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University of Illinois at
Urbana-Champaign Library
# Technical Standards for Library and Information Science

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*Issue Editor*

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Foreword

In an effort to get this issue to its readership in a timely manner, and because our standard for bibliographic citations has always been The Chicago Manual of Style (University of Chicago Press), we have not followed Issue Editor Rush's request to use the newer ANSI standard for citation formats. Although individual authors were asked to follow the ANSI standard, they either could not or would not do so, and we therefore chose to follow our past policy and practice. Let the record show that Dr. Rush would have preferred the ANSI standards—one of life's little ironies.

Charles H. Davis
Editor
Introduction

JAMES E. RUSH

This issue of *Library Trends* is devoted to an in-depth examination of technical standards that affect the library and information sciences and related publishing practices. Nine articles have been prepared for this issue by people who have extensive knowledge of and experience in the development, promotion and use of standards.

Standards may address any area of concern, and they may be either descriptive at the one extreme or prescriptive at the other. Standards are intended to make it possible for those who apply them to achieve a greater degree of compatibility among their practices, procedures, techniques, equipment, data, and so on. Such compatibility must, however, achieve a careful balance between competition (and invention and innovation) on the one hand, and collusion (and stagnation) on the other. And, of course, it is not easy to predict exactly the effect of any standard prior to actual employment in routine operational settings. Economic factors play a part at least as important as that of quality or consistency in determining the nature and use of standards.

Standards no doubt represent something of a mystery to many people, even to those whose work must follow particular standards. Where do standards come from? Who enforces standards? How do you and I become involved in standards development? These and many more related questions are addressed first by Henriette Avram, Sally McCallum and Mary Price (all of the Library of Congress). In this paper you will read not only about the American National Standards Committee (ANSC) Z39, but about other standards-making bodies, such as the

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International Organization for Standardization (ISO), International Council of Scientific Unions—Abstracting Board (ICSU-AB), Unesco, National Bureau of Standards (NBS), and many more. This excellent article considers both formal and informal standards and many of the organizations that are involved in their development, promulgation and use.

But knowing the organizations that are involved in standards development is insufficient to enable us to understand standards development. We also need to know how standards are actually developed. Robert Frase (formerly Executive Director of ANSC Z39, now retired) takes on the task of analyzing and reporting on the procedures for development and access to published standards. Both national and international procedures are examined. Frase presents a well-crafted view of the formal and informal strictures under which various bodies operate in developing standards. His article, together with that of Avram, McCallum and Price, presents a coherent, in-depth look at the who and how of standards development.

Standards development is a slow and costly process. For this reason, among others, I have attempted to construct a model to facilitate the development of an integrated set of standards. Up to now, standards development in the library and information sciences and in related publishing practices has followed a rather incoherent approach. The model I present is aimed at providing a framework within which standards development can take place, and which should prevent redundant and/or conflicting standards from being developed. The model should also facilitate the establishment of priorities for standards development.

The next four papers in this issue treat aspects of standards development and use within the context of the model I have proposed. Thomas Brown (Washington Library Network) first deals with communication standards. Any message in a communication system is structured in a more or less well-defined way that affect the successful interpretation and use of the message by the recipient. Brown considers in particular online communication involving two or more computer systems, and discusses those standards which have been or are being developed to facilitate communication of data. As Brown shows, the bulk of this standards development work has been done outside the library and information sciences.

Walter Crawford (RLG, Inc.) next considers the standards related to the structure of data contained within a message. His focus is on ANSI Z39.2-1979(R) (and the parallel international standard ISO 2709), since this is one of the most important standards yet developed for use by
the library field. Other standards are also treated by Crawford, but he shows that these are used in quite restricted circles and have not had the significant influence in the fields of library and information science and related publishing practices that Z39.2-1979 has had. All is not a bed of roses, however, as Crawford shows in exploring the costs of implementation and use of data structure standards.

One of the most thorough and thoughtful papers in this issue is that written by Robert Tannehill (Chemical Abstracts Service) and Charles Husbands (Harvard University), with the assistance of Linda Bartley (Library of Congress). Their subject is "data representation conventions and standards for bibliographic data elements." In my opinion, librarians, information scientists and those involved in publishing seem to delight in perpetuating disparate conventions for representing the values of the vast assembly of data elements with which we deal every day. Date is just one example. "1982 July 4" can be (and is) represented in any of the following ways (among others):

July 4, 1982
4 July 1982
19820704
820704
4/7/82
7/4/82
7.4.82
4.7.82
4.VII.82
82185

The confusion and error this richness of variety has caused is unjustifiable. The U.S. counterpart of the international standard for representation of dates is ANSI X3.30-1971. This standard prescribes a hierarchical structure beginning with the most generic part (millenium) and ending with the day of the month. A related standard for representing time (ANSI X3.51-1975) simply extends this hierarchical structure to hours, minutes, seconds, and so on. Despite the existence of these standards, there is little adherence to them.

Tannehill and Husbands consider a wide range of problems and developments in standardization of data element values, and conclude that: "Strengthening of the existing standardization process would appear to be in order if standards are to play the viable role that is needed in order to achieve consistency, accuracy, and efficiencies in bibliographic data transmission and use."
The importance of standards in the foregoing categories notwithstanding, the manner in which data are displayed can easily negate the benefits of employing these standards. Hickey and Spies examine existing and proposed standards for presentation (display) of information in various forms. Although we usually think of display in visual terms (the mode emphasized by Hickey and Spies), audio and tactile displays are becoming important (primarily for those with impaired hearing or sight). The article by Hickey and Spies deals with a wide range of standards for information display, and one of its strengths lies in the identification and description of standards that fall within the category. Despite the number of standards identified, the authors note that little use is made of them by designers and developers, although users are becoming increasingly vocal in expressing their dissatisfaction with this state of affairs.

Speaking of use brings me to the penultimate paper in this issue. Sandra Paul (SKP Associates) and Johnnie Givens (Metrics Research Corporation) have taken on the very difficult task of writing about the application and use of standards in ordinary production operations or in routine daily use. While the literature seems to be rather extensive in regard to the need for and development of standards, there is very little literature dealing with the actual use of standards. The paper by Paul and Givens is thus an important contribution to the standards literature. These authors treat standards from the point of view of their importance to authors, publishers, librarians, abstracting and indexing services, and readers, and they discuss both the apparent benefits and the problems of standards use by these various groups. It is unfortunate that no one has carefully studied and reported on the effect of adoption of one or more standards on the cost and ease of use of information systems.

James Wood (Chemical Abstracts Service), who has been involved in standards work for many years (most recently as chairman of ANSC Z39), concludes this issue with a careful examination of the factors influencing the use of technical standards. He uses as a framework for his presentation the elusive nationwide library and information service network. Wood treats in an authoritative manner the activities that have taken place during the past decade or so