discussion groups on western actors of the silver screen as part of the Library's ''Hollywood Cowboys'' exhibit in 2003.

One of our most important activities promotes lifelong learning through museum tours, workshops for students and adults, conferences on historical issues, and outreach programs designed for schools and the public. We do this through specialized museum tours for diverse groups of visitors including preschoolers, elementary and high school students, bus groups, and senior citizens, among others. We also hold conferences, workshops, forums, and other specialized educational opportunities for students, seniors, teachers, and others interested in historical issues (Fig. 4).

We produced a variety of educational programs in 2002 worthy of special mention. Throughout the summer, the Hoover Library continued to play host to a range of youth groups. Some were summer camp visitors enjoying a museum visit; others were talented and gifted students from the Belin-Blank Center at the University of Iowa learning how to use primary sources. In the fall, the education staff shifted gears to once again offer a special program called ''History Detectives'' in the Hoover Library's conference room. Here students learned about primary sources and how to use them.

Everything slows down in Iowa in the winter. It is this time of the year that the education staff shifts gears and reaches out to the schools through three very special programs. First, using the Iowa Communications Network, the staff offers a series of three distance learning programs to students from across the state and even a few

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Fig. 4 In addition to housing more than 8 million documents, the Hoover Library–Museum is home to an extensive collection of gifts given to Herbert Hoover during his public life of 50 years.

around the nation. During January, February, and March of 2002, we hosted 108 schools and reached 2872 students from all over the state. Only a handful of these students had ever heard of the Hoover Library.

The second effort is the Hoover Library's popular outreach programs that send ''traveling trunks'' and a ''presidential troupe'' to schools within driving distance of the Hoover Library. The traveling trunks help children understand the nature of historical objects and our Presidential Troupe (docents dressed as presidents and first ladies) makes history come alive for these young ones. I can guarantee you that history, in general, and the Hoover Library, in particular, are frequent topics of conversation around the dinner tables of eastern Iowa.

Third is our effort to encourage participation in the National History Day programs offered through the State Historical Society of Iowa. Nearly 200 junior and senior high school students from eastern Iowa participated in workshops at the Hoover Library. The activities were designed to show students' and teachers' strategies to help create successful history day entries. The day's activities included large group and breakout sessions featuring hands-on exhibit work and a tour of the reading room and stack area.

CONCLUSION

Fifteen years after the reinvention process began, the Hoover Presidential Library bears little resemblance to its pre-1987 form. It is a leaner, more focused institution. In fact, the staff and the budget, in real dollar terms, are smaller. But because it is blessed with an extraordinary staff that thinks and acts in an entrepreneurial way and sees every obstacle as a challenge and a learning experience, and with a Library Association willing and able to raise funds to carry out imaginative programs, the Hoover Library has reinvented itself as a very special place.

Most important in this process is the fact that the staff kept its sights on a proactive mission to make history come alive for all who enter the Hoover Library. It is not

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enough to present information and objects in glass cases. It is not enough to make papers and documents available. It is not enough merely to show students the source materials of history.

The constituents of today's Hoover Library—and by implication all presidential libraries—expect more. They want to get a sense of the drama, excitement, and change that is America in the 20th century. The staff of the Hoover Library wants to share that excitement and drama with as diverse an audience as possible. History can be both educational and entertaining and the presidential library is often at the frontier of that pleasure and satisfaction.

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Information Commons

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INTRODUCTION

Information commons are a new type of library facility. They commonly include a large number of computer workstations that provide access to productivity software as well as the Internet and electronic library resources. Often, they are formed through a partnership with IT and the library and employ professionals from both areas. Help is provided for the technology as well as information research. They first appeared in the early 1990s and are being adopted by university libraries at a rapid pace, as they seem to meet the emerging needs of today's students.

EARLY TRENDS

The development of information technology and the growing demand for electronic resources were early predictors of change. Initially, the purview of the expert, software programs such as Excel and Word gradually became accessible to the novice. Concurrently, with the advent of the Internet and the concomitant explosion of electronically available information, expectations for presentation and delivery of academic work that incorporated these tools and information grew. Computer access became critical.

Faced with a growing student demand for computer access, libraries first met this challenge by installing library-based computer labs or, at the very least, a few computers in the library often near the reference desk. As the electronic resource component to the library collection took on greater importance, computer demand escalated, forcing the library to install more computers to provide greater access to resources. While providing access to information was a critical component, it quickly became apparent that more was needed. Users attempting to meet the increased expectations for their academic assignments began asking questions that related to how to use the technology as well as how to access information.

The options for the user were narrow. Information research assistance was available in the library, but technical assistance was limited. Productivity tools and other specialized software needed to complete assignments were available elsewhere on campus in computer labs, usually under the jurisdiction of university computing services or specific academic departments. The infrastructure was present, but there was little in the way of expert help or on-site assistance. Additionally, in computer labs, access to digital library resources or other Internet information was generally restricted. A user searching for information, writing papers, preparing presentations or doing data analysis had to go to several different places. There was little or no integration of either services or technology.

Early in the 1990s, some North American academic institutions began to look at this separation of information technology from information resources and its effect on the user. Many began a series of investigations and discussions. The dominant issue was how the educational and academic experience of the learner might be improved through collaboration and integration of the various units. The earliest results were recommendations that led to the establishment of ''information arcades,'' ''learning commons,'' or ''information commons'' where the emphasis was on the integration of technology into the learning and research of the institution.[1] The user became the central figure, shaping the demands of this new model.

While libraries have always been interested in the needs of their users, organizational structures often established the boundaries around which change could be made. In the case of the development of the information commons, user need explicitly assumed primary importance. What does the user want? What does the user need to access information? What does the user need to effectively use technology? What will enable the user to absorb, deliver, and create new learning? These were and are some of the questions that planning committees, university librarians, university computer services, and academic leaders asked themselves and the users. The forces for integration—user needs, technological advances, affordability, resource expansion, and the ability of a few visionary decision makers to see the need and benefit in collaboration and integration of services—led to a new concept of library services. Still in its infancy, the full impact of this development has not yet been realized.

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DESCRIPTION

A survey of the literature and visits to Web sites reveal that no one model or name for these new spaces exists. Instead, each institution has developed a structure in response to the unique and particular needs of its clientele. Names include electronic resource center, knowledge commons, information hub, and information commons, with information commons being the most widely used term. Size can range from 10 to over 300 workstations. Services and available technology also differ. Despite the variety, three common models emerge.

The Virtual Space

Somewhat peripheral but deserving of mention is the model of an information commons as a virtual rather than physical space. The world of digital information available commonly over the Web becomes the information commons. Physical place is not a factor. Users have access anywhere, anytime apparently seamlessly and without effort. The importance of this model, as a concept, is that in all aspects except service, it is particularly suited to the way in which today's user prefers to obtain and use information. ''Internet use is a staple of college students' educational experience. They use the Internet to communicate with professors and classmates, to do research, and to access library materials. For most college students the Internet is a functional tool, one that has greatly changed the way they interact with others and with information.''[2] Where the information commons model has been most successful, it has emulated this concept while adding a physical place with access to technology and services.

The Library Computer Laboratory

The library computer laboratory model represents the minimalist approach and is the least-inclusive model. In this model, the lab may exist within the library building or in a separate space but under the umbrella of the library. The focus of the computer laboratory model is on the technical infrastructure. A variety of computer and digital technologies, peripherals, software, and network options will exist.[3] Commonly included are the Microsoft Office suite, statistical packages, Web design software, and the Internet. Help is limited if offered at all. In essence, this model represents the nonintegrated, localized approach. It epitomizes a concept in which the client must go to different places to retrieve information, use software, and find help.

Integrated Centers

Integrated centers are emerging as the preferred model. The philosophy behind the integrated center is meeting the client's need for information and technology in one space. The design is user-centered. Service is holistic and is offered as seamlessly as possible by a variety of staff including librarians, library assistants, information technology specialists, and student help. In this model, the information commons integrate resources, service, and technology.

The goal is to provide a common and inclusive experience of information. All computers are able to access the Internet and other library resources. As much as possible, software loaded on the computers is the same throughout. A user can go to any workstation in the information commons and find the same tools to do his or her work. Service is similarly consistent and holistic. Ideally, all staff can provide basic help in all features, whether it is help with using software, resolving technical problems, or searching for information.

SPECIALIZED SERVICES

While successful information commons are holistic, integrating technology and information research, differences do exist. This is most noticeable in the area of specialized services and software. For example, some information commons include instructional centers. Services available may range from basic instruction in productivity software and information literacy to advanced help with instructional design and development. Similarly, areas providing access to advanced statistical, mapping, audiovisual production technology, or other high-end software may exist. Centers such as these add a new dimension to the information commons. They may also be indicative of future directions as the library redefines its role to meet user expectation and need.

The issue is not one of uniformity vs. differentiation. As in the case of other ubiquitous tools and places, ''there must be enough relatively uniform interface features... that the mass of people who encounter them can use them without inordinate training. There also has to be enough differentiation that different models and locales are attractive to relevant cross sections of the population.''[4] This is not an easily achievable goal and requires constant monitoring and adjustment as user demand shifts and changes. Successful models will offer that balance between information resources and information technology, homogeneity, and specialization that best suits the needs of the clients.

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The spontaneous arrival of information commons on many campuses is testimony to their apparent value. Yet the concept is not without its detractors. An opposing view holds that the departure from strict information provision is detrimental to the library and library services. Already scarce resources are stretched further by having to share space and budgetary allocations. In addition, the expectation that library staff should be proficient in providing advice on the use of technology as well as information searching is perceived as unreasonable. Asked to take on a role for which they were not trained, staff resistance is common. ''A related issue is the librarian's loss of professional identity. Staffing a desk where many questions are technical can be demoralizing for a reference librarian whose research skills and professional expertise are being underutilized. Constant training as technology is upgraded is expensive, and inadequate training can result in a librarian feeling unprepared.''[5]

Some users also dislike the high-technology space. They are frustrated by the loss of space for quiet study and the departure from their perception of what a library should be as revealed in the following anecdote. ''Can you tell me, where is the library? I'm trying to find the library. It used to be here.''[4] Additionally, with the utilization of computers for many different purposes, users may find it difficult to obtain one when they only want to do traditional library research. In planning for an information commons, negative as well as positive aspects need to be considered.

Despite the challenges, the model of a one-stop service center where the user can have access to information, technology, and user-support appears to be a winning one. The idea of the scholar's workstation where the researcher can access the resources of the institution plus the resources of the Internet plus have the software to produce a document, chart, or presentation and have expert help when needed achieves the goals of the user and of the institution to advance the integration of technology into the learning environment. The resulting environment truly represents more than its parts. It attracts and retains users.

IMPLEMENTATION

Successful implementation of an information commons involves a number of steps, foremost of which is obtaining commitment from potential partners and user groups including students, faculty, staff, and senior university administration. Collaborating partners should be integrated into the planning process early in the development phase so that the expertise and knowledge that each brings can help shape the outcome. Second, a sound communication strategy soliciting input and feedback from all potential stakeholders should be put in place. Moreover, where applicable, information and ideas obtained from the stakeholder groups should be incorporated into regular progress reports that go back to them. At the University of Calgary Library, these steps were followed faithfully and were a factor in the eventual success of the information commons. In the words of the Head of the Information Commons, University of Calgary Library, ''The result was user ownership; the users knew what was coming, why it was there and how it could be used. From the beginning there was high use.''[6]

PHYSICAL LAYOUT AND DESIGN CONSIDERATIONS

The design of the information commons should be based upon a well-researched service plan that includes a description of the user goals in using the facility and its resources. This will enable the development of detailed descriptions of how users will interact with the spaces, technologies, and services and will inform architects and/or facilities planners about how the facility should be configured. Factors to be considered include the proximity of services such as information or help desks, printers, scanners, and other equipment to workstations; layout of the physical workstations; and the spaces which enable a variety of uses and traffic flow throughout the facility.

Workstation design is extremely important and must take into consideration how users work. ''It is common for students to gather in groups and work in a computer lab for long periods of time. While in groups, students often appear to be working on academic tasks although most often one student is at a computer terminal typing while

Fig. 1 Students at a computer workstation.

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Fig. 2 Information commons service desk.

the remaining group members are socializing and contributing information when asked by the typist.''[2] Ergonomically correct workstations and chairs will meet the need for comfort for students who are working for long stretches of time. Spacious work areas will allow students to spread out books or other study materials and accommodate small group work. Finally, well-designed workstations and spaces will accommodate users with a variety of physical abilities, particularly when they are supplemented by specialized workspaces for the use of adaptive technologies (Fig. 1).

Service points should be clearly visible, close enough to workstations to encourage use but removed enough to permit comfortable conversation between staff and users. The design of help desks should accommodate users with quick questions and include space where they can be invited to sit down to work with staff on more complex queries. The space must be comfortable and easily shared by staff of varying sizes and computer use preferences (Fig. 2). Enough printers and scanning stations should be provided to meet demand and should be distributed throughout the facility with appropriate space for queues. Clear signage is a necessity to guide users, particularly if there are multiple service points within the facility.

Flexibility to accommodate changes in demand is a key design consideration. If a classroom dedicated to information literacy instruction is included in the facility, the design should facilitate open use between classes. For example, windowed walls would enable this flexibility with blinds being closed to remove distractions from activity within the information commons during instruction and opened when the space is available as part of the general workstation pool. The open blinds can quickly become a visual clue to users that the space is available for general use.

Library users need to be comfortable in the information commons. The space should be welcoming, safe, and appropriately lit. Collaborative workrooms with glass walls, or large windows, and clear sightlines aid in the provision of a safe environment (Fig. 3). The incorporation of artwork into the facility will humanize the space by providing a balance to the plethora of technology. Comfortable seating for students waiting for workstations, the inclusion of larger worktables, and the wise use of color all contribute to the welcoming atmosphere desired by users and staff.

ORGANIZATIONAL ISSUES

Information commons organizational structures are as many and varied as there are institutions. The primary models are

- Library-owned and operated.
- Library-owned and shared operations (either with units in the library and/or with units within the academic institution).
- Shared ownership (library and academic computing, or other academic unit) and shared service delivery.
- Owned and operated by academic units—not involving the library.

The importance of the models is that they influence the service being offered. In models where the reporting structure and budget are centrally controlled, decisions regarding the operation can be made more simply. As the responsibility for the operation of the information commons is dispersed, either through other units within the library or outside units, the task of coordination increases exponentially. Standards of service, infrastructure decisions, and operational issues are more complex and difficult to resolve. One possible solution is to create a

Fig. 3 Collaborative workroom.

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position that holds primary responsibility for providing coordination and leadership, ensuring a smooth delivery of services across functional groupings. While this role can be extremely challenging, it has many positive aspects. The partnerships formed through collaboration with other units and the opportunities this provides to integrate more fully into the teaching and learning mission of the university enriches and enhances the place of the library on campus.

STAFFING AND TRAINING

The organizational structure and service program determines the types and levels of staffing and training requirements. Are other units involved in the delivery of service? What is their involvement? Administrative decisions must sort out these challenging questions. Hours of service, the mixture of technology available, provision of reference service, technical assistance, and the level of expertise are service program elements to be considered.

Offering an integrated service, many information commons endeavor to train staff in both technical skill development as well as development of reference knowledge and skills. Methods employed include tutorials, cross-training opportunities, workshops, classes, and, in general, an atmosphere that promotes and encourages self-directed learning and development. Training needs to be seen as ongoing and continuous both by the individual and the organization. As commitment to this philosophy can be costly and time-consuming, managers must look at ways of incorporating training into the basic culture of the service providers. ''Staffing and training are crucial issues. A well-trained IC staff is essential to achieve the best integration of professional knowledge, technology, resources, and services for patrons.''[5] Without the provision of expert help, the central concept of the information commons, as a place where a learner can move along the scholarly continuum from research to production, is hampered. Yet even with excellent training programs, it is unrealistic to expect that all staff in all areas will achieve expertise. Most information commons try to resolve this issue by seeking a balance. They utilize a combination of staff, including professional librarians, library support staff, technology experts, and student assistants. Normally, peak hours of service will see the broadest range of experts available to the user.

PARTNERSHIPS

The development of partnerships and the convergence of service are viewed favorably by the academic administration and the user as they facilitate the development of learner-centered environments. The administration generally views collaboration as a responsible and effective use of resources to the benefit of the user. By providing a good opportunity for libraries to partner with other units on campus such as information technology, student learning centers, media centers, and instructional design units, the information commons can enhance the role of the library in the academic mission. With these partnerships, however, come continuous discussions about administration, budget, service goals, priorities, and meeting user needs as well as the goals of the institution. Challenges as well as opportunities abound.

Collaboration and the convergence of different cultures, while improving the ability of the information commons to meet the needs of today's learner, provide their own difficulties. Different cultures have different perceptions of service and accountability. In addition, there may be different pay scales, degree requirements, and bargaining units. All contribute to the questions that must be resolved to accomplish a unified service.

Consider the example of service provision from a combined point. Who is responsible for what? Should questions of a technical nature be referred to the technical expert or should the first person to receive the question take ownership of it? What about reference questions? When is referral appropriate and how is it made? What is an adequate response time? Expertise in each other's area is often slow to develop and issues of territoriality exist. To ease these issues, clearly defined standards of service and accountability are necessary. Some commons attempt to solve these issues by moving away from a combined service point, dividing desks according to function. One desk provides reference assistance and another provides technical assistance. Debate continues as to which is the most effective, unified, or separate with each group providing cogent and compelling reasons for their choice. In the end, the individual culture and climate of the institution concerned will likely dictate the choice that is made.

Regardless of the final resolution, collaboration in some form is crucial if the information commons is to be successful. Successful collaborations seem to be rooted in the early establishment of common goals and understanding. Additionally, continuous involvement at some level of all interested parties in the design and delivery of the service should be built into the planning and operation.

USE ISSUES

With success comes challenges. In the information commons, these tend to fall into the following areas.

- Demand.
- Depletion of resources.
- Competing needs.

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In the authors' experience and from consultation with colleagues managing other information commons, meeting demand is difficult. By providing access to e-mail, the Internet, Microsoft Office, and other peripherals, the information commons becomes the main choice of workplace for many students. Lineups may be frequent, prompting a demand for regulating use. Busy students who perceive that others are using workstations for social purposes want action taken. The challenge is determining the action.

Initially, it may seem that e-mail and the open Internet should simply be removed from the workstations. In reality, this is becoming less and less viable. As more faculty use e-mail, chat rooms, and Web sites as a method of communicating with students and as students increasingly work in groups to complete projects, the line between academic and social use blurs. Furthermore, what may start as a social interaction as one student e-mails another may quickly turn to work as they discuss assignments and other group projects. Rather than looking at elimination of tools, a solution might be to examine ways to provide more even access. Some possible solutions include establishing a fair queuing system, designating some workstations as time-limited, and identifying some stations for specific purposes such as printing or scanning.

Demand also evidences itself in the ever-growing request for specialized software. Both faculty and students may request that particular programs be made available in the information commons. With increasingly tight university budgets, departments and labs may see the installation of specialized software in the commons as a way of relieving pressure on their limited resource budgets. There is a perception that the provision of access at the information commons replaces the need for provision of access within the department. Finally, adding to demand is the adoption of blended learning high-technology solutions to undergraduate education. Because of the ubiquitous nature of the information commons, it is seen as the ultimate provider. The task of those managing the commons is to see that adequate resources back this assumption.

Ultimately, both use and demand lead to a depletion of resources. Because the information commons is so technologically dependent, current versions of software and hardware are crucial. Finding funding to keep current can be an issue, particularly if the original commons was built on special or one-time funding.

Competition among the groups that use the information commons is high. It is the experience of the authors that this may be a difficult issue to resolve. Spaces such as collaborative workrooms or classrooms are highly desirable. Competition may exist between librarians, technology staff, faculty, and students with regard to who will have priority. Spaces that were originally designed for one thing may become adapted for use to another, bringing unexpected elements into the mixture. One example that the authors experienced at the University of Calgary Library was the use of the collaborative workrooms by teaching assistants to hold weekly meetings with their classes. Designed for student group work, these high-demand spaces were being utilized for a different purpose. As groups become comfortable in their use of the information commons spaces, one can expect that this will remain an issue.

BENEFITS

Much has been written about the declining use of libraries as the prevalence of electronic access to information has blossomed. ''Does the academic library have a viable long-term future? Some find reason to wonder and point to slumping book circulation, empty reading rooms and declining door counts on campuses across the country.''[7] The ability to reverse this trend may rest in the establishment of facilities such as the information commons. For example, the University of Calgary Library experienced a 24% increase in reference questions for the period 1998/1999–1999/2000. Technology queries totaled 18, 360 for the first year of operation.[6] These statistics indicate that the new facility was successful in achieving its first goal, that of meeting user need for information and technology help.

Other influences at work are more wide-ranging and sociological in nature. It has been noted that as people retreat to ''virtual space for more and more activities and interactions, they are being drawn to 'great, good public places' that satisfy and nurture their needs for community and human interaction.''[8] The information commons has the potential to be this space. With flexible collaborative workrooms, group study spaces, and well-designed computer stations underpinned by knowledgeable technical and information research help, it provides a welcoming learning yet social environment. It is an ideal fit for today's student. ''Today's college student will be well prepared to work in a wired world. Virtually all of them will have experience with email and the Web, and most will be familiar with a wide variety of software packages. Many will also be well versed in peer-to-peer file sharing and online collaboration.''[2] ''So, too will this generation mix work and social activity online thus blurring the line between work and home, work and leisure.''[2] The information commons fills this role admirably, providing a space that meets the needs of today's student and facilitates their transition to the worker of tomorrow.

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CONCLUSION

The information commons is a new and successful development in libraries. It is a strategic fit for today's academic environment where technology is affecting all areas of university life and where the user is demanding more service, access, and accountability. To date, proof of concept has been mostly anecdotal. Many significant questions that focus on the impacts of a changing learning environment remain. For example, what has been the impact of integrated service on the user? What has changed for the learner? What will be the long-term impact on the role of the library? Further study and substantive review will provide answers to these and other questions, assisting in the continued transformational process of libraries in the digital age.

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Information Counseling

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INTRODUCTION

Information counseling is a term that represents an extension of a traditional concept of practice and service in library and information science. Many definitions of librarianship, library science, and information science include some idea of *intermediation* (applying a service) in identifying, locating, and using the literary record of human thought and action for whatever purpose.[1] Information counseling, as a service concept, stresses the importance of *mediation*.

> The term mediator, rather than intermediary, is used for human intervention to assist information seeking and learning from information access and use. An intermediary intercedes between the information and the user but this interchange need not involve any human interaction. A mediator, however, implies a person who assists, guides, enables, and otherwise intervenes in another person's information search process.[2]

With reference to library and information service, human mediation, both as a theoretical and functional concept, applies current understanding of human behavior and communications. This understanding aids in determining the need and requirement for data, information, and knowledge demanded of the patron's task. It aids the patron by identifying and then organizing resources, either or both human and technological, consistent with and demanded of the task.

In 1977, Martha L. Dosa proposed the following definition of information counseling. Dosa's definition remains important for its emphasis on the follow-up and the feedback evaluative process that is central to information counseling.

> ...the interactive process by which an information professional (a) assesses the information needs of an individual or organization; (b) determines the optimal ways to fill such a need and assists the client in information use; and (c) assures systematic follow-up and feedback in order to evaluate the effectiveness of counseling.[3]

OVERVIEW

The features of information counseling that distinguishes it from other library reference services are the *importance of the formulation of the question* both by the patron and the information counselor[4–8] and the *documentation of the mediation process* that occurs between the patron's need for information and knowledge demanded of a task. The essential aspect of this process rests on the *continuous* interaction that occurs between the information counselor and the patron in the consummation of a task. The recording (documentation) of the reference transaction, whether in writing, voice, or media, provides the means to test the efficiency of the information-counseling process. It is the *feedback* (*positive/negative closure*) in this process that engages the counselor and the patron and the written record of this engagement that differentiates the function of the information counselor from other library functions.[9]

The use of the term ''information counseling'' first appeared in an article written by Hershfield[10] in 1972 at a symposium on the *Humanizing of Knowledge in the Social Sciences*. In the paper, Hershfield reflected on the activities of libraries at the time and suggested that attention be applied to bringing the patron and the library service closer together. Hershfield scrutinized the prevailing library as a learning environment and thought that the librarians should be educators.[11–13]

Information and knowledge services that emphasize some form of human intermediation have been around for hundreds of years. Court courtiers advised (counseled) royalty and others on the latest states of affairs in their kingdom (i.e., taxes, fortifications, etc.). Aspects of intermediation are part of a number of contemporary services. Some of these services can be ''in-service'' or ''outsourced.'' These include:

Readers' advisory.
Selective Dissemination of Information (SDI) and current awareness programs.
Reference and special library services.
Information brokerage.
Information consulting.

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Information entrepreneur.
Freelance librarianship.
Information officer.
Gatekeeper.
Government-sponsored activities promoting information transfer.

In each of the above, an aspect of mediation (information counseling) can be applied.

READERS' ADVISERS

In 1950, Dunn[14] wrote:

> From its beginning, the objective of the readers' advisory service has been assumed to be that of adult education. It concentrated its efforts on individual guidance with the goal of aiding the reader to establish his/her own program of self education through increased knowledge of library resources provided by the advisor. . ..

The idea of helping individuals find literary material to satisfy their needs and interests goes back to the later part of the 19th century.[15,16] Early in the 20th century and in response to the admonition of librarianship as a logistical operation by Williamson,[17] focus was applied to enhancing the role of the library as an educational institution anchored toward adult learning. Readers' advisors were specially trained librarians who would focus on the individual readers' learning. The objective of the program was to identify the library as an educational institution in general and the librarian as an *educator* instilling the capacity of handling knowledge that would have community value. The advisory role included an initial interview ''to determine the reader's goals, interests and capabilities.'' This was followed by ''the compilation for the reader of a personalized reading list of books readily available in the library.''[18] In 1950, the term ''readers' adviser'' was replaced by ''readers' guidance.'' This change was an attempt to relate the interaction of the librarian with the patron as a ''helper'' rather than a subject specialist. No substantial change in function, however, could be discerned. Also, at that time, ''information service librarian'' surfaced to be replaced later by the ''learner's advisory service,'' which consisted of skilled advisory librarians who counseled self-learners in individually designed ''learning projects.'' The term ''readers' advisors'' continues in usage. The tools, in its service and support, have been extended. A multivolume reference publication is now available.[19] It is intended to provide guidance to the readers' advisor aiding the patron in areas of interest ranging from philosophy, social sciences, technology, medicine, drama, and many other aspects of human interest.

SELECTIVE DISSEMINATION OF INFORMATION AND CURRENT AWARENESS SERVICES

The Selective Dissemination of Information and Current Awareness Services found their expression in the library and information science literature in the 1960 and peaked in the next decade.[20] The movements were inspired by the growing capacities offered by computer (data processing) technology in the retrieval of information, and, in this sense, related to the readers' advisory program. The intention was to heighten, through technology, the delivery of information and knowledge to the patron. In a correlated program, current awareness service found its application mainly in academic and special libraries. The librarian worked closely with patrons in establishing their interests and needs, thereby developing a profile of the user that would be used as a basis for directing relevant, pertinent, current information and knowledge resources to their attention. In the process, the librarian maintained continuous monitoring of the literature to insure that the client was ''on-top'' of what was happening in the field—both in thought and action. The concept of current awareness service included the physical delivery of text and presentation of data to the attention of the user, thereby lessening the patron's task of retrieving the relevant material. Presently, the processes that are part of SDI and current awareness services are considerably enhanced by computer capabilities. Computer software enables database identification, retrieval, and arrangement of data, information, and knowledge important to a person's requirements to be on-line.[21] These capabilities are central to the practice of information counseling.

REFERENCE AND SPECIAL LIBRARIANSHIP

The origin of reference librarianship can be traced back some 5000 years. An understanding of reference work and the relationship to information counseling is implicit in the following description of reference work.[22,23]

> The distinguishing feature of reference work is the personal assistance rendered by the librarians to patrons in pursuit of information. Such assistance is of two main types ('instruction in the use of the library') or the librarian may simply supply the information outright ('direct information service'). A third and minor help is the help which librarians may offer patrons in deciding which material to read for pleasure or study.[24]

Special libraries existed in ancient times. Special librarianship is of more recent vintage finding expression in the 19th and 20th century.[15] These libraries focus on

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specific needs generated by the special requirements that are part of the human and social enterprise at the time.

> Special libraries serve a limited defined clientele. Most frequently, the special library's clientele is limited to its present organization, and within this limitation the clientele may range from the personnel of a single department to employees throughout the organization and may or may not extend to the organization's employees in other locations.[25]

Special libraries are ''mission oriented, centered on the total need of their users.''[26] Special libraries as a service concept are examples of the application of the principle of intermediation cited previously. They come close to the service concept of information counseling.[27]

THE INFORMATION BROKERAGE

An information brokerage is involved in the provision of ''. . .information on demand, that is, research done on an hourly or contract basis, and, in theory, any or all of a long list of services. . .including consulting services.''[28]

Outsourced and for a fee, information brokers obtain information and knowledge that are desired by a client, but are beyond the reach of other available professionals. There have been a number of functions that are associated with brokers and are also part of the work of others in the professional field. Functions of brokers can include all the function of librarians plus many other information professionals. Brokerage includes service in a number of areas including abstracting, analyzing information, appraising collections, bibliographies, cataloging, clipping service, computer software design consulting, current awareness programs, directories, displays and exhibits for libraries, document delivery, editorial services, evaluating information needs, identifying experts, indexing industry overview, literature searching, maintenance of collections, market research and survey preparation, on-line searching, organizing collections, and many other functions.[29]

INFORMATION CONSULTING

An information consultant is a specialist (expert) in a specific (scientific, technical, and professional) area usually available outside of the asking organization. The basis for information consulting lies in the growth of information technology and the importance of integrating this resource into the total structure of an organization. An information consultant is recruited when everyday, there are issues and problems important to an organization. Consider the following descriptions of information consulting:[30]

> Consulting is a service which helps organizations in reengineering and rethinking their business through technology, strategy, people, and business processes. Consultants transfer their knowledge to clients through training, help motivate employees to support changes, and collaborate in implementation stages with client managers and employees to assure results.

and

> offers advise and is paid for that advice. The consultant's primary function is to make recommendations for solutions to problems, but in the course of advising a client, the consultant may actually be called on to provide solution.

The information consultant and information counselor are intertwined through the intermediation role:

> instead of performing the task him/herself, the consultant tries to help the client clarify and set goals, maintain possible motivation, and develop and implement effective plans. In other words, the counselor's job is to help the client gather, analyze, and develop conclusions from his/her experience.

INFORMATION ENTREPRENEURSHIP AND FREELANCE LIBRARIANSHIP

There are a host of professionals and trained librarians who work outside of the formal structure of the library organization and are willing to make available expertise to those individuals and organizations who are willing to pay a fee for information services. These professionals are referred to as information entrepreneurs, infopreneurs,[31] and freelance librarians.[32] These professionals work on their own and move from both within and outside of organizational structures in providing information and knowledge-related services. Their relationship to information counseling is understood in the methods they use when providing service. These include the patron interview, information searching, and retrieval and formatting material to meet the requirements of a task.

> It is not the suppliers of information technology who deliver the results from automation. In each organization there is a group of individuals—high performance people—who are the agents of change. It is they who facilitate the transformation which takes full advantage of computers.[33]

In the literature, information counselors have been considered as serving in an outsourcing capacity and as information entrepreneurs.[34,35,63]

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THE WORK OF INFORMATION OFFICERS

An information officer (CIO) works in an organizational setting sometimes in an industry or military setting, although the vocation can be found in some international libraries. Its information counseling and intermediation attributes include questioning, guiding, and advising. These attributes are relegated to operations planning and security programs that deserve executive attention. The term is also used to refer to a public relations specialist (PRC). The PRC prepares press releases and contacts people in the media, print, or broadcast their material. Information officers serve also government functions.

Today, heads of industries find information about looming decisions through ''information officers,'' professionals who insure that the chief executive officers are kept up to date on matters regarding the management of the organization. The way these ''information briefings'' are tailored and presented is often based on an understanding of the information processing style of a particular executive. For example, the military briefing (information) officer provides commanders with the data, information, and knowledge required to engage in military operations. The manner in which the information and knowledge are presented to commanders is based on the briefing officer's understanding (feedback) of the commanders' personal style in dealing with the tasks and how they use and apply information and knowledge. Chief information officers (CIO) are also found in American Research Universities where they share responsibility for decision making in administrative systems and telecommunications.[36]

GATEKEEPERS AS INFORMATION COUNSELORS

In the 1960s, advances in information technology had a significant impact on industry, particularly on industrial management.[66] Computers and other technologies offered new opportunities in data, information, and knowledge processing in meeting production and other management needs. Allen's[37] dissertation at MIT provided a focused role of intermediaries in support of these activities. He suggested the title of *technological gatekeepers* as:

> A gatekeeper is a member of the scientific and industrial research group who can be observed performing an information counseling function with colleague…this indicates a fundamental preference for information mediated by human interaction, and the argument will be supported by illustration from information behavior both in industrialized and the developing world.

Gatekeepers have assumed different functional roles (broker, information professional, and unaffiliated gatekeeper profiles) stressing the importance of culture in human information-seeking behavior.[38–40]

GOVERNMENT AND INFORMATION TRANSFER ACTIVITIES

Following the October 4, 1957 Russian launching of Sputnik, the first artificial satellite in space, an unprecedented revival of interest in the advancement of available mechanisms and institutions that acquired, stored, and retrieved data, information, and knowledge emerged. The Weinberg report (Presidents Advisory Committee, White House, 1963[41]) focused on the habits of scientists in reporting their findings and how these findings were disseminated. It also alerted libraries and other institutions to be more aggressive in assessing their role in meeting the demands of the space age. In 1958, NASA established and funded a number of Regional Dissemination Centers (RDCs), some connected to universities throughout the United States with the objective of disseminating scientific and technical data, information, and knowledge gained from the space program.[42] These nonprofit centers were staffed primarily by librarians and other data processing specialists who served particular clients in industry and other institutions. These centers were funded by the government. The centers provided their customized information services to fields of business, science, engineering, and other institutions involved with intellectual property.[43] The professionals who worked at these centers served as information counselors because their relationship with clients was marked by close interaction in the posting of their needs and requirements. Yet it is important to note that available information indicates an absence of follow-up action in the form of documentation of the counseling function to determine whether or not the service offered at these centers met the needs and requirements of their clientele. That said, the effectiveness of these services did not go beyond the renewal of the contracts that insured further work of the centers. As a result, many of these centers no longer exist.

THEORETICAL BACKGROUND OF INFORMATION COUNSELING

The theoretical background of information counseling can span the entire spectrum of theories found in the behavioral–social and biophysical sciences in addition to those now included in library and information science.

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Information counseling conceivably rests on three operational, interrelated models (paradigms). These include:

- The clinical paradigm.
- Cognitive paradigm.
- Communication-cybernetic paradigm.

The Clinical Paradigm

In 1972, Havelock,[44] a social psychologist, studied how the library and other information and knowledge dispensing and delivery systems could be used to enhance innovation in the public interest. His objective was in response to the national requirement for enhanced technology and innovation demanded because of the emerging space age. Havelock, in the development of his approach for enhancing innovation through effective information service, details the three major dimensions considered relevant to this objective. They are *personality*, *individual background*, and *organizational factors*. It is these factors and others that Havelock developed in his assessment of the information environment that can induce innovation. These dimensions are represented in the educational program in information counseling presented later in this article.

Havelock's need state

This concept was predicated on the determination (diagnosis) of ''an individual's need state.'' He described this state as a dynamic property of the organism varying in intensity with corresponding undulating physiological and psychological states (Figs. 1 and 2).

Havelock in Fig. 3 provides a diagram of the dynamic process that prevails between the resource person and the user in the resolution of a problem in a knowledge utilization environment.

Havelock discussed the relationship between the behavioral subsystem and the need subsystem. The need system includes the state of (physiological/cognitive) arousal created by a problem and the reduction of ''pain'' when the need is satisfied. The behavioral system is envisaged as those actions taken (search) toward the reduction of the ''discomfort'' created by the problem. This concept entails the communication process between the patron (user) and the provider in the resolution of a problem or task (Fig. 4).

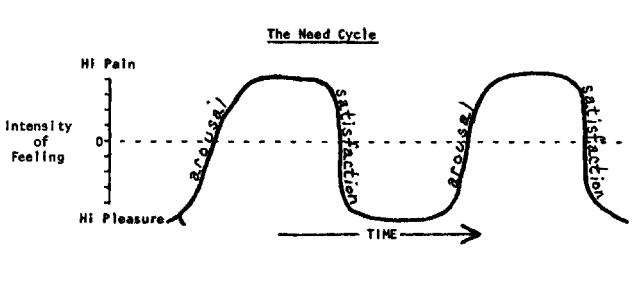

Fig. 1 The need cycle. (From Ref. [44], Fig. 2.6, pp. 2–11.)

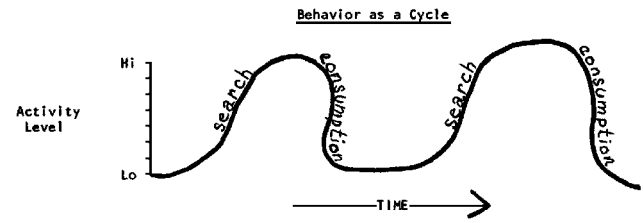

Fig. 2 Behavior as a cycle. (From Ref. [44], Fig. 2.7, pp. 2–12.)

Havelock's clinic

Havelock envisioned an environment (clinic) that could significantly aid a patron in dealing with marshalling information and knowledge resources required of a particular task. The individual (patron) in this setting would enter the system (clinic) by presenting the problem in a form of a question. At the entrance to the clinic, pertinent background on the patient (patron) and other data would be acquired. These data would then be submitted to a doctor who would assess the nature of the problem based on his memory and understanding. The doctor would combine the data obtained on the patient when the patient arrived at the clinic and would recommend (prescribe) actions to be taken. The prescription would then be given to an assistant (nurse) who would prepare the resources prescribed by the doctor prior to their presentation to the patient (patron) (Fig. 5).

The Cognitive–Affective Paradigm

The cognitive–affective model of information-seeking behavior is grounded on two perspectives of the service environment, namely, the person and the institutions, organizations (systems) that serve the patron.[45] The ''personal orientation '' is differentiated from the ''system orientation.'' The ''person-oriented'' perspective attempts to determine the impact of the amount of information required to be processed for a task, the ability of the processor to *make sense of the task*, and the capacity of the patron to *learn from the experience*. The ''system-oriented'' perspective centers on the ability of current institutions (library) with their resources to deal with the

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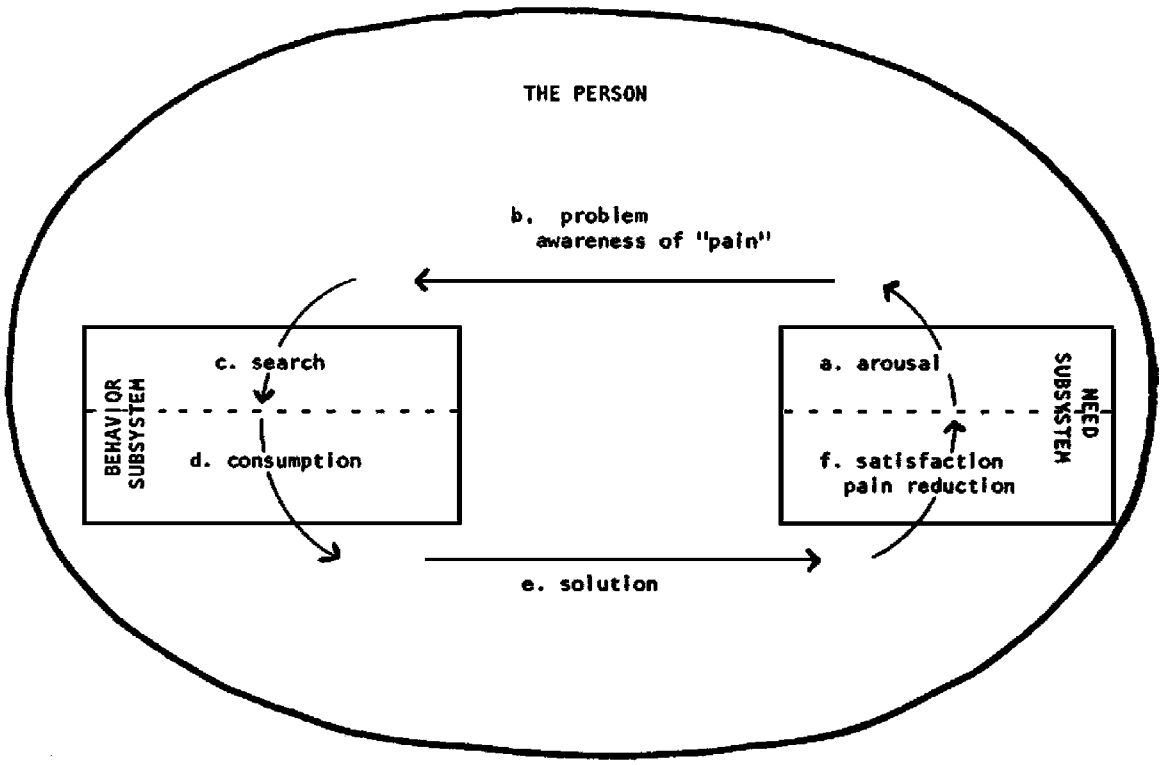

Fig. 3 The need behavior cycle inside the person as a system. (From Ref. [44], Fig. 2.8, pp. 2–13.)

task at hand and the ability of patron to use these resources efficiently and effectively in both task and nontask environments. Both of these perspectives are represented in what Nahl[46] has suggested to be the ''User-Oriented Revolution.''[64,65]

An understanding of what constitutes an information and knowledge need is of primary importance to both of these perspectives. A number of library and information scientists have attempted through several decades to address the nature of the human need for information. Taylor[47] proposes that information represents ''A visceral state of being, a state of consciousness, difficult to express.'' Debons considers the need to be a state of awareness, the state that asks questions of ''what, where, when and who.'' Knowledge asks questions of ''how and why.''[48] In this concept, Debons uses Benjamin Bloom's taxonomy of cognitive functions to represent the cognitive needs. These include comprehension, application, analysis, synthesis, and evaluation.[49,50] Bloom's taxonomy includes affective needs as well (ability to receive, respond, value, and organize). Others have pointed to the role of the unconscious.[51] Ballestros's[52] research explored the role of the unconscious and detailed how the unconscious and affect can play a part in identifying the human need for information. Ballestros stressed that, whether conscious or unconscious, identification of need

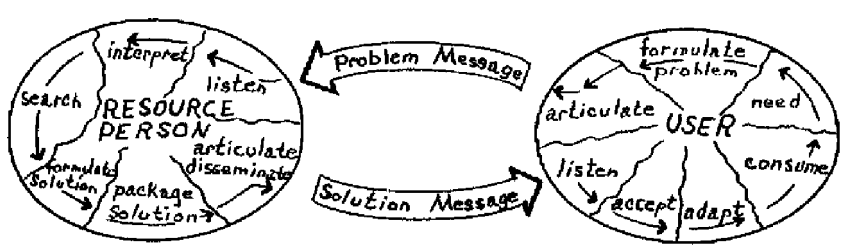

Fig. 4 A two-person knowledge utilization system. (From Ref. [44], Fig. 2.11, pp. 2–17.)

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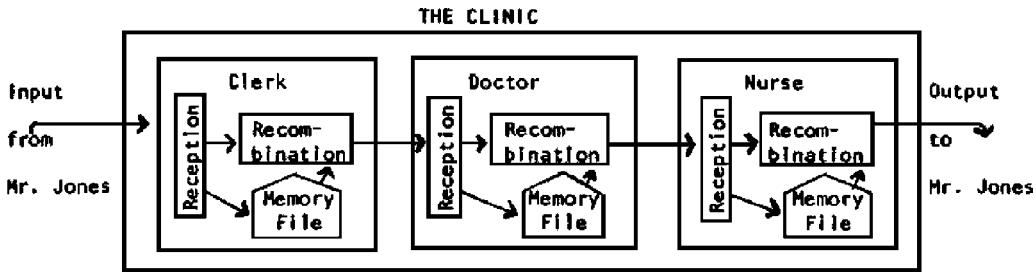

Fig. 5 The resource subsystem: details of a hypothetical throughput process. (From Ref. [44], Fig. 2.16, pp. 2.23.)

that is part of human information-seeking behavior is very much dependent on the question–answer process between the patron and the librarian.

> ...it may be more important from an information counseling point of view to elicit deeply embedded information from the inquirers' memory for the articulation and solution of their problems, than to provide or refer to external sources (p. 157).

The research of others have hypothesized that information need represents a condition in which the patron receives knowledge (from the retrieval process) but that knowledge do not match [anomalous state of knowledge (ASK)];[53] ''a gap exists when what information a patron receives and that which the individual expresses as his/her need.''[54] One of the more persuasive research initiative in information-seeking behavior of significance and relevance to information counseling is the work of Kalhthau[55] at Rutgers University. Her extensive, 5-year longitudinal studies with high school students embraced many aspects of the information-counseling functions, providing data on important issues to information counseling. These include need identification, question methodology, role of uncertainty, decision making, and problem solving. The importance of the affective dimension in these applications is also stressed. Grounded on constructionist theory of behavior, her longitudinal studies detail the role and function of learning and perceptual variables in her subjects' capacity to seek information. Her studies enable her to formulate a program for the training of information counselors as well.

In many of these studies, there is a clear recognition of the importance of the question–answering experience that is engaged between the patron and the librarian. The interview process, in which the structuring of questions for the patron is fundamental in identifying needs and requirements, is a centerpiece in the education of information counselors, in general, and particularly in the practice of information counseling.[55] Harmon[56] sees the process as constituting a number of steps taken by the patron to establish some standard or rule by which one can be successful achieving an answer to the question that is posed.

The Communication-Cybernetic Paradigm

The person-to-person interaction that is germane to information seeking and particularly to information counseling is bound to the communicative process. Attention and discourse on the importance of communication in information seeking and use are diverse in theory and practice. It is integrated in the general thinking of library and information scientists. Specifically, it finds expression in research on information-seeking behavior and directly on the identification of human need for information and the questioning process that is engaged in reference service previously discussed.[57] Of interest to information counseling is synthesis of two perspectives on the nature of the reference service—the system perspective and the attention to state of the user in the quest for awareness and knowledge. The marriage of this concept to cybernetics is found in the dynamic engagement of sender and receiver, the properties of which are considered to be part of the science of communication and control. Cybernetics[58] considers the exchange between the sender and receiver as dynamic—a two-way process—the importance of which rests on the impact of the message on the receiver. Patrick R. Penland, an information scientist, submitted an extensive discourse on information counseling as a communicative experience that is shaped by cybernetic thinking.

> ...Man himself is always on the cutting edge of awareness, struggling to articulate the deeply felt concerns and interests that continuously beset him. Although he may be immersed in technology, the environment of which he is the center never seems to stay in place. Stimuli that surprise and irritate him must be considered and evaluated before adjustments can be made in his own behavior or in the world around him (Ref. [59], p. 18).

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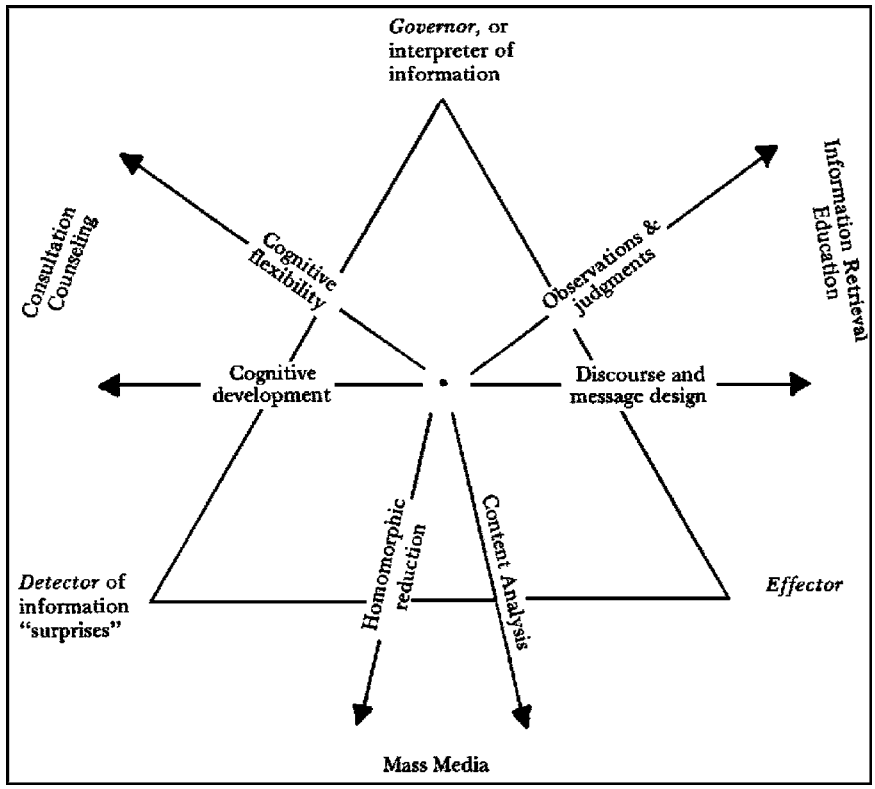

Fig. 6 Adaptive control organism. (From Penland, Vol. 1, Fig. 3, p. 18.)

Conceptually, the cybernetic paradigm envisages the individual (organism) as adaptive.

> The notion of the amount of information attaches itself very naturally to a classical notion in statistical mechanics: that of entropy. Just as the amount of information in a system is a measure of its degree of organization, so the entropy of a system is a measure of its disorganization; and the one is simply the negative of the other.[58]

Fig. 6 provides a diagrammatic, conceptual view of the dynamic and cybernetic (noise reduction) properties of the communicative process. The detection of unexpected information (from media) is subject to interpretation. Through consultation and counseling with the patron, the cognitive aspect of the communication (content of the message) is undertaken, leading to information retrieval and patron understanding (knowledge) (Fig. 6).

EDUCATION IN INFORMATION COUNSELING

The education and training of information counselors rest on the amalgamation of the three paradigms discussed and incorporate current concepts used in the education and training of librarians, particularly reference/special librarianship and other professionals cited as information scientists and technologists. Insights toward this end are derived from a tried educational program[a],[61] a longitudinal research program on information-seeking behavior conducted by Kalhthau,[55] and reflections from outsourcing applications in industry.

The background, education, and training of information counselors require 1) an intellectual sensitivity to the differences in patron's state of learning, perception, and personality as these may influence the efficient and effective use of resources and 2) the capacity to identify, organize and direct patron's actions with resources (human and technological) that can be applied to the patron's task. Each of these requires the skillful application of question–answering and communicative skills in culling the most sensitive aspects of the patron's cognitive–affective states. A thorough, well-developed educational program in information counseling would be an

[a]An academic degree program specifically cited whose objective is primarily directed to the education and training of information counselor was initiated at the Graduate School of Library and Information Science at the University of Pittsburgh in 1978.

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extension of a liberal arts degree. It would emphasize technical skills in the access, processing, and management of data, information, and knowledge resources (human and physical), including 1) the ability to be creative in the manner and form in which the physical resources (library, media, Internet, WWW) are used and presented to the patron, 2) instruction on the nature and application of problem solving, decision making, and communicative skills pertaining thereof, 3) instruction on the principles of knowledge and business management important to the effective and efficient outsourcing activity, and 4) the development of skills in documenting all aspects of the information counseling experience to insure that it serves as a test of the information counseling concept and practice.[34,35,62,67]

CONCLUSION

Information counseling is a broad-based concept of the practice of mediation across the professional landscape of library and information service. While the presence and exercise of intermediation in the rendering of professional service are long standing and find expression in library and other services, mediation derives its definition from the ever-increasing technological competence required in the use of data, information, and knowledge resources demanded by an ever-increasing task complexity. The information counselor, as a mediator, is a service professional with communicative skills centered on the identification of human cognitive–affective needs and the ability to organize both human and physical resources required to meet these needs. One view conceives the information resource environment as a clinic. This view considers the human need for data, information, and knowledge as a cognitive–affective state, both conscious and unconscious. The nature and importance of the communicative process stress particularly the questioning process in establishing the need state. A practice theory of information counseling consistent with this view includes 1) the identification (*diagnosis/assessment*) of the patron's (cognitive–affective) need state (conscious or unconscious), 2) the identification and the organization (*prescription*) of resources (human and technological) that match the need state to engage efficiently task demands, and 3) the documentation of the diagnostic and prescriptive processes that provide data for the *evaluation* and validation of the concept and practice. The education of information counselors can incorporate a wide spectrum of present training formats (levels) that span the education of library and other information service professionals. This concept favors a liberal undergraduate education, higher-level instruction in the acquisition and use of data, information and knowledge resources (human and technical), problem solving/decision making, development of communicative skills, and extensive training and exercise in the recording (documentation) of the interactions (counselor and patron) that are part of the information-counseling process. Furthermore, the possible outsourcing of information counseling favors instruction in business administration and knowledge management.

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Information Productivity

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INTRODUCTION

The term ''information productivity'' was coined by Purdue University's Ferdinand F. Leimkuhler and MIT's Philip M. Morse in 1979 in their study[1] ''Analysis and Application of Information Productivity Models,'' supported by the National Science Foundation's Division of Information Science and Technology. The primary goal of this study was to develop a theoretical foundation for the striking empirical regularities occurring in a large and diverse class of information resources, describe how these empirical phenomena would change over time, and show the implications and applications in such changes.[2]

What are these empirical regularities? For example, in a software system some functions are used more often than the others, and in information retrieval process a relatively large number of queries seem to center around a small proportion of records. The distribution of usage tend to be skewed, and we can separate the usage pattern into the ''significant few'' (the frequently used ones) and the ''trivial many'' (rarely used) groups. The simplest way to model this empirical phenomenon is the 80/20 rule.[3] Four other more complex regularities are well known among information scientists: Bradford's law of scattering[4] describes how articles are distributed over a corpus of journals; Lotka's law of scientific productivity[5] describes how papers are published by authors; and Zipf's law[6] and Booth's law[7] of word occurrence, respectively, describe how frequently used and infrequently used words are uttered.

Information productivity models are mathematical functions useful in describing the empirical regularities and predicting their future behavior.[1] Four leading models are the multinominal urn model,[8] the Markov chain model,[9] the Simon–Yule model,[10] and the Mandelbrot–Shannon model.[11] Using the principle suggested by Herbert A. Simon, a Nobel Laureate,[12] Chen and his colleagues conducted a series of researches[13–31] to evaluate these information productivity models. They used two crucial criteria—1) the result derived from the model should be similar to the observed one, and more importantly, 2) the generating mechanism provided by the model should be plausible and explanatory; otherwise the model must be refined to better represent the real world—for evaluation and concluded[32,33] that the Simon–Yule model is a promising approach to the information productivity modeling.

THE SIMON–YULE MODEL AND ITS EXTENSIONS

The Simon–Yule model is theoretically sound and ''the applications ... are numerous and the implications of the model are enormous.''[32,33] The model has been suggested for increasing productivity in continuous speech recognition,[22,24] Halstead's theory of software metrication,[25] command languages,[23] indexed file performance evaluation,[26] self-organizing linear search,[26] information weeding,[34] self-adaptive database buffer management,[35] relationship marketing,[36] Web-based teaching and training,[37] Web-enabled data warehousing,[38] World Wide Web cache policy,[39,40] and electronic commerce.[41,42] Adding to the long list of applications of the Simon–Yule model, this paper provides a report of recent development of the Simon–Yule model in strategic growth of firms.

Without loss of generality, we use the process of growth of firms for our description. According to Simon,[10] the firm grows based on the following assumptions, where $f(n,k)$ is the number of different firms that have exactly the size of n at the time k:

1. Gibrat's law: the probability that the growth opportunity at the $(k+1)$st time is taken up by a firm that has the size of n proportional to $n \times f(n,t)$, i.e., to the total number of sizes of all the firms that have exactly the size of n.
2. New entry of firm: there is a constant probability, α, that at the $(k+1)$st time the growth opportunity is taken up by a new firm, i.e., a firm that has not occurred in the first k time periods.

Based on the two assumptions, Simon derived

$$f(n) = \rho B(n, \rho + 1), \qquad n = 1, 2, 3, \ldots$$

where $\rho > 0$ and $f(n)$ is the frequency of words with n occurrences; $B(n, \rho+1)$ is the beta function with parameters n and $\rho+1$. Simon calls the last equation a

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''Yule distribution'' because Yule's paper,[43] which predated the modern theory of stochastic processes, derived the same equation in a study of biological problems. Simon's model is frequently cited as the Simon–Yule model.

What happens if one of the assumptions is violated? How much would the theory still describe the striking empirical phenomena adequately? This suggests the need for successive refinements of the theory. A major refinement of the theory above includes the empirically grounded autocorrelated growth phenomenon.[44] Here assumption two of new entry of firms with rate of α remains the same. Assumption one of Gibrat's law, however, is significantly refined. If in a particular time the industry grows by the enlargement of an existing firm rather than by the addition of a new one, the probability of any existing firm experiencing this growth is a weighted average of $1-\alpha$. The weight of each individual firm depends on how recently it experienced growth. The assumption here is that a firm that has experienced recent growth is more likely to grow again in the present than is another firm that experienced growth a relatively long time ago. The strength of this industry recency effect, or growth potential, is measured by a number γ between 0 and 1. In an industry with $\gamma=0$, neither current size nor past growth give any advantage in current growth. Mathematically, the autocorrelated growth model expresses the probability P that a particular firm i will grow by one unit in the $(k+1)$st interval as:[44]

$$P[y_i(k+1)=1] = \frac{1}{W_k}\sum_{\tau=1}^{k} y_i(\tau)\gamma^{k-\tau}$$

where k is the current time period; $y_i(\tau)$ is 1 if firm i grew by a unit in time τ, and 0 if not; γ is the industry growth potential; and W_k is the sum of growth potentials of all firms.

In addition to this autocorrelated growth element of individual firms, a further refined model—incorporating the share of the growth of the industry—was proposed[45] and supported by the empirical growth data of large U.S. firms in the period of 1958 to 1962. Besides allowing for serial correlation of growth, another stream of successive refinements[46,47] of Gibrat's assumption is to include the occurrence of mergers and acquisitions in the theory. This kind of research has significant implications for the governmental antitrust policy on business concentrations. One final note on Simon's successive refinements is the refinement of entry of new firms[48] allowing for a decreasing entry rate of new firms:

> (2′) New entry of firm: there is a decreasing probability function $\alpha(k)$, $0 \le \alpha(k) \le 1$, that the growth opportunity is taken up by a new firm, i.e., a firm that has not occurred in the first k time periods.

An interesting observation of this refinement is that a substantial decreasing rate of entry of new firms will help us explain the curvature departures of the Pareto distribution plotted on a log–log scale.

Simon's thought process of refining explanatory theories based on assumptions well grounded in empirical data evidently has caught the attention of researchers. For example, in their study on the forces generating and limiting concentration under Schumpetian competition, Nelson and Winter[49] enhanced Simon's stochastic models of the sizes of business firms with the findings that the development of concentration in the industry is significantly affected by the following major factors: the growth potential rate, the effectiveness of technological efforts, and the restraints on growth as firms grow large. Another similar example can be found in Sutton's[50] study of the evolution of technology and market structure.

IMPLICATIONS OF THE SIMON–YULE MODEL FOR STRATEGIC GROWTH OF FIRMS

As part of the study of strategic implications of the Simon–Yule model for the explanatory theories of firms, Simon found that instead of enjoying decades of high growths, a successful firm's more than average growth rate at a particular time will likely regress fairly rapidly to the average. For example, in one study of American data, Ijiri and Simon[51] reported: ''a firm that doubled its share of market . . . in the first 4 years could be expected, on the average, to increase its share of market by about 28 percent in the second 4-year period'' (p. 181). What are the reasons behind the ''regress'' phenomenon? What are the reasons behind the ''half-life'' phenomenon? Simon's[52] arguments stand on the notion of organizational evolution.[53]

In the evolutionary processes of natural selection, organizations survive and thrive based on their continuous abilities to innovate and adapt to changes; otherwise the momentary successes of firms (e.g., innovations of many different kinds) will be gradually being copied or phased out because of environmental changes. Modeling the evolution of organizations is a complex task. Simon[52] believed that three inextricably interwoven issues play significant roles in designing an organizational structure capable of adapting to the changing environment and gaining in ''fitness'' in the evolutionary process: *external* ''big questions'' of competition of products and markets, *internal* characteristics

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of the firm—''in terms of its human, organizational, physical, and financial resources—that constitute its comparative advantage,'' and *historical* background of the firm and ''what its history had made of it.'' The importance of the history of the firms in an evolutionary world can be seen in Simon's arguments: ''... human motives change over time, responding to experience and the surprises of history. Individuals do not form their preferences in isolation from other individuals, but in response to both public events and information that is widely broadcast. Theory must make room for tulip crazes, responses to oil shocks, or the unexpected rise of ethnicity.''[54] Thus, managing the *historical* background of the firm and ''what its history had made of it'' involve the efficient and effective management of the massive information[55] residing in the history of the firm.

DIGITAL NERVOUS SYSTEMS AND INFORMATION PRODUCTIVITY

In the following, we show that a framework can be developed to manage the massive information produced in the *historical* process of the firms, deal with the *internal* characteristics of the firm, and address the issue of *external* ''big questions'' of competition. This framework can be implemented by the digital nervous system (DNS), proposed by Bill Gates[56] in his 1999 best-seller book *Business @ the Speed of Thought*. In addition, we show how the Simon–Yule model can be used to increase the productivity in the DNS.

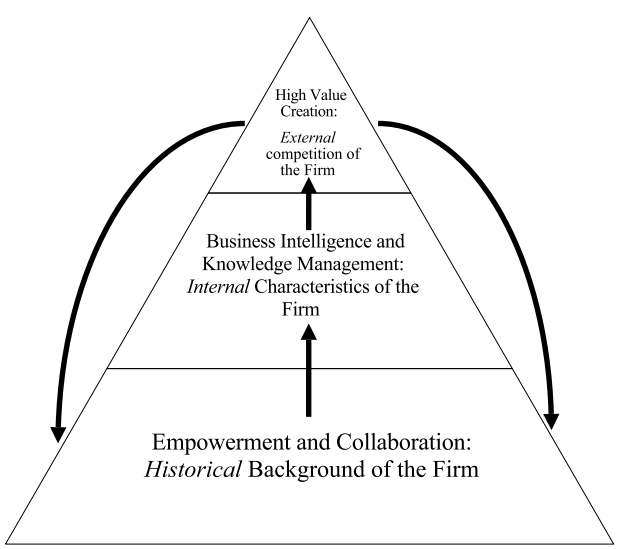

Fig. 1 Digital nervous systems and strategic growth of firms.

Digital Nervous Systems and Strategic Growth of Firms

According to Gates,[56] a DNS ''is the corporate, digital equivalent of the human nervous system, providing a well-integrated flow of information to the right part of the organization at the right time'' (pp. xvii–xviii). A DNS ''consists of the digital processes that enable a company to perceive and react to its environment, to sense competitor challenges and customer needs, and to organize timely responses,'' and it ''requires a combination of hardware and software; it is distinguished from a mere network of computers by the accuracy, immediacy, and richness of the information it brings to knowledge workers and the *insight* and *collaboration* made possible by the information.'' The development of a DNS goes through three phases: empowerment and collaboration phase, business intelligence and knowledge management phase, and high business value creation and implementation phase. Figure 1 shows the direct relationship between the three phases of DNS and the three aspects of strategic growth of firms by Simon:[52] external, internal, and historical. The up-going arrows indicate the feeding of information from the lower level to the upper level. The down-curing arrows indicate the feedback after the strategic value creation is implemented and executed.

The Simon–Yule Model in the Empowerment and Collaboration Phase

The first phase of building a DNS is the empowerment and collaboration phase. According to Gates,[56] in this phase ''knowledge workers receive PCs for productivity use, local area networks are installed to provide documents sharing on file servers and Web servers, and a single, back-end e-mail system is deployed to improve collaboration'' (p. 429). This phase corresponds to the *historical* background of the firm, since volumes of (numerical, textual, imaging, video, and other kinds of) data transactions are generated daily in the processes of using information technologies for empowerment and collaboration. As such, strategic questions of the firm such as ''what its history had made of it'' are buried in the historical data and needed to be analyzed to turn into valuable information for strategic decision making.

Many striking empirical regularities of system usage have been observed. For example, Zipf's law of word frequency[6] is one of the most cited empirical distributions for Web site activities.[42] Information productivity modeling in the empowerment and collaboration phase focuses more on the efficiency of the DNS, i.e., how to ''do things right'' by taking advantage of those striking empirical regularities of system usage. It has been

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shown[39,40] that the Simon–Yule model provides a robust dynamic model of Web user access patterns. Based on the historical data of Web server usage, they provide a method to estimate the parameters α and γ in the Simon–Yule model. Second, they show that the generation of document requests in the Web servers can be simulated quite accurately using the algorithms developed from the Simon–Yule model. Finally, the performance of leading Web cache policies can be analyzed and evaluated. The results from the simulation study show that the least weighted usage (LWU) removal policy has the best performance because of its ability to take both frequency and recency into consideration.

The Simon–Yule Model in the Business Intelligence and Knowledge Management Phase

The business intelligence and knowledge management phase of DNS building, according to Gates,[56] focuses on ''link existing business operations into knowledge management systems. Usually this is in the form of data warehousing that converts operational data into a form that it is easy to search and query to glean business intelligence'' (p. 429). This phase corresponds to the *internal* characteristics of the firm, since vital operational and resources issues (such as human, organizational, physical, and financial) are well understood through the instant reporting and knowledge management systems. As such, informed and collaborative actions, which constitute the firm's comparative advantage, can be effectively executed in real time.

Plenty of empirical regularities exist in this phase as well.[42] While the information productivity modeling in the previous phase focuses on the efficiency, the business intelligence and knowledge management phase focuses more on the effectiveness of the DNS, i.e., how to do the right things. Managers may take advantage of the empirical regularities exit in the process and focus on the ''vital few'' activities. Here are some examples. In building and using a data warehouse, it is recommended[38] that when determining *where* to start the data warehouse project, select a small project that has the most significant impacts and continue building on the success evolutionarily. In *data cleansing*, start with a small set of vital, high-quality data and continue cleansing and incorporating the rest of data evolutionarily. In *data aggregation*, use a hybrid online analytical processing (OLAP) technology that utilizes relational OLAP tools 80% of the time and multidimensional OLAP tools 20% of the time to make queries and reports. When analyzing the complexity of *user needs*, start with simple tools that can satisfy most of the user needs and only continue using dedicated tools for the rest when there are proven success. Finally, when *maintaining* user needs, start with many simple steps for users to achieve self-sufficiency.

An immediate question is, then, will the ''vital few'' group be stable over a period of time? How can these changes be monitored? Once again, the Simon–Yule model can be used to answer such questions. Recall the autoregressive growth assumption in the Simon–Yule model reviewed above. Instead of using the process of growth of firms, we use the process of text generation[42] for our description. That is, the probability for the jth word to be chosen in the $(k+1)$st selection is $P[y_j(k+1)=1] = \frac{1}{W_k}\sum_{\tau=1}^{k} y_j(\tau)\gamma^{k-\tau}$, where $W_k = \sum_{j=1}^{T}\sum_{\tau=1}^{k} y_j(\tau)\gamma^{k-\tau}$ and T is the total number of words used at the end of the kth selection. Since $y_j(k)$ represents the selection of the jth word during the kth selection and $y_j(k)$ is either unity or zero, then the *frequency*, or the total usage, of the jth word at the end of the kth selection is simply $\sum_{\tau=1}^{k} y_j(\tau)$. The parameter γ, on the other hand, is used to represent the *recency* of the jth word. That is, if γ is larger, then the most recent occurrences of the jth word have bigger impact on the probability for the jth word to be chosen in the $(k+1)$st selection. Thus, user access behaviors of frequency and recency are the real drivers in the Simon–Yule model. By incorporating the estimated parameters α and γ using the methodology shown in Ref. [39] the Simon–Yule model enables us to track the user behaviors of frequency and recency. That is, we are able to monitor and predict the changes of the vital few groups over time.

The Simon–Yule Model in the High Business Value Creation and Implementation Phase

According to Gates,[56] the high business value creation and implementation phase adds ''new back-end applications that connect to existing systems but that use the new common architecture. The goal is to select projects that achieve the greatest reward in the shortest period of time'' (p. 429). To achieve this goal, one needs to understand the competitive environment of the business. In his well-known book on competitive strategy, Porter[57] proposes a five-force model of business competition that includes bargaining power of buyers, bargaining power of suppliers, rivalry among existing competitors, threat of new entrants, and threat of substitute products or services. This phase corresponds to the *external* competition of the firm with respect to the competitive forces (such as those described by Porter) in the business environment.

Chen et al.[41] argue that Porter's five forces can be summarized to a strategy that includes reducing bargaining power of buyers through differentiating a product to avoid direct competition or building customer loyalty through having a product that is superior to other competitors, and pushing supplier's market toward pure

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competition by creating more direct competition from other suppliers or indirect competition from substitute goods. Using the Simon–Yule model, they show that theoretically the parameter α (i.e., probability of entry or barrier of entry) indeed is the primary factor in determining the market concentration. As such, one may consolidate the competitive decision criteria to just one: their effect on reducing the entry rate α. Patents, start-up costs, or availability of expertise, for instance, can all change the level of this entry barrier. Chen et al.[41] also argue that the primary benefit of the Internet, then, is for finding new suppliers and customers to reduce their bargaining power and increase the economies of scale.

While the probability of new entry α is the corner stone of the Simon–Yule model's first assumption, survival rate γ plays an important role in the second assumption. In addition to focusing on reducing the entry rate α, Chen et al.[41] show that while the theoretical maximum market concentration is determined by α, whether this maximum can be reached depends on what survival rate γ is. They suggest that ''rivalry among existing competitors'' and ''threat of substitute products'' are two forces that affect γ. Increase in any one of these forces will reduce the market concentration within the limit set up by the probability of new entry in the industry. In an industry where the survival rate is low, the smaller firms do have the opportunity to carve out a niche or wrestle a new technology to market without being completely ignored. They may use their new products or services to temporarily become a monopoly, and their products or services may serve as substitute products and take the market share away from established leaders quickly. Thus, it is necessary for the firm to continuously improve and market its products and services. However, the urgency depends on the competition within the industry that may in turn affect the survival rate.

Thus, information productivity modeling in the high business value creation and implementation phase focuses on the innovation of the DNS. Efforts should be placed on, e.g., developing new innovative back-end applications or connecting to existing systems. The goal is to either decrease the new entry rate α of the industry or increase the visibility of the firm under the industry survival rate γ.[58]

INFORMATION PRODUCTIVITY IN FRANCHISE ORGANIZATIONS: A CASE STUDY

In this section, we will show how to apply the Simon–Yule model to perform information productivity modeling on a DNS-based organization. Gates[56] writes: ''Information Technology and business are becoming inextricably interwoven. I don't think anybody can talk meaningfully about one without talking about the other'' (p. 6). Thus, building an effective DNS-based organization requires intimate knowledge of how an organization functions. The organization chosen for the discussion in this section is franchising, where the author has years of collective academic and consulting experiences in this industry.[59–73]

A Brief Overview of Franchising

According to Justis and Judd,[74] franchising is defined as ''a business opportunity by which the owner (producer or distributor) of a service or a trademarked product grants exclusive rights to an individual for the local distribution and/or sale of the service or product, and in return receives a payment or royalty and conformance to quality standards. The individual or business granting the business rights is called the *franchisor*, and the individual or business granted the right to operate in accordance with the chosen method to produce or sell the product or service is called the *franchisee*.'' Franchising may be used to transfer technology and import entrepreneurial activity into developing economies and emerging markets, and it has been used as an electronic commerce growth strategy in the global market such as China.[63,67,71,72] Both traditional retailing and Internet technology companies have used this strategy of ''marriage'' between electronic commerce and franchising.[63,64] The franchise business functions and processes supported by each of the three phases of DNS are described below.

Empowerment and Collaboration Phase in Franchising

We need to consider the three important entities—franchisor headquarter, franchisee unit, and franchise community—during this implementation of the empowerment and collaboration phase. Unlike other large businesses, a franchisor headquarter is typically small. Operations in the franchisor headquarter consist of four major activities:[65] helping and supporting business units, marketing and advertising to prospective franchisees for franchise development, managing people who perform franchise support and franchise development, and dealing with financial issues such as accounting and finances. A franchisee unit is a small business highly dependent on its franchisor. Operations in the franchisee unit must include four crucial activities:[65] making sales to customers, managing people who make sales to the customers, marketing and advertising to customers, and dealing with financial issues such as accounting and finances. In a franchise community there are three interrelated groups of relationships, relying on the support of the first phase of

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the DNS:[62] relationship management within the franchise system; relationship with consumers, including customers, investors, competitors, media, and government; and relationship with suppliers, including the International Franchise Association (IFA), law firms, cobranding partners, goods distributors, real estate agents, information system consultants, accounting firms, and marketing agents.

Business Intelligence and Knowledge Management Phase in Franchising

The empowerment and collaboration phase creates systems to allow a franchise system to generate volumes of data every day. The data are collected and then analyzed in the business intelligence and knowledge management phase. For example, each business transaction, billing, customer tracking, and inventory control process creates enormous amount of data. At the end of the day, a report is sent through the communication system to the franchisor headquarter to summarize daily business transactions such as total sale, total cost of raw materials, and total cost of labor. If the report is not received after a predetermined time, a message is triggered to request prompt actions by the franchisee. Once the daily sale reports are received from all the business units, they are converted into information using a variety of analytical methods such as statistical data modeling including regression analysis, correlation analysis, time series analysis, forecasting, Pareto analysis, and quality assurance, or data mining[59,60] modeling including decision tree analysis, cluster analysis, market segmentation analysis, cross-sell analysis, and association analysis. These statistical data analyses also help generate many business intelligence reports. The information contained in the daily business intelligence reports becomes the foundation upon which the working knowledge management of the franchise system may be built. A typical franchise system usually includes site profiles, personality profiles, and customer/product profiles.[64]

Information technologies used in the first two phases of DNS building can help franchise businesses increase efficiency and productivity, but unfortunately these technologies are too expensive and complicated to implement for most franchise companies, especially smaller ones. One alternative is to have applications delivered by an application service provider (ASP) on a subscription basis instead of purchasing. The concept of subscribing information technologies through ASPs has special appeal in the franchising industry[69] because an ASP can duplicate success for other similar franchises quickly and economically. There are three key words: *applications*, *services*, and *providers* in ASP company shopping. Corresponding to these three key words are these three steps:[69] develop an overall vision of the applications needed for the company; determine what applications and the specific services you want an ASP to host; and evaluate ASP providers. Information productivity modeling becomes even more important for ASPs because they will have to serve their clients with similar issues of information productivity.

In these two phases, usage pattern analysis (thus the Simon–Yule model) may be used to determine whether ASP is feasible. For example, the ''operation'' side of information needs in general is more structured, thus suitable for ASP or other automations. The strategic side of the business functions is less structured, and it may be more suitable to use human experts. The efficiency can thus be improved in the first phase. On the other hand, when the decisions are analyzed, the goals of the company can be identified and the resulting system will become more effective in the second phase. The α and γ, once determined, may be used to decide the balance between the efficiency and the flexibility a system needs to be. For example, with a high α (i.e., less structured) a company may focus on developing more ad hoc solutions rather than a comprehensive program. With low γ (i.e., short service life) a company will have to devote more resources to update application programs and to remove unused programs to reduce confusion.

High Business Value Creation and Implementation Phase in Franchising

In terms of the Simon–Yule model, the strategy for the high business value creation and implementation phase of DNS is to decrease the new entry rate α of the industry while increasing the survival rate γ. At the heart of a successful franchise system, especially large ones, is to leverage and market the working knowledge behind the successful brand name of the business.[62] The new products or services coming out of the process of leveraging the working knowledge may transform the franchise business into a more profitable enterprise. For example, according to the founder of McDonald's, Ray Kroc, McDonald's real estate business, Franchise Realty Corporation, became the real moneymaking engine:[75] ''McDonald's made its money on real estate and on a little-known formula developed by Harry J. Sonneborn .... Harry alone put in the policy that salvaged this company and made it a big-leaguer. His idea is what made McDonald's rich'' (pp. 152–153).

The strategy of leveraging and marketing the working knowledge is no doubt crucial to increase the survival rate γ of the franchise firm. For decreasing the new entry rate α of the industry, a franchise may try to increase the size through vertical or horizontal merging and acquiring other franchises. That is, the size of the franchise (and the

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resulting economies of scale and increased expertise) becomes a barrier for new entrants. If merger and acquisition is used as a competitive strategy, a merger-and-acquisition DNS shall be developed to add high business value to the company.

CONCLUSION

Strategic decision making, in the words of Herbert Simon[52]—Nobel laureate in Economics in 1978—is ''a chapter in the topic of decision making under uncertainty—in fact, massive and unending uncertainty.'' In the rapidly changing digital economy, the cycle of winning and losing and asset redistribution intensifies as the speed of information exchange increases. As a result, the sizes and performances of business firms increasingly resemble skew distributions. That is, a few businesses, such as eBay and Amazon, dominate the market, while a large number of smaller companies struggle to survive. The study of strategic growth of firms is indeed within the framework of decision making under ''massive and unending uncertainty.'' It is thus more necessary than ever to find explanatory theories to describe, model, and predict the emerging market structures of the hypercompetitive digital economy.

Drawing upon the comprehensive work on Information Productivity Modeling[32,33] and its application in electronic commerce[42] by Chen and his colleagues, the paper reported how the Simon–Yule model can be used to model the strategic growth of firms in the digital economy. The DNS proposed by Bill Gates[56] was used as the framework for our discussions. Specifically, we showed how the Simon–Yule model can be used to increase efficiency of organizing *historical* background of the firm in the empowerment and collaboration phase of DNS, effectiveness of *internal* characteristics of the firm in the business intelligence and knowledge management phase, and innovation of the *external* competition of the firm in the high business value creation and implementation phase. We also demonstrated how franchise organizations can increase their efficiency, effectiveness, and innovation by using the Simon–Yule Model of the information productivity in their DNS development.

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Institutional Repositories

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INTRODUCTION AND DEFINITION

In a general sense, an ''institutional repository'' can mean many things. A library, an archive, a museum, or even a warehouse that stores for use and safekeeping an organization's records or artifacts falls under the broad definition of an institutional repository. In recent years, however, an institutional repository has taken on a more specific, new, but still evolving, meaning that refers to the storage and preservation of an organization's digital information or knowledge assets. As more and more information is created in digital formats at the individual, desktop level, institutions are beginning to turn their attention to how to identify and manage for long-term use, and for the common good of the organization or a larger public, important digital assets. In 2002, the Massachusetts Institute of Technology (MIT), in collaboration with the Hewlett-Packard Corporation launched, Dspace, which is a highly publicized, open-source, institutional repository system, and The Scholarly Publishing and Academic Resources Coalition (SPARC) issued ''The Case for Institutional Repositories: A SPARC Position Paper.'' These events put institutional repositories in the spotlight as an interesting new development in librarianship and information management.

Although institutional repositories are still evolving and taking on differing manifestations in specific institutions, they can be defined in general as systems and service models designed to collect, organize, store, share, and preserve an institution's digital information or knowledge assets worthy of such investment. This may, of course, sound very much like a library, and in many cases an institution's library should and is taking responsibility for developing and operating such a digital repository. But while the mission of an institutional repository coincides nicely with that of a library, the technical infrastructure and the types of material collected in such a repository present new challenges and extended responsibilities for the traditional library.

GENESIS OF INSTITUTIONAL REPOSITORIES

Repositories, in their broadest sense, have existed ever since humans began collecting and storing important information and artifacts for safekeeping and long-term use. The long and rich history of libraries, museums, and archives provides the foundation for any type of repository program, but two contemporary developments in particular have helped shape the nature of today's institutional repositories: 1) the emerging knowledge management movement; and 2) the maturing, but still rapidly advancing, technology of content or asset management in the digital information system.

Knowledge Management Movement

In 1988, Peter Drucker[3] published an influential paper entitled ''The Coming of the New Organization'' in the *Harvard Business Review*. In this paper, Drucker argued that for the modern organization, knowledge had become its most important asset, and that those organizations best able to manage and exploit their corporate knowledge assets would be the most successful in the marketplace. Drucker did not explain in any detail what he meant by ''knowledge,'' but he was clear that knowledge manifested itself in many forms in the organization, ranging from patents and trade secrets, to operational routines, to the expertise inside the heads of employees. Subsequent books, articles, and conferences by researchers in the multidisciplinary fields of information science and business management have elaborated on Drucker's ideas about the importance of knowledge management in the organization. These researchers have pursued the meaning and implications of knowledge as it is differentiated from data and information, and they have developed models, conceptual structures, and best practices for managing knowledge in the modern organization.[4]

Repositories, and that is the name commonly used in the knowledge management field, play an important, but supporting, role in a knowledge management system. Davenport and Prusak, for example, in their 1998 book *Working Knowledge: How Organizations Manage What They Know*, list ''knowledge repositories'' first in their review of knowledge management projects in practice. They claim to have ''come across three basic types of knowledge repositories:

1. *External knowledge* repositories (example: competitive intelligence);

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2. *Structured internal knowledge* repositories (example: research reports, production-oriented marketing materials and methods);
3. *Informal internal knowledge* repositories (example: discussion databases full of know-how, sometimes referred to as 'lessons learned').''[5]

While a definite part of a knowledge management system, repositories play a supporting role, for as Davenport and Prusak point out, they tend to treat knowledge as an ''it,'' while in reality knowledge is ''a fluid mix of framed experience, values, contextual information, and expert insight that provides a framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations, it often becomes embedded not only in documents or repositories but also in organizational routines, processes, practices, and norms.''[5]

The knowledge management movement of the 1990s influenced the development of institutional repositories in a number of significant ways in addition to establishing the nomenclature. Management consultants and senior administrators endorsed the movement's emphasis on the competitive value to an organization of paying attention to its knowledge assets. And the movement's broad view of knowledge as diverse and dynamic made the identification, capture, and management of knowledge assets much more complex and challenging. Books, articles, or any types of published documents were viewed as only one obvious manifestation in a wide range of explicit and tacit knowledge assets that needed to be managed in an organization.

Maturing Digital Asset Management (DAM) Technology

By the year 2000, several broad technological developments in the digital information system were also pushing individuals and their organizations toward the creation of institutional repositories. First, it was becoming easier for individuals or small groups to create and to disseminate digital assets through the use of microcomputer desktop tools and computer networking. At a university, for instance, it would not be uncommon by 2000 to find faculty members or small disciplinary centers around campus creating digital text documents, digital multimedia, web sites, or on-line courses. While the highly decentralized and distributed nature of microcomputer desktop publishing was empowering to the individual, it presented some managerial or stewardship challenges for organizations interested in coordinating, sharing, and preserving its units' or employees' digital assets. Clifford Lynch, for example, in his 2003 report, *Institutional Repositories: Essential Infrastructure for Scholarship in the Digital Age*, pointed out that important desktop digital content in an uncoordinated technical system was at serious risk, because ''faculty are generally not capable of responding to the endless series of security exposures and patches,'' and as a result, ''our university networks are riddled with vulnerable faculty machines intended to serve as points of distribution for scholarly works.''[6] How could this growing amount of decentralized, diverse, and vulnerable digital knowledge assets be identified, collected, shared, and preserved by the organization?

As this desire for institutional stewardship of digital assets has grown, the technology and standards needed to create digital repositories have matured to the point of advanced experimentation, and to some extent, acceptance and adoption. Technology companies and nonprofit groups have developed and are actively marketing digital asset management (DAM) systems or components of such systems, protocols, and standards that enable an organization or institution to create a technical infrastructure to store, manage, share, and preserve a variety of digital content. Some of the important new developments in the technology of digital content management include:

- The Open Archival Information System (OAIS) model developed by an international group of information technology organizations spearheaded by NASA's Consultative Committee for Space Data Systems, which offers ''a comprehensive logical model describing all the functions required in a digital repository.''[7]
- The Open Archives Initiative from the library and scientific community, which has developed an Open Archives Metadata Harvesting Protocol (OAI-PMH) that defines a mechanism for harvesting XML-formatted metadata from repositories.[8]
- A Metadata Encoding and Transmission Standard (METS) developed under the sponsorship of the Digital Library Federation, which provides a schema for encoding descriptive, administrative, and structured metadata in a digital repository or library.[9]
- Shareable Courseware Object Reference Model (SCRORM) developed by the federal government agency Advanced Distributed Learning to provide guidance for the preparation and storage of digital educational material so that such material is ''reusable, accessible, interoperable, and durable.''[10]
- Publishing Requirements for Industry Standard Metadata (PRISM), a schema under development by the publishing industry to create a common language for the metadata that describes published digital assets.[11]
- Open source and proprietary software systems such as Dspace, ePrints, FEDORA, bepress, Documentum, CONTENTdm, IBM's Content Management, and Artesia's TEAMS that offer technical infrastructure

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options for implementing all or part of an institutional repository.[12–19]

Institutional Stewardship and the Culture of Sharing

While the proliferation of digital assets and the maturing of digital asset management systems were pushing toward and making possible the creation of digital repositories, the jurisdictional boundaries for such repositories remain open to a range of organizational options. In fact, a digital repository can be owned and managed by an individual, a small group, an institution or commercial organization, a consortium of organizations, or a government entity. A digital repository can be defined by its jurisdictional scope but also by the type of assets it collects. Disciplinary repositories focus on the collection of digital assets in a subject area, e.g., arXiv, which collects e-prints from around the world in the fields of physics, mathematics, nonlinear science, and computer science.[20] Institutional repositories organize themselves along organizational or political jurisdictional lines, and they collect and manage digital assets in a variety of formats and subjects for the constituents within that jurisdiction. MIT's Dspace[1] is an example of an institutional repository, for its mission is to collect in digital form the intellectual output of the MIT faculty.

Does an institution provide a logical or effective framework for a digital repository? Someone like Peter Drucker, of course, would see competitive value in a commercial organization's careful control over the sharing and restricting of its knowledge assets. Employees will be more productive if they can identify, share, and pass on expertise within an organization; and, in turn, the commercial organization through centralization or careful coordination can better control the flow of its knowledge to outside competitors and consumers. In the nonprofit and public sectors, however, ownership and control of information within the organization are usually more diffuse. In higher education in the United States, e.g., certain types of technical research and knowledge are tightly controlled by the institution through patent, trademark, and invention policies; while creative work, which usually takes the form of books, articles, or course material, remains largely unregulated, at least for the time being.[21] If students and faculty in an academic setting are ''free agents'' rather than ''workers for hire'' when it comes to the ownership and control of their creative work, will they deposit their digital assets in an institutional repository?

Academic administrators and librarians appear motivated to create institutional repositories for two primary reasons: improving access to and preservation of unpublished digital assets, and reforming the scholarly publishing system. The Council on Library and Information Resources 2003 report *New-Model Scholarship: How Will It Survive* by Abby Smith[22] is an excellent summation of ''the growing problem of digital stewardship'' in the academy. Smith describes and characterizes the growth of new digital scholarship in the academy but worries about its ephemeral nature. Will these new, digital models of scholarship—''digital objects that are created outside the library and seldom developed expressly for publication,''[22]—be available for long-term use? Smith finds a small but growing number of universities, academic disciplines, publishers, and government or nonprofit agencies trying to address this preservation and access challenge through the deployment of digital repositories. Raym Crow[2] the author of the SPARC paper[2] on *The Case for Institutional Repositories*, believes the rational for creating institutional repositories centers on an interest in a ''new scholarly publishing paradigm'' and on ''institutional visibility and prestige.'' While Smith identifies preservation and access as basic, altruistic reasons for creating digital repositories, Crow emphasizes the more self-interested motivations of a creator or an institution gaining control of its digital content assets for reasons of economics and prestige. As librarians find it increasingly difficult to buy back the output of faculty who have given it to publishers, why not create new, less expensive venues for sharing scholarship through institutional repositories and open access? Academic institutions and their faculty are the wellsprings of much new knowledge, and these same institutions can do more to collect, share, and preserve this knowledge at its very source through institutional repositories.

In the end, institutional repositories in the academic setting are likely to succeed only if there are shared values and motivations among administrators, faculty, and students. Certainly, many creators of digital assets would appreciate an institution's assistance with the long-term management of these assets if they could trust the institution to protect and honor their property and privacy rights. As a broad social goal, faculty and academic institutions both value the creation and dissemination of new knowledge and the preservation of this knowledge for future generations. If an institutional repository can be shown to advance these values, it might become the common ground for the safekeeping and sharing of digital knowledge assets. But it will be a challenge. David Blair in his review article, ''Knowledge Management: Hype, Hope, or Help?'' makes an important observation about the critical role that a ''culture of sharing'' plays in a successful knowledge management program. According to Blair,[4] ''the kind of culture of an organization can be an important factor influencing whether it encourages the sharing of knowledge between employees or inhibits it.

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Organizations that have a culture of being very competitive internally, with employees competing against each other for customer and projects, will have a great deal of trouble convincing expert employees to pass their expertise/knowledge on to those who are less knowledgeable.'' The culture of academic institutions is complex, with cooperative as well as competitive elements. Faculty and students will have, and will choose from, a range of options in managing their digital assets: keeping them close to home on individual computers or departmental servers, depositing them in institutional repositories, or turning to disciplinary repositories or publishers in their fields of interest.

CONCEPTIONAL MODEL AND STANDARDS FOR A DIGITAL REPOSITORY

The Open Archival Information System (OAIS) Reference Model

For an overview of the requirements, components, and functions of a digital repository, it is useful to review the *Reference Model for an Open Archival Information System (OAIS)*,[23] which provides a ''conceptual framework for an archival system dedicated to preserving and maintaining access to digital information over the long run.'' The OAIS reference model, which is a 148-page document published in January of 2002, became an ISO standard in 2003 (ISO 14721: 2003).[24,25] The model can really apply to any type of archive—physical or digital, institutional or disciplinary—and delineates the general environment, the characteristics of information, and the basic functional arrangements and responsibilities of an archive or repository.

At its most abstract level, as seen in Fig. 1, the environment around an archive or repository has three basic players: producer, management, and consumer.

The assets or ''information objects'' that go into an archive or repository can be deconstructed into different types of information, such as content information or

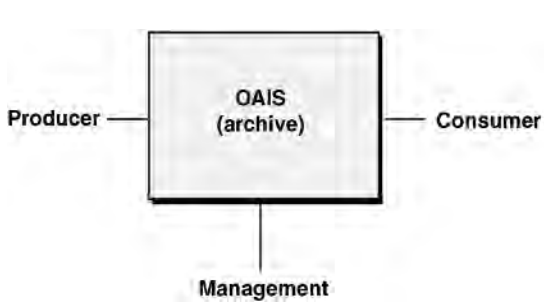

Fig. 1 OAIS environment. (*View this art in color at www.dekker.com.*)

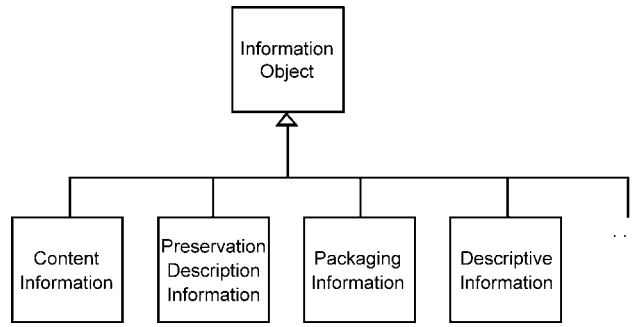

Fig. 2 Information object in OAIS model.

metadata information, which can take the form of preservation description information, packaging information, and descriptive information, as illustrated in Fig. 2.

An archive or repository has six basic functional activities or responsibilities, as illustrated in Fig. 3: ingest, archival storage, data management, access, administration, and preservation planning.

In the OAIS functional model, the producer prepares a submission information package (SIP), which has content and metadata information. The repository ingests the SIP and generates an archival information package (AIP), which complies with the archive's data formatting and documentation standards, and extracts descriptive information from the AIP for inclusion in the Data Management function. Archival Storage provides services and functions for the storage, maintenance and retrieval of AIPs; while Data Management maintains descriptive information that identifies archive holdings and administrative data used to manage the repository. Access is the function that allows consumers to learn what is in the repository and request and receive a Dissemination Information Package (DIP) from the repository. Administration and Preservation Planning are high-level responsibilities of the management of the repository, ensuring overall operation of the repository system and ongoing preservation of content accessibility for the consumer even if the original information format or computing environment becomes obsolete.

The need to manage digital assets for long-term use is one of the driving forces behind the establishment of institutional repositories, and the OAIS reference model provides a strategy for accomplishing this challenging responsibility in the highly changeable computer technology environment. The Preservation Planning function in the OAIS reference model is based on information structures and on digital migration strategies. First and foremost, metadata information about a digital asset that is essential for preservation must be captured and stored in a standard manner. The Archival Information Package (AIP) in the OAIS reference model contains both content

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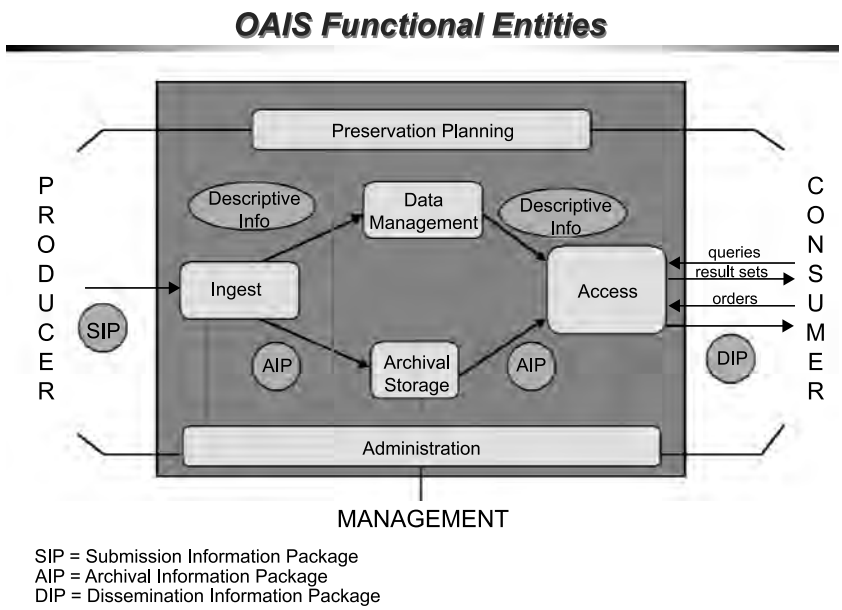

Fig. 3 OAIS functional model. (*View this art in color at www.dekker.com.*)

information and preservation description information, as illustrated in Fig. 4.

Preservation Description Information (PDI) can be broken down into its components of reference information, provenance information, context information, and fixity information, as illustrated in Fig. 5.

With this preservation information available to the management of a repository, a digital technology migration strategy can be employed when factors such as media decay or software evolution dictate a need for change. Digital migration can take the form of refreshment, replication, repackaging, or transformation, all of which are defined in the OAIS reference model. While the OAIS reference model structure and strategy for digital preservation provides a reassuring guideline or standard, it will take fortitude and resources from the management of the repository to carry out this preservation responsibility over time.

The Open Access Movement and the Open Archive Initiative

The word ''open'' has become quite popular in the computing and academic communities. There is the Open Archival Information System (OAIS) Reference Model discussed above; there are the Open Access Movement and Open Access Initiative (OAI) discussed below; and there are several important other ''opens'' such as the Open Knowledge Initiative (OKI)[26] in course management software and the Open Source Initiative (OSI)[27] in computer code and programming. All these ''opens'' can

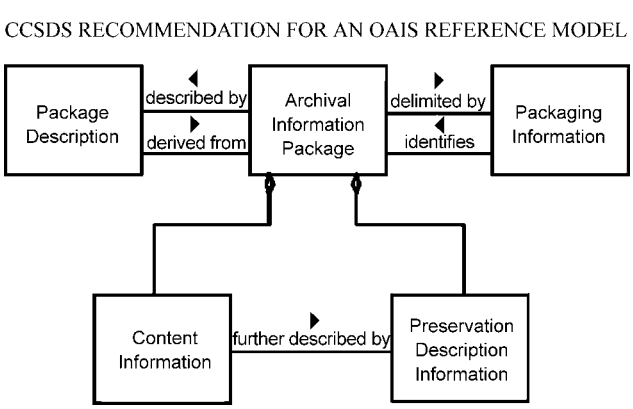

Fig. 4 OAIS archival information package.

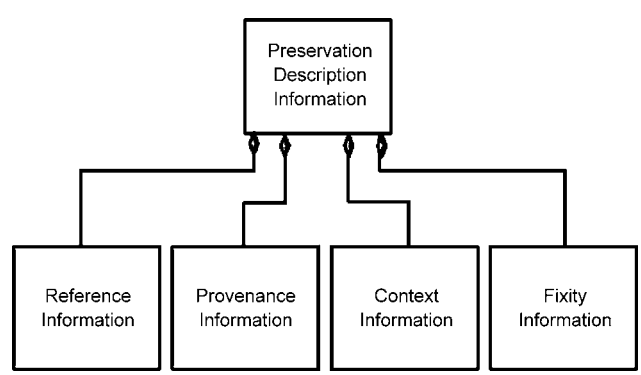

Fig. 5 OAIS preservation description information.

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be confusing, for they are not all the same thing in purpose or scope. Some are broad, general movements or social positions, while others are more specific technical standards or models. However, they all use ''open'' to connote an approach that fosters the free exchange of information, whether that be in the development of software codes or standards, or in the actual sharing of content in digital repositories. The culture of the Internet and the World Wide Web, where one finds common, public protocols underlying a system that provides mostly free access to digital information and services (e.g., the Internet Archive's motto is ''universal access to all human knowledge''[28]), has an ''open'' philosophical base to it, and this ''open'' approach is clearing influencing the development of institutional repositories in their software systems as well as in their approaches to sharing metadata and content information.

The general Open Access movement and the more specific technical protocol activity called The Open Archive Initiative (OAI)—not to be confused with OAIS, which is a reference model for the design of a digital repository—grew out of the scientific and library communities' experience with disciplinary e-print archives or repositories.[29] The most prominent example of such a disciplinary e-print repository is arXiv, which was begun in 1991 by Paul Ginsparg at the Los Alamos National Laboratory and is now hosted at Cornell University.[20] Today, arXiv, as a disciplinary, open, digital repository, manages 230,000 papers with abstracts and citations in fields of physics, mathematics, nonlinear science, and computer science. The success of arXiv and a few other disciplinary e-print archives as an innovative collection and dissemination approach to digital scholarly communications has generated a growing international interest in the ''open access'' model, where scholarly publications housed in repositories are made freely available to the public over the Internet. Both the Budapest Open Access Initiative[30] and the Public Library of Science[31] are efforts by scientists to make their literature more openly accessible to the public through the use of national, institutional, or disciplinary repositories that share their content freely over the Internet.

The Open Archives Initiative (OAI) is an information and library science group supported by the Digital Library Federation, the Coalition for Networked Information, and the National Science Foundation to develop and promote interoperability standards that ''facilitate the efficient dissemination of content'' in digital repositories. The group, led by Carl Lagoze from Cornell University and Herbert Van de Sompel from the Los Alamos National Laboratory, has formulated and is promoting an Open Archives Metadata Harvesting Protocol (OAI-PMH) that provides guidance on a common format for metadata in digital repositories.[32,33] The Protocol guides repository data providers on how to structure and format their metadata in a manner that allows service providers to harvest the metadata for centralized search and discovery services. The OAI-PMH protocol facilitates open, union access to at least the descriptive metadata in multiple repositories, exposing pointers to the content in these repositories. Depending on the rights management policies and procedures of the individual repositories, content can then be shared or restricted.

Steven Hitchcock from Southampton University has prepared a report entitled *Metalist of Open Access E-Print Archives: the Genesis of Institutional Archives and Independent Services*.[34] Hitchcock's primary interest in this report is to identify and describe open access archives or repositories, particularly those containing digital full-text papers that have been self-archived by their authors, but he admits that it is difficult to quantify the growth and number of digital archives or repositories even of this type. There are growing numbers of institutional archives or repositories as well as subject-based, disciplinary archives. Material in open access disciplinary repositories tend to be preprints or e-prints of scholarly articles and technical reports, while institutional repositories are more eclectic with assets drawn from the institution's diverse teaching and research output. Hitchcock questions how likely it will be for the public to search an individual institutional repository's holdings, and he believes the harvesting and central search services that the OAI protocol can enable will more effectively expose the content of institutional repositories. In describing institutional archives or repositories, Hitchcock refers to lists of institutional repositories maintained by SPARC and by Signal Hill, and he points to the University of California's eScholarship Repository, Caltech's Collection of Open Digital Archives (CODA), and the Department of Energy's Information Bridge as representative examples of institutional repositories.

BASIC COMPONENTS OF AN INSTITUTIONAL REPOSITORY

Technology Platform

The Open Archival Information System (OAIS) Reference Model and the Open Archives Metadata Harvesting Protocol (OAI-PMH) discussed above, along with the Metadata Encoding and Transmission Standard (METS) and other metadata schema, basically offer abstract models, guidance, and standards on the technical architectural issues in building a digital assets management system and in insuring its interoperability with other systems. In practice, there are now a number of digital

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asset management (DAM) systems on the market and in operation in corporations, government agencies, and higher education institutions. These digital asset management systems fall into two basic categories: commercial, turnkey systems such as those offered by Documentum, Artesia, IBM, and the Berkeley Electronic Press; and nonprofit, open-source systems such as Dspace developed by MIT and Hewlett-Packard, ePrints from the University of Southampton, and FEDORA now under development by the University of Virginia and Cornell University.

The digital asset management (DAM) systems industry is still in its infancy, but there are optimistic forecasts for its growth—according to one forecast, the industry will grow from a $200 million market level in 2003 to a $3.5 billion level by 2009—as private sector organizations such as broadcast agencies, multimedia publishers, and advertising houses as well as public sector institutions in government, health care, and education embrace DAM systems.[35,36] A growing number of higher education institutions and agencies are adopting, or at least experimenting with, digital asset management systems that can provide a technology platform for their institutional repository needs. The University of California system is using bepress from the Berkeley Electronic Press for its eScholarhip repository program. The California Institute of Technology and more than 50 other educational agencies are employing ePrints software in their digital repository programs. Washington State University is using CONTENTdm to manage its growing collection of digital maps, historical photographs, texts, and videos. Stanford University is deploying Artesia Technologies' TEAMS system in its repository program; while OhioLINK, the statewide consortium of academic libraries in Ohio, has built its Digital Media Center repository for multimedia digital assets on the Documentum platform. MIT, in partnership with Hewlett-Packard, has developed and released its open-source, institutional repository system called Dspace, which stands for ''Durable Digital Depository,'' and is now testing a federated implementation of this platform with six other universities: Columbia, Cornell, Ohio State, and the Universities of Rochester, Toronto, and Washington. The University of Michigan is currently reviewing the field of DAM systems options for an enterprise-wide solution and has prepared a request for proposals from DAM system vendors.[37]

In this expanding and competitive market for digital asset management systems, institutions will have to choose among a variety of proprietary and open-source options. Many of these technical platform options are still in development, and all of them will have to continually expand and upgrade their capabilities to remain competitive. As one might expect, each digital asset management system (just as in the integrated library system platform arena) has its advocates and critics, its strengths and shortcomings in handling various types of digital content, and its range of costs. While open-source options such as Dspace and ePrints may have free or low entry prices, ongoing local development and support requirements for this type of system must be factored in when comparing

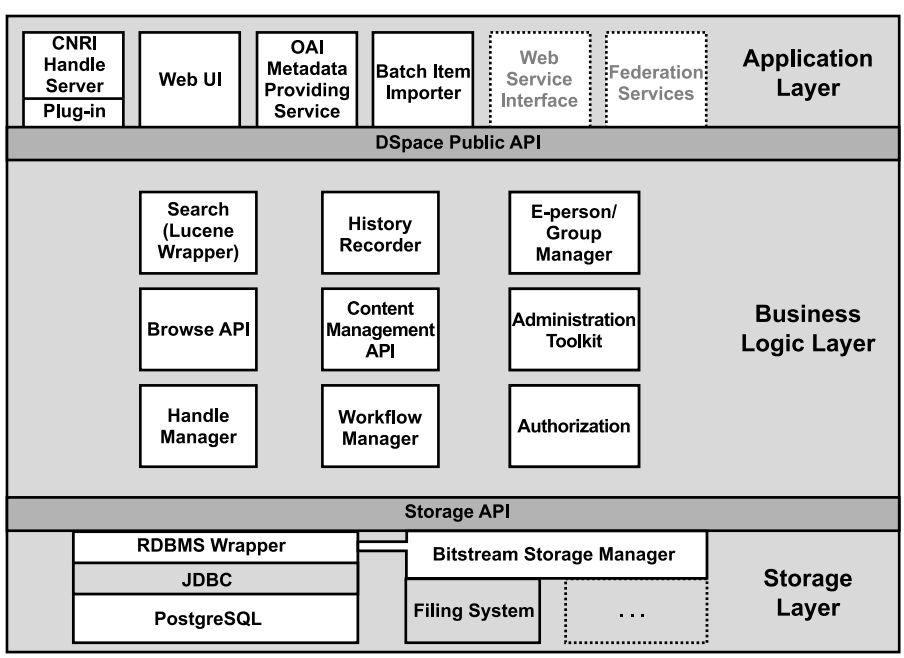

Fig. 6 Dspace technical architecture.

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longer-term costs to those of commercial, turnkey system options. Interoperability and extensibility—a system's ability to interface with other systems as well as its ability to expand and add new components—are also important factors in evaluating the merits of a digital asset management system. The OAIS reference model and interoperability standards and protocols provide helpful guides to evaluating the functionality, interoperability, and extensibility strengths and weaknesses of various DAM systems.

Whether or not institutions adopt MIT and Hewlett-Packard's Dspace for their digital asset management system software, this private university and computer company deserve credit for openly sharing the development of their institutional repository program. Not only is the software of this system open source and freely downloadable, but the policies, procedures, and business plans for MIT's institutional repository are all carefully documented and open to public scrutiny at the Dspace web site. Anyone interested in institutional repositories can gain insight into all aspects of such a program by studying the Dspace documentation and literature. Its technical architecture, for example, which is built on three basic layers of application, business logic, and storage, as illustrated in Fig. 6, is explained in open detail at their web site and in published articles.[38]

Service Model

The technology platform is, of course, an essential component—and its capability a driving force in the establishment—of an institutional repository, but it may prove over time the least expensive and least complicated component. As DAM system technology matures and as digital storage cost decline, service activities and organization surrounding and supporting an institutional repository may turn out, over the long-term, to be the more expensive and challenging aspects of such a program. A service model for an institutional repository will have to include some or all of the following activities:

- assistance with digital asset creation and submission,
- metadata preparation, or training and guidance in metadata preparation,
- intellectual property rights management,
- preservation management,
- assistance with content access and use,
- marketing.

An institutional repository should be an integral part of a larger knowledge management or information services program of an institution. The repository itself simply stores and provides capabilities for preserving and sharing digital assets. To be successful, individuals in the institution must understand the purpose and benefits of the repository, willingly submit digital assets to the repository, and finally, make full use of the assets in the repository in their work. Using the terminology of the OAIS reference model, management must make the institutional repository program understandable to producers and consumers through marketing and training, and easy to use through efficient, streamlined, and highly automated or personalized services.

At the Ohio State University, for example, the Knowledge Bank project places its institutional repository in the larger context of a multifaceted knowledge management program.[39,40] The university library's traditional focus on collecting, storing, and preserving published scholarly material is related and extended to new responsibilities for handling unpublished digital assets such as working papers, research databases, and multimedia course material. Administrative and academic computing's responsibilities for data warehousing, teaching technology, and course management systems also are related to the institutional repository through the Knowledge Bank project. And other knowledge management activities such as the development of expertise directories and information policies for rights and privacy are viewed as related parts of an overall knowledge management program. Figure 7, from the Ohio State University's Knowledge Bank project, provides a listing of the components of this knowledge management program and establishes a context for an institutional repository as an integral—not isolated—function within an institution's information service environment.

In designing the service model for an institutional repository, management (again using the terminology of the OAIS reference model) will have to decide how much assistance it wants and can afford to provide producers and consumers. Up-front services to producers might

Digital Knowledge Bank at OSU

- **Online Published Material**
  - E-books, e-journals, government documents, handbooks
- **Online Reference Tools**
  - Catalogs, indexes, dictionaries, encyclopedias, directories
- **Online Information Services**
  - Scholar's portal, alumni portal, chat reference, online tutorials, e-reserves, e-course packs, technology help center
- **Electronic Records Management**
- **Administrative Data Warehouse**
- **Digital Publishing Assistance**
  - Pre-print services
  - E-books, e-journal support
  - Web site development and maintenance
- **Faculty Research Directory**
- **Digital Institutional Repository**
  - Digital special collections
  - Rich media (multimedia)
  - Data sets and files
  - Theses/dissertations
  - Faculty publications, pre-publications, working papers
  - Educational materials
    - Learning objects
    - Course reserves/E-course pack materials
    - Course Web sites
- **University Information Policies**
- **Research/Development in Digital Information Services**
  - User needs studies
  - Applying best practice
  - Assistance with Technology Transfer

Fig. 7 OSU knowledge bank project components.

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include multimedia production and design assistance, digitization, and metadata training and preparation. Or management could decide that self-archiving, the use of templates, and automated services that place preparation and submission responsibilities almost entirely in the hands of the producer are more scaleable and economical ways to design front-end services. Metadata preparation and conformance to metadata standards play a critical role in a digital repository, because they underpin the search and discovery, interoperability, as well as the preservation capabilities of a digital repository. Whether the producer or management takes responsibility for metadata preparation and compliance, this front-end service function demands careful attention in any institutional repository program.

On the back-end, management will have to decide how much access availability and service assistance it will provide consumers of an institutional repository. What search and discovery tools will management provide for consumers and will there be training in the use of these tools? Will metadata and content in the repository be exposed and accessible to general or specialized search services? Will there be reference assistance to help consumers make effective use of the knowledge assets in the institutional repository? Critical to access services for the consumer are the preservation and rights management responsibilities of management in an institutional repository program. Management must carry out proper backup, disaster preparedness, and timely migration strategies in the institutional repository to ensure long-term access to assets by consumers. And finally, consumers should have access only to assets they are authorized to see and use. In a full-service institutional repository, rights management will extend the gamut of access control, from private assets only available to the producer, to assets restricted to certain groups or types of consumers, to complete open access to the public domain.

In establishing an institutional repository in an academic setting, the greatest initial service challenge is likely to be inducing faculty or student engagement and participation. In a corporate setting, management may require that all employees deposit their appropriate digital assets in the organization's repository, but in an academic setting where power and control are diffuse and where faculty and student are treated as free agents, at least when it comes to creative work, convincing producers to contribute their work to an academic institutional repository becomes a significant marketing challenge. One approach to this marketing challenge—one used in the Ohio State University Knowledge Bank project—is for management to conduct an inventory of current digital information projects on campus and then to discuss with identified producers their needs and the capabilities of the repository program to store, preserve, and share their assets. Such identification of early adopters of digital technology, assessing their needs, and involving them in the design of repository services and policies can only strengthen an institutional repository's viability. Another service and marketing strategy to reach producers and consumers is to identify, design services, and market to ''communities of practice,'' a concept taken from the knowledge management field. Most knowledge work is performed neither in isolation nor in big, impersonal institutional settings, but rather in smaller, more focused, communities of practice where producers and consumers share some common interest in a subject or activity. In both the eScholarhip project in the University of California system and in Dspace at MIT, communities of practice—i.e., academic departments or disciplinary centers—are providing an organizing focus and structure for their institutional repository marketing, service, and policy development activities.

Collection and Information Policy

What goes into an institutional repository, and can it come out once it goes in? Will the repository accept all kinds and manner of digital assets created by members of an institution, or will there be selectivity based on a collection policy that guides digital format, subject, and content submission? In a traditional library, of course, selectivity is a grounding principle. Only materials with predicted immediate demand or with some degree of lasting value to the members of the institution are selected for acquisition and the ensuing costly tasks of cataloging and long-term inventory maintenance and preservation. Except for their special collections, libraries, by and large, deal with published material in a limited range of formats. As a result, libraries have been collecting an important segment but not a full range of knowledge assets for their organizations. If one looks at the universe of library holdings represented in the OCLC WordCat database, for example, and characterizes these holding by broad type, as Lorcan Dempsey, the Vice President for Research at OCLC, has carried out in the data map of metadata in Fig. 8, it becomes clear that new, unpublished, digital resources have fallen outside the scope of most traditional library programs.

This traditional collection focus and selectivity are not necessarily bad, for they have allowed librarians to concentrate their resources on what might be the most valuable or vetted and standard forms of explicit knowledge assets. The expanded collection scope of an institutional repository that includes unpublished digital assets in many new formats will require more resources as well as more economical, less labor-intensive procedures for cataloging, storing, and preserving digital assets. But even with an expanded collection scope, an institutional

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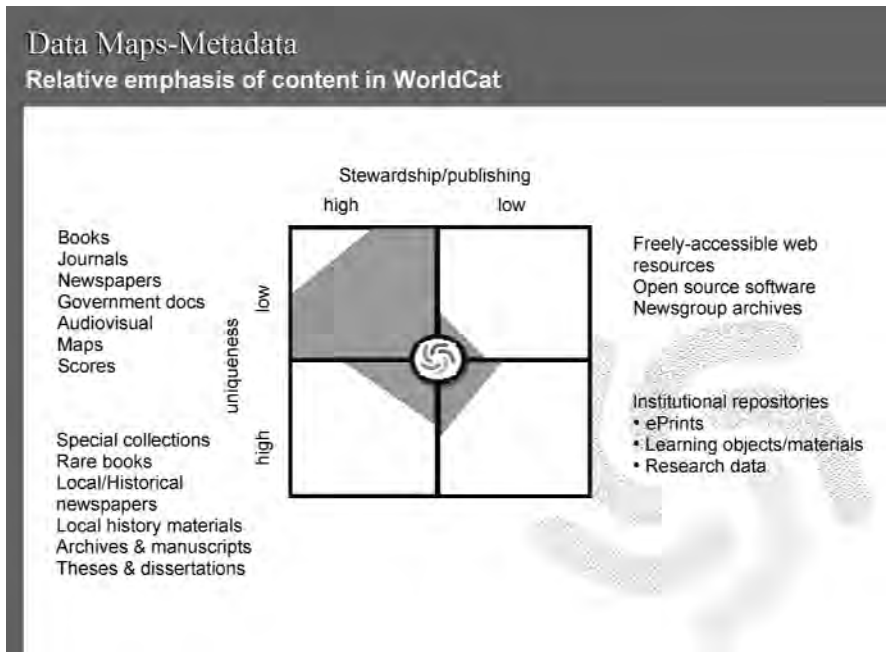

Fig. 8 OCLC data maps—metadata. (*View this art in color at www.dekker.com.*)

repository will still need some degree of selectivity. Choices will still have to be made—and who will make these choices?—about which particular digital assets should be archived in a repository. Are they worth the cost of stewardship or are they of such an ephemeral nature they do not warrant deposit in an institutional repository? DAM system technologies are being designed to handle an increasing variety of digital formats, from text, to images, to sound, to moving images, to multimedia. However, there are still limitations in many of these systems as to the range of digital formats they can handle or handle well, and there is still a lack of established standards for every new digital format that makes metadata preparation and preservation planning difficult. The technology platform capabilities and established metadata standards, therefore, may dictate some of the format selection criteria in an institutional repository.

Intellectual property rights policy is likely to loom large in many institutional repository programs. In the digital information environment, the more powerful capabilities to copy, reuse, repurpose, as well as restrict digital assets are intensifying intellectual property rights issues. Most universities have established intellectual property policies for technical information, but many have no such explicit policies for creative works, such as scholarly e-prints or courseware. In general, academic institutions have a tradition of not exerting ownership rights over the creative works of faculty or students unless that work was carried out with the support of ''significant'' or ''substantial'' institutional resources. As an institutional repository begins to collect and store a faculty member's unpublished working papers or course material or a student's e-portfolio, all the parties involved need to know the institution's ownership policies and the repository's rights management protections for this material. Several universities, such as Cornell and Brigham Young University, do have carefully prepared and comprehensive intellectual property and copyright polices, and these can serve as models for other institutions.[41,42] At MIT in the Dspace program, contributors to their institutional repository complete a nonexclusive distribution license that state the rights and responsibilities for intellectual property for both the producer and management.

CONCLUSION: ADMINISTRATION AND COST

The management and administration of an institutional repository could be taken up by a variety of entities in an organization: in most cases, responsibility will likely fall to an information technology (IT) unit, to a library, or to a combination of these units. The traditional mission of a library to collect, preserve, and share books, journals, and other published materials for the common good of its institution's members could be extended to cover the same responsibilities for a wider variety of unpublished digital assets. However, this extension of collecting, cataloging, servicing, and preservation responsibilities can appear daunting in the face of new and unclear boundaries, technologies, and additional costs. Librarians do know the

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cost and their own limitations in managing the universe of published information. How can they afford to take on yet a larger universe of published as well as unpublished knowledge assets? Early adopters of institutional repository programs obviously believe in their value, and they are finding ways to redirect activities, create new partnerships, and invest new resources to make them happen.

It is not possible to describe the exact costs of institutional repositories, because they are new and because they can vary so much in size and scope. At the high cost end, CNN is working with IBM and Sony Electronics to create the CNN Global Content and Storage System. This is a 5- to 7-year, $20-million project to digitally archive 120,000 hr of CNN footage from the last 21 years, as well as 15,000–20,000 hr of footage arriving annually at this news network.[43] On a smaller scale and with much more modest investments, some academic institutions are establishing repository programs without such significant costs. The California Institute of Technology, for example, is creating its Caltech Collection of Open Digital Archives (CODA) repository and keeping costs low by integrating repository and library services as much as possible and making use of free software such as ETD-db from Virginia Tech and Eprints from the University of Southampton.[44] The Hewlett-Packard Corporation and MIT have spent approximately $2 million on the development of Dspace, but now that this open-source repository system is past the research and development phase, MIT estimates that it will take $285,000 to operate annually for the scope of their program. A business plan with a complete breakdown of costs for staff, equipment, and supplies for MIT's operation of Dspace is available at the project's web site. Beginning with fiscal year 2003, the Ohio State University is investing $265,000 in new funds annually for the implementation and operation its Knowledge Bank repository program. For library programs the size of MIT or Ohio State, these projected costs for operating an institutional repository program are rather modest, amounting to just 1–2% of their total budgets.

However, because they are new, the true costs of operating an institutional repository program are still tentative. How big an institutional repository becomes in an academic setting depends partly on the repository's collection policy and partly on the willingness of faculty and students to contribute digital assets to it. And what are the long-term costs of maintenance, particularly the costs for active preservation, of digital assets into the future? On the other hand, what will it cost an institution or society not to provide stewardship of its important digital knowledge assets? If Peter Drucker is right that the modern organization's value is primarily based on its collective knowledge, then investing in an institutional repository is a wise decision today for an institution. Librarians, of course, as a profession, have to worry about access to knowledge on a broader scale and for a longer period of time. Institutional repositories offer hope that local resources will be committed to the development and application of metadata standards, open access strategies and connections, and careful preservation management to ensure that important digital knowledge assets will be safeguarded and accessible for future generations.

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Integrated Library Systems

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INTRODUCTION

Integrated Library Systems are a natural outgrowth of library automation systems. Libraries have eagerly employed whatever tools have become available to assist in the enormously labor-intensive tasks of managing a library. As we shall see, Integrated Library Systems combine various components in numerous ways to meet the needs of libraries ranging from small school and hospital libraries, large academic and government libraries, and huge consortia of public libraries.

BACKGROUND

Library automation systems began to appear as soon as tabulating equipment and early computer systems had sufficiently advanced to support library applications. Some very early automation tools such as circulation control systems using punched cards were implemented in the 1940s and 1950s, but the work was limited to a very few installations where the necessary resources were available, and of course, the costs were extremely high, making these options available only to a very few libraries.

As computer technology advanced and became commercially available in the late 1960s and 1970s, the first Integrated Library Systems emerged. These systems have continued to evolve and there have been rapid advances in their functionality and deployment throughout the later half of the 20th century. Integrated Library Systems have revolutionized library operations. They have led to tremendous advances in ease of use and productivity, both for library staff members and for library users.

Anyone who has ever worked in a library knows that library tasks are extremely labor-intensive. Successful collection development, cataloging or bibliographic control, reference, and other library work depend on the presence of highly trained and skilled people who are dedicated to making information available to library users. In addition, careful record keeping is needed to preserve the integrity of the collection, to manage patron information as well as circulation transaction data, and to keep track of acquisitions and other financial information.

Originally dependent on computer mainframe technology for the data storage and processing power required, early library automation systems often cost millions of dollars, both to develop and to operate. As computers became ever more powerful and inexpensive, the large mainframe-based systems were gradually replaced with microcomputer-based systems costing hundreds of thousands of dollars rather than the millions required by their predecessors. Development of the personal computer in the 1980s led to dramatic reductions both in the cost and staff required to support these systems, thus making library automation affordable for even the smallest libraries.

The tremendous and rapid changes in the computer equipment, operating systems, and software available, not to mention the impact of the Internet, have led to the gradual development of a wide range of Integrated Library Systems. Appropriate systems are now available to support institutions as large and complex as the Library of Congress, large academic institutions, corporate and law libraries, public libraries, and small school libraries.

Integrated Library Systems, or ILS as they are frequently known, grew slowly from stand-alone systems developed to meet specific library needs. Some of the earliest systems were quasi automated. Each of these systems depended for its existence on having the necessary information available in machine-readable form, or as we would say now, in ''digitized'' form. These systems were certainly not on-line and most operated via overnight batch processing of one sort or another. Examples of these early systems are the circulation transaction processing systems developed by or for large public libraries using punched cards and overnight batch processing. Soon after, fledgling Optical Character Recognition (OCR) and bar code technologies were employed to make it easier to capture the necessary information to support these systems. The data captured were often minimal: titles truncated to 50 characters, upper case characters only, and no diacritics or other special characters.

Although these early systems provided enormous savings in labor for large libraries, they were only able to handle a small part of the work load. As a result of the development of the MARC format,[1] it became possible to create high-quality cataloging records in

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machine-readable form for library collections. These soon led to the development of computer-generated public catalogs, produced by using the bibliographic records. Suddenly, it was possible to conceive of the first Integrated Library System by exploiting a linkage between the library catalog database and a database of patron information with the addition of holdings information to identify specific copies of items in the library collections.

Two of the first Integrated Library Systems were CLSI[2] and NOTIS.[3] These two systems were developed at about the same time in the late 1970s. CLSI was primarily developed for public libraries, although it was implemented in many other types of libraries later on. It used highly innovative, touch-screen technology to provide a very easy interface for library patrons, who, for the first time, were encouraged to use these systems on their own. Of course, this amazing new approach introduced new problems as librarians in charge of children's libraries found themselves constantly wiping sticky finger marks off the screens.

NOTIS, which stands for Northwestern's Total On-Line Integrated System, was the first true on-line, Integrated Library System. It was developed by Northwestern University library staff members in the late 1970s and was first made available to library patrons about 1980. The early implementations of NOTIS included systems to support circulation, cataloging, and on-line patron access to the catalog.

At about the same time, the term ''OPAC'' (standing for On-Line Patron Access Catalog) was born. This term has been used ever since to designate that portion of an integrated library system that enabled library patrons to search the catalog on their own. This component has generally been treated as a separate component from the cataloging subsystem, which supported the creation and maintenance of bibliographic records for the library's collection.

STATUS

Marshall Breeding writes an article each year on the Automated System Marketplace for Library Journal.[4] While not all of the vendors included are ILS vendors, strictly speaking (some offer only automation tools or a single module rather than an integrated system), taken together, they present a comprehensive picture of the library automation industry in the early 21st century. In 2001, 32 companies responded to Breeding's annual survey and provided information on 49 systems. According to Breeding, a small number of large firms now dominate the library automation marketplace. These firms tend to have a global customer base, to be highly diversified, and privately owned.

The Integrated Library Systems industry has been extremely volatile during its relatively short history. Only a handful of companies (e.g., Follett, Gaylord, GEAC, Innovative Interfaces, Sirsi, VTLS) have survived untouched by mergers or acquisitions. Over the years, many ILS vendors have been purchased by larger companies or have merged with other ILS vendors to form new companies with new products. Examples are Elsevier's purchase of Endeavor and the purchase of Data Research Associates (DRA) by Sirsi.

COMPONENTS OF THE INTEGRATED LIBRARY SYSTEMS

Each of the components of an Integrated Library System became known as a ''module,'' and ILS were generally considered to be ''modular'' systems. This term may have perhaps been borrowed from the Space Program that was also in its ascendancy at about the same time. In that environment, many complex systems were composed of numerous, more-or-less stand-alone components known as ''modules,'' for example, the ''LEM'' or ''Lunar Excursion Module.'' The term seemed completely appropriate for the components of the ever-evolving ILS in an environment in which libraries could combine the modules they needed to create a system to meet their needs.

The first Integrated Library Systems consisted of just two or three modules:

- Catalog—for storage and management of bibliographic records for each title owned by the library.
- OPAC—provides public access for searching the collection.
- Circulation system—tracks borrowing and returning of materials, generates overdue notification, and calculates any fines or fees owed.

These modules, taken together, were generally referred to as the ''core system.'' The core system was the smallest unit that could be purchased or licensed for use by a customer.

Throughout the remainder of this article, I have used the word ''library'' as an inclusive term to describe various repositories of information. Integrated Library Systems have been used (and are being used) to automate many different types of technical information centers, newspaper morgues, archives of various sorts, and even television stations. The main differences among these are the types of information being handled and some specific application requirements.

Once the core modules had been developed and implemented, new modules were soon added to meet the

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needs of different kinds of libraries for specific purposes such as:

- Authority Control—a special module used with the Cataloging module as a repository for creating, storing, and managing the authorized headings such as author names, subject headings, etc. These headings are used in the bibliographic records in the Catalog module.
- Acquisitions—for purchasing and tracking receipt of library materials, sometimes including serials.
- Serials Control—for purchasing and checking-in serial publications including journals, newspapers, monographic series, etc. The Serials Control module also generally includes provisions for claiming if issues are not received when expected.
- Holdings support—used especially in library systems with multiple branches and holding multiple copies of items to link the physical collections to the bibliographic information contained in the Catalog and to provide the item-specific information needed for the Circulation module. Note that Holdings support is frequently incorporated into the Catalog or Circulation module. However, some systems treat it as a separate module.
- Materials Booking—most often used in public libraries to manage and reserve special resources such as audiovisual equipment, meeting rooms, etc.
- Course Reserves—most often used in academic institutions to handle circulation of materials with loan periods of less than 1 day.
- Inventory Control—designed for taking physical inventory (either complete or partial) of the collection. This module may also include some functions normally included in the Circulation module.
- Binding—intended to identify materials that are ready for binding and/or notification of missing issues, define binding specifications, and track shipments and receipts of materials.
- Community Bulletin Board—designed to work with the OPAC to provide a place for library users to obtain information on-line about upcoming community events. This module is most frequently included in systems designed for public libraries and generally utilizes the MARC21 Community Information Format, which was specifically designed for this purpose.
- Interlibrary Loan—designed to track borrowing and loaning of library materials not to library patrons, but to and from other libraries.
- Reporting—some Integrated Library Systems embed reports that can be generated for each function in the appropriate module while others have a separate, stand-alone Reporting module that may be used to produce a variety of reports from the system.
- Administration—many systems include support for Administrative functions within each module while others have a separate Administration module for use by the library staff in configuring the system for their own needs.

Fig. 1 shows the relationships among the various modular components of a typical Integrated Library System. The following sections briefly describe each of these modular components and show how each contributes to the Integrated Library System.

1. The Catalog—Bibliographic records, available in machine-readable (or digitized) form for the materials in the library's collection form the foundation for the entire Integrated Library System. The records may be created within the ILS itself or with the assistance of a Bibliographic Utility such as OCLC, the Research Libraries Group (RLG), the Library of Congress, and numerous commercial vendors.

   Most Catalog modules today provide support for importing MARC records from these and other sources. MARC was developed by the Library of Congress in the mid-1960s. It was widely adopted nationally and internationally and is now available in a number of variations, some minor (OCLC MARC, RLIN MARC) and some requiring translation for compatibility with U.S. MARC systems (UNIMARC, NORMARC). *MARC 21 Format for Bibliographic Data 1999* is the most recent edition of the LC version. This standard combines the USMARC and CANMARC standards and will soon incorporate the current UKMARC standard. Although few ILS originally provided support for exporting records in MARC format, many systems have added this functionality because of customer demand.

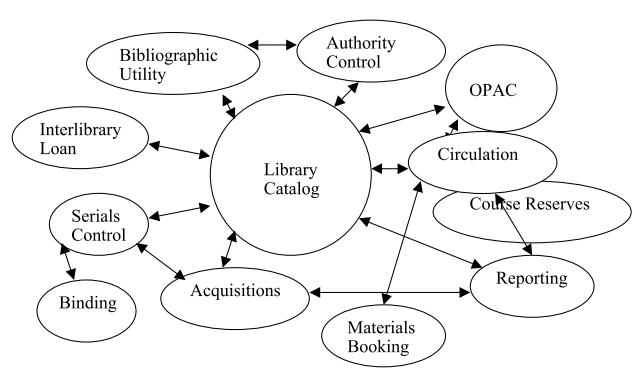

Fig. 1 Typical modular components of an integrated library system.

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Digital libraries / William Y. Arms.

LC Control Number: 99014773
Type of Material: Book (Print, Microform, Electronic, etc.)
Brief Description: Arms, William Y.
Digital libraries / William Y. Arms.
Cambridge, Mass. : MIT Press, c2000.
x, 287 p. : ill. : 24 cm.

CALL NUMBER: Z692.C65 A76 2000
Copy 1
– Request in: Jefferson or Adams Bldg General or Area Studies Reading Rms
-- Status: c. 1 In Process 07-07-2000

Fig. 2 A bibliographic record in human-readable form. (From the Library of Congress web site.) (*View this art in color at www.dekker.com.*)

Most Catalog modules provide support for an extended ASCII character set including special characters (e.g. β) and diacritics (e.g. ∼ È). Many newer Catalog modules and OPACs now support Unicode, greatly expanding the number of languages and characters that can be represented in the catalog database. Unicode is now an international standard. Its widespread use has had an enormous impact of the ability to exchange cataloging information among libraries and bibliographic utilities in different parts of the world.

Most Catalog modules provide support for entering bibliographic information (or cataloging) using the classic MARC tagging structure and field layout. These systems may also have been designed to closely work with a bibliographic utility such as OCLC or RLG. In addition, most Catalog modules also have a user-friendly data entry and editing format that prompts the cataloger for frequently needed fields such as title, author, ISBN, etc. These systems then convert the data as entered to the appropriate MARC tags for future use (Figs. 2 and 3).

The Catalog module is generally intended for use by library staff members and not by end-users or library patrons. The Catalog module generally provides search access by typical bibliographic data elements such as title, author name, subject heading, publisher, etc. It may also provide search access by other fields such as ISBN, ISSN, record identifier, cataloger's ID, etc.—fields that are less often important to patrons. The Catalog may also offer an expert searcher mode, sometimes limited for staff use only that allow limiting the search by date range, language, material format, and other parameters that might be of interest to library staff members but not to patrons.

Most Catalog modules are designed to work in a tightly integrated fashion with a Bibliographic Utility such as OCLC or the Research Library Group (RLG). Because producing original bibliographic records (i.e., cataloging information) for publications is especially labor-intensive and by extension, expensive, libraries very early on realized that there would be tremendous cost savings for all if they could share cataloging information across many libraries. OCLC began operation in the early 1970s and RLG followed a few years later. These two are not-for-profit organizations and are supported by their member libraries. A few library automation vendors also provide bibliographic records for their customers.

Most Integrated Library Systems therefore require access to a Bibliographic Utility or other source of MARC records for adding title records to

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LC Control Number: 99014773
000 01041cam 2200265 a 450
001 4520689
005 20000707100744.0
008 990310s2000 maua b 001 0 eng
035 __ **|9** (DLC) 99014773
906 __ **|a** 7 **|b** cbc **|c** orignew **|d** 1 **|e** ocip **|f** 19 **|g** y-gencatlg
955 __ **|a** pc03 to ja00 03-10-99; ljl 1 to subj. 03-11-99; lj07 03-16-99; lk02 03-17-99; AA3d lk25 received for CIP verification Jul 6, 2000; lk18 07-07-00; to BCCD 07-07-00
010 __ **|a** 99014773
020 __ **|a** 0262011808 (alk. paper)
040 __ **|a** DLC **|c** DLC **|d** DLC
043 __ **|a** n-us---
050 00 **|a** Z692.C65 **|b** A76 2000
082 00 **|a** 025/.00285 **|2** 21
100 1_ **|a** Arms, William Y.

Fig. 3 The same catalog record showing the MARC tags and contents of the fields. (From the Library of Congress web site.)

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Fig. 4 A typical OPAC basic search entry form. (From the Library of Congress web site.) (*View this art in color at www.dekker.com.*)

the Catalog in addition to allowing creation of original records. However, the Bibliographic Utility is not considered to be a part of the ILS.

2. Authority Control—A separate module to support Authority Control may be included for use with the Catalog or the library may perform necessary authority control tasks through a Bibliographic Utility or other vendor. It is extremely important in managing a very large collection of materials that are brought together under a single form of author name, title, etc. Minor variations in the form of these entries can mean that closely related information is separated by hundreds or thousands of entries, or, perhaps lost forever!

   A high-level Authority Control module will manage the headings used by the records in the Catalog module, allowing for global changes to be made to a single heading and reflected in all linked bibliographic records. MARC 21 Authority Format records are used to manage the headings and associated cross-references, which will be searchable and viewable in the OPAC to lead end-users to the headings used in the Catalog.

   The Catalog module generally does not provide any information on the status of the items linked to the bibliographic record. For example, a particular item might be on order, in circulation, at the bindery, or lost. This information is generally provided by the Holdings (item) records stored within the integrated system.

3. The OPAC—The On-line Public Access Catalog, or OPAC as it is universally known, is the ''public face'' of the library catalog. They are designed to provide a very easy and user-friendly way for

The Facts on File encyclopedia of science.

LC Control Number: 98053201
Type of Material: Book (Print, Microform, Electronic, etc.)
Brief Description: The Facts on File encyclopedia of science.
New York. NY : Facts on File, c1999.
2 v. (840 p.) : ill., maps ; 29 cm.

CALL NUMBER: Q123 .F334 1999
Copy 2
-- Request in: Jefferson or Adams Bldg General or Area Studies Reading Rms
-- Status: Not Charged

CALL NUMBER: Q123 .F334 1999
Copy 1
-- Request in: Reference - Science Reading Room (Adams, 5th Floor)
-- Status: Not Charged

Fig. 5 On-Line Patron Access Catalog record showing Holdings and Status information for an item in the Library's collections. (From the Library of Congress web site.) (*View this art in color at www.dekker.com.*)

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library patrons to locate needed materials or other information from the library Catalog. Fig. 4 shows a typical OPAC search data entry form.

As noted above, the Catalog module often does not include information on the status of items in the library's collection. However, the OPAC is linked to holdings information within the Integrated Library system so it can provide this vital information. Details provided can include the location of the item, whether it is available for loan, whether it is already in circulation, etc. Fig. 5, below shows an example of how this status information may be displayed in the OPAC.

Early in the 21st century, library information resources are increasingly available in electronic form. Thus it is becoming very common to include the Universal Resource Locator or URL in the information that is displayed in the OPAC. By using these links, users may go directly to the needed information or other material at whatever site it may be available. In some cases, libraries maintain locally loaded stores of electronic resources. In others, the materials may be made available directly by the publisher at the publisher's site or via third-party suppliers. Aggregators also provide relatively seamless access to electronic resources for authorized users.

The need to authenticate users and to control or limit access to certain electronic resources introduces new problems for libraries. Integrated Library Systems vendors and others have responded with new services and products. In some cases, there is a separate, stand-alone module to meet this need, while other vendors supply the necessary functionality as part of their total system.

The NISO Z39.50 standard has allowed libraries to host their Catalogs on the Internet and/or provide searching of other Z39.50 Catalogs to their patrons. Most ILS systems either provide integrated Z39.50 functionality or utilize a third-party vendor product to support this feature.

4. Community Events—A Community Events module is often included with the OPAC, especially for public libraries. The events described may be limited to events sponsored by the library or may include any community events that the library wishes to post and make available via the library's OPAC or web site. Some libraries use the MARC 21 Community Information Format to integrate this information into their OPAC while others maintain separate web

Fig. 6 Community events calendar for the Boston Public Library. (From the Boston Public Library web site.) (*View this art in color at www.dekker.com.*)

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Fig. 7 Bar code labels for a circulation system. (From the Gaylord web site.) (*View this art in color at www.dekker.com.*)

pages for this purpose. Fig. 6 shows the Events posted for the Boston Public Library. The site also shows that each of the branch libraries may have its own listings.

5. Circulation—Large libraries frequently have hundreds of thousands or millions of loan transactions and thousands of patron records to maintain. Therefore this function was among the very first to be automated. Some of the very early systems employed punched cards and tabulating equipment. Over the years, these systems have become enormously complicated and have evolved to include features to cover special circumstances and materials. *Course Reserves*, *Materials Booking*, and *Interlibrary Loan* are often listed as separate, stand-alone modules; however, each is really a special case of the more general Circulation module.

The classic library Circulation system is generally used to control circulation transactions for periods of time as short as a day and as long as a year. It can accommodate a variety of types of materials, loan periods, and patron types, and can handle a wide variety of fee and penalty formulas to deal with overdue materials.

Most Circulation systems also allow patrons to place materials *on hold*. This means that if a needed item is already in circulation, at the bindery, or is a newly acquired item being processed, a patron can request that the item be set aside for him or her as soon as it becomes available. The Circulation System will notify the staff when the item in question is available and will block loan of the item to anyone else until the hold is cleared.

The Circulation system depends on accurate identifying labels of some sort on the materials to be loaned. A variety of techniques have been used for these identifiers. The most common form in use today is the bar code label. These are easy to scan with inexpensive equipment and are relatively error-free. A similar form of bar code label is usually used to identify the patron who is borrowing the item, but the form of the bar code enables the system to distinguish between them (Fig. 7).

Fig. 8 shows the back and front of a sample Patron ID card, showing the library logo and the patron identifying bar code.

Circulation modules may also offer self-checkout kiosks or terminals, or link to third-party products for this functionality. A number of larger ILS, particularly those involved with consortial library systems, are beginning to offer the functionality provided by the newly approved NISO Z39.83 NCIP (Circulation Interchange Protocol) standard, which allows protocols for checkout, requesting, ILL, and other system to system communications.

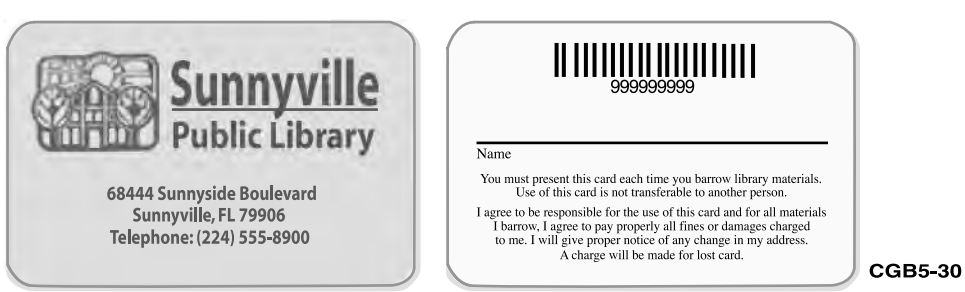

Fig. 8 A patron card showing the bar code label. (From the Gaylord web site.) (*View this art in color at www.dekker.com.*)

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6. Course Reserves is a special case of the Circulation module. There are some significant differences:

   - The basic loan period is almost always less than a day. A frequent exception is for loans made late on a Saturday evening that will not be due until Monday.
   - Fines may be calculated on the elapsed time (hours or even minutes!) that a needed item is returned after the due time.
   - Patrons may need to identify and request materials based on the instructor or professor's name and/or course identifying number rather than by more conventional access points such as author, title, or subject.
   - Materials for the Course Reserves may belong to the library's permanent collection or they may have been especially loaned for the course. If from the library's permanent collection, they may be unavailable for normal circulation while they are on Reserve.

As libraries become increasingly digital, more and more materials are being made available for Course Reserves in electronic form. The challenge with these materials is to ensure that access is limited to authorized users and that the materials are removed from the Course Reserves at the designated time.

7. Materials Booking is another special case of the Circulation module. In this instance, the features of the Circulation System are used to manage the prebooking and loan of primarily equipment and facilities such as overhead projectors, DVD players, conference rooms, lecture facilities, etc. The major difference between Materials Booking and the usual circulation hold transaction is that patrons may use the features of this module to reserve a particular piece of equipment or facility for use at a designated date and for a specified amount of time. As with Course Reserves, the needed search criteria may be different, i.e. equipment type rather than an author or title, and possibly a location.
8. Interlibrary Loan is yet another variation on the Circulation module. In this case, the loan transaction takes place not between a patron and a library but between participating libraries. Various fees may be charged, depending on the net borrower/lender relationship among any two libraries exchanging materials. Further, the statistical usage reporting requirements can be daunting and may involve special reports generated for local use, state use, and one or more consortia of similar institutions.

   Once again, the move to digital content is changing the way Interlibrary Loan is managed. Many libraries now are able to loan copies of articles and other materials transmitted via fax or Ariel[a] when possible. In this situation, the item is never expected to be returned.

   Interlibrary lending of electronic journals and other digital content is more problematic. As of this writing, many publishers do not allow loaning of electronic documents under the terms and conditions and/or their license agreements for access to electronic content.
9. Inventory Control is another special purpose module provided by some ILS vendors. This module is especially useful in large public or other libraries where there is extensive browsing use of the collection. Items may or may not have been reshelved or may have been misshelved. The Inventory Control module generally uses a remote scanning device embedded in a hand-held reader. This enables a library staff member to scan the items on the shelves detecting the bar code label that has been placed on the item. Items that are located on the shelves as well as missing items will be detected. The module generally includes a subset of Circulation functions so that the library staff member can change the status of an item, for example, from ''In Transit'' to ''Checked In'' if it is located on the shelf or from ''Claims returned'' to ''Lost'' if it is not found.
10. Acquisitions—The Acquisitions module provides support for purchasing and other means of acquiring materials for the library's collection. This module is sometimes called Collection Development, but Acquisitions is the more usual term.

    Some Acquisitions systems are intended to handle only procurement of nonserial materials (e.g., books, audiovisual materials, pamphlets, ephemera). Others are designed to handle all publishing patterns including serials (with all of their various publishing patterns), monographic series, books-in-parts, newspapers, and other dailies.

    Most Acquisitions systems are designed to work closely with the Catalog and other modules of the Integrated Library System so status information

[a]Ariel is combination of software and scanning technology for transmitting high-quality images. Developed by the Research Libraries Group (RLG) in the early 1990s, Ariel generates high-resolution copies of even difficult text. Photographs, mathematical equations, graphs, charts, and footnotes are all clearly reproduced. The Ariel technology was acquired by Infotrieve in January 2003.

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about items that are being procured is available to staff and sometimes to patrons. For example, the link between the Acquisitions module and the Catalog can provide a way to alert both library users and staff when new materials have been received.

Many acquisitions systems also include features such as allocation of monies from designated Funds for procuring materials, currency conversion, and exchange of ordering information with publishers and other sources via Electronic Document Interchange or EDI. Some systems also can exchange procurement and ordering information with the controller's office or other purchasing group within the host institution. These features save vast amounts of record-keeping and labor on the part of the library staff.

A major benefit of an Acquisitions module is that it enables the library to monitor expenditures for new materials throughout the year. It can easily provide early warning if the library's acquisitions budget is in any danger of being overspent and/or if there is any possibility of funds being available that need to be encumbered before the close of the fiscal year. Acquisitions modules also notify staff if material on order has not been received, and often can generate notices to vendors.

11. Serials Control—This module has perhaps the most variation from vendor to vendor of any of the modules in an Integrated Library System. Some vendors, for example, offer the Serials Control module as a stand-alone system that includes components from the Catalog, Acquisitions, and Serials Control modules. Such a module would enable library staff members to:

    - create bibliographic records for serials in their collection,
    - prepare and transmit Orders for serials subscriptions, either to an agent or directly to the publisher,
    - check-in serials issues as they are received,
    - flag missing issues and prepare Claims as required, and
    - notify library staff members when an issue is ready for binding.

Other vendors may offer a Serials Control module that is closely integrated with other modules in the ILS. In this case, the Serials modules would support only the check-in function and Claiming operations. The module would be closely linked with the Catalog module for establishing the bibliographic records for serial titles, with the Acquisitions module for preparing and transmitting Orders for serials subscriptions, and with a Binding module for notification when issues are ready to be bound.

The level of support for full MARC 21 Holdings records for serials data also greatly varies from system to system. Libraries with large serial collections—particularly academic and law collections where print subscriptions can be very costly—are particularly concerned with the capability for full serial pattern and issue level holdings support, as demonstrated by the tremendous interest and progress made by the CONSER Pattern Initiative project.

Although many Serials modules were originally designed to transmit Ordering and Claiming information using paper forms, today's libraries, subscription agents, and publishers are increasingly able to accept this information in electronic form (EDI). Various standards have been developed to control the data elements and format in which the information is communicated among the various participants in the process.

Many special variations of the Serials module have been developed over the years to meet the special requirements of law libraries and other types of collections that have special needs, either for ordering or check-in or for OPAC holdings display.

12. Binding—The Binding module is a special purpose module intended to assist a library in determining when issues are ready for binding and when issues are missing that would prevent a volume from being bound. This module is most useful for a library with a very large and active serials collection and a continuing program of binding journal volumes, perhaps using in-house facilities. Many ILS systems do not include this module.
13. Holdings—A Holdings module is generally required in situations where the library's collection may be spread over many branches as in a large university library system or in a case where many libraries belong to a single system or consortium. As previously mentioned, support for holdings information is frequently incorporated into the Catalog or Circulation module.

    Comprehensive and full-featured support for holdings information is essential for large library systems with many different collections or branches, different circulation policies for various copies, and patrons who may be eligible to view and/or check-out items belonging to any of the collections. The *MARC 21 Format for Holdings Data* provides the standards information on how this information is to be recorded and represented (Fig. 9).
14. Reporting—The Reporting function is sometimes included in the various modules of an ILS (i.e., the

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The American Heritage college dictionary.

LC Control Number: 2001039826
Type of Material: Book (Print, Microform, Electronic, etc.)
Brief Description: The American Heritage college dictionary.
4th ed.
Boston : Houghton Mifflin, c2002.
xxviii,1636 p. : ill., maps : 25 cm.
Links: Publisher description

CALL NUMBER: PE1628 .A6227 2002
Copy 4
-- Request in: Jefferson or Adams Bldg General or Area Studies Reading Rms
-- Status: c.4 Charged: Due - 12-31-2003

CALL NUMBER: PE1628 .A6227 2002 Ref Desk
Copy 2
-- Request in: Reference - Business Reading Room (Adams, 5th Floor)
-- Status: Not Charged

Fig. 9 Multiple holdings for an item in different collections and with different circulation status. (From Library of Congress web site.) (*View this art in color at www.dekker.com.*)

Circulation module may have its own Reporting subsystem) or the ILS may include a special Reporting module that can extract data from any part of the system to produce the desired Reports. Capability for libraries to format reports or create their own data sets and custom reports widely varies from system to system. Various vendor–proprietary report generators are used. However, the Reports are increasingly available in PDF format so they may be transmitted and easily read by recipients.

15. Administration—As with Reporting, the administration functions are sometimes embedded within each separate module while other vendors provide a separate Administration module for use by designated members of the library staff. The Administration module may be used for a wide range of functions, including but not limited to the following:

    - Create User IDs and passwords for library staff members.
    - Configure library staff member user accounts to allow/disallow certain functions.
    - Establish Patron Classes and Item Classes for use in Circulation.
    - Establish loan periods, fine and fee structures, and other parameters for use in Circulation.
    - Post items to the Community Bulletin Board.
    - Register institutional IP range or ranges for use in authenticating access to various electronic resources.
    - Specify indexing parameters (what indexes are available, fields included in each) and display characteristics (what fields and data is displayed, what labels are used) for the system.

NEW MODULES

1. Web OPACs—The rapid growth of the Internet in the late 1990s and early 2000s has had a dramatic impact on Integrated Library Systems, especially the OPAC. Most ILS now have a Web interface for the OPAC that allows users to browse library catalogs from any Internet Browser such as Netscape Navigator or Microsoft Internet Explorer. Countless OPACs are now available on-line to the general public. The OPAC modules for most academic and public libraries do not require any kind of log on to gain access to the Catalog. Many government agencies and other quasi public groups also allow totally unrestricted access via the Internet to their Catalogs. Of course, corporate and other private institutions still generally provide access only to their own user community and thus require some sort of log on or registration.
2. Wireless OPACs—Recognizing that many library patrons want to search an OPAC from wherever they are, some ILS vendors are now offering OPAC access via Personal Digital Assistants (PDAs) and cell phones.

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3. Extended Catalogs—Many ILS vendors now offer additional modules that broaden the scope of information resources that can be made available to their patrons. These extensions enable the library to provide access to internal documents that may not normally be considered part of the library's collections. Additional resources made available in this way might include internal technical reports and documents, engineering drawings, blueprints, and other images. These extensions may also provide access to various resources available on the Internet by providing URL links to those sites.

   In addition to the enhanced cataloging support required (many of the materials to be included may not have applicable MARC formats established for them), these modules require some sort of URL checker to ensure that the stored links are still active.
4. Portals—Many ILS vendors now offer various types of Portals that extend the resources available to include those that are outside of the institutions collections. These Portals may provide access to on-line databases, abstracting and indexing databases, aggregator databases, etc. In general, they require that access rights to the various resources be secured beforehand. However, some publishers are now making electronic content available via Pay Per View. Thus a Portal might link a user to an electronic journal article, for example, that may be purchased on-line at the publisher's site.
5. Digital Rights Management—As libraries include more electronic resources among their collections, the problems posed by Digital Rights Management must be tackled. The problem is especially acute for electronic journals because the content may be available to a library's users under a variety of arrangements. For example, a library may subscribe to a single e-journal directly from a publisher or agent or it may have rights to an e-journal's content via subscription to a ''package'' containing multiple journals and perhaps electronic databases as well. Publishers, aggregators, and others provide a wide array of such offerings. In addition, libraries may also have subscription rights to certain electronic publications as a result of blanket agreements negotiated by consortia on behalf of their members. Library patrons may then find that there are several choices available to them for obtaining a particular e-journal article or other document. Providing guidance to the user in selecting the most appropriate source is called the ''Appropriate Copy Problem.'' Consider, for example, in a given institution, a user may have access to a particular article from multiple sources. The institution may have already negotiated access rights to content available from some of these sources but not others. Thus the ''Appropriate Copy Problem'' is the task of ensuring that the end-user obtains the desired material from the most appropriate (i.e., free of any additional cost) source.

   Additionally, different users at the same institution may have varying rights to access specific publications, so specific user identification and rights control is an important factor. Integrated Library Systems vendors and others have devised several auxiliary modules to assist libraries in managing this problem.
6. Metasearching—Several ILS vendors now include a module that allows library patrons and staff members to search the resources in other collections that have been predefined. These Metasearch engines have frequently been designed to take advantage of the Z39.50 protocol, but they can also search resources using proprietary web searching technologies.

   The major advantage of Metasearch modules is that they provide the long sought-after ''one stop shopping'' for library patrons. A user may enter a single search strategy and know that it will be executed against all of the resources that are available to that library. The results are generally presented in a relevance-ranked listing with duplicate entries removed.

OTHER SERVICES

As libraries face increasing budgetary pressure and have had to cut staff in many areas, ILS vendors are adding services to help ease the burden. Some examples are listed below:

1. Hosting—Many smaller institutions and libraries do not have access to highly skilled IT staff members or the budget to support them. Therefore several ILS vendors are now able to provide the servers, data storage devices, network controllers, and other devices that are needed to support today's Integrated Library Systems. Library staff members and patrons may gain access to the system via standard Internet Browsers or via a Virtual Private Network (VPN).
2. Implementation and Training Services—Several ILS vendors now offer a variety of consulting, project management, and training services to assist the library in implementing an ILS. Such assistance may be

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especially helpful during a conversion from one ILS to another.

3. Electronic Resource Management—This service extends the Digital Rights Management module described above by providing assistance to the library in managing licensing, purchasing, and access rights to electronic publications. It is extremely time-consuming for library staff members to keep track of ever-changing licensing requirements and Terms and Conditions (T&C) for electronic publications. Further, many staff members do not have the legal training and experience required to negotiate these arrangements with publishers and others.
4. Data Conversion—This service is essential for most first-time ILS implementation as well as for conversion from one ILS to another. It may be necessary to convert bibliographic, patron, and other data from a proprietary format supported by one vendor into a format that can be imported by another.
5. Scanning—As libraries wish to add other materials to their catalogs, archival-quality scanning may be required to produce materials that can be delivered on-line in electronic form. Some ILS vendors now are able to provide this additional service.

CONCLUSION

It is readily apparent that Integrated Library Systems have had an enormous impact on library operations in the past decades. Integrated Library Systems have rapidly evolved since the 1960s. They have taken every advantage of advances in computer hardware and software, networking capabilities, and, of course, the Internet. In addition, the dramatic decreases in costs to develop, implement, and maintain an Integrated Library System have made them affordable for even the smallest library. There are few good cost/benefit analyses for library automation. However, it seems clear that today's libraries could not function as they do without substantial support from automated tools and services.

A LOOK TO THE FUTURE

Libraries have been early adopters of computer and other library automation technologies because these options first started to become available. The desire for easy, inexpensive tools to manage ever-expanding collections is never satisfied. Both librarians and vendors continue to chase ''the next greatest thing'' to help libraries achieve their goals of providing the best possible access to the best possible information for their patrons.

At the same time, user expectations keep rising. For example, users now not only expect that today's metasearch engines will find whatever information is available somewhere in the world, but also that they will understand the context of the query and make allowances for those words that carry a heavy semantic burden.

Libraries will increasingly rely on resources in electronic form and the library's collection will be defined in terms of the materials its users can access rather than being limited to those materials that are physically within its collections.

Library users will expect to be able to search and access materials from the library—or the universe of libraries—using whatever device may be available be it a personal computer with a dial-up connection, a computer with a wireless connection or a cell phone or PDA.

The only constant in the future for Integrated Library Systems will be change as they continue to grow and evolve to meet the ever-increasing demands of libraries and their constituencies.

ACKNOWLEDGMENTS

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The Internet and Public Library Use

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INTRODUCTION

The Internet as a widespread end-user tool is a relatively new phenomenon in the history of libraries, yet in its short existence, it has had a significant impact on every facet of library operations. The areas affected range from internal administration and management functions, such as staffing and staff training, workflow, and collection management, to technical functions such as systems software and hardware, to the more publicly visible services offered by libraries such as access to computers and the Internet and training in the use of these, digital reference and other information services, community-oriented services and resources, as well as a variety of public relations issues related to these. A fundamental issue underlying all these is the impact that the Internet is having upon public library use. The development of the Internet as a tool has been so rapid that it is safe to say that libraries have (understandably) been caught by surprise, and the initial planning and response to the Internet's functionality within the library was, in many cases, more reactive than proactive. This rapid development also meant that libraries did not have access to empirical research that could guide them in some of their decisions; fortunately, enough time has elapsed so that some research results are now available on various aspects of Internet use in relation to the public library.

This article will review what is currently known about the relationship between the Internet and public library use, looking first briefly at the state of Internet connectivity in libraries, and then summarizing how the Internet is affecting public library use in areas such as access, digital reference, circulation, and services offered. The article concludes with a more in-depth discussion of user decision criteria in relation to choices of whether to use Internet or library resources. Issues such as managing and supporting Internet services, the Digital Divide, and filtering are out of scope for this overview. While Internet connectivity has facilitated services such as E-mail for libraries for several decades, the Internet as referred to in this overview assumes graphical Web browsing capabilities such as became more widely available with the emergence of the World Wide Web in the mid-1990s.

Note that with the advent of the Internet, definitions of ''use'' of the library must expand beyond traditional measures such as circulation counts, counting patron walk-ins, numbers of library cards issued, or number of reference questions answered. Delineating measures of use in an on-line environment is complex; if a patron finds the answer to a question using a search engine on a library computer, or a link on a library Web page, how is this use to be most accurately measured and classified? Privacy issues also impact the ability to measure use, and other factors such as satisfaction are difficult to assess in the on-line environment. While there is a large amount of anecdotal evidence to suggest that librarians are busier than ever before, assisting patrons with computer access questions and providing training in navigating the Internet, on an empirical level, libraries and LIS researchers are currently grappling with what tools to use and how to measure use in this environment, and how to interpret the kinds of statistical data that can be gathered.

INTERNET CONNECTIVITY IN PUBLIC LIBRARIES

A series of studies has tracked Internet connectivity in public libraries; the most recent of these[1] reported the following statistics for urban, rural, and higher poverty level (>40%) public libraries. Virtually all public library outlets (98.7%) have an Internet connection, up from 95.7% in 2000. Most of these (95.3%) provide public access to the Internet. Urban libraries and public library outlets with more than 40% poverty lead rural libraries in connectivity; 100% of urban libraries and public library outlets with more than 40% poverty (including rural libraries) are both connected and provide public access to the Internet. Rural libraries are 97.8% connected, up from 93.3% in 2000, and on average, 93.7% provide public access to the Internet. Data also indicate that public-access workstations for patron use have increased by a factor of 2–3 times since 1998, with public libraries now having an average of 10.8 workstations for public access to Internet services. The report also indicates that 42% of public libraries are providing formal Internet training services for patrons, and slightly more (43.6%) offer formal technology training for staff members. The report concludes that ''data indicate that libraries are increasing Internet technologies and services to meet the perceived demand for increased online services and resources.''[1]

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These statistics indicate that public libraries almost universally have an Internet connection and almost all provide the public with access to the Internet. Public awareness of access to the Internet through the public library is also high. A 2003 Pew Internet and American Life report[2] describes that 76% of Internet users know of Internet public-access sites in their community, and 60% of nonusers are also aware of public-access sites, and respondents state that these sites are easy to reach. The library is the most frequently identified access location.

Other data indicate that libraries need to do a better job of publicizing the availability of public-access computers; librarians participating in the Gates Library Program report that most had limited their outreach efforts to posters in the library, and most patrons stated they learned about public-access computers upon visiting the library.[3] Therefore only those who already used the library were likely to be aware of these services. The most recent survey, as of January 2003, shows Internet usage at public libraries at an all-time high, with 21% of Americans stating that they access the Internet at the public library.[4]

At the same time, after a period of rapid growth, expansion of Internet use among the general population appears to have leveled off. According to Ref. [2] several factors could be responsible: the economy, some users discontinuing use, or users reaching the peak of the adoption curve. The report also notes that while Internet use has grown across all demographic groups, gaps still exist across different demographic, socioeconomic, and geographic groups. Cost remains a considerable factor: 30% of Internet nonusers state that cost is the major issue. Nevertheless, over 60% of Americans now have Internet access and 40% of Americans have been on-line for over 3 years.[5]

Use of the Library for Internet Connectivity

Clearly, then, public libraries have accepted the role of providing Internet access to the general public, an especially important service for those who would otherwise not have access. There is much anecdotal evidence that providing computers and Internet access greatly increases public library use. One group which has researched the impact of access to computing and the Internet at the library is the Public Access Computing Project (PACP) at the University of Washington, which conducted assessments of the impact of the Gates U.S. Library Program (http://gatesfoundation.org/Libraries/USLibraryProgram/). Public response to the availability of Internet access is positive and strongly indicates increased use of libraries to access the Internet. For instance, in a summary of 23 evaluation reports issued by the PACP over 4 years, libraries offering public-access computing report significant increases in visits, in circulation, and in new patrons. Specifically, data for 2002 show that libraries participating in the U.S. Library Program reported an average increase of 36% in library traffic and a 9% average increase in book circulation. Among the groups with the lowest income (those earning less than $15,000 per year), library use increased from 34% in 2000 to 57% in 2001.[6] In other focus group research with participants attending the Public Library Association's annual conference in 2002, the PACP proposes (based on the collective experiences and comments of those participating) that community expectations around the nation regarding technology access have now been set, and that local libraries will do whatever it takes to sustain their programs in public-access computing, although funding for this will be difficult for many communities.[7]

Expanded Services

In addition to the direct effects of public Internet access upon public library use, libraries have expanded traditional services or added new services or features in response to the Internet presence. One major addition is the creation of a library home page, which functions as an interface to the library. Durrance and Pettigrew[8] note that library Web pages have become the public library's ''major public face'' to the community and the world and credit the Web with bringing public libraries an ''exponential expansion'' of their audience. Often the first major service libraries offered through Web pages was access to the on-line library catalog. Now libraries use their Web sites to post information about the library, its services and programs, additional information about collections, access to on-line databases, and, increasingly, direct access to digitized special collections, access to digital reference services and other user-centered services, and links to community information. Library home pages, however, have generally reflected the lack of experience that librarians bring to this new environment. Durrance and Pettigrew[8] also comment that a number of libraries fail to understand the marketing power of a library's Web site or feature links to fines and fees at the top level, thus reinforcing negative stereotypes about the library.

Libraries are going beyond the home page to create library portals, which Schottlaender and Jackson[9] define within the context of libraries as ''new tools for discovering a range of diverse content, from resources freely available on the public Web to the online catalogs, abstracting and indexing databases, licensed journals, and special collections and archives.'' They continue, ''portals offer a range of services that facilitate post-discovery information use,'' thus searchers using a portal to find information items are supported by a range of library services, also accessible through the portal interface.[9] Portals are software that provides seamless access to a variety of resources; the application mediates between the

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resources and the presentation software (which is likely a Web interface). While a library Web page provides an access point to many different resources, the burden is upon the patron to put a search strategy together; portals reduce some of this end-user burden.

Assessing the impact of library Web sites and portals upon public library use can be a difficult endeavor. Web logs can produce vast amounts of data, and methods for analyzing this data can be costly and difficult to implement and complex to interpret. Currently, about 60% of libraries measure remote usage of the Internet through the library's Web page or portal.[10] Accessing the on-line catalog and other end-user accessible databases has accounted for a large proportion of library Web site usage. Remote access must also be distinguished from within-library access for on-line databases, and libraries have been increasing their database access through public-access workstations. In 2002, 90.6% of public library outlets were offering database subscription services on some or all of their public-access workstations; this is an increase from 81.1% in 2000. Remote database access has also increased from 36.1% in 2000 to 44.3% in 2002.[1]

Because users are anonymous in the on-line environment, it is difficult to evaluate whether users are successful in their searches or satisfied with their library Web site interactions. Tracking the course of an information search, which spans the library catalog, library-accessible databases, and the Internet, requires research methods which are time-consuming and resource-intensive. Thus there is little empirical data describing the typical patron's search for information in this environment, and once again, we find that much usage evidence of these resources is anecdotal. Librarians report heavy usage of Internet search engines, and one recent article notes that ''an increasing number of library users are turning to Google or other commercial search engines for their information needs before they avail themselves of the resources their libraries provide. Why? Simply put, because they value simplicity. For some users, three mouse clicks is one click too many.''[9]

Another area of expansion is the addition of digital reference services to the public service arena. Recent statistics (2002) show that 31.7% of public libraries are offering digital reference services.[1] While the majority (59.9%) do not, another 8.4% were planning to offer these services within a year. In assessing the current use of digital reference services, it must be noted that much of what is written on the topic of digital reference is anecdotal or implementation-oriented, and, as in other areas, there is a lack of empirical research on the usage and outcomes of these services. A recent project analyzing the literature on digital reference[11] notes that E-mail has been the primary medium for delivering digital reference services since about the mid-1980s. With the availability of the Internet and Web-based capabilities, more libraries are beginning to use Web forms. Digital reference has been largely an asynchronous process, and although some libraries have experimented with synchronous methods such as videoconferencing, these have encountered a number of technical problems. Another method being used to complement E-mail reference is chat, and it appears that increasing numbers of libraries are adding chat reference services.

However, in terms of actual usage of these services, libraries providing digital reference as a supplement to traditional reference report that they receive relatively few requests; several reports indicate a range of 26–56 queries per month for academic libraries,[11] and for public libraries, the rate is lower, averaging 5.6 E-mail questions per week, with the modal or most frequent response to the question being 3 per week[12] (as reported in Ref. [11].) Higher usage statistics are reported for consortial projects, such as CLEVNET, a cooperative project between the Cleveland Public Library and 30 other library systems, which offers a 24 hour a day/7 days a week digital reference service. With 1.3 million library cardholders, this service averages between 3000 and 3500 questions during the school year and from 1000 to 2000 during the summer. While the service is fast growing, even these numbers are a small percentage of the total reference question totals: in 2002, the Cleveland Public Library's Main Library alone answered a total of 1,071,448 reference questions.[13] The Internet Public Library, solely an on-line service, reports approximately 8000 questions per year.[14] According to David Lankes, an expert in the virtual reference movement, the ''problem of low usage statistics continues to plague the field, with a few notable exceptions.''[15]

In contrast to these numbers are the staggeringly high usage statistics reported for such Internet services as search engines (as of February 2003, Google reports 250 million searches daily on its Web site, with Overture as a runner-up at 167 million[16]). Other services, such as the ''Ask-A'' services (''Ask Dr. Math,'' ''AskERIC''), receive heavy usage. For instance, the AskERIC (part of the Information Institute of Syracuse) service currently averages 700 live questions a week and 45,000 E-mail questions a year. AskERIC director Lankes notes that the cost of digital reference services has been a problem but feels that a transformation is taking place, with Web-networked digital reference evolving into a basic reference tool.[15] At this point, however, statistics suggest that digital reference services, because of their low usage, appear to have had little effect on public library use. Other problems, as noted by Ref. [11] are that the ''low volume of traffic in digital reference is coupled with descriptions of services that are not widely publicized, not very visible on the library's web page, developed without user involvement, and only minimally evaluated.'' Library Web sites also fail to demonstrate that librarians are experts in question answering.[8] These, however, are all

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conditions which can be remediated through a better Web site design process and attention to usability studies (see also Ref. [17].)

Another example of the expansion of services offered is the community information network, following in the tradition of information and referral (I & R) services offered by public libraries since the 1970s. A 1999 study showed that 71% of public libraries provide library Web page links to community information (CI) developed by other organizations, but far fewer provided links to library-developed Web pages or to library CI databases.[8] This study notes that there is a series of rapid changes happening in the development of CI initiatives among libraries. A major change with these networked CI systems is that public libraries become one of many partners in a community information network, leaving behind the tradition of a localized (within the library) I & R service. Another change is that ''community information projects represent a change to that role: the library moves beyond the role of identifying and gathering existing information sources into the role of publishing new resources.''[18] This new role as active publisher, rather than passive information provider, is a key development in the impact of the Internet on the public library. As public libraries produce or become part of community information networks, this can also have an effect on the use of the library.

THE RELATIONSHIP BETWEEN THE INTERNET AND PUBLIC LIBRARY USE

These new undertakings indicate how the Internet has stimulated new or expanded public library services, and there are numerous unique and worthwhile projects being initiated at individual libraries. However, it remains difficult to assess the impact of these Internet-mediated services upon the use of libraries. Circulation statistics are a standard indicator of library usage and could offer some insight. In the late 1990s, statistics indicated a general trend of decreasing library circulation,[19,20] at the same time that increasing usage of electronic resources was noted. Since the beginning of the recent recession in March 2001, the Library Research Center found that circulation has increased significantly[21] (supporting the notion that in times of economic hardship, library circulation goes up). Recent research sponsored by the American Library Association (ALA) showed that 26% of people visiting the public library used the Internet while they were there.[21] According to Library Journal's budget survey, Internet usage inside libraries rose by nearly 25% and remote usage was up 45% in libraries that measure such usage.[10] Libraries from the New York Public Library to the Multnomah County Public Library (Portland, Oregon) report increased Internet usage and an increase in technical questions, many from job seekers, but not in attendance at Internet instruction classes.[22] Paralleling these increases, libraries report that Internet-related expenditures continue to rise as well. Library Journal's budget survey showed that in 2002, respondents reported 4.6% of their budgets going to the Internet, representing a 28% increase from 3 years ago; in 2003, libraries project a hefty 7.9% increase in Internet expenditures over FY 2002.[21]

At this time, therefore, it appears that a major new use of the library is for Internet access. There are, however, a number of unknowns in the relationship between the Internet and public library use, and the nature of the relationship between the two remains uncertain. An essential question being debated among library administrators and staff is whether people will still feel the need for the public library, as access to the Internet within the home becomes more widespread and more users become adept and confident in its use. An additional question is whether people will still use the library for information seeking and other information services, with the availability of the Internet in their homes. There are several scenarios that could play out over time. The Internet and the public library could evolve a complementary relationship, with each fulfilling certain information needs and functions. Beyond a complementary relationship, the two information providers could actually benefit each other by reinforcing each other's use. A stressor relationship could also evolve, resulting in change with the library accommodating by revising its mission and providing a new mix of services. A competitive relationship could result in the least desirable scenario, with the eventual obsolescence of the library.

CONSUMER TESTING OF LIBRARY AND INTERNET SERVICES

A recent research project[23] attempted to shed light upon this evolving relationship by conceptualizing the public library and the Internet as operating within the context of the consumer market, with patrons acting as consumers of information and other services and ''product testing'' the two information providers. The Internet is currently providing similar information, services, and materials, such as consumer-, job-, and homework-related information and assistance, leisure reading material such as magazines and newspapers, and informal and formal book reviews (similar to the ''reader's advisory services'' offered by the library), and these appear to be in direct competition with the services currently offered by public libraries. The following discussion provides an overview of this research and is adapted from Ref. [23].

The research was designed for the following reasons: to identify the current proportion of users using the public

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library, the Internet, both, or neither; to identify the reasons people use the library and/or the Internet; to identify the decision criteria that people use when choosing to use either the library or the Internet; and to evaluate how consumers think the library and the Internet perform on these decision criteria. By identifying the current market segmentation, the reasons for use, decision criteria, and performance ratings, the research establishes a baseline upon which change in the Internet/public library usage patterns and decision criteria can be measured and suggests areas to be monitored by public libraries in their planning processes. Telephone interviews with 3097 English- and Spanish-speaking adults, 18 years of age or older, were conducted in March/April of 2000 (interviews with other language groups were terminated because of language constraints; Asian and Native American groups had very small sample sizes which limit their reliability). Eight sets of detailed questions asked people about their information needs, their access to and use/nonuse of the library/Internet, and the service characteristics of the library/Internet and their importance, as well as demographic questions.

In terms of use of the Internet and/or the public library, the survey found the following results, which are similar to other recent studies:

66.4% of people use the public library.
59.3% of people have Internet access.
53.2% use the Internet.
40.0% use both the public library and the Internet.
18.6% use neither the public library nor the Internet.

Of the 53.2% who use the Internet, 75.2% of these people also use the library, and of the 66.4% who use the public library, 60.3% of these library users also use the Internet. Thus there is currently a very strong association between Internet use and public library use.

In terms of where people access the Internet, of the 59.3% with Internet access:

47.0% have Internet access at home.
37.5% have Internet access at the library.
4.3% have Internet access *only* at home.
0.5% have Internet access *only* at the library.

The demographic characteristics of the respondents were similar to those of other studies, showing age differences and strong evidence for the ''Digital Divide.'' In terms of age, library users and Internet users were both significantly younger than nonusers of the library and Internet, and, not surprisingly, Internet users were also younger than library users. Race or Hispanic ancestry did not affect public library use, but use of the Internet was significantly related to race: Hispanic Americans reported the lowest usage of the Internet (32.1%), followed by African-Americans (43.7%), while White (non-Hispanic) usage was 58%. Not surprisingly, use of the library and use of the Internet both increased with level of education attained and with household income. Sex also appeared to be related to use of the Internet or the library: 70.4% of females reported using the library vs. 62.2% of the males, and 57.1% of males reported using the Internet vs. 49.5% of the females.

The researchers developed a set of questions to determine the reasons that people used the library; these were developed from the Public Library Association's set of service responses (defined as ''what a library does for, or offers to, the public in an effort to meet a set of well-defined community needs'')[24] with additional data from focus groups conducted by the researchers. The reasons that people use the library shed light upon what services and resources may be used at the library. The respondents were presented with the following list and were asked if she/he used the library for each reason:

Finding information that I need	Finding local history/ genealogy
Information on personal interests	Finding government information
Borrowing for personal enjoyment	Bring children there for fun of reading
Researching personal projects	Reading newspapers and magazines
Finding business information	Bringing children to do school work
A place to go to	Finding ethnic heritage information
Information on consumer products	Attending programs for adults
Information on community services	Learning to use PC and Internet
Finding job and career information	Using library's meeting room
Studying or doing schoolwork	Attending literacy classes
Doing research for my job	

The ranked list of reasons for use of the library is presented in Table 1.

The data were analyzed to see if there were differences in use of the library among three groups, users of the library (who have Internet access and do or do not use it) and users of the library who do not have access and do not use the Internet at all. While there were statistically significant differences in reasons for use among the groups, a pairwise correlation of reasons for use showed that the rank ordering of reasons for use did not differ significantly among the groups. This is taken as evidence that use of the Internet is *not* changing the reasons *why* people use the library at this time. For the group of users

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Table 1 Percentage of respondents who reported using the library for each type of use* (segments 1, 2, 3)**

Use library for...	*N*	%
Finding info that I need	2055	80.3
Info on personal interests	1646	77.6
Borrowing for personal enjoyment	2051	75.8
Researching personal projects	2049	55.9
Finding local history/genealogy	1648	41.0
Finding government information	1644	40.4
Bring children there for fun of reading	2055	39.5
Reading newspapers and magazines	2054	37.4
Finding business information	1647	36.5
A place to go to	2051	35.5
Info on consumer products	1647	34.0
Info on community services	1648	32.6
Finding job and career info	1647	29.5
Studying or doing schoolwork	2052	28.6
Doing research for my job	2053	28.2
Bringing children to do school work	2055	27.3
Finding ethnic heritage info	1647	23.7
Attending programs for adults	2048	21.7
Learning to use PC and Internet	2046	16.0
Using library's meeting room	2050	14.7
Attending literacy classes	2051	4.2

*Respondents were able to choose multiple reasons for use.
**Segment 1. Respondents who use the library and the Internet.
Segment 2. Respondents who use the library and have Internet access but do not use it.
Segment 3. Respondents who use the library and do not have Internet access.
Source: Ref. [23].

that have Internet access and use *both* the library and the Internet, additional analyses were performed. A correlation analysis for the reasons for use was also run against measures of Internet use such as recency of beginning use, the number of years using the Internet, and frequency of use of the Internet; these mostly nonsignificant correlation coefficients also indicated that these aspects of Internet use are not affecting *why* people use the library. A third correlation analysis for recency, length, and frequency of *Internet* use was run against frequency of *library* use; all of these correlation coefficients were statistically insignificant, again indicating that Internet usage patterns do not currently appear to be affecting *frequency* of library use.

It should be noted that while the study distinguished among those with and without Internet access, the study did not try to distinguish whether those who used the Internet for specific information needs used it at home or at the library; rather it focused on the types of uses and services themselves, the assumption being that as people gain Internet access at home and comfort with the technology, they become more likely to use it there rather than making a trip to the library solely to use the Internet.

In a final question, respondents who used both the library and the Internet were asked to estimate their future use of the library. While most estimated that their frequency of library use would remain the same, approximately 10.4% of the respondents estimated that their usage would increase. However, a small number (2.5%) anticipated that they would stop using the library all together.[25][a] Given the fact that public responses to questions about the library historically are very positive, this response should not be taken lightly.

A comparable list of reasons for use was developed for the Internet (with some additions specific to the on-line environment, such as E-mail, on-line shopping, and playing on-line games), drawing upon previous research[26] and the research project's focus group data. The use of a somewhat comparable list enables distinctions between information providers as to which provider is chosen for specific types of use. The purpose here was not only to determine the reasons why people use the Internet, but also to determine if use of the *library* affects *why* they use the Internet. Using the previous methods, users of both the public library and the Internet, and users of the Internet, were presented with the following list and were asked if she/he used the Internet for each reason:

Finding info that I need	News, weather, and sports info
E-mail	Finding business information
Info on personal interests	Doing research for my job
Browsing Web for own enjoyment	Shopping
Researching personal projects	Finding job and career info
Info on consumer products	Finding local history/genealogy
Finding government information	Browsing Web with kids for fun
Getting computer technology info	Chat rooms or listservs
Learning how to search the Internet	Investing
Playing games	Finding ethnic heritage info
Info on community services	Distance education classes
Studying or doing schoolwork	Getting info for kids' schoolwork

The ranked list of reasons for use of the Internet is presented in Table 2.

The same method of correlation analysis of the rank orders of the reasons for using the Internet was employed

[a]A recent ALA-sponsored survey of public opinion found that 91% of respondents believed that libraries will exist in the future, despite the large amounts of information available on the Internet; however, 7% believe the library will not continue to exist.

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Table 2 Percentage of respondents who reported using the Internet for each type of use* (Segment 1: respondents who use the library and the Internet, and Segment 4: respondents who do not use the library but do use the Internet)

Use Internet for...	*N*	%
Finding info that I need	1649	94.4
E-mail	1649	91.5
Info on personal interests	1557	85.3
Browsing Web for own enjoyment	1633	84.9
Researching personal projects	1647	80.9
Info on consumer products	1556	72.2
News, weather, and sports info	1646	63.4
Finding business information	1557	61.4
Doing research for my job	1648	57.9
Shopping	1648	53.8
Finding job and career info	1557	51.2
Finding government information	1557	50.2
Getting computer technology info	1555	49.1
Learning how to search the Internet	1647	45.4
Playing games	1649	40.8
Info on community services	1554	37.0
Studying or doing schoolwork	1645	35.0
Getting info for kids' schoolwork	1649	31.0
Finding local history/genealogy	1555	30.7
Browsing Web with kids for fun	1649	26.7
Chat rooms or listservs	1648	23.5
Investing	1649	23.0
Finding ethnic heritage info	1557	20.1
Distance education classes	1649	8.9

*Respondents were able to choose multiple uses.
Source: Ref. [23].

and again showed that the rank orderings of reasons for use are practically identical. According to the 2001 UCLA Internet Report,[27] Internet users employ substantially more media (with the exception of television) than nonusers, including print media such as books, magazines, and newspapers. These analyses suggest that users of both the library and the Internet are heavy consumers of information resources and services and that they currently use both providers for this purpose.

The group using both the Internet and the library is of particular interest as their usage patterns may shed some light upon which information provider is used for specific types of information resources or other types of services. Therefore for each set of comparable reasons for use (for that group which uses both the public library and the Internet), the data were segmented into the percentage of users who used *both* the Internet and the library for that use, used *only* the library, *only* the Internet, or used *neither* (Table 3). Using a chi-square analysis for contingency tables, statistically significant differences emerged among the providers used for 17 of these reasons for use. These results indicate that this group of users was in fact discriminating between which provider (or neither) to use for *each* reason.

For those users that are using *either* the Internet or the library (but not both), approximately twice as many of the respondents were using the *Internet* rather than the library to obtain information about government (20.5% to 10.1%) and for kids' schoolwork (12.0% to 5.3%). Approximately 4 to 7 times as many of the respondents were also using the Internet rather than the library exclusively in other areas such as consumer products (38.5% to 5.4%), business (28.4% to 8.1%), jobs and careers information (26.7% to 5.8%), research for their jobs (27.5% to 5.4%), research for personal projects (29.9% to 7.6%), and reading newspapers and magazines (37.4% to 10.3%). For obtaining information about local history and genealogy, the library was preferred by a margin of 2 to 1 (15.5% to 7.7%). Even in the area of Internet and computer learning, the Internet is preferred exclusively by a margin of more than 7 to 1 (34.7% to 4.5%). The library leads in traditional service areas such as kids' reading (by 16.1% to 4.5%) and as ''a place to go''(22.6% to 13.1%). This suggests that, for users who choose to use one provider exclusively, the library is experiencing considerable competition as an information provider and also in areas considered to be traditional service areas of the library, such as leisure reading and for children's schoolwork. It is noteworthy that the average percentage across all uses of respondents who used *only* the Internet (20.3%) is twice as large as the average percentage who used only the library (9.7%), and these two groups combined is already equal to the average percentage who used both providers (30.3%). It must be noted that, at this time, it cannot be determined whether these apparent use preferences for the Internet represent migrations of use away from the library *to* the Internet or *new* demands for information being generated by the Internet. This may also suggest increased access to the Internet within the library, and that could in turn be encouraging users to find their own answers, rather than using mediated reference services within the library.

Given the need for a particular type of information need or service, another key question is the decision criteria users consider when choosing to use the Internet or the public library to fulfill this need. The researchers modeled a set of decision criteria drawing upon communication theory,[28] management information systems theory,[29] and digital information resources evaluation.[30] This produced a set of 17 criteria, which the researchers assumed represented the *service characteristics* of the two providers, and included factors such as availability, accessibility, ease of use, timeliness, range of materials, accuracy, and so forth. These were formulated into paired sets of statements, such as:

My privacy is protected when I use the library.
My privacy is protected when I use the Internet.

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Table 3 Cross-tabulations of comparable reasons for use by the provider used for respondents who use both the library and the Internet ($N=1240$)

Use for	Used both	Used only library	Used only internet	Used neither	*p*
Finding info that I need	77.0	4.0	17.9	1.1	0.550
Info on personal interests	**74.1**	**7.2**	**12.4**	**6.3**	**0.000**
Borrow/browse for fun	**66.0**	**11.0**	**18.1**	**4.9**	**0.004**
Researching personal projects	**51.3**	**7.6**	**29.9**	**11.2**	**0.000**
Info on consumer products	**32.8**	**5.4**	**38.5**	**23.3**	**0.000**
Finding business information	**32.3**	**8.1**	**28.4**	**31.3**	**0.000**
Finding government information	**30.5**	**10.1**	**20.5**	**38.9**	**0.000**
Doing research for my job	**28.8**	**5.4**	**27.5**	**38.3**	**0.000**
Studying or doing schoolwork	**26.6**	**6.0**	**9.8**	**57.7**	**0.000**
Reading newspapers and magazines	**26.6**	**10.3**	**37.4**	**25.7**	**0.000**
News, weather, and sports info					
Finding job and career info	**25.8**	**5.8**	**26.7**	**41.7**	**0.000**
Finding local history/genealogy	**24.7**	**15.5**	**7.7**	**52.2**	**0.000**
Bringing kids for fun of reading	**24.1**	**16.1**	**4.5**	**55.2**	**0.000**
Browsing Web with kids for fun					
Children to do school work	**20.5**	**5.3**	**12.0**	**62.1**	**0.000**
Getting info for kids' schoolwork					
Info on community services	**17.1**	**15.1**	**19.7**	**48.1**	**0.000**
Finding ethnic heritage info	**14.9**	**8.0**	**7.7**	**69.5**	**0.000**
A place to go	**11.6**	**22.6**	**13.1**	**52.7**	**0.000**
Chat rooms or listservs					
Learning to use PC and Internet	**11.1**	**4.5**	**34.7**	**49.8**	**0.000**
Learning to search the Internet					
Attending programs for adults	5.2	15.3	19.6	59.9	0.830
Chat rooms or listservs					
Using library's meeting room	4.4	10.6	20.3	64.7	0.097
Chat rooms or listservs					
Mean %	**30.3**	**9.7**	**20.3**	**39.7**	**0.000**

The raw data were submitted to chi-square analyses for contingency tables ($p=0.05$ or less). Statistically significant values are in **bold**.
Source: Ref. [23].

These were read to respondents who used both the library and the Internet, and each respondent was asked to rate his/her degree of agreement with the statement using a 10-point scale. The analysis of these data revealed significant differences between the perceived service characteristics of the library and the Internet. Respondents rated the Internet higher for 10 service characteristics and the library higher for 6. Therefore among users who use both the library and the Internet, these characteristics may be forming the basis for consumer differentiation and choice between the library and the Internet as providers of information and information services.

The library received higher ratings for:

Ease of use.
Low cost.
Accuracy of information.
Helpfulness of librarians (vs. net helplines).
Protection of user privacy.
Availability of paper copy (vs. digital copy).

The Internet received higher ratings for
Availability (hours of access).
Ease of getting there.
Time to get there.
Range of resources.
Up-to-dateness of the information.
Expectation of finding what is sought.
Ability to act immediately on the information obtained.
Fun.
Enjoyability of browsing.
The ability to work alone (vs. being among people at the library).

Additionally, each respondent was asked to rate the *importance* of the service characteristic to them, also on a 10-point scale. Not surprisingly, most of the service characteristics were rated as being highly important, and the majority of ratings of service characteristics were below the ratings for the importance of the service

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characteristics for both the library and the Internet. However, the ratings for three Internet service characteristics (availability, privacy of use, and fun) were not significantly different from the ratings of their importance. This suggests (as these ratings are on the high end) that the Internet may be fulfilling user expectations on these three (possibly key) decision criteria.

These results lend credence to the *time* and *convenience* factors as components of the criteria leading users to choose the Internet over the library. Other support for these factors comes from data focusing on users of the Internet who did *not* use the library. Data analysis compared reasons for nonuse of the library among Internet users and Internet nonusers. If users of the Internet had different reasons for nonuse of the library than Internet nonusers, this could indicate an effect of Internet use upon library use. There were eight significant differences, and several of these related to the time and convenience factors. Those who used the Internet felt they did not have time to go to the library, expressed problems with distance and accessibility of the library, and expressed a dislike for returning library materials. Additionally, more of those with access to the Internet who choose *not* to use it cite feeling safe and fear of pornography as reasons for not using the *library*, suggesting that fear may affect their nonuse of both providers.[2]

In summary, these results may point to users' key choice factors in deciding whether to use the library or the Internet. The library appears to be maintaining its status as a helpful provider, a source of accurate information, and a protector of user privacy. However, time and convenience may be becoming more important choice factors.

What emerged from our informal conversations with the different user segments in the focus groups is a portrait of people who, faced with time demands from their jobs and other life issues, have problems even taking care of the basics of daily living. When a complicating factor, such as a serious illness among a family member, is added, the time burden becomes even greater, and the report concludes, ''Thus even though the library is seen as a 'better' provider of information, the bottom line choice for these people may be made on the time factor.''[23]

An additional factor is the availability of end-user technologies such as search engines. Libraries have longed used systems that were designed for librarians, not for end-users. Search engines allow users to search directly and easily, albeit with varying levels of success. As Schottlaender and Jackson note: ''The single, powerful search engine, simple search interface, and rapid result sets offered by Google and similar services are sufficient to satisfy many information needs. Users appear to prefer speed and ease of use to comprehensiveness of information.''[9] Other evidence supporting high user satisfaction with the Internet comes from a Pew Internet report: of Internet users who have sought information from the Web on health care, government agencies, news, and shopping, about three-fourths have had positive experiences in finding what they need.[5]

CONCLUSION

The Internet has had a wide-ranging impact on the public library in terms of allocation of resources and provision of a broad suite of services to the public, but it is unclear how these new Internet-based services affect public library use. Based on a number of research projects and a wide range of data, it appears that users may be beginning to differentiate between use of the Internet and the public library in terms of reasons for use and opinions about the service characteristics of each. If the decision criteria found in Ref. [23] for choosing between the two information providers are confirmed (a scenario which seems likely but requires further research), what remains to be seen is whether the library can accommodate changing consumer choices by emphasizing or modifying existing services or adding new services, while maintaining a healthy balance in allocation of resources. It would be ironic if the large amounts of money being spent on providing access to technology and training in its use were actually hastening the decline in use of the library, rather than solidifying its user base.

While the results of several studies discussed here indicate that use of the Internet and use of the public library are currently complementary, public libraries can benefit by paying very close attention to research results related to Internet use (such as Ref. [31]), library use, and the intersection between the two. In this way, the less desirable scenarios could be avoided and libraries could achieve more positive outcomes, moving beyond evolving a complementary relationship to the more powerful scenario of reinforcement. As noted earlier, there is evidence that users of the Internet use substantially more media in all forms, so that using one information provider stimulates the user to explore resources from others. Rather than thinking simply about how to function in an Internet world, libraries should employ these research results to strategize and plan how to leverage the resources of the library in concert with the Internet to create an ever-strengthening and ever-widening library environment for information discovery.

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Joint Information Systems Committee

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INTRODUCTION

The Joint Information Systems Committee (JISC) promotes the innovative use of information technology in colleges and universities across the UK by providing advice, funding, services, and leadership. Its central role stimulates the uptake of new technologies in a cost-effective, comprehensive, and well-focused way.

BACKGROUND: HISTORY OF THE JISC

The JISC can trace back its origin to 1966 when the UK government set up the Computer Board to establish a single shared network for researchers in the university sector. This was succeeded in 1991 by the Information Systems Committee of the Universities' Funding Council. The JISC name and acronym were established on April 1, 1993 by the higher education funding bodies for England, Scotland, Wales, and Northern Ireland. Devolution required a formal commitment by the funding councils to continue working jointly on network provision and in other strategic areas of information technology. In 2000, the JISC's remit extended to colleges by agreement of, and funding from, the further education funding bodies.

This entry highlights major changes and new initiatives launched since the original JISC entry in the *Encyclopedia of Library and Information Science, Second Edition* was written. Readers are referred to that earlier article for a fuller overview of JISC's history.

WHAT IS THE JISC? WHO BENEFITS FROM IT?

The JISC is a nested set of advisory committees to the seven further and higher education funding councils in the UK supported by an executive of ca. 60 staff. These funding councils oversee grants made by the UK government to colleges and universities in support of their learning, teaching, and research activities. The grants paid to institutions by the funding councils are ''top-sliced'' to fund the JISC's program of work. This ensures that senior managers in colleges and universities scrutinize their activities closely, and that experts in the community contribute to informing its program of work to ensure that actual benefit is derived from national, cooperative effort.

The JISC gathers advice and expertise from its communities through numerous subcommittees. Members of the JISC and its subcommittees are senior managers, academics, and technology experts from across the education sector. This ensures that the JISC remains responsive to the changing needs of institutions and users. Based on this input from the community, the JISC makes recommendations to the funding councils as to its strategic agenda. The current JISC strategy can be viewed at http://www.jisc.ac.uk/.

To ensure that its community is at the leading edge in the use and development of new technologies for learning, teaching, and research, the JISC provides:

- A high-speed, broadband network (known as SuperJANET)
- Development programs to improve products, processes, and services
- Collections to support learning, teaching, and research
- Advisory and support services to help individuals and institutions

NETWORK INFRASTRUCTURE

SuperJANET

The need for a robust, high-speed network for the UK academic and research communities was one of the primary reasons for the formation of the JISC. The original network was formed through rationalization of regional network islands based around large computer centers and research facilities. The vision for JANET was to bring these together under common management and to achieve pervasive coverage using a single unified network running a coherent set of nonproprietary protocols.

At its inauguration in April 1984, JANET served around 50 institutions with network access of less than 10 kbit/sec. As time progressed and user expectation grew, incremental investment led to evolutionary upgrades of the network. By the early 1990s, JANET

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provided access links at 2 Mbit/sec, and the user base had grown from the original 50 sites to more than 200 connected institutions. The network has been constantly developed and upgraded since its inception, and now all UK colleges and universities plus a wide variety of public libraries, museums, schools, and businesses are connected via the fourth generation of the SuperJANET network. At the time of writing, the core backbone is 10 Gbit/sec, and an experimental optical network has just been procured. SuperJANET provides the UK with a world-class network that has won many awards for its innovation and achievements.

The regionalization of education provision has been a marked development in the UK over the past few years. Metropolitan area networks have become increasingly important, partially fuelled by economics but also by this recognition of the need for greater regional collaboration. It is intended that regional networks will mature to become the building blocks for SuperJANET over the coming decade.

Athens

Security and authentication are vital to providing a robust networked environment. To provide secure access to content and services, the network must be safeguarded against the spread of viruses and the threat of malicious attack. Information technology systems and resources are potentially vulnerable to attacks from anywhere on the Internet, and they must be protected against such threats by effective security strategies and mechanisms. The demand for secure access to university and college systems from offcampus locations means that it is also essential to have effective authentication to have confidence in the identity of any person requesting access over the network.

For these reasons, the JISC maintains a national authentication service. This is based on the Athens service, operated by EduServ, a not-for-profit company providing services to UK colleges and universities (http://www.athens.ac.uk/).

Athens was developed in the mid-1990s in response to the expanding range of licensed electronic resources made available to the community with the aid of JISC funding. Because all such resources required authentication of the user, individuals were faced with the need to remember ever-increasing numbers of usernames and passwords. This also caused difficulties for the information suppliers who had to manage these user populations, often on a scale well beyond what is normal in the commercial world.

Athens provided a solution to the password proliferation problem by means of a central database of authorized usernames and passwords for staff and students in all universities and colleges. The usernames are created and managed by designated Athens administrators in each institution. An individual requesting access to a licensed resource, whether from a campus machine or from a hall of residence, home, or any other location permitted under the license, will be referred to the central Athens authentication service. If the username and password match those in the database, and the institution has permitted the individual to use the resource in question, the request is validated and a message is returned to the information provider's server authorizing the access. There are more than 2,000,000 Athens user accounts from more than 450 institutions; the system manages access to more than 200 different resources, operated by numerous publishers and data service providers. Athens may be the largest access management system of its kind anywhere, and it is believed to be unique in its national scope.

RESEARCH AND DEVELOPMENT PROGRAMS

JISC funds a portfolio of research and development activities to improve processes, products, or services for UK education and research. These activities lie in a continuum of research, development, and deployment, and are informed by the following vision about the future of networked information provision:

An individual user is simultaneously a member of several communities—researchers, students, administrators, and teachers, and also employees, citizens, and consumers. They are increasingly mobile—demanding reliable access at home, at work, and while travelling. Their information needs are immediate, and they exploit an increasing variety and quantity of resources. JISC research and development activities build around both the current and future needs of the user, reflecting the fact that technology supports modern ways of working.

To meet these demands, users will require different services—those tailored to a chosen role; some to support personal work areas, reduce information overload, or aid communication and collaboration; and those used to tailor information received or provide purchasing tools.

Such expectations demand a coherent underlying infrastructure operating in a genuinely pervasive way, accessible when and where required. Responsive mechanisms for storage and retrieval of information, and innovative management of the digital content lifecycle, will need to be underpinned by a next-generation, high-performance network. Intelligent machine-to-machine dialogue will replace many routine

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processes, leaving the user free to use and benefit from information in the ways that they choose.

The JISC funds numerous research and development programs that exploit the potential of information systems for the benefit of users. The programs are developed after careful analysis of the needs of educational institutions and the potential benefits of new technology. Strong links are maintained with other organizations working in these areas, particularly research and government bodies, to avoid duplicate funding and to promote collaborative working. The increasing globalization of education has increased the number of international partners working with the JISC.

Some development programs investigate specific technologies with the potential to benefit educational users, and others investigate how specific user needs can be addressed with a range of technologies. There is also continual development in support of the JISC's core services, such as the network. Some successful development projects become long-term services in their own right.

JISC programs mostly investigate near-market technologies, and the emphasis is on demonstrating their value in real applications within colleges and universities. There are comparatively few projects that are research-focused, although some support is provided for partnerships between researchers and implementers. Great emphasis is placed on disseminating the results of the programs throughout the education community, so that the benefits of the lessons learned are made available as widely as possible. The JISC also commits resources to predicting and evaluating the benefits of the programs, publishing the lessons learned, and incorporating those lessons into future programs.

A wide range of research and development programs is underway to realize this vision, and each is described in turn below.

Authentication, Authorization, and Accounting (AAA) Program (End Date: December 31, 2004)

The AAA program is intended to address both the general needs for access management to electronic library materials and learning objects, and also the more specialized needs of the e-science research program.

Awareness and Training Environment for E-Social Science (End Date: July 31, 2006)

The Awareness and Training Environment for E-Social Science plans to support social science researchers to move beyond the desktop environment and take advantage of e-science infrastructures and the developing research grid. The program will promote new opportunities and skills available to researchers to exploit geographically distributed leading-edge data storage, computational, and network resources to manage and analyze data in a timely and cost-effective way.

Digital Libraries in the Classroom Program (End Date: July 31, 2006)

This international program, jointly funded with the US National Science Foundation, will bring about significant improvements in the learning and teaching process by bringing emerging technologies and readily available digital content into mainstream educational use.

Digital Library Infrastructure Program (End Date: December 31, 2004)

This program area covers projects working toward an infrastructure to support a possible future national union catalogue for monographs and serials in the UK. This work currently has two strands: the procurement of a pilot serials union catalogue (SUNCAT) and a project work to further interoperability between the eLib Phase 3 Clumps, virtual union catalogues, and COPAC, a physical union catalogue.

Digital Library Infrastructure Program (End Date: December 31, 2004)

This program aims to boost the capacity of UK educational institutions to ensure long-term access to records and other digital assets, and to comply with legislation such as the Freedom of Information Act.

Digitization Program (End Date: December 31, 2006)

This high-profile program will digitize the content of strategic national importance and make materials available to UK educational institutions in perpetuity. Collections include the ITN news archives, historical British newspapers and official publications, and backruns of important medical journals published in the UK. The content created in this program will be accessioned into the JISC collections.

Exchange for Learning (X4L) Program (End Date: December 31, 2005)

The focus of X4L is on projects that will foster change in online learning and teaching by exploring the potential of repurposing and sharing content for use in learning. Part of this activity is to explore the process of integration or

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plugging in of usable objects into online learning such as virtual learning environments.

Focus on Access to Institutional Resources (FAIR) Program (End Date: July 31, 2005)

FAIR will contribute to developing the mechanisms and supporting services to allow the submission and sharing of content generated by the UK educational community. The JISC content portfolio has the potential to grow to embrace both externally generated content from publishers and aggregators of educational content and community-generated resources. Furthermore, staff and students clearly need a place in which to lodge suitable content and products, and a currency for exchanging and adding to it. Therefore the information environment must create the mechanisms and supporting services to allow this process to prosper.

Infrastructure Program (End Date: April 30, 2004)

This program of activity includes projects that explore developments that contribute to integration and advances in the access to digital resources.

JISC Framework Program (End Date: September 30, 2006)

This is a new program that aims to develop and evaluate a framework to facilitate interoperability across learning, teaching, research, and their supporting systems.

Managed Learning Environments (MLEs) for Lifelong Learning (End Date: July 31, 2005)

An MLE integrates the whole range of information systems and processes of a university or college that contribute directly or indirectly to learning and learning management. These include the following:

- The components through which learners and tutors participate in ''online'' interactions of various kinds, including online learning
- Online learning resources, with pointers to traditional learning materials
- Student record systems
- Business and administrative systems.

The JISC is helping the UK Higher and Further Education sector to implement MLEs through works on components and interfaces, data interoperability, and standards. Much of this work is facilitated by the Center for Educational Technology Interoperability Standards (http://www.cetis.ac.uk/), which prepares specifications of interfaces that will need to be established between different components of learning systems. These interfaces between different software components are based on, and contribute to, the continuing development of international standards such as the IMS.

Both phase 1 and phase 2 of this successful program aim to explore the issues associated with developing learning environments to support the seamless movement of the learner between and across education sectors and institutions.

Network Development Program (End Date: December 31, 2005)

A program of network-related developments has been initiated by the JISC Committee for Networking to keep the SuperJANET network at the leading edge.

Portals Program (End Date: March 31, 2005)

The Portals Program will investigate the role of portals within the information environment and build demonstrators in different areas to demonstrate possibilities, leading to full portal services. Supporting studies and cooperative development with other JISC programs will be carried out toward creating a fully developed view of the nature and use of portals within learning, teaching, and research.

Presentation Program (End Date: March 31, 2005)

This program aims to investigate and discover how different types of resources can be presented within a variety of web environments in ways that best benefit users.

Semantic Grid and Autonomic Computing Program (End Date: April 1, 2005)

The Semantic Grid and Autonomic Computing Program involves a number of development projects designed to progress the development of semantic grid and autonomic computing based on open, vendor-independent standards. The program is funded in conjunction with the Engineering and Physical Science Research Council (EPSRC).

Service Provider Development Program (End Date: July 31, 2005)

This program has been developed to ensure that technical developments undertaken by JISC services are compatible with the Information Environment Technical Architecture.

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Shared Services Program (End Date: July 31, 2005)

The aim of the Shared Services program is to develop a common set of infrastructure services that portals and content aggregators and brokers can all ''talk'' to.

COLLECTIONS TO SUPPORT LEARNING, TEACHING, AND RESEARCH

The JISC provides UK Higher and Further Education institutions with a collection of high-quality online research tools, learning materials, and digital archives.

The JISC negotiates with publishers for licenses to a very wide range of digital resources. The collection has taken more than 10 years to build and consists of thousands of resources distributed across numerous access providers. Types of resources in the collection include scholarly journals, monographs, textbooks, abstracts, manuscripts, maps, music scores, still images, geospatial images, and other kinds of vector and numeric data, as well as moving pictures and sound collections. Full information about these collections is available online at http://www.jisc.ac.uk/index.cfm?name=coll.

ADVISORY AND SUPPORT SERVICES

The JISC takes a holistic view of stimulating the innovative use of information technology, recognizing that encouraging human and organizational change is extremely challenging. Thus it provides a wide range of advisory and support services for colleges and universities. Some of these are national; others are regional. Services undertake outreach and awareness raising, stimulate the production of information strategies, support the use of new techniques and media, and advise developers about making their products more accessible to users with disabilities. Services also provide advice and guidance on detailed issues such as copyright and intellectual property rights, plagiarism, and legal issues. The impact of these services is especially felt by institutional managers who are planning change, or who are introducing new systems and processes.

The range of advice and support is available in a one-stop shop on the JISC web site (http://www.jisc.ac.uk/index.cfm?name=advice), or can be accessed locally through a friendly member of staff at one of the regional support centers. Located within institutions, these centers stimulate the transfer of expertise and experience between colleges and universities, act as focal points for raising awareness, broker training, and provide feedback on institutional and user needs.

CONCLUSION

By funding service provision and development projects and by investing in the provision of advice and guidance, the JISC adds value to the UK educational sector. But its efforts have a value beyond this. By focusing on the needs of computer users—simultaneously with members of several communities—the JISC is well placed to add value in the future to the way each of us interacts with computers in our daily lives.

This broader vision for the JISC's work can only be realized in partnership with other agencies. Key partnerships include those with other funders including the Mellon Foundation, the National Science Foundation, the UK Research Councils, and the Wellcome Trust. Collaboration with other information providers is building momentum especially through the work of the Common Information Environment group (http://www.jisc.ac.uk/index.cfm?name=wg_cie_home), through collaboration with publishers (http://www.palsgroup.org.uk/), and through dynamic organizations such as the Digital Preservation Coalition (http://www.dpconline.org/graphics/index.html).

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1. Further information about the JISC, its services, and its programs can be found on the World Wide Web at http://http://www.jisc.ac.uk/.

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JSTOR

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INTRODUCTION

The purpose of this entry in the Encyclopedia of Library and Information Science is to provide an overview of the evolution of Journal Storage (JSTOR), to highlight some of the lessons that have been learned through JSTOR's experience, and to comment upon the challenges that lie ahead as the academic community becomes increasingly reliant on electronic technologies for scholarly communication.

JSTOR is a not-for-profit organization founded in 1995 with a broad mission to help the scholarly community benefit from advances in electronic technologies. Its initial objective has been to build a database comprising the back volumes of important scholarly research journals. The goal in building this central electronic archive has been to lower the system-wide costs associated with storing and preserving these academic materials while simultaneously increasing their utility. Although originally a grant project of the Andrew W. Mellon Foundation, JSTOR does not rely on the foundation for its ongoing support; rather, it has developed an economic model designed to enable it to achieve financial self-sufficiency and to allow it to operate independently. In its first 9 years, JSTOR has made remarkable progress. In fact, it has been successful beyond anyone's original expectations. As of October 2003, the archive contains nearly 13 million journal pages from 353 titles in 27 academic disciplines. More than 1800 academic institutions in 76 countries have licensed the database, contributing fees to support the preservation and ongoing maintenance of the archive. The organization continues to add more journals while also reaching out to new types of participating libraries and organizations all over the world and adapting to meet new types of archiving needs. It is fair to assert that there has been a clear endorsement in the scholarly community of JSTOR's goal to serve as a trusted archive of electronic journal literature. This article presents a summarized version of JSTOR's history and the lessons that may be learned from it; for more detail on these topics, a new book may be consulted.[1]

HISTORY

JSTOR was one of the first of a new set of scholarly resources to be developed with the World Wide Web in mind. Its history is inextricably linked to the technological and economic environment from which it emerged.

Genesis at the Mellon Foundation

William G. Bowen, President of the Andrew W. Mellon Foundation, first conceived of the idea that led to JSTOR in 1993. The pressures on academic libraries at this time are well known and well documented, but it is useful to review them briefly here to set the context for JSTOR's origins. In the late 1980s, materials budgets at academic libraries were rising, as indeed they had been for almost two decades. Still, the growth in these budgets was not sufficient to enable libraries to keep pace with the increasing quantity of academic literature being published. In addition, the subscription prices to academic journals, especially in the scientific fields, were rising far faster than the growth rate of library budgets. Because most of these journals had no direct substitutes, were vital to faculty research and teaching, and were part of a continuing series, journal subscriptions had budgetary priority. The natural consequence of these forces was that journal subscription purchases crowded out investments in other kinds of academic research materials, most notably scholarly monographs. The reduced market for monographs caused book publishers to raise prices to cover their costs, setting in motion a self-perpetuating and circular process that led to less demand for the books and still higher prices. These events threatened the continued publishing of important, but admittedly small market, scholarly books. In 1989, the Association of Research Libraries declared that the serials pricing problem had ''spiraled out of control.''[2]

It was clear that electronic technologies made it possible to think of these problems in new ways, assessing them from a system-wide perspective, rather than solely from a local one. It was possible, as authors at the Mellon Foundation were suggesting, that emerging technologies

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might be harnessed in such a way as to make collections development more effective and more efficient.[3] Nevertheless, there had been little progress in developing business models that would bring savings.

One reason that rising journal prices received the most attention was because these direct costs are easily measured and can be tracked over time in a library's acquisitions budget. But beyond the costs of acquisition, libraries also incur substantial costs to store, preserve, and maintain access to each item in perpetuity. This ongoing and perpetual obligation is taken on in varying degrees by all libraries, but it is especially significant for research-oriented libraries. These costs, many of which are ''hidden'' in capital investments previously made, are more difficult to measure and account for than subscription payments. But the costs are real, becoming most obvious at those times when space is limited and new space needs to be acquired or built. The annualized construction and building maintenance costs associated with one volume were being estimated in various studies at the time to be somewhere between $24 and $41.[4,5] Even without accounting for circulation and preservation costs, the long-term storage of a volume in a library is often more expensive than the cost of purchasing it initially.

It was in the wake of the Mellon Study, while Mr. Bowen was attending a Board of Trustees meeting at Denison University, that the basic idea for JSTOR was born. Denison was preparing to build a $5 million addition to its library, much of which was to be used to provide additional shelf space for Denison's growing collections. Mr. Bowen and other board members wondered what it was that was filling the stacks that caused the additional space to be necessary. The answer was that 25% of the library's shelves were filled with older journals and government documents. Here seemed an opportunity to take advantage of emerging technologies in a way that could yield cost savings. These documents were rarely used and, as was made obvious by the cost of the new addition, were being maintained at Denison at considerable expense. If academic journals could be stored electronically rather than as bulky paper copies, and if access to those electronic files could be shared among a large number of institutions, substantial cost savings might be generated. The enormous potential of the idea pushed work on the project ahead rapidly.

In 1994, the Mellon Foundation established a pilot project to test the concept, and to see if its theoretical potential was attainable in practice. A grant was made to the University of Michigan to extend and enhance the software and database infrastructure that was originally developed for The University Licensing Program (TULIP). Ten journals, five each in history and economics, were selected to participate in the pilot, as were six test-site libraries. The objective was to develop a working prototype system with the digitized back issues of the 10 journals (estimated to total 750,000 pages) and to provide access to that database to the test sites. Would the faculty and students at the test sites use the resource? Was it possible to imagine that the digital versions of the journals could actually serve as a substitute for the printed volumes? These were just two of many questions that the foundation hoped to answer during the pilot.

At a very early stage of the pilot project, the feedback from test-site libraries suggested strongly that the JSTOR idea should be pursued. It seemed possible that the benefits offered by the idea might make it possible for an independent organization to support itself, and it was abundantly clear that the project was too complicated to be administered within the foundation. An independent organization was going to have to manage it and carry it forward.

ORGANIZATIONAL LESSONS FROM JSTOR'S EXPERIENCE

The new organization was founded on the same principles that were established as part of the original project, and so it was natural that the entity be established as a 501(c)(3) not-for-profit organization. As a result, libraries tended to trust the organization to stay true to its mission, which was the long-term development and care—the archiving—of its collection of digitized journals.

The Importance of Mission for Not-for-Profits

One of the most important early lessons derived from the JSTOR experience has been the importance of defining and following a clearly articulated mission. Because not-for-profit organizations are not driven by standard market-based measures of financial success, the mission provides the primary guiding framework for the organization. The mission must not only guide broad strategic decision making, but must also serve to help chart a course through detailed and difficult daily decisions. It can inform everything that is carried out.

Broadly speaking, JSTOR's mission is to help the scholarly community benefit from advances in information technologies. In pursuing this mission, JSTOR takes a system-wide perspective and attempts always to balance the needs of libraries, publishers, scholars, and students. Our initial activities have been centered around building a trusted electronic archive of important journal literature reaching back always to the first issue published. In building this archive, JSTOR has two primary objectives: to protect and preserve important scholarly journal

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literature for future scholars and students, and to improve and enhance the accessibility of those materials today.

One set of examples illustrates how JSTOR's mission has helped to guide decision making concerning technologies chosen in the early stages of the effort. At the time, the complexity and rapidly changing nature of the technological environment made it a challenge to make decisions. A clearly defined mission can help an organization continue to make progress and not become paralyzed while seeking perfect solutions. Compromises must be made.

In the case of JSTOR, as would be true for all digital projects, key decisions had to be made about the appropriate formats and technologies for storage, display, and distribution of the digital material. The first decision was whether to store and deliver the information from the journal pages as image or text files. JSTOR decided to take advantage of the best of both images and text. Because JSTOR's focus is to offer a faithful replication of the original published material, and because the database is intended to serve as a substitute for the printed pages on shelves, storing and delivering the content as images is essential. The files preserved must aim for 100% accuracy. JSTOR's goal to make the older literature more useful and accessible led the organization to complement the image files by creating a set of text files generated through the use of optical character recognition software (OCR). Although it proved to be prohibitively expensive to create text files at or near 100% accuracy, text at lower levels of accuracy can be used to facilitate full-text searching. The two primary objectives of JSTOR's mission, to offer a trusted archive while also enhancing access to the older material, drove the dual storage approach JSTOR has taken to date.

Another key decision concerned how to deliver the database to users as soon as it was created. Although delivery over the Internet and World Wide Web dominates the world now, it was not obvious in 1994 that the present situation would come to pass. Many publishers and digital projects delivered information via CD-ROM. Given JSTOR's reliance on images to display journal pages, an approach resulting in large data files that transmit more slowly if network connections are narrow or congested, serious consideration was given to CD-ROM delivery. Because it is central to JSTOR's mission to save money in the long-run for libraries and their parent institutions, and because that can best be accomplished through centralized storage of the electronic archive, it was a natural decision for JSTOR management to develop a Web-based interface and delivery mechanism. To distribute CD-ROMs would duplicate the existing system, with each library having to store and maintain the CD-ROMs for archiving and preservation purposes. Although this decision may have delayed the participation of low-bandwidth institutions, ultimately it reduced the cost of participating for all.

A third important technological decision that was guided by the mission was the selection of 600 dots-per-inch (dpi) as the scanning resolution for the creation of the digital page files. At the time the decision was made, 300 dots-per-inch was the prevailing standard, and there were relatively few reasonably priced scanners that could create 600 dpi images and even fewer printers that could print them. Looking at the decision in strictly economic terms, one would have been inclined to choose 300 dpi. The decision to digitize at 600 dpi was driven by JSTOR's archival mission. A key challenge associated with electronic archiving is that technologies for storage and display are constantly changing (and generally improving).

So when a decision is to be made to digitize at a given resolution, a question to be considered is whether it will become necessary later to consider redigitizing all of the pages as printers and screen displays improve. In pursuing an archival approach, one seeks out a stable level of quality that is faithful to the information content displayed in the original. The decision to scan and store the images at 600 dpi was right for JSTOR because, at resolutions higher than 600 dpi, the improvement in appearance of predominantly text-based pages is limited. The increased clarity achieved by moving to higher resolutions is barely perceivable by the human eye, if at all. It definitely does not alter in a material way the information being conveyed in the document. But there are perceivable differences between 300 and 600 dpi, making the higher of these two resolutions more appropriate for JSTOR, notwithstanding the increased cost. Thus the increased storage and distribution costs that are associated with larger, high-resolution files is not justified by the benefits that result.

The technological decisions made in the early stages of JSTOR's existence were not easy ones. In fact, there are no ''right'' answers in an absolute sense, but these three choices, guided by mission nearly 10 years ago, have held up.

Flexibility

Although mission is very important, especially for an organization that views its mission as archiving, JSTOR tried to avoid rigidity. Instead, flexibility and innovative solutions have been necessary to achieve the mission. The commitment to migration, or updating software and standard to stay accessible via ever-changing technologies, is a fundamental requirement of any electronic archive, one that requires an ongoing commitment of institutional resources. But migration is not the only commitment to flexibility required of JSTOR as an electronic archive.

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In addition to technological flexibility, organizations must be prepared to modify their business practices and approaches as circumstances change. In JSTOR's early days, it was expected that the database would house not only the back issues of journals, but the current issues as well. As JSTOR's staff discussed the nature of its service with potential publishing participants, however, it became clear that a service made up of both current issues and the back issues struck them as being competitive. If JSTOR were to act as a publisher of digital versions of current issues, it would put publishers' primary source of revenue at risk. Our intention was to work positively with publishers, not compete with them. In addition, the back files represented the content most likely to become lost in the transition to an electronic environment, and, therefore, more in need of the attention of a not-for-profit organization such as JSTOR. We decided to focus our efforts on the backfiles, those journal issues that were not of direct economic value to the publishers. This decision was an important shift from the original conception of JSTOR's responsibilities; one that we believed allowed us to better focus ourselves to achieve success. It is a good illustration of JSTOR's emphasis on taking a system-wide perspective, which takes into account the needs of publishers, as well as those of libraries and researchers.

Another example of the need for flexibility relates to the fee structure that JSTOR initially adopted. JSTOR's initial fee structure was designed to help libraries by rising only very rarely, if at all, for a given collection of journal titles. But, as a result, there were few natural opportunities to adjust pricing in response to market forces. Nevertheless, as soon as adequate data were available, JSTOR staff analyzed the logs of usage activity at over 200 colleges and universities of various types and sizes. Through this analysis, it became apparent that the relative contributions being made by smaller and medium-sized colleges were higher than the comparative amounts being paid by the largest research libraries. JSTOR adjusted its fee structure in response to this information, lowering the relative cost of JSTOR to smaller institutions. Since then, there have been periodic efforts to introduce pricing plans to respond to the needs of community colleges, secondary schools, and overseas college and universities, among others.

These examples of flexibility are presented to illustrate some of the ways by which JSTOR stay true to its mission given the complicated real-world conditions.

GROWTH

With some of these fundamental tenets regarding mission and flexibility, JSTOR has grown both in terms of content and participants. JSTOR's initial collection, now known as Arts and Sciences I, remains at the core of the archive. This collection contains 117 journals across core arts and sciences disciplines, and its digitization was completed toward the end of 1999, by the promised deadline.

Since Arts and Sciences I was released, JSTOR has continued to add new collections at a rate of approximately two per year. Some of these have been smaller and discipline-focused, such as Business, Ecology and Botany, General Science, Language and Literature, and Music. There have also been a number of further Arts and Sciences collections. All told, JSTOR offered access to the complete backfiles of 353 titles as of October 2003, with many more in various stages of the digitization process.

Participation in JSTOR began with American four-year academic institutions, but in 2003, these schools account for only approximately half of JSTOR's participants. In addition, there have been numerous community colleges, research institutes, secondary schools, and government agencies that have sought to participate in one or more of JSTOR's collections. Of the total number of participants, approximately one-third are outside the United States, and this percentage seems likely to continue to grow. Participation in JSTOR beyond American higher education was always anticipated, but never to the extent that has arisen. With this degree of enthusiasm for JSTOR's work, it seems likely that further collections growth can be expected.

UNEXPECTED OUTCOMES

One of the most interesting examples of a new and unintended use of the JSTOR database has been the work of Fred Shapiro, a law librarian at Yale University. Mr. Shapiro is using JSTOR to conduct lexicographical research, specifically to find early uses of important words and phrases. Many of Mr. Shapiro's discoveries document published uses of terms that antedate the earliest known uses as published in the Oxford English Dictionary (OED). For example, Mr. Shapiro found the term ''software'' in an article in the American Mathematical Monthly in 1958 (the OED showed the first use as occurring in 1960). Shapiro also found a use of the term ''double-standard'' in a 1900 article in the American Journal of Sociology when the OED had the first use dated as 1951. Shapiro has made more than 500 similar discoveries for other terms, improving the historical record for terms such as racism, Marxism, postmodern, and the term United Nations.

But Shapiro's interest in this research extends beyond just finding early uses of terms; his interest is in illuminating the history of ideas. He has begun to use JSTOR to conduct searches on the origins of well-known quotations. He has already identified a misattribution of the

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well-known truism ''There's no such thing as a free lunch.'' This quote is generally believed to be from Milton Friedman, because he published a book by that name in 1975. But a 1952 article in the journal Ethics attributes the saying to ''Professor Alvin Hansen in his famous TINSTAAFL formula—'There's no such thing as a free lunch.'''

Another somewhat unexpected outcome of the availability of journal backfiles through JSTOR has been the degree to which the archive has proven itself to be a valuable teaching resource. Older scholarly journals are not typically important sources of material for undergraduates. It was expected that JSTOR's primary use would be as a research tool, and while it has been proven to be a valuable resource for scholarly research, it is also true that JSTOR has emerged as an important tool for teaching. As Mark Fernandez, an assistant professor at Loyola University–New Orleans said, ''This is simply a tool we have never had before.... Seeing the facsimile presentation of these documents is important for students. I think it will encourage them to become more engaged with historical documents and sources.''

This value for teaching has been especially notable at smaller colleges that have never had access to such a chronologically deep collection. Steve Soud, a professor at Maryville College in Tennessee says, ''JSTOR is especially exciting for students at Maryville because we didn't have access to the long back runs of scholarly journals before.'' Soud requires his students to make use of JSTOR for his class. He and the Maryville librarian Roger Myers work together with students to help them use JSTOR for a final research paper for Soud's course on seventeenth century English literature. ''I want my students to understand that literature doesn't happen in a vacuum,'' Soud said, ''it is created in a cultural matrix, which has political, philosophical, historical, and economic aspects.''

The Maryville example illustrates an additional and somewhat unexpected consequence of the creation of the JSTOR archive. While JSTOR was initially created with the purpose of allowing the saving of space and the increasing of access at libraries that already held these journals, it has also provided the first access to these titles at some smaller institutes and colleges that never had access to the paper equivalents. This value is especially apparent at the smaller non-U.S. libraries, some of which are the heaviest users in their respective JSTOR classes. Jane Ann Lindley, the University Library Director at Koc University in Turkey, said: ''It is virtually impossible for our library to comprehensively acquire, let alone store and preserve, the voluminous backsets of even the most critical titles.'' Access and storage space also presented a challenge for ITAM in Mexico City. ITAM became the number one user of JSTOR among very small institutions worldwide after it signed up in December 1998. As its library director, Jamie Catalina-Alvarez said, ''With JSTOR, we now have a very complete collection of selected academic periodicals.'' These benefits were simply not possible in the days before digital technologies and the World Wide Web.

ARCHIVING DEVELOPMENTS

JSTOR's commitment to archiving has been one of the hallmarks of its success. If JSTOR could not be a trusted archive of its journal content, then it would not be possible for libraries to view JSTOR as an adequate replacement for their own archiving work. Understanding this, JSTOR has worked hard so that both libraries and publishers would trust its commitment to the long-term preservation and care of its journal content.

Seeking to develop the trust of libraries and publishers, JSTOR built backup sites in three locations on two continents. It ensured that replacement copies of the electronic files were kept off-site. It has continued to develop and rebuild the technological infrastructure of the database, the server and storage infrastructure, and the digital content files themselves, the critical and ongoing—yet virtually invisible—work of archiving. It has also added new features in response to demand from its participants.[a] And, every year, another year of journal content is added to the archive, at no additional expense to libraries or publishers. But perhaps most importantly, JSTOR maintained an organizational commitment, and the necessary financial resources, to undertake whatever work was necessary to keep its standards and its content up-to-date, as a core part of its mission.

Notwithstanding its commitment to archiving its collections of digitized journals, JSTOR was always aware that electronic copies of the journals would not be a complete solution. More recently, the library community has manifested a growing conviction that there is artifactual importance to keeping at least some copies of any print materials that were digitized. Consequently, one important area of JSTOR's work in 2002 and 2003 has been working with libraries to ensure that one or more ''paper repositories'' of the journals will be maintained under the highest preservation standards. It is expected

[a]One development that has been visible to users, and valuable to them, has been the deployment of mechanisms that allow for linking from outside resources directly to JSTOR articles. This resulted from many years of consideration and planning, and has now begun to result in steady improvements to JSTOR users' experiences. Once an article is located via an indexing database, it is often possible to link directly to that article.

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that these efforts will bear fruit with formal agreements that will ensure the long-term preservation of multiple copies of the original paper versions of the journals in the JSTOR collections.

In addition to preserving the paper copies that have been digitized, which is itself organizationally complicated, there is an even more complex problem regarding the preservation of journals that were born not in print but in electronic formats. If these e-journals are to play a similar role in the system of scholarly communications as have their print counterparts, a robust archiving solution will have to be developed. It has always been JSTOR's commitment that, as journals in its archive began to publish electronic versions, it would archive these, too. While the challenges posed by this commitment are significant—they are not only technological, but also organizational and financial—JSTOR has created a unit, tentatively known as the Electronic-Archiving Initiative, to develop an organizational structure, a business model, and the necessary technological infrastructure to address them.

With both the paper repository plans and the Electronic-Archiving Initiative, JSTOR has adapted to maintain and enhance its commitment to the long-term preservation of the journals in its database. The popularity of electronic journals and the library community's interest in maintaining print versions have both presented JSTOR the opportunity to meet its mission in new ways, and there may prove to be more such examples in the future. While it is too soon to report on the outcomes of these endeavors, JSTOR's willingness to explore new needs and to devote substantial resources to these efforts is an important demonstration of its commitment to its mission.

THOUGHTS FOR THE FUTURE

There is no doubt now that the introduction of electronic technologies, of which JSTOR is an example, is having a profound and permanent impact on the way academic institutions fulfill their missions to create and disseminate knowledge. Electronic technologies offer the possibility to make information more widely available and economically attainable, potentially reducing the gap between resource-rich and resource-poor institutions. Very small institutions have the opportunity to provide to their constituents the same resource that was only the domain of large research institutions prior to the advent of new technologies. Put in economic terms, this reduces the ''barriers to entry'' to competing in this domain, a fact that is likely to increase competitive forces. In addition, new entrants, and potentially for-profit entrants, may be able to compete with services that have traditionally been exclusively the responsibility of universities.

The introduction of electronic storage and dissemination has made it possible to ''unbundle'' access from the geographic location of the resource. From a technological standpoint, resources can now be provided very readily to support distance and on-line education initiatives. The extent of the demand, and the ability of the providers of content and instruction to adapt their traditional economic, sociological, and organizational processes, will determine the extent to which technological possibility results in the prevalence of such initiatives.

While these broadest of organizational changes are still a matter of conjecture, it is more clear that the community will benefit if colleges and universities adapt their economic and accounting structures to address the changing nature of capital investments and operating expenditures that must be made in this new environment. The JSTOR archive provides a clear example of how the existing systems do not account for these changes. The total costs associated with storing paper volumes of a journal are accounted for in separate places in a university's financial and accounting system. There is the capital cost of building the structure and shelves to house the material. There is the ongoing maintenance cost associated with this physical infrastructure. There is the cost of acquisition of the item. There is a cost associated with preparing the acquired item to be maintained, such as to bind it, label it, and locate it on the appropriate shelf. And then there are circulation costs.

The comparable costs associated with storage, access, and maintenance in the electronic environment are profoundly different, and could potentially be decreased significantly on a system-wide basis, but only if institutions can work collaboratively and cooperatively. It is not necessary for every institution to hold the journals on their shelves (or, in the electronic milieu, to mount local servers to store all licensed content), but if they do not, they must rely on others to ensure ongoing access. Not only must central libraries and library-like organizations emerge that can take responsibility for the electronic archiving challenge, but the community must trust them to take care of that responsibility. Only then can the potential savings be realized.

But for that to be possible, the financial systems must evolve to recognize the value derived from these collaborations in ways that enable their institutions to take advantage of them. To illustrate with an example, it is not entirely appropriate for access to JSTOR, which is an archival service to these institutions, to be purchased solely from funds in a library acquisitions budget. There is a portion of the value JSTOR provides—the central

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archiving service that permits decreased construction of new stack space—that should accrue to the benefit of the parent institution in an area that would normally appear in its capital investments. The mechanisms and decision-making processes need to evolve to recognize and account for this issue if the promise of the electronic technologies are to be fully realized. This need for academic institutions to address investments in digital technologies with a broader institutional perspective may prove someday to be the most important lesson that emerges from the JSTOR experience.

CONCLUSION

This paper has provided a brief history of the evolution and growth of JSTOR, a not-for-profit organization that has developed an electronic archive of the back issues of scholarly journals. The goal has been to describe some of the key organizational lessons learned and to analyze JSTOR's experience in an effort to shed light on some of the major issues and problems facing the scholarly community.

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Libraries in Belarus

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INTRODUCTION

The history of libraries in Belarus and book culture generally reflects and has been affected by Belarus' historical and geopolitical situation. Thus to better understand the various factors that impact the history of Belarusan libraries and their studies, a few general remarks are in order.

The history of Belarus is complex and very often misinterpreted. In the 14th century, several independent Belarusan principalities—Połacak (Polotsk) and Turaŭ (Turov), the largest and most influential among them—united with some neighboring Baltic provinces to form the Grand Duchy of Lithuania (GDL). In the 15th–16th centuries, the GDL became a commonwealth of the Belarusans, Lithuanians, and Ukrainians. Belarusan was the official language of the GDL. At the end of the 16th century, the GDL entered into commonwealth with Poland. By 1795, the entire Belarusan territory was incorporated into the Russian Empire. Then, in 1918, Belarus enjoyed a short-lived independence. In 1919, it became the Belarusan Soviet Socialist Republic, which joined the Union of Soviet Socialist Republics (USSR) in 1922 until December 8, 1991, when the USSR was formally dissolved. On August 25, 1991, Belarus declared independence.

OVERVIEW

The political instability of the region, its geographical situation on the crossroads of Eastern Europe, numerous wars with consequent ravaging of the country and its cultural riches, the destruction and loss of books, as well as the removal and dispersions of libraries are all factors that have contributed to the difficulty of the study of libraries, which was neglected for many years.

Unfortunately, the literature in English on this topic is very sparse. For this study, materials chiefly in Belarusan, Polish, and Ukrainian were used.

Throughout history, the territory of Belarus has changed dramatically. Some of the historical Belarusan lands are now part of Russia, Ukraine, Lithuania, or Poland.

The names (persons, cities, etc.) are generally transliterated in their Belarusan form in the Belarusan Latin alphabet; other spellings are given parenthetically.

FIRST LIBRARIES

The first libraries on Belarusan territory were church and monastery libraries. One of the first was the library of the Safijski Sabor (Cathedral of St. Sophia) in Połacak (Polotsk), founded in 1066 by Jeŭfrasińnia, who was later canonized as the patron saint of Belarus. She was the Princess of Połacak (Polotsk) who had taken the veil. She was engaged in the replenishment of its stock, as well as copying and disseminating of the books. Połacak (Polotsk) at that time was the major center of Belarusan cultural and religious life.

Another center of religious and cultural life in the 12th century was Turaŭ (Turov). Bishop Kiryla Turaŭski (St. Kiryl, Bishop of Turov) (1130–1182), the church activist and writer, whose works were well known outside the land of Turaŭ (Turov) and were stored in libraries of the ancient Ruś, was the organizer of the Turaŭ (Turov) Church Library. The first books of these libraries were scripture and service books, lives of the Saints, Chronicles, historical books, geographical descriptions, and *Izborniki*, i.e., Miscellanies.

In the 14th and 15th centuries, the most significant monastic libraries were those in Supraśl (now Poland), Žyroviči (Zhyrovichy), Viciebsk (Vitebsk), and Słuck.

The Supraśl library was founded and funded by the Belarusan nobleman Ian Khadkevič (Jan Chodkiewicz) in 1498. By 1557, it contained over 200 books. With the establishment of the printing press in Supraśl in 1659, the number of books in the library grew considerably, and in 1876, when the books from his library were transferred to the Vilnia (Vilnius) Public Library, the collection included 1109 books and 191 manuscripts.

The Połacak (Polotsk) Dominican Monastery Library, one of the largest of its kind, numbered 10,300 books by the mid-18th century.

One of the first ''special'' libraries was the Library of a monastery in Ščučyn (Shchuchyn), near Hrodna (Grodno).

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It contained 1469 books, chiefly devoted to the natural sciences, medicine, and mathematics.

In the 16th and 17th centuries, a new kind of library appeared—Brackija (Brotherhood), or religious school libraries. They were intended for the use of teachers and students and, for the most part, contained educational materials, religious books, and textbooks. The most prominent of these were those in Mahiloŭ (Mogilev), Vilnia (Vilnius), and Brest (also Berascie).

PRIVATE LIBRARIES

A few of the prominent private libraries should be mentioned.

The Radzivlls' Library in Niaśviž was founded in the 16th century by Mikalai, the Black, Radzivill (1515–1565). Because of Mikalai's wide connections, his library included numerous books from various European publishers. The library also contained volumes from his own printing presses in Niaśviž and Brest. His family successfully built up the library. In the mid-17th century, Albrecht Radzivill (1545–1656) compiled the first catalog of the library. The library then numbered close to 9000 volumes.

In 1772, the first partition of the Commonwealth between Russia, Prussia, and Austria took place. After that, the eastern part of Belarus was incorporated into the Russian Empire, and more than 20,000 volumes—some incunabula, classical and renaissance literature, history and law books, and numerous manuscripts—were taken from Niaśviž and passed to various St. Petersburg libraries.

The Sapeha Library was founded by Leŭ Sapeha (1557–1633) of the Grand Duchy, one of the authors of *Statut Vialikaha Kniastva Litouskaha* (The Statute of the Grand Duchy of Lithuania); his son, Kazimir-Leŭ (1609–1656), willed the library in 1644 to Vilnia (Vilnius) University. The Library was known as Biblioteca Sapehana and numbered close to 3000 books.

The Library of Count Khreptovič (Chreptowicz) was founded by Ioakhim Khreptovič (Chreptowicz) (1729–1812), a highly educated man. From 1764 onward, he was Secretary of State of the Grand Duchy of Lithuania, and in 1773 founded an Educational Commission and headed the Department of Academies and Schools of the Duchy. In 1793, he became an Advisor of the Grand Duchy. In 1770–1776, he erected a special building on his family estate in Ščorsy (Scchorsy), near Navahradak (also Novogrudok), to house his rich library. His son Adam (1768–1844) continued to expand the library and by 1820, the library included over 10,000 books.

Alaksandar Elski (Jelski) (1834–1910) was the founder of the library and museum on his family estate, Zamoscie, in the Minsk region. His library and archives numbered about 20,000 manuscripts, dating from the 17th, 18th, and 19th centuries, as well as some 7000 books—chiefly ethnographical material, the history of Belarusan towns, and early printed Belarusan books. He was one of the first individuals to collect material for a Belarusan bibliography and later, a biographical dictionary of luminaries from the Minsk region. During World War I, part of his library and museum was destroyed, including his bibliographical works. The remaining part of the collection was dispersed among various Polish and Russian libraries and museums.

PUBLIC, ACADEMIC, AND SPECIAL LIBRARIES

The library at Hrodna Medical School [established in 1775 by the famous French scientist J.-E. Gilber, who was invited to Hrodna (Grodno) by the magnate A.Tyzenhauz] ought to be considered as the first scientific library of Belarus. In 1781, the school, together with the library (3000 books), transferred to Vilnia (Vilnius) and became the precursor of the Medical Faculty of the Academy. The first special agricultural library in Belarus (that was part of Russia Empire) was founded in Mahiloŭ (Mogilev) simultaneously with Hory-Horyckaja Agricultural School in 1840.

Regional public libraries on Belarusan territory began to open after 1830, following the decree of July 5, 1830 by the Russian Minister of the Interior. Thus the first public libraries were organized: in Mahiloŭ (Mogilev) in 1833, in Hrodna (Grodno) in 1837, and in Minsk in 1845. In December 1990, the Public Library of the City of Minsk, named after A.S. Pushkin was founded, equipped with special reading rooms. A lending system was also implemented at this library. As a result of the social initiative of the city of Minsk, the library named after L.N. Tolstoy was founded in Minsk in 1911.

Local governments closely controlled the libraries and the books were carefully censored. There were lists of books that were prohibited in the libraries, as well as lists of books allowed by the Russian Ministry of Education. Admittance to the library was free and open to all, except for persons in ''indecent condition'' or ''improper attire.'' However, it was very expensive to borrow the books, and the libraries did not prosper.

To counteract this, some philanthropists organized free public libraries. One of the first of such ventures was founded in 1905 in the Brest Region in the village of Astramečava by book publisher Florentii Pavlenkov.

By 1913, there were 815 libraries in existence in Belarus, housing a total number of 423,000 books.

In December 1921, the first All-Belarusan Conference of Librarians took place in Minsk. Among other projects

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discussed at the conference was a plan, which the participants adopted, to organize a network of Libraries in Belarus.

That same year, the Belarusan State Library was organized within the Belarusan State University. It was reorganized in 1922 into the Belarusan State and University Library. At that time, the Belarusan Book Chamber was also established. The library became a depository library for Belarusan publications, as well as for materials from the Russian Book Chamber. In 1923, this policy was expanded to include Ukrainian materials. In 1926, the Belarusan State Library became an independent unit. The acquisition of private collections was an important factor in the rapid growth of the library. When the library first opened, the famous scholar Jaukhim Karski (1861–1931) donated his collection of over 4000 volumes. In 1922, part of Belarusan writer Janka Kupala's library was acquired, as well as Belarusan historian Aliakśej Sapunov's ethnographic collection of Vitiebsk (Vitebsk) and Połack (Polotsk). Later, the law library of Vladzimir Slučeŭski and the collection on history, literature, and musical folklore of the slavist and historian Mikalai Jančuk (1859–1921) were added. However, many libraries and private collections on Belarusan territory were subject to constant relocation depending on whether they were under Polish or Soviet administration. As a result, Belarusan collections were scattered throughout the Slavic and non-Slavic world. At the First Congress of Belarusan Archeologists and Archeographers in Minsk in January 1926, great concern was expressed for the fate of libraries, museums, and archeological collections removed from Belarus. For example, The library of Homel (Gomel) (founded in the beginning of the 19th Century) was transferred to Moscow by the count N.P. Rumiantsev. Later, it served as the core of the famous Rumiantsev Museum in Moscow (at present—the State Library of Russia). The library of I. Khreptovič that was being collected at his mansion of Ščorsy (Shchorsy) was assigned in 1913 to the St. Vladimir Kiev University (Ukraine), with the provision that it should to be transferred back to Belarus after the establishing the University in Belarus. Until now, however, the stock of this library is still in Ukraine. One of the resolutions adopted by the congress was to urge the newly established Institute of Belarusan Culture to intervene with the appropriate authorities in the matter of returning libraries to Belarus.

Another major book repository, the Library of the Academy of Sciences, was organized in 1925 within the Institute of Belarusan Culture. The Institute was a forerunner of the Academy of Sciences and served as the heart of Belarusan cultural life. When the Library was first organized, it consisted of a few hundred books donated by scholars to the Institute. One of the major donors was Branislaŭ Epimakh-Šypiła (1859–1934), a Belarusan scholar, bookman, and collector of old Belarusan books and manuscripts. In 1929, he bequeathed his 5000-volume private library to the Academy. In addition, many books were acquired through exchanges. The first exchange partners were Poland, Germany, France, Canada, and the United States (The New York Public Library, The Library of Congress, and the Chicago Public Library, among others). By 1929, the Library had 70 exchange partners.

The network of public libraries developed slowly. By 1928, the number of public libraries had reached 634–404 libraries in cities and towns, and 230 in villages, with the total number of books and periodicals reaching 1,509,600.

In 1939, when Western Belarus was incorporated into the Belarusan Soviet Socialist Republic (BSSR), the number of libraries grew considerably; by 1940, there were 4172 public libraries, with a total of 5,028,000 books. Especially significant was the growth of small village libraries: from 230 in 1928 the number of village libraries increased to an impressive 3574.

The largest Belarusan book repository in Poland was the Luckevič Museum and Library in Vilnia (Vilnius), which numbered thousands of volumes of old and new Belarusan books and manuscripts. Unfortunately, in 1945, this museum was closed and its holdings were partly transferred to Minsk and partly to the Academy of Sciences of the Lithuanian SSR (now Lithuania).

During World War II, many libraries perished, many others were removed from Belarus, and many books were simply lost, dispersed, or stolen. In the years following the war, the reconstruction of libraries to their prewar level was the goal. This goal was partly achieved by 1950, when the number of public libraries reached 4847. This figure continued to grow until 1960, when the number of libraries totaled 7300. After that, however, a gradual decrease was observed as a result of centralization, so that by 1974, there were only 7159 public libraries in Belarus. In addition, there were over 10,000 children's libraries and 3171 special and research libraries. Most of these libraries were within the jurisdiction of the Ministry of Culture, although some were within the jurisdiction of the collective farms, and others, the worker's unions.

PRESENT TIME

There are 11,000 libraries of all types and sizes in Belarus. About 5000 of them are public libraries, which have a real chance of assuming a new position in today's world. There are public libraries open in every Belarusan region.

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The book stock of public libraries is about 60 million items. About 4000 inhabitants utilize public libraries, which is about 40% of the population and this percentage has increased in recent years. All visitors to the modern public library are identified according to social–demographic characteristics and are as follows: women (68.7%) represent the largest group of users. More then a half of all customers (55%) are young people, all ages up to 35 years old. A third of all readers (33.4%) are specialists in the educational and cultural fields.

The 1990s can be characterized as very difficult period for public libraries as a result of the political, social, and economic changes in our society. Financial instability posed a negative impact, particularly on public libraries. Thirteen percent of these establishments, mainly in villages, were closed. Document acquisitions were significantly reduced.

In 1995, a law was adopted: ''On Librarianship in the Republic of Belarus.'' Despite many problems, this was the beginning of a new period in which public libraries have been connecting with the emerging information society in relation to democracy, economic development, lifelong learning, and cultural diversity. Public libraries are now on their way to becoming a modern service and have changed their image both internally and externally.

The National Library of Belarus is the major general information institution of the Republic of Belarus. The total number of visitors exceeds 500,000 yearly; the general circulation of documents is over 3 million copies per year. The overall total of registered readers exceeds 66,000. Each year, over 400 displays are mounted; among them are subject and anniversary exhibitions and previews. Interlibrary and international loans allow 1000 libraries at home and abroad to use the Library's resources. There is also a regular international book exchange with 325 partners in 48 countries worldwide. At present, an automated information system based on a local computing network is currently in use at the National Library of Belarus. It connects more than 150 personal computers of the series PC AT. The Library's publishing activity is primarily aimed at producing bibliographic indexes (more than 20 titles per year) dealing with Belarus. Among retrospective and current bibliographic tools, there are such important issues as *Kniha Belarusi, 1517–1917* (The Book of Belarus, 1517–1917) (1986), *Bibliografia po istorii Belarusi: feodalizm i kapitalizm* (Bibliography on Belarus History: Feudalism and Capitalism) (1969), ''Belarus in XVI–XX centuries print'' in five volumes (1982–1989), (1991), bibliographic monthly *Novyja knihi: ahliad belaruskikh knihau* (New Books: The review of Belarusan current books) (since 1960), and others. The Library currently employs a staff of more than 520 specialists, including 400 professional librarians.

The Jakub Kolas Central Scientific Library of the Academy of Sciences of Belarus has 3,107,730 volumes of books, periodicals, and serials. There are collections of incunabula, manuscripts, West European publications from the 16th to 18th centuries, books printed in Cyrillic, rare books from the 19th and 20th centuries, archival collection of the Academy's publications, literature on regional studies, personal libraries, etc. There are administrative divisions handling acquisition; automation of library-bibliographical processes; book cleaning and restoration; catalogues and literature systematization; foreign literature; rare books and manuscripts; reference and information service; scientific bibliography; scientific organizing work.

Today's Presidential Library was founded in 1933. As of April 1996, it contained more than 1,500,000 volumes, 418 titles of current periodicals; there are 20,000 annual accessions.

The Republican Scientific Pedagogical Library (RSPL) was opened in 1965. The document collection was based on collections of the libraries of the Research Institute of Pedagogy and of the Institute for Postgraduate Training of Teachers. At present, the RSPL is a branch scientific library, information reference center, scientific-and-methodic center, and also a coordinating center providing services to pedagogical workers and to the network of affiliated libraries of the Ministry of Education of the Republic of Belarus.

The library collection consists of 500,000 copies of books and periodicals in Belarusan and in foreign languages. The major portion of the collection (75%) is specialized literature; the literature on history, philosophy, law, and arts as well as the belles lettres and reference books are also widely presented. The library subscribes to all of the pedagogical newspapers, journals, and magazines that are published in the Republic of Belarus. The stock of pre-Revolutionary (i.e., pre-1917) editions is of a great value. It consists of 2769 copies of books and 27 titles of periodicals in pedagogy, psychology, and childcare that were published in the 19th century and the beginning of the 20th century.

The library conducts much work in the area of compiling retrospective bibliography indexes—two of which are ''Education in Belarusan Soviet Socialist Republic during 50 years of the Soviet power'' (published in 1973) and ''Pedagogical science and people's education.'' The latter reflects literature from 1968 to 1982, and was published in 1990. Two more issues of this index have been prepared that chronologically continue the previous one and reflect the period of 1983–1987 and 1988–1992. The use of the data included in this index for automation retrieval is also being planned. Creation of the bibliographic index of prerevolutionary literature remains a matter of primary importance.

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The library compiles reference books in the methods of teaching some school subjects, in particular, Belarusan literature (the available index reflects the period of 1906–1971) and the history of Belarus. Bibliographic work in methods of teaching the Belarusan language describing the documents of 1969–1970 has already been prepared.

Since 1990, the RSPL is engaged in automation of the information-and-library process. At present, stock counting and processing of new titles as well as subscription for periodicals are automated. Since 1993, the electronic catalog and bibliographic database on pedagogy are being created.

CONCLUSION

The history of libraries in Belarus is part of Belarusan history. There were colossal cultural losses during World War I and World War II. For a period, there were invasions and conquests by various stronger and more aggressive neighbors. There was also the destruction of book heritage by the Stalin regime. Nevertheless, the Belarusan libraries were rebuilt. The public and private libraries of Belarus all uplift and highlight Belarusan culture and provide its historical reflections. It is evident that the library's influence makes Belarusan history part of the national culture, as well as part of European culture.

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Libraries in Ukraine

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INTRODUCTION

Ukraine is located in Central-Eastern Europe. The geopolitical location of Ukraine has significantly influenced the historical and present development of the country. Ukraine is the second largest country in Europe. The Ukrainian culture and dramatic history goes back to the 5th century, when Kyiv (the capital of Ukraine) was founded. The Ukrainian Parliament passed a declaration of sovereignty in July 1990 and, in August 1991, declared Ukraine independent of the Union of Soviet Socialist Republics (USSR).

Libraries and librarianship in Ukraine reflect the history and development of the country and its people. Because Ukraine became an independent sovereign state, the libraries have been rethinking their role in society, considering different goals and facing new challenges. Those challenges are closely linked to democratic changes occurring in Ukraine during the last decade. This article gives a brief history of libraries in Ukraine, reviews conditions and development of Ukrainian libraries, and discusses new trends in their activities. It also contains basic information about some of the major libraries in Ukraine.

HISTORY OF LIBRARIES IN UKRAINE

Earliest chronicles of libraries in Ukraine date from the 11th century (the Library of Saint Sophia's Cathedral, also known as ''The Prince of Kyiv Rus Yaroslav's the Wise Library'' and ''The Library of the Kyiv-Pechers'ka Lavra'').[1] ''At the beginning of the 14th century a large collection (215 manuscripts and books) was housed at Supral' Monastery; there were smaller ones at Sluc'k (founded 1494), L'viv (founded 1579), and elsewhere.''[2] There were well-known libraries located in monasteries and private libraries owned by famous clergymen and Cossack's nobility during the 16th–18th centuries. Examples of these are the libraries of L'viv Stavropygian Brotherhood (16th century); Petro Mohyla (1596–1647), later donated to the Kyiv Academy; Dmytro Tuptalo; Feofan Prokopovych (1681–1736), containing 3000 volumes; and Lazar Baranovych.[2]

During the 19th century, many academic and public libraries were founded. Some of them are the libraries in Kharkiv (1805), Odesa (1829), and the Library of Kyiv University (1834).[3]

There was a short period when Ukraine attempted to establish itself as an independent state (1918–1921). At that time, the National Library of the Ukrainian State was established (1918). However, Ukraine lost its own state system and became a part of the USSR in 1922. During the World War II, German troops occupied Ukrainian territory (1941–1944). This war brought great losses to the libraries. Before the beginning of the Second World War, there were 44,662 libraries with total book collections amounting to 102 million items.[1] The official estimates of losses say that more than 40,000 libraries were ruined or damaged and about 80 million books were destroyed or stolen. Nevertheless, the library network in Ukraine was basically restored by 1950.[1] Under the Soviet regime, the libraries had a strict centralized administration ensuring strong censorship and dictating communist ideology. The Soviet Union had proclaimed a new ''nationality,'' ''the Soviet human being,'' which meant the erasure of individual national and ethnic identities. The libraries were an important instrument toward the achievement of that goal. The libraries of the Soviet republics were deprived of their individual identities. They were all headed by the Moscow library administration, and they served Moscow politics and ideologies.

CONTEMPORARY LIBRARY SYSTEM IN UKRAINE

Most of the modern library network in Ukraine had been formed during the Soviet era (1920–1991). Since 1991, when Ukraine achieved its desired independence and became a sovereign state, the libraries have been rethinking their role in the society, considering different goals and facing new challenges. The library community is currently working toward ''new library policies in Ukraine based on free access to ideas, library materials and services. Intellectual freedom issues are the basis of contemporary library and information policies in Ukraine.''[4] Intellectual freedom is closely connected to important issues such as

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open and free access to information and resistance to censorship. Successful achievement of these goals is highly contingent on changes in the librarians' attitudes and training.

The information technologies that have changed the missions, goals, and functions of world libraries during the last 10 years have become a part of library practice in Ukraine. Users of the Internet in Ukraine in 1999 have increased 3 times (from 0.5 million at the beginning of the year to 1.5 million at the end), and the user growth rate was the highest among all the European countries.[5] The impact of computerization has significantly changed the tradition functions of library services. Now Ukrainian librarians, along with their traditional services, are providing virtual services such as e-mailed reference, electronic catalogs, and Internet access. Most librarians welcome technological changes but also see the value in their historical function of assisting people to find information—whether digitized or between the covers of a book. They understand that for success, the professional librarian needs a combination of communication and computer skills. When the computerization of libraries is successfully completed and a general unified network is created, the new information technologies will ease the tasks related to bibliographic and authority control.

Another important task for libraries is the creation of a national bibliography ''Ukrainica,'' which will accumulate all publications published in Ukraine, all publications in Ukrainian language, irrespective of place of publication, and all publications linked to Ukraine irrespective of language. Three libraries, the Vernadsky National Library, the National Parliament Library, and the Stefanyk Lviv Scientific Library, are at the head of this undertaking. The Vernadsky National Library has already published the fifth volume of the ''National Bibliography of Ukraine.''

> The decade has not been easy for the Ukrainian people as they strive to create a democratic state, a free-market economy, and a civil society. This transition period has been extremely difficult for libraries and librarians who now have far less financial support from the government than during the Soviet period.[6]

In recent years, there has been positive movement in the state library politics. Important documents such as ''The Law of Ukraine on Libraries and Librarianship'' (1995), ''The Program on the Preservation of Library and Archival Collections, 2000–2005'' (approved by the Cabinet of Ministries of Ukraine, 1999), ''The Program of Libraries' Acquisitions for the Period up to 2005'' (approved by the Cabinet of Ministries of Ukraine, 2002), and two Presidential Decrees, ''Establishment of the All-Ukrainian Day of Librarians—September, 30th'' (1998) and ''Urgent Measures toward Development of Libraries of Ukraine'' (2000), have been signed.[7] Those documents increase the prestige of the libraries and give them new parameters for improved and increased operations. Although Ukraine has affirmed these documents, they have not been followed by either sufficient funding or support to meet the libraries' growth and development needs.

Ukrainian libraries are striving to integrate into the international library society. They are working on extending their international contacts, seeking international partnerships and funding, and participating in international associations and programs. One of the results of such partnerships is the bilingual (Ukrainian/English) Internet reference site, ''Ukrainian Library World Gateway.''[8] This Web-based directory has been developed by the British Council in Ukraine, the Ukrainian Library Association, and the Library of the National University ''Kyiv-Mohyla Academy.'' It is a centralized source of information regarding to Ukrainian libraries and professional information for Ukrainian librarians.

The present library network of Ukraine consists of public, academic, school, university, and special libraries (Fig. 1). The greatest problems facing Ukrainian libraries of all types are insufficient budgets for collections and general operating expenses, substandard salaries for librarians, and low levels of computerization and Internet access for both library professionals and users.

Ukrainian librarians have two professional associations: The Association of Ukrainian Libraries (ABU) and The Ukrainian Library Association (UBA). Membership in both associations is open to individual librarians as well as for the libraries. The Association of Ukrainian Libraries (ABU), founded in 1991, unites mostly academic, medical, agricultural, technical, and some university libraries. Information on this organization can be founded on its Web site.[9] The Ukrainian Library Association (UBA) was founded in 1995. The Web site for this organization

Type of Libraries	Amount of libraries	Amount of collection (million)	Amount of readers (million)	Use of library materials (million)	Amount of library staff (thousand)
Public	20.000	350	17	350	36
Libraries of educational institutions, including schools	20.800	8	1.6	10	18,7
University libraries	267	106	1,5	102	6,5
Technical/Industry	2.500	156	0,75	10	3,5
Medical	1.033	30	0.77	25.3	2,2
Agricultural	275	21	3	20	2
Academic	96	29	0,37	8	1
Total	**45.000**	**700**	**25**	**500**	**70**

Fig. 1 Libraries in Ukraine statistics. (*View this art in color at www.dekker.com.*)

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provides practical information for professionals in the field.[10]

There are two levels of professional library education: ''medium'' that is the equivalent of 2-year college program and ''high'' level of professional education that requires completion of a 4-year program at an accredited college or university. Three academic institutions in Ukraine currently certify the librarians with ''high'' qualification: The Kyiv National University of Culture and Arts,[11] The Kharkiv State Academy of Culture,[12] and The Rivne State Institute of Culture.

Public Libraries

Public libraries are the most extended library system under the patronage of the Ministry of Culture and Arts of Ukraine. According to the Ministry statistics, there are almost 20,000 public libraries in Ukraine. The complete book collections of them amount to 302 million issues. On average, a public library contains 16,000 publications; a village library contains 10,000. The book supply, per capita, is about 6 issues in municipal libraries and 10 issues per capita in village libraries. These numbers are relatively high in comparison to the IFLA standards, which recommend sustaining collections based on a count of three books per capita in small towns and villages and two books per capita in more populated areas. The book supply in Ukrainian village libraries is three times larger than world standards. It is estimated that there are 17 million users of the public libraries in Ukraine. However, the amount of new acquisitions in recent years is three times less than the International Federation of Library Associations and Institutions (IFLA) standard, 70 publications per 1000 people.[13] Compared to other types of libraries, the public libraries are funded better, their collections are more or less updated, and more and more regional libraries are opening their own Web sites. An important role in solving the problem of public libraries' computerizations belongs to the Library Electronic Access Project (LEAP). This is a project of the Public Affairs Section of the U.S. Embassy. It helps to create free Internet centers in public libraries and to provide an open exchange of information and communication. Public libraries have received grants up to $24,000 for computer equipment, software, Internet access, and training. In the last 2 years, 71 Internet centers have been opened in public libraries throughout Ukraine.[14]

The National Parliamentary Library of Ukraine

Founded in 1866, as a public library, this library became the State Library of Ukraine in 1957. In 1994, the status of national library was conferred and it was renamed ''The National Parliamentary Library of Ukraine'' (NPLU). This library is the main library of the Ministry of Culture and Arts of Ukraine, and it is the central library of the Ukrainian public library system. The NPLU is a research institution in library science and bibliography. It serves as a national depository for all Ukrainian publications and is a center for international book exchange. Its collection is universal in character and amounts to more than 4 million issues, including rare Old-Slavonic books of the16th–18th centuries.[16] NPLU considers formation of an electronic database, including the establishment of electronic catalogs linking them to other library and research institutions around the world, as its primary goal. At present, the library has established an electronic catalog of new acquisitions (containing more than 209,000 bibliographic records) and an electronic catalog of articles from Ukrainian and Russian research publications (more than 200,000 bibliographic records). The creation of the information system and expanded access to world information resources is growing through grants and aid from international charitable foundations and International Research & Exchanges Board (IREX).[15]

Korolenko State Scientific Library in Kharkiv

One of the oldest and largest libraries in Ukraine was founded in 1886 as a public library. A significant role in the development of the library was played by notable figures in Ukrainian history and culture; among them are professors Bahalii and Sumtsov and librarian Khavkina. At the beginning of the 20th century, many foreign libraries contributed to the development of the unique collection of the library, including The New York Public Library, The Library of Congress, and The National Library of France.[3] In 1921, the library acquired the designation of state library and became a national depository. The collections of the library run to more than 6 million items, including 50,000 in the rare book collection, more than 600,000 Ukrainian language publications, and a unique collection of musical scores (104,000 items). Like other Ukrainian libraries, this one is working toward the automation and computerization of library processes. The library is also a research center in the field of library science. Each year, it publishes approximately 30 titles of bibliographies and books on librarianship.[16]

The State Library of Ukraine for Children

Founded in 1967, it is the primary children's library in Ukraine and the national depository of children's literature. It is also the research, reference-bibliographic, and consulting center for more than 1000 children's libraries

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and about 22,000 school libraries in Ukraine. Its collections run to 440,000 books, magazines, audio recordings, videos, and CDs. Each year, about 18,000 users visit the library. The library hosts many different activities and events for children at the library. Examples include a puppet theater, theater studio ''Ovation'' and a club of connoisseurs of Ukrainian arts, and circles of soft toys ''Fantastic Needle.'' The library publishes the bibliographies of recommended reading for different age groups (also available online), some topical bibliographies, and method materials for teachers and children's librarians. The library Web site and online catalog are also available.[17]

Academic Libraries

The network of academic libraries in Ukraine consists of The Vernadsky National Library, The Stefanyk Library of the National Academy of Sciences of Ukraine, and 96 other libraries of the scientific-research institutions of the National Academy of Sciences of Ukraine. The complete academic library network's collections amount to 26 million items of materials, including about 6 million in foreign languages. These collections serve as a document base for scientific research and experiments in different areas of humanities, social sciences, engineering and technology, business, sciences, and arts. Annually, the academic libraries of Ukraine serve more than 208,000 users.[18]

The Vernadsky National Library of Ukraine

The Vernadsky National Library of Ukraine is the largest library in Ukraine. Founded in 1918, as the National Library of the Ukrainian State, it changed its functions several times as well as its name. In 1996, the library received the status of the National Library and its contemporary name and designation. The library contains many distinctive collections that are universal in scope and range from the 3rd century BC to contemporary foreign and Ukrainian publications. A fire in May 1964 inflicted significant damage on the collections of the library.[19] In October 2002, more than 200,000 books, magazines, and newspapers were heavily damaged by water, steam, and humidity when a pipeline in the library's central heating system began leaking.[20]

There are more than 14 million items in the library holdings. Annually, the library receives 140,000–160,000 documents (books, magazines, newspapers, etc.). Each year, about 250,000 readers use the library resources and receive 3.5 to 4 million documents.[21] Since 1969, the library has developed a large collection of publications of the United Nations (UN) and its specialized bodies. Every year, it receives more than 15,000 UN documents. The library maintains an international book exchange with more than 1400 academic foreign institutes and libraries participating. There are more than 30 catalogs and card files and a specialized collection of 160,000 reference and bibliographical publications, including one of the few sets in Eastern Europe of the printed catalog of the New York Public Library in 800 volumes.[19] The Vernadsky National Library has more than 250 computers in use for creating the National Electronic Library of Ukraine and to serve readers by providing electronic information resources. The library has about 40 departments, staffed by 900 employees.[21]

The Lviv Stefanyk Scientific Library

The Stefanyk Library of the National Academy of Sciences of Ukraine is one of the largest libraries of Ukraine. It was founded in 1940, based on the collections of several private and institutional libraries, including the libraries of the Ossolineum, The Shevchenko Scientific Society, and The Lviv National Home. In 1989, the library acquired the status of an official research institute. The sole Research Center of Periodicals in Ukraine functions in this library. The Lviv Stefanyk Scientific Library's research priorities include the following: ''Documental Memory'' of Ukraine, bibliography and librarianship, and rare books collection. The library personnel numbers about 300 employees. The library collections have more than 7 million items, including the remarkable collection of Ukrainian periodicals of the 19th–20th centuries, rare books (250,000 items), and manuscript holdings of more than 120,000 units from the 13th to 20th centuries. These collections make The Lviv Stefanyk Scientific Library the second richest library in Ukraine.[22]

The University Libraries

The Maksymovych Scientific Library of the National Shevchenko University

The library was founded in 1834, at the same time as the university. Its collection was based on the library of the Kremenets Lyceum holdings. Now the library collection counts more than 3.5 million items including more than 16,000 titles of periodicals. Among these are rare books of the 15th–19th centuries in Old-Slavonic, Ukrainian, Russian, Polish, German, French, Italian, and English, the works by University professors from 1837 until present, and books (with autographs) of famous figures in the fields of science and arts. Annually, more than 72,000 readers are served in 32 reading rooms and 13 circulation

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divisions. The library provides different activities such as authors' readings, literature debates, and book exhibitions. The library is a research center that coordinates and consults with more than 150 other university and college libraries in Ukraine.[16]

Scientific Library of the National University "Kyiv-Mohyla Academy"

This library is one of the newest research libraries in Ukraine. It is an important part of the university education and creative laboratory. This library began in 1992, with one book and two librarians. Ten years later, at the beginning of 2002, its collections consisted of 300,000 volumes/80,000 titles. The library provides services for students and professors based on its own collections and database as well as utilizing the resources of other Ukrainian libraries. The library introduced methods such as barcoding in circulation and checkpoint monitoring systems. This library is one of the very few libraries that uses international standards such as Anglo-American cataloging rules (AACR-2), U.S. machine readable cataloging (USMARC) format for bibliographic and authority data, and the Library of Congress Subject Headings. The library has received financial support and grants from International Renaissance Foundation (IRF), the America House, International Research & Exchanges Board (IREX), the German Library Institute, Lange & Springer, McArthur Foundation, and others. The library has an electronic catalog and database.[23]

Special Libraries

Special libraries include a wide range of libraries that belong to different businesses and organizations. They incorporate medical, technical, and agricultural libraries as well as libraries of different ministries and governmental organizations. The libraries for the blind also belong in this category.

The State Scientific Medical Library of Ukraine

The State Scientific Medical Library of the Healthcare Ministry of Ukraine, founded in 1930, is one of the largest medical libraries in Europe. It is a research, consulting, and administrative center for 998 medical libraries in Ukraine. It is also a national depository of publications on medicine and related fields. Its complete book collection amounts to 1.3 million items, dating from the 16th century to current editions.[16] The library also maintains the largest department of patents and normative technical documentations in medicine in the country. The library has official exchange partners in 32 countries that allow improvement and development of the library collection. There are a few card catalogs, including alphabetical, systematical/topical, and subject catalogs. Since 1993, the library has generated electronic catalog of books and dissertations, and since 1998—electronic catalog of articles. The library Web site (only in Ukrainian) gives information about the library, its facilities, reference sources, and links to other medical libraries.[24]

Agricultural Libraries

In the category of special libraries, the agricultural libraries play a very important role in agrarian Ukraine. The network of agricultural libraries consists of 273 libraries, including 20 libraries of agricultural universities, 77 libraries of agricultural research institutes and their branches, 61 libraries of research-experimental stations, and 115 libraries of agricultural colleges. They have concentrated about 20 million of items of general and specific information resources of agriculture and related fields. Annually, more than 700,000 users visit the agricultural libraries and borrow 19 million documents, including books, magazines, newspapers, and patents.[25]

The Scientific Agricultural Library of the National Agricultural University

Founded in 1921, the library is the main research, consulting, and interlibrary loan center of the agricultural libraries network. It is also the national depository of agricultural publications. The library collection runs to more than 1 million books, magazines, and dissertations in Ukrainian, Russian, and other languages. Annually, the library receives more than 30,000 books and 600 periodical titles, including foreign publications.[16] The special collection of rare books includes the works by famous agricultural scientists Dokuchaev, Vavilov, Chaianov, and Williams. The library contains valuable Russian periodicals of the 19th century, e.g., ''Trudy Volnogo Ekonomicheskogo Obshchestva'' and ''Selskii khoziain'' (1888–1917). The library has Yearbooks of the Department of Agriculture of the United States dating from 1896.[3] The library activities are not limited to collection development and public service. They include research and consultation services on the specifics of agriculture libraries, and they provide continuing education for agricultural network librarians. The library also publishes information relevant to both the fields of agriculture and agriculture librarianship. The library has developed and begun to create an ''Electronic Agricultural Library.'' They organize seminars, workshops, and conferences for librarians. On the pages of the Library's Bulletin (first published in 2001), readers

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can find reviews of the practices of agricultural libraries and exchange information and experiences in that field.[25] Besides the bulletin, the library publishes monthly lists of new agricultural publications and some topical bibliographies.

The State Scientific Technical Library of Ukraine

Founded in 1935, the library is the primary and the largest technical library in Ukraine. It is a national depository of technical publications. Its collections consist of 20 million items, including books, magazines, dissertations, Ukrainian and foreign standards, technical specifications, and special catalogs of Ukrainian- and foreign-manufactured products. One of the most important and popular departments among users part of the library is its patent department. There are approximately 18 million documents acquired from 57 countries in the patent department. There is a complex of different catalogs, card files, and electronic databases that allow retrieval of information.[26]

The Central Library of the Ukrainian Association of the Blind

Founded in 1936, the library is an important educational and cultural center for visually impaired people.[16] The library collection consists of about 170,000 items, including talking books, Braille books, Ukrainian and Russian audio periodicals (Gorizont, Obrii, Zdorov'ia, Svit liudyny), CDs, and descriptive videos. It includes materials in Ukrainian, Russian, Polish, Romanian, Bulgarian, and Esperanto, among other languages. The library provides reference and information services for users.[3] The Central Library for the Blind has, for many years, been the distributor of Ukrainian and Russian Braille Bible excerpts to sight-impaired people all over Ukraine. The library sends Bible Portions to 78 other libraries for the blind throughout the country.[27] Annually, the libraries for the blind serve 40,000 readers.[16]

CONCLUSION

The libraries have always played an important role in the history and culture of Ukraine. They have preserved the rich Ukrainian heritage and have served as the frontline resource in education and as the heralds of new ideas. Recent changes in political situations have greatly affected Ukrainian society and libraries. The libraries of Ukraine are now active participants in the international library society and are becoming a contributing part of the world information force. Now Ukrainian librarians can discover the accomplishments of their colleagues abroad and share their own experiences in the field of library science.

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Library Standards in Higher Education: An Overview

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INTRODUCTION

Academic libraries have a key role in the provision, evaluation, and transmission of information for higher education. It is necessary that their performance be evaluated for improvement, and various measures are available. Standards are most effective for a valid evaluation, and the regional accrediting associations and ACRL [Association of College and Research Libraries, a division of the American Library Association (ALA)] have developed and revised standards from time to time. This brief historical sketch of higher education library standards summarizes regional accrediting association standards, then discusses the development and evolution of ACRL standards. Most frequently the search for authoritative academic library standards has resulted in quantitative goals, but qualitative standards have also been important. The first ACRL standards were for college libraries and published in 1959; two-year college standards were published in 1960; and university standards were first published in 1979. With the introduction of outcomes assessment in the 2000 edition of the College Library Standards, and regional accrediting association emphasis on information literacy, librarians are increasingly responsible for assessing student learning that results from interaction with library services and instruction. The Association of College and Research Libraries has drafted a single comprehensive standard for all libraries in higher education to replace the three current general standards written for two-year, four-year, and university libraries; final approval is expected in 2004.

REGIONAL ACCREDITATION ASSOCIATION STANDARDS

The process of accreditation in the United States is one of self-regulation and there has been improvement through the evolving accreditation process, which has provided some assurance that an institution has met at least the minimal standards.[1] The self-regulation of higher education in the United States began with the formation of the six regional accrediting associations between 1885 and 1924. The associations initially identified high schools that adequately prepared students for college work, but after 1900 began to evaluate colleges as well.[2] To help determine whether an institution deserved to be placed on an approved list, it became necessary for the associations to develop standards by which to judge the institution. Original accreditation standards were quantitative, based on determining that an institution had enough of what it needed in order to do the job, but over the years have become much more qualitative.[3]

By 1990 higher education began to focus on measuring the outcomes of its programs as the primary indicator of quality. A primary force that impelled this focus included a restructuring of the criteria of the regional accrediting agencies to emphasize assessment. This change was precipitated by the U.S. Secretary of Education, who in 1987 proposed that accrediting agencies change their focus to place more emphasis on the assessment of student achievement that can be documented, in order to ensure wise use of Federal education funds.[3]

In the early 1990s Garten, in reviewing the six regional accreditation association standards for libraries, separated the standards into 12 categories: 1) access to resources; 2) adequacy and appropriateness of staff; 3) audiovisual media; 4) computing; 5) evaluation and outcomes assessment; 6) facilities; 7) formal agreements and external libraries; 8) information literacy and bibliographic instruction; 9) linkages across support units; 10) off-campus library services; 11) resource selection/collection management; and 12) sufficiency of resources for curricular support.[4]

Coleman and Jarred compared the library assessment criteria of five of the regional accrediting bodies with the 1986 edition of the ACRL ''Standards for College Libraries.'' They identified 20 categories for comparison of the ACRL and regional standards. The authors noted that the North Central Association was omitted because it did not specifically address libraries in its institutional requirements.[5]

Gratch-Lindauer conducted a content analysis of the then current and draft standards of the regional accreditation associations in 2001. Her analysis showed a greater emphasis in regional accreditation standards on outcomes assessment, distance education, information literacy, as well as encouragement for collaboration, innovation, and experimentation in teaching and learning. Gratch-Lindauer's analysis concludes that academic librarians

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have good reason to develop assessment plans that include outcomes assessment strategies and associated methods. She identifies the potential benefits as: 1) improvement of teaching and learning, and 2) development of an outcomes assessment plan that is required to receive federal funds.[6]

In 2002 Nelson and Fernekes reviewed the current and proposed regional standards for provisions affecting academic libraries. Within each region, they categorized the standards by the 12 sections of the 2000 edition of the ''Standards for College Libraries:'' planning, assessment, outcomes assessment, services, instruction, resources, access, staff, facilities, communication and cooperation, and administration.[7]

Through the years the regional association standards have required an institution to provide adequate library collections and services in order to be accredited. There are eight different standards, six for higher education in general, plus two separate ones for community and junior colleges. The regional standards typically have very vague requirements that relate to libraries and learning resources; this trend is more pronounced in the revised standards, which are much less prescriptive. All six of the regional accrediting associations have rewritten their standards in the last several years. The most important changes in the standards were 1) placing more emphasis on what students learn and less on how they learn it; 2) accepting the increase in numbers of part-time faculty members; 3) developing ways to evaluate the effectiveness of distance learning; and 4) allowing colleges to tailor the accreditation process to their own concerns.[8]

The official position of the accrediting associations is generally not to accept any standards, other than their own, in determining whether an institution should become or continue to be accredited. However, ACRL standards have been informally used to supplement those of the regional associations in the evaluation of academic libraries.[5] In fact, some believe those ACRL standards to have an impact on the library more significant than accreditation itself.[3]

ACRL STANDARDS

For college and university libraries, voluntary standards are adopted by professional associations, then librarians seek to influence administrators and the various accrediting agencies by persuading them that these standards are useful for evaluating academic libraries. As most library standards are used for evaluation, those designing them develop an instrument of evaluation and seek to establish realistic goals of excellence to be applied.[9]

Academic libraries have been dependent upon the level of support they receive from the parent institution for the funds necessary to provide the collections and services to properly support the library program. Academic libraries have searched for viable and authoritative standards by which to measure the strength of the library program. This quest has most frequently resulted in quantitative goals that librarians can use with the administration. The first edition of the ''Standards for College Libraries'' was published in 1959 to address these needs. Subsequent editions were published in 1975, 1986, 1995, and 2000.[10] The ACRL standards for two-year institutions were first published in 1960 and followed the pattern of those for college libraries. Because of controversy over the 1960 standards described below, the next official document was a set of guidelines issued in 1971 and revised in 1972. In 1979 a set of quantitative standards were approved to supplement the guidelines; the guidelines were again revised in 1982. Finally, a comprehensive set of standards for two-year institutions was approved in 1990 and revised in 1994. The ACRL standards for university libraries were first issued in 1979 and revised in 1989. The Association of College and Research Libraries has proposed a single comprehensive standard for all academic libraries, with approval by the ACRL Standards Committee and Board of Directors expected in 2004.

Most standards for academic libraries are based on comparisons. Using statistics derived from the data, standards are set as being at or above the average. Even expert opinion is based on the use of comparative standards because the expert will compare a library to what experience and training indicate are similar or better libraries. Comparative results tend to become exact standards for individual parts of library practice. Thus by the 1940s the library literature contained fairly definite expectations for a number of the features of library organization and practice.[11]

Lynch summarized the six most common elements used in efforts to produce academic library standards: 1) size of the book collection; 2) size and composition of staff (especially the number of professional librarians); 3) the library percentage of the institution's total budget; 4) seating capacity of the library; 5) library services; and 6) the library administration. She concluded that the primary objective of all standards for academic libraries is to support the instructional and research programs of the institution.[9]

College Library Standards

In 1957 ACRL began work on a standards document by assigning the task to its Committee on Standards. The committee understood that any new standards would not please everyone, but sought agreement on the fundamental issues. They held open meetings at two American Library Association conferences and consulted with a number of prominent librarians. After consulting with

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some leading university librarians the committee decided that, despite the desirability of one set of standards that would include both colleges and universities, the disadvantages would outweigh the benefits. Therefore the new standards were intended to apply to institutions with four-year undergraduate programs which may or may not offer graduate instruction.[12] The final document was approved in 1959 as, ''Standards for College Libraries.'' These Standards covered functions, structure and governance, budget, staff, collections, facilities, library service, and interlibrary cooperation. They provided quantitative measures for collection size, budget, and facilities. The 1959 document identified a minimum of 50,000 ''carefully chosen'' volumes for a college library up to 600 students, with steady growth of the collection as essential.[13]

The committee that developed the ''Standards for College Libraries'' wanted to provide a blueprint for the decade of the 1960s. They felt it necessary to give a few quantitative measurements, although the clear emphasis was on quality. The standards were set high enough so they would serve as a guide into the future, and not just reflect the status quo. For a good college library, the two top requirements were seen as a high caliber staff and a rich and current collection of materials. They felt it important that college libraries cooperate, while providing the essential services for their own patrons.[14] Quantitative measures of adequacy were included, as the standards were expected to be of practical value in increasing the quality of college libraries. The committee that prepared the standards document also sought ACRL member participation and subsequently gained a high degree of membership acceptance and the Standards proved to be of immediate interest.[15,16]

A major challenge to the quantitative figures for library collections was raised by Clapp and Jordan in 1965. They asserted that the volume requirement of the 1959 Standards was simply arbitrary and not backed by research. They argued that adequate collection size should vary among institutions because of their different characteristics and programs. They presented a model, now called the Clapp–Jordan Formula, where appropriate collection size is determined with new formulas based on the primary factors affecting academic needs in each institution.[17]

When the 1959 standards were approved, few libraries met the minimum standards. However, it appears they were quite effective, as these libraries had made substantial improvement by 1970.[9] In the mid 1960s Meder expressed the opinion that the influence of professional librarianship upon college evaluation has been more effective through development of the standards than if there had been direct accreditation of college libraries by the profession.[18]

The first attempt to revise the 1959 standards led to the 1970 proposed, ''Guidelines for College Libraries,'' which were not approved by the ACRL membership, primarily because of the absence of quantitative standards in the document.[15] In 1975 a standards revision was approved; it featured updated formulas for the number of volumes, number of librarians, and arrangement of facilities, which profited somewhat from the Clapp–Jordan research.[19] One significant difference in the 1975 edition of the standards was the use of letter grades as measures of compliance with the standards. Another innovation was the division of the document into two separate sections: ''standards'' and an accompanying ''commentary'' which provided a brief rationale for the standards. A survey by Kaser found that 94% of respondents were familiar with the standards and 87% used them in some manner.[20] Hardesty and Bentley surveyed 300 institutions on the use and effectiveness of the 1975 edition. The results showed that 61.6% of respondents were either ''very'' or ''thoroughly'' familiar with these standards. The greatest uses of the 1975 standards were to upgrade collections and improve services.[21]

Another study of the 1975 edition used Higher Education General Information Survey (HEGIS) data to determine whether college libraries met the quantitative criteria in the standards. The analysis showed that the collection sizes of both public and private baccalaureate institutions did not meet the standard for number of volumes. For staffing, 81% of them failed to meet the standard. Eighty-four percent of the libraries did not meet the minimum of 6% of institutional budget; indeed, more than a third allocated less than 4% of the budget for libraries. The study concluded that most college libraries were underdeveloped, understaffed, and underused.[22]

The next revision of the College Library Standards was approved by ACRL in 1986.[23] Concern had been expressed about the currentness of Formula A (collection), Formula B (staff), and the standard for budget (6% of the institution's educational and general budget). However, few substantial changes were made in the new edition and the standards retained their quantitative nature. Despite some sentiment for less emphasis on quantitative measures, the vast majority of opinions expressed supported their continued inclusion in the standards.[24]

Walch conducted a survey of the 1986 Standards that paralleled the Hardesty–Bentley survey. This survey showed 58.2% were ''very'' or ''thoroughly'' familiar with the 1986 edition. Ninety-five percent of survey respondents found the standards to be ''useful'' or ''very useful.'' The major uses of the standards were for 1) accreditation; 2) arguing for increased budgets; and 3) education of institutional administrators. The two standards considered the most useful (collections, budget) both had specific quantitative ingredients. As a matter of

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fact, a large majority (64.5%) desired to retain a quantitative approach, whereas only 25.6% desired a qualitative approach to library standards. This was the case although Walch asserted that there was no current research and rationale to support the quantitative criteria.[25]

Coleman and Jarred compared the regional accreditation standards with the 1986 edition of the Standards. They concluded that the ACRL standards play a prominent but ambiguous role in academic librarianship. While college librarians prefer quantitative elements in their standards, the authors noted there was considerable controversy over this very element. From their comparison, the authors concluded that the ACRL Standards and regional criteria treat substantially the same topics, but the Standards provide greater specificity and detail. While the regional standards vary greatly in the coverage of libraries, every aspect of college libraries covered by the regional associations is included in the Standards. They found that academic libraries use the Standards in accreditation reviews; most accrediting bodies do not formally adopt the Standards, but accept them as a credible auxiliary tool.[5]

During the process of gathering input for the next revision of the standards it soon became clear that academic librarians wanted to continue the use of quantitative measures.[26] Some adjustments were made in Formula A (collections); Formula B (librarians) and Formula C (facilities) were unchanged. The facilities formula was considered by the library directors to be the most reliable quantitative measure of the standards. There was lengthy discussion regarding the requirement that 6% of the institution's educational and general budget be allocated to the library. Despite controversy, the 6% budget standard was retained from the 1986 edition.[27] Surveys generally concluded that the 1986 edition of the standards was useful. However, there remained a continuing question about the basis for the quantitative parts of the Standards.

The committee responsible for producing the 1995 edition concluded that there was no sound basis for revision of most of the quantitative formulas and recommended that future revisions be based on research. The Standards Committee charged with the revision recognized that academic libraries were already operating in an environment of tremendous change in the system of scholarly communication. They felt it was premature to attempt to incorporate all these changes into the 1995 edition, but in the introduction identified trends to be addressed in a future edition.

Academic librarians continued the long-standing practice of using the standards for self-assessment, to gain accreditation, and in justifying staffing and budgets despite the concerns expressed during the last two revisions that there was little research to support the quantitative measures. Asserting that there was presently no sound basis for revision, the committee suggested research in these areas.[26] Crawford and White took up the committee's challenge several years later, noting that there had been little of the recommended research since 1995 to determine the relevancy of the quantitative formulas for collections, librarians, and facilities. They used those formulas to examine a sample of baccalaureate colleges to determine the degree to which they were meeting the guidelines for collections and number of librarians. Their aim was to determine whether, based on the sample, these specifications should be considered as a base from which to build or a goal to reach for in collections and staffing. Based on the data collected, they were unable to make this determination.[10]

They were able to use the Integrated Postsecondary Education Data System (IPEDS) data to determine that only 33.3% of colleges met or exceeded the recommended collection size; 10% received a failing grade, with collections less than half the recommended size. In summary, two-thirds of baccalaureate colleges did not meet the guidelines for collection size in the Standards. Results for number of professional librarians employed were even lower; only 11.7% of the institutions exceeded the recommended number. Twenty percent employed less than 50% of the recommended number, receiving a failing grade by this measure. The authors concluded that the results provided cause for alarm, and the data demonstrated a clear need for an increase in college library budgets and in the number of professional librarians.

In 1996 ACRL formed the Task Force on Academic Library Outcomes Assessment to address the association's lack of a statement on outcomes assessment, perceiving that its standards, largely written as input measures, were out of step with the practices and philosophy of regional and professional accrediting agencies and state higher education agencies. The Task Force was asked to develop a philosophical framework for assessing libraries in terms of desired campus outcomes and to develop prototypes for such assessment. The apparent conflict between input standards on the one hand and the trends toward greater attention to outcomes as a method of assessment had become a profession-wide concern. The Task Force report therefore included suggestions for incorporating outcomes assessment into ACRL standards, as well as for using them in other contexts. The document also provided useful definitions for the terms: ''outcomes,'' ''inputs,'' and ''standards.[28]'' These definitions were incorporated into subsequent ACRL standards.

In the mean time a new standards committee had been at work crafting a major revision of the standards, which ultimately resulted in the 2000 edition. This edition of the standards addresses 12 different aspects of academic libraries: planning, assessment, outcomes assessment, services, instruction, resources, access, staff, facilities,

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communication and cooperation, administration, and budget. The document provides some basic definitions, introduces peer comparison, and includes an informative section on planning, assessment, and outcomes assessment. The new standards use both qualitative and quantitative measures, and employ inputs and outputs for internal trend analysis and peer comparison. The major innovation of this edition is incorporating outcomes using performance indicators. Taking guidance from the ACRL Task Force, the new standards committee's changes included less emphasis on numbers, a nonprescriptive process for assessment, more emphasis on the quality of services provided, and a greater recognition of the impact of technology on libraries.[29]

The committee departed from the trend of establishing prescriptive standards. Some standards about quality and quantity were retained, but the main thrust of the newest standards is to help libraries establish individual goals within the context of their institutional goals. The new guidelines include basic statistical ''inputs'' used for traditional aspects of assessment as well as outcomes assessments. The new edition provides methods to analyze library outcomes and operations and there are also questions to provide guidance for the provision of library services.[10]

There was considerable concern among college librarians over the lack of quantitative standards in the draft revision. In the final version the committee incorporated ratios and peer comparisons to provide some measure of quantitative comparison. There was also a questioning of how the outcomes assessment elements of the 2000 edition could be applied. The first library to be assessed using the new edition was at Governors State University. That library's approach to the assessment process was described and the actual report made available on the library's webpage.[30,31]

Fernekes and Nelson examined the application of the 2000 edition to academic libraries. They concluded that academic libraries, both college and university, have found the newest edition to be practical for the following reasons:

1. They meet the expectations by accrediting associations that require outcomes assessment.
2. They are applicable to any size library, and are the basis for a single standard for all academic libraries.
3. They have been successfully applied by academic libraries.
4. They provide a nationally approved professional standard for comprehensive assessment of academic libraries.[32]

Of those who have successfully applied the Standards, several have made all or part of their assessment publicly available on the web.[33–36] To provide further guidance for the practical application of the 2000 edition, ACRL published a workbook keyed to the Standards.[7]

The ACRL Board of Directors mandated that all new and revised standards incorporate outcomes assessment, thus the 2000 edition of the ''Standards for College Libraries'' is serving as a model for applying outcomes assessment in other type-of-library standards.[a] In 2002 the ACRL Board appointed a College and Research Libraries Standards Task Force with representatives from the university (ULS), two-year (CJCLS), and college (CLS) libraries sections to work together on a common set of standards for academic libraries and to make recommendations for implementation. The Task Force developed a draft document, ''Standards for Libraries in Higher Education,'' which closely follows the 2002 edition of the CLS Standards.[37] The Task Force is soliciting comments on the draft document, which is expected to be approved in 2004 to replace the present separate standards for universities, colleges, and two-year institutions.

Two-Year Library Standards

The two-year colleges emerged from two basic sources, either as an extension of high school or as an independent junior college. The first group was influenced by the high school emphasis on textbook study, whereas the second group tended to identify themselves with higher education, with a corresponding emphasis on lectures and outside reading assignments. The early two-year college standards were developed through the example of the junior colleges and their emulation of the four-year colleges.[38,39]

In 1953 the Junior College Library Section established a committee to develop a ''statement of evaluative standards for junior college libraries.'' The committee developed a document that leaned heavily on state quantitative standards. The document was approved by the Section in 1956, but not by ACRL, which referred the document to the ACRL Standards Committee. That ACRL committee had just completed the ''Standards for College Libraries'' and now developed parallel standards for two-year schools, which were published as ''Standards for Junior College Libraries'' in 1960. Despite the title, the standards were designed for all two-year schools: junior colleges (primarily concerned with the liberal arts, with limited vocational offerings); community colleges (serving their local area with a combination of varied

[a]The three ACRL type-of-library sections are Community and Junior College Libraries Section (CJCLS), College Libraries Section (CLS), and University Libraries Section (ULS).

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programs); and technical institutes (emphasizing a vocational curriculum).[40]

For the two-year college standards document, the ACRL Standards Committee followed a similar process to that employed for the college library standards. They consulted many junior college librarians, reviewed statistics, and submitted the draft standards to junior college presidents, deans, and librarians for review and comment. The document emphasized qualitative standards, while including quantitative elements that the committee considered indispensable. The standards were designed to apply to all two-year institutions, regardless of region or public/private affiliation. Among quantitative measures, the committee agreed to specify a budget of 5% of the institution's educational and general budget. The book collection should have a minimum of 20,000 volumes for an institution of up to 1000 students. Also, the library was to provide seating for 25% of the student body and employ a minimum of two professional librarians.[40,41]

Tanis identified the following difficulties in implementing the new junior college standards: 1) the extreme diversity of junior colleges; 2) the changing role of the junior college in U.S. society; 3) the rapid growth in enrollment; and 4) insufficient finances because of the rapid enrollment increases. The author then recommended employing a library self-study using the standards as a basis for identifying deficiencies and of bringing them to the attention of the faculty and administration in order to effect improvement.[42] He conducted such a study, wrote a report after the completion in September 1961 of the self-evaluation of the Henry Ford Community College library, and shared the outcome as a practical example for other librarians.[43]

There was considerable controversy over the 1960 Standards. Objections included 1) whether ALA had authority to issue the standards without participation of junior college administrators; 2) whether any valid standards could be issued by other than regional accrediting associations; 3) the subjective application of the quantitative criteria; and 4) the applicability of the ambitious standards to small two-year college libraries. Despite the controversy and objections raised, Wallace asserts that the 1960 Standards were responsible for some real accomplishments: 1) fostering direct, continuing communication between American Association of Junior Colleges (AAJC) and ALA; 2) the quantitative norm for book collections contributed to larger collections; 3) the U.S. Office of Education used the quantitative figures for evaluating books collections, resulting in larger supplemental grants for purchase of library materials; and 4) it provided an administrative pattern for library services, resulting in accelerated improvements in junior college libraries.[38,39]

A joint ALA–AAJC committee was appointed to revise the standards. The final product of the committee was the ''AAJC–ACRL Guidelines for Two-Year College Library Learning Resources Centers,'' approved in 1971. While not having the force of standards, the Guidelines were nevertheless an important document. Specific qualitative criteria were included, rather than quantitative figures, because the committee found a lack of adequate research to support them. Besides the lack of quantitative criteria, these guidelines differed considerably from the college and university standards in that they were concerned only with the provision of learning resources (including services) throughout the campus. Recognizing rapid changes in two-year colleges, the guidelines were revised in 1972, and endorsed and adopted by the three national associations concerned with two-year academic libraries: American Association of Community and Junior Colleges (AACJC), ACRL, and Association for Educational Communications and Technology (AECT).[44–46]

When the 1972 Guidelines document was completed, a supplementary document of quantitative standards was planned. This document was needed in order to provide quantitative figures for use in planning and evaluating programs. The result was the 1979, ''Statement on Quantitative Standards for the Two-Year Learning Resource Programs.'' For this new standard, no absolute numbers were included because of a lack of conclusive research; and extensive experience and professional judgment were applied where necessary. Tables for staff, collection size, and space requirements are provided in these standards and are used to specify numbers required based on size of enrollment. A table on equipment for distribution specifies the number of specific types of equipment according to the number of uses per year. A ''fully developed'' Learning Resources Program was expected to require 7% to 12% of an institution's educational and general expenditures, and minimum annual acquisitions should be 5% of the collection size. As no standards existed for user services, a lengthy, ''Checklist for User Services Statistics to be Collected,'' was provided.[47]

Carpenter used HEGIS data to analyze the two-year college libraries to see how they compared to the 1979 Standards. His analysis showed that a majority of the libraries did not meet most of the variables in the standards, for which data were available. The institutions studied consisted of over 95% of the total of two-year schools. The analysis also showed that a majority of the institutions did not meet the minimum criteria for professional staff or support staff, and both public and private two-year libraries were significantly short of the recommended levels for support staff. A majority of both groups (public and private) fell below the standard for number of periodicals. Book collections for both groups

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fared better in the analysis, yet a majority of both groups were below recommended levels. The holdings of audiovisual titles came the closest to reaching the specified standards. The collection development standard that 5% be added annually was met by 69% of public institutions and by 41% of the private institutions. Only 14% of private and 10% of public institutions met the minimum of 7% of the institutional budget allocated to the learning resource center. Based on the HEGIS data for two-year library resource centers, most libraries were below the Standards for nearly all factors that could be measured by the data. This analysis showed that there were clearly shortcomings in meeting these minimum ACRL standards.[48]

The two-year college guidelines were revised in 1982 and issued as, ''Guidelines for Two-Year College Learning Resources Programs.'' This document was not a standard, but was diagnostic and descriptive in nature, providing valuable directions to those two-year programs desiring to develop a comprehensive program for learning resources. In the introduction, the committee that produced the document described the impediments to developing guidelines for this diverse group, then deemed them necessary, as all two-year programs need to have qualitative recommendations based on best practices and professional expertise to be used for planning and self-evaluation. After providing a context for the role of a learning resources program, a glossary of terms is provided. The guidelines then provide detailed direction in a number of areas.[49,50]

In 1990 a comprehensive standard for two-year institutions was issued as, ''Standards for Community, Junior, and Technical College Learning Resources Programs.'' This document included both qualitative and quantitative measures. The standards, approved by both the AECT and ACRL, replaced both the 1982 Guidelines and the 1979 Qualitative Standards. Specific standards for community, technical, and junior colleges were needed because these two- and three-year institutions make a significantly different contribution to U.S. higher education than other academic institutions and over half of students pursuing higher education in the United States was enrolled in these institutions.[51]

These standards are organized around the following seven elements: objectives, organizations, administration and staff, budget, services, collections, and facilities. Checklists for 1) basic library services; 2) basic audiovisual and learning technology services; and 3) special services components are appended to the Standards. The basic organization employs a ''standards'' statement, followed by a section of ''commentary.'' For the quantitative elements, two figures are given: one for a minimum program and another for an excellent one. The minimum budget for a learning resources program is 6% of the institution's educational and general budget, while 9% is specified for an excellent one. An alternate figure for the budget uses an equivalent dollar amount per Full-Time Equivalent (FTE) student; for this purpose a table is provided. Similar tables are provided for 1) staffing; 2) size of collection; 3) assigned space; and 4) total number of library services and media services provided. Each of the tables provides a number for minimum and excellent service, based on the number of FTE students.

An ACRL–AECT joint committee spent two years producing revised standards which were approved in 1994. This edition retained the basic format from the 1990 standards, using almost identical elements in its organization and providing a standards statement followed by commentary and three appendices. Different material was appended as: 1) Checklist of Basic Learning Resources Center (LRC) Services and Activities; 2) Checklist of Additional Services Components; and 3) Example Table of California Facilities Standards. The 6% and 9% budget figures were retained for minimum and excellent portion of the institution's educational and general budget. Updated tables (specifying ''minimum'' and ''excellent'') are provided for staffing, dollar expenditures per FTE student, and collection size. A new table is provided for determining obsolescence of equipment and a different approach is used for determining assigned space. It is noted that some higher education regulatory agencies issue formulas for state campus facilities and these should be followed, if available. An example of a state-mandated formula is provided as an appendix.[52]

Since ACRL requires all new standards to incorporate outcomes assessment, the CJCLS began another standards revision, then joined the task force producing a common ACRL standard for libraries in higher education. To accommodate the need for quantitative standards, a separate ''guidelines'' document is planned as a CJCLS supplement to the joint document now in final draft.[53–55]

University Library Standards

Until 1979 there were no official general standards for university libraries, although in 1968 an Association of Research Libraries (ARL)–ACRL joint committee had been formed to study the need for university library standards; determine if it were possible to produce such standards; and actually produce them, if possible. In 1972 Watkins felt that such a statement of standards was needed, because the planning of the academic programs in U.S universities had not taken into account the book and journal requirements of those programs. He named the following standards as especially needed for university books and services: standards of financial support and authoritative standards for professional personnel. He

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reiterated that in the absence of professionally established norms, others, without adequate information, would produce standards for university libraries. Indeed, this had already happened when the U.S. Department of Education produced standards for collection size in order to equitably distribute state and federal funds.[56]

Watkins identified the following major difficulties in producing university library standards:

1. There is a great diversity among institutions called a university.
2. There is danger in the stated minimum standards being interpreted as maximum standards.
3. It is very difficult to determine standards for book collections in all the various subject areas.
4. Some universities have centralized library services, whereas others have decentralized services.[56]

However, as college libraries had produced a set of official standards in 1959 that were quite influential, there was a precedent for developing standards for a very diverse group of academic libraries. Indeed, university librarians were impressed by the overall effect of the College Library Standards which had resulted in the upgrading of college libraries.[9]

Since at least 1967, there had been definite interest in crafting general standards for university libraries. In November 1967 a joint conference with ARL, funded by the Council on Library Resources, was held to consider the subject. Out of this meeting came the recommendation for a joint ARL and ACRL committee to develop university library standards. They recommended that the new committee 1) analyze presently available statistical data; 2) develop standards that appear feasible based on the analysis; and 3) determine other areas of library performance for which standards are desirable.[57] In 1968 the ARL–ACRL Joint Committee on Library Standards was appointed and decided to prepare a set of criteria on the best current practices. They selected 50 leading North American university libraries and collected statistics in an effort to draw useful conclusions upon which to base the proposed standards; the data were published in 1970 as, ''Standards for University Libraries.'' A university library could use this data to compare itself with this peer group or a selected subset.[9,58] The committee, chaired by Robert B. Downs, proposed standards for the areas of resources, personnel, space, finances, public service, and administration; based on norms from the data collected from the 50 libraries. There was some controversy over whether or not to include a percentage standard for library budgets. They finally settled on a recommendation of 5% of the institution's educational and general budget, a departure from the 3.5% norm of the 50 libraries in the data report. The Downs committee did not believe its report, issued in 1975, appropriate for adoption for university library standards, but their expectation was that a separate committee would use their report to formulate standards.[9]

The subsequent committee (appointed later in 1975) was chaired by Eldred Smith. This committee tested three approaches for quantitative formulas for possible use with the standards. The committee settled on an approach of grouping similar institutions into separate categories and applying regression analysis to the data in each category. This type of analysis does not produce a standard, but does provide a method of systematic comparison among institutions. The Smith committee surveyed librarians for comments about standards; the survey results were mixed. Librarians at larger and wealthier institutions were opposed to quantitative standards, believing that standards would be based on minimum levels far below what their libraries had already achieved. Librarians at smaller, less wealthy institutions were much more willing to support quantitative standards. The divided opinion eventually caused the committee to abandon the ideal of quantitative standards, opting instead for a document recommending common techniques.[9]

The first standards for university libraries, approved in 1979, were prepared to assist in the evaluation and improvement of university library services and resources. They were intended to apply only to doctoral granting institutions; at the time there were 184 institutions in that group. The committee did not view these as prescriptive standards, but rather a framework for applying the particular circumstances of each library. They outlined what they considered as particularly important trends for university libraries.[59]

In summary, the committee regarded the standards as limited to succinct statements regarding critical elements for university library adequacy. Each ''standard'' is followed by a ''commentary'' which amplifies the principles addressed in that standard. The ARL–ACRL Standards, rather than presenting quantitative standards, emphasize the performance of university libraries. In contrast with the clearly quantitative ''Standards for College Libraries'' then in effect, the university library standards failed to relate library size and resources to performance. Thus Stubbs was of the opinion that, while appearing very much like standards, they did not meet that criteria.[60] Stubbs nevertheless recognized their value for presenting the argument that a university library should be judged not by its collection size or expenditures or staffing but by how well it serves its academic users. He felt that these standards recognize that whether a student finds needed information is the best appropriate test of a library. Stubbs said that the University Library Standards put the

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emphasis on the most important elements by emphasizing service and performance.

To determine whether the ''Standards for University Libraries'' were useful and effective Lynch surveyed the directors of the 184 largest libraries in 1981. The questionnaire was based on the one developed earlier by Hardesty and Bentley for their survey to gather data on the 1975 standards for college libraries. The response showed that university librarians favored the standards and some had used them for guidance. The results showed a continuing disagreement on whether the standards should be quantitative. Despite criticism of the University Library Standards, there was not then widespread support for revision of the standards.[9]

The development and adoption of the university library standards was a major accomplishment, and there was agreement that librarians were the appropriate ones to develop the standards. However, in order to gain consensus and approval, some compromises were necessary and consequently there was disagreement over their utility. These standards did not provide quantitative criteria or measures of excellence, and thus could not demonstrate whether a library meets quantitative standards. The collected data could be useful in describing the current status of university libraries and the quantitative relationships among them. However, the standards did not demonstrate whether a particular library met a minimum standard or criteria.[9,60]

A review of the 1979 Standards began by soliciting input from the university community through an open hearing in 1986 and from guests invited to the ACRL Standards Committee meetings in 1986 and 1987. Comment was also solicited from regional accreditation associations and university administrators and an open hearing was held on the draft in 1988. The most contentious issue was whether the standards should be quantitative or qualitative. Based on all the input received, the committee concluded that neither approach was appropriate and, instead, produced model procedures for determining measurable expectations. They determined that the basic need of users of the standards was to relate 1) how well the library is doing; 2) how well it is supported; and 3) how well it compares to other libraries. They described a process through which pertinent facts could be gathered to answer these questions.

The 1989 edition of the Standards was developed on the assumption that each university library system is unique and should be responsible for determining its own criteria for evaluation and performance. The committee did incorporate some prescriptive concepts. There is a clear requirement that librarians develop skill in 1) examining and redefining their mission; 2) establishing coherent and measurable goals; 3) effectively assessing user needs; and 4) identifying and applying measures of the extent the library is fulfilling its mission and goals. In summary, the standards set forth a process to be used for establishing expectations and identify the topics that should be addressed in evaluating university library performance.[61]

The ACRL's University Libraries Section (ULS) effort to produce standards based on outcomes assessment led to dialogue with the standards committees of CLS and CJCLS. A recommendation for a common ACRL standards document grew out of these discussions and led to the appointment of the ACRL College and Research Libraries Standards Task Force in early 2002. The Task Force, representing all academic and technical libraries, used the ''Standards for College Libraries, 2000 Edition'' as the basis to produce a draft, which has been widely distributed for discussion and comment. Open hearings were scheduled at the Toronto (2003) and San Diego (2004) ALA conferences; final approval is expected in 2004.[62–64]

CONCLUSION

Through the years the regional accrediting association standards have required an institution to provide adequate library collections and services in order to be accredited. All the regional accrediting associations have rewritten their standards in the last several years, making them much less prescriptive and emphasizing outcomes assessment and student educational outcomes.

ACRL developed separate type-of-library standards beginning with college library standards in 1959, then developing those for two-year institutions (1960) and for universities (1979). There has been disagreement between the advocates of quantitative standards and those favoring qualitative standards. Quantitative standards have proven quite valuable in improving library collections, but the lack of a solid research basis has generally led to the ascendancy of qualitative standards. Mandated by the ACRL board, outcomes assessment was incorporated into the 2000 edition of the College Library Standards, which became the basis for a draft standard for all libraries in higher education. Prospects are bright for final approval of a single set of ACRL standards to replace the three currently separate, type-of-library standards.

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Medical Library Association

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INTRODUCTION

The Medical Library Association (MLA), a 501(c)3 not-for-profit educational association, is a leading advocate for health sciences information professionals, with more than 4700 members worldwide. Through its programs and services, MLA provides lifelong educational opportunities, supports a knowledge base of health information research, and works with a global network of partners. The association also promotes the importance of quality information for improved health to the health care community and the public. The association's organizational structure includes a Board of Directors, 16 committees, a variety of task forces, 23 sections organized by special subject interests and areas of responsibilities, 17 ad hoc special interest groups (SIGs), representation to 23 allied organizations such as the National Information Standards Organization, and 14 affiliated chapters representing the United States and parts of Canada. MLA adopted a new strategic plan in 2003 (http://www.mlanet.org/about/strategic.html), aspiring to be the association of the most visible, valued, and trusted health information experts working to enhance the quality of health care, education, and research throughout the world. Members and staff, working in partnership to achieve the association's vision, have embarked on new directions and refined past initiatives.

PROFESSIONAL AND MEMBERSHIP RECRUITMENT

Founded in 1898 in Philadelphia, Pennsylvania, MLA has 4700 members including 3800 health sciences librarians and 900 health sciences libraries. MLA also has international members from 56 countries in addition to the United States and Canada and cooperative agreements with the Canadian Health Libraries Association, the German Working Group, and the European Association of Health Information Libraries—a truly global organization (Fig. 1).

Demographically, MLA is primarily comprised of white females in their 50s, with master of library science (MLS) degrees who are employed in hospital settings. This description is based on data from the Hay Group/MLA 2001 Compensation and Benefits Survey.[1] Forty-two percent of MLA's members are employed in hospital libraries, 29% in academic medical centers, and 29% in other settings such as pharmaceutical companies. Eighty-nine percent of the membership is white, 3% Asian, 1% African American, and 1% Hispanic or other backgrounds. In 2001, the median annual salary for a health sciences librarian was $47,300 and the average annual salary was $49,955. Between 1998 and 2001, actual wage rates of health sciences librarians outpaced inflation by 6.1%. This is likely attributable to the elevated demand for labor in this specialty between 1999 and 2001.

Membership recruitment and retention is becoming more difficult for a variety of reasons for both the national association and affiliated chapters. The majority of health sciences librarians who entered the profession in the 1970s after the passage of the Medical Library Assistance Act are now retiring. Downsizing and consolidation in the health care industry have resulted in library closings and fewer health sciences librarians. Although a record number of new members have joined MLA since 1997, these members do not offset those who are leaving the association because of retirement or change in profession. There are still not enough qualified health sciences librarians to fill vacant positions in spite of consolidation in the health care industry. This is, in part, because of the transitioning of librarians into nonlibrary jobs in the for-profit sector. These positions generally pay more than traditional library positions. Most recently, this situation has been ameliorated by the collapse of the technology sector and the return of some of these professionals and others into the library and information sciences area.

To meet this challenge, MLA has established the Professional Recruitment and Retention Committee. The committee has begun to develop initiatives to recruit people into the profession of health sciences librarianship while the Membership Committee continues to work on recruiting librarians into the association. These initiatives are based on an in-depth action plan developed by MLA's Task Force to Recruit the Twenty-First Century Workforce. Also, in 2000, through a grant from the National

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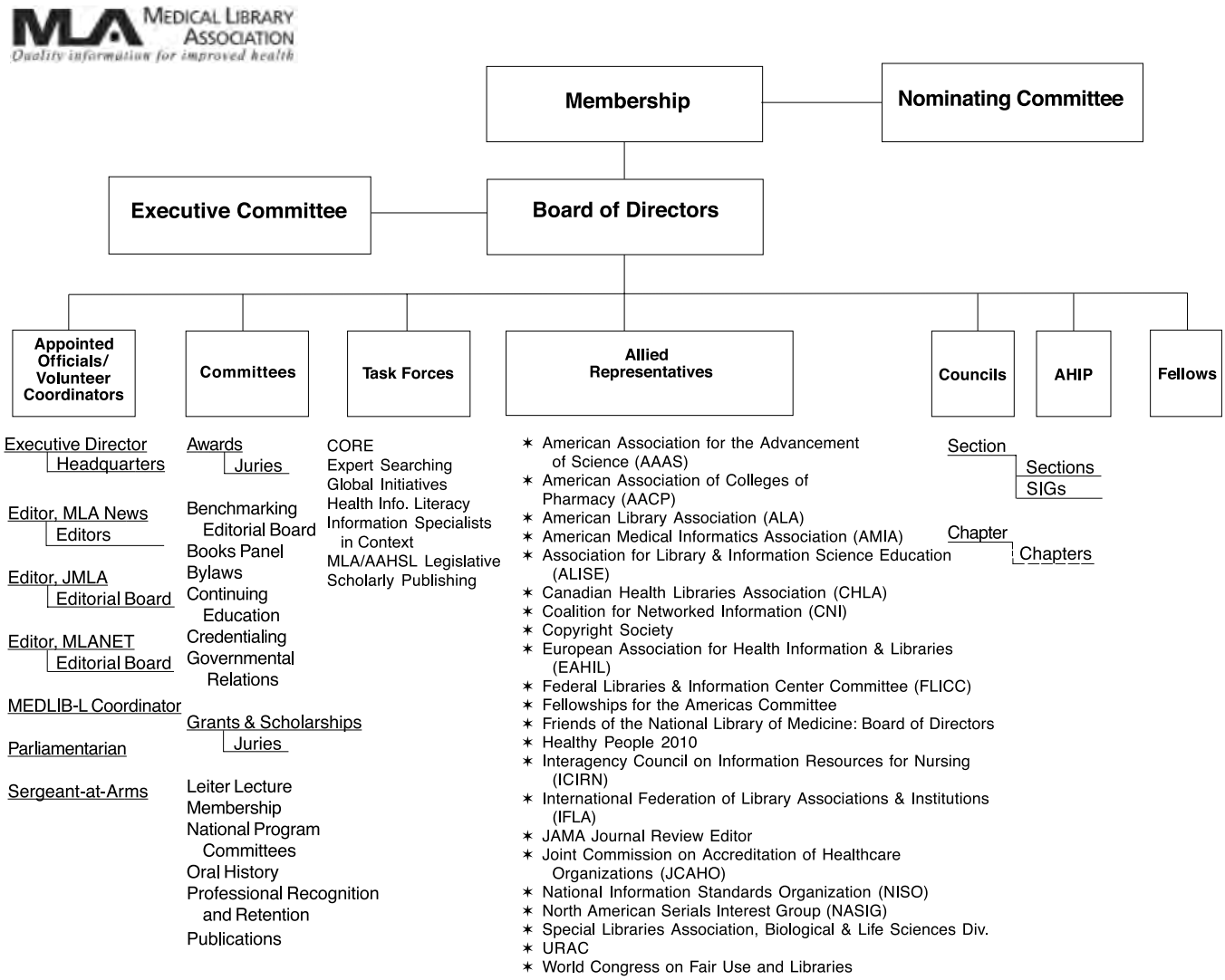

Fig. 1 Association structure chart 2003.

Library of Medicine (http://www.nlm.nih.gov), MLA began a program to recruit people from diverse cultural backgrounds into health sciences librarianship. Through the grant, MLA was able to increase the number and stipend amount of graduate schools of library and information science (GSLIS) scholarships and develop career materials, in both English and Spanish, to inform students about opportunities in the profession. MLA is also funding minority leadership grants through the Association of Research Library's leadership diversity program and is actively involved in the American Library Association's Spectrum Initiative. Finally, it launched its mentoring website in 2003 (http://www.mlanet.org/mentor/) to link people in the profession with interested students and other professionals.

PROGRAMS AND SERVICES

MLA fulfills its mission and goals[2] through its continuing education, credentialing, professional recognition, and publications programs. The association also offers career services and advocates on behalf of its members through the association's public relations program and governmental relations programs. In 1994, MLA adopted the Code of Ethics for Health Sciences Librarianship (http://www.mlanet.org/about/ethics.html). The code describes the goals and principles for ethical conduct for its members in relation to society, their clients, their institutions, the profession, and themselves. MLA also promulgates practice standards for membership segments such as hospital librarians and chiropractic

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librarians and promotes research in the provision of information for quality health care.

Lifelong Learning

Medical practice, research, and technology will continue to change at a breathtaking pace well into the future. Supporting and promoting lifelong learning opportunities for health sciences librarians to meet these future challenges has been a major priority of MLA for almost 50 years. The history and current state of the program in the 1970s is described in detail in the first edition of the *Encyclopedia of Library and Information Sciences* (*ELIS*)[3] and in a supplement published in 1997.[4] Lifelong learning includes both MLA's continuing education and credentialing programs. The newly appointed Center of Research and Education Task Force (CORE) is working to bring together all of the programs in MLA that relate to education and research in one coordinated whole.

Major changes occurred in the continuing-education (CE) program during the 1990s because of the costs involved in administering the program, the need to more quickly incorporate new trends and topics into the course offerings, and the demand to make educational opportunities more accessible using new technologies. Today, CE courses are no longer designated as core or basic courses and new perspective courses, but are organized by areas of knowledge and skills needed by health sciences librarians as described in MLA's educational policy statement, Platform for Change (http://www.mlanet.org/education/platform.html).[5]

Courses are offered at the association's annual meeting and by chapters at their annual meetings. Also, MLA's annual meeting schedule frequently includes symposia on important topics, such as electronic and scholarly publishing and leadership development. The course approval process (http://www.mlanet.org/education/cech/cedevelop.html) is a rigorous one, and course evaluations are carefully considered by the Continuing Education Committee (CEC). Contact hours are awarded for each course based on the number of hours students are in class.

MLA CEC and headquarters staff worked together to establish MLA's Educational Clearinghouse (http://www.mlanet.org/education/cech/), an on-line listing of continuing-education opportunities, from a variety of sources that support the core competencies deemed necessary and appropriate for health sciences librarians in their professional development. Searchable by subject/area of knowledge, location offered, instructor name, and experience level, the Educational Clearinghouse has proven to be an effective resource in furthering health sciences librarians' professional development, and MLA continues to enhance it. Currently, information about 280 courses is available through the clearinghouse.

The kinds of courses offered, both in subject matter and in format, have also changed. The increasing number of courses about Internet applications reflects the tremendous change in the practice of health sciences librarianship over the past 10 years. Courses such as searching the Web for quality health information, developing Web-based CE courses, negotiating licenses for electronic journals and databases, expert searching, and consumer health have been offered. MLA also continues to address the challenge of offering quality and affordable professional development opportunities to people both regionally and at their desktops. MLA's first teleconference in 1996, ''The Role of the Library in Accreditation,'' was received by over 100 sites in the United States and Canada and was seen by about 1300 people. Since that time, MLA has offered one or two teleconferences per year, sometimes in collaboration with other library associations. In 2004, MLA will offer its latest teleconference on health information literacy via streaming video as well as DVD to accommodate its members' needs. MLA also began to offer Web-based courses in 1997 and has seven courses available on a variety of topics. Finally, MLA is introducing its independent reading program in 2004 to allow members to earn CE credits through reading selected professional articles and completing a self-assessment tool. The MLA's move into distance education has increased participation in the association's continuing-education program more than 700% from 1990 (1245 participants) to 2002 (9238 participants).[6,7]

Specialist Credentials

In 2000, MLA established a specialist program in consumer health, developed for health sciences librarians as well as other librarians working in the area of consumer health. The program consists of basic and advanced courses on various aspects of consumer health (http://www.mlanet.org/education/chc/) taught by health sciences librarians. The program was introduced in 2001 at the ''The Public Library and Consumer Health'' conference cosponsored by MLA, the Public Library Association, and the National Library of Medicine. Other specialist credential programs, modeled after the consumer health program, are under development.

The demand for Web-based courses will substantially increase over the next few years, and this demand will prove challenging for small associations with few staff and fewer financial resources. MLA is exploring some alternatives for meeting this demand. These include partnering with graduate schools of library and information sciences; providing software for members to develop Web-based courses; providing access to Web-based

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courses from other providers through MLA's Educational Clearinghouse; and developing less costly, local opportunities for CE including independent learning and journal clubs. Success in effectively using new technologies in this area is essential for the continued success of MLA's lifelong learning program.

Credentialing and the Academy of Health Information Professionals

MLA is the only library association as of December 2003 that has a recognized credentialing program. It established the Academy of Health Information Professionals (AHIP) (http://www.mlanet.org/academy/) in 1989 to encourage individual professional growth and lifelong learning in health sciences librarianship. The academy replaced a test-based certification program. MLA's program was established partly as a factor of the environment in which health sciences librarians work. Physicians, nurses, and allied health workers require licenses or certifications and recertifications to continue to practice in their chosen professions. Health sciences librarians also feel a need to seek additional credentials beyond the MLS as a way to document their continuing education and to demonstrate continued competency in their profession. The program originally required that librarians pass a competency-based examination to receive certification, but this requirement was eliminated in 1989. Today, admission to the academy is based on educational qualifications, documented knowledge in the previously mentioned knowledge and skills areas, and professional contributions through teaching, publishing, or holding leadership positions in the association and its units.

Membership in the academy is open to both MLA members and nonmembers. In 2003, about 1210 people belonged to the academy at one of five levels: provisional, member, senior, distinguished, or emeritus member. Data from the 2001 Hay Group/MLA Compensation and Benefits Survey[1] indicated that academy members were better compensated than nonmembers, but more analysis is needed to establish a cause-and-effect relationship. MLA, through its Credentialing Committee and mentorship program, continues to simplify the application process to encourage membership in the academy as part of an individual's lifelong learning program.

ADVOCACY

MLA plays a strong advocacy role on behalf of its members to demonstrate the value of quality health information to society and the role that health information professionals play in producing and managing that information. This is achieved through the association's professional recognition, governmental relations, and public relations programs.

Professional Recognition

The grants and scholarships program (http://www.mlanet.org/awards/grants/) and the awards program (http://www.mlanet.org/awards/) remain strong components of MLA's professional recognition program. At the close of 2003, endowment funds for this purpose represented 40% of the association's total assets.

Grants and Scholarships

MLA offers a variety of scholarships and grants administered by the Grants and Scholarships Committee. These stipends assist qualified students to attend graduate schools of library and information sciences and enable practicing health sciences librarians to take advantage of opportunities for continuing professional development. One of the major challenges for this program is to keep the grants and scholarships financially competitive so that people will apply for them; they will truly make a difference in someone's professional career. The association offers grants and scholarship for both minority and other applicants to attend graduate schools of library and information science (GSLIS), to attend meetings, do research, and receive additional continuing education.

In 2001, MLA established the Lindberg Research Fellowship, honoring Donald A.B. Lindberg, M.D., director of the National Library of Medicine (NLM), in recognition of his significant national and international achievements at NLM, the world's largest medical library. The $25,000 research fellowship, given annually, helps to ensure ongoing funding of research initiatives that will strengthen the knowledge base of information research and improve the practice of librarianship. It also provides a more formal structure for supporting research activities that will benefit the health sciences. The first fellowship was awarded for a study focused on overcoming the ''consumer vocabulary'' problem: The potential mismatch between terms used by health care professionals and those used by the people who need their services—both patients and the people who care about them.

Awards

The awards program, administered by MLA's Awards Committee, honors superior individual achievement in specific areas of librarianship including hospital librarianship, collection development, history or philosophy of the profession, chapter programs, education, research, and

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distinguished public service. Named in honor of distinguished health sciences librarians and honorary members and sponsored by corporate partners important to health sciences libraries, awards are given annually. MLA also honors those who have made outstanding and sustained contributions to the advancement of the purposes of the association through fellowships and honorary memberships.

Governmental Relations

MLA's governmental relations program (http://www.mlanet.org/government/) addresses national information issues and policies that affect the health sciences library community. Annually, the association is asked to testify before Congress on the importance of the National Library of Medicine to the provision of clinical and scientific information that supports medical education, research, and, ultimately, improved patient care. MLA has published position papers on telemedicine, copyright, scholarly publishing, open access, and access to government information. The association also works in coalition with the other major library associations on issues of mutual concern through the Shared Legal Capability (http://www.arl.org/info/slcfact.html) and the Information Access Alliance (http://www.informationaccess.org/). MLA will continue to partner with other organizations to address information access issues as they continue to evolve in this very complex digital environment.

Public Relations

MLA began a major public relations effort in 1996 to help promote the association's Centennial Celebration in 1998. Today, the program focuses on assisting MLA members and other health sciences library professionals to market their expertise and services both to their institutions and to outside publics (http://www.mlanet.org/publications/tool_kit/). MLA provides publications such as the Advocacy Toolbox (http://www.mlanet.org/members/advocacy/) and posters for librarians to use in their institutions to heighten awareness of the value of the services provided by the medical libraries and librarians. The association has designated October as National Medical Librarians Month (http://www.mlanet.org/press/nml-month/) and established 4/11, Medical Information Day (http://www. mlanet.org/press/411/), to help members promote their services to their institutions and users.

The public relations program also aims to create awareness of the health sciences library profession through several outreach initiatives to consumers. The Health Reporters' Internet Seminars (http://www.mlanet.org/resources/health_writer/), taught by MLA members, are designed to teach health reporters from major newspapers how to efficiently access authoritative and up-to-date health information via the Internet. Media training for MLA leaders helps them effectively explain and promote their professional skills and services to the public through the media. Distribution of consumer health information such as Deciphering Medspeak, in both English and Spanish (http://www.mlanet.org/resources/medspeak/), provides health and website information to the public in a simple format and, again, creates awareness of the profession. MLA recently appointed a Health Information Literacy Task Force to continue outreach to consumers and allied health professionals about how health sciences librarians can put ''information'' into health literacy initiatives.

MLA will continue to use its public relations program as an advocacy tool for the profession by addressing the needs of specific membership segments such as hospital librarians or academic medical center librarians. One of the challenges of the program is to make members realize the important role public relations can play in the perceived value of the library and librarian to the institution and to the community.

CREATING AND COMMUNICATING OUR KNOWLEDGE

Research

Part of the MLA's mission is to promote research in information management and the profession. Several of the association's grants and scholarships provide stipends for those interested in doing research that will contribute to the profession's body of knowledge including the newly established Lindberg Research Fellowship. MLA published Using Scientific Evidence to Improve Information Practice, the research policy statement of the Medical Library Association (http://www.mlanet.org/research/science1.html),[8] in 1995. The statement provides direction for the association's research program. In addition, MLA sponsors research studies in areas that will help the profession. The newest initiative, MLA Benchmarking Network (http://www.mlanet.org/members/benchmark/), offers hospital, academic, and specialty health libraries an opportunity to learn more about benchmarking, compare data, establish best practices, and identify and work with a benchmarking partner. Almost 400 health sciences libraries nationwide have participated in this study to date. Two other studies deal with the compensation and job responsibilities of health sciences librarians vs. information technology professionals in health care settings (http://www.mlanet.org/

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members/hay_study/index.html) and the value of information services to institutions' bottom lines (http://www.mlanet.org/research/value_study/).[9,10] MLA also posts presentations and posters presented at the association's annual meetings on MLANET and is developing a member area on the website where members can exchange ideas, research, and other helpful information. MLA worked with the Pew Internet and American Life Project (http://www.pewinternet.org) to study how health sciences librarians locate health information via the Internet as opposed to how the public finds information. With Pew, MLA members also developed a user's guide to finding and evaluating health information on the Web (http://www.mlanet.org/resources/userguide.html) and other consumer resources. The association will continue to partner with other organizations to provide research data and resources that will assist health sciences librarians and consumers.

Publications

The association's publications program encourages and publishes research in health sciences librarianship, provides texts for those studying to be health sciences librarians, provides authorship opportunities for health sciences librarians, and provides consumer health materials for the public. The venerable *Bulletin of the Medical Library Association* (*BMLA*) (http://www.mlanet.org/publications/bmla/), published almost continually under several names since 1902, was one of the first regular MLA publications. MLA Board of Directors voted to change the name of the *BMLA* to the *Journal of the Medical Library Association* beginning in January 2002. The journal has been made available electronically since January 2000 over PubMed Central (PMC), a digital archive of life sciences journal literature developed and managed by the National Center for Biotechnology Information (NCBI) and the National Library of Medicine (NLM). Recently, NLM, working with MLA Headquarters, made the full-text archives of *BMLA* from 1911 available online through PMC. This is an excellent resource for the study of health information sciences and the management of knowledge-based information, putting into practice MLA's belief in open access.

A Handbook of Medical Library Practice[11] was one of the first texts published by MLA in the association's book publications program and went through four editions over a 40-year period. The handbook was succeeded by *Current Practice in Health Sciences Librarianship*,[12] a multivolume series completed in 2001. Until about 1990, all association publishing was centralized at MLA headquarters. In 1990, the association began working with a series of copublishers to produce a number of noteworthy books, adding to the research base of the profession. This includes *The Medical Library Association Guide to Managing Health Care Libraries*,[13] recognized as ''the new gold standard in health sciences library textbooks.''[14]

During the 1990s, MLA expanded its publishing program (http://www.mlanet.org/publications/) to include DocKits and BibKits. These publications are collections of documents or bibliographies of resources about specific topics and are published in-house. MLA also publishes materials in compact disc and electronic formats to make information more widely available. Other components in the program are house publications (annual report, Directory, MLA-FOCUS) and the *MLA News* (http://www.mlanet.org/publications/mlanews/). Beginning in 1996/1997, all or parts of the *BMLA*, the *MLA News*, the annual report, and the directory have been available on MLANET (http://www.mlanet.org), MLA's Website.

Supporting a comprehensive publications program in a small association is very challenging because of the relatively small potential market for its publications. MLA has partnered with several commercial publishers to help the association maintain a quality books program, which is coordinated by headquarters staff and MLA Books Panel. MLA's goal is to publish about two books per year in addition to other publications. The association actively solicits authors from among its members and nonmembers.

MLA also supports MEDLIB-L (http://www.mlanet.org/discussion/medlib_l_faq.html), a discussion list that has about 2000 member and nonmember participants. The list is used for interlibrary loan, reference, announcements, and other items that help health sciences librarians in their daily work. MLA headquarters staff also supports more than 100 discussion lists for association units and provides space on MLANET for section and chapter websites.

It is hard to predict how electronic publishing will affect MLA's publishing program. Will the free availability of some of the publications that were previously considered member benefits result in fewer members, fewer subscriptions, and less advertising revenue? Or will it provide increased visibility for the publications and the association, resulting in more members and more people who want to receive the print version? How long will the association continue to produce both print and electronic formats of the same publication? If the *JMLA* is any example, its electronic availability to all has lead to a reduction in paid subscriptions. However, there is no demonstrable relationship as yet between reduction in memberships and the free availability of the journal. MLA currently publishes its annual report and membership directory only in electronic form. Conversion of MLA's publications to electronic form and the development of electronic publications is another challenge. Experimentation with electronic formats will continue for the

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foreseeable future as the association continues to convert print products into electronic ones and develop new electronic products and services.

BUILDING A NETWORK OF PARTNERS

MLA actively works to serve health care providers and the public through a global network of members and partners who share expertise and resources. Some of the programs already mentioned support this goal through collaborations among the association's sections and chapters, other library associations and organizations, and the international library and information community. In the international arena, MLA is a long-time member of the International Federation of Library Associations and Institutions (IFLA) and actively supports the Fellowships for the Americas Program, a program that provides grants for younger members of the library community from the Americas to attend IFLA. MLA also has a sister library initiative and supports the International Congress on Medical Librarianship (ICML). The Congress, held every 5 years, will be held in Salvador, Brazil, in 2005 (http://www.icml.org/). The newly appointed Global Initiatives Task Force will be working to coordinate MLA's international activities.

OTHER FUTURE CHALLENGES

MLA is actively working on several other future challenges for the profession concerning roles of the health sciences librarian. The association is furthering the concept of evidence-based medicine through its exploration and definition of expert searching techniques (http://www.mlanet.org/resources/expert_search/) conducted by the Expert Searching Task Force and the provision of continuing education opportunities in this area. These techniques identify best practices and cutting-edge clinical and research knowledge and cull through the overwhelming amount of medical literature that continues to grow exponentially. MLA's work in the area of expert searching was prompted by the increased emphasis on evidence-based practice by the Institute of Medicine. This, along with publicity about the need for more vigilance about the quality of literature searching following the unfortunate death of a healthy research volunteer at Johns Hopkins, has created a renewed interest in the knowledge base and skill set required for expert literature searching and expert consultation. The use of evidence- or knowledge-based information retrieved through the expert searching process can help insure the clinical, administrative, educational, and research success and positive performance of the individual health care provider as well as the hospital or academic health center.

In addition to retrieving the best evidence, it is also important to deliver knowledge and services within the specialized context to patient care, research, and learning. MLA's exploration, along with the National Library of Medicine, of the informationist concept, e.g., specialist librarians who blend the knowledge and skills of both the clinical and information sciences, is defining new roles for librarians for providing filtered and customized clinical/research information at the point of need and decision making (http://www.mlanet.org/research/informationist/). Librarians are being recruited to join clinical and research teams as clinical medical librarians and information specialists in context and to provide expert consultation on issues ranging from informatics literacy to evidence-based medicine classes. The Information Specialist in Context Task Force is engaged in defining these roles and future career models.

Future challenges for MLA as for many other associations are in the areas of membership, technology, finances, outside competition, and environmental impacts. Keeping up with new technologies to provide programs and services is a tremendous challenge for a small association. Technology costs for the association have tripled over the past 10 years because of developing and maintaining its Website, MLANET (http://www.mlanet.org). MLANET provides MLA with a global reach and reveals the richness of our resources and the expertise of our members as never before possible. MLANET not only provides organizational information about MLA, the Website also provides member networking services; acts as a resources gateway; contains career, educational, and recognition information; and provides online access to research, standards, publications. More than 50% of MLA's new members now join via MLANET. However, the transition of MLA into a virtual association is costly both in terms of human and financial resources and requires providing programs and services in multiple formats. For example, continuing-education courses are beginning to be offered in both Web-based and face-to-face formats, and association publications are provided in both print and electronic formats. Finding qualified people to staff Web services and information services positions in a small, not-for-profit organization is also difficult.

MLA has had to become more entrepreneurial to generate enough income to provide the membership with new programs and services, especially services available over the Internet. In spite of the association's dues increase in 2001, dues revenue will provide only 22% of the operating revenue needed to fund programs and services in 2004. MLA relies on the annual meeting, advertising, mailing list sales, and sales of publications to generate 78% of the association's operating revenue. During the 1990s, the association's endowments and reserves grew because of a strong economy and increased support from the membership and corporate partners.

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Even with the economic downturn in 2001, this reserve has enabled MLA to increase some grants and scholarships and provide additional grants, particularly for health sciences librarians from foreign countries, to attend international meetings.

However, the economic situation has adversely affected the support the association receives from its traditional corporate supporters. As in other industries, there have been a number of mergers of the companies who provide products and services to the library community. This translates into fewer exhibitors at association meetings, fewer corporate donations, and less revenue from these sources. Replacement of these revenues requires the association to seek other corporate partners, analyze programs and services carefully to determine new revenue streams or ways to cut costs, and cut programs and services that are not essential to the mission of the association. MLA, to date, has been very fortunate in its ability to navigate in this uncertain financial environment. The membership was willing to increase dues in 2001 to help offset increased costs; association reserves are still healthy, and we have found other sources of corporate support and revenue. However, finances will continue to be of concern as the decade progresses and future dues increases are inevitable.

CONCLUSION

The Medical Library Association continues to be a vital organization after more than 100 years of operation. One of the major reasons that the association was founded was to provide for an exchange of materials among its membership. Today, the MLA Exchange is transmitted electronically among 900 subscribers and has become just one of many programs and services that MLA provides for its membership. MLANET, MLA's Website, is the association's face to the world, enabling a librarian in India to teach MLA's health writers seminar for reporters in his community and librarians from Australia and Asia to participate in its Web-based courses. There has never been a more exciting or challenging time to be a librarian or a library association staff member.

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National Library of Sweden: History of the Royal Library

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INTRODUCTION

The Royal Library of Sweden functions as the national library. It has its beginnings as a national archive in 1618. The Royal Library opened in 1878. The collections are focused on materials about Sweden and the Swedish people. The Library Information System (LIBRIS) began in the 1950s and has evolved into an online nationwide system.

FROM A ROYAL LIBRARY TO A NATIONAL LIBRARY

The 30-year war (1618–1648) left Sweden as a minor great power in Europe. Sweden and its powerful ally, France, became dominant in the political scene for almost a century. The task to transform the poor country from a position far up in the very north of Europe to a modern and efficient central European state was enormous. This difficult duty fell mainly upon the King Gustav II Adolf (1594–1632) and his brilliant Chancellor, Axel Oxenstierna (1583–1654). The first priority was naturally to secure the administration the new provinces. But they also realized that they had to promote intellectual life and build up a strong and modern bureaucracy. New universities were established in different parts of the new settlements. The Royal Chancery underwent big changes. Some of authorities established during these years are still working. The reforms were also extended to cover the archival and cultural sectors of society and, in 1618, an ordinance was developed to organize a National Archive to preserve the documents from the entire empire. Between 1611 and 1634, one person, Johannes Bureus, was appointed to be responsible both for the National Archive and for the royal book collections as well as the national monuments.

Some years later, in 1661, another ordinance ordered all printers in the realm of Sweden to send two copies of every publication printed to the Royal Chancery before the material was distributed. One copy was to go to his Majesty's Archives (Riksarkivet), and the other to the Royal Library. The motive for this provision stemmed not from a desire to preserve publications for posterity but from a desire to monitor their contents. This act gave the Royal Library the status of Sweden's National Library, which meant that its tasks came to include the preservation of all Swedish printed items as well as materials published abroad about or by Swedes. However, the library did not, in fact, become an independent civil service department until November 1877. Until that date, it remained a part of the King's Chancery. However, in spite of its name, the Royal Library was not the King's private library, although the royal families of the 17th century did not always make clear distinctions between their own property and that of the state. In a Royal Ordinance of 1713, it had been decided that the Royal Library should be open at certain times daily to those visitors who had authorization from the Chancery Offices. However, it was not possible to borrow books. It was not until 1863 that borrowing was permitted against a deposit. It was at this point that the Royal Library began to function like a public library.

When the doors of the Royal Library's brand new building in Humlegården were opened on January 2, 1878, the library was at last able to fulfill its role as the national library of Sweden.

THE LIBRARY AT THE ROYAL PALACE TRE KRONOR

Many items noted in the records and accounts of His Majesty's Archives would indicate that Gustav Vasa had

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begun to acquire books on history, science, and theology as well as musical prints and maps for the Royal Palace in the 1520s. His sons, Erik XIV, Johan III, and Karl IX, continued to expand the collection of books. In 1587, during the reign of Johan III, an 80-m-long corridor lined with open bookshelves, which was known as the ''Green Corridor,'' was set up in the attic of the Palace. Eight years later, we found Nicolaus Olai appointed to take charge of the King's books.

The monarchs of the Vasa dynasty generally bought their books from abroad, but they were not averse to removing volumes for their own personal use from the collections confiscated from Sweden's Roman Catholic monasteries during the Reformation. In 1620, Gustav II Adolf donated the collected remnants of the Swedish medieval monastery libraries to Uppsala University, thus laying the foundation of the library there.

During the following decades, books were to flood into Sweden as a result of war booty taken by the Swedes in the course of their campaigns on the continent. In response to a decree from on high, books and manuscripts in monasteries, cathedrals, and royal and private castles in the Baltic, Poland, Germany, Bohemia, Moravia, and Denmark were confiscated. They were transported to Sweden and incorporated into public collections, primarily Uppsala University Library and the Royal Library. In 1648, the Royal Library's most spectacular manuscript, the Devil's Bible, or Codex gigas dating from the 13th century, was removed from Prague. When the Swedes sent back reports from their campaigns, they often enclosed local news sheets or flyers. The acquisition of these rare items has given the Royal Library special standing in this field because it possesses the oldest records of European newsprint.

During the period 1611–1634, Johannes Bureus was entrusted with the care of the National Records Office and the King's library. He was then appointed Custodian of the National Monuments (Riksantikvarie). The fact that one person could hold all three posts gives an indication of the close administrative link among them within the walls of the Royal Palace. In 1634, Master Lars Fornelius was appointed to take care of ''Our library and that of the Crown, both the old and the new.'' The latter referred to the war booty, which was being kept at the Palace for Queen Kristina. Case upon case filled with books piled up in the Palace until, in 1650, the Queen summoned several foreign academics to serve as librarians. The Dutchman Isaac Vossius (1651–1652) made an inventory of the books by employing a system of shelf-markings on the spine of the books. His work makes it easy to identify volumes from the Queen's collection that are still to be found in the Royal Library today.

To house all the books, the Queen had several rooms put in order in the east wing of the Palace. However, even as she did this, she dispersed large sections of the library by making gifts of books to her favorites (e.g., to Magnus Gabriel de la Gardie) and to the grammar school libraries in Strängnäs and Västerås. (These were founded by Gustaf II Adolf to educate men for the civil service or the church.) In lieu of the wages he had not received and in place of payment for the sale of his father's library, Vossius took with him numerous books and manuscripts when he left Sweden. Many of these are to be found today in the University Library at Leiden. However, the finest treasures accompanied Kristina when she left Sweden for Rome in 1654. The bulk of them are now in the Vatican Library, where they form a special section.

The Royal Library received some compensation for these losses when Karl X Gustav brought war loot home from his campaigns in Poland and Denmark. However, after 1660, the library stocks stagnated, although there were some new acquisitions when Karl XI repossessed Crown Lands from the Swedish nobility. In 1683, Karl XI donated around 6000 books that had been part of Queen Kristina's collection to the Lund University Library. The greater part of De la Gardie's collection was donated to the Uppsala University Library. But the works in Swedish and the historical literature were transferred to the Antikvitetskollegiet (College of the Antiquities), which had been founded in 1666. In 1690, this was merged with the embryo institution that Johannes Bureus had created in the 1630s to form the Antikvitetsarkivet (Archives of the Antiquities).

The real catastrophe in the history of the Royal Library occurred on May 7, 1697. Just before 2 o'clock in the afternoon, a violent fire broke out in the west wing of the palace. It raged for a full day and night, destroying most of the older sections of the palace. No part of the Chancery wing or the Royal Library remained. The books had been carried in great haste down the Chancery staircase or thrown out of the fourth-floor windows down onto the banks below. Even today, visitors may come across singed and sooty covers—a reminder of the palace fire. In all, 17,386 books and 1103 manuscripts were lost. The inventory made after the fire lists 6826 books and 283 manuscripts, including the Devil's Bible, which, fortuitously, had survived. The remains were moved first to the home of Count Axel Lillie located on the current site of the Opera House. From 1702 to 1730, the collection was accommodated in the palace of the Bonde family and, from 1730 to 1768, in Per Brahe's home on Helgeandsholmen. But Count Pehr's mansion was in such a poor state that the floors threatened to cave in. Finally, in 1768, the Royal Library moved from this series of highly provisional homes into the northeast wing of the new Royal Palace, although the premises were not fully equipped until 1796.

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IN THE LIBRARY WING OF THE NEW ROYAL PALACE

While planning the rebuilding of the Royal Palace, the architect, Nicodemus Tessin the Younger, reserved space for the National Record Office in the north and lower northwest vault of the palace. But when the time came to discuss the exact location of the Royal Library, the situation had changed. Since the fire, the library had become an institution that was open to the public. Furthermore, plans were afoot to merge the Royal Library with the Antikvitetsarkivet (Archives of the Antiquities). In fact, a plan for this merger, presented by Carl Reinhold Berch, was actually approved by the Government in 1751 but was never implemented. This caused the man who was to become head of the Royal Library, Magnus von Celse, to publish Bibliotecae regiae Stockholmensis historia that same year. In this historical account, he mentions Johan Gabriel Sparfwenfeldt's gifts in 1705, which included the Codex aureus from 750 and various donations made during the period 1726–1741 from E. Carleson and C. F. von Höpken, which included some of the oldest Turkish books.

In 1796, the Royal Library could finally move into the hall that had been prepared by Carl Johan Cronstedt and Carl Fredrik Adelcrantz. However, the library was forced to share the premises with the Royal Museum (Kungl. museum), the Royal Academy of Letters, History, and Antiquities (Vitterhets-historie-och antikvitetsakademien), and the Swedish Academy (Svenska akademien). It soon got overcrowded.

GREATER EMPHASIS ON SWEDISH PRINTED WORKS

An official report from 1813 lays down the guidelines for the future operations of the Royal Library. According to this report, the Royal Library was to contain every published work concerned with knowledge of the fatherland, a comprehensive collection of Swedish literature, ''of which there should be a complete collection somewhere in the Realm, first and foremost in the National Library. Further, philological literature, works describing the history of learning and such rare and costly works that can only be acquired with great difficulty by individuals.''

During the 19th century, great pains were taken to fill the gaps in Swedish materials, in particular from earlier periods in history. In spite of the deposit obligation decreed in 1661, it was not until its return to the Royal Palace that the Royal Library was able to put force behind its warnings to printers. Foreign visitors, who in the main wished to study the medieval manuscripts, were appalled at the deplorable state of things at the Royal Library. There was virtually no reading space for the public and there were no offices for the staff. However, the confusion was considered to be justified because officials were so poorly paid that they were obliged to seek sources of income in other quarters.

During the time that A. I. Arwidsson and J. E. Rydqvist held the post of Chief Librarian (1843–1858 and 1858–1865, respectively), work began to separate the foreign and Swedish collections. Rydqvist laid the foundations of the separate Swedish department by removing all the Swedish works from the humanities section. In addition, he began to order the ephemeral literature (i.e., miscellaneous printed items and advertisements) according to a systematic plan. This work was to be continued by his successor, Gustaf E. Klemming (1865–1890).

After passing his civil service examination in Uppsala, Klemming had begun work at the Royal Library in 1844. He had been quick to procure Swedish literature privately. This was why, in 1856, he was able to hand over some 10,000 volumes to the Royal Library as a complement to the burgeoning department of Swedish literature. By 1860, he had such unique knowledge of the collections in the Royal Library that he was permitted to assume the post of Chief Librarian, when Rydqvist developed ague because of the cold library premises.

By this time, construction of the National Museum had started. Thus it was generally known that the Royal Museum's premises in the palace would be vacated. But it had also become increasingly evident that the Royal Library needed a new building of its own. Klemming's colleague, Harald Wieselgren, agreed. In 1864, he visited Paris and London. In the initial stages, he preferred the layout of the British Museum but later realized that something along the lines of the Bibliothèque St. Geneviève would offer better scope for expansion. A 29-year-old architect, F. Gustaf A. Dahl, was offered a scholarship to explore possibilities. He was to visit London and Paris and then draw up a proposal for a library building. In 1870, the Parliament charged Dahl with the task of planning and implementing this project.

THE MOVE TO HUMLEGÅRDEN

During the 1850s and 1860s, many new town plans for Stockholm had been drawn up. The town's population had doubled in the preceding 25 years and it had become necessary to clean up the slums of the city.

The staff of the library did not regard the construction of a new building with great enthusiasm. But Gustaf Dahl's practical attitude to his task came to permeate the entire project. In July 1871, the foundation stone was laid. The ensuing period of construction was dogged by a number of problems. In part, these were due to the harsh

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economic climate of the times, but also to the fact that Sweden was caught in the transition between the age of craftsmanship and the age of industrialization. At the outset, the builders had to import most materials from England (e.g., cast iron columns, beams, pipes, etc.). But by 1873–1874, some sections of the Swedish industry were beginning to catch up.

Following the example of the central stack at the Bibliothèque Nationale, Dahl used cast iron columns to distribute the weight of the stacks evenly throughout the building. These supported the beams of the stack, thereby relieving pressure on the external walls, which meant that the windows could be made larger. Dahl's plans for the windows almost came to nothing owing to manufacturing difficulties, but at the last minute, a Swedish company promised to deliver window frames in the lighter wrought iron that Dahl wanted for the building—an accomplishment that no other company in Sweden had been able to match until then.

In many respects, the Royal Library building represented an experiment for the Swedish engineering industry. When the building was completed in 1877, the opinion in foreign circles was that the library constituted an unusually functional building from a technical point of view. It had cost a total of SEK 960,000. At first, the reading room, the lending library, and the entrance hall were gas-lit. In 1887, electrical lighting was installed in five offices. In 1891, the gas pipes were replaced by electric lights. But the stacks were not fully electrified until 1964.

In 1873, Klemming had made the unpleasant discovery that they would not have sufficient room for acquisitions in the new building on Humlegården. As early as 1870, financial constraints had forced Dahl to reduce both the length and breadth of the building by one-sixth. The new building was planned to hold 200,000 volumes but the library had almost that number before the move had even started. In part, this was due to the acquisition of Karl XV's private library as well as some of Karl XIII's books from Rosersberg, some 30,000 books in all. Later, Klemming engaged in ''barter'' using duplicates from the Royal Library to acquire desirable books and manuscripts from various institutions, including institutions abroad. In connection with the move, the collections of Swedish and foreign literature were systematically divided up alongside the works of the manuscripts department.

THE ROYAL LIBRARY AS SWEDEN'S NATIONAL LIBRARY

In 1862, work had begun on a catalogue, written on loose catalogue sheets, each containing information on the title of a single volume. These sheets were compiled in a register of titles and subjects. Prior to this innovation, visitors searching for information had been forced to look up works in ledgers in which the books were numbered.

The other members of the library staff also felt a responsibility for the library's bibliographic records. Elof Tegnér, senior librarian, proposed the compilation of a joint catalogue of the foreign literature acquired for Sweden's public libraries (from 1886). This idea was implemented by Erik W. Dahlgren. Dahlgren became head of the Royal Library in 1903, an event that marked the beginning of a dynamic era. He had a long career behind him as recorder in the Swedish Parliament. Consequently, he had a network of valuable contacts that he was able to use for the benefit of the library. Among other things, Dahlgren was able to procure increased grants for the purchase of books and to pay staff. In 1910, he introduced a new instruction for the library. The same year, the title of ''Chief Librarian'' was changed to ''National Librarian'' (riksbibliotekarie).

On becoming head of the Royal Library, Dahlgren ordered a general inspection and inventory of the library to determine its size at the end of 1903. He was able to ascertain that the Royal Library collections with their 314,902 volumes and boxes were almost equal to those of the Uppsala University Library, which had 341,911 volumes. The Royal Library's department of Swedish literature was slightly larger, but Uppsala's collection of manuscripts was far superior. The strength of the Royal Library lays in such areas as bibliography; ecclesiastical history and the history of literature, geography, fine art, archaeology, political economy, and political science; and its general newspaper section. The two libraries were equal when it came to history, biography, law, fiction, and philosophy. According to Dahlgren's assessments, the library's unique collection of ephemeral literature amounted to almost 1 million items.

In 1878, the Royal Library had received the Rålamb collection, founded by President Gustaf Rålamb. It contained manuscripts (including Turkic ones) and 1630 books dating from before 1750. It was not until 1906 that the Royal Library succeeded in buying the first book ever printed in Sweden, the Dyalogus creaturarum moralizatus dating from 1483. This was finally purchased from Hildesheim. But Dahlgren was not as enthralled with Swedish printed publications as his predecessors had been. He considered it more important to procure foreign literature. For example, in 1916, the favorable exchange rate enabled him to obtain ''10,970 titles or a total of 154.82 meters of books mostly from Germany and Austria.'' In the course of just a few years, the Royal Library acquired the main body of Anglo-Saxon and Romance literature via agents in London, Paris, the Hague, and Leipzig.

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For the Royal Library, 1909 was ''a year of note in the sense that it ranks alongside 1878,'' according to Dahlgren. Appropriations from public funds were increased to SEK 131,500 and salaries were raised. However, staff were now obliged to work for 6 hr every day, something which had not previously been the case. Until now, it had been difficult to recruit men to the poorly paid posts that the library had to offer. This was almost certainly the reason why, in 1905, the management, with some hesitation, appointed the first woman—Valfrid Palmgren—to the post of junior civil servant. There were no misgivings when it came to employing women as assistants; in 1909, four ''ladies'' were engaged.

TWO NEW WINGS

A reconstruction of the Royal Library in 1912–1913 removed the most obvious inconveniences. But it fell to the lot of Dahlgren's successor, Isak Collijn (1916–1940) to find a radical solution to the problem of the premises. Collijn succeeded in winning the support of the Government and, in 1920, the architect, Axel Anderberg, put forward proposals for reconstruction and extensions.

This time, too, the plans were amended, reducing the building to two-thirds of its size according to the original plans. In the first phase, the large viewing room was rebuilt to include an entresol, thereby making room for the manuscripts department. Between 1926 and 1927, two wings were added to Dahl's building. In addition to more storage space, a research room and rooms for the maps and posters collection were added in the east wing. In his 1928 annual report, Collijn claimed that the extension had only helped to satisfy the most urgent needs for extra space and that a great deal more was required. In 1942, officials came close to initiating a reconstruction project. An appropriation was granted in the 1946–1947 budget but was not utilized until 10 years later.

As a researcher himself, Isak Collijn possessed an impressive knowledge of Swedish printed materials and older printed matter from abroad. Before becoming National Librarian, he had published catalogues of the Royal Library's incunabula (1914, with a supplement in 1940) and of the De la Gardie collection of town scenes (1915). His bibliographies of Swedish printed materials dating from before 1700 (1934–1946) represent his most significant achievement. Collijn also ensured that the catalogue rules proposed by Dahlgren were implemented. During his study trips abroad, he had become convinced that ''our cataloguing system is antiquated and changes are called for.'' The old alphabetical catalogue system written on some 600,000 sheets of papers was now transferred to a card system, which was put into practical use in 1928.

The acquisitions of the library from that time were very much influenced by ''der Reisebibliothekar,'' as Collijn was jestingly called. His international reputation facilitated contacts between the Royal Library and foreign institutions, and made it easier to set up exchange schemes. However, he did not take the opportunity to intensify cooperation with the University College of Stockholm in the 1920s, and for that reason, he did not have access to doctors' dissertations that he might have been able to use for exchange purposes.

However, the most important of all acquisitions was the large deposit of Strindberg manuscripts received from the Nordic Museum in 1922. Because August Strindberg had served at the Royal Library as a junior civil servant from 1874 to 1882, it might have been natural for his literary remains to have gone to the library upon his death in 1912. But at the time, E. W. Dahlgren did not consider that there was a place for contemporary literature in a scientific library. His successor came to hold a different view of the matter.

During the war years and the early postwar period, the library stagnated owing to parsimoniousness on the part of the government. But in 1950, a shift in attitudes could be discerned. This was when Nils Afzelius became head of the manuscripts department, an event that came to influence the character of new acquisitions—the Mårbacka Foundation immediately deposited the manuscripts of Selma Lagerlöf with the Royal Library.

1952—THE BEGINNING OF A NEW ERA

When Uno Willers took over as National Librarian in November 1952, this marked the beginning of a period of vigorous development for the library.

An agreement with the Stockholm University College and University in December 1953 laid down the guidelines for the development of the Royal Library into ''a university library for the humanities and the social sciences.'' This agreement gave the Royal Library access to a considerable number of the university's dissertations, which could be used for exchange purposes. Thus, the Royal Library gained a privilege long enjoyed by the university libraries—Lund had been in this fortunate position since 1818.

Most important to Willers, however, was the reorganization of the Royal Library and he worked to ensure that the library would get more space. In the 1953 annual report, he described the situation when he took office: ''the overcrowded conditions of the 75-year-old library, where only 25 per cent of the building has been expanded, have now reached the point where certain of the library's functions have been rendered totally unproductive, at the

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same time as the building itself is in a marked state of neglect.''

The creation of the Bibliographical Institute in 1953 made it more urgent to restructure the Royal Library's catalogues. In 1956, new rules were laid down for the library's cataloguing routines and storage in the shelving system in the stacks. The following decades saw further restructuring as a result of the introduction of computerized systems in connection with the introduction of LIBRIS (the LIBRary Information System). Responsibility for the introduction of the new system devolved upon Sune Lindqvist (for more about LIBRIS, see discussion below).

In 1958, work on a central catalogue of Swedish printed materials commenced, as the Royal Library had been charged with the new task of providing the university libraries with catalogue cards free of charge, a service that was also offered to other libraries on special terms. In 1975, when this work was transferred to a computerized system, the central catalogue ceased to exist in its original form. The acquisitions catalogue was modernized in 1956, but it was remodelled once again in 1972, adapted this time to the LIBRIS project. (It was finally discontinued in 1993.)

In 1958, the foundations of the gramophone records and tape recordings department were laid. The model for this ''national archive of sounds'' was la Phonothèque Nationale in Paris, an independent department under the French National Library. In 1979, the Swedish collection was transferred to the newly established National Archive of Recorded Sound and Moving Image (Arkivet för Ljud och Bild).

However, the most pressing concern for Willers was the question of overcrowding at the Royal Library. As an investment grant of SEK 590,000 from the 1946–1947 fiscal year remained untouched, the first stage in a reconstruction project could commence in 1956. The work was led by the architect, Carl Hampus Bergman. In the last stage, which was completed between 1968 and 1971, three underground stacks were built adjacent to the library's north wall. An enclosed glass corridor connected the lift shaft to the main building.

Some miles northwest of Stockholm, in Bålsta, the government's library depot, designed by the architect, Leif Olsson, was erected. This depot was the product of the efforts of a joint committee of the Stockholm libraries, which commenced operations in 1949. Another similar venture also initiated by the committee was the library-on-wheels service, which began to circulate between libraries in 1953. Other libraries also use the Bålsta depot. Although it was extended in 1975 and again in 1986, there will not be sufficient space in the long term to meet all needs.

CHANGES IN THE 1970s

Soon after Bergman's reconstruction project was completed, the question of space at the library was raised once again. Visitors, loans, and acquisitions were quite simply increasing at a faster rate than originally projected. The Royal Library receives over 150,000 pieces of printed material annually, which is equivalent to 1000 m of shelf space per year. The first contacts with the National Board of Public Building (Byggnadsstyrelsen) were made in 1975–1976, but it was not until 1987 that the work of planning really began in earnest. The architect, Jan Henriksson, was drawn into the work at this early stage. The spirit of the 1950s and 1960s had changed. Now the ideal was to adhere as far as possible to the intentions of Gustaf Dahl. In the meantime, the Royal Library's facade, reading room, and entrance had been listed by the Central Board of National Antiquities (Riksantikvarieämbetet).

But the Royal Library was also in a position to give away material. Thus, in 1975, the Heimskringla fragment dating from around 1250 was donated to the new Stofnun Àrna Magnússonar in Reykjavik. The Japanese library that A. E. Nordenskiöld had brought home with him from the ''Vega Expedition'' was given to the Royal Library.

One of Willers' ambitions was to live up to and surpass the expansive vigour shown by his grandfather, E. W. Dahlgren, at the beginning of the century. To his delight, the status of the National Librarian was consolidated as the supervising authority for, inter alia, the diocese and rural libraries. This made it possible to incorporate the Strängnäs diocese and grammar school library with the Royal Library. The collection was moved into the newly renovated Roggeborgen in 1968 and given a new name—the Rogge Library.

However, at the Stockholm University, staff wished to see a clear delineation of responsibility between the Royal Library and the library at Frescati. In 1975, it was decided that the cooperation between staff members should be discontinued as of July 1, 1977. In fact, the matter had been the subject of a special inquiry, carried out by the special coordinating committee on libraries and documentation known in Swedish as BIDOK (Biblioteks-och dokumentationssamverkanskommittén), which was set up in September 1975. As a member of this committee, Willers played an active role in submitting opinions on the future status of the Royal Library as a central body for the provision of information. His efforts bore little fruit, however. In 1979, the Swedish Delegation for Scientific and Technical Information (Delegationen för vetenskaplig och teknisk informationsförsörjning, DFI) was established as an independent authority and the Council for Research Libraries was incorporated into the new organization.

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When Willers retired in November 1977, it was clear that the Royal Library would assume responsibility for the administration of the LIBRIS system. Furthermore, the Royal Library would be headed by a governing board whose members would be appointed by the government. According to the new statutes that came into effect on July 1, 1979, the National Librarian is appointed for a period of 6 years. The Royal Library's new organization was introduced gradually during the autumn of 1981. The library was divided into three departments—one each for administration, the library, and the bibliography—under the purview of the board and the National Librarian. These departments were subdivided into a number of sections.

FROM 1977 TO 1996

As mentioned above, the government had chosen to set up a special planning and coordinating body for scientific information parallel to the operations of the Royal Library. This meant that the Royal Library had lost a vital component in its central role in the library community. Contacts between the two authorities called for considerable mutual respect in a situation that was not always so easy to handle. The question of LIBRIS was to become particularly disruptive, as the Royal Library was responsible for administration and maintenance and the Delegation for the continued development of the system. Towards the end of the 1980s, the government realized that the situation was impracticable and, in 1987, it appointed yet another commission of inquiry to review the management situation in the Swedish library system. Initially, Lars Tynell (National Librarian, 1977–1988) followed the work of the commission as a passive observer, but in the winter of 1987–1988, he took the initiative and succeeded in bringing about a complete reversal of opinion. One result of this change of heart was that Royal Library both assumed full responsibility for the increasingly important LIBRIS system and also took over the planning and coordination duties of the Delegation. These changes came into effect in the summer of 1988. Certain funds were granted to the Royal Library for development purposes. These changes meant that the Royal Library became the main driving force for the provision of information in Sweden, a development that, in all probability, has benefited the entire library community because leadership has become clearer and administration has become simpler. Thus, Uno Willer's ambition to create an effective and powerful Royal Library came to be fulfilled by his successor, Lars Tynell.

The need for changes in the internal organization of the library became increasingly evident after 1980. The emerging information technology society made new demands on the national library as the nation's memory and a guarantor for long-term preservation of published materials regardless of medium. Computer technology is generally very well suited to most of a library's internal routines and public services, and the gradual introduction of computerized operations meant that the 1981 organization was soon out-of-date.

However, during the decade that Lars Tynell served as National Librarian, efforts focused on plans and preparations for the reconstruction and extension of the library building. Unfortunately, a project to erect a parallel wing along the north side of the building in Humlegården had to be shelved at the last minute and this delayed the entire process. Tynell's successor, Birgit Antonsson (National Librarian, 1988–1994), was able to learn from Tynell's experiences when she finally managed to get the library reconstruction project moving in the summer of 1993, a project that was eagerly awaited by staff and visitors alike.

As mentioned earlier, the Royal Library had ceased to function as the university library for Stockholm University when responsibility for the provision of books was transferred to the university in 1977. An era lasting 25 years in which the Royal Library had a double role—as national library for the entire country and as a humanities and social sciences resource for the University of Stockholm—had come to an end. In practice, it meant that the library no longer purchased foreign literature in political and social science but instead was able to focus on the acquisition of foreign material in the humanities, a policy that is still pursued today.

When the Royal Library relinquished its role as university library, it was able to devote more energy to its primary area (i.e., to Swedish printed materials) and this ambition manifested itself in many ways. In the 1981 organization, a new section was created to handle Swedish ephemera (i.e., the vast number of printed items that are delivered to the library without being processed or analyzed in the same detailed way as books). This section handles several different categories of valuable materials that are in great demand (e.g., posters).

In 1983, the government granted special funds to the library to transfer the entire contents of Swedish daily newspapers to microfilm. This was of special importance with respect to daily newspapers produced around the turn of the century—these were printed on such poor-quality paper that it will not be possible to preserve them in their original form. A special unit performs this task. Owing to overcrowding at the library and the rebuilding project, this unit has been housed in separate premises in the northern part of the City Centre since it was established. Daily papers are microfilmed immediately

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upon issue. The project of retrospective microfilming is still in progress (2000).

With regard to descriptions and the analysis of new Swedish books—the so-called national bibliography—an agreement was made at the beginning of the 1990s with publishers (represented by their wholesale dealer) concerning closer cooperation and rapid voluntary delivery of new Swedish books. This has resulted in a very up-to-date national bibliography presented both in the LIBRIS database and in conventional hardcopy publications. The latter will probably cease to exist by 2001.

As electronic publishing became more established in Sweden in the 1990s—primarily in the form of such media as CD-ROMs—the question of the long-awaited modernization of the Swedish Legal Deposit Act was raised once again. Unfortunately, the amended legislation approved by the Parliament in 1994 has all too soon proved to be inadequate for the task. The Commission of Inquiry failed to deal with the rapidly expanding, dynamic development of online electronic publishing, something that was quite understandable at the time. Developments in recent years, however, show that it is impossible to ignore this type of publication if we want to secure as complete a version as possible of our Swedish heritage for future generations. A new Legal Deposit Act was presented to the government in 1998, but due to different circumstances (most important being that Sweden now is a part of the European Union), so far nothing has been decided upon. In the mean time, since 1996, the library has been collecting the Swedish part of the Internet. This project, called Kulturarw3, has been very much observed both in the country and outside, and functions as a model for similar projects in different parts of the world. This project means that the library harvests the Swedish pages of the WWW twice a year. Up to today (2000), more than 40 million URLs are hosted in our computers.

A very generous grant from the Bank of Sweden Tercentenary Foundation (Riksbankens Jubileumsfond) enabled the Royal Library to bring to a conclusion the 10-year project making the Swedish national bibliography truly comprehensive in historical terms. This project was completed in the 1980s. Until then, there had not been any complete or reliable account of publications in Sweden for the period 1700–1829. But this has been remedied and the material is now available in a special, easily accessed database. Thus, Swedish printed materials from the 15th century up to the present day are now satisfactorily documented.

Since the 1980s, the Royal Library has become increasingly involved in projects designed to develop and modernize libraries in Eastern Europe and in the Third World. Special projects have been carried out and are still in progress to support libraries in Nicaragua, Guatemala, Honduras, El Salvador, and in the Baltic states Estonia, Latvia, and Lithuania.

The organizational changes mentioned above making LIBRIS an independent department and creating the Secretariat for planning and coordination were prepared and implemented in the spring of 1988 by Lars Tynell and his deputy, Bo-Ingemar Darlin (Deputy National Librarian, 1987–1995). The changes were brought to their conclusion by Birgit Antonsson with the recruitment and staffing of the two sections.

The primary goal of the Royal Library's Department of National Coordination and Development (Sekretariatet för nationell samordning och utveckling, BIBSAM) is to ensure that the resources of the Swedish research libraries are used and developed in an optimal way, and that individual users have access on reasonable terms. However, it should be emphasized that cooperation is entirely voluntary.

At the outset, the most important task was probably that of developing and administering the special national resource system. According to this scheme, a number of central research libraries assume national responsibility for the provision of information in particular subject areas to the research, development, and higher-education communities in return for a certain remuneration. This system is the department's largest individual item of expenditure, accounting for half of the annual budget.

The duties of the department include conducting inquiries, participating in and financing development projects (including the preparation of standards), arranging courses and conferences, collecting and processing statistics, and monitoring legislative matters.

The digitization of information and communications systems has turned many concepts upside down. The aim is to give the user immediate access to a worldwide ''virtual'' library. Both publishing patterns and the role of the librarian are changing. As is the case at other libraries, the department devotes a great deal of energy to charting and analyzing the development of our modern information society, and acting and reacting on the basis of its findings. In the future, work will have to be based more on the needs of those seeking information than on the needs of the libraries.

In recent years, international perspectives have become more prominent. To an increasing degree, national borders are losing their significance for library and information policies.

At the national level, the department has taken initiatives to increase collaboration between archives, libraries, and museums, as well as between research institutions and public libraries. The basic idea is that the barriers between closely related information-intensive sectors can be eliminated with the help of modern technology.

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For a long time, the national bibliographic system LIBRIS had two principals—the Royal Library with responsibility for running and administering the system, and the Delegation with responsibility for development. This arrangement, which did not function satisfactorily, was changed in 1988, when the Royal Library assumed responsibility for the entire LIBRIS system, whereupon the LIBRIS Secretariat formed its own department.

In its role as a nationwide system, LIBRIS encountered a number of initial setbacks in the form of sluggish technology and higher running costs to users than expected. However, from the mid-1980s onward, LIBRIS' status as a national catalogue was strengthened. In the last 10 years, the database has expanded and currently contains 6 million items with transaction volumes that have doubled many times over. Today (2000), the volume of a certain day can extend to 120,000 inquiries. This is a remarkable achievement in view of the fact that Swedish research libraries purchased their own local library systems at the same time. However, the rapid development of personal computers has facilitated interplay between local and central databases.

In 1996, 73 research libraries registered their acquisitions in the LIBRIS database. All of them registered the material first in the LIBRIS database before transferring the information to their local systems. At the same time, 720 customers had signed agreements, giving them access to the LIBRIS base for information retrieval.

Over a 15-year period, the LIBRIS system was charged with an increasing number of tasks, a fact that strengthened its position. Searching by subject was introduced in the middle of the 1980s, but was replaced by a better system at the beginning of the 1990s. An advanced routine for interlibrary loans with automatic ordering has proven to be a national success story, and generates a constant stream of new customers. At the same time, LIBRIS' connection to SUNET, the Swedish universities' computer network, and the subsequent connection to the Internet meant that a larger number of services were made accessible to users.

In the mid-1990s, LIBRIS faced sweeping changes. Its role as a comprehensive nationwide system has been emphasized by the government, which has granted additional funds for both a total modernization of the system's technical specifications and free use of the Internet to the public. This will give LIBRIS a more flexible, open, computer-based environment and a simpler user interface.

During the 1990s, the government has grown to regard the Royal Library as a strategic resource for pursuing a more consistent library policy. Not only have officials and politicians considered library matters in relation to research and higher education, they have also tried to put them in a wider perspective. Thus, the resources of the Royal Library have been used in a progressive way. This approach has made it necessary to once again adapt the organization to the tasks with which the Royal Library is entrusted. In 1995, the acting National Librarian, Folke Sandgren (1994–1995), began a review of the organization completed by his successor, Tomas Lidman (National Librarian, 1995–present).

When the library building was reinaugurated in May 1997, the Royal Library stepped into a new era. Having secured sufficient space for visitors, staff, and its collections at least for the foreseeable future, the Royal Library in the last 3 years has focused its energies to exciting outreach projects that have not been considered feasible before. Mentioned above are the projects that deal with the new information technology, collecting, preserving, and making electronic information available, digitizing the material and creating a virtual library, and modernizing the information system, LIBRIS. But there are also other ambitious projects going on (BIBSAM).

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INTRODUCTION

Polish libraries have followed the same general pattern of historical development as Western European libraries. The history of libraries in Central Eastern Europe may be divided into the following periods: the Middle Ages (8th–15th centuries); Renaissance and Reformation (16th century to the beginning of the 17th century); Counter-Reformation (17th century to the beginning of the 18th century); the Enlightenment (the second half of the 18th century); 19th and early 20th (until 1918) centuries; the interwar period; World War II; the postwar period (Socialist/Communist era 1945–1989); and the post-Communist era (since 1989–1991).

In the specific case of Poland, we may also note the partition period (1795–1918), during which Poland was divided into three parts dominated by Germany, Russia, and the Austro-Hungarian Empire. This essay provides an overview of developments in Polish libraries during all these periods.

THE MIDDLE AGES

In 966, Poland was Christianized and many missionaries and religious orders came to spread Christianity among its inhabitants. The scriptoria and libraries were organized by the Catholic religious orders, including the Eremites, Benedictines, Cistercians, Dominicans, and Franciscans, among others. The first collections of books were brought with them, a majority of which were works needed for celebrating or teaching the Christian faith. As they became familiar with the Polish language, they were able to record documents in the Slavic vernacular language, as well as in Latin. Thus the Benedictine monks of the Holy Cross monastery on Łysa Góra (Bald Mountain, southern Poland) created the Polish vernacular *Ancient Holy Cross Annals* [*Rocznik Świętokrzyski*] in the middle of the 12th century, and the *Holy Cross Sermons* [*Kazania Świętokrzyskie*] in the 14th century. Cistercians in the monastery of Henryków compiled an important source document, *Henryków Volume* [*Księga Henrykowska*] in 1269. These documents constitute important sources in the history of Polish language.

Church libraries were divided into three types—capitular, collegiate, and parochial—becoming important centers of Polish culture and education. The largest among them were the Cathedral Library in Gniezno (Biblioteka Kapitulna) and the Cathedral Library in Kraków (Biblioteka Kapitulna), both established in the 11th century. Church libraries were also repositories of administrative documents relating to church activities.

The ruling dynasty of Poland, the Piasts, was actively engaged in the development of literary culture in medieval Poland. Many of the Princes and feudal elite were well educated and organized their own book collections, including the last king of the Piast dynasty, Kazimierz III (1310–1370). Queen Jadwiga, consort of Władysław II Jagiełło, King of Poland (ca. 1374–1399), collected many religious and secular books, including meditations and prayers of Saints Bernard and Ambrose, Polish versions of *St. Brigid's Revelations*, the *Legenda aurea* [*Golden legend*] of Jacobus de Voragine, and so on. It is assumed that *Psałterz Floriański* [*St. Florian Psalter*], one of the oldest manuscripts in the Polish language, was used by the Queen. Other notable owners of private libraries included the Polish historian and chronicler, Jan Długosz (1415–1480); Jan of Dąbrówka (ca. 1400–1472); Prof. Jan Isner (ca. 1345–1411); the lawyer, Paweł Włodkowic (ca. 1370–ca. 1435); and the Bishop of Kraków and Chancellor, Zbigniew Oleśnicki (1389–1455).

On May 12, 1364, the Jagiellonian University (Uniwersytet Jagiellonski) and the Jagiellonian Library were founded by Kazimierz III, King of Poland. The university was first known as Cracow University (Uniwersytet Krakowski), and from the 15th century until 1780 as the Cracow Academy (Akademia Krakowska). The university declined under the reign of Louis I (1326–1382), King of Hungary and Poland. In 1400, Władysław II Jagiełło (1350 or 1351–1434), King of Poland, using the personal property of his late wife, Queen Jadwiga, refounded the university and introduced wide-ranging organizational reforms. As the university developed, separate libraries in various colleges and dormitories appeared. The largest was the library of the Collegium Maius of the theology and humanities departments, which became the main library of the university. In 1429, a statute of the library was enacted, instituting positions for two honorary

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curators, elected from among professors authorized to lend books from the collection. After the fire of 1492, the Collegium Maius was rebuilt, and some rooms were designated for the collections.

RENAISSANCE AND REFORMATION

At the end of the 15th century and during the 16th century, Poland was influenced by the humanistic trends of the Renaissance emanating from Italy. Poland made significant economic advances in the mining and metallurgical industries, expanded exports of agricultural products, and increased commerce and crafts. Economic advancements resulted in increase in wealth and social changes. The Polish state became far more organized with a functioning administrative and legal system. Civil rights, including religious tolerance, became legally protected. All these promoted the development of science, art, and literature.

Polish intellectual and cultural life was influenced by the Italian Renaissance through personal contacts of students and scholars. The invention of printing increased the availability of books and helped spread new ideas. Many professors, scholars, and other professionals assembled large book collections according to their interests. The more notable collections were acquired by Erazm Ciołek (1474–1522), Bishop of Płock and diplomat, whose library included illuminated manuscript codices; Jan Łaski (1456–1531), Chancellor and Primate; Piotr Tomicki (1464–1535), vice Chancellor and diplomat, who collected Greek and Hebrew philology; Jan Dantyszek (1485–1548), poet and diplomat; and Samuel Maciejowski (1499–1550), Bishop of Kraków and Chancellor. Significant collections were also owned by secular dignitaries, such as Krzysztof Szydłowiecki (1467–1532), Chancellor; Piotr Kmita (1467–1532), Voivode of Kraków Province; Jan Tarnowski (1488–1561), hetman; and Jan Zamoyski (1542–1605), hetman, founder of the Zamoyski Academy in 1594. His library supported instruction at the academy and included books on Polish and Roman laws, Polish chronicles, and classical literature.

Polish kings and their families also assembled large libraries. The library of Sigismund II Augustus, King of Poland (1520–1572), was the most outstanding, including over 4000 volumes supervised by special curators, including the writer, Łukasz Górnicki (1527–1603). The collection was comparable to other European court libraries of the period, and contained law treatises, books on history, theology, classical literature, and religion. The books were bound in brown leather bearing the royal exlibris. The collection was dispersed after his death. This tradition of collecting was continued by Sigismund III, King of Poland and Sweden (1566–1632), who established an extensive library on law, history, theology, and natural sciences at the King's Castle in Warsaw. The books were bound in parchment or red-stained leather, with the bookplate of the Vasa dynasty.

The important role in this period was played by school libraries at all levels. The 16th century also witnessed the evolution of religious schools organized by Calvinists, Socinians, Arians, Lutherans, and other Protestant sects. The most famous was the library of the Church of the Polish Brothers in Raków (Zbór Braci Polskich w Rakowie). In the second half of the 16th century, the Jesuits began their activities in Poland, making use of libraries and education as a means of countering anti-Catholic teachings propagated in other institutions. The Jesuit libraries contained theological literature, mainly of a polemical character, as well as scientific literature in the fields of philology and historiography. They established a college in Vilnius in 1570, which became the Wilno Academy (Akademia Wileńska) in 1578. The college library received part of the library of King Sigismund II Augustus after his death.

Books became an important part of the educational process in schools of all levels. Collecting and reading books were essential for many professionals and educated people of this period. The best example of importance of books and libraries is the Jagiellonian Library. The library received many notable book donations from professors, students, and bibliophiles throughout the 15th and 16th centuries. The library has been renowned for its collections and has been visited by prominent personalities.

COUNTER-REFORMATION

The 17th century in Poland was a period of intellectual and cultural decline. The Jesuits headed a strong nationalist and antireformation movement. At the same time, Poland found itself in wars against Sweden, the Russian Empire, and the Ottoman Empire. It also had to deal with internal revolts by Cossacks and Polish peasants. Poland was economically devastated.

During the wars, particularly with Sweden from 1621 to 1660, Polish libraries were severely looted. The state, royal, and church libraries and archives were systematically destroyed by the Swedish armies. Large collections of books and manuscripts were taken to Sweden to enrich libraries there. The university library in Uppsala, for example, received over 20,000 valuable books confiscated from Poland. The library of the astronomer, Nicolaus Copernicus (1473–1543), housed in Frombork, was among those taken to Sweden. Many other books and collections were simply destroyed during the fighting.

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After the Polish–Swedish war, Jan II Kazimierz, King of Poland (1609–1672), began to rebuild his looted library. His collection included about 350 volumes in 1668. After his abdication, the King took part of his library to France; the rest was dispersed into other collections. Another Polish King, John III Sobieski (1629–1696), assembled a valuable collection of books, including some recovered from Swedish libraries after 1682. His library comprised over 7000 volumes in science, history, and law, bound in dark red, with a royal bookplate. The library was housed in the beautiful Wilanów Palace near Warsaw.

Individual private libraries were not as common as in the previous century. Wealthy magnates continued to build their family libraries. The Radziwiłł, Leszczyński, Zółkiewski, Tarnowski, and Lubomirski families, among others, continued their bibliophile activities. Their libraries reflected more practical than intellectual interests, with collections of foreign books in fine bindings, richly illustrated and decorated with their own bookplates.

More specialized libraries were assembled by renowned scientists. These were collected by the astronomer, Johannes Hevelius (1611–1687); mathematician and Prof. Jan Brożek (1585–1652); and naturalist and physician, Joannes Jonstonus (1603–1675). Hieronim Pinocci (1613–1676) of Kraków, the King's secretary, collected an interesting library of 1700 contemporary scientific books. Adrian Engelcke (d. 1661) of Gdańsk owned an unusually large collection of 15,000 volumes.

The rapid development of school and college libraries came to a stop during the devastation of the Polish–Swedish war. The beginning of the 17th century witnessed a vast expansion of reformist as well as Catholic schools, including those of the Piarist order. After the wars, in the second half of the 17th century, school libraries acquired primarily textbooks, polemical literature, and religious writings of Polish origins, reflecting a lowering of their educational level and scope.

ENLIGHTENMENT

In the middle of the 18th century, French rationalism became the dominant influence on Polish culture. An improved economic situation, reforms in agriculture, and the development of manufacturing and banking fostered political reforms and social activism. A new democratic constitution was adopted in 1791. The first ministry of education in Europe, the National Education Committee (Komitet Edukacji Narodowej), was established in 1773. The first Polish public library was also founded in Warsaw in 1774.

The Zaluski Library (Biblioteka Załuskich) was established in Warsaw in 1747 by two brothers, Andrzej Stanisław Załuski (1696–1958) and Józef Andrzej Załuski (1702–1774). In 1774, after Józef's death, the library was taken over by the state, becoming the public library. In 1780, the library was granted the right to receive a legal deposit copy of books printed in Poland. The library held almost 400,000 items, including 11,000 manuscripts and 24,500 drawings at the time of its dissolution in 1795. The collections were arranged by language, subject, and size. In addition to books in foreign languages, the library succeeded in collecting an almost complete output of Polish literature, becoming a center of scientific and intellectual activities in Warsaw.

The success of the Załuski family in organizing the Zaluski Library encouraged other families to restore and enhance their own libraries. The library of Stanisław II August, King of Poland (1732–1798), influenced the collecting habits of other members of the aristocracy. The royal library accumulated about 15,000 volumes and a separate collection of 596 magnificent albums containing about 30,000 drawings and engravings. The library was housed in the Royal Castle in Warsaw and there was a reference collection of over 2000 volumes in Łazienki Palace. The Royal Cabinet of Prints and the Archivum de Varsovie constituted a valuable collection of prints and manuscripts, respectively. The library was open to a large number of privileged readers, many prominent Polish historians, and authors.

Other important family libraries included the Radziwiłł Library in Nieśwież with about 20,000 volumes in 1772, the Czartoryski Library in Puławy, and those of the Czacki, Potocki, and Jabłonowski families. The libraries of this period comprised works of the classical authors, modern French literature, philosophy, law, history, and natural sciences. In addition to book collections, there were also collections of coins, drawings, geological and natural objects, paintings, and so on.

The important role played by school libraries in the 18th century was the collection of textbooks and didactic materials. Stanisław Konarski (1700–1773), an educational reformer, founded the Collegium Nobilium in Warsaw with a modern educational library. In 1767, King Stanisław II August established a military school in Warsaw, the School of Knights (Szkoła Rycerska), with a library containing about 10,000 volumes of military literature mostly in French and German.

Two important developments marked the second half of the 18th century in Poland. The Jesuit order, which played a dominant role in Catholic education, was dissolved in 1773. The National Education Committee, led by prominent Polish educational reformer, Hugo Kołłątaj (1750–1812), was organized in 1773 and assumed administrative control of all school libraries in Poland. It also administered former religious libraries of the defunct Jesuit order. The reforms introduced by the

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committee at the Jagiellonian University became a model for the entire educational system in Poland. Basically, all university libraries at the Crown Main School (Szkoła Główna Koronna, now the Jagiellonian University) were consolidated and the collections of religious libraries were incorporated into one central library, that of the Collegium Maius. Another university library was organized in Lwów (L'viv, in Ukraine) in 1785.

During this period, professionals and intellectuals organized their own small collections needed for their specialized work. Professional organizations (e.g., guild of merchants in Warsaw) also began organizing their own libraries to provide their members with current literature.

PERIOD OF PARTITIONS (1795–1918) AND FOREIGN DOMINATION

After the partitions of Poland (1772, 1793, and 1795), Russia, Prussia, and the Austro-Hungarian Empire incorporated Polish territories into their respective countries. Poland lost its independence for 125 years. The primary task of Polish society became the preservation and advancement of Polish national consciousness and culture. Despite tremendous losses during unsuccessful national upheavals such as the November Uprising (Powstanie Listopadowe) in 1830–1831 and the January Uprising (Powstanie Styczniowe) in 1863–1864, as well as other revolutionary events sweeping all of Europe, Polish society and libraries persevered. They had to try to preserve Polish heritage within the limits imposed by the administrations put in place by various foreign governments.

Private collections either continued their collecting traditions, or were organized into foundations that made their holdings available to a wider readership. Such a library was formed by Stanisław Zamoyski (1775–1856), as the Zamoyski Library (Biblioteka Ordynacji Zamojskiej), in Warsaw during the years 1811–1815. The library included parts of the library of the Zamoyski Academy, his family library from Podzamcze, and his private collection. The Krasiński Library (Biblioteka Ordynacji Krasińskich) was organized by Wincenty Krasiński (1782–1858) in Warsaw in 1844. The library was based on the collection of Tomasz Czapski (1711–1784), a wealthy bibliophile. In 1861–1863, a collection of a prominent bibliophile, Konstanty Świdziński (1793–1855), was added to the library's holdings. It was declared a public institution in 1861, accessible to researchers. During the years 1868–1915, it published a selection of source materials in the *Biblioteka Ordynacji Krasińskich*. The Ossoliński National Institute (Zakład Narodowy im. Ossolińskich) was organized by Józef Maksymilian Ossoliński (1748–1826) in Lwów in 1817. The library—based on his private collection of rare manuscripts, prints, and medals—soon became an important scholarly center. In 1827, it held 25,402 volumes, 708 manuscripts, 133 maps, 551 medals, 1445 prints, and 962 paintings. The Institute established its own publishing house in 1833. The Raczyński Library (Biblioteka Raczyńskich) was organized by Edward Raczyński (1786–1845) in Poznań in 1829 (Fig. 1). It was a public library that concentrated on the collection of books in the sciences, and handbooks. After his death, the library was administered by Germans, who emphasized the collection of German literature. The foundation libraries benefited greatly from private gifts and donations throughout the 18th century.

Private libraries played an important role in the preservation of Polish culture. The most significant libraries belonged to the Czartoryski family, organized by Prince Adam Kazimierz Czartoryski (1770–1861) and his wife, Izabella (1746–1835). In 1830, this library held 7000 volumes and 3000 manuscripts. After the November Uprising of 1831, the library was liquidated by the Russian authorities. Parts of the collections were rescued by other family members, and Prince Władysław Czartoryski reopened the library for researchers in Kraków in 1875. It held 24,000 volumes and 10,000 manuscripts of historical significance. The Lubomirski family owned a library in Przeworsk. At the end of the 18th century, the library held about 2000 volumes. It was inherited by Henryk Lubomirski (1777–1850), curator of the Ossolineum Institute. Its holdings were increased to 13,000 volumes during the 19th century. Eventually, the library became part of the Ossolineum. The Pawlikowski family organized its library in Baden near Vienna in 1830. The bibliophile, Gwalbert Pawlikowski (1792–1852), assembled a valuable collection of 19,000 volumes of Polonica

Fig. 1 Color lithograph of the Raczyński Library by Julius Minutoli, from 1833.

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and 6000 volumes of foreign language books. The collection included manuscripts, drawings, and prints. In 1848–1849, it was transferred to Lwów, and in 1914, it was incorporated into the Ossolineum. Between 1812 and 1830, the Dzieduszycki family organized a collection in Poturzyca in Eastern Poland. Józef Kalasanty Dzieduszycki (1772–1847) collected works on Polish history and literature, including manuscripts. His son, Włodzimierz (1825–1899), organized the Museum of Natural History (Muzeum im. Dzieduszyckich) in Lwów and brought the library to the museum in 1857. The library had expanded its holdings to approximately 50,000 volumes when it was transferred to the Ossolineum in 1938. Other important collections were assembled by the Branicki, Potocki, and Tarnowski families.

In this century, scientific societies were organized by researchers with personal libraries holding scholarly materials. The first library of this kind was organized in Warsaw by the Society of Friends of Science (Towarzystwo Przyjaciół Nauk) in 1803. In 1811, the library was opened to the general public and, by 1833, held over 30,000 volumes. After the November Uprising, the society was closed and, in 1833, it was liquidated by the Russian authorities. Foreign language materials were taken to St. Petersburg, whereas Polish language materials were transferred to the Warsaw University Library (WUL). In 1821, the Scientific Society of Płock was founded. Its collection of about 8000 volumes was also dispersed after the November Uprising. In 1898, most of the collection was transferred to the library of the Academy of Sciences in St. Petersburg. Other scientific societies were also organized in Kraków (1856), Poznań (1857), Toruń (1878), Wilno (1907, present Vilnius), and Przemyśl (1909).

There were four university libraries operating in Poland in the 19th century. In 1809, The Jagiellonian Library held 2943 manuscripts, 29,994 books and pamphlets, and 2273 numismatics. Professor of Slavic languages and historian, Jerzy Samuel Bandtkie (1768–1835), served as director from 1811 to 1835. His successors were Professor of bibliography, Józef Muczkowski (1795–1858), from 1835 until 1868; the noted Polish bibliographer, Karol Józef Teofil Estreicher (1827–1908), from 1868 until 1905; and Professor of history, Fryderyk Papée (1856–1940), from 1905 until 1926. In 1905, the library held 274,465 books, 6440 manuscripts, 2192 maps, 9673 prints, and 4693 musical scores. The University Library of Lwów held 51,000 volumes before fire destroyed all but 13,000 volumes in 1849. The library underwent renovations and was rebuilt, and by 1905, it held over 120,000 volumes. The Library of the Imperial University of Wilno (Biblioteka Cesarskiego Uniwersytetu Wileńskiego) was organized in 1803 and dissolved in 1832 after the November Uprising, with over 60,000 volumes dispersed among libraries throughout the Russian Empire. The Library of the Royal Warsaw University (Biblioteka Królewskiego Uniwersytetu Warszawskiego) was founded in 1817. The first director of the library was the well-known linguist, Samuel Bogumił Linde (1771–1847). His deputies included one of the foremost Polish historians, Joachim Lelewel (1786–1861). Until 1831, the WUL actively built collections, acquiring holdings from other libraries such as the Warsaw Lyceum (Liceum Warszawskie), including the collection of the School of Knighthood; the library of the prominent Polish poet, Ignacy Krasicki (1735–1801); the Bishop of Warmia; the Appeals Court Library (Biblioteka przy Sądzie Apelacyjnym), founded by Feliks Łubieński (1758–1848), Minister of Justice; the Law School (Szkoła Prawa i Administracji); the Medical School (Szkoła Lekarska); and collections of many defunct monasteries and collegiate churches. In 1818, the library acquired a collection of prints and drawings assembled by Stanisław II August Poniatowski (1732–1798), King of Poland (known as the Royal Print Room). Between 1818 and 1821, it received a collection of prints and drawings belonging to the writer, politician, and art collector, Stanisław Kostka Potocki (1755–1821). These two collections formed the Print Room (Gabinet Rycin). In 1819, the library was granted the right to receive an obligatory, legal deposit copy of any publication issued in the Kingdom of Poland. After the failure of the November Uprising, the library was closed down and reorganized. At that time, the library held 134,067 books, including 6000 incunabula, about 2000 manuscripts, and 102,501 items in the Print Room. The Russian authorities confiscated and moved to St. Petersburg foreign language publications, and the Print Room. Only 40,000 Polish language books and 303 manuscripts were left in Warsaw. In 1834, the library was renamed the State Library (Biblioteka Rządowa), and again in 1840 as the Main Library of Warsaw's Educational District (Biblioteka Główna Okręgu Naukowego Warszawskiego). In 1862, the library was renamed as the Main Library of the Main School (Biblioteka Główna Szkoły Głównej), with over 95,000 books. One of the deputy directors of the new library was the noted Polish bibliographer, Karol Józef Teofil Estreicher (1827–1908). The library acquired a valuable collection of over 22,000 volumes of books from the library of Ignacy Turkułł, Minister of Affairs of the Polish Kingdom. By the end of 1860s, the library held 161,628 books, 5008 volumes of serials, 1878 maps, 742 manuscripts, and 10,412 items in its numismatic collection. After the failure of the January Uprising of 1863–1864 (Powstanie styczniowe), the Russian authorities closed down the Main School and created the Imperial University of Warsaw (Cesarski Uniwersytet Warszawski). In 1871, the Main Library of the Main

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School was reorganized and renamed as the Imperial University Library (Cesarska Biblioteka Uniwersytecka). During the years 1871–1915, the library became the largest university library in the Russian Empire. The library held 480,934 books, 90,753 volumes of serials, 1384 manuscripts, and 10,926 other library items such as maps, prints, and scores. During that time, the library acquired collections of Arkadii Andreevich Tolochanov (a Russian administrative official) containing 15,362 books, including 3800 volumes of serials, and the Warsaw Branch of the State Bank [formerly the Polish Bank (Bank Polski)] of 11,626 books, including 6251 volumes of serials, 12 incunabula, and 228 16th-century rare books. In 1894, a new building for the growing Imperial University Library was opened. In 1915, during the German occupation of Warsaw, the Imperial University of Warsaw was relocated to Rostov-na-Donu in Russia, along with its manuscripts, incunabula, library catalogs, and archives.

The second half of the 19th century and the beginning of the 20th century brought the development of educational and popular libraries available to the population at large. In 1861, the Department of Reading Rooms of the Warsaw Philanthropic Society (Wydział Czytelń Warszawskiego Towarzystwa Dobroczynności) organized the first admission-free reading room for the public. The society organized several such rooms by the end of the 19th century. During the same year, the People's Library of Cieszyn (Czytelnia Ludowa w Cieszynie) was organized. Later on, similar activities were undertaken throughout the partitioned lands of Poland by the Society for People's Education (Towarzystwo Oświaty Ludowej), the Society for People's Reading Rooms (Towarzystwo Czytelni Ludowych), the Polish Motherland (Macierz Polska), the Society for National Schools (Towarzystwo Szkoły Ludowej), the Polish Motherland for Schools (Polska Macierz Szkolna), the Reading Rooms Society of Warsaw (Towarzystwo Czytelń m. Warszawa), and others. After the revolution of 1905 in Russia, anti-Polish laws were liberalized. The process of Russification undertaken in the second half of the 19th century and in Russian-controlled parts of Poland, known since 1815 as the Kingdom of Poland (Królestwo Polskie), was relaxed.

During this period, many Poles were forced to leave Poland. After the failure of the November Uprising, so many Poles emigrated to avoid repression that the term ''the Great Polish Emigration'' has been used in Polish historiography to describe these events. The failure of the January Uprising also resulted in the forced emigration of many. Members of these emigrations continued their patriotic and nationalistic activities abroad through political and cultural organizations. Libraries were also established in emigration.

The Polish Library (Biblioteka Polska) was founded in Paris in 1838. The board of the library was led by Prince Adam Jerzy Czartoryski (1770–1861) and included, among others, General Karol Kniaziewicz (1762–1842), author Julian Ursyn Niemcewicz (1758–1841), and publisher Karol Sienkiewicz (1793–1860), who served as the first director of the library until 1853. All Polish societies in Paris consolidated their collections in the Polish Library and, in December 1838, the collection numbered 2085 volumes. In 1856, the library also began publishing activities. In 1866, the library received official status as a public institution, which entitled it to receive state funding. In early 1870s, the library held 37,981 volumes of books and 6701 ephemera. In 1873, the Polska Akademia Umiejętności (Polish Academy of Sciences and Letters) was organized in Kraków, Poland. In 1891, the Polish Library joined the Polish Academy of Sciences and Letters as its branch in Paris. In 1899, the son of the prominent Polish poet Adam Mickiewicz (1798–1855), Władysław (1838–1926), became director of the library. He subsequently donated his father's and his own collection of books and papers and, in 1901, the Museum of Adam Mickiewicz

Fig. 2 Castle in Kórnik where the library is located.

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(Muzeum imienia Adama Mickiewicza) was organized as part of the library. The Polish School Library (Biblioteka Polskiej Szkoły) was established in Paris in 1843. It contained many materials on the history of Polish emigration, including the collection of the historian, Joachim Lelewel (1786–1861). As a result of the withdrawal of state support, the library was closed and moved to Kórnik in Poland in 1874 (Fig. 2). It held over 21,000 volumes, 5000 prints, about 2000 maps, and many manuscripts. In 1869, Władysław Broel-Plater (1808–1889) formed the National Polish Museum (Muzeum Narodowe Polskie) in Rapperswil, Switzerland. In 1871, the library of the museum was founded. It included materials pertaining to the November Uprising emigration. At the end of the 19th century, the library accumulated the largest collection of Polish books abroad, with 100,000 volumes, 25,000 ephemera (including leaflets), 3100 maps and atlases, 13,000 prints, 9100 photographs, and 2800 musical scores. It also held valuable archives relating to the Great Emigration, the National Government of the January Uprising, and so on.

THE INDEPENDENCE (1918–1939)

In 1918, after the World War I, Poland regained its independence. The partitioned lands were again united in one state. Even during the war, Poles attempted to organize national institutions, including libraries. The German authorities granted permission to establish a Polish university. In 1917, the WUL (Biblioteka Uniwersytetu Warszawskiego) was granted the right to receive an obligatory, legal deposit copy of any publication published on Polish territory under German occupation. The Polish government subsequently reaffirmed this right in 1919 and again in 1927. In 1919, the art historian, Zygmunt Batowski (1876–1944), became the first director of the WUL. As a consequence of the Treaty of Rīga in 1921 ending the Russo-Polish War of 1919–1920, in 1923, the Soviet Union returned collections of manuscripts and the Print Room to the WUL. By 1939, it held 820,000 books and serials, over 100,000 prints, and about 4000 manuscripts.

The National Library of Poland (Biblioteka Narodowa) was officially established on February 24, 1928 by the Decree of the President of the Polish Republic, Ignacy Mościcki (1867–1946). Its stated mission was that the library should acquire and preserve the intellectual output of the Polish nation, foreign literature concerning the Polish nation, and foreign literature indispensable for the continued development of Polish culture. On May 10, 1927, the National Library was granted the right to receive an obligatory, legal deposit free copy of any publication published in Poland. Its first director became the eminent bibliophile, historian of literature, and librarian, Stefan Demby (1862–1939). The Treaty of Rīga also led to the repatriation of the collections of the Załuski Library and the Society of Friends of Science to the National Library. The National Library also acquired the collections of Polish émigré libraries, including the National Polish Museum in Rapperswil, Switzerland, and the Library of the Polish School at Batignolles in Paris. The Polish Library in Paris donated 20,000 volumes of its duplicates. Other important interwar acquisitions were the 40,000 volumes, 19,000 plates, and 700 manuscripts of the Wilanów Library (Biblioteka Wilanowska) presented to the Polish Republic by its last owner, Adam Branicki; the library of Seweryn Smolikowski, editor of *Wielka Encyklopedia Ilustrowana* [*The Great Illustrated Encyclopedia*]; and the Horyniecki Library [Biblioteka Horyniecka] of the Poniński princes, each containing about 30,000 volumes. On the eve of World War II, the collections of the National Library numbered over 700,000 items, including 82,000 rare books, 28,000 scores, 72,000 prints, 11,000 maps, and 24,000 manuscripts. The library became the national bibliographic agency through the Bibliographic Institute (Instytut Bibliograficzny) established in 1928. The institute published the current national bibliography under the title, *Official List of Printed Works* (*Urzędowy Wykaz Druków*), from 1928 until 1939. The library established international exchanges of publication in 1931.

During the years 1927–1947, the Jagiellonian Library continued to modernize and expand under the directorship of the historian, Edward Kuntze (1880–1950). The library completed a new building in 1939, and moved its collections to this state-of-the-art building a year later.

The library of the Lwów University resumed its activities after War World I. It greatly enhanced its collections through acquisitions and donations, and it held 420,000 volumes, including 1300 manuscripts, 3000 incunabula, and additional 14,000 items in a numismatic collection by 1939.

Three university libraries were organized in Poznań, Wilno, and Lublin. The Poznań University Library (Biblioteka Uniwersytetu Poznańskiego) was established in 1919, including the collection of the former Kaiser Wilhelm Bibliothek. The major challenge for this library was to include Polish research publications in its collections. By 1939, it held 500,000 volumes. The University Library in Wilno was organized in 1919 and, by 1939, held about 657,000 volumes. The Library of the Catholic University of Lublin (Biblioteka Katolickiego Uniwersytetu Lubelskiego) was established in 1918, focusing on collecting publications in theology and the humanities. The library received some collections returned from the Soviet Union. The Library of the Polish Academy of Sciences and Letters (Biblioteka Polskiej Akademii Umiejętności) continued its activities in

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Kraków. By 1939, the library held 196,000 volumes and 2074 manuscripts.

Other specialized libraries were organized together with technical, economic, and agricultural colleges. Technical libraries included the Central Library of the Academy of Engineering (Centralna Biblioteka Wyższej Szkoły Inżynierskiej) in Lwów, the Library of the Warsaw Academy of Engineering (Biblioteka Waszawskiej Szkoły Inżynierskiej), and the Library of the Mining and Metallurgical Academy (Biblioteka Akademii Górniczo-Hutniczej) in Kraków. The economics libraries included the Library of the Main School of Planning and Statistics (Biblioteka Szkoły Głównej Planowania i Statystyki) in Warsaw. The agricultural libraries included the Library of the Main School of Farming (Biblioteka Głównej Szkoły Rolniczej) in Warsaw.

Numerous governmental libraries were founded during these years. Among these were the Central Pedagogical Library (Centalna Biblioteka Pedagogiczna) belonging to the Ministry of Religious Creeds and Public Enlightenment (Ministerstwo Wyznań Religijnych i Oświecenia Publicznego), the Library of the Central Statistical Office (Biblioteka Głównego Urzędu Statystycznego), the Central Military Library (Centralna Biblioteka Wojskowa), and the Parliament Library (Biblioteka Sejmowa).

Public libraries were organized by the local governments and social organizations such as the Polish School Society. In 1938, there were 8982 public libraries in Poland, including 884 run by local governments. A large number of public libraries were organized for minorities with books in other languages, including over 1200 Ukrainian libraries, 662 Jewish libraries, 140 German libraries, 55 Lithuanian libraries, and so on.

During this period, issues of the organization of professional librarianship were raised. In 1917, the Association of Polish Librarians (Związek Bibliotekarzy Polskich) was established. The organization organized educational programs and conferences where problems facing librarians were discussed. Librarianship was not yet recognized as a profession at that time, and no formal educational program was established.

The independent Polish Republic existed for only two decades, during which time a sweeping economic and social transformation of the formerly divided nation was undertaken. Despite these fundamental challenges, its achievements in the areas of education and cultural development were substantial.

WORLD WAR II (1939–1945)

Poland suffered tremendous losses during the war and Nazi occupation. Its economy, population, and cultural assets were devastated. The Nazis desired to exterminate not only the population, but also its culture as well. As a result, over 66% of Polish book holdings as they existed in 1939 were destroyed by war's end. Losses were even higher in Warsaw, which was systematically destroyed by Nazis after the failure of the Warsaw Uprising of 1944. Collections were burnt during the siege of Warsaw in 1939. Eighty percent of the National Library's holdings were destroyed. Some of the more valuable manuscripts and rare books were removed by the Nazis and taken to Germany during the war.

THE SOCIALIST/COMMUNIST ERA 1945–1989

Poland emerged from World War II as a state increasingly controlled by the Communist Party, directed by the Soviet Union, which introduced Soviet-style economic and social systems. The Yalta and Potsdam Conferences in 1945 established a new political situation in Europe. Poland lost vast territories in the East to the Soviet Union (parts of present-day Lithuania, Belarus, and Ukraine), and received former Prussian and German lands to the West as reparations. This involved massive population repatriation and the organization of new institutions. During 1944–1946, land reforms were carried out, in which large estates were parceled up among peasants and farmer workers. In 1946, all privately owned industrial enterprises were nationalized. In 1947, cooperative enterprises, private trading, and retail companies were dissolved. Central planning was introduced with the Three-Year Reconstruction Plan of 1947–1949. By 1948, the Communist Party of Poland became the dominant political force and the Stalinization of the Polish political system had begun. In the years following the death of Soviet leader, Joseph Stalin, in 1953 and as subsequent consequence of the political ''thaw'' in the Soviet Union itself, Poland experienced workers' revolts, and a more liberal version of communism was introduced. After the student revolts of 1968 and worker unrest in 1970, the Communist Party adopted a still more open economic policy towards the West. Further economic decline and foreign debt triggered more worker unrest in 1976, leading to the beginning of organized, independent, democratic opposition to the communist regime. Workers' strikes in 1980 and the organization of an independent labor union, NSZZ ''Solidarność,'' initiated an unprecedented period of democracy until the imposition of Martial Law, which began on December 13, 1981 and continued through 1987.

After the war, education was reformed into a universal and free system, and all private schools were abolished. Forty-six colleges and universities were opened in the

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years 1945–1946, including newly organized universities in Lublin, Łódź, Toruń, and Wrocław; the academies of engineering in Gdańsk, Gliwice, Łódź, and Wrocław; and the colleges of engineering in Poznań, Szczecin, and Warsaw (Fig. 3).

Libraries were also reorganized to be free and accessible to general public systems of public, school, and research collections. In 1946, the first ''Decree on Libraries and the Custody of Library Collections'' was approved by the Council of Ministers. The libraries were divided into public libraries supported by the state or other public organizations, societal libraries, private collections open to the public, and home libraries. Control over the national library network of public, school, and research libraries was delegated to the Ministry of Education. An advisory body, the State Library Council (Państwowa Rada Biblioteczna), was established. This system existed until 1950. To facilitate and control the distribution of books to the public libraries, the Book Disseminating Committee (Komitet Upowszechniania Książki) and the Central Storage of Books (Centralna Zbiornica Książek) were established in 1948. The training of professional librarians was introduced at that time. The State Center for Educating Librarians (Państwowy Ośrodek Kształcenia Bibliotekarzy) was established in Jarocin near Poznań. The first courses in library science were organized in the University of Łódź by the prominent Polish librarian, Jan Muszkowski (1882–1953), in 1945. During the years 1946–1949, the State Book Institute (Państwowy Instytut Książki), under the directorship of Adam Łysakowski (1895–1952), conducted research in library science, bibliography, and reading. After its dissolution, research was continued at the National Library. During the years 1950–1951, control of libraries was divided among three ministries: the Ministry of Education assumed control of school and pedagogical libraries, the Ministry of Higher Education assumed control of research libraries, and the Ministry of Culture and Art assumed control of the National Library and all public libraries. In 1952, the Polish Academy of Sciences (Polska Akademia Nauk) was established to coordinate research activities in Poland, and assumed control of the Library of the Polish Academy of Sciences and Letters and other research libraries. In 1953, the Center for Scientific Bibliography and Information (Ośrodek Bibliografii i Dokumentacji Naukowej) was organized within the academy, coordinating the bibliographic and documentation work of its departments.

Fig. 3 Main reading room of the University Library of Toruń (new library).

Industrialization created the need for control of and information about the scientific and technical research all over the world. For this purpose, the Center for Scientific and Technical Documentation (Centrum Dokumentacji Naukowo-Technicznej) was established in 1950, renamed as the Center for Scientific, Technical, and Economic Information (Centrum Informacji Naukowej, Technicznej i Ekonomicznej) in 1961. The center developed its own system of documentation centers throughout industrial enterprises. In time, these evolved into specialized scientific and technical information centers.

In 1968, the Polish Parliament issued the Statute on Libraries, regulating the library system in Poland. This new act upheld the decree from 1946, formulating a national library network, and specified particular ministries responsible for various libraries. In general, research libraries reported to the Ministry of Science, Higher Education, and Technology, and the Polish Academy of Sciences, among others. School and educational libraries reported to the Ministry of Education. Public libraries, art school libraries, and the National Library reported to the Ministry of Culture and Art. Labor union libraries reported to their central unions, and so on.

In 1985, there were 225 large research libraries in Poland. Research collections in Poland have been built through a policy of legal deposit by publishers to designated libraries. Two deposit copies are received by the National Library; the Jagiellonian Library; the university libraries in Lublin, Łódź, Toruń, Warsaw, and Wrocław; the Silesian Library (Biblioteka Śląska) in Katowice; the Public Library in Warsaw; the Public Library in Szczecin; and 17 libraries of administrative regions (Biblioteki Wojewódzkie). In 1977, another administrative initiative, the National Library Resources (Narodowy Zasób Biblioteczny), was launched. The National Library, the Jagiellonian Library, and the Ossoliński Institute were to cooperatively collect comprehensively the output of Polish publishing in Poland and abroad. In 1979, an intergovernmental decree established a system of specialization among 18 central Polish libraries, dividing the

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collecting and technical processing responsibilities. Libraries were charged with the task of organizing local library networks and information services.

After World War II, the National Library (http://www.bn.org.pl) became a central depository library for other collections that needed to be rebuilt, and distributed many collections to other libraries in Poland. Two valuable collections remained in the National Library, the Krasiński Library with 95,000 volumes and the Zamoyski Library with over 3000 manuscripts and old imprints. The National Library has built its collections through a combination of legal deposit, acquisition and exchange programs, and donations from private individuals and public institutions. The National Library has continued its role as the national bibliographic agency through the Bibliographic Institute (Instytut Bibliograficzny). In 1955, the Books and Readers Institute (Instytut Książki i Czytelnictwa) was established. The National Library became a national center for international information systems, including coordination of ISSN and ISBN numbering in Poland, and is a center for the preservation and conservation of printed materials. The National Library actively participates in international library programs and organizations, including the Council of Europe. Its printing house sponsors publications by the National Library and other organizations. Automation of catalogs began in the late 1960s and today, the National Library provides access to its databases via an Internet interface. Similarly after the war, the WUL (http://www.buw.uw.edu.pl) immediately resumed operations, and began rebuilding its collections and facilities. Thousands of books taken to Germany during the World War II were returned to the WUL in the immediate postwar period, including many from the University Library and its system of specialized departmental libraries. The collections of the WUL have retained their humanistic profile and, since 1979, it has been designated as the first Central Library of Social Sciences (I Centralna Biblioteka Nauk Społecznych) in Poland, with responsibilities for collecting research materials in the following fields: history, philosophy, education, law, psychology, sociology, political science, and methodology of science. The WUL began automation in the late 1970s and, in the 1990s, received support from the Mellon Foundation to purchase an automated library system, as well as the funding for the creation of a national union catalog for Poland.

The Jagiellonian Library (http://www.bj.uj.edu.pl) continued after the war in relatively good condition. The library expanded its facilities in the early 1960s and built a new state-of-the-art building in 2000. The Jagiellonian Library constitutes a second national library, collecting books and periodicals about Poland, including publications issued in Poland before 1800 and after 1945. Since 1979, the Jagiellonian Library has been designated as the second Central Library of Social Sciences (II Centralna Biblioteka Nauk Społecznych), with responsibility for collecting research materials in culture, linguistics, history, and the theory of literature, arts, and religious studies. The library began automation in the late 1970s, and, in the 1990s, it, too, received financial support from the Mellon Foundation. The University Library in Wrocław (the Biblioteka Uniwersytetu Wrocławskiego; http://www.bu.uni.wroc.pl) was established along with the university in 1945, in place of the former German university and library, taking over the remainder of its predecessor, as well as the former public library of Breslau (Stadtbibliothek) and many nationalized private, family, and monastic collections in the Silesian region. As a result of this process, the library became the largest collection of rare books in Poland. In the 1990s, it also received financial support from the Mellon Foundation, enabling it to automate its operations (Fig. 4).

Libraries of the Polish Academy of Sciences constitute a network of independent research libraries, the largest of which is the National Ossolinski Institute (Zakład Narodowy im. Ossolińskich; http://www.oss.wroc.pl), which transferred to Wrocław from Lwów (present L'viv in Ukraine) after the war. However, only part of its original collections came to Wrocław.

Other academy libraries are located in Gdańsk, Kórnik, Kraków, and Warsaw, and there are scientific society's libraries in many Polish cities. In addition to 10 university libraries, there were also 20 higher technical school libraries in Poland.

In 1985, the system of 9899 public libraries was divided into regional (wojewódzkie), city, and community (gminne) networks. Some of them, located in large cities such as Warsaw, Poznań, Kraków, Toruń, Łódź, and Lublin, were also classified as research collections. There

Fig. 4 Building of the University Library of Wrocław that holds special collections.

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were 19,868 school libraries located in primary, secondary, and vocational schools. A large network of 3736 trade union libraries was dispersed through most commercial enterprises and trade union headquarters. A separate network consisted of special and scientific libraries such as the Main Medical Library (Główna Biblioteka Lekarska; http://www.gbl.waw.pl), founded in Warsaw in 1945; the Central Agricultural Library (Centralna Biblioteka Rolnicza; http://www.cbr.edu.pl), founded in Warsaw in 1955; the Main Communication Library (Główna Biblioteka Komunikacyjna; http://www.bg.pw.edu.pl/Pl-asc/gbk.html), founded in Warsaw in 1919; the Central Statistical Library (Centralna Biblioteka Statystyczna; http://statlibr.stat.gov.pl), founded in Warsaw in 1918; the Central Military Library (Centralna Biblioteka Wojskowa; http://www.cbw.pl), founded in Warsaw in 1919; and the Parliamentary Library (Biblioteka Sejmowa; http://bs.sejm.gov.pl:4001/ALEPH), founded in Warsaw in 1920.

The education of professional librarians was reorganized during these years. In addition to library science studies at the University of Łódź, the Universities of Warsaw (since 1951), Wrocław (since 1956), and Poznań (since 1967) have offered library science education. Since 1975–1976, 14 additional Graduate Library Schools have been established, eight at universities and six at Teacher Training Colleges (Wyższe Szkoły Pedagogiczne). Professional librarians organized the Association of Polish Librarians (Stowarzyszenie Bibliotekarzy Polskich; http://ebib.oss.wroc.pl/sbp) in 1954.

POST-COMMUNIST ERA (1989–PRESENT)

Political repression during the late 1980s failed to prevent the demise of communism. In 1989, the communists and the democratic opposition concluded the Round Table Agreement guaranteeing a peaceful transition to a democratic system. In 1990, the first democratic elections to the Parliament (Sejm) took place. In 1999, Poland became a member of a political–military defense organization, the North Atlantic Treaty Organization (NATO). On December 13, 2002, Poland was invited to join the European Union, a political–economic organization of European countries. Beginning in the early 1980s, Polish libraries have faced significant financial difficulties and budgetary constraints. Many special libraries sponsored by state enterprises and labor unions were closed after 1989. However, research and public libraries have received foreign aid and grants for collection development and automation. It is expected that Poland will continue to benefit from financial aid supplied by the European Economic Union.

The educational system has undergone dramatic changes since 1989. Private education was restored, and a number of private high schools and postgraduate schools (especially in economics and commerce) have been organized. Many colleges and teachers colleges were reorganized into regional or private universities. Important university departments in areas such as law have become semi-independent from the universities. All these changes have resulted in difficulties in organizing new libraries, or adjusting existing institutions to the new reality. For example, the National Library in Warsaw has, in fact, become the university library for a number of newly organized schools lacking their own information resources. The rising cost of books and serials has also strained older collections in their efforts to keep up with current specialized literature.

In 1995, there were 12 universities, 30 polytechnic schools, 9 agricultural academies, 39 economic academies, 13 teacher training schools, 11 medical academies, 6 sport and physical education academies, 19 fine arts academies, and 8 theological academies. In 1994, there were libraries: 9558 public libraries, 353 educational libraries, 1591 industrial and commercial libraries, 1311 libraries in research institutes, and over 20,000 school libraries. Among the 1285 research libraries in 1993, in addition to the National Library, there were 109 libraries of the Polish Academy of Sciences, 1027 university and academy libraries, and 9 public research libraries.

In 1989, freedom of associations was restored in Poland, and librarians organized new professional organizations such as the Polish Bibliological Association (Polskie Towarzystwo Bibliologiczne; http://www.miks.uj.edu.pl/ptb/index.htm), founded in 1989; the Polish Association of Scientific Information (Polskie Towarzystwo Informacji Naukowej; http://uranos.cto.us.edu.pl/~ptin), founded in 1992; and the Polish Reader's Association (Polskie Towarzystwo Czytelnicze), founded in 1991. The government also organized the State Committee for Scientific Research (Komitet Badań Naukowych; http://www.kbn.gov.pl) in 1991 to coordinate policy in the areas of science and technology. Polish librarians have also organized their own informal forums on the Internet. The most important is the Electronic Library EBIB (Elektroniczna biblioteka EBIB; http://ebib.oss.wroc.pl/index.php), which includes an electronic journal (*Elektroniczny Biuletyn EBIB*), selection of important documents, links, and so on. There are two e-mail discussion lists among Polish research librarians: INFOBIB-L and AIBIBL. The Association of Polish Librarians also runs its own e-mail discussion list.

CONCLUSION

The history of Polish libraries suggests that they have developed along the lines of their counterparts. Despite

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tremendous losses inflicted upon Polish libraries by the Nazis and post-World War II territorial realignment, they were rebuilt. Introduction of communism to Poland after the war further disrupted the development of modern Polish libraries. For much of its history, Poland has experienced economic and social development similar to those encountered in Western Europe. It is obvious that the Polish state and society will continue to be a part of European and modern civilization for the foreseeable future. Polish libraries as well will continue to be a part of an integrated European library system in the future.

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Public Libraries, Public Access Computing, and the Bill & Melinda Gates Foundation

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INTRODUCTION

This article describes how the emergence of new information technology resulted in disparities between those with access to computers and the Internet and those without, and how public libraries in the United States play a critical role in giving all residents access to the latest information at no charge. Public libraries were supported in this effort through a combination of funding sources, including: federal state and local governments, foundations, businesses, and individuals. By 2001, this has resulted in 96% of public libraries in the United States offering Internet access.[1] A Pew Internet & American Life survey revealed that Americans most frequently identify libraries as a public location to access the Internet (Fig. 1).[2]

THE ''DIGITAL DIVIDE''

The diffusion of the Internet and information technologies into the homes and everyday lives of people in the United States in the 1990s was heralded with both optimism and caution. Access to the technology provided opportunities that were previously nonexistent, including the ability to improve one's education, employment, community knowledge, and more. Technology quickly became an indispensable resource in tasks from finding employment to performing academic research to buying a house. In addition, local governments, banks, schools, and businesses began migrating crucial services to the Internet. New opportunities such as these, enabled by information technology, emerged and multiplied at an accelerated pace.

These opportunities, however, bypassed large segments of the population that lacked either access to the new tools or the skills necessary to benefit from them. By the mid 1990s, the discrepancy between those with access to the benefits of information technology and those without solidified into a policy debate that centered on the concept of a ''digital divide,'' a term popularized by a series of reports from the National Telecommunications and Information Administration (NTIA).[3]

Concern about a digital divide stemmed from a belief by many that lack of access to information technology—and lack of relevant skills—may aggravate existing socioeconomic disparities or, to the dismay of many technology proponents, create new disparities. Studies such as those conducted by the NTIA suggested that access to computers and the Internet was largely determined by economic, demographic, and geographic conditions (Fig. 2). The ''digital divide'' implied a burdensome gulf in which those with the greatest needs would be at the greatest disadvantage if barriers to access were not removed.

It was in this atmosphere of enthusiasm for information technology, tempered by the realism concerning its potential negative impacts, that Bill and Melinda Gates decided to engage their philanthropic interests. The idea of providing equity of opportunity, a theme central to all of their philanthropic activities, was a guiding principle as they attempted to remove barriers to accessing information technology. Their goal was to ensure that everyone has the opportunity to access the Internet and the emerging world of digital information. To this end, the foundation has helped develop public access computing services in the United States and throughout the world.

PUBLIC ACCESS COMPUTING AND PUBLIC LIBRARIES

The question of how to effectively remove barriers to access sparked numerous policy debates. NTIA's 1995 report documented a discrepancy in access to computers and the Internet in the United States. The Telecommunications Act of 1996 acknowledged the emerging importance of the Internet as a communications tool. This act updated the 1934 definition of universal service (which was related to telephone service) to include Internet access, and enabled the Federal Communications Commission to develop a program, the E-rate, by which schools, libraries and other targeted organizations would receive discounts on many of the costs associated with providing Internet access. The E-rate program reflected what many policy makers had come to understand: that the expansion of computing services that are accessible to the public at no charge carried great potential to reduce inequities caused by new technologies.

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Fig. 1 The main library of the Stark County (Ohio) Library District has computers in the children's services department as well as a designated computer lab for adults and computers in the teen services department. (*View this art in color at www.dekker.com.*)

In 1997, the Benton Foundation and Libraries for the Future published ''Local Places, Global Connections,'' a report that explored the theoretical underpinning of using public libraries as public access computing locations. This publication, along with others, highlighted the unique role of public libraries in the United States as 1) open and accessible to all residents, 2) community institutions with a history and tradition of offering lifelong educational opportunities at no or low cost, and 3) structured to provide services to 97% of the geography of the country.

In the mid-1990s, many libraries were transforming themselves by introducing Internet access in their buildings. In 1996, 44% of public library systems had Internet access.[4] However, the actual percentage of buildings was most likely lower, as the research was not able to disaggregate individual buildings from library systems. Systems could be composed of multiple buildings, and even if one building had Internet access out of a system of 20 buildings, for example, the entire system would be counted as providing Internet access. Therefore far fewer library buildings had computer and Internet access. Public access to the Internet was even more rare. Only 28% of library systems, most often in urban areas, offered direct patron access to the Internet.[4]

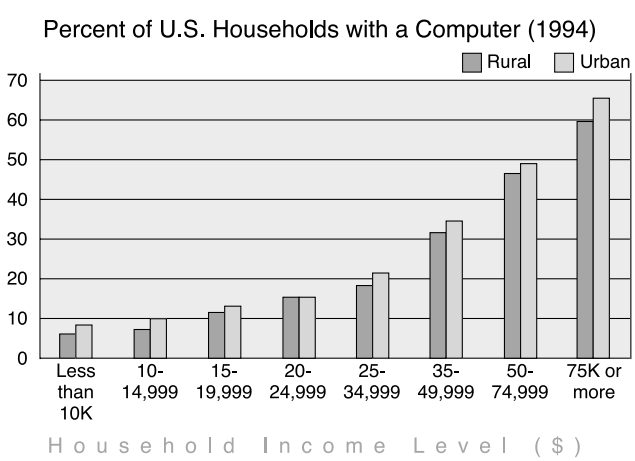

Fig. 2 Source: Falling Through the Net, 1995, National Telecommunications and Information Administration, http://www.ntia.doc.gov/ntiahome/fallingthru.html.

Fig. 3 Public libraries in many communities offer interactive educational software for school children. (*View this art in color at www.dekker.com.*)

Libraries did not offer Internet access because of several factors. Most often, libraries were concerned about the costs of computer hardware and software, telecommunications equipment, and Internet access. Many library staff members also expressed concern over their lack of in-house technical skills, training opportunities, and limited staff resources to assume a new library service.

THE U.S. LIBRARY PROGRAM

In June 1997, Bill and Melinda Gates formed the Gates Library Foundation, later changed to the Bill & Melinda Gates Foundation, with a cash contribution of $200 million to support the expansion of public access computing in public libraries in all 50 states. The main goal of the Gates Library Foundation was to support libraries that serve low-income communities. The foundation provided public libraries with the computer hardware, software, and networking capabilities required for access to the Internet, as well as technical support and training for library personnel (Fig. 4). The foundation's vision was, ''If you could reach a public library, you could reach the Internet.''

Before the end of the year, the foundation installed the first computers and conducted the first staff training in Alabama public libraries. Over the next six years, the foundation would work its way through all 50 states and

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U.S. Library Program
Key Statistics

Number of computers: 48,870

Number of public library buildings reached: 10,860

Number of library staff and volunteers trained:
Approximately 62,000

Fig. 4 U.S. Library Program Key Statistics.

territories, beginning with the poorest communities in the most impoverished states (Fig. 5).

Principles

Need: The program targeted libraries serving low-income communities, where the need was the greatest and the fewest people had computers and Internet access at home. Eligible libraries had to be situated in communities with at least 10% of its residents living below the 1990 U.S. Census poverty level. Libraries that did not meet this requirement were given the opportunity to gain eligibility based on special situations, such as targeted outreach to people lacking access to information technology and/or significant changes in the demographic make-up of the community since the census collected its data.

Partnerships: Funding was designed to build partnerships between the grant recipient and the foundation, the local community, and others within the library community. For example, some public libraries formed partnerships with their local economic development agency to provide computer training in return for financial support. Other public libraries partnered with local nonprofit and volunteer agencies. The agencies provided volunteers and expertise, and the library provided computer space for the agency.

Leveraging: Funding was intended to serve as a catalyst for others, such as government agencies, businesses, foundations, and individuals, to support the public library and help it provide broad public access to information technologies.

Sustainability: Built into all foundation programs was an emphasis on long-term financial sustainability of local public access programs. The partnerships and leveraged funds developed as a result of the grant programs were intended to create a support structure enabling the continuation of public access computing without recurring financial support from the foundation.

Components

Computer hardware/software: Each library was granted funding to buy one to six computers. The number of computers was determined by population needs. Grantees could opt to purchase computers specially designed by the foundation to perform in a public access setting. These customized models enabled librarians to manage them using minimal technical skills and provided security settings that prevented patrons from altering the software

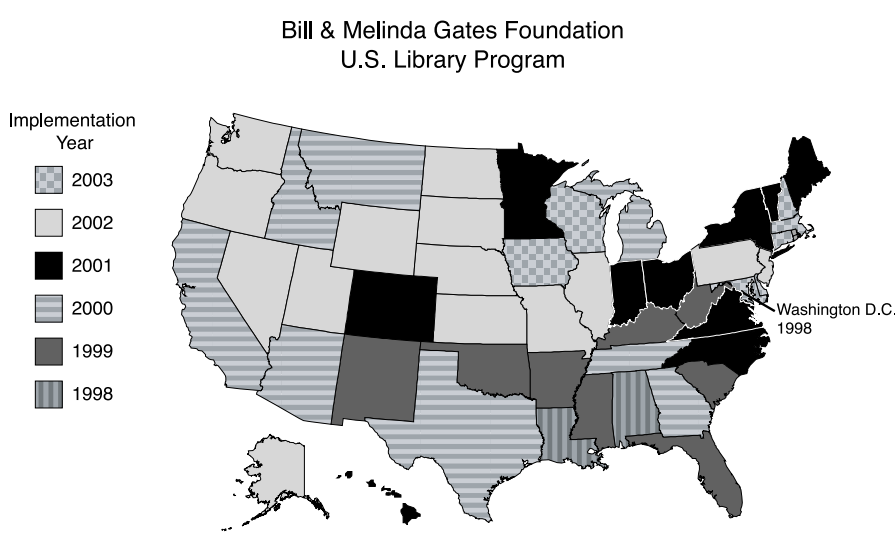

Fig. 5 U.S. Library Program Implementation Map.

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Fig. 6 A trainer for the Bill & Melinda Gates Foundation conducts a training session for library staff in the Colfax Branch of the Whitman County (Washington) Library System. (*View this art in color at www.dekker.com.*)

configuration. The computers included software applications to enhance a library's reference collection, as well as productivity and children's educational software (Fig. 3). Libraries that already had a public access infrastructure in place prior to receiving a foundation grant were able to use grant funds to purchase computers to complement their existing computing environment.

Internet connectivity: The provision of Internet access to the public was a key goal of the program. Therefore telecommunications equipment and initial costs were often covered by the grant. If a library did not meet the minimum Internet connectivity requirements, the foundation paid for the initial circuit installation, set-up charges, and required equipment, or the charges related to upgrading the connection and equipment to the minimum standards. Recurring connectivity costs were the responsibility of each individual library. Whenever possible, libraries were encouraged to migrate to broadband access.

Training: The effective use of information technology and digital resources required multiple levels of training classes and materials. Library staff received training in these tools by foundation staff and, in turn, taught other staff and library patrons how to benefit from the existence of public access computing. Typically, library staff would receive training at their library by foundation representatives. The foundation also provided ''train-the-trainer'' workshops at the foundation's offices in Seattle for staff from library systems that served populations of greater than 100,000. In addition, the foundation offered a round of training grants to state library agencies to help states establish their own training programs for library staff (Fig. 6).

Technical support: Maintaining and troubleshooting public access computers requires recurring technical support. The foundation provided help through telephone support and a Web site designed to give library staff solutions to technical problems.

EVALUATION AND IMPACT

The foundation continually evaluated the U.S. Library Program so that it could improve its design and implementation, as well as gauge the impact of the program on patrons, libraries, and communities. Beginning in 1998, researchers working with the Public Access Computing Project (PACP) at the University of Washington conducted a multiyear, multimethod, independent research project.

Findings reported by PACP researchers revealed an important link between libraries, public access computing, and removing inequities in access. The research showed that public libraries provide the only access to computers and the Internet for many people, including those who are lower income, minority, unemployed, or have less than a high school education. Twenty percent of patrons who reported using library computers had no other computer access. Thirty percent had no other Internet access.[5] Ethnic minorities were overrepresented among library computer users, and a greater proportion said libraries provided their only access.[6]

Public access computing had a particularly positive impact on libraries in rural and small towns, which represent almost four-fifths of all public library systems and serve about 17% of the nation's population.[7] Librarians and patrons of these libraries, which are often understaffed and underfunded, felt that the Internet provided increased opportunities and access to all kinds of information that are ''not on site.''[7]

PACP also showed a marked increase in library visits and circulation as a result of offering public access computing. Participating libraries reported an average increase of 36% in library traffic and 9% in book circulation.[8] Research found that teens visit the library more often and stay longer than adults. Nearly all teenage library patrons surveyed (95%) said they are library computer users. Nearly half said the library should extend their operating hours and acquire more computers, lengthen time limits, and shorten waiting times.[9]

The popularity of library computers among patrons has led to widespread support for public access computing in libraries. Local community members, especially people living in poverty, have come to depend on this free access to digital information.[10] Overall, library patrons said that they are happy to have computers in libraries and want more (Fig. 7). They expressed frustration about too many people wanting to use too few computers.[11]

Another major finding of the PACP research was that libraries need help to sustain public access computing. Approximately half of library administrators surveyed anticipated needing to upgrade their public access computing resources in the near future, including

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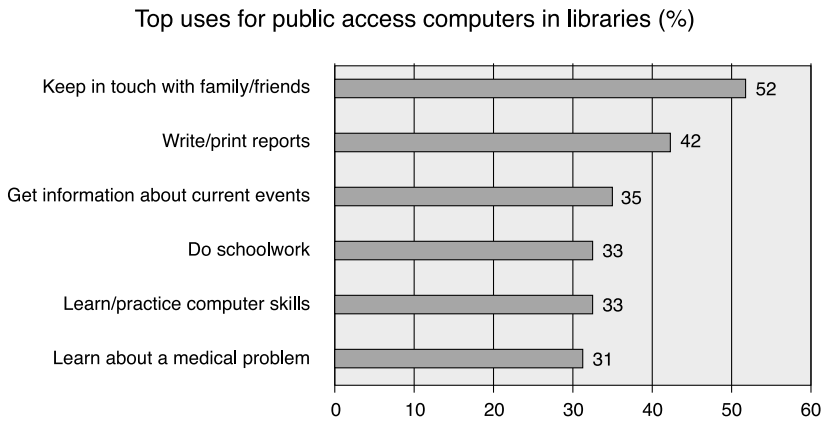

Fig. 7 Source: People from Low-Income Families Disproportionately Use Library Computers, 2002, Moore et al., http://www.gatesfoundation.org/Libraries/USLibraryProgram/Evaluation/default.htm.

acquiring more computers (83%), technical expertise (53%), and training (49%).[12] Librarians said that the training component of the U.S. Library Program differentiates it from other programs that solely provide machines or hookups for public access computing. Staff in libraries that received on-site training said they were better able to deal with the challenges often presented by public access computing.[13] Yet research showed there is still a need for more training and technical support both for library staff and for patrons.[12]

As few as 25% of libraries offer technology courses and more informal assistance for patrons. One in two patrons indicated they would take a library computer class if one were offered. Administrators reported several factors limiting their ability to offer such courses, including insufficient funding, inadequate number of staff, deficient staff technical skills and lack of computers or space.[6] Overall, librarians were committed to sustaining public access computing programs for community members, especially those with lower incomes who have come to depend on library computers, and said they would do ''whatever it takes.''[13]

Sustaining Public Access Computing

Due to ever-evolving technology, libraries need to regularly upgrade their computers and obtain additional staff training and skills to sustain public access computing. The foundation's sustainability initiatives included a strong focus on building the capacity of state library agencies to serve as technology resources for local libraries—both in terms of training and ongoing maintenance.

The foundation established several key programs to transfer knowledge and expertise gained through the program's implementation directly to state and local libraries. The foundation's help desk staff developed an intranet for the library grantees to provide a self-service, online resource to help librarians with technical issues. The site offered tools, tips, and step-by-step guides that were updated regularly to reflect the calls the help desk received. The foundation developed another online resource in partnership with the Online Computer Learning Center (OCLC). This Web-based portal, WebJunction (http://www.webjunction.org), was designed to help public libraries plan for technology integration, manage hardware and software, implement advanced applications, train staff and patrons, share best practices, and deliver digital library services.

An important aspect of the foundation's sustainability efforts was encouraging libraries to reach out to members of their communities for support. A communications handbook, *Staying Connected*, was designed to help libraries engage local communities in their technology programs and enlist their help in sustaining them. In addition to specific steps on how to gain financial and technical support from state and community sources, the kit also included examples of unique and successful programs created by libraries around the country. From the beginning of the program, the foundation hoped its investments would encourage other foundations, government bodies, businesses, and individuals to support libraries' efforts in providing broad public access to information technologies.

The foundation also issued financial support to encourage sustainability in the form of Staying Connected Grants. These grants, available to state library agencies, supported hardware upgrades, particularly in areas with persistent poverty; broadband connectivity; technical support; and technology training programs.

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OTHER PUBLIC ACCESS COMPUTING PROGRAMS

In addition to the U.S. Library Program, the Bill & Melinda Gates Foundation created a number of other library initiatives within the United States and all over the world.

Recognizing that native communities in the United States often have unique information and training needs, in 1998 the foundation worked directly with tribal leaders, librarians, and educators in the southwest to help bridge the digital divide among Native Americans. The goal of the Native American Access to Technology Program was to empower native communities through increased access to digital information resources. The program provided access to tools and technology to preserve local culture and heritage, as well as opportunities for communities to teach digital skills to its members. As of June 2003, more than $9.6 million had been given to 44 tribes in Arizona, Colorado, New Mexico, and Utah at 161 different sites. Grants provided funds for two to four computers with preloaded software and Internet access; supplemental equipment such as a scanner, digital camera, and headset microphone; training on applications for staff and community members; and three years of technical support.

The foundation's Community Access to Technology program sought to help organizations and communities in Washington state, the headquarters of the Bill & Melinda Gates Foundation, use digital technologies to make changes to the lives of individuals and their communities. Its goal was to promote ''digital equity'' so that low-income and other disadvantaged communities have opportunities to utilize technologies for the betterment of themselves and their communities.

The Bill & Melinda Gates Foundation also supported libraries internationally to help individuals improve their lives through information and technology. Through 2003, the foundation worked with libraries in Canada, Chile, Mexico, and the United Kingdom.

CONCLUSION

Due to the efforts of library professionals across the country, working in partnership with the Bill & Melinda Gates Foundation, computers and public access to the Internet have become permanent fixtures in libraries and will remain key components of the information services that libraries offer their patrons. As the U.S. Library Program enters its final phase of implementation and nearly every public library in the United States has public access computers, the focus among the library community is shifting toward finding ways to sustain these programs in the long term and giving library professionals the tools, both traditional and contemporary, to ensure everyone has access to the same world of information.

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The Queens Borough Public Library

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INTRODUCTION

The Queens Borough Public Library is one of New York City's three public library systems. It serves 2.2 million people in one of the most ethnically and culturally diverse counties in the United States. Queens Library serves the public from 63 locations plus 6 Adult Learning Centers. It has circulated more books and other library materials than any other library system in the country since 1994, and is the second largest public library in the United States in terms of size of collections.

HISTORY AND FOUNDING

The first library in Queens was organized in 1858 in Flushing on a subscription basis. Incorporated in 1869, it became a free circulation library in 1884. In the 1890s, several other communities started local library service—Steinway, Hollis, Queens Village, Richmond Hill, Ozone Park, Long Island City, and Astoria. These seven libraries formed the nucleus of the present Queens Borough Public Library. Three (Long Island City, Steinway, and Astoria) were members of the Long Island City Public Library, chartered in 1896, which became the Queens Borough Library in 1899.

New York City contributed support to most of the seven libraries. Preferring to deal with one group rather than seven, the city held several conferences to consider consolidating the administration of these independent units. In January 1901, all of the libraries except Flushing joined to form the Queens Borough Public Library. The charter granted to the new system by the Regents of the State of New York was worded to extend the service area of the old Long Island City Public Library to the entire borough. Operating funds were provided by the City of New York.

Shortly after the formation of the system, Flushing joined, as did a new library founded in College Point. Funds totaling $240,000 donated by Andrew Carnegie were used for the construction of seven new libraries in the most heavily populated areas of the borough. Five of these buildings (Astoria, Elmhurst, Poppenhusen, Richmond Hill, and Woodhaven) are still in use.

In 1906, a traveling library office was set up to extend library service to underserved, less densely populated areas. Its primary function, at first, was the placement of collections of from 100 to 600 volumes in various Queens locations. These locations were chosen based on the ability of the owner of the facility to provide space, to administer the collection, and to insure use by the public. By 1910, use of these collections had grown to such an extent that a Traveling Libraries Department was established. In addition to collections, stations were established in stores and offices, and trained librarians were on hand to provide service to the public. In 1914, stations were established in schools, and by 1915, prison service was also offered through a station.

The Department of Work with Children was created to supervise and direct all aspects of children's work in the agencies. Training classes, story hours, and radio programs were developed. In 1919, the Department of Branches and Apprentices was created, combining responsibility for work with children, management of staff, and supervision of branches. In addition, the department head was responsible for operating the Library's Training School. By 1923, this new department ceased to function and the Department of Work with Children was reinstated. In 1926, the Traveling Library Department became the Extension Department, and its service units were reclassified as subbranches, school stations, community stations, and collections.

In order to provide library service to the many areas still without it, bookmobile service was added in 1930. Hospital service began in 1933 and was further extended in 1937 when shut-in service was inaugurated. Meanwhile, service to schools had grown so that it became necessary, in 1930, to create a Department of School Libraries. By 1934, collections were supplied to 16 schools, and trained librarians were on duty at all times. This service continued until 1944 when staff shortages and lack of funds forced its elimination.

The Extension Department and the Department of Branch Administration merged in 1956 to form the current Extension Services Department with responsibility for the development of all public services outside of the Central

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Library building. All subbranches were raised to full branch status. Professional staffs were assigned, hours of service expanded, book collections enlarged and cataloged, and other steps taken to place all branches on an equal-service footing. A review of the new department's activities led to the elimination of collections in schools and gradual discontinuance of the use of bookmobiles for school service.

One of the Library's major innovations was the establishment of its ''Operation Head Start'' program, which began in March 1965. Made possible with federal funding through the Library Services and Construction Act (LSCA, later changed to LSTA), it was designed to introduce preschoolers to books. Staff provided picture book hours and parent programs in branches in educationally disadvantaged areas. In 1967, the library inaugurated ''Library-Go-Round,'' a bus that made designated stops in areas where children were unlikely to be taken to a library, offering much the same service as ''Operation Head Start.'' It was expanded to include the ''Tell-a-Tale Trailer'' for older children and the ''Teenmobile'' for young adults, which also served prisons and drug rehabilitation centers. Cuts in federal support ended ''Operation Head Start'' in 1972 and terminated all vehicular special services on November 30, 1976.

The 1965 LSCA also spurred an ambitious capital-building program by making federal funds available to build libraries in communities that were underserved. Unfortunately, LSCA provided only 10% seed money. The balance of the funding, including site acquisition, outfitting, and operating costs, was left to the City to provide. The City was in a serious fiscal crisis that persisted throughout the administration of Mayor John Lindsay. Many new branches that had been approved under Mayor Robert Wagner's administration remained unbuilt, unfinished, or unopened until the late 1970s or early 1980s. (In 1965, 12 branches were on the list that had been approved but could not be built.) Although numerous, cost consciousness when those branches were eventually built reduced them to the most spare, utilitarian design, branding them with the derisive name of ''Lindsay boxes.'' In the mid 1960s, additional LSCA funds were granted on an emergency basis to finish Central Library and the Flushing and Far Rockaway Branches, which were desperately needed but stalled because of lack of funding.

The 1990s saw a truly successful renaissance in library building, thanks in large part to the support of Borough President Claire Shulman and the City Council. Unwavering support to literacy and education resulted in the funding and opening in 1998 of the 76,000-square-foot Flushing Library (Fig. 1). The flagship facility houses a branch library, an Adult Learning Center, the International Resource Center, a state-of-the-art auditorium, and exhibit space. It is the busiest branch library in New York State. In 1999, new Langston Hughes and South Jamaica Branches opened for customer service. Additionally, Borough President Shulman and the Council provided funding for new branches in Cambria Heights and Long Island City that are scheduled to open in 2003.

Fig. 1 The 76,000-square-foot Flushing Library is the busiest branch library in New York State, hosting more than 5000 visitors a day. *(Go to www.dekker.com to view this figure in color.)*

In 1989, Queens Library piloted a Latchkey Program in response to the growing problem of unattended children in the library, apparently sent there after school because parents perceived the library to be a safe haven with adult supervision. Latchkey and Homework Assistance Programs are given in approximately half of Queens Library locations. Major funding for monitors, homework help materials, and recreational programs comes from corporate and institutional donors. In FY 2001, 156,300 children were served.

Queens Library has been a leader in using technology to improve both information delivery to customers and back-office operations. In 1978, Queens Library had the City's first computerized circulation system. Computer Output Microfilm (COM) catalogs supplanted the card catalog. Later, stand-alone CD-ROM catalogs became the norm. In 1990, a second-generation circulation system was installed. With a newer data communications network, a few reference databases such as the World Book Encyclopedia were provided to the branches as early as 1991. In 1992, the circulation system was linked to a network of other, similar systems for exchanging cataloging records. The library's catalog became available on the Internet in May 1993 and was accessible from anywhere in the world. In September 1993, a text-based Online Patron Access Catalog (OPAC), dubbed InfoLinQ™, was installed in Central Library to test its feasibility. Support by the City Council made it possible to expand the OPAC systemwide, and in 1996, Internet access was available at every branch.

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The face of information delivery changed with the expansion of the Internet. In celebration of Queens Library's Centennial on March 19, 1996, the Library unveiled its own web site with its web-based OPAC. It permitted access to the library's catalog, commercial research databases, fast links to select Internet sites, and more. The catalog was available with English, Spanish, Chinese, and Korean interfaces. In November of that year, a new service of selected international Internet sites was made available for customers who speak languages other than English through WorldLinQ™, which was developed through a grant from AT&T. Electronic information delivery has continued to progress. In 2000, the City Council once again supported library technology by allocating funds to upgrade aging equipment. In 2001, library customers can access Queens Library's catalog and research databases from their homes, schools, or offices; can take workshops in computer and software use; can read a selection of electronic books (''e-books'') in English or Chinese without ever coming into the library; and more.

In January 1999, the Cyber Center opened at the Central Library. It features 48 workstations for customer use, closing the gap between technology ''haves'' and ''have-nots'' in Queens. Partnering with corporations and foundations permitted expansion of this valuable service throughout the system. Grants from the Gates Foundation, for instance, funded the Far Rockaway Small Business Resource Center, which opened in 1997, as well as smaller Cyber Centers in the Laurelton, Steinway, and other branches, which opened in 2000 and 2001. They are heavily used by customers.

Queens Library is committed to the global exchange of information, to facilitate collection development, and to serve the information profession as a whole. Queens Library signed agreements of interlibrary cooperation with the Shanghai Library in 1996 and the National Library of China in 1997. Other international library partnerships include the Bibliothèque publique d'information, Paris, France, and the Biblioteca Pública y Complejo Cultural Mariano Moreno, Bernal, Argentina. They permit the exchange of personnel, library materials, and exhibits and greatly facilitate collection development in languages other than English.

The importance of global information was emphasized further with the opening of the International Resource Center in 1998, as part of the Flushing Library. It houses information on the economy, geography, and culture of the world, with special emphasis on economics.

COMMUNITY SERVED

Queens Library serves 2.2 million people in Queens County, one of New York City's five boroughs. Racially, they identify as 33% Caucasian, 25% Latino or Hispanic, 19% Black, and 18% Asian. Forty-six percent are born outside of the United States. Only 46% speak English alone. Major immigrant languages are Spanish, Chinese, Korean, Russian, Italian, Indic languages, and Tagalog (Fig. 2).

Fig. 2 The Queens Borough Public Library serves the public from 62 branches plus the Central Library. No one in Queens is more than a mile from a public library. *(Go to www.dekker.com to view this figure in color.)*

By age, 19% of the population of Queens is under 14 years old; 9% is between 15 and 21 years; 21% is between 22 and 34 years; 38% is between 35 and 64 years; and 13% is older than 65 years.

Fifty-two percent of Queens households earn under $45,000 per year; 25% earn between $45,000 and $74,999; 19.5% earn between $75,000 and $149,999; and 3.5% earn more than $150,000. The median household income, according to the 2000 census, is $42,439. Note, however, that being a borough of New York City, rents and other costs of living are relatively high. Approximately 14% of the population live below the poverty level.

BENEFACTORS

Andrew Carnegie was an early benefactor of the Queens Borough Public Library, donating $240,000 for public

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library buildings on the condition that municipal support would pay ongoing operating expenses.

There were many community-minded residents who advocated for a free local library in its earliest days. One whose name is often mentioned is Mary Ann Shaw. Ms. Shaw was a pioneer educator, the principal of a school for African-American children in Flushing during the mid to late 1800s, and the wife of John Shaw, minister of the African Methodist Episcopal (AME) Church. Ms. Shaw was very active in the cause for the library and was one of the citizens who joined the community fund-raising effort for the library initiated by the Library's Board of Trustees. Upon her death in 1905, Ms. Shaw bequeathed $1,000 to the Flushing Free Library. However, because no such institution by that name existed, the ensuing legal tangle took years to resolve. Ultimately, her bequest established the Shaw Reference Collection in the Flushing Branch where her photograph still hangs.

Following several periods of lean governmental funding, the Queens Library Foundation was established in 1988 under an independent Board of Directors. Its mission is to diversify the funding base of the Library by generating financial support from corporations, foundations, and private citizens. On the occasion of Queens Library's Centennial in 1996, ''The Futures Fund'' was established. It is an endowment, the proceeds of which will provide supplementary funds for children's materials and programs at Queens Library in perpetuity.

GOVERNANCE AND ADMINISTRATION

The Queens Borough Public Library is an autonomous library system, guided by a 19-member Board of Trustees appointed by the Mayor of the City of New York and the Queens Borough president. The Mayor of the City of New York, the Comptroller, the Public Advocate, and the Borough President of Queens are ex officio members of the Board.

Financial support comes primarily from governmental sources. In Fiscal Year (FY) 2002, 84% of Queens Library's total funding came from the City of New York; 7% from New York State, and 3% from federal funds. The balance came from outside grants, contributions, fines and fees, and other sources.

MAIN LIBRARY BUILDING

The original Central Library building was dedicated in 1930 and expanded with WPA funds in 1941 (Fig. 3). It was on Parsons Boulevard in downtown Jamaica. The four-story Renaissance-revival building was designed by R. F. Schirmer and J. W. Schmidt. It was replaced by a new, more spacious facility through the persistent efforts of the Library Director, Harold W. Tucker. The modern, city-owned building at 89-11 Merrick Boulevard, Jamaica, was built at a total cost of $5.7 million. It was dedicated on April 11, 1966. The architects were York & Sawyer, Koff, Colean, Voss & Souder. Although less architecturally distinctive than its predecessor, it has the distinction among New York City's three city library systems of having most public services on one floor. The building was renovated and expanded in 1989. The Central Library is 217,000 square feet and houses more than 1,250,000 books plus tens of thousands of periodicals, musical recordings, DVDs, videos, CDs, opera libretti, pamphlets, photos, electronic databases, and more.

Fig. 3 The Central Library in Jamaica, Queens, features a tremendous array of library services on one level, including the Queens Library Gallery, a 48-station Cyber Center, and a Job Information Center. *(Go to www.dekker.com to view this figure in color.)*

PROGRAMS AND SERVICES—ADULT, CHILDREN, ONLINE

Branch Libraries

Sixty-two branch libraries feature collections, programs, resources, and services that are relevant to the individual community needs and interests and provide easy access to library service across Queens—virtually no one in Queens is more than a mile from a public library. Branch libraries have more than 7 million items covering all subject areas including books, videotapes, books-on-tape, newspapers, periodicals, CDs, CD-ROMs, and DVDs. All branches

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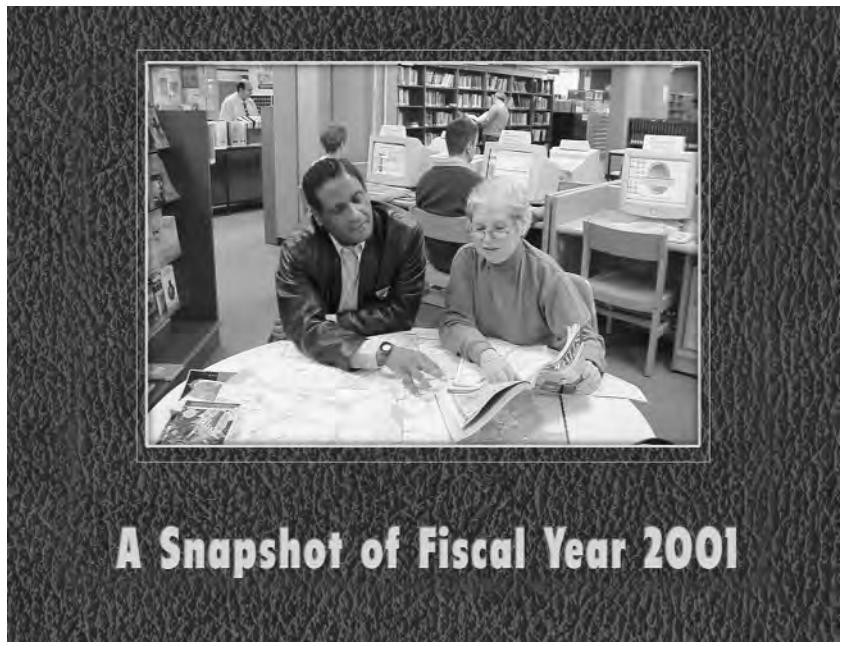

Fig. 4 The Queens Borough Public Library serves 2.2 million people in one of the most ethnically and culturally diverse counties in the United States. Materials are circulated in 70 languages in addition to English, with extensive popular collections in the major immigrant languages. *(Go to www.dekker.com to view this figure in color.)*

offer free Internet access and an extensive selection of online reference databases.

Special multilingual collections meet community demand. They include the largest collections in the United States for general readers in Spanish (117,000 items) and Chinese (108,000), extensive fiction and nonfiction collections in Korean (30,000 items), Russian (17,000), South Asian Languages (25,000 items in Bengali, Gujarati, Hindi, Malayalam, Urdu, and Punjabi), French and Haitian Creole, and materials by and about Caribbean people. Other languages are available on a rotating basis.

Free literary, cultural, and informational programs are favorites with library customers. From author talks to puppet shows to flamenco dancers to classical concerts, some 591,000 customers attended 27,400 programs in FY 2001 (Fig. 4).

Services for Adults

The Queens Library has continued its long history as a leader in developing specialized services that meet identified community needs, as the following examples illustrate.

The New Americans Project (NAP), established in the early 1970s to assist new immigrants through popular collections of materials, programs, and services in their native languages, has served as a model for other libraries. NAP's first formal collection was in Spanish, begun in 1986. Chinese was added in 1988; Korean in 1991; six Indic languages in 1994; and Russian in 1996. Smaller collections in 19 other languages, such as Haitian Creole or Polish, are purchased for branches where the need exists.

English for Speakers of Other Languages (ESOL) classes, originally administered by NAP but part of the Adult Learner Program since 2001, have been received with special enthusiasm in this rapidly changing borough.

In 1977, Queens was the first public library in New York City to establish a literacy volunteer program (the Adult Literacy Program), which provides free individual and group instruction to persons 16 and older who read below the fifth-grade level or who want to improve their fluency in English. Tutoring is offered in six Adult Learning Centers. Pre-GED classes are also available, as are combined ESOL/Literacy classes. In 1988, a literacy class for deaf adults (conducted in sign language) was introduced.

Since 1981, the Library has maintained special services (including materials, equipment, programs, and information/referral) for senior citizens and the handicapped through two state-funded operations, Library Services to Older Adults and Library Services to Person with Disabilities. In 1991, these units were combined and renamed Special Services, a division of the Outreach Services Department.

In 1998, the first Queens Directory of Immigrant-Serving Agencies was compiled and published by the

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Library. It is the only resource of its kind, listing available social and human services and cross-indexing them with their linguistic capability, so a library customer can find legal advice or medical testing or child care in his preferred language. A Database of Community Service, listing similar services for all residents, was also compiled. Subsequently, both directories were made available electronically.

Job Information Centers at the Central Library and Flushing Library provide individualized reference to adults regarding career focus, job search strategies, training, and education. In addition, a kiosk at the New York State Department of Labor's One-Stop Career Center in Jamaica directs job seekers to the library's resources. A part-time Job Information Librarian offers counsel at that site, as well.

Mail-A-Book service is provided to the homebound. Limited Mail-A-Book in languages other than English is provided to new Americans to acquaint them with library services. Large print collections are provided on a rotating basis to nursing and adult homes. Library orientation is provided for inmates at the Queensboro Correctional Facility, Elmhurst Hospital Ward, and Queens Men's House of Detention.

Queens Library interprets its mission as being beyond collecting and lending library materials. In 1995, the Queens Gallery opened in the Central Library. Several major exhibitions are on display yearly incorporating cultural, historical, and cultural themes. An exhibit of special interest to children is installed during the summer.

Services for Children

Queens Library aims to develop a lifelong love of reading in children by reaching out to them from infancy onward, and also to support academic success by providing materials and reference services that support school curricula. All library locations have books for children, ranging from board books and nursery rhymes to a variety of fiction and nonfiction for elementary school children. Every Children's Room has KidsLinQ™, a special youth-oriented web page that guides children to the best that Internet has to offer.

Story programs for children from 18 months to 7 years are given in small, age-appropriate groups to stimulate an early love for the library and to reinforce emerging literacy. Toddler Learning Centers combine a five-session children's play group with a learning opportunity for parents or caregivers. Professionals from such fields as nutrition, physical fitness, speech, and child psychology speak with adults, make simple referrals, and give advice while children play. Toddler Learning Centers are given in languages other than English on a rotating basis.

After-school Homework Assistance/Latchkey Enrichment Programs for children ages 5 to 12 are given at selected library locations. These programs are funded by private, organizational and institutional donors.

Every library location holds Summer Reading Clubs for children and young adults. Games, prizes, recreational programs, and other incentives encourage reading and keep literacy skills sharp during the school hiatus.

Special outreach efforts help to bring teens into the library. Programs that are popular with this age group include Open Mic Nights, Poetry Slams, and drama and chess clubs. A Teen Advisory Board gives teens a leadership role in planning.

In October of 1994, the Connecting Libraries and Schools Project (CLASP) began in School District 30, eventually expanding throughout the borough. Its job was to form a close liaison between schools and libraries. In FY 2001, CLASP served 156,300 students. It was suspended in 2002 because of budgetary restraints.

KidsWorld Queens℠ is a partnership of cultural institutions in Queens, under the leadership of the library. It has included the printing and/or web publishing of a summer calendar of children's events in Queens, and periodic Activities Fairs with hands-on activities where children and adults can find out about what the museums, gardens, libraries, zoos, and more have to offer.

On-line Services

Every Queens Library location has Internet access. The on-line catalog can be accessed from the web page (www.queenslibrary.org) from any Internet-connected computer at any time. The library subscribes to more than 50 electronic databases, offering everything from electronic books to full-text periodical articles to maps, photos, economic databases, and more. Some are in languages other than English. Most are available from remote locations with a valid registered borrower's card. Also available is a host of self-service library-account options, such as the ability to make on-line requests and renew some materials.

The library also has specialized web portals for children (www.kidslinq.org) and teens (www.teenlinq.org) to help them find information and homework help, and to direct them to the best of the Internet. Four Queens Library locations subscribe to Tutor.com, an interactive homework help service that matches inquiries with subject-specific tutors who guide students through their homework.

Queens Library was a pioneer in providing interactive Internet experiences for library customers who speak languages other than English. WorldLinQ (www.worldlinq.org) was introduced in 1996. It was developed through partial funding from AT&T. WorldLinQ allows library customers to search the Library's catalog in Spanish,

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Chinese, or Korean using familiar vocabulary; it catalogs web sites from all over the world in their original languages and makes them available with just a mouse click; it allows for interactive searches in the major immigrant languages in Queens, even those that do not use the Roman alphabet.

All Queens Library locations have customer-use computer workstations that offer research tools, the library's on-line catalog, and a suite of popular software for word processing, spreadsheets, and other applications. Several locations also have Cyber Centers, larger banks of workstations with printers, where workshops on computer basics are held in English and other languages. The Cyber Center at the Central Library has 48 workstations.

SPECIAL COLLECTIONS

The Long Island Division houses books, maps, photographs, manuscripts, census records, and clipping files pertaining to the four counties that make up Long Island and its history. The papers of Lewis Latimer, African-American inventor and collaborator of Thomas Edison, are included in the collection, as are the photo archives of the erstwhile *New York Herald Tribune*, the photo archives of Joseph Ullman, Joseph Burt Sr., and Frederick W. Weber, prolific photographers whose work chronicled the development of Long Island. An extensive map collection documents Long Island's growth over the centuries, including maps going back to the 1600s and the very detailed E. Belcher Hyde Co. and Sanborn Map Co. Real Estate Maps.

The top level of the Flushing Library is home to the International Resource Center, a citywide resource of information and materials about the peoples, cultures, and economies of the world. Designed for general readers with a serious interest in international subjects, it is a unique concentration of resources for global studies and international commerce, rivaling any that is available, free to the public, anywhere. Many of the International Resource Center's items are rare and not usually accessible by the general public. Many others are the only circulating copies in the United States. Gallery space displays exhibitions with an international theme.

The Langston Hughes Community Library and Cultural Center, located in a showcase new facility at 100-01 Northern Boulevard in Corona, houses the Black Heritage Reference Center of Queens County, New York City's largest circulating collection on Black Culture. Noteworthy resources include more than 1000 volumes of master theses and doctoral dissertations concerning Africans and African Americans in the Diaspora; and the Adele Cohen Music Collection of original works by Langston Hughes set to music.

DIGITAL LIBRARY PROJECTS AND INNOVATIVE SERVICES

Digital Collections

The Queens Library Gallery has curated several original exhibitions. Some of these have been digitized and remain accessible through the Queens Library web site. They include *From Burgh to Borough: Queens Enters the 20th Century* (2002), an exhibit on local history; *Visible Traces: Rare Books and Special Collections from the National Library of China* (1999), which featured ancient artifacts and manuscripts from the National Library's archives; and *The Book as a Work of Art* (1998) on the aesthetic aspects of the bound manuscript.

The Long Island Division's photo archives have been largely digitized, so they are available for library users to study without endangering the original photos. Most chronicle the history and lifestyle of Queens and its neighboring counties.

International Librarianship

As a model for libraries worldwide, particularly in service to diverse populations, Queens Library is often asked by the U.S. Information Agency, private foundations and others to train public librarians from around the world. In the 1990s, particular emphasis was placed on Eastern European nations that formerly were part of the Soviet Union. In 1997, Queens Library signed historic agreements with the National Library of China in Beijing and the Shanghai Library for the exchange of library materials, personnel, information, and exhibitions. In 2000, Queens Library was named a Sister Library with the August Cesarec Library, Zagreb, Croatia, by the White House Millennium Council. Queens Library is also a Sister Library with the Mayakovsky Central City Public Library in St. Petersburg, Russia. In 2002, the International Center for Public Librarianship was formally launched to provide an environment and structure through which international librarians can learn about the North American model, which effectively serves all members of the community. The Center hosts groups of visiting Fellows, usually for a minimum of 3 months. Queens' librarians learn as much as they teach, and the exchange of information benefits all parties.

CONCLUSIONS AND FUTURE

Planning to serve future generations of Queens residents is an integral part of library operations. Five-Year Plans had been in effect at Queens Library for many years—a useful, but static, way to plan. A dynamic, formal, strategic

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planning process was begun in FY '95. The process incorporates staff from all levels of the library's operations. Its purpose is to drive library operations in a concerted way across all levels, to analyze potential threats, and to maximize opportunities so that Queens Library can continue to serve its customers to the best of its ability, in the present and future, while at the same time being flexible enough to respond to quickly changing circumstances. The strategic planning team's first job was to define a mission statement, the library's vision and values, and to identify strategic directions from which all other actions flow (full text of the mission, vision, values, and strategic directions follows this section). In 1998, a Leadership Team was formed to study goals and directions for the organization as a whole, while simultaneously, multiple Strategic Planning Teams work on specific aspects of the plan. By FY 2001, many worthwhile projects were completed, including the expansion of children's collections to reflect the full range of human diversity, several brochures to inform customers about Queens Library programs and services, and more.

Queens Library's circulation has continued to increase exponentially:

1896–1905	1,305,982
1906–1915	9,164,234
1916–1925	18,586,436
1926–1935	29,198,858
1936–1945	35,651,185
1945–1954	36,180,736
1955–1964	71,392,548
1965–1974	73,888,353
1975–1984	61,355,977
1985–1994	123,313,971
1995–1999	78,492,243

As new methods of information delivery technology develop, however, circulation will be only one of several indicators of the quantity and quality of public library service Queens Library provides.

Throughout its history, Queens Library has innovated ways of serving the information needs of its publics, as the Borough itself changed. Staff and administration, under the leadership of the Board of Trustees, have every expectation of continuing that tradition. Queens Library will be as relevant in the next century as it was in the past century.

Mission Statement

The mission of the Queens Borough Public Library is to provide quality services, resources, and lifelong learning opportunities through books and a variety of other formats to meet the informational, educational, cultural, and recreational needs and interests of its diverse and changing population.

The Library is a forum for all points of view and adheres to the principles of intellectual freedom as expressed in the Library Bill of Rights formulated by the American Library Association.

Vision

The Queens Borough Public Library represents a fundamental public good in our democracy. It assures the right, the privilege, and the ability of individuals to choose and pursue any direction of thought, study, or action they wish.

The Library provides the capital necessary for us to understand the past and plan for the future. It is also our collective memory, because history and human experience are best preserved in writing.

As Queens Library enters its second century, it will be universally recognized as the most dynamic public library in the nation. This recognition will arise from the Library's dedication to the needs of its diverse communities, its advocacy and support of appropriate technology, the excellence of its collections, and the commitment of its staff to its customers and the very highest ideals of library service.

We at Queens Library believe deeply in equity and that libraries are fundamental in empowering people to take charge of their lives, their governments, and their communities. In this way, Queens Library has an essential role to play in the new millennium. The collections we build, the access we provide, and the technologies we embrace will carry the people of Queens into a productive and creative future. Please join the Library in this quest.

Values

Service

We believe that library and information service is essential to a learning society because information and knowledge are indispensable to the development of human potential, the advancement of civilization, and the continuance of enlightened self-government.

Customers

We believe that meeting the needs of our diverse customer base is first and foremost.

Quality

We value the importance of providing rapid and comprehensive access to knowledge and information and

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strive to constantly improve the services we provide to our customers.

Technology

We believe the Queens Library must be an active partner in the development and implementation of technology to ensure that access to knowledge and information will be equitably available to all.

Individuality

We respect the individuality and integrity of each customer and each employee and foster an environment in which creativity, productivity, and individual responsibility are encouraged, recognized, and rewarded.

Teamwork

We believe that each individual is a member of the team, working together to serve our customers.

Strategic directions

Queens Library has identified the following four strategic directions, which will carry it into the next century of service:

People in Queens access information, ideas, and knowledge that they need and want through inviting state-of-the-art Community Libraries.

The Queens Library celebrates the legacy of the printed word by fostering and promoting the understanding of the vital role of books, reading, libraries, and literacy in society.

People in Queens consistently receive quality library service provided by dedicated, knowledgeable, experienced, and diverse customer-oriented staff.

Children and teens in Queens access the educational and informational resources they need to be successful.

RECENT AWARDS

Queens Library has been recognized nationally as a role model and innovator, earning it many recognitions and awards. They include:

10/2002, 21st Century Librarian Award, Syracuse University, to Gary E. Strong

2002, Dun & Bradstreet Award for Outstanding Service to Minority Business Communities, for a variety of programs in support of business

2002, Charlie Robinson Award, to Gary E. Strong

2002, 3rd Place IFLA 3M Marketing Award, International Federation of Library Associations, for the opening of the Flushing Library

10/2001, Businessperson of the Year, Queens Chamber of Commerce, to Gary E. Strong, for large organizations

2001, Gale/EMIERT Award, ALA-Ethnic and Multicultural Information Exchange Round Table, to Queens Library Strategic Workteam on Children and Teens, for publication of ''Open the Books and See All the People''

2001, 2nd Prize for Exhibition Catalogs, American Association of Museums, to Visible Traces Exhibit Catalog, Museum Publications Design Competition

5/2001, AIA Award for Architecture, American Institute of Architects, to Polshek & Partners/Queens Library, for excellence in architectural design—Flushing Library

2000, National Award for Library Service, Institute of Museum and Library Service, to Queens Library, national recognition of community service

2000, Digital Steppingstone Project, Tomás Rivera Policy Institute, to Queens Library, for being an outstanding example of how a community library can bridge the ''digital divide''

4/2000, Earth Day Top Ten Award, American Institute of Architects, to South Jamaica Branch, for sustainable energy design

1999, ALA/Information Today Library of the Future Award, ALA, to Queens Library, for multilingual customer training programs for electronic information resources in four languages

10/1999, Groundbreaker Award, Transitional Services for NY, to Gary E. Strong, for leadership

7/1999, Sister Libraries designation, U.S. National Commission on Libraries and Informational Science, to Queens Library, for international partnerships

6/1999, ALA/AIA Award of Excellence, ALA and American Institute of Architects, to Queens Library and Polshek & Ptrs., for distinguished accomplishment in library architecture—Flushing Library

4/1999, Library Site of the Month, Hot Spot, to WorldLinQ, for outstanding contribution to the library community on-line

6/1998, RUSA/ALA Gale Research Award for Excellence in Reference and Adult Library Services, ALA, to Queens Library/New Americans Program, for Queens Directory of Immigrant-Serving Agencies

1998, Joseph E. Schubert Library Excellence Award, NY State Regents Advisory Council on Libraries, to Queens Library, for WorldLinQ

1998, Recognition, Queens County Builders & Contractors Association, to Queens Library, for excellence in design and construction—Flushing Library

1997, John Cotton Dana Award for Library Public Relations, ALA/LAMA, to Queens Library, for centennial year celebration and entry onto World Wide Web

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1997, PLA/Highsmith Library Innovation Award, PLA, to Queens Library, for WorldLinQ
1994, Governor's Award for African-Americans of Distinction, to Andrew Jackson, Executive Director of the Langston Hughes Community Library, for educational outreach programs
1991, Leonard Wertheimer Multilingual Award, PLA, to Adriana Acuan Tandler, for the New Americans Program
1987, Pura Belpré Award for Achievement, ALSC/REFORMA, to New Americans Program for ''Say Sí: promotional campaign
1983, Winifred Fisher Award, NY Adult Education Council, to QBPL, for skill in assisting the handicapped

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SFX

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INTRODUCTION

SFX, first introduced by Herbert Van de Sompel,[a] facilitates linking of scholarly information in an optimal way for libraries and for publishers and offers seamless access for researchers to information from a diverse set of resources. The most common form of linking among scholarly information resources is from a citation to the item that is referenced by the citation, typically the book or the article. But many other possible links to services, now available with SFX, help leverage the inherent value of the resources.

SFX—or special effects—was the term applied to a specific open-linking philosophy proposed by Van de Sompel with the view that SFX linking would enliven our interaction with scholarly information. SFX is now the trade name for a link server marketed by the library automation company Ex Libris. However, SFX is often used more generically to describe a new type of open linking that places control firmly in the hands of the librarians. Note that for the purpose of this description, ''SFX'' will refer generically to all link servers that, like SFX, are based on the NISO OpenURL standard for the transport of metadata.

LINKING BEFORE SFX

Linking information is not a new concept although is only now a reality for many involved in scholarly research. In 1945, Bush,[1] in his groundbreaking paper ''As we may think,'' identified the importance of actionable links between conceptually related items. Bush described an approach he termed ''associative indexing'' and suggested that this process of selecting by association rather than through indexing might one day be mechanized. The Web has in 2004 not yet shown itself flexible enough to support Bush's vision to link everything to everything under the control of the individual user, but solutions such as SFX provide control at least at the level of the library and, together with other technological advances, offer hope for user-specific linking.

In the mid-1990s, vendors of abstracting and indexing (A&I) databases introduced links from their systems to library OPACs so that users, having retrieved a citation, could check local library holdings for print copies of the journal containing the cited article. To this, vendors added links to e-journals as these became available; however, deployment was inconsistent and incomplete—A&I vendors offered full-text linking in different ways and were dependent in most cases on agreements with publishers. Not all A&I vendors were able to sign agreements with all e-journal publishers and aggregators, and the linking was left in the hands of the information providers.

Van de Sompel, in a recent published interview, described his frustration with the approach being taken by the information providers and the problems he could foresee in librarians not being involved in the linking game. ''I saw an enormous danger: if one agrees that libraries are in the business of organizing information, and if one agrees that links do organize information, it occurred to me that a very important part of the mission of the library got undermined by what was going on.''[2]

While certain vendors were implementing links from their A&I databases to the full text, some vendors were adopting an alternate approach to linking between resources from different vendors by republishing electronically a clearly defined set of journals and provide interlinking within this discrete set of data. This approach was taken by Ovid with their Biomedical Collections available through Journals@Ovid. This has been very successful in certain niche markets.

The linking solutions available prior to SFX, and in many cases still available, fall short of expectations of both users and librarians for a number of reasons:

- Links are calculated and embedded in documents at the time of creation of the documents. To create these ''static'' links, the information service provider must, at the time of creation of the links, have knowledge

[a]Herbert Van de Sompel is now Digital Library Researcher at the Research Library of the Los Alamos National Laboratory. Van de Sompel's work on SFX was undertaken while he was head of library automation at Ghent University in Belgium. In June 2003, Van de Sompel received the G. Kilgour Award for Research in Library and Information Technology for his work on SFX and OpenURL. See http://lib-www.lanl.gov/~herbertv/.

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of all resources to be interlinked. This approach cannot easily be scaled up to deal with a large number of resources, may cause delays in the delivery of information, and the resulting links may not be reliable.

- Solutions were ''closed'' with the control of the linking in the hands of information service providers who are focused on maximizing the link traffic to their sites, rather than in the hands of the librarian who would like to maximize usage of the varied resources for which the institution has already subscribed.
- The scope of the links offered to users is limited typically to full-text retrieval or to holdings lookups in online catalogs. Little, if any, provision is made for a richer range of links to extended services such as those for citation database searches, related Web searches, and online bookstores.
- Links are not context-sensitive to the user and appear in information resources regardless of whether the user has rights of access to the resource. The user may click on a link only to discover that they are barred from access to the service. This leads to user frustration and, in some cases, may result in the user purchasing a service for which the institution has already paid, but via an alternate provider.

The ''Appropriate Copy'' Problem

The last constraint is often referred to as the ''appropriate copy'' problem.[3] Despite today's interlinked world where in theory it is possible to access a single version of a resource no matter where it is hosted in the world, it is still possible for many copies of an article to exist in electronic form. Alternate provision of resources is mostly a good thing. For example, regional—or even institutional—hosting may improve speed of access and, where applicable, reduce costs in wide-area network traffic. Databases available from multiple vendors give libraries choice of interface and pricing models to best suit their needs and those of their users. However, it might be that the appropriate copy of an article is not an electronic one for which the library has a subscription, but rather the print one in a journal on the library shelves. The appropriate copy could also be one obtained through an InterLibrary Loan request to another institution, a request to an approved commercial document delivery supplier, or on a ''pay-per-view'' service from the publisher or other provider. Furthermore, not all electronic forms of documents available over the Web are the same version, but may nevertheless be variously quoted as authoritative sources. Value judgments on ''appropriateness'' are the preserve of the librarian.

SFX—MAKING A DIFFERENCE

In the late 1990s, Van de Sompel and his team at Ghent University in Belgium, developed a software application, now known as a link server or link resolver, to address not only the ''appropriate copy'' problem, but also the other constraints on linking that were prevalent at the time.[4–7] In February 2000, Ex Libris purchased the SFX link server technology from Ghent University[8] and have successfully implemented SFX servers for libraries around the world. Other link servers have since emerged including homegrown solutions and those from a range of commercial vendors including integrated library system vendors, information providers, and other technology companies. Some examples of other commercial link servers include LinkFinder*Plus* from Endeavor Information Systems, LinkSource from EBSCO, and Article Linker™ from SerialsSolutions. Homegrown solutions in the United States include those developed by OhioLink, the University of Illinois at Urbana Champagne, and the Colorado Alliance, and in the United Kingdom, the OpenResolver from UKOLN.

Link servers, such as SFX, introduce a revolutionary step in the linking process by disconnecting the link source from the link target. The links provided in a source document, such as an article citation in an A&I database, no longer describe the target of the link—as is the case with embedded hyperlinks—but rather contain metadata describing the source document itself. In this way, the source document provides a link to the library's independent link server and the library can then define the target(s) of the links based on their own requirements and local conditions. Thereby, the library can take control of its linking environment either by supplementing or, in some cases, replacing the linking capabilities provided by

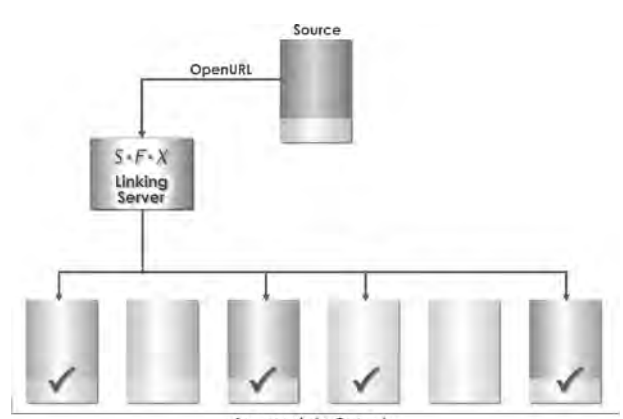

Fig. 1 The SFX link server introduces a revolutionary step in the linking process by disconnecting the link *source* from the link *target*. (*View this art in color at www.dekker.com.*)

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the information providers. A standard has already been defined for the link syntax to transport the metadata from the source document to the library's link server—the OpenURL (Fig. 1).

THE OPENURL: ENABLING SFX LINKING

The OpenURL, as defined by the NISO standard, enables the transport of descriptive metadata elements and/or identifiers from a source document to the library's link server and provides to the link server details about the context in which the link appears. The OpenURL is implemented by the information service provider in their service and can be applied by them at various levels. The OpenURL could, for example, in an abstracting and indexing database, be offered to the user for each record shown in a brief results list and for each full record shown. In a full text database, the OpenURL could be presented for each reference cited so that the user can easily access the full text of the referenced articles (Fig. 2).

A generic or customized SFX button is the visual representation of the OpenURL in a source document such as an article citation or library catalog record for a book, journal, or journal issue. When a user clicks on the SFX button, metadata describing the source document is transmitted in a prescribed format, via the OpenURL, to the link server, which then determines what links to present to the user via the SFX menu. Note also that it is possible for libraries to configure link servers to link directly to the full text rather than via an intermediate menu.

OpenURL v0.1, already a de facto standard for linking, is widely implemented by scholarly information providers, and it is anticipated that OpenURL v1.0 will be adopted as a NISO standard during the second quarter of 2004.[9]

LINKING LOCALIZATION

The OpenURL is at the core of context-sensitive or open-linking technology; but another important element is required to ensure successful and context-sensitive linking—a knowledge database that supports the linking localization.

For linking to be effective, libraries must configure their link server to accurately reflect the library's collections and the types of services to offer to their users. SFX uses the term ''extended services'' to refer specifically to those types of services that extend the notion of linking beyond linking just to the full text (Fig. 3).[7]

Service types for a link, e.g., from a citation, may include, among others:

- A link to the full text of the article on a publisher or aggregator site.
- A link to the library's OPAC for the catalog entry for the journal from which the article is cited to check local holdings details and status.

Fig. 2 SFX buttons are shown for each cited reference in an IOP journal article. (*View this art in color at www.dekker.com.*)

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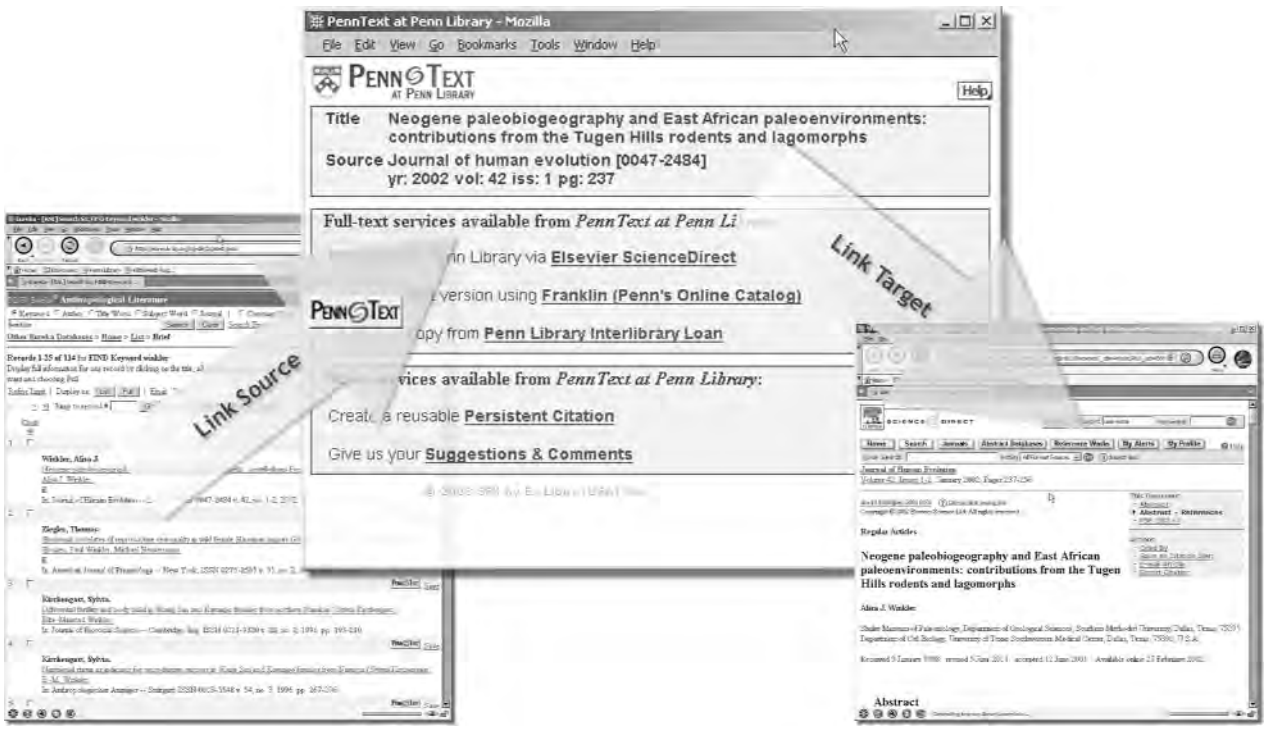

Fig. 3 User workflow for SFX linking—from an SFX *Link Source* via an SFX *Link Services* Menu to an SFX *Link Target*, in this case, the article. This example is courtesy of University of Pennsylvania. (*View this art in color at www.dekker.com.*)

- A link to submit a request for the article from the library's preferred document delivery supplier.
- A link to other articles by the author cited in a predefined resource.
- A link to related information in local information repositories.
- A link to related information in relevant Web-based resources, for example, Google or specific subject gateways.

The quality of the SFX services offered to users is only as good as the information provided by the librarian in configuring their link server. The more detailed the information, the better the level of granularity for linking. If, for example, the librarian provides configuration details identifying the year or volume and issue from when a particular journal was made available in electronic form, then link services for this e-journal will only be shown to the user if they meet the necessary date or enumeration criteria.

An SFX server comes with a global knowledge base that includes generic information such as how to link to a particular target service, what journals are held on that target site, and the extent of coverage. If the library subscribes to the base set of information, such as all journals from JSTOR, then it suffices simply to activate the SFX JSTOR target to select all the journals that are part of the JSTOR service. However, if the library subscribes to only some of the Elsevier ScienceDirect journals or for only a specific period—or indeed these journals are hosted locally—then such local information will need to be reflected in the knowledge base. If details about the library's e-journal holdings are held elsewhere by the library in electronic form—in a library catalog or an Excel spreadsheet—then it is possible to import this into the knowledge base to expedite the localization.

MORE THAN JUST A LINK SERVER

Link servers, while primarily focused on linking, are proving themselves to be more than that. In order for an SFX server to operate effectively it must have comprehensive information about the library's collections and services (Fig. 4). When fully configured, an SFX server can be considered as the authoritative resource for information on the library's electronic—and in some cases print—holdings and this information can be used in a variety of ways including:

- To generate a journal title list. Many libraries offer a browseable list of journals on their Web sites and

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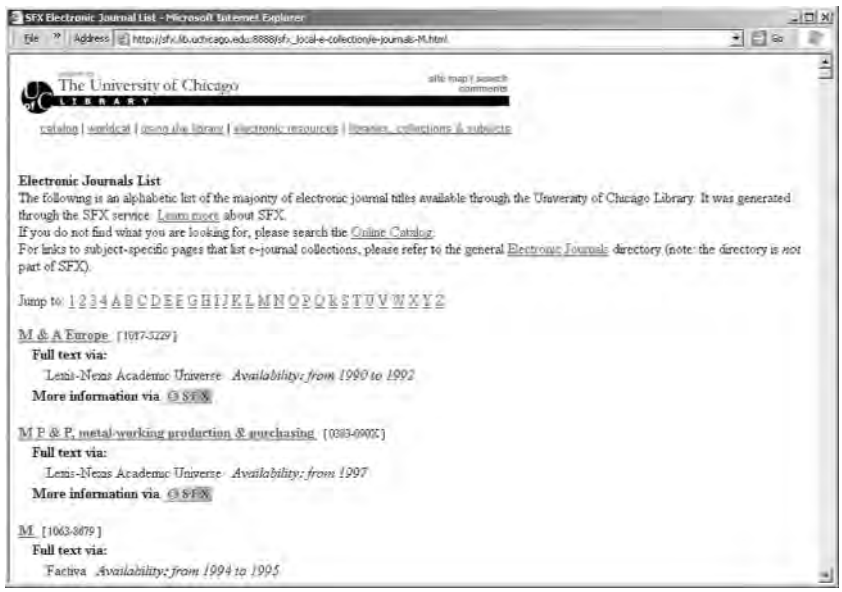

Fig. 4 A–Z journal title list generated by SFX. Courtesy of University of Chicago. (*View this art in color at www.dekker.com.*)

these are maintained as static lists. With SFX, these can be generated directly from the knowledge base.

- To prequalify a user's document delivery requests. The library's InterLibrary Loan Web form can be modified—or replaced—by an SFX-supplied form, which will first check for local holdings before accepting a document delivery request, thereby preventing unnecessary requests, particularly in an unmediated environment.
- To generate a set of journal records (in MARC, XML, or other format) for loading into other applications such as a library catalog.
- On request to dynamically deliver services from SFX to another application on the same or a different server.

THE STAKEHOLDERS

SFX has clear advantages for libraries to take control of their own linking environments, determining what types of links to offer their users, and how these links should be resolved. However, SFX has many benefits for other stakeholders in the linking of scholarly information resources, including the users and the information providers.

SFX for Libraries

SFX linking ensures that library holdings—electronic and print—in which libraries invest so heavily, are fully exploited by exposing resources to users and by making it easy for users to get to the content they are seeking.

- For user services librarians: SFX allows for standardization of link services across resources, reducing training needs. Users will see SFX buttons appearing in many, if not all, of their resources.
- For technical services librarians: SFX offers a single point of administration of the various services across different data sources. The librarian configures SFX with ''knowledge'' about all the resources to be interlinked. With SFX, it is no longer required to upload holdings files to many different service providers to enable linking.
- For library managers: SFX is well positioned to capture and report on a wealth of statistics on the use of distributed resources.

SFX for Users

The benefit of SFX for users reaches way beyond the desktop delivery of the full text of an article when available electronically. SFX expands the research horizons of the user and helps them navigate effectively through the library's e-resources without having to retype and reenter searches.

Furthermore, with SFX, links are presented to users in a consistent manner across information resources and will lead users only to relevant resources and specifically those resources to which the user has access rights.

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SFX for Information Providers

SFX provides the necessary breakthrough for information providers who wish to fully integrate their information resources into their customers' overall information services. Depending on the nature of the services offered by an information provider, a resource might become the source or target of SFX links or both. As an SFX source, through the implementation of the OpenURL, information providers do not need to manage linking for each library, but rather allow libraries to add their own customized linking services.

Because SFX is a fully dynamic service component, no precomputation of links is needed. Simple methods of implementing the OpenURL are available that do not require any redesigning of applications or services. According to Crawford,[10] Senior Analyst at RLG, ''If properly implemented, OpenURL is a win-win situation. Good abstracting and indexing services become valuable by linking to local resources. Licensed resources and print holdings see more use because the link from the identification to holdings is fast and easy. None of this requires fancy new numbers; the information is already there—ISSN, journal and article titles, year, volume, and so on.''

Furthermore, by also incorporating their resources into the OpenURL/SFX linking framework as targets of SFX links, information providers will also see an increase in traffic to their sites.

SFX/OPENURL VS. CROSSREF/DOI LINKING

SFX linking as a library-initiated service and CrossRef as a publisher-initiated linking service both provide for improved user navigation through heterogeneous resources, yet are entirely complementary technologies.

CrossRef is offered by the Publishers International Linking Association (PILA) and was started in January 2000 by 12 major publishers to enable linking between their resources. CrossRef now has 275 member publishers—a remarkable achievement for the publishing community. CrossRef is one of the registration agencies for the International DOI Foundation (IDF), which means that CrossRef, on behalf of its members, is authorized to register unique and persistent identifiers—Digital Object Identifiers (DOIs)—for scholarly material.

Journal publishers participating in CrossRef are assigned a unique DOI publisher prefix so that a DOI is unique across publishers. The publisher assigns a DOI to each article they publish. This DOI, together with basic metadata, is deposited in the CrossRef reference database, and the central DOI resolver is notified of the location of the article—typically the publisher's own Web service or one operated on their behalf, e.g., by Highwire Press or ingenta. In addition, as part of the publication process for new articles, the metadata for each reference in the article is used to query the CrossRef database. Where a match is found, the DOI is retrieved and inserted as a CrossRef link in the article reference. This provides for a potentially very effective linking system.

Users finding a CrossRef link, for example, in a cited reference for an article, will be able to link directly to the full text of the cited article. The publisher of the article referenced determines the location of the article to which the user will be linked. This would not be a problem if there were only ever one possible service—the publisher's own—where such full text could be found. As previously mentioned, alternatives are quite possible, both in terms of alternative versions of the electronic material and in terms of other manifestations of the work.

Because all CrossRef links go through the centralized DOI server, this server can detect whether or not a user clicking on a DOI (typically presented to the user as a ''CrossRef'' link) is a user from an institution with an SFX link server. If so, then the link would not be resolved by the DOI handle resolver, but rather by the institution's own link server. As the link server has knowledge about the library's collection, only relevant links would be presented to the user and all such links would resolve to the ''appropriate'' copy or service.

Underlying this simple concept is a reference database lookup. The link server receives an OpenURL (from the DOI service) that contains only a DOI identifier. To deliver services, the link server needs metadata and so retrieves this from the CrossRef database.[11]

SFX and CrossRef are complementary in another dimension. Some primary publishers require SFX to use a DOI for inbound linking to the article level. However, the DOI is not always available on the OpenURL received by SFX from the source. In such cases, SFX can perform a database lookup on CrossRef using article metadata to retrieve the DOI that it can then use to generate the link to the article.

CONCLUSION

SFX linking enables new types of services for libraries and has been extremely well received by the library community. With SFX, a librarian can determine which resources to include in their interlinked environment and how best to link these. Librarians are free to use predefined SFX services or to create their own services, e.g., to link to a local data repository such as an electronic theses and dissertations database. As new services become available from the service providers, these can also be configured.

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While SFX puts linking under the control of the library, in the real world, linking can be under the control of any—or all—of a number of different stakeholders and not just the local library. Link servers are now developing to accommodate a range of different environments in which rights evaluation can be determined in a distributed manner by the appropriate authority. Such distributed authorities could include the local library, the library consortium, and potentially other third-party providers with whom the library has contracted. SFX servers could, for example, communicate with each other—server to server—to evaluate the generation of a unified set of services based on the user's rights as a member of a local institution as well as the rights the user has as a member of a much larger consortium.

Recent developments in the industry will allow for more in-built intelligence in the delivery of services to individual users or a group of users. Such developments include:

- OpenURL v1.0, which provides the means to describe additional information about the context of the request, particularly who made the link request.
- Shibboleth, the Internet2/MACE initiative, provides for the infrastructure and the system that supports the release of attributes for a user under the control of the institution. SFX servers are well positioned to take advantage of such attributes in the delivery of services.

These and other developments will continue to transform the linking landscape in the coming months and years.

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Special Libraries in the UK

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INTRODUCTION

The special library sector in the UK is elusive. At first glance, it would appear to be a fairly straightforward proposition to review. A few years ago, a study of the combined memberships of the Association of Information Management (ASLIB IMI) and the Institute of Information Scientists (IIS), with some of the then Library Association (LA) special interest groups, would certainly have given a reasonable, although not complete, overview of the range and diversity of the mainstream of special libraries in the UK. The IIS was certainly regarded as the main professional association for special librarians in the UK and membership conferred suitable professional status.

In 2003, the LA and IIS merged. The IIS was amalgamated within the new association, now known as the Chartered Institute of Library and Information Professionals (CILIP), creating one main professional body for all library and information professionals in the UK.

THE PROFESSIONAL ASSOCIATIONS & SPECIAL LIBRARIES

Several special interest groups of CILIP now represent groups of special libraries and information units. Two IIS interest groups, which represented particular aspects of the special library community, became part of the new CILIP—the Patent and Trade Mark Group and the UK Online Users Group (UKOLUG). These have directly accommodated some of the former memberships of the IIS. There were also several interest groups of direct relevance and a mainly special library membership within the old LA structure—the Health Libraries Group and the Industrial and Commercial Libraries Group (ICLG), which incorporates an Aerospace and Defense Libraries subgroup. But, a significant group, the City Information Group (CIG), with a large membership, which was part of the old IIS, did not choose to become part of CILIP and now it is necessary to study their structure and composition separately. CIG represents a large and diverse group of professionals, with a core membership in the financial services sector, and now describes itself more generally as a ''networking group of 800 business information professionals working in London.''[1]

There is no information available about how many of the old IIS memberships declined to join CILIP and so how many disappeared into other associations, or are no longer represented at all as special librarians.

THE STATISTICAL PUZZLE

Consulting the latest (2002) annual Library and Information Statistics Tables for the UK[2] is also very disappointing from the perspective of learning more about special libraries. These are the only overall statistics on library and information services (LIS) available and neglect special libraries. The only idea of the sector is included in ''The Library Profession by Occupation,'' where there is a breakdown from the LA and IIS, which had not merged to date, and includes only four categories that could possibly include special libraries roughly indicating around 3000 members. These are industry/commerce with 1531 individual members, government with 977, medical/hospitals with 919, and independent consultants with 243 (only some of which will be involved in the special library work). These figures would appear to indicate that special libraries are either a very small sector in the UK, or are very poorly represented by CILIP members.

There is also difficulty in compiling, using, and analyzing LIS statistics from the various associations discussed in this paper in that it is difficult to differentiate between those that have personal memberships and those with institutional memberships.

DEFINITIONS

In some ways, it is much easier to define what types of libraries are not represented by the term ''special libraries'' in the UK, rather than what are, as Spiller[3] points out in a paper in 1999 on library statistics. This definition by elimination indicates that a special library in the UK is any library or information service that is *not* a public, academic, school, or national library. These types of libraries make up significant sectors in themselves in

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the UK and are not normally thought of or understood as being special libraries in most of the recent literature, or by various associations or interest groups.

Looking at other UK associations that could always definitely be regarded as representing special libraries (ASLIB IMI), the composition is one of organizations and enterprises, rather than personal members. The focus of the association has changed and it now makes no attempt to define the term ''special libraries,'' rather describing itself as ''a world-class corporate membership organization with over 2000 members in some 70 countries. We work with a wide range of organizations worldwide, promoting best practice in the field of information management.''[4]

Studying the current membership list of ASLIB IMI, the association is now actually heavily representative of an international academic library sector, with the special libraries of the private and nonprofit sectors representing a much smaller proportion of the total membership today. The academic library sector is also well served and defined by the Society of College, National, and University Libraries (SCONUL), which represents LIS in universities and higher-education institutions funded by one of the UK's higher-education funding bodies, and the national libraries, which are either officially designated as such or approved by SCONUL's Executive Board and General Meeting, and are not generally regarded as part of the special libraries sector in the UK.

CILIP describes the main library groups in the description of its role as ''the leading professional body for librarians, information specialists, and knowledge managers, with over 23,700 (personal) members working in all sectors, including business and industry, science and technology, further and higher education, schools, local and central government, the health service, the voluntary sector, national and public libraries.''[5]

In a recent CILIP publication ''An Investment in Knowledge: Library and Information Services in the United Kingdom'' in 2002 by Villa,[6] special libraries are included in a group described as ''workplace libraries'' and are described in a short paragraph in a long report, which focuses on the three main library types: public, academic, and national libraries. The term ''workplace libraries'' seems to have been adopted by CILIP since 1999 to describe any other libraries and information units that do not fit into these three main categories. CILIP broadly estimates that there are over 10,000 of these libraries in the public and private sectors and this number has remained unchanged since 1999. Workplace libraries are defined by CILIP as special libraries and information services (not defined themselves) serving the special information needs of one organization and focusing on one or two subjects.

There is another complication when attempting to write about special libraries in the UK as a homogenous group. The use of the term ''special collection'' is often used confusingly and interchangeably with ''special library'', which, in fact, on further investigation, usually describes unit that is a mix of library and/or information service with an archive collection of original unpublished documents, with some sort of historical context. In describing these units, the line between libraries and archives becomes blurred. Students and researchers of all kinds regard these collections as a treasure trove and most are accessible to those wishing to use them for specialist research, but they cannot be regarded as in the mainstream of special libraries A good example would be the cathedral libraries located in the cathedral cities throughout the country. These types of libraries or collections will not be considered in this paper as special libraries.

An area that is very interesting and that will be discussed is that of several sector-based groups and associations, all of which have a membership of a group of professionals who work in research and information-related fields, but none of which can be said to be truly representative of a group of solely special libraries in the UK. They also do not fit the ''workplace libraries'' description. These are described in this paper below as the hidden community of special libraries.

MAINSTREAM SPECIAL LIBRARIES

For this survey, five groups of what could be classed as the ''mainstream'' special libraries will be described, as they seem to be the most representative view of the sector. These are the LIS in the business, government, medical, scientific, and technical fields and a set of LIS representing the not-for-profit voluntary sector.

BUSINESS LIS

There are two distinctive types of business LIS that are evident in organizations in the UK: corporate and advisory. An interesting recent study of mainly business LIS services and related areas, such as media and legal, was conducted by IRN Research and published in April 2003.[7]

IRN selected a set of the seven leading professional associations and groups that could be considered as a whole to represent this area of LIS. Some have already been described above. These were:

ASLIB Economics and Business Information Group (AEBIG)
Association of UK Media Librarians (AUKML)
Business Information Northern Network (BINN)

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CILIP
CIG
City Legal Information Group (CLIG)
Special Libraries Association (SLA) (of the United States), European Chapter.

All these associations have websites, with varying amounts of detail about their membership. BINN, CIG, and CLIG are geographically based and the European Chapter of SLA represents around 100 special librarians in the UK as part of a very large geographical region covering all the countries of Europe. AUKML is the only sector-based association in this group.

Unfortunately, there is no information in the survey about the total number of either individual professionals or organizations represented by these organizations. The survey mainly concentrated on the information services used and changes taking place, rather than making any detailed investigations into the constituents of the whole community, but it is a very useful snapshot of business information services as they exist today in the UK.

CORPORATE LIS

Corporate LIS is the business information service that exists in companies, and it is very close to the CILIP description of workplace libraries above. This LIS provides an internal service designed for the individuals within the company and specializing in providing business information service that covers mainly company information provision with a focus on research into the industrial and market sectors of the company. The ''library'' part of the unit description for this group has virtually completely died out, and the services that do still exist are mainly inquiry and research-based, with few remnants of a traditional library service left. Some also provide an information service for external clients of the company.

Many were originally set up as parts of the corporate strategic planning initiative and have now developed more as competitive intelligence units, rather than as an enhancement of the traditional, centrally based print-dominated library, which was either never developed for the company, or phased out many years ago. Others have always been part of marketing departments or sales support functions used to help identify new business opportunities.

The number of these types of business information units has declined quite dramatically over the last 20 years. They have often been the first casualties in costcutting or downsizing exercises, and have generally only survived in any recognizable form if they have been part of a profit-making unit or linked in some way to senior management functions. Business information functions are also sometimes amalgamated with scientific and technical information service if that existed in the company, or may have always been a part of the main research and development (R&D) function in companies based in manufacturing.

This gloomy demise had long been predicted in the UK. What came to be known as the ''Doomsday Scenario'' was an influential paper written in 1977 by a British corporate librarian, Lewis,[8] who went on to head ASLIB IMI. The message of the paper was ''There Won't Be an Information Profession in 2000 AD'' and it was much discussed and debated at that time.

The prediction had really come true to a certain extent during the 1990s in the UK, even before the impact of the Internet and the fallacy that everyone in any corporate environment could be their own competent researcher. Lewis had been writing and speaking about the corporate libraries he then knew well, which were very strongly representative of the special library sector in the UK. These LIS were, of course, as we recognize now, very traditional, almost entirely print-based, and very expensive to maintain. Online database usage had then hardly made any impact on their work. Nevertheless, Lewis was right; corporate information centers and libraries run as a central resource had almost died out by 2000.

There is one other possibility that has made these corporate business information centers virtually nonexistent in the UK in 2003, which would have been very difficult to foresee. This is the rise of the influence of advisory firms in the corporate boardroom during the 1980s and 1990s. The general move during these decades was toward company growth through mergers and acquisitions. Corporate organic growth, developing products and services internally from inception to market that had become the normal corporate strategy for companies in market economies post World War II, began to disappear in a wave of takeovers. Advisers such as investment bankers, strategic management consultants, accountants, and lawyers became essential in the mergers and acquisitions process, and also took over a proportion of the investigatory and due diligence work that might have been done in the past as an in-house process and so required a dedicated special library. The information work was, in fact, transferred to the special libraries in the advisory sector, which would work for the ''deal makers.'' They quickly became the dominant type of special library specializing in business information in the UK from the mid 1980s to date.

This shift was also clearly indicated by the demise of the main professional body for corporate librarians and information professionals in the 1990s—the IIS—as described above. The very name ''information scientist'' suggested a specialty in scientific information work, rather than that of business or general corporate information

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services. The CIG special interest group, which represented many of the professionals in the special libraries of the advisory firms, grew substantially. Members of CIG, although affiliated with the IIS, were not required to become full members of the institute and presumably saw no benefits in joining the IIS and consequently decided not to become part of the merged CILIP.

BUSINESS INFORMATION UNITS IN ADVISORY FIRMS

The growth in the number of these special libraries has been noticeable in the last two decades in the UK, for the reasons cited above. They had hardly been envisioned in the late 1970s when Lewis made his prediction.

These special libraries are located in the companies of the financial services sector, particularly in the various sections of investment banks and in other advisory firms, such as the management consultancies, accountants, and corporate lawyers. They can be large departments, often with over 10 professional staff and several unqualified assistants. They are geared toward providing a value-added information service to a wide range of professionals, often across several countries and time zones, and are expected to provide an information service covering many different industrial sectors. They often work directly for the client companies that are being advised, through the principals of the firm who are assigned to the corporate client. Some even work at the client site, in the companies themselves, on specific projects alongside other professionals.

However, even these advisory companies are finding their revenues cut as the very activity; mergers and acquisitions deal activity, which brought them to their very prominence in the corporate world, declines dramatically and corporations cut back in the latest economic downturn, so these special libraries are very much under threat and are being downsized in their turn.

GOVERNMENT LIBRARIES AND INFORMATION SERVICES

These LIS represent a significant section of the special library community. CILIP estimates that there are almost 1000 members in this sector for 2001.

Most information about government LIS services in the UK is available from the Circle of State Librarians, which is described as ''a semiformal organization run by and for librarians and other information workers from government departments, agencies, and other organizations.''[9] The circle has around 600 individual members, who are encouraged to join from all grades of LIS, and is involved in education and training in government LIS. The circle also represents the professional interests of its members in the government LIS by submitting comments to committees and working groups. There are direct representatives appointed from 20 major government departments and agencies, indicating that these organizations must have substantial LIS units

SCIENTIFIC, TECHNICAL, AND MEDICAL (STM) LIBRARIES

These special libraries are often grouped together in LIS literature as ''STM'' libraries.

The nonmedical/pharmaceutical scientific and technical LIS in the UK are now perhaps the most difficult group of special libraries to track. With the amalgamation of the IIS into CILIP, the main association for these professionals has now disappeared and all that is left are a few specific interest groups such as the Patent and Trade Mark Group and the Aerospace and Defense Libraries subgroup of the ICLG of CILIP that are directly representative of this sector. There is obviously still a community in the UK because the use of the complex online scientific and technical services, such as INSPEC or Dialog, is still evident. The decline in manufacturing industry in the UK and the loss of this economic base have certainly contributed to the decline in the number of LIS professionals in this area of expertise.

It may well be that many of these specialists are now not working in distinct library and information departments, which have long since been phased out in costcutting but are now mainly dispersed throughout their organizations, working with other scientific professionals in teams or on projects. The evidence of this is hard to find, but it would seem to be at least a partial explanation for the lack of hard facts about these special libraries, which were once so significant.

MEDICAL AND PHARMACEUTICAL SPECIAL LIBRARIES

These two types of libraries form a significant proportion of information professionals working in the scientific and technical categories of special libraries in the UK. Represented by several associations, the community is well defined and these associations regard their members as being required to be skilled information professionals in all of the STM areas.

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A group of special libraries that really demonstrates this multifaceted approach is the Association of Information Officers in the Pharmaceutical Industry (AIOPI). AIOPI is the professional organization for individuals in the pharmaceutical industry involved in the provision and management of information. The association was formed in 1974 and now represents over 600 members who work in a variety of pharmaceutical information management roles. Although the majority of members are based in the UK, AIOPI also has representatives from other countries in Europe, North America, and South Africa. The association makes the role of information professionals in the pharmaceutical sector very clear in its General Information Booklet: ''Information is vital to the pharmaceutical industry and AIOPI members play a critical role in managing proprietary and publicly available information and making it available in the right format at the right time for the business. The role of an information management professional is a dynamic and varied one, providing a valuable service to customers and company personnel.''[10] AIOPI members are also often very involved in the provision of business information in their departments and provide a very good example of special libraries that can be considered to be in both of the main groups. They are possibly the only truly thriving examples of corporate special libraries left in the UK.

An important group of medical libraries that is part of the National Health Service (NHS) is known as the NHS Regional Librarians Group, which is soon to be replaced by a new identity—the National Health Service Library and Knowledge Development Network. The NHS Regional Librarians Group represents around 400 NHS LIS in all regions of the UK. Their main aims are to improve the quality of NHS library services information, influence policy makers, and ensure the best possible access to the knowledge base of health care.

NOT-FOR-PROFIT VOLUNTARY SECTOR

There are a relatively small number of special libraries in the not-for-profit voluntary and social welfare sector. Good examples would be the nationally and regionally based LIS in the social welfare agencies, such as the National Society for the Prevention of Cruelty to Children, the National Children's Bureau, the Policy Studies Institute, and the London Voluntary Services Council. These libraries have a range of ''free'' and fee-earning services. The special libraries in these organizations have always varied in size and distribution, depending on the limited funding available, and often have an important role in providing external information service for various types of users.

SPECIAL LIBRARIES HIDDEN COMMUNITIES

There are many professionals who could be described as being part of the special library community in the widest sense, but are rarely recognized or described as such in LIS literature and constitute what might be described as the hidden communities of special libraries.

There are many who are affiliated with information technology (IT) professionals and yet are much closer to special libraries and their work, rather than the mainstream IT world, than would appear at first glance. These would include all the management and professionals connected with Internet and intranet content, and the knowledge managers and specialists developing expertise collections in companies. These professionals are even harder to identify and quantify into cohesive groups than the mainstream special libraries.

Another unquantifiable group is composed of ''analysts'' who evaluate and analyze published information in any way within an organization. These are often found in corporate marketing departments among professionals who are involved in commissioning and using primary market research. These analysts have to have a very good command of secondary market research information sources and services. The group also includes competitive intelligence professionals working in companies, analysts in professional and trade associations that may analyze specific sectors, analysts in all kinds of directory publishing companies, and many researchers who work for trade press publications. Some may belong to the professional LIS associations, but it is likely that the majority do not.

Many managers of special libraries in the private sector are also involved in the management of purchase of information services for the whole organization and often command significant budgets for this expense as it may require purchasing of global contracts. A good example would be members of the Information Providers User Group (IPUG), an organization in the UK representing users of market data services on technical, administrative, and strategic levels. Some of these market data professionals from London's major investment banks and investment management firms may be special librarians involved in contract management of these services. IPUG's goal is to represent the current and future interests of member firms by forging relationships with industry suppliers, IE market data vendors, consultants, and stock exchanges.

Another good example of the hidden community would be the UK Executive Research Association (ERA), an association for researchers in the Executive Search industry. This group could be classed as business LIS, but there is very little common membership of this group and any of the other LIS associations, and few would be

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qualified as information professionals in having a first degree or postgraduate degree in librarianship and/or information science.

Lastly, there is what could be described as a further hidden community of units and groups within organizations that could well be seen to represent some groups of special libraries in the broadest definition of the sector. These can be difficult to identify because of the diversity of the job descriptions and functions from organization to organization. This hidden community includes specialists working within the information vendor companies, who have specifically been recruited to provide services to special libraries and are often professionally qualified, but are certainly not working in a recognized LIS unit.

CONCLUSION

This paper is an attempt to describe the overall range and types of special libraries in the UK from very limited sources and data. The overall picture is fragmented and no one professional association represents the majority of professionals in the sector.

It is clear that there are still substantial numbers of professionals working in a wide range of dedicated units in the private sector, government, and the not-for-profit areas in units that can be described as special libraries. The two main areas of business information and scientific/technical and medical information services are still dominant. The much quoted number of around 10,000 ''workplace'' LIS estimated by CILIP seems to be an entirely possible estimate of the number of distinct and discrete units there might be in the UK. However, if the hidden community that is suggested in this paper is also taken into account, then the actual numbers must actually be much larger. This number probably also does not take into account qualified information professionals who might be working alone in an organization, with no formal LIS and who do not affiliate with any professional organization.

Some of the groups of special libraries appear to be thriving and will obviously continue to develop, despite the gloomy predictions of the past and generally poor economic conditions.

Most of the information about the mainstream special libraries is to be found in the data supplied by the various associations and interest groups that represent special libraries in the UK that have been mentioned in this paper. A study of any of the websites of these groups will give a very good idea of the concerns and areas of interest currently exercising the membership. However, it must be understood that these associations do not represent anything like the whole community of what might be classified as special libraries, and in a rapidly changing world of information in the widest sense, it will always be difficult to track and describe those working in every area of the sector.

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Student Outcomes Assessment

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INTRODUCTION

Student outcome assessment is a process of documenting, measuring, and describing student learning in ways that focus on learning expectations. Outcome-based assessment has distinct advantages for students, for faculty, for programs, and for institutions, yet there is both resistance and misinterpretation of the approach. For some educators, outcome-based approaches to education and assessment ''give an image of a factory model in which something is produced rather than developed.''[1] For many faculty, fear may be the underlying factor in their resistance—fear of how assessment information will be used. For others, outcomes provide clarity of expectations for students and faculty, direction for curriculum and pedagogy, a basis for decision making at multiple levels, and accountability for programs and institutions. In the current climate of calls for greater accountability and a newly conceptualized focus on student learning as academic currency,[2] student outcomes focus assessment on what graduates have learned. With the realization that ''good assessment of students' knowledge, skills, and abilities is absolutely crucial to the process of learning,''[3] student outcomes assessment provides an approach that is practical, useful, and supportive of teaching and learning processes.

DEFINITIONS AND EXAMPLES OF STUDENT OUTCOME ASSESSMENT

At this point, specific definitions of key terms in student outcome assessment are necessary. The definitions will be accompanied by examples from California State University Monterey Bay (CSUMB), an outcome-based educational institution. First, a distinction must be made between assessment and evaluation. Assessment is the process of gathering evidence or data to determine whether and what students have learned. Using assessment information, faculty and others make judgments and decisions about learning, e.g., pass/fail, grades, graduation requirements met or not. That step is evaluation.

An outcome-based approach to assessment of student learning typically has the following specific components: *outcomes*, *evidence*, *criteria*, and *standards*, and each of those components must be defined by those who will use the assessment. At CSUMB, the components form *assessment protocols*. Those protocols offer a consistent or coded format of information about each outcome. The section that follows provides definitions of each component, generic definitions that will be useful to any institution (Fig. 1).

Outcomes refer to results in terms of student learning, development, and performance.[1] Outcomes answer the question, ''What do we expect of our students?'' At CSUMB, outcomes describe actual skills, understandings, behaviors, attitudes, and values students are able to demonstrate at the completion of the learning processes. An example of an outcome from CSUMB's general education goal of informational literacy is as follows:

Students will be able to describe and categorize the basic types of information resources available for a single topic.

Once an outcome is developed, it is important to design and describe the kind of student work that will allow students to demonstrate achievement of the outcome. Such student work is referred to as *evidence* and it may include papers, projects, presentations, exams, and other forms of assignments. For the previous outcome example, the evidence required of students is as follows: an electronic document containing:

A statement of the topic
A list of information resources related to the topic
A profile of resources that includes type of resource (encyclopedia, dictionary, almanac, directory, newspaper, book, magazine, journal, web site, and other media) and a short sentence explaining its function and scope

Once the evidence has been prescribed, it is important to articulate and describe the *criteria* that will be used to judge the evidence. Criteria are those qualities desired in student work. As such, they represent powerful professional judgment of faculty and support objective evaluations of student work. Students who receive criteria in advance of producing their evidence are more apt to self-assess their own work before submitting it for evaluation.

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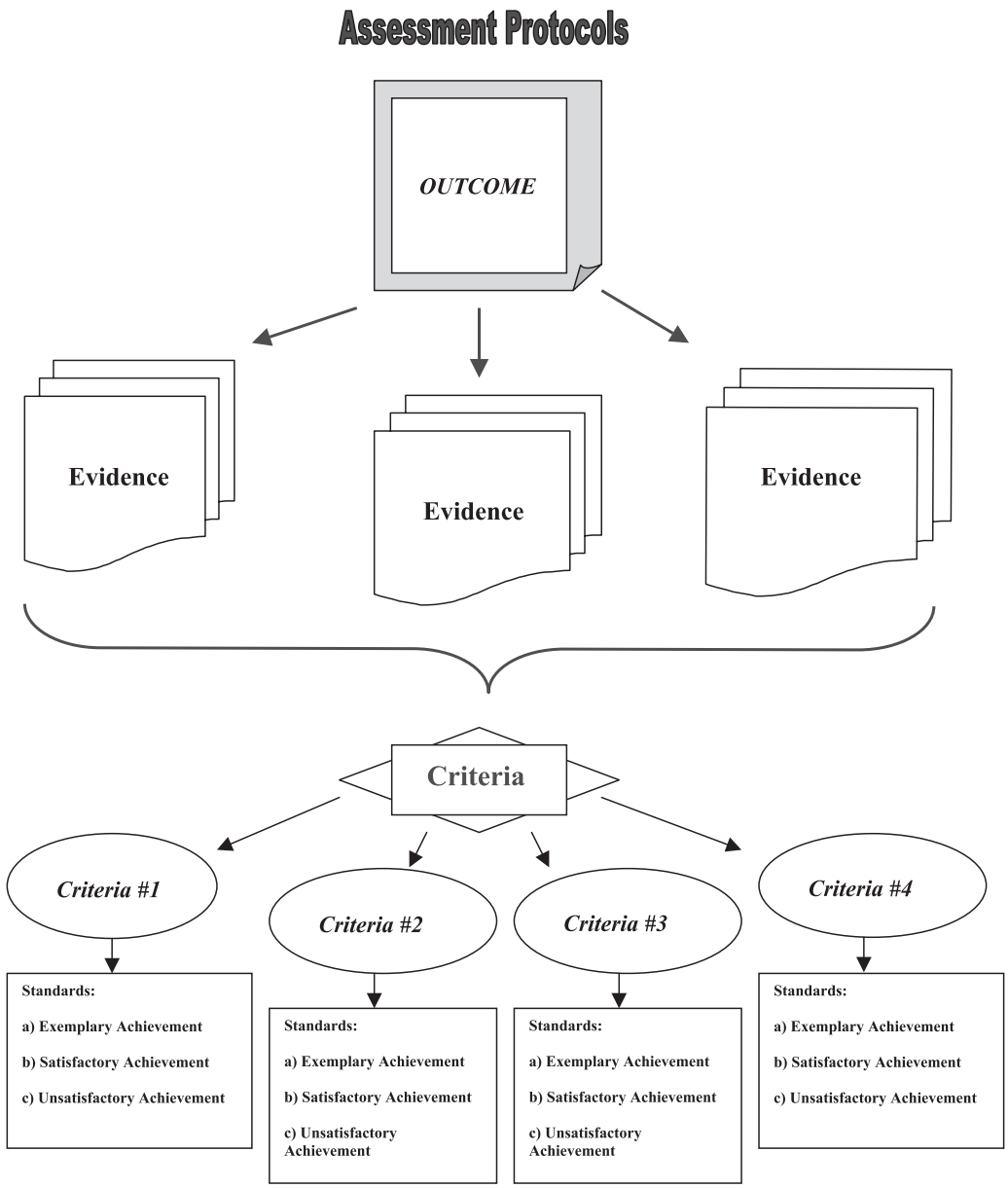

Fig. 1 Assessment protocols. *(Go to www.dekker.com to view this figure in color.)*

Some examples of criteria for the information technology outcomes are ''breadth of understanding,'' ''written effectiveness,'' ''relevance,'' and ''completeness.''

The final component, *standards*, describe levels of achieving criteria and provide specific indications of criteria. Standards are important because criteria are subject to multiple interpretations by both faculty and students. Without a specific description of a criteria, there could be misunderstandings and faulty interpretations, thereby jeopardizing student success. The example that follows is connected to the outcome and evidence previously stated and to the criteria of ''breadth of understanding.''

Standards for satisfactory achievement of criteria ''breadth of understanding'':

1. The list and profile will include at least six potential resources with at least four different types represented.
2. The list and profile will include an explanation of why each resource is appropriate for the given research topic and question.

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3. A description of the main idea to be addressed by the specific resource.

Sometimes, standards are provided for multiple levels: exemplary, satisfactory, and unsatisfactory. They provide supportive guidance to student learning efforts and continue to promote objective evaluations by faculty.

The full example that follows illustrates all of the essential components of a student outcome assessment protocol (Fig. 2).

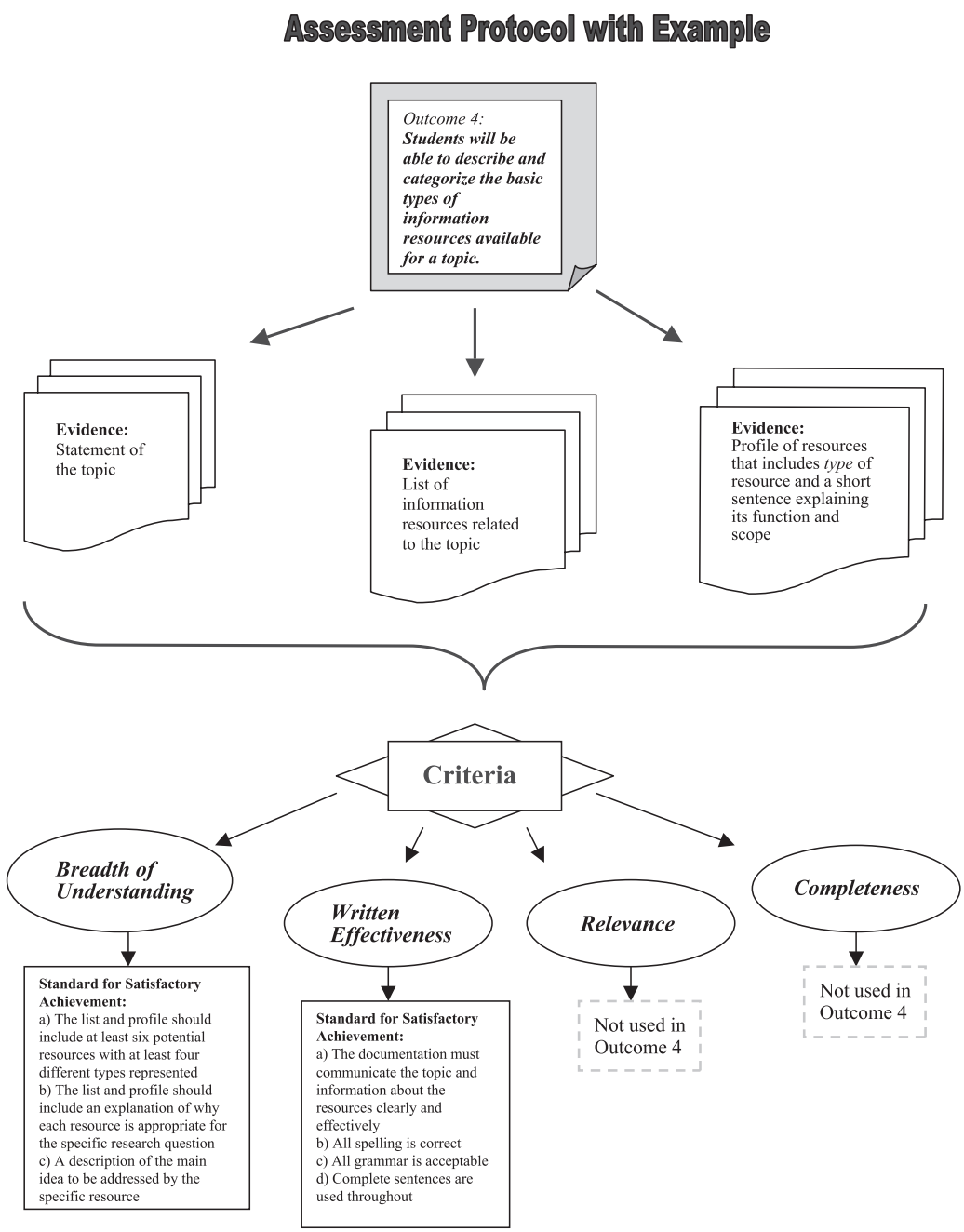

Fig. 2 Assessment protocol with example. *(Go to www.dekker.com to view this figure in color.)*

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IMPLEMENTATION OF STUDENT OUTCOMES ASSESSMENT

Developing the assessment protocols is a powerful learning experience for faculty. They begin by considering the knowledge base related to the outcome, often from a disciplinary perspective. National or state or disciplinary standards are consulted. As they contemplate clear expectations of student learning (outcomes), faculty reflect on both curriculum and pedagogy. They must be certain that teaching and learning experiences are aligned with the outcomes to promote student success.[4] From there, the discussion of appropriate evidence comes easily for faculty. The faculty at CSUMB has a commitment to meeting the needs of diverse learning styles and assets-based pedagogy, so students typically have choices of evidence. The student who struggles with written communication may choose to make a presentation or a graphic representation of a concept, whereas the student who writes well may choose to produce a report or a paper.

For many faculty, the process of articulating criteria is unique especially in collaboration with other faculty. Faculty ''carry criteria around in their heads'' and use them when it is time to evaluate and grade papers or projects. The process of using criteria is sometimes a conscious process and sometimes not so conscious, but it is almost always a private process. One faculty described it as ''pretty much an internal process, usually my inner voice tells me about the quality of student work and I have my own little formula for assessing the quality and computing and giving grades.''[5] It is a process prescribed for the current emphasis on authentic assessment by educators like Tom Angelo. He urges faculty to shift from ''a culture of implicitly held individual hopes, preferences, and beliefs to a culture of explicit, broadly shared goals, criteria, and standards.''[6] Teacher collaboration around criteria also addresses the concern over inconsistency of faculty judgments with respect to evaluation and grades. The ''lack of communication'' among faculty about criteria and the ''prevalence of inconsistent assessment of student work is an extremely widespread phenomenon leading to a distrust of grades as a credible metric of actual student achievement.''[7]

Advantages of Student Outcome Assessment

As noted in the introduction, student outcomes assessment has distinct advantages for all of the constituencies of learning institutions—for students, for faculty, for programs, for colleges and universities. It has advantages as well for external constituencies—families of students, community, legislators, supporters, and other institutions.

When student outcomes are provided with clarity and in advance of instruction, students are able to direct their learning efforts to those expectations. Outcomes provide security for student learning efforts and enhance motivation by providing direction for those efforts. With outcomes, students can make decisions about their learning—where to put their efforts, how to prioritize their studies, and so on.

For faculty, student outcome assessment focuses both curriculum and teaching on those expectations. There is increased clarity about student progress and completion when determined by achievement of learning outcomes. Lee Shulman[8] described another advantage of designing outcomes collaboratively among teacher groups with ''a shared sense of outcomes frees up instruction for inventing, creating, and constructing new forms of pedagogy.''

For programs, student outcome assessment provides information to evaluate effectiveness and make improvements. The gaps or strengths in student outcome evidence often direct decision making for budgetary allocations, faculty time, course development, and additional assessment. For institutions, student outcome assessment ensures and enhances accountability. Student outcomes provide a profile of the graduates of a college or university, yielding information for accreditation, advancement, recruiting, and overall improvement.

For those outside the institution, student outcomes assessment provides information often sought by parents or family members of students. It responds to curiosity, criticism, or specific calls for accountability by the external community. On some campuses, the outcomes are collaboratively developed with community partners, or reviewed by potential employers. Many outcomes reflect the current needs of today's work force—collaboration, technology, critical thinking, and communication. The advantage of such reflection is that employers of alumni are able to provide specific feedback to institutions about the effectiveness of educational programs.

Student outcomes assessment has an additional advantage in that the articulation of outcomes sets the stage for ongoing assessment processes that ultimately lead directly to improvement of teaching, learning, and programs.

Continuing Assessment Processes

The development process of articulating outcomes, evidence, criteria, and standards is but a first step in a cycle of continuing assessment processes. Once developed, the information of the assessment protocols is made ''public and visible'' for students and others through course syllabi, program brochures and web sites, and other forms. At the point in which assessment protocols are well established, available, and embedded in courses, it is

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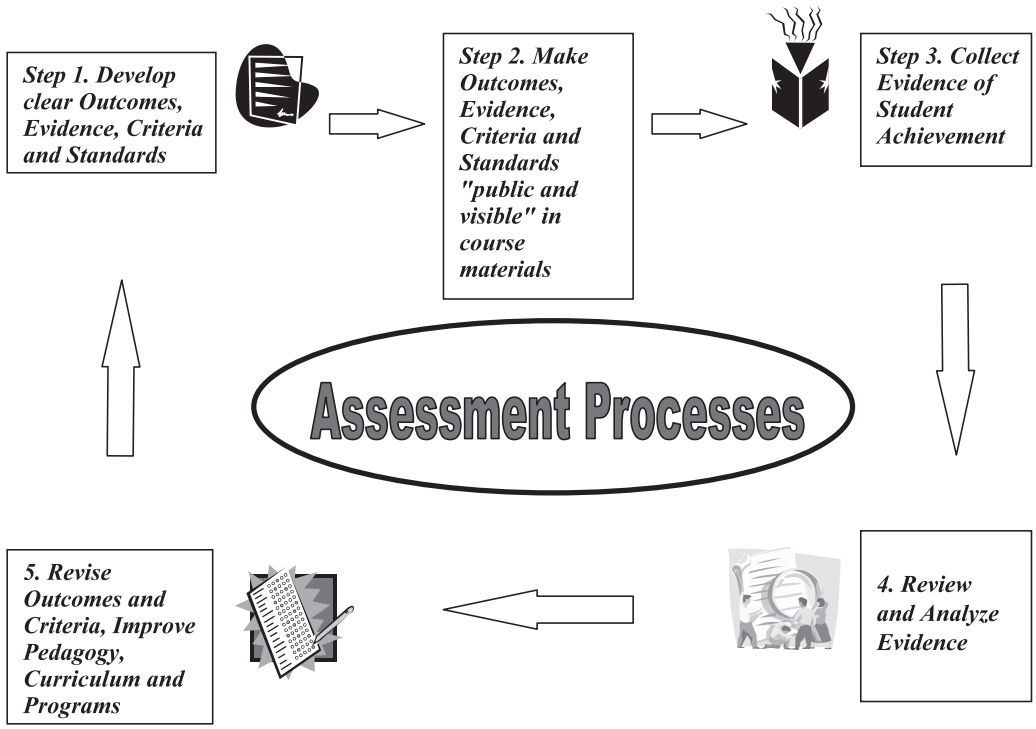

Fig. 3 Assessment processes. *(Go to www.dekker.com to view this figure in color.)*

important to collect evidence of student achievement of those outcomes.

It is not necessary, however, to collect evidence from every student to determine whether students are achieving outcomes. On many campuses, faculty collect representative evidence, i.e., samples of excellent work, samples of satisfactory work, and samples of unsatisfactory work. From there, a collaborative process is essential. Faculty gather to review samples of student work and analyze the evidence with the following steps:

1. A holistic reading to determine whether faculty agree that students have achieved the outcome, a kind of reliability check.
2. A set of successive readings to identify examples of the criteria, a kind of reliability check.
3. A final reading for insights about pedagogy and curriculum, and for program implications.

This review and analysis process is another powerful learning experience for faculty and one that leads to significant improvements. The process often reveals the need to revise outcomes and criteria, to add specificity to the evidence description, or to adjust the standards. Ultimately, it leads to clarification of all components of the assessment protocols. The process also contributes to improved alignment of assignments and assessment with learning outcomes. The collaborative review process consistently leads to improved teaching, programs, and ultimately, student learning, as faculty critique and contribute ideas about pedagogy and curriculum. It is truly a constructivist process in that faculty ''make meaning'' of student outcomes assessment by analyzing student work.

The cycle above illustrates the processes just described for collection of evidence, review of student work, and use of the findings for improvement (Fig. 3).

CONCLUSION

Student outcomes assessment is an approach to teaching and learning that requires extensive time and commitment as well as new understandings and intense involvement of faculty. There are distinct advantages for the internal community—students, faculty, programs, and institutions. Outcome-based assessment also responds to external communities with increased accountability and a description of the value added of a degree program.

Student outcomes assessment enhances learning and promotes authentic educational effectiveness. It does so by providing clear and supportive information for students as they pursue learning and by directing the curricular

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and pedagogical decisions of faculty. It is a promising approach to assessment, one that truly promotes and enhances student learning.

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Trends in Legal Publishing

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INTRODUCTION

Legal publishing, the largest area of professional publishing in the United States,[a] has undergone significant changes in the past several years spurred on by technology, market demands, and the sheer volume of new and revised laws and regulations enacted each year. These changes have affected all areas of the industry including the types of products that are offered, how and when they are provided to the customer, and the relationship between legal publishers and their customers.

HISTORY OF LEGAL PUBLISHING

The Growth of Legal Information

The United States is indeed a nation of laws. And each year, tens of thousands of new or revised laws and regulations are enacted. Consider, for example, the growth of just one area of law: the federal income tax code. In 1913, the entire tax code as well as analysis and interpretation of the regulations could be published in just a single, 400-page volume. Fast forward to 2004: The *CCH Standard Federal Tax Reporter* is now more than 60,000 pages long and includes dozens of volumes to cover the federal tax law[1] (Fig. 1). Multiply this by the thousands of different areas that law covers—family, real estate, securities, etc.—and it is easy to see not only how reliant our nation is on the law but also the challenges this presents for publishers of legal information and the attorneys and other professionals who rely upon these works.

In fact, with the continued increase in regulation, many attorneys today specialize in specific areas of the law, and firms are aggressively looking to expand the number of practice areas in which they can offer service to clients. The industry is also affected by the limited number of new attorneys entering the field. By 2000, the number of attorneys had reached 1.048 million, according to the American Bar Association.[2] However, this figure only increased by 1000 attorneys in each of the following two years. This is significantly different from the rapid increase in preceding years. In fact from 1970, when there were just 326,842 attorneys, to 2000, the number of attorneys increased more than 220%.

In addition to attorneys, customers of legal publishers also include other professionals who must understand and ensure their organizations or clients comply with the appropriate laws and regulations. For example, human resource professionals, accountants, financial services executives, and small business owners all rely on legal and compliance information.

From Print to On-Line

In 1913, the Corporation Trust Company first introduced a loose-leaf service, which was shortly thereafter acquired by Commerce Clearing House (both Wolters Kluwer companies today). Loose-leaf service was considered an entirely new approach in legal publishing as it allowed customers relatively quick access to updated information compared with the months they would have to wait for an updated book or directory. In the 1960s, microforms were first introduced. This helped law firms and law libraries more efficiently manage their ever-growing collection of printed materials. A decade later, aggregators like Lexis, followed shortly by West, introduced computer-based legal research, taking printed information, digitizing it, and making it available and searchable through huge proprietary databases.[3]

These aggregators were among the first commercial companies to make the move to offering products electronically. They did not publish original content, but through licensing content from the original publishers were able to build giant databases of information including court decisions, statutes, laws, rules, regulations,

[a]Legal is the largest segment of professional publishing based on revenue in a SIMBA report (SIMBA Information, Publishing for the Professional Markets 2003–2004, p. 8):

Segment	*2002 Revenue (billion)*
Legal	US$5.33
Scientific/technical	US$4.86
Medical	US$2.40
Business	US$2.41
Total	US$15.00

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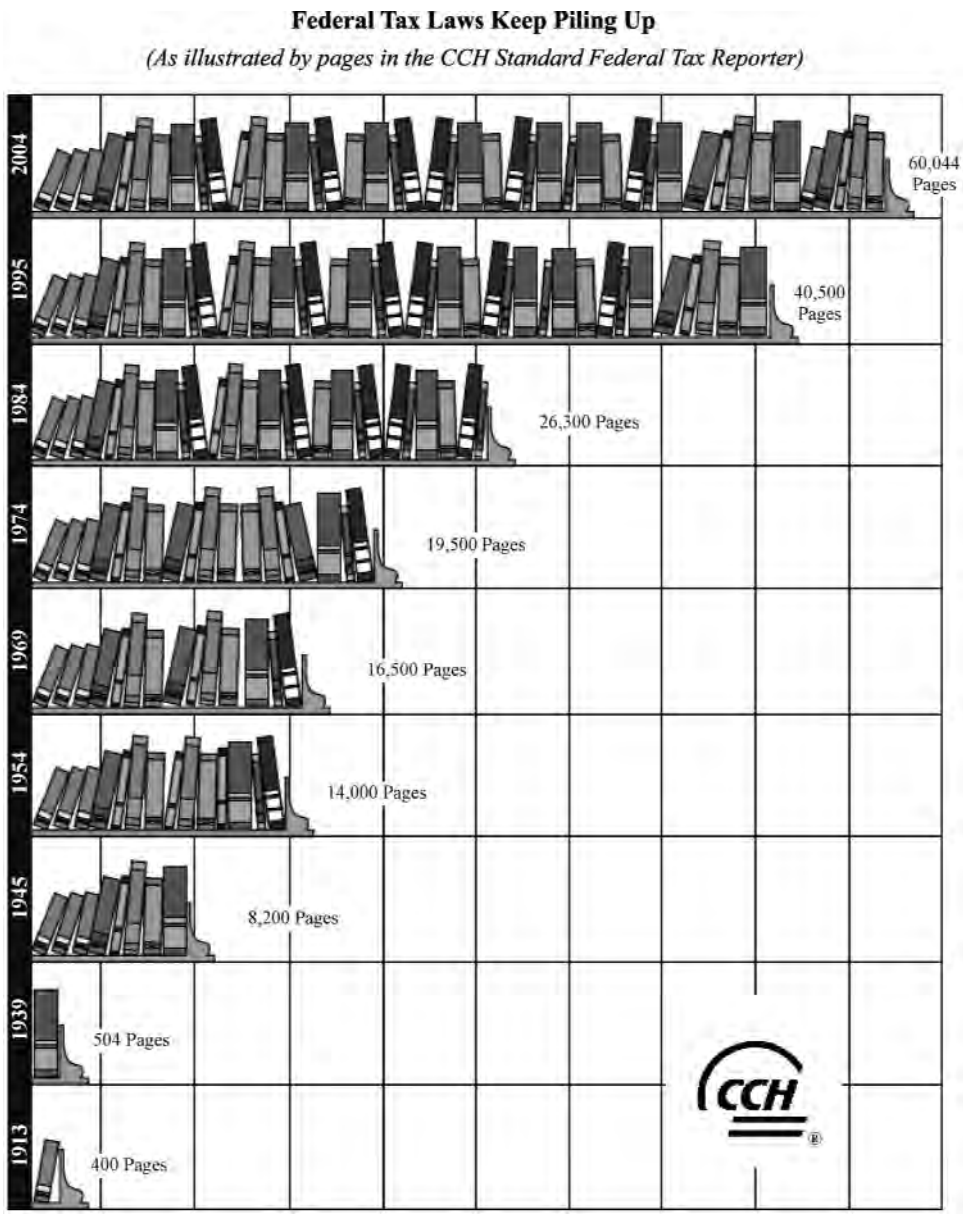

Fig. 1 When the federal income tax was introduced a century ago, the entire tax code as well as analysis and interpretation could be printed in a single 400-page volume. It now takes more than 60,000 pages and dozens of volumes to cover the federal tax law. (From Ref. [1].) (*View this art in color at www.dekker.com.*)

and accompanying analysis as well as treatises, annotations, directories, law reviews, and newsletters.

As the Internet took off in the 1990s, publishers started building their own on-line sites. However, while these sites offered some integration within a particular publishing division, they did not offer integration across a publisher's entire spectrum of products, requiring customers to log on separately to multiple sites, depending upon the type of information they were seeking.

Today, all major publishers recognize the importance the Internet has in their current and future offerings. On-line products now account for more than one-fourth (26.8%) of U.S. legal publishing media revenues[2] (Fig. 2). There is no question that the demand for on-line products continues to grow at a steady nonreversible pace.

Industry Consolidation

Advancements in technology and the need for more content and more integrated content have also been among the factors driving the significant acquisition and consolidation activity in legal publishing during the past

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Fig. 2 While books, loose-leaf and other printed information still hold a substantial role in legal publishing, the demand for on-line products continues to grow at a steady pace. (From Ref. [2].) (*View this art in color at www.dekker.com.*)

30 years. For example, in 1977, there were 23 fairly substantial independent legal publishers.[3] Today, three major legal publishing companies—Reed Elsevier, Thomson Corporation, and Wolters Kluwer—along with a fourth midsize publisher—Bureau of National Affairs (BNA)—account for approximately 97% of the legal publishing industry.[2]

Within each of these companies are multiple divisions and business units focused on different areas of the law with dozens of specialty groups producing hundreds of products for the legal community.

SHAPING THE FUTURE OF LEGAL PUBLISHING

From 1913 to the 1990s, the most significant changes in the industry were likely the introduction of loose-leaf and the move to on-line research databases. Both met customer demands for faster access to information. For example, the ability to conduct searches electronically and gain access to the most current information were the immediate benefits individuals realized from using on-line research.

Now, however, customers want greater functionality and have greater expectations of what can be provided to help them in their legal research and use of legal information. Customers are seeking not only the ability to access content quickly but also the integration of content and content-enabled tools into their daily workflow.

This is both a tremendous challenge and opportunity for legal publishers as they attempt to develop complete and integrated lines of information and invest in the technology formats required to deliver this information to customers how and when they want it.

As publishers respond to customer expectations, among the trends now taking place are:

- Continued demand for more on-line content for legal research;
- Development of new, integrated tools to support customers' workflows; and
- A renewed focus on better understanding customer requirements and their constraints in migrating to digital libraries.

Continued On-Line Migration

Primary legal content—laws and regulations—is now almost entirely accessible on-line from the major legal database providers. Secondary legal content—analysis, treatises, etc.—the focus of publishers like Wolters Kluwer and BNA, is also moving rapidly to on-line formats as publishers identify ways to make it most relevant in electronic form. For example, publishers are taking traditional print books and, beyond simply posting that data electronically, adding links to primary law sources or other tools to enrich the information.

A major challenge for legal publishers, particularly those focusing on publishing primary legal content, has become the increasing availability of free content from other on-line sites. These sites include government entities that pass the laws or regulations as well as associations and trade organizations and general business news sources. As free sources continue to become more sophisticated and widespread, they also become more of a potential threat to traditional legal publishers.

While attorneys today will often turn first to free sites for such tasks as finding definitions of legal terms, gathering initial information on a case decision that was just issued or for preliminary background checks, they are often reluctant to rely on free sites for detail at the heart of a legal matter. For the vast majority of their information requirements, and particularly those most germane to their research, they continue to rely on information provided by the legal publishers.

Integrated Workflow Tools

With the advent of the Internet, the initial focus had been migrating print content on-line. The demand is now growing for productivity tools that actually integrate content into the customer's day-to-day work. For example, professionals want to go from reading about a regulation to filing the forms required by that regulation; they may want a quick answer rather than an in-depth analysis of a law, and they want to conduct searches that

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are best-suited to find the information most relevant to their query.

Publishers are responding with a variety of transaction tools, intelligent tools, and specialty-focused tools designed to meet these requirements.

Forms and transactional tools

While publishers historically have been considered pure content providers, this view has shifted significantly with the advent of the Internet: the market now demands that content is integrated with workflow tools so that a professional can conduct research to understand a law and then immediately launch the form they may be required to file on behalf of their organization or for a client.

For example, some publishers use document systems and decision-tree software to present a set of questions, and, based on the responses the user provides, the appropriate forms are created and completed. Another example could be an attorney responsible for filing a client's forms through the Securities and Exchange Commission (SEC) EDGAR system. Using an integrated publishing system, the attorney can review the EDGAR rules, look up sample filing language, integrate this language into the disclosure he is preparing for his client, and file the form—all from the same system and all within the same workflow.

Answer-driven intelligent tools

In instances where major cases or complicated legal matters are being undertaken, traditional, methodical, and thorough research is essential. However, in many of the situations an attorney encounters, a client may just have a general question that does not need in-depth research for response. Similarly, other professionals, such as human resource executives or small business owners, often face situations where they simply need top-level guidance.

In these instances, rather than conducting an exhaustive database search and wading through the findings, the practitioner can use value-added structured content to find high-level answers to their questions. For example, using a tool like *CCH HRAnswerNow* allows an HR executive to drill down through a question-and-answer format to reach specific answers on issues in employment law.

In addition to these types of ''pull'' tools, where customers go in search of an answer, legal publishers are developing tools that can ''push'' specific, relevant information to practitioners' desktops and into their workflow. For example, more customized intelligent tools can include e-mail alerts to notify customers when a change occurs in the regulations or laws affecting their area of focus. Tools can also be built to inform attorneys of the particular clients that may be impacted by a specific change to a law. This approach allows the attorney to know specifically which of his clients are affected as soon as he is made aware of the changed law.

Specialty-focused tools

Anyone who has conducted a search on a commercial search engine understands that often the volume of information returned far exceeds the quality of information. With millions of pages continuously coming on-line, individuals are becoming inundated. The response from professionals is clear: They do not want *all* the content on a given term or topic. What they really want is the most complete and authoritative information and answers which are specific to their issue at hand.

As a result, one major trend in the last few years has been the emergence of on-line specialty law libraries. In these instances, publishers, rather than simply offering on-line products along their individual business lines, are developing larger single sites that interconnect all the legal content they may produce in a particular area—for example, pension, health care, or securities law—to produce highly specialized sites containing the depth of information practitioners require to research and stay current in their specialty.

Not only is the information categorized into specialties, it generally provides cross references or hyperlinks to other content that is specifically pertinent. This ability to hyperlink and move content around from one product to another to develop customized products is what sets legal publishing sites apart from aggregators' on-line or proprietary databases.

For example, using *CCH's Pension Integrated Library*, a researcher reading a treatise on pension law can directly link to the specific section in the law that a part of the treatise is discussing. Conversely, the primary law also provides hyperlinks to treatise material; hence, a researcher reading the law can quickly link to the treatise for additional information.

Essentially, this takes the searching capability a step further. For example, reading a treatise in print or simply on-line without embedded links to the primary case law would require the researcher to search either electronically or through stacks of printed material for the referenced cases. With embedded hyperlinks, practitioners can easily move back and forth between cases and treatises as they desire.

In addition to developing integrated on-line libraries by specialty areas, publishers can further customize their products based on the particular requirements of an individual law firm. For example, a publisher can now cut across all its content on corporate law to develop a product

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focusing just on corporate law in the state of California for a small, specialized law firm.

Knowledge management tools

As legal publishers continue to look for new ways to expand their portfolios, some have begun to introduce knowledge management tools. The general premise behind these tools is to build systems that include a variety of materials from a publisher along with a firm's internal working papers, best practice reports, etc. This allows firm attorneys conducting research on bankruptcy law, for example, to have access to both internal and external information from the same site.

While many firms contend that they have been building internal knowledge management systems for years, it is unclear how many will embrace knowledge management systems that include both internal and external information. Currently, such systems are extremely costly and their use is generally limited to the very largest of law firms.

Tools for global practices

Globalization is also emerging as another potential area of growth for publishers as some of the larger firms adopt global practices. While laws remain local in areas such as international mergers and acquisition, an understanding of laws from various countries can be important. Emergence of a growing body of European Union case law is also likely to fuel demand for international legal publishing resources.

The Future of Digital Law Libraries

While books, loose-leaf, and other printed information still hold a substantial role in legal publishing, the growth of on-line content will continue and it will become the predominant medium in the not-too-distant future. However, it will never likely become the exclusive medium.

There is no doubt that the searching, integration, and customization of on-line content holds tremendous value. But there are also inhibitors to on-line adoption, including customer preference, often based on what they are trained to use; expectations or unmet needs; and pricing models customers may feel are confusing or inflexible.

Books remain more user-friendly to many professionals, particularly those 35 years of age or older who grew up reading books and mainly using books in college and law school. Even among younger practitioners, there is a general consensus that books are a better resource in some instances. For example, individuals may be comfortable starting out with a database search within their specialty because they already are familiar with the terms and concepts needed to create good search parameters and form a strong query. However, if it is an area they are not familiar with, they may prefer starting with secondary sources that provide analysis and context to a law. And, often, they may prefer using a book so that they can see the document in its entirety, look at the table of contents, read the sections of interest, and know they have exhausted that resource before moving on to another print resource or going on-line.

As more professionals come to expect the benefits of print to be available in the on-line environment, the onus is on publishers to respond with interfaces that give customers the experience they want.

Effectively pricing on-line tools has been a challenge. Facing pressure from customers, some publishers now allow customers an option between flat-rate or per-transaction pricing for certain tools, while others are experimenting with greater segmentation of content so that customers feel comfortable that they are just paying for the portion of the content they most use.

Licensing issues can also cause resistance to on-line products. For example, a legal publisher may produce a loose-leaf reporter that is updated weekly. An organization purchases a subscription to the reporter. Once the subscription expires, the organization no longer receives updates, but still has access to the physical reporter and past updates it had received. With on-line resources, however, once the license expires, access to all the back information also expires.

While cost and licensing of electronic tools may cause obstacles for some organizations, the cost of real estate is simultaneously putting pressure on firms to move to digital formats. Specifically, as law firms look to further tighten their budgets, some are eliminating or consolidating their libraries to cut down on lease costs.

In the near term, those firms downsizing their libraries are the most likely to undergo a quick transition to a digital approach. For other firms, it will be a slower, evolutionary process. Publishers will continue to offer products in the medium that is most desirable to customers for years to come. As customers become comfortable as on-line tools offer greater functionality and their price comes in line with expectations, the choice will increasingly be electronic formats.

CONCLUSION

The introduction of loose-leaf publishing at the beginning of the 20th century and the advent of on-line publishing at the close of the century were both significant changes in the legal publishing industry. During the next several

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years, the industry is likely to undergo a far more rapid change as technology allows publishers to develop entirely new, integrated, and interactive products.

As many professionals are now discovering, the true value of on-line content is not simply digitizing print formats so they can be accessed on-line, but rather enriching the information and embedding it into their workflow.

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Undergraduate Library Collections

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INTRODUCTION

The undergraduate library is a collection specifically set aside to serve the research needs of undergraduate students. Generally, it is in a building separate from the main research collection. Historically, it is a recent phenomenon, located primarily in the United States within the past 50 years. This article will examine the reasons why this special collection is desired and developed, and continues to be useful in today's hyperinformation-rich culture; and will look at the history, architecture, collections, and services of undergraduate libraries.

BACKGROUND

An undergraduate library's purpose is to serve expressly the needs of students in their first 4 years of college. Although the collection is not limited to resources that are required for an undergraduate education, it is expected that the majority of the student's research needs will be met with finely tuned holdings. Undergraduate libraries are most often found at large research institutions where there are multiple libraries, many of which are highly specialized. In effect, undergraduate libraries are designed to help the inexperienced student researcher find a way through too many research options. According to the American Library Association (ALA), ''as a group, most first-year students share the following characteristics:

1. They do not yet have the sophisticated research skills needed to exploit the research library's potential.
2. They are intimidated by the complexity and size of a large library system.
3. They are often reluctant to ask for assistance in the use of a library.
4. They are unaware of the many services and resources that are available in university libraries.''[1]

Many undergraduates lack research experience and sophistication. Although a small college library is better able to direct users to materials, universities the size of University of California at Berkeley, Michigan, or Harvard are frustrating mazes of multiple libraries that confuse and discourage novice researchers. The undergraduate library makes space for young researchers in a complicated library system.

HISTORY

The yearning for a specialized library serving the undergraduate population is neither original nor recent. In 1601, at the University of Uppsala, Olef Rudbeck proposed a duplicate library for undergraduates. He felt that it ''should be set up in the main building for students who may always use them (the books) there.''[2] Not long after, in 1602, the Bodley Library (precursor to the Bodleian) opened. As early as 1608, the new librarian, Thomas James, inquired into building a special collection to better serve his young clientele. He received this response from Sir Thomas Bodley:

> Your deuise for a Libarie for the yonguer sort will haue many great exceptions, and one special force. That there must be an other keeper ordeined for that place. And where yow mention the yonguer sort, I knowe what books should be bought for them, but the elder as well [as] the yonguer, may hae often occasion to looke vpon them: and if there were any suche, they can not require so great a rowme. In effect, to my understanding, there is muche to be saied against it, as vndoubtedly your self will readily finde, vpon further consideration. (Wagmen.[3])

It is fascinating and telling to realize that the issues of staffing and audience were readily invoked in the nascent history of library management, in the end trumping public service for the presumed lack of funding.

In spite of Thomas James' request for a special collection, early library collections were not concerned with undergraduates. With nowhere near the number of publications that libraries now offer, books were rare, valuable, and not readily available. It was difficult to make books accessible to students, much less have duplicate collections, when folios were chained to the wall to discourage theft. In addition, the pedagogy of the day relied on rote memorization that did not require the use of a large number of books. The emergence of the research university model revolutionized old disciplines. Two countries, Scotland and Germany, developed the

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single-discipline professorial model we know so well. The advent of an industrial society, from around 1789 to 1939, transformed education. Just as the division of labor segmented the work environment, so it came to effect the educational system. According to Harold Perkin, most universities were envisioned as seminaries, with a few other disciplines also taught. Schools had ignored the need for technically trained students, even as ''the applied science and technology needed for the new manufacturing, mining, and transport industries had to be taught in new institutions.''[4] Along with the expansion of disciplines in higher education came changes to the library's collections. Although the early university libraries had strong ''divinity'' collections, along with law and science, the new education model, with its stress on research, emphasized growth in the subjects of literature, political thought, and natural sciences. As libraries collected more titles, the use of monographs went up accordingly.

The expanding curriculum did not immediately change undergraduate education. But over time, students began to desire access to the stacks and to a greater variety of titles. One solution was for student societies and student libraries to purchase and manage a selection of basic texts. Person[2] notes that ''student-owned libraries were particularly strong at Yale, Princeton, Columbia, and Dartmouth, and in some cases surpasse(d) the college libraries themselves in holdings.'' Harvard and others used a model of ''house,'' or dorm, libraries where each house owned a working library of titles necessary for research.

In 1857, Harvard students proposed a separate collection of books specifically for their needs. They pointed out the ''utter inadequacy of the College library to meet the wants of undergraduates in their last two years.''[5] In 1907, Columbia College, just down the road in New York City, listened to the students and developed the Columbia College Study, which became the first special library service directed toward undergraduates. Although the Columbia College Study was a step in the right direction, it did little more than highlight a service dilemma: How is a library to serve the deep research needs of graduate students and faculty while also supporting the very general needs of a large, inexperienced group of undergraduates?

Further complicating the issue, President Franklin D. Roosevelt signed into law the Servicemen's Readjustment Act of 1944. Also known as the GI Bill, this law helped millions of veterans reacclimate to civilian and academic life. From 1946 to 1948, returning veterans made up almost 50% of all students. This influx of students overburdened libraries and universities, and caused a flurry of building and expansion matching the growth of the student body.

Widener Library (Harvard's primary research library in the humanities and social sciences), always tight on space, became more crowded. How do we serve both the faculty and the growing number of undergraduate researchers? The answer came from Harvard in 1949 when Lamont Library, the first undergraduate library, opened to great anticipation. Keyes D. Metcalf, the Director of the Harvard University Library at the time of Lamont's completion, had strong objectives in mind for Lamont. These objectives, one could say, can still be applied to any successful undergraduate library, as follows:

1. To concentrate as far as practicable the library service for undergraduates in a central location;
2. To make the books readily accessible to the students;
3. To encourage general and recreational, as well as assigned and collateral reading.[6]

The opening day collection of 39,000 titles (over 80,000 volumes) was a great success—unless you were a student from Radcliffe. Although students from both Harvard and its sister school, Radcliffe, were now allowed into the Widener stacks with a pass, it took until 1967 for women to be allowed into Lamont. Female students were barred from Lamont Library for fear that making the secluded stacks coed might distract students from their studies and encourage romantic trysts. Today, there are few limitations on which campus users can enter into an undergraduate library, with many faculty and graduate students enamored with the ease of use and open stacks.

ARCHITECTURE

Undergraduate libraries have many physical commonalties. Most have a modern architectural sensibility that comes from both a recent history and an embracing of the contemporary aesthetic of function over ornate form. The Lamont Library, for example, was the first modern building built on the Harvard campus to break from the neo-Georgian brick tradition. It has smooth lines, an abundance of large windows, burnished woodwork, and natural light in the tradition of mid 20th century architecture. Although nobody will deny that it is much easier to use than the Widener Library, Lamont did have detractors. An article in the *Harvard Crimson* pointed out that, ''in the past five years, some of the enthusiasm for blonde wood and plate glass has evaporated, and unfortunately for Lamont, its machine-like, often submarine atmosphere has proved the main deterrent to its complete popularity. Nevertheless, by and large, the story of these five years is a success story.''[7]

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The Moffitt Library, at University of California at Berkeley, also incorporates a contemporary design. The modernist concrete frame building is meant to suggest a Japanese garden pavilion but has instead been nicknamed the ''parking garage.'' Critics aside, the radical way in which undergraduate libraries simplified research encouraged a whole new approach to the library as a ''place.''

A successful undergraduate library will be located smack dab on undergraduate traffic routes. The University of Texas at Austin did a fabulous job in locating its undergraduate library between the student union building and the main library. Such libraries should be easily accessible with the open stacks and materials arranged with user ease in mind. Library services, such as reserve reading, a circulation desk, and a welcoming reference desk, are designed to be front and center on entering the building. Seating and study space is more important in a library where students gather for long periods of time. Crowded dorms, lack of quiet study space, and the desire to be near friends usually guarantee that the undergraduate library is a popular destination. Other special resources such as media and computer centers as well as group study rooms are incorporated into the design. Undergraduates use these services more heavily than senior researchers; thus it makes sense to place them in an easily accessible location. It is also true that undergraduates incorporate new technologies into their lives more readily. Therefore many undergraduate libraries are the first to add cutting-edge technologies and new media into their services.

When Harry H. Ransom (Main University Vice President and Provost, at the University of Texas at Austin) conceived of the undergraduate library, he understood the contemporary reasons for building a specialized collection. However, he also understood the shifting nature of academics when he outright acknowledged the need for an undergraduate program to mutate. ''Its (the library's) planners have resisted all influences to make the place a mausoleum of dead ideas attended by the undertakers of polite scholarship. No amount of planning can anticipate the opportunities and obligations that a dynamic educational program will produce from year to future year. Equally important inhabitants of the mere building, of course, will be both the immortal words and the growing, mortal minds. Therefore the really significant changes that lie ahead will be mental rather than architectural.''[8] Ransom is an example of the forward thinking that allowed University of Texas at Austin to develop innovative partnerships with campus computing, resulting in its highly successful web-based library education site, TILT.[9]

It is not an overstatement to emphasize the importance of the library to the undergraduate. As a sense of place, it defines the learning experience, the socializing of students, and the exploration of new subjects. In many institutions, the undergraduate library is the central academic experience. What we do not know is how future library use and technology will affect the infrastructure of the library. Seers have been announcing the end of brick-and-mortar libraries for over a decade. And although building and collection use has changed phenomenally, the desire on the part of faculty and students for a place to be surrounded by books (and computers) is unabated.

COLLECTION DEVELOPMENT

The onus of an undergraduate collection is to reflect and support the institution's curriculum. The collection is seen as an ever-changing reflection of classic readings and current topics. In general, undergraduate titles circulate for a shorter period of time, reflecting the tighter schedule and general nature of their scholarship. The need for weeding is ongoing, and it is the mission of the selector to keep abreast of new classes and departments. Being that it was first, the Lamont Library card file became the standard that latter undergraduate collections were built on. The University of Michigan's Shapiro Undergraduate Library holdings were also referred to as a supreme example of a public university's undergraduate collection. Static lists of titles, in the long run, were not very useful in building dynamic collections. In 1964, the ALA and the Association of College and Research Libraries began to publish *Choice: Current Reviews for Academic Libraries*. *Choice's* purpose was to provide reviews of recently published books that best fit in an undergraduate collection. *Choice* subject editors choose a limited number of titles that are then reviewed by librarians. As the *Choice* web site says, their reviewers are ''selected for their subject expertise, their active involvement with undergraduate students and curricula, their diverse viewpoints and backgrounds, and their sensitivity to scholarly trends. Reference publications are reviewed by practicing academic librarians, many of whom are subject specialists with advanced degrees.''[10] In today's collection climate, approval plans are often the default for building undergraduate collections. A librarian with a solid understanding of a user's needs and the ability to fine-tune an approval plan can receive shelf-ready books more quickly than ever.

When building or maintaining an undergraduate collection, ALA encourages a well-thought-out collection policy that considers the following:

1. Because many undergraduate courses require large numbers of students to use the same library materials, direct curriculum support will be provided through

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reserve collections and through purchase of multiple copies of items with high demand.
2. Undergraduate libraries provide effective access to information resources through reference sources in a variety of formats. Reference collections in undergraduate libraries should concentrate on the more standard and interdisciplinary indexes and sources. Periodical collections should emphasize the titles covered by these indexes.
3. Subject coverage of collections in undergraduate libraries encompasses a broad range of disciplines that offer the information needed for papers, speeches, and projects required in the wide variety of courses taken by undergraduates. More specialized and advanced needs will be met by specific referral to other library sources on campus.
4. The library experience of undergraduates should encourage them to seek information of personal interest. Collection policies should include access to information on current events, cultural interests, careers, and recreational reading, among others, to encourage exploration of information resources as a part of everyday life. Because of the special nature of undergraduate libraries, collection policies should include withdrawal practices. Collections should be dynamic and responsive to the needs of a changing curriculum and clientele.[11]

The joy of a well-developed undergraduate library is that it informs and serves all university researchers while staying current and useful. For upper-level undergraduates as well as professors and graduate students, the undergraduate library is an excellent starting place. For deeper information needs, there is always the option of visiting the research library.

CONSTANTLY MUTATING PURPOSE

Throughout the decades, the expansion of undergraduate libraries continued, peaking with 30 undergraduate-specific libraries being added from 1960 to 1970.[12] The increase of undergraduate libraries matched the growing number of students enrolled in college. However, the 1970s saw a decline in the number of undergraduate libraries as missions changed, space was reallocated, and libraries were merged or shut down. Henry W. Wingate, author of *The Undergraduate Library: Is It Obsolete?* claimed, ''The reasons for the disenchantment with the undergraduate library concept can be traced to 1) changes in curriculum and teaching methods, and 2) tighter library budgets that preclude the extensive duplication of books and services required, and, perhaps most importantly, the realization that a separate facility works to deprive the undergraduate of a learning experience that only a large research library can offer.''[13]

Undergraduate libraries succeeded when they developed a well-thought-out mission that supported a user-centric focus. In Irene Braden's 1970 book, *The Undergraduate Library*, she lists six categories in which undergraduate libraries differ from research libraries, as follows:

1. Providing open access to the collection to avoid the difficulties of the closed stack system;
2. Centralizing and simplifying services to the undergraduate;
3. Providing a collection of carefully selected books, containing the titles all undergraduates should be exposed to for their liberal education, as well as incorporating the reserved book collection;
4. Attempting to make the library an instructional tool by planning it as a center for instruction in library use, to prepare undergraduates for using larger collections, and to staff it with librarians interested in teaching the undergraduates the resources of a library and the means of tapping those resources;
5. Providing services additional to those given by the research collection;
6. Constructing a building with the undergraduates' habits of use in mind.[8]

In effect, Braden took the physical qualities of the earliest undergraduate libraries (a distinct building and collection) and added a pedagogical purpose that would build critical learning skills into library research. Braden was a harbinger of the importance of instruction in undergraduate libraries—a trend that has yet to slow down.

Libraries have become more complicated as online resources multiply and universities develop multiple catalogs to handle their metadata. The need for understanding how information is researched, published, and made available is one of the most important tools we can pass on to our students. Critical thinking skills—the ability to develop, question, test, and prove one's own as well as another's hypothesis—are the basic purpose of undergraduate education. The undergraduate library is often the locus of discovery. Paula Kaufman (Librarian, University of Illinois, Urbana-Champaign) states, ''There is a renewed interest in undergraduate teaching in research universities. Also we feel acutely the need to provide a different kind of instruction to our students, most of whom are undergraduate students.''[14]

Many of our students feel they are competent online researchers. They troll the Internet, find full-text articles, and link to sites that fulfill their curiosity. The reality is that they do find information, just as students were able to find titles in the research library, when allowed access.

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The question asked by instruction librarians throughout the 1980s and 1990s is broader: Now that you have found information, do you know how to evaluate it, then find even more that is on target for your research and ever-growing information needs?

UNDERGRADUATE LIBRARIES TODAY

The 1990s were a time of refocusing on the undergraduate library's purpose, as well as questioning the purpose of all libraries. As the Internet and online resources threatened funding and a lessening of faculty support, innovative libraries looked to transform how they were viewed and used.

One unusual example is the David Adamany Undergraduate Library at Wayne State University. Built in 1997, it is the newest undergraduate library in the nation. The rethinking of a library for undergraduates culminated in a building with 500 computer workstations providing access to electronic resources and a media collection of videos, DVDs, laser discs, and audiotapes. A one-stop service, the undergraduate library also provides students with information on careers and student survival skills. And yes, it still holds books and periodicals.

UWired, at the University of Washington, is the perfect example of the library collaborating with the Office of Undergraduate Education and Computing and Communications. This amalgam promoted ''broad-based discussions, experimentation, and analysis about the following areas:

- Innovation in teaching and learning with technology tools;
- Fluency in information technology;
- New ways for students and faculty to access technology-enabled tools and resources.''[15]

Those three points could not be more different, and yet similar, to the reasons for constructing the Lamont Library more than 50 years ago.

In their article, ''One Size Doesn't Fit All: Designing Scaleable, Client-Centered Support for Technology in Teaching,'' Mark Donovan and Scott Macklin explain that, ''though UWired began as an initiative to support student uses of technology, the UWired partners understood that parallel efforts aimed at supporting teachers were a necessity. UWired's efforts to support faculty were initially confined to workshops and faculty showcases. These early efforts were driven by the energies of those faculty who were pioneering educational uses of then-new technologies such as email and the Web.''[16] Working in space donated by the undergraduate library, UWired became highly lauded as a model of instruction/library/technology partnership.

Information commons and information gateways are two other terms that have gained relevancy. The term *commons* refers back to community, a collective entity. It is the library trying to recreate a sense of place, shared community, and information sharing. The gateway concept relates to the opening of an access point, perhaps to the commons. Interestingly enough, the physical undergraduate collections at the University of Washington are kept in the Odegaard Undergraduate Library and Computing Commons, whereas the University of Indiana has the Information Commons/Undergraduate Services. The traits shared by information commons and gateways are not unlike those shared by the earliest undergraduate libraries.

For many libraries, the collection focus has changed to a combination of virtual and physical resources—relying heavily on computers and wireless access. Yet the sense of purpose continues with the focus on undergraduate-specific collections as well as common study space and furniture appropriate for lounging. In addition, most libraries now incorporate a café and/or coffee shop. The café is a certain moneymaker, replacing the once-golden copy center. But more than that, it is a social center that is yet another hook for pulling in users. In the past, smoking was the number one social consideration when designing an undergraduate space. Today, it is coffee.

UNDERGRADUATE LIBRARY ORGANIZATIONS

The ALA's subgroup, the Association of College and Research Libraries, sponsors the Undergraduate Librarians Discussion Group.[17] Known as UGLI, they are the primary group for conversation on subjects of interest to the operation of undergraduate libraries. They support a basic web site and list of active undergraduate libraries. The endnotes from previous citations refer to the ALA web site where two important undergraduate library documents are located. *The Mission of a University Undergraduate Library: Model Statement* and the *Guidelines for University Undergraduate Libraries* are useful reads for any library that serves undergraduates, even if undergraduates are not the primary audience of collection. Directly below is a list of self-designated undergraduate libraries. Although the numbers are down from the peak in the 1970s, it is still an impressive list of institutions that have made a symbolic, budgetary, and pedagogical priority of our ''yonguer sort.''

CURRENT UNDERGRADUATE LIBRARIES

Columbia University (New York, NY)
Philip L. Milstein Family College Library

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Cornell University (Ithaca, NY)
Uris Library
George Mason University (Fairfax, VA)
Johnson Center Library
Harvard University (Cambridge, MA)
Lamont, Harvard College Library
Indiana University-Bloomington (Bloomington, IN)
Undergraduate Library Services
Purdue University (West Lafayette, IN)
John W. Hicks Undergraduate Library
Southern Illinois University at Carbondale (Carbondale, IL)
Undergraduate Library Division (in Morris)
Stanford University (Stanford, CA)
Meyer Library
State University of New York at Buffalo (Buffalo, NY)
Oscar A. Silverman Undergraduate Library
University of Arizona (Tucson, AZ)
Integrated Learning Center
University of California at Berkeley (Berkeley, CA)
Moffitt Undergraduate Library
University of California at Los Angeles (Los Angeles, CA)
College Library
University of California at San Diego (San Diego, CA)
Center for Library and Instructional Computing Services (CLICS)
University of Chicago (Chicago, IL)
Harper Library
University of Illinois at Urbana-Champaign (Urbana, IL)
Undergraduate Library
University of Michigan (Ann Arbor, MI)
Shapiro Undergraduate Library
University of North Carolina at Chapel Hill (Chapel Hill, NC)
R. B. House Undergraduate Library
University of Southern California (Los Angeles, CA)
Thomas and Dorothy Leavey Library
University of Texas at Austin (Austin, TX)
Undergraduate Library
University of Virginia (Charlottesville, VA)
Clemons Library
University of Washington (Seattle, WA)
Odegaard Undergraduate Library
University of Wisconsin-Madison (Madison, WI)
Helen C. White College Library
Wayne State University (Detroit, MI)
David Adamany Undergraduate Library[18]

CONCLUSION

The one constant in the half century since Lamont was built is its focus on undergraduates and their research needs. It is important that developing scholars have a safe place in which to learn how to use the multitude of research options available to them. The building design is as important as the selection of the collection and the service configurations that help acquaint users with the tools. As libraries become ever more complicated and as students are faced with a growing number of full-text resources, students will need guidance in formulating their research strategies and selecting appropriate and trustworthy artifacts (physical or not).

Although many libraries have changed how they serve undergraduates, there will most certainly be a number of large research libraries that will continue to support their undergraduate libraries as part of their research and library mission.

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Unicode

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INTRODUCTION

Unicode™ is a standard for a universal character set for encoding the characters in the scripts of all the world's languages. There are hundreds of languages in the world and each has its own writing system or script. Many languages use the same script. English, French, and German, for example, use Latin script. Arabic, Persian, and Urdu use Arabic script. Chinese, Japanese, Korean, and historical Vietnamese use many of the same Han ideographic characters in their writing systems. The term ''Han'' is a reference to the Chinese Han dynasty (206 BC–AD 220). These characters were developed in China and adopted by other cultures for their own writing systems. The Unicode standard, first published in the early 1990s, is one of the most important standards to facilitate the global interchange of textual data in multiple languages and scripts via computers.

CHARACTER SETS BEFORE UNICODE

Developers of computers systems had to define standards to encode the characters in scripts so that a computer could process and display them properly on a computer screen. A variety of industry, national, and international standards developed from the outset of the computer age.[1] It is useful to understand the background of some of these character sets to understand why Unicode was developed. *Extended Binary Coded Decimal Interchange Code* (EBCDIC) is an example of an 8-bit single-byte industry standard created by IBM that is commonly used in IBM mainframe computers. The *American Standard Code for Information Interchange* (ASCII), also known as ANSI (American National Standards Institute) X3.4, is a commonly used standard in the computer industry that encodes the 26 upper and lower-case letters in the English alphabet along with punctuation, some symbols, the space, and some control characters. ASCII is a 7-bit single-byte character set. Any character that is encoded must be transformed into bits for a computer to be able to store or transmit it. The number of bits in each byte or code unit plus the number of code units needed for each character is the limiting factor in determining the number of characters that can be defined in any encoding scheme. In a 7-bit single-byte encoding scheme, only 128 characters can be encoded. Each character is represented by one byte and each byte has seven bits. As each bit only has one of two values (e.g., 0 or 1, on or off), the possible number of combinations for these seven bits can be mathematically calculated as 2^7, which is 128.[2] In an 8-bit single-byte system, the limit is 256 characters (i.e., 2^8) and so on.

ASCII works well for the English language, which has a limited number of letters, but the writing systems of other languages, such as Chinese, have thousands of characters. In order to deal with the large number of characters in their scripts, East Asian countries developed multiple-byte encoding schemes. The *East Asian Character Code* (EACC) *for bibliographic use* is a multiple-byte encoding scheme that uses three 7-bit bytes. This character set was developed by The Research Libraries Group (RLG) to encode characters used in East Asian writing systems. EACC is used in MARC records.

When ASCII was extended to include an eighth bit, the European Computer Manufacturers' Association (ECMA) developed several character sets for European and Middle Eastern Languages, which were eventually adopted as an international standard, ISO/IEC 8859. The eighth bit allowed 128 more characters beyond the basic Latin characters to be defined. Joan Aliprand describes these character sets as follows:

> In an 8-bit character set in which the lower half encodes the International Reference Version (IRV) of International Standard ISO/IEC 646 (equivalent to ASCII), the ninety-four graphic character positions in the upper half may encode the characters of another script. Joint Technical Committee 1 of the International Organization for Standardization and the International Electrotechnical Commission (ISO/IEC JTC 1) has issued a number of standards conforming to this pattern: specifically, Latin/Cyrillic (ISO/IEC 8859-5:1999), Latin/Arabic (ISO/IEC 8859-6:1999), Latin/Greek (ISO/IEC 8859-7:1987), Latin/Hebrew (ISO/IEC 8859-8:1999), and Latin/Thai (ISO/IEC 8859-11:2001). The 8859 family of character sets also includes character sets for various European languages that are the IRV of ISO/IEC 646 augmented with other Latin script characters (chiefly letters with diacritical marks).[3]

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However, each character set had to use the same 128 numeric values to represent their characters, resulting in the same value assigned to several different characters from the different character sets. This limited the ability for computers to simultaneously display multiple scripts on a computer screen. The computer could basically deal with two at a time, the Latin script and one other. However, if more than two scripts were needed such as Latin, Arabic, and Hebrew, it was a problem. To solve this problem, a technique for designating alternate character sets was standardized in ISO/IEC 2022, *Character code structure and extension techniques*. This is the international version of ANSI X3.41, *Code Extension Techniques for Use with 7-bit and 8-bit Character Sets*. This technique is used in MARC records and is described in *MARC 21 Specifications for Record Structure, Character Sets, and Exchange Media*.[4]

Character Sets in MARC Records

Libraries have been able to support a variety of scripts in the bibliographic records in their catalogs using the MARC-8 coded character set (i.e., MARC-8 character sets), also described in the *MARC 21 Specifications for Record Structure, Character Sets, and Exchange Media*. These characters use either 8 bits (single byte) per character for European and Middle Eastern languages or 24 bits (three bytes) per character for East Asian characters. ASCII and ANSEL (*Extended Latin Alphabet Coded Character Set for Bibliographic Use*, ANSI/NISO Z39.47) are the default character sets for MARC records. Hebrew, Cyrillic, Arabic, and Greek character sets are also defined for use in the MARC-8 environment. MARC records use EACC for characters in the writing systems of Chinese, Japanese, and Korean. EACC contains thousands of Han ideographic characters, Japanese katakana and hiragana, several thousand modern Korean Hangul, and punctuation marks used in Chinese, Japanese, and Korean. The MARC-8 character sets are currently limited in the number of scripts they can support. Unicode will allow libraries to support many more scripts.

As MARC is an 8-bit environment using several different character sets in the 128 positions beyond the basic Latin characters in ASCII, how does the computer know which one to use? How does it know whether to display Hebrew characters or Arabic characters, for example? As previously mentioned, ISO/IEC 2022, addresses this issue. A sequence of characters, beginning with the Escape character and ending with a numeric or alphabetic designation for the character set, signals a computer to use an alternate character set. The escape sequence locks the computer into using that character set until it sees another escape sequence that switches to a different character set. This inefficient method of switching back and forth between different character sets is one of the issues that Unicode would address.

The MARC 21 format uses the 066 field to identify the specific character sets present in a record. The 880 fields represent the content of another field in the same record in an alternate script. The 880 subfield 6 links the alternate script field to its corresponding field and provides information about the alternate script. The following are examples of a 066 and an 880 field from a record containing Hebrew:

Example: 066 bb $3(2

Working from right to left, the ''2'' indicates that Hebrew character set is present in the record. The left parenthesis, ''('', indicates a single-byte character set. If a dollar sign, ''$'', is used instead of the left parenthesis, it indicates a multiple-byte character set. The digits used to identify some of the MARC-8 character sets indicate that these are privately defined designations specific to the library community.

Example:

245 10 $6880-02$a[Romanized Hebrew title]
880 10 $6245-02/(2/r$a[Title in Hebrew]

The 245 field subfield 6 indicates that there is a corresponding 880 field in an alternate script. The numeric designation, ''02'', points to the corresponding 880 field. Working from right to left in subfield 6 of the 880 example, the ''/r'' is the orientation code and indicates that the field is displayed right to left. Multiple scripts can be used in a field. Subfield 6 indicates the first alternate script encountered in a first to last scan of the field. In this case, the ''2'', indicates that Hebrew is the first alternate script. The 880 field is linked to the corresponding 245 field using the numeric designation ''02.''

UNICODE

The numerous existing character sets were by no means universal. They were geared toward one language or one set of languages. There was duplication of characters among the existing character sets. Different characters had the same numeric value in others so they were not compatible. Many of them were limited in the number of characters they could encode. Thus Unicode was born to create a universal character set that would address these issues. Original members of the Unicode® Consortium,

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the organization responsible for maintaining the standard, included major companies such as Xerox, IBM, Microsoft, and Apple as well as RLG. Version 1.0 of the Unicode Standard was published in 1991.[5] Several other library organizations and companies were also interested in these issues and joined later. The OCLC Online Computer Library Center, and several library system companies such as Endeavor Information Systems, Inc., Ex Libris, Innovative Interfaces, Inc., The Library Corporation, SIRSI Corporation, and VTLS, Inc., are listed in Version 4.0 as associate members of the Consortium.

There was already an international standard under development, ISO/IEC 10646, the *Universal Multiple-Octet Coded Character Set*, also known as the Universal Character Set (UCS).[6] Joint Committee 1 (JTC 1) of ISO and the International Electrotechnical Committee (IEC) developed this 32-bit character set. The character repertoires of the Unicode Standard and International Standard ISO/IEC 10646 are fully synchronized. Every character encoded in Unicode is also represented in ISO/IEC 10646 and their code values are identical.

Unicode's original use of 16 bits allows for 65,536 code points, quite a substantial increase over the 128 available in 7-bit ASCII. This was still not enough values for all of the characters in existing and historic writings systems so Unicode Version 2.0 designated a system of ''surrogate pairs'' to allow for encoding additional characters.[7] It basically sets aside a range of values that can only be used in pairs to represent a character. The first half of the range consists of 1024 values known as high surrogates and the second half of that range consists 1024 low surrogate values. A high surrogate value is always followed by a low surrogate value. This system increases the number of characters that can be encoded to over a million.

Design Principles

Unicode is based on a set of 10 design principles that guide its development: universality, efficiency, characters (not glyphs), semantics, plain text, logical order, unification, dynamic composition, equivalent sequence, and convertibility.[8] Universality, providing one international character set for all of the scripts of the world's languages, is one of the guiding principles of Unicode. Unicode is also designed to be efficient for computer systems to deal with because each character has a unique value. The computer doesn't have to deal with shifting among different character sets by recognizing Escape sequences.

Two primary principles that need to be considered in conjunction with one another to understand Unicode are the principle of unification and the principle of convertibility. Unification means that one unique code would represent each character even if that character was used in multiple writing systems. For example, there are many punctuation marks that are common to many writing systems. The punctuation mark is assigned one code but can be used with different scripts to write particular languages. The same is true of the Han ideographic characters common to Chinese, Japanese, Korean, and historical Vietnamese. These characters were encoded in numerous East Asian standards. As there are thousands of these ideographs, it took much cooperation and effort among countries to eliminate redundancy and bring all of these characters into one unified encoding scheme. Convertibility means that the standard guarantees interchange of characters between Unicode and several national, international, and vendor standards. The Consortium gathered the lists of characters encoded in the various standards in widespread use at the time Unicode was developed. To insure that data can be converted from these character sets to Unicode and back again (i.e., round-trip mapping), characters that are in these other standards are represented in Unicode even if they are variants of another Unicode character. In order to accomplish this, Unicode defines ranges of values for ''compatibility characters.'' It keeps separate codes for variant forms or the same form of a character if the character is encoded that way in the base standard. Although this may seem like the convertibility principle is juxtaposed to the unification principle in these instances, the intention is to insure round-trip mapping between Unicode and these other standards.

Another important principle is that characters, not glyphs, are encoded. Characters are abstract representations of letters, punctuation marks, numbers, etc. Glyphs are the visual representations of characters as they are written or displayed. Characters can have different forms or shapes. For example, the Latin capital letter ''A'' has a printed form, a cursive form, and many different typeface forms (Fig. 1). Some Arabic characters take on a different form depending upon whether the character appears at the beginning, in the middle, or at the end of a word. The Unicode standard encodes the character, not the various

Glyphs	Unicode Characters	
A A A A A A A A	U+0041	LATIN CAPITAL LETTER A
a a a a a a a a	U+0061	LATIN SMALL LETTER A
fi fi	U+0066 + U+0069	LATIN SMALL LETTER F LATIN SMALL LETTER I
п *n* *ū*	U+043F	CYRILLIC SMALL LETTER PE
ه ه ه ه	U+0647	ARABIC LETTER HEH

Fig. 1 Characters vs. glyphs. (From Ref. [8]. Copyright © 1991–2003 Unicode, Inc. All rights reserved.)

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ways it can be visually represented. The form that the character takes on a computer screen, for example, is left up to the font or text rendering software.

Plain text characters are encoded in the standard. Other information that could be added to characters such as formatting codes to create rich text for displaying characters in bold, italics, etc. is not part of the standard. This is left up to higher-level protocols in specific implementations. The characters are stored in a computer system in logical order from first to last (i.e., the order in which they are typed on a keyboard) as opposed to written or display order. In some writing systems, such as Arabic and Hebrew, text is written from right to left. For these scripts the character that is stored first in a sentence is the right-most character. For English it would be the left-most character. The text rendering process needs to recognize the directionality of each character and display the characters in the correct order. This becomes complicated when texts that run in opposite directions are mixed together. Unicode describes an algorithm, *Unicode Standard Annex #9: The Bidirectional Algorithm*, which provides formatting codes so that mixed left-to-right and right-to-left text can be displayed in proper order.[9]

The principles of dynamic composition and equivalent sequences are concerned with characters that have accents and the Hangul syllables used in the Korean writing system. For example, the Latin letter ''e'' can have an acute accent above it in French. Dynamic composition means that a character and its accent, for example, have two different code values but the characters are combined when rendered for display. The accent is considered the combining character because it can be combined with any number of other characters. The convention of the Unicode standard is for the base character to precede the combining character. In the case of Hangul syllables, two or more alphabetic characters called ''jamo'' are combined to form a syllable. In some older standards, the character and its accent or the conjoining ''jamo'' are encoded as one character (i.e., a static precomposed form of the character). Unicode provides a mapping from the precomposed form to the equivalent sequence of the dynamically composed characters. It is up to the particular implementation of the standard to decide whether to normalize these characters as precomposed or dynamically composed. Either one is acceptable to conform to the standard.

The standard also provides a set of well-defined semantics or properties for each individual character in a set of files called the Unicode Character Database.[10] Developers of applications can use this information to properly process the characters. Each character has an official name and value represented in hexadecimal format. For example, the first letter in the English alphabet is named ''LATIN CAPITAL LETTER A'' and has a value of U+0041. Properties such as ''letter,'' ''number,'' ''punctuation,'' etc. are assigned to characters. Some of these properties have been mentioned previously such as the directionality of the character and whether it is a combining character. The Case property applies to upper- or lowercase letters. If the character is a surrogate, this is indicated. There is also a mapping from a precomposed character to the canonically equivalent decomposed sequence of base character and combining character(s).

Basic Multilingual Plane

The abstract characters in a character set are basically mapped onto a table called the encoding space. As Unicode was originally designed as a 16-bit encoding scheme, the characters are assigned to a cell in table or spreadsheet that has 256 rows and 256 columns for a total of 65,536 cells. Each cell is called a code point and its value is represented in hexadecimal format. Both Unicode and ISO/IEC 10646 refer to the first 65,656 code points as Plane 0 or the Basic Multilingual Plane (BMP). It contains characters for most existing and some historic writing systems (Fig. 2). The left side of Fig. 2 shows the general ranges. The BMP contains ranges that are for the 2048 surrogates and the compatibility characters. There is also a range of values called the Private Use Area. It contains 6400 code points that can be defined by a user (e.g., a vendor) for their own use. The characters used in East Asian scripts for Chinese, Japanese, Korean, and historical Vietnamese (CJKV) occupy a large part of the BMP. The CJK Miscellaneous area contains punctuation for East Asian scripts, the hiragana and katakana for Japanese, and the CJK compatibility characters. Note that the CJK compatibility characters have their own range of values separate from the other compatibility characters. The right side of Fig. 2 shows more details about the specific alphabets in the range U+0000 to U+2000. These include Latin, Greek, Cyrillic, etc. The first 256 code values are identical to those in the Latin-1 (ISO/IEC 88559-1) character set. ASCII characters are the first 128 of these.

With the addition of the concept of ''surrogate pairs,'' Unicode was able to go beyond the BMP and designate 16 supplementary planes for the more uncommon characters. With each new version of Unicode, more characters are assigned to code points. The number of graphic characters in the BMP has grown from 28,292 in Version 1.0 to 96,428 (50,635 on the BMP and 45,613 on the supplementary planes) in Version 4.0. Graphic characters do not include format, control, private use, surrogate, or noncharacters. It was with Version 3.1 that the first use of the supplementary planes began with the addition of

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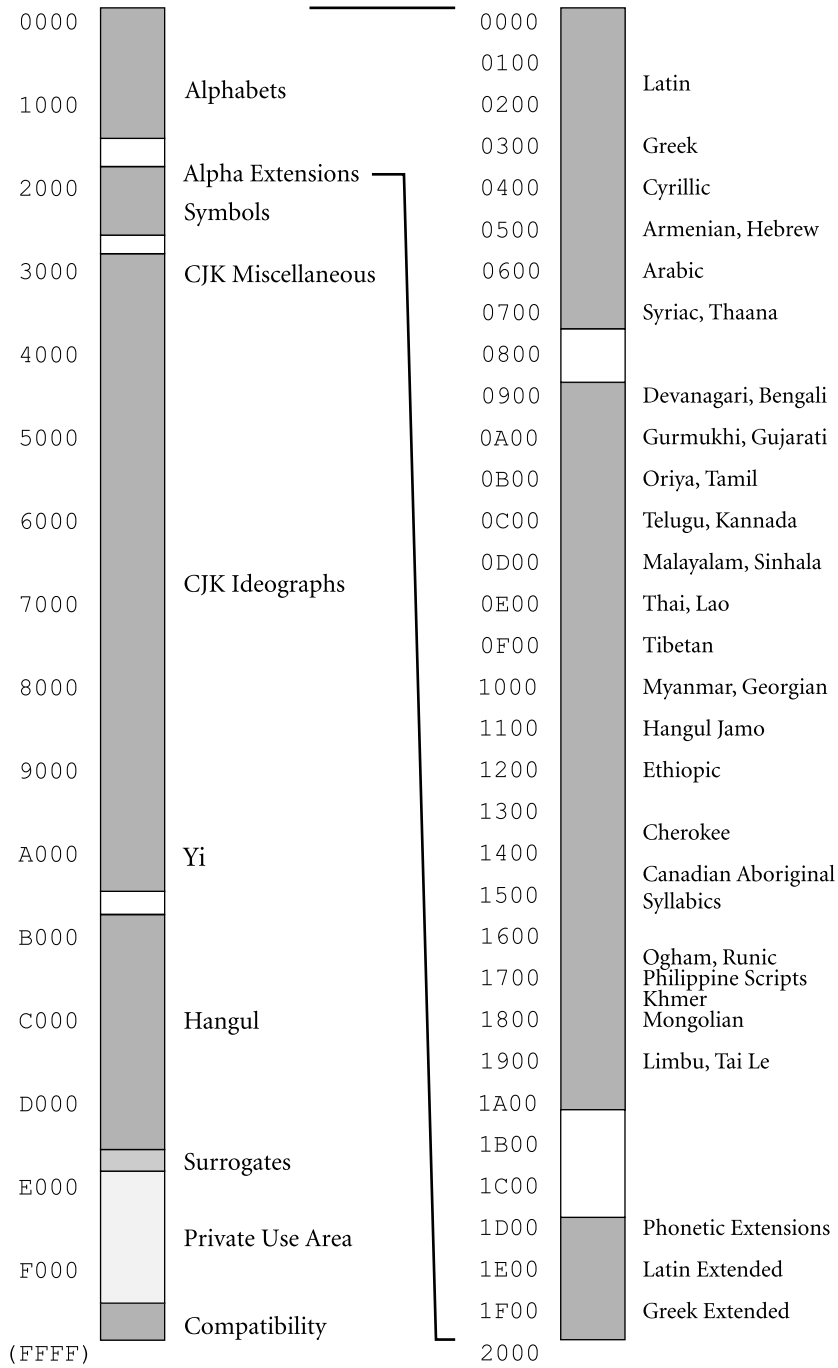

Fig. 2 Allocation on the BMP. (From Ref. [8]. Copyright © 1991–2003 Unicode, Inc. All rights reserved.)

44,946 characters including a large number of CJK ideographs. Version 3.2 added 1016 characters including a large set of symbols, which will benefit mathematical and technical publishing. With Version 4.0, additional currency symbols, additional Latin and Cyrillic characters, the Limbu and Tai Le scripts were included among the 1226 additional characters as well as Yijing Hexagram symbols, Khmer symbols, Linear B syllables and ideograms, Cypriot and Ugaritic.

Character Encoding Forms

The abstract characters that are mapped to code points in the Unicode character set must be transformed into a

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sequence of bits in order to be stored or transmitted by computer systems. Version 4.0 describes these encoding forms as follows:

> The Unicode Standard supports three character encoding forms: UTF-32, UTF-16, and UTF-8. Each encoding form maps the Unicode code points U+0000..U+D7FF and U+E000..U+10FFFF to unique code unit sequences.
>
> The Unicode Standard uses 8-bit code units in the UTF-8 encoding form, 16-bit code units in the UTF-16 encoding form, and 32-bit code units in the UTF-32 encoding form.[11]

UTF-16 uses one to two 16-bit code units. UTF-8 uses from one to four 8-bit code units or bytes. The big advantage of UTF-8 is that the first 128 code points of Unicode are converted to single bytes in UTF-8, and so are indistinguishable from ASCII. UTF-32 uses a single 32-bit code unit to represent each character.

UNICODE IN COMPUTERS AND ON THE WEB

It is not surprising that Microsoft and Apple, original members of the Unicode Consortium, intended to incorporate support for Unicode in their operating systems but it took several years after Unicode Version 1.0 was published in 1991 before this was available. Microsoft's Windows NT operating system was the first major operating system to use Unicode at the system level.[12] Apple's Macintosh operating system version 8.5, released in 1998, included Unicode support. Apple's Mac OS X operating system, based on BSD UNIX, is yet another operating system that uses Unicode. Web browsers, like operating systems, have been increasing their support for Unicode, with each new version and adding capabilities for more scripts. Current versions of Internet Explorer, Netscape Navigator, and Opera all include support for Unicode.

As previously mentioned, the Unicode standard specifically left many of the display functions up to the text rendering process. As the Unicode standard encodes characters, not glyphs, it is up to the font software to be able to supply the proper glyph. Most operating systems come with numerous fonts that can support a variety of scripts. There are a few fonts that support a large number of the characters in Unicode. Microsoft produces Arial Unicode MS font. It contains over 50,000 glyphs including ones for Arabic, Hebrew, Chinese, Japanese, and Korean. Code2000, a shareware font produced by James Kass, contains over 34,000 glyphs in version 1.12.[13]

Reference to Unicode is included in several important Internet standards that are maintained by the World Wide Web Consortium (W3C). HTML (Hypertext Markup Language), which is used to publish documents on the Web, uses Unicode as its character set. HTML 4.01 states: ''The ASCII character set is not sufficient for a global information system such as the Web, so HTML uses the much more complete character set called the *Universal Character Set (UCS)*, defined in [ISO10646]. This standard defines a repertoire of thousands of characters used by communities all over the world. The character set defined in [ISO10646] is character-by-character equivalent to Unicode ([UNICODE]).'' ''This specification does not mandate which character encodings a user agent must support.''[14] HTML documents may be encoded in any character encoding and the specific encoding can be specified in the document. Unicode is the default character set for XML (Extensible Markup Language). XML 1.0 (2nd ed.) states: ''All XML processors must be able to read entities in both the UTF-8 and UTF-16 encodings.''[15] The document is assumed to be in UTF-8 or UTF-16 unless another character encoding is identified using an encoding declaration. A *Character Model for the World Wide Web 1.0: W3C Working Draft*, which is based on the Unicode character set, has been under review for quite some time.[16] As of Aug. 2003, this is still a working draft in its final stages of review.

UNICODE AND LIBRARIES

Unicode is a great leap forward for display of multiple scripts and international information exchange. Libraries that have large collections of materials in other languages have used a variety of techniques over the years to assist patrons to find these materials, from transliterating and romanizing the non-Latin characters from Middle Eastern and Asian writing systems into Latin characters to using special terminals and software to display the native scripts. The development of Web catalogs was a great boon to libraries because Web browsers could switch among character sets. With PC operating systems and Web browsers that support Unicode, it has become easier to support multiple scripts in library Web catalogs.

The library community, like the computer industry, was not ready to take advantage of Unicode when the standard was first published. Several issues needed to be addressed for this to happen. MARC specifications still restricted the characters used in MARC records to the MARC-8 character sets. To facilitate record exchange, these characters had to be mapped to Unicode in order to enable round-trip mapping between these character sets and Unicode. The American Library Association's Machine-Readable Bibliographic Information (MARBI) Committee established several committees to deal with

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these issues. The major bibliographic utilities, RLG and OCLC, from which libraries obtain and contribute MARC records had to consider how to incorporate Unicode into their systems. The Library of Congress (LC), a major source of records for RLG and OCLC, also had to consider conversion to Unicode and how to keep in sync with RLG and OCLC. Library system companies that supply libraries with software for their Web catalogs and cataloging systems needed to consider their customer's needs and how they would proceed with this development effort. It took several years before many of these issues were addressed.

In 1994, the MARBI Committee appointed a Character Set Subcommittee to consider issues related to mapping characters from the MARC-8 character sets to Unicode. In 1996, the Subcommittee's work resulted in MARBI *Proposal 96-10, USMARC Character Set Issues and Mapping to Unicode/UCS*, which was approved by the U.S. MARC Advisory Committee and the Library of Congress.[17] The proposal contained mapping tables for Latin (ASCII and ANSEL), basic and extended Arabic, basic and extended Cyrillic and Hebrew. The Character Set Subcommittee also recommended the appointment of a separate committee with more expertise in East Asian languages to deal with mapping characters from EACC to Unicode.

The East Asian Character Set Task Force, established in 1997, finished their mappings from EACC to Unicode in 2001 resulting in *Proposal 2001-09, Mapping of EACC Characters to Unicode/UCS*.[18] There are 15,728 characters in EACC. The Unicode Consortium had already mapped 13,226 of the ideographs to Unicode. The Task Force reviewed these mappings as well as established mappings for Korean Hangul, Japanese kana, CJK punctuation and component characters. To ensure the integrity of all EACC characters in round-trip mapping, it was necessary to map a few EACC characters to code points in the Private Use Area. RLG and OCLC agreed upon the ranges of code points to be used, and the assignment of individual characters.

The Unicode Encoding and Recognition Technical Issues Task Force was established in 1997 to address the issue of encoding MARC records with Unicode. Their *Proposal 98-18, Unicode Identification and Encoding in USMARC records* was approved in 1998.[19] Although it allowed MARC records to be encoded in Unicode, it restricted the encoding form to UTF-8 and the leader to ASCII. As mentioned previously, with UTF-8, the first 128 code points of Unicode are converted to single bytes and are identical to ASCII. The leader of any MARC 21 record, encoded in UTF-8 or not, could be examined by any system to determine the character encoding scheme used in the record. Leader byte 09 identifies the particular scheme. As not all systems would be prepared to handle all of the Unicode scripts, records encoded using UTF-8 were limited to those characters listed in the USMARC to UCS mapping. Proposal 98-18 mentions this restriction:

> One of the principal motivations for adopting a UCS encoding is to facilitate expansion of the USMARC character repertoire and once this encoding has been specified there will be considerable pressure to use additional characters in USMARC records. The specifics of such expansion lie outside the charge to this Task Force, but restriction of characters to those listed in the USMARC to UCS mapping are viewed to be operative only until such time as proposals concerning expansion are submitted by interested parties and adopted by MARBI.

MARBI is proceeding with caution in relation to expanding the number of characters used in MARC records. An interesting development occurred in 2002, which expanded the characters to include 630 characters in the Canadian Aboriginal Syllabics (CAS) writing system. The Canadian Committee on MARC submitted *Proposal no. 2002-11, Repertoire Expansion in the Universal Character Set for Canadian Aboriginal Syllabics*, to allow the inclusion of the CAS in MARC records encoded with UCS/Unicode.[20] The background for this proposal was the creation of a new Canadian territory called Nunavut in 1999. Most of the population is Inuit and their language, Inuktitut, is one of the official languages of the territory. It is written using CAS. Unicode Version 3.0 added these characters to the standard. The proposal was approved, which has assisted Canadian libraries to catalog materials published in this script. This was the first major expansion of characters since the restriction was put in place. Although the MARC 21 Character repertoire now includes the 630 characters in CAS, the characters are restricted to UTF-8 encoding. As there are no equivalent characters in the MARC-8 character sets, CAS characters in MARC records cannot be converted to MARC-8.

MARC 21 Specifications currently describe the UCS/Unicode environment in this manner:

> Use of the Universal Coded Character Set (UCS or ISO/IEC 10646) and its industry subset Unicode have been approved for standard interchange of MARC 21 records according to the following specifications. The restrictions in these specifications are intended to optimize the interchange of data encoded using the MARC-8 character sets and UCS/Unicode during the period of transition from a largely 8-bit environment to the 16-bit UCS/Unicode environment. The specifications are built around enabling round trip movement of MARC data between MARC-8 and UCS/Unicode with

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> as little loss as possible. Since the characters permitted in MARC 21 records now include scripts which are only covered by UCS/Unicode, conversion back to the MARC-8 environment will not always be without loss. It is, however, without loss for all legacy data created prior to the establishment of UCS/Unicode as an accepted MARC 21 character encoding.
>
> MARC 21 has established a subset of the full repertoire of characters in UCS/Unicode that is permitted in MARC 21 records at this time. This subset is made up of the UCS characters that correspond to the over 16,000 characters defined in the separate MARC-8 character sets for MARC 21. The MARC 21 subset also includes a new group of 630 characters from the Unified Canadian Aboriginal Syllabic (CAS) script repertoire in UCS/Unicode. This is what is meant by the MARC 21 repertoire of characters.[21]

Authority Records

Authority records, like bibliographic records, can be encoded in UTF-8 as the *MARC 21 specifications* describe. MARC 21 authority records can also include 880 fields to record the content of another field in the same record in a different script. However, the Library of Congress Name Authority and Subject Authority Files are currently limited to Latin characters. Some unsettled authority issues still remain for the library community. One of the major issues is the source of authority and whether to use a single authority record to record other forms of the heading or to use multiple authority records to represent the various authorized forms of a heading.[22] MARC 21 authority records currently only allow for one authorized heading. The International Federation of Library Associations and Institutions (IFLA) maintains the UNIMARC format, which is used for international record exchange among the national bibliographic agencies. UNIMARC authority records are also restricted to one authorized heading. IFLA has recommended the multiple-record approach.

Library of Congress, The Research Libraries Group, and OCLC

RLG and OCLC, the bibliographic utilities, are major sources of cataloging records for libraries worldwide. Members retrieve records from their databases of bibliographic records and contribute records to the databases. Here is where the issue of record exchange becomes quite crucial. Both RLG and OCLC have projects underway to include Unicode support within their systems. In 2000, RLG started using Unicode in Eureka®, the Web-based interface to the RLG Union Catalog. RLG uses XML and Unicode (UTF-8) for the records of the RLG Cultural Materials resource, released in January 2002. Their RedLightGreen project also uses XML and UTF-8. The RedLightGreen database is comprised of records converted from the RLG Union Catalog and includes non-Roman data. Records of the RLG Union Catalog and RLG's other resources will also be converted to XML-structured records encoded in UTF-8. This will allow RLG the flexibility to support more scripts such as the Greek alphabet.

In the summer of 2001, OCLC announced that it had selected the Oracle database technology to replace its aging proprietary system for WorldCat, its bibliographic database. This will allow the organization to support Unicode and eventually encode and store the vast amount of records, representing materials in languages from all over the world, in Unicode. In 2002, OCLC enhanced FirstSearch, their Web-based search interface, to display Arabic, Chinese, Japanese, and Korean characters in WorldCat. However, at the time that this article was written, searching with those characters was not yet available in the European language interfaces.

The Library of Congress (LC) started converting their records to Unicode in 2003. This is an exciting step forward as they are a major source of records for RLG and OCLC. The records will be stored in UTF-8 encoding form.[23] The MARC Distribution Service will continue to provide records in MARC-8 but will also offer records in UTF-8 as soon as their conversion process is complete. It will also be possible to download bibliographic and authority records from the LC Online Catalog http://catalog.loc.gov) and LC Authorities http://authorities.loc.gov) in either MARC-8 or UTF-8. They are closely coordinating this conversion with the major bibliographic utilities and their vendors.

Library Systems

Support for Unicode in library systems is also gaining momentum. Many major library system companies have either started the process of incorporating Unicode into their software or have plans to accomplish this by the end of 2003.[24] There are a couple of methods of supporting Unicode. Some library systems have ''native'' support where the records are actually stored in UTF-8. Others have ''enabled'' Unicode support by continuing to store the records in the MARC-8 character sets and mapping them to Unicode values for display in a Web browser. Companies have been incorporating Unicode on a script-by-script basis to meet the primary needs of their customers. The small numbers of library system companies operate in a globally competitive environment. Some of the impetus for Unicode support is in response to current customer needs as well as trying

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to expand their business to other countries that use a variety of languages.

CONCLUSION

Unicode may well be one of the most important standards developed since the rise of the computer age to enable easy exchange and display of textual information in multiple languages and scripts. It is well established in the computer industry in everything from operating systems to programming languages. Library system companies are well on their way to supporting Unicode in their software. RLG, OCLC, and LC have already incorporated Unicode to some extent in their systems. Although the standard addresses a fundamental issue for international exchange of data (i.e., the character set), developers of international software still have other issues to address in multilingual computing. Developers of applications, such as library systems, will have to deal with others issues to develop multilingual software to meet the needs of their customers. For example, providing translation tools and user interfaces in multiple languages is another development path. Another issue that needs to be addressed is providing the ability to sort lists in a library Web catalog, for example, in an order that makes sense to a speaker of a particular language. The *Unicode Technical Standard #10: Unicode Collation Algorithm* provides the basis for this.[25] Unicode is definitely a step in the right direction but these other areas also need to be developed to support multilingual computing.

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Video on Demand—The Prospect and Promise for Libraries

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INTRODUCTION

Moving images are unique in the use of multiple information streams (audio, visual, and textual) to provide a compelling and immersive educational experience. They provide a dramatic window to the physical world, capturing wildlife in its natural habitat, taking students along on space or deep-sea explorations, and recreating artistic performances for viewers. They also engage all the senses in the learning experience—illustrating natural phenomena through experiments such as earthquake shake tables and hurricane wind chambers, and clarifying math and physics concepts through animated visualization. Yet, moving images represent a very small percentage of the digitized resources in Web-based repositories and have remained isolated from the mainstream as an information resource, rarely cited in research papers or consulted as primary reference sources.

Digital moving images are also rarely merged with other digital resources to create a multifaceted educational experience, except within the confines of proprietary software, such as Blackboardis®, WebCT®, and other learning management systems. There are many reasons—primarily technical—why video resources are not fully integrated into the digital information mainstream. Fortunately, within the last few years, technology has evolved to support the addition of significant digital video resources to the digital library. We can expect to see exponential growth in resources as thousands of hours of rich, compelling videos become available via the Web for research and education use.

THE TECHNOLOGY OF VIDEO ON DEMAND

Digital video is simply defined as the representation or encoding of an analog video signal into digital bits for storage, transmission, or display.

''Video on demand,'' also known as unicast video, can be defined as digital video that is available for individuals to view. ''On demand'' is something of a misnomer, as viewing the video may require that the user fulfill some condition, such as enrollment in a course or the payment of a fee. However, the term ''video on demand'' is used to distinguish video files available upon request to the individual from videoconferencing, which uses either a digital phone signal or Web-based Internet Protocol (IP) addressing to encode live video and audio streams of participants in a teleconference, and from video multicasting, which involves broadcasting digital video to a large, often unknown, number of viewers at a preset time.

Video on demand requires several components to successfully provide a video file to a viewer. First, unless the video exists as a native digital video file, it must be encoded, or represented in digital bits, that can be read and operated upon by a computer processor. An important concept in video encoding is the pixel, or picture element, which is a two-dimensional base unit of programmable color, also represented in bits. A pixel is a logical rather than an absolute unit of measure, as its physical representation can vary based on a number of factors, such as the bit depth and screen resolution of the computer used to display the pixel. The color represented in a pixel is a blend of some component of the red, green, or blue color spectra, as the human eye perceives colors in these spectra. Analog colors are translated to pixels in the RGB digital color space. Digital video uses a nonlinear variation of RGB called YCbCr, where Y represents luminance or brightness and CbCr represents chrominance or ''pure'' color, in the absence of brightness.

Colors in digital video are represented, like all digital information, in bits. The more bits employed to produce the color (8-bit, 16-bit, 24 bit, etc.), the more precise the representation of the blend or hue from the red, green, blue (RGB) color space of the original. This may sound very similar to the technical description for digital imaging of photographs and text. Digital video works identically to analog film and video in that the technology involves the rapid viewing of consecutive, still images to create the illusion of forward motion and actions evolving over time. Just as in analog film and video, one or more synchronized audio and text tracks

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can be added to the video tracks to create a composite audiovisual file.

VIDEO ENCODING

A video encoding card accepts inputs from an analog source, such as a VCR or video camera, and converts the analog signal to bits. Alternatively, encoding may occur within the initial capture device, such as a digital video recorder. Encoding software and hardware are available in a range of costs and offer a range of capabilities, including different levels of compression, integration with video and audio editing software, such as Adobe Premiere®, support for multiple frame sizes, and support for multiple encoding formats, such as M-JPEG, QuickTime, MPEG-1, MPEG-2, MPEG-4, RealVideo, etc.

Encoding standards for digital video can support both uncompressed and highly compressed files. Video encoding standards are issued by a variety of organizations, including the International Organization for Standardization (ISO), the International Electrotechnical Commission (IEC), the International Telecommunication Union (ITU), the Institute of Electrical and Electronics Engineers (IEEE), and the Society of Motion Picture and Television Engineers (SMPTE). Many standards address video for television broadcast, such as the CCIR-601 standard, with the resolutions PAL, NTSC, and SECAM.

While the term ''standard'' may be used interchangeably with more generic terms such as ''scheme'' or ''format,'' a standard has certain requirements that proprietary schemes lack. Standards must be proposed to a standards body, opened for public comment, ratified, published, and maintained. Revisions to the standard usually require the same rigorous process of review as the drafting of the initial standard. Standards bodies also must address issues such as backward compatibility when new versions of a standard are released. Standards are usually developed via community collaboration or competition. Standards, such as the video encoding standards MPEG-1, MPEG-2, and MPEG-4, must be made openly available to anyone interested in their use, although they may require fees for licensing.

The Moving Pictures Expert Group (MPEG) arose to develop multimedia standards to support some important commercial and educational needs. MPEG develops and maintains standards within the ISO/IEC joint working group framework. In the MPEG development process, once the need for a standard has been identified, a request for proposals is issued and one or more ''best of breed'' standards are selected as the base platform for development of the proposed standard. MPEG participants test every component of the emerging standard. MPEG is an open membership organization with heavy participation by the computer and digital video industries.

MPEG-1 (ISO/IEC 11172) provides ''VHS-equivalent'' quality digital video and was developed to produce video for CD-ROMs, for playback at $1\times$ speed. The standard implementation or ''sweet point'' for MPEG-1 supports 352 pixels $\times$ 240 lines/sec at 30 frames/sec and requires 1.5 Mbit/sec bandwidth for transport. MPEG-2 (ISO/IEC 13818) supports a bandwidth range of approximately 2 Mbit/sec to potentially more than 80 Mbit/sec. It was originally designed for coding television broadcast signals with CCIR-601 resolution but was expanded to encompass HDTV requirements ranging from 12 to 20 Mbit/sec and higher. The most common compression for MPEG-2 is ''CCIR 601'' or main level, at 720 pixels $\times$ 480 lines at 30 frames/sec. The ''sweet points'' for MPEG-2 support bandwidth in the range of 2–6 Mbit/sec. Digital video files on DVDs are encoded as MPEG-2.

The newest standard to emerge from the Moving Pictures Experts Group is MPEG-4 (ISO/IEC 14496), which was finalized in 1998 and became an international standard in 1999. MPEG-4 integrates audio, visual, and textual information, as well as contextual metadata synchronized to content. MPEG-4 provides object-oriented encoding, with media objects organized into audiovisual scenes. MPEG-4 supports a range of bandwidths from 5 kbit/sec to potentially 1 Gbit/sec for digital video coding.[1]

In addition to international standards for encoding digital video, there are a number of proprietary encoding systems and file formats specific to proprietary operating systems or digital video systems. Windows and Mac operating systems offer native digital video file formats that encoding systems operating on those platforms must create and support. AVI, or audio video interleave, is the file format for the digital video storage and playback on the Windows operating system. Mac offers the QuickTime native video file format, which can be created by a number of encoding schemes, including the Sorenson encoding scheme. In the past, native digital video formats were not interoperable across operating systems. Now, Mac and Windows operating systems both offer playback support for AVI and QuickTime video file formats. RealVideo® is a uniform term for a video streaming architecture supporting a number of encoding schemes. Many video encoding cards offer Motion JPEG (M-JPEG) encoding—an encoding scheme that creates JPEG still images in a consecutive, time-dependent video track.

An interesting new standard has emerged to support still image encoding that also has great promise for digital video. JPEG20000 emerged as ISO 15444 in 2001, offering significant benefits for still image encoding. JPEG2000 uses a different algorithm—discrete wavelet transform—that can compress images up to 200 times without a corresponding reduction in image display.

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Among other capabilities, JPEG2000 allows the end user to select the display resolution—from thumbnail to high-resolution full image.[2] JPEG2000 also supports extensible metadata providing detailed information about the encoding of the image. Part two of the JPEG2000 standard provides, among other capabilities, for Motion JPEG2000 encoding. Unlike M-JPEG encoding, which provided separate sequencing information for displaying the JPEG frames as a sequential video, Motion JPEG2000 integrates the information that determines both order and speed for displaying the resulting sequential video file. A study at Washington University found that Motion JPEG2000 compared favorably with MPEG-2 in the areas of ''compression efficiency, error resilience and subjective image quality.''[3]

STORAGE, TRANSPORT, AND DELIVERY

One of the significant challenges with digital video is the amount of physical storage required for digital video files. A minute of uncompressed digital video may require more than 500 MB of space.[4] Developers of the Informedia digital video library at Carnegie Mellon University discovered that ''even with MPEG1 compression, a thousand hours of video will take approximately a terabyte of storage.''[5] In addition to storage concerns, the MPEG video standards, in particular, require considerable bandwidth for transport. The 1.5 Mbit/sec required for transporting the standard MPEG-1 profile can strain the capabilities of a local area network, particularly when competing for shared bandwidth with other applications. Storage and transport together represent a significant challenge for digital video access over a local area network or across the Internet.

A server is generally employed to store and share a video over a network, as even a few digital video files may quickly overwhelm the ability of an individual workstation to store and share video files. If a significant digital video collection is developed, it is likely that a hierarchical storage system that employs both online and near line storage and retrieves files upon demand from a variety of storage devices, while caching only commonly requested files, will be employed, because of the sheer cumulative size of a significant digital video collection. A library wanting to develop a video collection of a few hundred to more than a thousand videos will want to seriously consider a digital storage system offering terabytes of storage capacity.

Video files are meaningful only when forward progression, providing continuity of information, is maintained. A video cannot show a car driving along a road in one scene and the car parked, being shifted into gear to initiate driving, in the next, if the video is to make sense. A person's mouth cannot be moving out of synchronization with the spoken words. Video data must be played in the correct order, with little or no packet loss and smooth, continuous timing, or else essential information will be missing and the viewing experience seriously compromised.

Video on demand may be delivered to the viewer's computer in two ways—streaming or nonstreaming. Nonstreaming video requires that the entire video be downloaded before viewing. Nonstreaming video may reside on any server; video server software is not required to store and serve nonstreaming digital video. Nonstreaming or downloaded video is an option when the time required for the download process, which can range from several minutes to several hours depending on connection speed and file size, is not an issue for the end user.

Streaming video requires video server and client software. A streamed video begins playback on client software as soon as enough of the video has loaded to begin and sustain playback at a continuous rate. A cache is established from Random Access Memory (RAM) on the client computer and is used to receive the file, insure that frames are in the correct order, establish timing, refresh compressed frames, and check for dropped packets. The video file continues to download into the client cache even as the beginning of the video is being viewed. Video streaming is a collaborative effort between the video server and the client software to receive and assemble a video in which all data bits play smoothly, in progressive frame order.

Video streamed via the Web must be transported within the IP architecture. Streamed video has low tolerance for the enforced reliability of TCP, which would keep an application waiting for retransmission of dropped packets. A number of protocols have emerged, such as User Datagram Protocol (UDP) and Real-time Transport Protocol (RTP), for time-dependent, consecutive packet media, such as digital video. These protocols support the playback and timing of consecutive frames but do not address network congestion issues, which can be quite critical when multiple users are viewing streamed video files over a network. A missing ingredient for successfully networking large amounts of digital video files has been the ability to reserve the bandwidth required for digital video transport, regardless of the other application demands on bandwidth.

Internet2, a collaboration of universities and research organizations to develop middleware and test applications to maximize use of high bandwidth Internet for research and education, has been actively involved in bandwidth reservation, known as ''quality of service.'' As the Internet2 QoS Working Group notes, ''certain applications need absolute assurances from the network that that

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they will receive performance from the network within certain well-defined end-to-end transmission parameters.''[6] Internet2 has developed a draft quality of service architecture known as Q-Bone to address applications requiring quality of service to perform adequately regardless of network congestion.[7]

MPEG has addressed the issue of quality of service within its latest multimedia encoding standard, MPEG-4. MPEG-4 includes support for differential quality of service parameters for different media streams within a composite MPEG-4 file, so that a ''talking head'' video might provide high quality of service for the person talking and moving, and low quality of service for the surrounding environment and any other static elements.[8]

Indexing

Describing and indexing digital video presents some interesting challenges, because of the nature of the medium. Digital video creates the illusion of motion through the use of a large number of consecutive images that are viewed over time. A digital video is thus a very opaque medium, when browsed in its natural state. The adage that a ''picture is worth a thousand words'' encompasses the concept that an image tells a story through the objects depicted within its frame. Video, consisting of thousands of still images, cannot effectively tell a story at a glance but instead, without descriptive indexing, becomes essentially a ''black box, giving the user no way to know what is within it short of viewing it.''[5]

Because a video is a time-dependent medium, it may be described not only by overarching descriptors that apply to the entire video but also by descriptors specific to a segment of the entire video file that might bear little or no relation to other segments, as for example descriptors for a newscast segment about the birth of a polar bear at the zoo which has no relation other than date of event to the lead story concerning a terrorist attack in the Middle East.

Digital video is generally a composite medium consisting of one or more video tracks and audio tracks that often includes textual information that is integral to the visual track, such as text on a whiteboard in a video lecture, or textual information that is superimposed on the visual track, such as closed captioning for a commercial broadcast. While description and indexing of this dense composite medium is very complex, it has the potential to be much richer than indexing provided for single-faceted media.

Standard approaches to describing and indexing digital video include external textual description, such as *Archival Moving Image Materials* (AMIM)—an application profile and rule interpretation for describing moving image resources in archives and libraries according to the *Anglo–American Cataloguing Rules, 2nd ed.* (AACR2) within the MARC21 framework. AMIM was developed by AMIM Revision Committee under the auspices of the Library of Congress with assistance and support from the Association of Moving Image Archivists.[9]

Other digital archives and collaborations have used schema such as Dublin Core to describe digital video resources, including the Video Development Initiative (ViDe), an international collaboration of universities that promotes the use of digital video in research and education. ViDe issued an application profile for describing digital video using Dublin Core in 2001,[10] followed in 2003 by an application profile, codeveloped by the Moving Image Collections (MIC) Project, that supports both Dublin Core and MPEG-7.[11]

External, text-based description has served other complex resources, such as books and serials, very well, but it does not take advantage of the opportunities presented by a format rich in images and sound. Given the inherent difficulties in browsing a very large number of consecutive images played back with synchronized sound, a number of indexing technologies have been developed to document and convey the meaning of the video as it changes and unfolds over time, using a visual shorthand that does not require previewing the entire file. Videos can be decomposed into meaningful segments that can be browsed, for example. This is particularly useful for composite programs consisting of segments that can exist independently, such as newscasts or magazine-type programs.

Keyframes can be identified and ''strung together'' to create a summary that either exists as static consecutive images viewed very much like a digital filmstrip or reanimated to create a video summary that serves as an abridged ''preview'' version of the whole file. A keyframe is the frame that most completely documents a meaningful segment of a video. Keyframes are identified first by identifying transitions between segments, through analysis of fades, dissolves, etc., and then by identifying a frame that carries most of the information that is consistent throughout the segment. Motion analysis can also be used to determine scene changes that separate one meaningful video segment from another.

Information is often analyzed through pixel analysis as changes in color ultimately create objects within a video frame. Pixel analysis can document changes in hue, through histogram analysis, and also changes in contour or shape. Creating a truly useful keyframe summary is often a combination of low-level machine analysis of color changes, transitions, etc., combined with human evaluation. A weather report may show the

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national weather followed by the local forecast. Analysis of transitions and changes of information in the frames results in three identified segments. Pixel analysis identifies the frames with information that is both stable and detailed enough to qualify as keyframes. After analysis, the keyframe for the first segment might show the meteorologist pointing to a national weather map, while the keyframe for the second segment might show the meteorologist pointing to the local weather map, and the keyframe for the third segment might show the primarily textual three-day forecast, with the meteorologist absent from the frame.

In addition to documenting changes of scene to create segments and summaries, the information within a frame can be analyzed for meaningful information. Content-based image recognition (CBIR) identifies objects within an image or frame that have abstract meaning beyond the individual image or video, in order to discover similar objects, or concepts, across disparate image files. CBIR often employs human analysis to document relevant concepts—for example, a butterfly might represent the insect itself but also wings, or camouflage, depending on context. The CBIR engine is then ''trained'' to identify similar abstract concepts based on analysis of ''concrete'' factors such as color, shape, and even movement.

In addition to visual elements, most digital video includes one or more sound tracks that can be mined for keywords, transcripts, and themes through speech and melody recognition, as well as textual information through captions, titles, credits, and other textual elements. The Informedia digital video library at Carnegie Mellon University has an ''overarching goal. . .to achieve machine understanding of video and film media, including all aspects of search, retrieval, visualization and summarization. . ..''[12] Informedia ''combines speech, image, and natural language understanding to automatically transcribe, segment, and index linear video for intelligent search and image retrieval.''[12] In Phase II of the project, Informedia is striving for a richer integration of information from all available information streams to produce ''collages' and 'auto-documentaries' that summarize documents from text, images, audio, and video into one single abstraction.''[13]

Informedia creates what the developers term ''alternate representations for video clips'' that include relevant representative information from all media creating the composite file, which may include a textual abstract derived from a transcript or captioning, a title scraped from the title frame, a representative image and a video ''skim'' consisting of a video summary documenting the major scenes within the video. These alternative information sources can present an integrated whole that may be viewed as a single preview or can allow the user to select the preview abstraction that works best, such as a brief text abstract or a single image to select among very disparate videos, or a video skim of each video, when selecting among a smaller subset of apparently similar video files.[5]

The Open Video Project is a ''shared digital video repository and test collection intended to meet the needs of researchers in a wide variety of areas related to digital video.''[14] The Open Video Project, also known as the Open Video Digital Library (OVDL), was developed at the Interaction Design Laboratory at the School of Information and Library Science at the University of North Carolina, Chapel Hill. OVDL has focused its research efforts in areas of browsing and searching and also in digital library interface design. The Open Video browse interface creates access clusters based on attributes such as genre, duration, color, sound, and contributing organization. Users are taken from a quick, high-level attribute search to increasingly detailed, contextual overviews of database partitions and video previews.

These overviews, which increase the specificity and contextual relevance of the indexing information before the user retrieves the actual video to view, are termed ''look aheads.'' ''Look aheads'' are a key component of a user search and retrieval interface developed via the Open Video Project called the ''AgileViews interface framework.''[15] An example would be the initial attribute selection of the genre ''documentary'' that might result in a number of videos, including a segment about folk musicians in a documentary about folk arts in North Carolina. A ''details'' icon for the video shows full bibliographic information, keywords, a visual preview for the segment, and a link for the full video. At any point, the user may download the segment, preview the segment for more information, download the full video, or use the subjects and other descriptors in the bibliographic record to discover complementary materials.[15]

MPEG-7 (ISO/IEC 15938), the multimedia content description interface standard developed by the Moving Pictures Experts Group, integrates description and indexing of low-level audio and visual features, such as color, texture, motion, speech, etc., with high level, abstract textual indexing of subjects, concepts, classification, usage, and creation information. MPEG-7 supports segmenting and annotation of multimedia files and supports multiple media profiles for a multimedia work that may differ by bandwidth requirements, quality, etc., but not by content. MPEG-7 incorporates user interactivity, including the ability to specify a media profile for delivery based on user preference or bandwidth availability.

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The Moving Image Collections project, a union catalog of moving images in archival collections, co-sponsored by the Library of Congress and the Association of Moving Image Archivists, has collaborated with ViDe to develop an MPEG-7 application profile and cataloging database available for download by any interested party. The MIC/ViDe MPEG-7 application profile is fully mapped to Dublin Core, with mapping to AACR2/MARC21 under development, to spearhead a metadata strategy that interoperates with legacy metadata while preparing the way for the nontextual indexing useful for linear media.[11] This nontextual indexing includes low-level features such as transition and pixel analysis but also speech recognition and concept indexing based on actions within a segment. An important innovator in MPEG-7 is the MPEG-7 Project at Columbia University, which has played a leadership role in the development of MPEG-7 and also in the development of both low- and high-level indexing tools utilizing MPEG-7.[16]

MANAGEMENT OF INTELLECTUAL PROPERTY RIGHTS

Digital video, like other authored resources, is governed by copyright. The creation of commercial moving image resources for various markets is a major industry in the United States. As more digital video resources are created and marketed, licensing of commercial digital video collections will probably become commonplace expenditures in libraries. Digital video and audio resources, particularly in the entertainment field, have been subject to highly publicized piracy, particularly through peer-to-peer sharing. As a result, multimedia publishers have been active supporters of tougher laws governing the use of copyrighted digital materials.

In addition to general copyright concerns about unauthorized use of commercially produced resources, simple copyright attribution for digital video may be more complex than for print or image resources. Consider, for example, a digital video recording of a campus drama department performing the musical *Oklahoma!*. Intellectual property rights reside not just with the current direction and performance but also with the *Oklahoma's* score composer, librettist, and playwright. To add still more complexity, many digital video files may be excerpts from larger files that no longer include credit frames, or a link to the master video, with the result that rights holders may be unknown.

While active rights management has only recently emerged as a need in digital repositories, it has been an early concern for the management of digital video. Rights management includes rights expression, which documents the rights holders for the resource, the users authorized to use the resource, the permissions available for use of the resource, and any constraints or conditions imposed on those permissions. Rights entities and rights transactions are documented in a rights expression language, which references a rights data dictionary, in order to provide unambiguous definitions for entities and transactions.

The newest standard emerging from the Moving Pictures Experts Group is MPEG-21, a multimedia framework standard concerned with defining ''a multimedia framework to enable transparent and augmented use of multimedia resources across a wide range of networks and devices used by different communities.''[17] Different parts of the standard are concerned with defining digital item identification, content representation, content usage and handling, and terminal/network interfaces. However, the first parts developed and released in July 2003 are the rights data dictionary and rights expression language, which are based on prior work by the <indecs> 2rdd consortium,[18] a consortium of content owners and technology companies and the extensible Rights Markup Language (XrML)—developed and maintained by ContentGuard.[19] Both standards emerged from industry with a largely commercial focus toward rights management transactions.

In addition to the MPEG21 specifications, the Metadata Encoding and Transmission Standard (METS), maintained by the Library of Congress, released a simple rights declaration schema for review in August 2003. One of the functions of METS is to provide an XML ''manifest'' for associating digital objects with the metadata records describing and managing the object, including rights metadata.[20]

MPEG-7 also includes rights, financial, and availability descriptive schemes and descriptors to document usage availability and requirements. Open Rights Description Language (ODRL), a mature rights expression language, includes the capability of referencing external metadata, such as MPEG-7, to specify differing media profiles and media quality based on constraints to usage. For example, a digital video may be offered as a low-bandwidth QuickTime file at no cost but require a fee for a high-bandwidth MPEG-2 file.[21] The newest completed standard from the Moving Picture Experts Group, MPEG-4, includes support for unique identifiers for the individual components of a composite resource that represent unique intellectual property. MPEG-4 also offers a standard interface that is integrated into the systems layer to allow media managers to apply proprietary access control systems to MPEG-4 resources.[8]

Accessibility

Providing digital video to disabled users poses significant challenges because of the many media that may be

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integrated into a single resource. Hearing impaired users may be able to view the video and text components but not hear the audio track. Video can often be understood if the sound track can be experienced. A visually impaired user can enjoy a musical or dramatic performance and obtain most of the information contained in a news report without seeing the visual or textual information provided, for example. Closed captioning tracks can be added to digital video either through direct capture or through a Synchronized Multimedia Integration Language (SMIL) implementation that concatenates synchronized audiovisual and text tracks for simultaneous streaming to provide the same level of understanding for the hearing impaired.

The Corporation for Public Broadcasting and WGBH have collaborated to develop NCAM—the National Center for Accessible Media, a research and development facility with a mission ''to expand access to present and future media to people with disabilities...''[22] among other goals. NCAM has developed and issued the Media Access Generator (MAGpie), a free ''captioning, subtitling and audio description software'' application to add accessibility to rich media for hearing-impaired users.[23]

MPEG-4 offers inherent support for disabled users that can be personalized to support different disability levels. MPEG-4 supports multiple content layers that can be used to supply versions of media objects in an interactive manner, so that key objects, such as whiteboards, text tracks, maps, etc., can be viewed in multiple enlargements to support gradations of visual impairment. MPEG-4 also includes functionality to slow the speed or change the pitch of audio tracks during playback, which may compensate for mild to moderate hearing impairment.[8] The value of MPEG-4's capabilities for selecting and manipulating media objects to support disabled users lies in the flexibility to support a range of impairment rather than the ''all or nothing'' approach available for analog media.

DIGITAL PRESERVATION

A final issue of serious concern to the moving image archives world in particular is the fragile state of analog moving images, which exist in massive quantities on deteriorating or obsolete media. To understand the problem of analog moving images, it is only necessary to think of the massive amounts of video and audio generated by the news broadcasts of local, national, and international news organizations on a single day. A single theatrical film can require banks of shelving to house the master print, the outtakes, special cuts (such as the director's cut, which may be different from the general release), foreign language releases, etc. All of these pieces can be critical for a serious analysis of an important film.

Moving images were mastered onto nitrate stock until around 1950. As nitrate stock degrades, it becomes extremely flammable. Although there are some very old nitrate films in stable condition, nitrate film requires special storage to prevent further deterioration and to prevent danger to life and property through spontaneous combustion. By the 1950s, the dangers of nitrate were well known, and moving images were mastered onto safety stock, generally with an acetate base. Unfortunately, acetate is also a fragile medium and subject to severe degradation, particularly a condition known as ''vinegar syndrome'' because of the strong order associated with decomposing acetate. Color fading is another serious preservation issue for many moving images that used less expensive color mastering processes.

The Association of Moving Image Archivists, with funding from the National Film Preservation Board of the Library of Congress, commissioned the design of a union catalog that could bring together the heterogeneous metadata of archives, libraries, museums, and other organizations that collect moving images. They recognized the need to first identify the breadth and composition of the nation's moving image collections so that hard decisions could be made about what to preserve and when.

The forthcoming union catalog—the Moving Image Collections project—was funded in 2002 by the National Science Foundation as part of the National Science Digital Library. Its focus and mission has expanded beyond preservation to include the integration of moving images into the educational process, particularly science education, recognizing that ''society values most highly what it understands and uses.''[24]

Another issue for long-term access is the problem of obsolete technologies, such as rare film gauges and videotape sizes. Analog information may be physically stable and yet may still be lost because no working playback equipment exists.

Although best practices exist for digitizing photos and text, best practices for creating durable digital video and audio files are still emerging. To some extent, this is the result of enormous file sizes. Uncompressed digital masters are obviously preferred, but most computer operating and file systems may be incapable of encoding and processing long video files without significant compression. Uncompressed files also require considerable storage and may be difficult to manually access and review for routine management.

Encoding standards such as MPEG-1 and MPEG-2 are highly compressed and, depending on the encoding algorithm employed, may be unrecoverable if a single error occurs. MPEG 1 and 2 compress pixel redundancies from index frames (I-frames) in both forward and backward prediction. One strategy being employed by

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some libraries and archives is to use MPEG-2 encoding using I-frames only, with no forward or backward prediction of pixels. This provides an editable file with only intraframe compression that can be segmented for repurposing on the Web. Intraframe compression also increases the potential for overcoming limited file corruption. If the technical ability exists to create uncompressed digital video, however, this is the preferred strategy. Creation of uncompressed digital video is an expensive, time-consuming process that may require a collaboration with an organization that works extensively with digital video encoding, such as an interactive media center, public television station, or a media production studio. Proprietary file formats, even those producing high-quality files with good fidelity to the original, should be avoided.

Motion JPEG2000 can provide lossless intraframe compression that produces excellent perceived image quality with strong error recovery using a highly efficient wavelet compression. This encoding standard is just emerging and, because it is not backward compatible with legacy motion JPEG, it will require retooling of existing encoding, editing, and display hardware and software for support. However, the encoding and streaming efficiency of JPEG2000, for both still and consecutive moving images, provides great potential for the expanding wireless market, in particular, which may lead to widespread adoption of the Motion JPEG2000 standard. Motion JPEG2000 may provide a viable ''digital preservation'' standard over the next few years, as supporting hardware and applications emerge.[25]

Increasingly, digital video files are being created natively by the image capture device, such as DVCAM. Native digital video files will vary in quality and compression. Some native digital video formats offer excellent quality comparable to commercial-grade analog video, such as Digital Betacam (''Digi-Beta''). Unfortunately, even high-quality commercial video formats utilize proprietary encoding schema, with no standards body overseeing issues such as backward compatibility for interoperability or migration to future technologies. Currently, the verdict is still out on whether it is better to maintain the proprietary digital file in its native format or transcode it to an international standard. Transcoding from one encoding scheme to another, which may use an entirely different compression algorithm, can lead to unwanted artifacts. On the other hand, transcoding to a standardized schema makes management of large digital video collections much simpler and provides a better hedge against future format obsolescence. Perhaps the best strategy is to maintain both files, with preference given to the original format file as the digital master, unless format obsolescence renders it unusable.

PROMISING PROJECTS AND COLLABORATIONS

As technologies evolve to effectively create, store, index and display digital video, substantial collections are emerging that offer information of great value to library patrons.

The Open Video Project currently consists of 1939 video segments that are publicly available for research use. The collection includes the Informedia digital video library collection and the Prelinger digital film archives, with a focus on ''everyday life, culture, industry and institutions in America in the 20th Century.''[26] The current Informedia digital video library consists of ''a 1,500 hour one terabyte library of daily news captured over the last two years and documentaries produced for public television and government agencies.'' Current work is focusing on improving the integration of video, audio, and text indexing and applying indexing across multiple video documents and libraries.[27]

ResearchChannel, a consortium of research institutions and corporate research divisions collaborating on expanding access to broadband digital media, offers an extensive, university-oriented digital video collection of more than a thousand original videos from leading research institutions.[28] ResearchChannel, which is hosted by the University of Washington, is also developing a collaborative media repository, together with the University of Washington, KEXP radio, and UWTV.

DigitalWell is a ''collaborative effort...to explore discovery, distribution and use technologies surrounding digital media technologies on IP based networks.''[29] DigitalWell includes the capability for defining and managing customized media repositories within the collaborative repository infrastructure through the use of custom extensibility tables for the DigitalWell metadata schema and through the association of collections with unique NetIDs belonging to individual collection owners.[30]

The British Universities Film and Video Council (BUFVC) is providing leadership and access to large-scale media collections and projects in the United Kingdom and beyond. Projects of the BUFVC include the Hermes database of more than 25,000 currently available media resources; the Moving Image Gateway, a guide to some 700 Internet sites with a focus on media for education; TRILT, the Television and Radio Index for Learning and Teaching, a cumulative database with more than a million records; and BUND, the British Universities Newsreel Database, a catalog of more than 160,000 records documenting British cinema news stories from 1911 to 1979.[31]

In Canada, the National Film Board of Canada is offering as a pilot project access to 800 moving image

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titles in elementary, high school, and higher education collections to educational and research institutions connected to the high-speed CA*Net 4 network. This project, titled CineRoute, will eventually be available via subscription to Canadian households and institutions with sufficient bandwidth to support access to the collections.[32]

The Moving Image Collections (MIC) project will offer access to descriptive information about the resources of participating collections in a union catalog portal, including direct access to videos available for streaming, such as an extensive video outtakes collection from National Geographic Television. Other initial participants include the Library of Congress, National Library of Medicine, and the Smithsonian Institution. In addition to descriptive metadata, the MIC will provide extensive information on obtaining or viewing resources from each participating archive. The MIC will also have a strong educational focus with extensive information resources on moving image preservation and cataloging. Many of these resources are currently available at the MIC project development site.[33]

An emerging role for public broadcasting stations is the provision of high-quality digital video resources, primarily to support education. Thirteen Online (WNET New York) currently offers 15,000 free video clips that can be searched by subject and grade level in its K-12 Video Library on Demand.[34] On January 7, 2003, WXXI Public Broadcasting Council in collaboration with the other eight public television stations in New York and the New York State Education Department launched a Web-based video on demand system featuring 10,000 video clips for every grade level, intended for classroom use, at no charge for educators, students, and parents.[35]

Universities also offer broadcasting stations that provide Web-based video on demand to their campuses, such as UCTV, the University of California television station that provides approximately 25 hr of original programming each week, consisting of ''documentaries, faculty lectures, cutting-edge research, symposiums and artistic performances from each of the ten UC campuses.''[36]

Many organizations offer training and guidance on developing and managing digital video collections. The Association of Moving Image Archivists (AMIA) offers training and information on moving image preservation, including digitization of moving images, and cataloging, primarily through its weeklong annual conference.[37] ViDe offers information on every aspect of digital video in research and education at its website and hosts an annual digital video workshop with focused training tracks on video access, video encoding and streaming, and videoconferencing. ViDe's *Videoconferencing Cookbook* is recognized as the preeminent resource for videoconferencing on the web. An excellent overview of MPEG-4 is currently available at the website, and a streaming video cookbook is currently under development. The MIC/ViDe application profile for MPEG-7 and Dublin Core with downloadable database is accessible via the ViDe and MIC project websites.[38]

CONCLUSION

In 1999, John R. Smith of IBM's Watson Research Center described the capabilities that a digital video library should offer its users thus: ''The digital video library users should be able to access and search visual material as easily as text. The users should be able to form complex queries that involve both visual and textual content. The users should be able to effectively express the queries using graphical tools, visual content examples and results of previous queries. The users should be able to browse high-level abstractions and summaries of video. The users should be able to retrieve, download or stream specific video material.''[39]

Three years have elapsed since Smith summarized these basic needs. Although one or more of these capabilities have been developed in test beds at research institutions and offered by some projects—most notably in the Informedia and Open Video Libraries—in a robust and effective manner—these technologies remain beyond the reach of most digital library initiatives. However, this situation is rapidly changing for educational institutions and organizations, as technologies converge to make digital video accessible to adventurous digital library initiatives.

Digital video is a rich but complex medium. It is fairly easy to digitize and offer access to digital video, but fairly difficult to do this well. However, this very difficulty creates a fertile proving ground for improving access to the vast array of Internet resources generally. Ultimately, the efforts required to create an accessible and useful digital video archive pale against the rewards inherent in uncovering the wealth of information hidden in miles of moving image footage stored in film vaults, studio archives, broadcasting stations, and scientific laboratories around the world.

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Virtual Libraries and Distance Learning in the United States

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INTRODUCTION

The phenomenal growth of distance learning programs in higher education worldwide has had immense implications for the provision of library services to students learning at a distance. Major trends such as telecommuting and the changing profile of traditional college students have fueled the demand for distance education. More adults, especially, are working full-time, balancing family responsibilities, and seeking to return to study at the post-secondary level on a part-time basis. Distance learning has become an attractive alternative especially for working mothers, military servicepersons, and rural residents. This proliferation of distance learning opportunities has had considerable implications for the provision of library services to distance students. Distance learning without access to electronic information resources and services may be impossible. Concurrent with the emergence of the virtual university has been the rise of the virtual library. This essay defines the virtual library and situates it within the context of contemporary electronic learning.

DEFINITION OF THE VIRTUAL LIBRARY

In the broader historical sense, the term *virtual library* became trendy in the mid-1990s but never captured professional use in a formal sense to connote an operational definition as did the phrase *digital library*. Then, the terms digital library, electronic library, and virtual library often were used interchangeably. Critically, the term *digital library* arose and evolved within the broad library community beginning in the late 1960s. During that period, many physically based academic libraries initiated innovative long-term projects to facilitate access to their continually expanding hardcopy collections. These programs integrated emerging information technologies with traditional printed materials, thus making libraries among the first integrated users of alternative media such as microforms, audiotapes and other sound recordings, and electronic files—all predecessors of today's online commercial database systems and aggregated digitalized collections.[2] Today, by most measures, the term digital library when used in this broader sense has won the day in terms of common use; perhaps, in part, because of the belief on the part of many information professionals that the word *virtual* was so vague. *Virtual library*, however, is increasingly the term of popular choice when one refers to the aggregated digital learning resources *and* librarian-assisted services that support the curricula offered by totally online or *virtual universities*. Increasingly, librarians who may support distance learning as found in more traditional and residential universities will also employ the term virtual library when referring to the amalgamation of resources and services which they provide their students at a distance. While there are no limits on the size, content or relative value of data afforded students by a virtual library, its definition is always shaped by the pedagogical needs and expectations of its parent learning community. Today, the term virtual library is nearly always associated with those library support services offered to students and faculty in the distance delivery and online learning environment.

THE VIRTUAL LIBRARY: CRITICAL ELEMENT IN TODAY'S DISTANCE LEARNING

The term distance learning as employed here follows the scope and definition as found in the Association of College and Research Libraries' *Guidelines for Distance Learning Library Services*.[3] Distance learning refers to any program of instruction in which students and instructor are not simultaneously present in a single on-ground classroom on the campus of a college or university. It also applies even when students and the instructor are present together in a classroom, if that classroom is located at a learning center or on a branch campus or at any other facility which is geographically removed from the main campus, and which exists expressly to bring higher education to students away from the main campus. The *Guidelines for Distance Learning Library Services* make

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clear that students engaged with distance learning communities are fundamentally entitled to library services and resources equivalent to those provided to students and faculty at traditional campuses.

Prominent and rapidly growing virtual universities today include such market leaders as Capella University, Park University, Jones International University, North-central University, the Kaplan Higher Education system, Devry University, The American Public University System, American Public University System, Walden University, and University of Phoenix Online. Some virtual universities are privately held, whereas others are publicly traded on the market. Most are for-profit and highly entrepreneurial, continually carving out new markets to meet growing demand for workplace-related credentialing. While offering some programs at the associates and bachelors degree levels, these institutions are much more characterized by and known for their often extensive graduate programs at the masters and doctoral levels. Others are increasingly well regarded for their online workplace certification and licensure programs. All of the leading virtual universities today have gained the critical recognition within the broader higher learning community through the attainment of regional accreditation. Online graduate education increasingly has become mainstream and subject to less of the criticism earlier voiced by more traditional universities.

Students and faculty associated with these relatively new higher learning providers expect that most learning resources they require will be provided online and in full-text format. Prior to the development of the fully articulated virtual library, most students studying in remote locations simply accepted the reality that they would likely need to travel to a nearby academic or public library to fulfill their course-related information needs.[4] Today, most such students and the faculty who teach them believe that graduate online course assignments, even those requiring more in-depth research, can be met more efficiently via full-text databases and document delivery services offered by virtual universities or traditional universities having major distance learning programs. Most librarians have resolved themselves to the new realities of online learning, an environment in which there clearly appears to be a fundamental shift in the minds of many graduate students (particularly professional working adults) relative to the importance of the library in their academic and workplace credentialing.[5] Indeed, it is critical to note that most librarians now have eagerly embraced the importance of a well-conceived and robust virtual library to quality distance learning, but at the same time are mindful of the changing conception students hold relative to what a library should be and how it should serve them in the online learning environment.

Good practice for the establishment of a virtual library today always assumes that virtually extended information services will:

- Provide content and imposes a structure to present that content to patrons.
- Offer search capabilities of databases and catalogs.
- Grant access to full-text documents.
- Provide tutorials for database use and information literacy.
- Provide links to course-specific Web sites reviewed and annotated by subject librarians.
- Link to general reference tools.
- Encourage interaction through e-reference options and discussion forums.
- Provide interlibrary loan and document delivery.
- Offer 24-h accessibility and reference service 7 days a week.
- Survey user needs and seek input from all constituencies.[6]

Additionally, one must add the growing popularity of chat reference as a part of virtual reference services. Virtual reference services have emerged as essential and thus must be considered best practice in the virtual library. An established and growing part of library service, future trends will likely include greater integration with other university online services such as portals, courseware, databases, and document delivery. It is likely that virtual reference services will move beyond the desktop chat environment and include mobile devices and videoconferencing. Virtual reference services have become just another facet of the services that reference librarians provide within the virtual library environment.[7]

Information professionals who evolve leading edge virtual libraries today demonstrate a willingness to provide their institutions' students subject-specific licensed databases through relatively sophisticated Web interfaces. Librarians engaged in the best asynchronous learning environments actively invite students to mine the range of library resources made available through the virtual library, bringing these resources to online conversation and discussion groups. With working adults, especially, one can expect a high level of appropriate natural peer-critiquing of the relative value of the quality of learning resources provided.[8] As they have evolved, the best virtual libraries demonstrate evidence of strong librarian–faculty member interaction that results in the integration of library resources with course objectives. Integration may mean, at a minimum, that instructional designers provide for the creation of templates to insert recommended information sources into course modules or provide for hot links to Web sites. While few virtual universities are affiliated with regional or state library

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consortia (such as, for example, OhioLINK), they have tended to better position themselves to gain more control over the licensing costs of electronic products.

A TYPICAL VIRTUAL LIBRARY

Commonly, only one model of the virtual library is found in practice, although many variants of this model exist peculiar to niche higher learning providers. The virtual library found in the completely online or virtual university often may be referred to as something other than *library*; for example, it may be referred to as an Online Research Center or an Electronic Learning Resource Center or some other descriptive phrase that a virtual university's leadership believes might be more inviting than the traditional term *library*. The institutional homepage most always has a hot link to the main Web page of the virtual library and this link may, initially, employ the more recognizable terms *library* or *online library*. Learner or faculty password access is required beyond the virtual library homepage because of database license restrictions. Virtual universities such as Northcentral, Capella, Jones International, and the American Public University System will have physical library offices, but these are typically simply offices and workplaces for one or two librarians and a few support staff plus space for commonly used reference works. Often a small, carefully selected physical book collection is available at the corporate location of the virtual university with titles lent to students when requested. Sometimes these book collections comprise an archival collection of textbook and other supplementary books that accompany courses offered via the Internet while other collections may be more expansive and comprise a carefully selected book collection to support very focused subject areas taught by the virtual university. Commonly, these physical collections are small, but carefully cultivated in support of institutional curricula. With documentary VHS films becoming available on DVD, some libraries are acquiring collections of curriculum-related titles. Virtual library staff are available by phone, fax, e-mail, and videoconferencing or directly from the institutional Web site to respond to student and faculty requests. Virtual library staff members coordinate the use of research facilities for each student, assisting them to find libraries and locate books, journal articles, and Web sites. Staff members assist in selecting search engines and identifying keywords. Such institutions typically have contracts with regional library bibliographic networks, e.g., Amigos, Solinet, Ohionet, etc., through which to obtain interlibrary loans and photocopies of articles. The most dramatic impact on the range of serial and electronic journal literature available to students engaged with online learning contexts has come from universal acceptance by virtual university librarians of full-text electronic journal databases such as those offered by EBSCO, Lexis-Nexis, Proquest, H. W. Wilson, Gale, and through such initiatives as Project MUSE and JSTOR. Like their traditional counterparts, most virtual universities are adding e-books to their canon of information products available through their virtual libraries. In addition, many institutions provide a student ID card and subsidize library card access to local college or private libraries. Information literacy tutorials are increasingly provided as links from the virtual library's Web site. Commonly, a stated institutional learning goal is to encourage and assist students learning at a distance to gain information skills and to effectively use all library resources.

Increasingly, regional and professional accreditation bodies, as well as governmental oversight agencies, have been instrumental in raising expectations, setting standards, and offering guidelines for virtual libraries. In short, today, online universities must provide access to both curriculum-appropriate and high-quality learning resources and must demonstrate that these resources are closely linked to measurable student learning outcomes. All of the six regional accreditation bodies in the United States as well as many of the disciplinary and professional accreditation agencies provide clear expectations and standards for practice in virtual library support. Typical of such expectations are coming from The Higher Learning Commission of the North Central Association which, in part, read:

- Good practice holds that a basic collection of reserve and course-related readings and texts are conveniently available to all of an institution's students (whether on a physical campus or learning from a remote location).
- Trained professional librarians who help the institution acquire, store, and retrieve appropriate learning resources; to assist students in using these resources; and to help students locate and obtain needed resources that the institution does not itself possess.
- Institutions should assure that their students learning at a distance and in the virtual environment have access to adequate learning resources. Access can be provided. . .by placing resources on an institution's web-site (the virtual library) or helping students identify some of the selected and dependable Internet sites where appropriate materials are available.
- Institutions should make formal arrangements with other learning resource centers they wish their students to use.[9]

Likely, students learning in online academic programs will continue to use physical libraries in their communities, there is increasing evidence that remotely accessible electronic resources as provided by the virtual library are

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the preferred medium for both students and faculty. Students will likely continue to use physical libraries in their communities, but increasingly, research shows that students and faculty prefer remotely accessible electronic resources. Learners today are approaching their online educational experiences from the perspective that the library is found in a more nebulous and distributed space. In the end, today the virtual library has gained broad-based acceptance among students alongside of other essential student support services critical for learner success.

CONCLUSION

The rapid expansion in recent years of virtual academic programs and providers is a direct result of the increased demand for postsecondary education and workplace credentializing as well as the broadened access afforded by the new technologies. Diverse actors and innovative partnerships characterize the competitive online higher education environment today resulting in expanded choice. Influenced by the quality movement, today's student studying in the online environment demands a high level of accountability and services including virtual access to library services.[10] Importantly, a new genre of higher education institution has emerged over the last decade: the totally online or highly online college and university. Many of these institutions operate in transnational environments. Such academic programs and the virtual libraries that have been created to support these programs vary widely in structure and sophistication.

While some critics continue to argue that many Web-based academic programs would appear, at first glance, to mandate little substantial research and supplemental reading beyond their often highly modularized and tightly packaged designs, progress by virtual institutional leaders has been made to correct such earlier-held assumptions. Critics aside, today, library resources made available to students within the virtual learning framework are nearly always carefully selected, continuously assessed with respect to utility and value, and increasingly integrated into online courseware. Librarians evolving virtual library support are increasingly engaged as equal partners with faculty and instructional designers. While there remain many questions surrounding the commercialization of online education, there is clear evidence of an honest and enthusiastic desire on the part of information professionals working in traditional libraries to accommodate to and partner with this rapidly growing learning mode. Virtual libraries will continue to develop and mature. As educational globalization continues in the economic sector, globalization of library services will continue to expand to address student needs and underscore the merits and advantages of the new technological tools in delivering distance services.

Virtual libraries will continue to develop and grow as both traditional and nontraditional institutions of higher learning seize opportunities to serve new clientele and to provide the rich learning resources that both good practice and accreditation agencies mandate. The advantages of the new technological tools in delivering distance service are increasingly more obvious. Academic librarians are ''uniquely positioned to become more active members of the education team within virtual universities and assist faculty to effectively integrate library assignments into online courses.''[10] Librarians are able to offer their distance learners far more options and avenues through which to support active learning. Consequently, this ''provides convenience, eliminates barriers of distance and isolation, saves the learner time, streamlines procedures and document delivery, makes communication easier, and can be used to provide library instruction in a way that was not previously possible.''[11] The establishment and enhancement of virtual libraries will continue to be critical to the success of distance learning; however, the emphasis in the near future will be focused on more effective integration of virtual library resources and services with online programs as well as a bottom-line concern that the virtual library directly link e-learning objectives to measurable outcomes, metrics, and student learning outcomes improvements. Finally, with a growing number of more traditional universities rapidly expanding into distance education, the future of the virtual library for those institutions will continue to see a balanced and responsive combination of a physical print-based library that has established consortium agreements and/or student use privileges at universities in distance learning sites; a Web-based virtual library that aggregates a wealth of carefully chosen, licensed, full-text and citation resources; a responsive document delivery service provided directly to the learner; and a librarian who will provide the human interface with students.[12]

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Women's Studies Databases

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INTRODUCTION

Women's studies came of age as an academic discipline as a by-product of the feminist movement of the 1960s. During this period of campus turmoil, women scholars and students began to demand courses focusing on women and their contributions to academic disciplines. Many campuses began to offer a few women-focused courses, and in 1970 the first women's studies program was inaugurated at San Diego State University (http://www.rohan.sdsu.edu/dept/wsweb/). By the year 2003 there were 650 women's studies programs in the United States and Canada.[1]

This article will discuss the history, emergence, and growth of women's studies electronic resources from their early existence as print sources through CD-ROM to the Web. While many women's studies databases are by subscription only, some free web databases on a variety of topics exist that are worthy of mention as well.

HISTORICAL PERSPECTIVE

History of Print Indexes

From the very beginning, women's studies attracted faculty from across the academic spectrum, and interdisciplinarity has continued to be a hallmark of feminist research. Marilyn Boxer discusses this issue at length in her article, ''Unruly Knowledge: Women's Studies and the Problem of Disciplinarity.''[2] For librarians and researchers, the cross-disciplinary nature of women's studies has proven to be a challenge. Both general and subject disciplinary indexes commonly used in the 1960s and 1970s proved inadequate as resources in feminist research. None provided adequate coverage of the new scholarship in women's studies and few used appropriate indexing terminology. Joan K. Marshall's classic work *On Equal Terms: A Thesaurus for Nonsexist Indexing and Cataloging*[3] was a critique of not just Library Congress Subject Headings and outdated indexing terminology, but a call to the library profession to become sensitive to the latent discrimination presented by male-dominated indexing terminology. Until the electronic revolution occurred, finding periodical articles in women's studies journals required the use of multiple indexes to popular and scholarly journals in combination with three women's studies indexes, a table of contents publication, and several annual bibliographies. The field has been expanding at such a rapid rate since 1999 that in 2003 there are four online women's studies indexes, one gay and lesbian index with another becoming available in 2004, and hundreds of full-text primary document databases.

Print indexes

The first women's studies index appeared in 1972 with the publication of *Women Studies Abstracts* (*WSA*). *WSA* was the first index to concentrate on the core journal literature in women's studies. Many, but not all, citations included abstracts. *WSA* focused on the feminist periodical literature and did not include indexing from discipline-focused journals. Beginning in the early 1980s, these subject indexes began to index feminist publications or articles of feminist content. As a result, women's studies scholars were required to continue consulting both the specialized subject indexes, such as *Psychological Abstracts*, as well as the popular *Readers' Guide to Periodical Literature* and also *Women's Studies Abstracts* for comprehensive research.

Until the 1980s, *WSA* was the only exclusive women's studies index available. However, other resources to periodical literature that were not indexes were published during this time period. The University of Wisconsin System's Office of the Women's Studies Librarian-at-Large produced a series of useful publications including the quarterly journal table of contents series, *Feminist Periodicals: A Current Listing of Contents* (http://www.library.wisc.edu/libraries/WomensStudies/homemore.htm#periodicals), which began in 1981. This has proven to be a valuable source of periodical information in women's studies because of its inclusive policy covering a very broad spectrum of national and international publications. As there is no indexing of articles, it does

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not substitute for the traditional index but it remains a tool for the serious researcher.

One of the results of the passage of the Women's Education Equity Act in 1974 was the creation of the Women's Education Equity Communication Network (WEECN). The WEECN served as a clearinghouse for information about women's education, and one product of its work was the publication of an annual bibliography, *Resources in Women's Education Equity*. This consisted of bibliographic and abstract information about journal articles, research reports, and dissertations culled from searching a wide spectrum of online databases. This print bibliography lasted only four issues, from 1977 to 1980, and was the product of a unique online database created by the WEECN and discussed in greater detail under ''Bibliographic Databases.''

Between 1977 and 1994 the Center for Research on Women at Memphis State University published *Women of Color and Southern Women: A Bibliography of Social Science Research*. The first volume of this series covers 1975–1988, with subsequent editions in 1989, 1990, 1991/1992, and 1993/1994. In accordance with the Center's primary goal, ''to disseminate research on women of color and southern women,'' these publications indexed periodicals, books, dissertations, chapters in books, and works in progress. This title eventually became a part of the online database *Women's Studies International*.

By 1991, two additional print indexes in women's studies had appeared. *Studies on Women Abstracts* (*SWA*) (http://www.tandf.co.uk/journals/carfax/1467596x.html) in 1983 and *Women's Studies Index* (*WSI*) in 1991. *SWA* was published quarterly in Britain, and at first glance seemed quite promising. It listed an impressive list of over 210 periodicals indexed, many from the UK and Canada. These included both core women's studies titles as well as subject discipline journals. Unfortunately, indexing was very selective and over time very few articles per issue were indexed. *WSI* was an annual of the women's studies indexes; it was the only index to include popular feminist periodicals, such as *Ms* or *Ladies Home Journal*, as well as scholarly journals. It was a well-constructed index; however, it did not contain abstracts and there was a considerable lag time between publication of an article and indexing.

A number of articles evaluated and compared all the print women's studies indexes and provided extensive descriptive and comparative information about their value for feminist research. Sanguinetti[4] discussed the improved access to women's studies periodicals in traditional and women's studies indexes; Gerhard et al.[5] examined the reliability of indexing; Mesplay and Koch[6] examined eight indexing and abstracting services for their coverage of women's studies; Krikos[7] compared three indexes, *WSA*, *WSI*, and *SWA*, for scope, depth of indexing, currency, format, and indexing vocabulary.

BIBLIOGRAPHIC DATABASES

The 1970s and 1980s brought the development of the first two online databases specifically dedicated to feminist interests. It is not surprising that the content of these databases addressed two prominent social issues of those times—education and employment equality for women.

Women's Education Equity Communication Network (WEECN)

As mentioned earlier, the enactment of the Women's Educational Equity Act brought about the development of the Women's Education Equity Communication Network (WEECN). The WEECN developed the first online women's studies ''tertiary'' database. The content for the online database was pulled from a number of discipline-specific databases, such as AGRICOLA, ERIC, and Management Contents. Appropriate entries were chosen based on their content and entered into the database using a unique software package that reformatted each entry to be consistent. An index based primarily upon *ERIC*-controlled vocabulary was developed and published. Unfortunately, a loss of government support brought about the cessation of the database. It was an interesting early experiment in using the power of the computer for cross-disciplinary research.

Catalyst Resources for Women (CRFW) Database

In 1962, Catalyst (http://www.catalystwomen.org), a nonprofit organization dedicated to addressing issues about women and employment (and later working families), was created. The organization began accumulating a wealth of literature about prominent women's issues. It was suggested that Catalyst become a clearinghouse of information for and about the working woman. Several grants from the Mellon Foundation and an agreement with BRS, a database provider, enabled Catalyst to develop an online searchable database. The *Catalyst Resources for Women* (*CRFW*) database started what would be a trend for many women's studies databases in the future—it indexed what is referred to as ''gray'' literature. While books and periodicals were indexed, other literature such as government documents, reports, conference papers, and newsletters were included, as well as audiovisual materials. The entries included abstracts and ''a thesaurus was adapted from existing vertical file headings in the Catalyst Library and from terms developed specifically for the two-career family collection by its staff.''[8] Unfortunately, by 1988 BRS had discontinued the online searchable CRFW database. The Foundation still has an Information Center that provides daily responses to requests for information.

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Interdisciplinary Databases

Before the development of women's studies databases, researchers and librarians had to rely on subject databases such as *PsycInfo/Psychological Abstracts*, *Sociological Abstracts*, *ERIC* and the *Modern Language Association* (*MLA*) *Bibliography* to locate women's-related resources. One of the challenges of extracting women's studies information was that ''not all literature on women is feminist, and feminism itself has been defined in different ways.''[9] Furthermore, the activist and academic natures of women's studies also posed challenges when researching because of the scattered nature of the literature. Much has been published addressing indexing issues and the use of subject headings. The publication of *The Women's Thesaurus* by Mary Ellen Capek[10] brought with it an arranged list of terms to help researchers when doing free-text searching in a variety of databases.

In 1990, Atkinson and Hudson edited a thorough and diverse collection of essays that address the challenges of doing women's studies research in *Women Online: Research in Women's Studies Using Online Databases*.[11] These essays focus on different topics such as the humanities, social sciences, biomedicine, law, and reference and the challenges of doing women's studies research within them. They also included practical tips for overcoming such challenges.

In the introduction to the book, the editors explain that ''*Women Online* is intended to be useful not only to students, scholars, and librarians who search databases but also to producers who design and market them.'' Furthermore, they write, ''database producers should expand their coverage of materials and promote access to resources in interdisciplinary fields like women's studies. They should consider the development of a women's studies database to be distributed in CD-ROM and/or online format.'' Unfortunately, it took a database vendor almost 5 years to respond to this request.

SUBSCRIPTION DATABASES

Women's Studies on Disc

It made sense that in 1994 the first CD-ROM *Women's Studies on Disc* (*WSD*) was developed from the print *Women's Studies Index*. The CD-ROM indexed only magazines and journals with a U.S. focus dating back to 1989. They were indexed using the Library of Congress Subject Headings as a basis for its thesaurus with assistance from Capek's *A Women's Thesaurus* as well. While the searching interface was user-friendly, the search results screen was not only difficult to use, but prone to producing false results.[12] While scholarly journals are indexed, there are more magazines with a popular focus.

Gale Group publishes *WSD* on a CD-ROM that is updated annually. There is currently no online access available. This, when coupled with the once-a-year update, makes it a less enticing purchase than other women's studies databases available now.

Women's Resources International

Two years later, NISC, a database publisher, responded to the creation of *WSD* by releasing *Women's Resources International* (*WRI*). Indexing as far back as 1984, *WRI* was much broader in scope as well as type of resources than *Women's Studies on Disc*. *WRI* responded to the necessity for ''the research or activist in women's issues to have access to political and legal documents, the alternative and underground press, local community information, ephemeral organizational materials, and other nontraditional and multimedia sources.''[13] Up to 30% of the content indexed in *WRI* was international in scope and included gray literature. The downside of the database is that it was a compilation of resources pooled from several other databases and bibliographies, resulting in a lack of consistent indexing terminology.

Women's Resources International has continued to grow over the years. The content now includes materials from 10 different women's studies databases, including *Women Studies Abstracts*, and coverage goes back to the early 1970s. The database is updated quarterly. In the last year the name of the database was changed to *Women's Studies International*. It is available both on CD-ROM and as an Internet accessible database from NISC.

Indexes for Gay/Lesbian/Bisexual/ Transgender Studies (GLBT)

One perennial criticism of the print and early women's studies databases was their lack of good coverage of GLBT publications. NISC filled this gap with its introduction of *Gay & Lesbian Abstracts*, now known as *Sexual Diversity Studies: Gay, Lesbian, Bisexual & Transgender Abstracts* (http://www.nisc.com/factsheets/qgla.asp). Available both on CD-ROM and online, this service indexes and abstracts articles from ''journals, magazines, newspapers, newsletters, bulletins, books, book chapters, proceedings, reports, dissertations, studies, important web sites and web documents, and multimedia publications.'' It covers a wide range of subjects from queer studies, to homophobia and transsexualism.

EBSCO Information Services has announced a new product in this arena to be available in 2004, *GLBT Life* (http://www.epnet.com/academic/glbt.asp). It is an indexing and abstracting service for over 80 GLBT publications, as well as gray literature such as newsletters and

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case studies. ''Disciplines covered by *GLBT Life* include civil liberties, culture, employment, family, history, psychology, religion, sociology and more.''

FULL-TEXT DATABASES

Contemporary Women's Issues

While *WRI* was being released, *Contemporary Women's Issues* (*CWI*) also became available from RDS in 1996 as both a CD-ROM product and an online database. *CWI* was the first web-based database to provide full-text access to women's studies materials.

The content of the database focuses on ''development, human rights, workplace issues, violence and exploitation, education, politics, family life, legal studies, lesbian concerns, health, reproductive rights, and social issues.''[14] It provides access to more than 600 sources. Similar to *WRI*, *Contemporary Women's Issues* indexes journals, reports, and other gray literature going back as far as 1987. Emphasis is ''on current research findings, primary source materials and statistical data; however, other sorts of articles such as fact-based personal narratives and editorials'' were also included.[12]

Contemporary Women's Issues provides subject cataloging based on Library of Congress Subject Headings and its own thesaurus. In addition to keyword and author searching, the database allows the user to search under the book reviewed, geographic area, source, title, keyword, publication organization, type of graphics, and special features.

The database continues to grow and is accessible online through Gale Group, OCLC FirstSearch, and LexisNexis, and is updated on a weekly basis.

Women 'R'/GenderWatch

In 1997, Softline Information released its first full-text women's studies database, *Women 'R.'* While *Women 'R'* did not have a defined subject focus, it did try to cover a broad array of women's-related issues. The content was composed of mostly magazines with some scholarly journals and other materials. What added to the content of the database was the addition of a group of resources from another database offered by Softline, *Ethnic NewsWatch*. This group of resources greatly enhanced the diversity and quantity of materials in the database that made it unique among the other women's studies databases. ''... A wide range of African American, Jewish, Asian American, Native American, East Indian, Hispanic, Irish, and Italian newspapers and periodicals published in the U.S.''[12] gave it an edge over other women's studies databases by providing access to resources not specifically geared toward white women.

While there was no subject indexing in the original database, *GenderWatch* has recently created subject headings and is adding these to new articles, but they are not attached to older records. Within a few years, *Women 'R'* changed its name to what is now called *GenderWatch* (http://gw.softlineweb.com). The database is described as containing ''unique and diverse publications that focus on how gender impacts a broad spectrum of subject areas. With archival material dating back to 1970, *GenderWatch* is a repository of an important historical perspective on the evolution of both the women's movement and major changes in gender roles.'' Its coverage is international and goes back to the early 1970s. The database is only available online and is updated quarterly by ProQuest.

Gerritsen Collection: Women's History Online, 1543–1945

Considered to be one of the largest collections of material about international women and the feminist movement, the *Gerritsen Collection* includes a wide range of materials from pamphlets to books and periodicals in 15 languages and covering four centuries (http://www.il.proquest.com/products/pt-product-gerritsen.shtml). Originally, the collection was offered only on microfilm by UMI. In 2000, Chadwyck-Healey digitized the collection. This is a fully searchable, full-text, and full-image database.

It is divided into monographs by language and periodicals sections. The periodicals section includes 265 nineteenth and early twentieth century women's periodicals. The 4471 monographs and pamphlets are grouped by language with English representing the largest part of the collection. Searching is available by keyword, author, book or article title, publisher, city of publication, and year of publication. All searches can be limited by language and also to books or periodicals only.

Past Masters: Women Writers Collection

The *Women Writers Collection* from InteLex is a full-text source of primary works, letters, journals, and notebooks from important women writers in the English language (http://www.nlx.com/pstm/pstmww.htm). Authoritative editions of the original works are digitized from highly respected publishers such as Oxford University Press, Pickering & Chatto, and Associated University Presses. This will be updated regularly. Scholarly editions expected to be added in 2004 include further texts from Austen, Mary Shelley, Eliot, and the Brontës, as well as from Maria Edgeworth and Jane Addams.

InteLex (http://80-www.nlx.com.ezproxy.library.arizona.edu/homepage.htm) has created several other full-text databases of great works, *Past Masters* and

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Poesis. *Past Masters* contains the works of what InteLex considers the great thinkers of Western Civilization. This collection includes one female author in the main collection. *The Women Writers Collection* seems to be their response to this oversight.

Defining Gender, 1450–1910

Over the next 5 years, Adam Matthews Publications will release this database that will include 50,000 images from primary source materials (http://www.adam-matthew-publications.co.uk/collect/p545.htm). The perspective of the subjects and materials chosen will be primarily European. The database can be searched by keyword and also offers a list of biographies and topics. A helpful feature of the database is its teaching module that assists professors in the integration of database materials into their classes and projects. Ultimately, the five sections that will be covered will be on Conduct and Politeness, Domesticity and Family, Consumption and Leisure, Education and Sensibility, and The Body.

LexisNexis Primary Sources in History: Access to Women's Studies

LexisNexis has created this history database that differs slightly from most databases that offer women's history information (http://www.lexisnexis.com/academic/universe/history/). Rather than just providing access to primary source materials, this database mixes primary source materials with secondary sources. The database covers the 1800s and 1900s and enables the user to search full-text legal documents, autobiographical information and critical analyses of important figures and events in women's history. Recently, LexisNexis modified the product's name to *LexisNexis Primary Sources in American Women's History*.

Godey's Lady's Book 1830–1880

Godey's Lady's Book was to the nineteenth century what *Ladies Home Journal* and *Seventeen* was to the twentieth century—every woman and girls' guide to homemaking, dress, behavior, and marriage (http://www.accessible.com/about/aboutGL.htm). While once only available on microfilm, Accessible Archives Inc. has made this collection available online. It provides full-text access to over 45,000 pages in the magazine as well as 18,000 sketches, fashion plates, and illustrations. There is no subject index but a researcher can search the full text using Boolean operators and truncation. There are plans to develop and make available a fifth folio to complete the full run of *Godey's Lady's Books* that were published.

Women Writers Online

Brown University created this database to provide access to writings by pre-Victorian women (http://www.wwp.brown.edu/). It was made available online in 1999 and continues to be updated. The database has over 200 full-text items dating between 1400 and 1850. As a subset to *Women Writers Online*, *Renaissance Women Online* is also available. This database, which was created from 1997 to 2000, includes 100 full-text items (40 from *Women Writers Online*) dating back to pre-1670. While the project is considered complete, there will continue to be small additions and changes made.

ALEXANDER STREET PRESS COLLECTIONS

Alexander Street Press (http://www.alexanderstreetpress.com/) was formed in 2000 with a goal of producing electronic products for the humanities—to fill a gap in electronic publishing that ignored the primary texts of humanities and social science scholars. It is the first and only company to produce so many quality full-text web products dedicated to women. Of the first 18 titles, five are specific to women and women's concerns. Alexander Street's first product, launched in 2001, was *North American Women's Diaries and Letters, Colonial through 1950*. This has been followed by a number of other products including three other female-focused electronic resources, *British and Irish Women's Letters and Diaries*, *Scottish Women Poets of the Romantic Period*, and *Women and Social Movements in the U.S., 1600–2000*. A fifth women-focused database, *North American Women's Drama*, will be available in 2004.

North American Women's Letters and Diaries: Colonial to 1950

As the title proclaims, this product presents over 300 years of personal accounts of North American women through their correspondence and diaries (http://www.alexanderstreetpress.com/products/wodr.htm). The database augments the source documents with short biographical pieces on all authors, and some longer biographical pieces taken from a variety of sources such as *Notable American Women 1607–1950: A Biographical Dictionary*[15] and *Black Women in America: An Historical Encyclopedia*.[16] As with the *British and Irish Women's* database, this does not include images of the original documents.

The Alexander Street Press products of diaries and letters all have a similar format. Authors, sources, years, places, historical events, and personal events organize each database. There is also author, source, and keyword

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searching of the entire database. A simple and advanced search screen is available. The advanced search offers cross searching by keyword and limiting by a variety of choices from age at writing or marital status to geographic limits, and historical events.

While the bulk of the material comes from the United States, there is material from or about foreign countries. The Historical Events index is organized chronologically also listing the number of documents for each event. A Personal Events index is organized by a predetermined list of life experiences such as childbirth, courtship, illness, marriage, death of a parent or death of a spouse.

Searching for material by ethnic groups is possible in advanced and author searches. As of yet there are no Native American and few other minority authors indexed and few indexed Historic Events relating to the experiences of the Native peoples or Hispanic populations. The publisher does intend to add material from these populations. This is a rich resource of primary documents and will be enhanced with the addition of materials from a wider array of North American women.

British and Irish Women's Letters and Diaries

According to Alexander Street Press, *British and Irish Women's Letters and Diaries* (http://www.alexanderstreetpress.com/products/bwld.htm) will be the largest collection of British and Irish women's diaries and correspondence ever assembled. Spanning more than 300 years, it will eventually bring the personal experiences of more than 1000 women to its subscribers. Most of the material has been previously published, but the editors intend to include about 1000 pages of unpublished materials.

While the well-known and famous are found in this database, so too are many women who were known only to their families and friends. These letters and diaries reflect the everyday lives of these women and thus provide an important tool for the study and understanding of the social, political, economic, moral, and religious underpinnings of society at that time.

The various indexes and search screens are similar to those in *North American Women's Diaries and Letters*. As this is a database in progress it does not reflect the final list of historical events. It is also possible to search just diaries or just correspondence. Upon completion, this will be a valuable resource in women's studies research.

Scottish Women Poets of the Romantic Period

Alexander Street Press introduced this unique collection of poetry in 2003 and at that time it included the works of 47 poets (http://www.alexanderstreetpress.com/products/swrp.htm). Sixty volumes of poetry are the basis of this electronic collection representing a rich heritage of writing by women Scottish poets of the late eighteenth and nineteenth centuries. Most of these female poets have not been recognized before for their work or talent. The editors include biographical and critical essays about each poet, but because of the historical exclusion of these women from the canon, for some, this database constitutes the only discussion of their work. *The Scottish Women Poets of the Romantic Period* is organized by author, poem, work (source publication of poems), essays, and web resources. In addition, searching by author, poem, works, and keyword of the entire database is available. The index labeled ''Essays'' is a list by author linking to both critical essays written for this project and a bibliography of all known published criticism. Not all poets as of yet have online critical essays, and the editors welcome outside scholars' participation in contributing to the scholarly essays. Both biographical information and a complete list of works are included. The ''Search Works'' search engine allows searching by keyword through all the texts and then limiting by author, date of birth or death, place of birth or death, ethnicity, religion, edition year, nationality, publisher, editor, and printer.

Not only will this database increase the accessibility to the works of these poets, but with the search engine capabilities, it introduces new ways of analyzing the works of individuals or the entire database.

Women and Social Movements in the U.S., 1600–2000

Women and Social Movements (http://womhist.binghamton.edu/about.htm) began as a project from the Center for the Historical Study of Women and Gender at the State University of New York at Binghamton (http://chswg.binghamton.edu/). Under the guidance of Kathryn Sklar and Thomas Dublin, professors of history at SUNY Binghamton, this site began as an innovative documentary project for their students. The class project has grown as historians across the country replicate the class experience with their students and submit additions to the web site.

This web site is built around a series of primary source collections relating to a variety of American women's social and political movements. Each documentary project poses a central interpretive question that is answered by examining the 20 to 50 primary source documents attached to the question. Besides the primary documents, the entries include an abstract, documented introduction, bibliography, images, and a page of related web site links. The site also contains a ''Teacher's Corner'' with 20 documented lesson plans containing over 100 teaching ideas to be used in college survey courses or advanced high school history courses.

By 2003 the database included 45 mini-monographs linking to over 1050 primary source texts and over 400

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images. The social movements range from ''Political Women During the American Revolution'' to ''Guerrilla Girls and Politics in the Art World, 1985–1995.'' The nineteenth and early twentieth centuries are the predominant time periods covered.

Because the project had outgrown the ability of the Center to maintain and edit new material, in the summer of 2003 the project came under the auspices of Alexander Street Press (http://www.alexanderstreetpress.com/products/wasm.htm). The free web site will continue at SUNY Binghamton, but subsequent additions and maintenance will be undertaken by Alexander Street Press. Subscriptions will be required for access. Alexander Street Press will continue adding primary source material to the online database of the same name. In addition to the original documents, it offers searching by keyword, author, document title, images, document projects, social movements, and subjects. The database maintains the organizational format of the original web site, but adds searching as well as new documentary histories. It will continue to grow and expand under the new publishers.

North American Women's Drama

Slated to be available in 2004, the following is information gathered from the prepublication announcement (http://www.alexanderstreetpress.com/products/wodr.htm). The intent of *North American Women's Drama* is to present the complete plays by more than 100 women playwrights from the United States and Canada that are rare, hard to find, or out of print. Upon completion this source will include over 1500 plays by leading playwrights as well as those of lesser known but important writers. Almost one quarter of the collection will include plays that were never published before. One will be able to search through the plays and identify all plays or scenes within plays with specific words, or about particular events, or by types of characters.

FREE ONLINE DATABASES

Interdisciplinary Portals

In modern technological tradition, commonplace language has been adopted to define the virtual world. A portal in the traditional sense is a door or gateway or entrance. On the Internet, a portal is a web gateway, a metasite, and an entrée to a web site of links to many other web sites. In the area of women's studies, several portals stand out for their reliability, comprehensiveness, and currency. These are gateways to the valuable resources about women on the web. *Women's Studies Online Resources* (http://www.research.umbc.edu/~korenman/wmst/), compiled by Joan Korenman, is one of the most highly regarded of these portals and the recipient of numerous awards. Focusing on women's issues and women's studies, this site includes pages of subject-related links, women's studies e-mail lists, links to women's studies programs worldwide, financial aid information, and the online text *Internet Resources on Women: Using Electronic Media in Curriculum Transformation* (http://www.research.umbc. edu/~korenman/wmst/updates.html). This e-text is updated frequently and is directed toward the novice Internet user.

In 1991, Joan Korenman established the first academic electronic list in women's studies, WMST-L. *Women's Studies Online Resources* contains information for current users as well as the archives of WMST-L. One finds here a collection of web syllabi, film reviews by Linda McAlister, and directions on how to use and access the listserv log files. Joan Korenman has also created the Center for Women and Information Technology at the University of Maryland, Baltimore County. Part of the Center's work is the maintenance of the Center's web site (http://www.umbc.edu/cwit/) which presents a wide range of current information about women and technology from an extensive bibliography linking to full-text materials, current news articles, curriculum resources, and information about Center events.

Several American universities have developed portals that are focused on the academic environment. The University of Maryland's *Women's Studies Database* is a good example (http://www.mith2.umd.edu/WomensStudies/). Besides pages listing links for computing, government, and history, this site also includes links to current position announcements, grants, syllabi, conferences, and a bibliography of reference sources. Both librarians and teaching faculty will find the *University of Wisconsin's Women's Studies Librarian's* portal valuable (http://www.library.wisc.edu/libraries/WomensStudies/home.htm). For the instructor there are course handouts and web tutorials (http://www.library.wisc.edu/projects/ggfws/iwitutorials/iwiindex.htm). For the librarian, this site provides a searchable women's studies video database that includes a list of video distributors, lists of feminist publishers, bookstores and review sources, links to homepages of feminist magazines and journals, feminist organizations, libraries, archives and research centers, pages of subject-organized links, and Core Book Lists (http://library.wisc.edu/libraries/WomensStudies/core/coremain.htm).

WSSLINKS: Women and Gender Studies Web Sites

This web site has been created by members of the Association for College and Research Libraries Women's Studies Section (ACRL/WSS) (http://libr.org/wss/WSSLinks/index.html). Volunteers create and maintain an extensive list of web pages for general sites, art,

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archives, business, culture, education, health, history, international, lesbian sites, music, philosophy, politics, science and technology, and theology. The pages are updated regularly and all include descriptive information about the linked site.

Women of Color Portals

There are several highly acclaimed portals devoted to women of color, beginning with the *Women of Color Web* (http://www.hsph.harvard.edu/grhf/WoC/) that is dedicated to providing access to writings by and about women of color in the United States. This site focuses upon issues related to feminisms, sexualities, and reproductive health and rights. It also provides links to organizations, discussion lists, and teaching tools. *Black American Feminism: A Multidisciplinary Bibliography* (http://www.library.ucsb.edu/blackfeminism/) includes a significant bibliography on black feminist thought dating back to the nineteenth century. It covers a very wide range of subject areas and genres, and a page that is a bibliography with links to significant web sites about feminist thought. Native American women are the focus of Native American Women on the WWW (http://www.library.wisc.edu/libraries/WomensStudies/native.htm) with links to multipurpose sites and full-text documents.

International Women's Portals

For the international perspective, the *Social Science Information Gateway* (*SOSIG*) based in the UK provides an online catalog of high-quality Internet resources. The *SOSIG* section for women's studies (http://www.sosig.ac.uk/womens_studies/) links to pages for 18 broad topics such as health, women and war, feminist theory, environment, and girls and young women. The unique feature of *SOSIG* is that rather than simply linking to the web site, this database links to a catalog record of descriptive information about the web site, subject headings, types of information at the site, e.g., articles, reports, etc., and a linked URL. There is a search engine attached to the site that allows searching by keyword through the whole catalog or just the women's studies section. *International Gender Studies Resources* (http://globetrotter.berkeley.edu/GlobalGender/) is another excellent portal for research on international women that was developed at the Institute for International Studies at Berkeley (http://globetrotter.berkeley.edu/). For the best portal to information about Latin American women, the University of Texas *LANIC Women & Gender Studies* (http://www.lanic.utexas.edu/la/region/women/) is the site of choice. It is organized with links to specific Latin American countries, regional, and international sources. *SAWNET: South Asian Women's NETwork* (http://www.umiacs.umd.edu/users/sawweb/sawnet/) is a forum for those interested in South Asian women's issues. Containing a potpourri of links to news, film reviews, a bookshelf for adults and children, organizations, charities, health, a discussion list, and links by country, *SAWNET* is unique for its geographic area.

Statistical Portals

Locating statistical information on women can be a daunting task. Many of the statistics that are needed are buried within other statistics databases. The U.S. Census Bureau maintains a web page that serves as a gateway to access reports on women and gender derived from U.S. Census data (http://landview.census.gov/population/www/socdemo/women.html).

For international statistics, the United Nations is responsible for *WomenWatch*, *Documents and Databases: Statistics and Indicators* (http://www.un.org/womenwatch/resources/stats.htm). This is a comprehensive web site that provides online access to data and reports on women around the world in general and also breakdowns based on different topics such as education, government, and employment. *United Nations Women's Indicators and Statistics* (*Wistat*) is available on CD-ROM and is a comprehensive and searchable database that covers a variety of topics relating to women and gender around the world. *GenderStats* is another database that allows the user to search not only UN data but also national statistics and World Bank data as well. The database allows for saving statistics as spreadsheets, which can then be used for customizable reports (http://devdata.worldbank.org/genderstats/home.asp).

The University of Wisconsin's Women's Studies Librarian's page (http://www.library.wisc.edu/libraries/WomensStudies/stats.htm) also maintains a portal for online statistical databases on a variety of women's studies-related issues such as rape, domestic violence, employment, and education.

The Henry A. Murray Research Center of Radcliffe (http://www.radcliffe.edu/murray/overview/index.htm) provides access to over 270 studies on the ''study of lives.'' The data sets include both female and male subjects from many different socioeconomic, racial, ethnic, and age groups. A researcher can search the archives by keyword or browse by title or contributor.

The Alan Guttmacher Institute (http://www.agi-usa.org/) also provides excellent policy briefs filled with statistical data on women's issues such as abortion, pregnancy, sexual behavior, and public policy. Besides having current reports and statistics, the web site also maintains a small archive.

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Portals of Popular Focus

For a less academic focus, Femina (http://www.femina.com/) provides a large searchable directory of links to female-friendly web sites. The subject directory list of topics is directed to the popular audience with links to sites about active wear, hair loss, plus sizes, as well as careers, reproductive health, and sexual harassment. Site users are encouraged to share ideas about current news and participate. Unfortunately, this site now includes advertising pop-ups that are annoying and distracting. The persistent advertising seems to almost defeat the usefulness of the site.

Primary Sources

A number of free web sites with primary source material include excellent collections about women. American Memory at the Library of Congress (http://memory.loc.gov/) is perhaps the best example with its rich collection of original documents reflecting the history and culture of the United States. Many collections are available on topics such as the suffrage movement, women pioneers, women journalists, and an excellent guide to women's studies collection at the Library of Congress. Several universities and research libraries have digitized sections of their unique women's collections. Smith College library has created *Agents of Social Change: New Resources in 20th Century Women's Activism* (http://www.smith.edu/libraries/libs/ssc/exhibit/) that features eight activist graduates including Gloria Steinem. Duke Universities Special Collections Library presents from its collection Women's Liberation Movement (http://scriptorium.lib.duke.edu/wlm/), African–American Women (http://scriptorium.lib.duke.edu/collections/african-american-women.html), and Civil War Women (http://scriptorium.lib.duke.edu/collections/civil-war-women.html). The Schomburg Center for Research in Black Culture has digitized material not previously accessible with its African American Women Writers of the 19th Century (http://digital.nypl. org/schomburg/writers_aa19/intro.html).

Excellent lists of links to the many women's studies archival sites can be found at the WSSLINKS ''Archives'' page (http://home.gwu.edu/%7Emfpankin/archwss.htm), *H-Women* (http://www.h-net.org/~women/manuscripts/), and *American Women's History: A Research Guide* (http://frank.mtsu.edu/~kmiddlet/history/women/wh-digcoll.html).

Collection Development Sites

While Amazon.com (http://www.amazon.com) has become the fallback for book searching, there is more to collection development than searching for book titles. With this in mind, a web collection of resources for librarians engaged in collection building was developed. *Collection Development Resources* (http://www.libr.org/wss/committees/colldev.html) contains a page linking to award-winning and notable titles for women's studies, a checklist for collection evaluation, review sources for books and films and videos, a list of women's studies publishers, a bibliography of materials relating to issues for women's studies selectors, and a set of unique database instruction guides designed for use by librarians, faculty and students. Topics also include collection assessment, the history of women's studies serials, women's studies in the Library of Congress classification, and information access. The focus here is on women's studies librarianship in the United States. In addition, this site links to several unique tools such as a page about electronic resources and assessment, a core list of serials in women's studies, and the Core Lists of Women's Studies Books. The Core Lists are bibliographies of current in-print books organized into more than 40 topics. Each list includes from 20 to 75 titles of the most essential books still in-print for a basic undergraduate collection to support a women's studies program. This list is updated every January and will soon be available in a searchable online database.

Another group from the American Library Association, the Feminist Taskforce, has always been interested in publications of interest to women librarians and women library workers. The Task Force subcommittee on Resources created a page (http://www.libr.org/FTF/resources.html) linking to alternative press sources, an Asian women's resource exchange, Lavender Legacies, a guide to gay and lesbian materials, and Mev Miller's Women's Presses Library Project.

CONCLUSION

The last few decades have brought about significant changes in how researchers obtain relevant material on women's issues, experiences, and lives. The introduction of many of these databases has significantly reduced the numbers of hours that a researcher once spent searching every database to locate information. However, gaps still exist.

Women's studies researchers now seek information on increasingly more interdisciplinary topics. Database producers are beginning to address these issues by creating products that incorporate materials on these newer research topics. *Gender Studies Database* (http://www.nisc.com/GENDER/) by NISC is an example of such a database. It combines several of NISC's other databases into one product. Some of the content of the *Gender Studies Database* comes from *Men's Studies*

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Database, *Sexual Diversity Studies*, and *Women's Studies International*. The creation of this database seems to indicate that database producers are now responding more quickly to researchers' needs.

Another significant gap that remains is the lack of information on women of color. While some databases provide access to materials by and for women of color, there are currently no databases that exist entirely dedicated to such needs. The only database created specifically for this area of research was *Women of Color and Southern Women: A Bibliography of Social Science Research*. This database was an outgrowth of the print resource and only indexed from1975 to 1995. It is now part of *Women's Studies International*.

Unfortunately, the lack of women's studies materials being integrated into all databases necessitates the development of new databases dedicated to women's studies and other related topics. It would be preferable for database companies to expand existing databases that integrate women's materials within them instead of adding on separate modules specifically for women's studies resources. When integration of women's studies materials becomes a standard in the development of databases, a new message about the validity of women's studies as a field of study will have taken place.

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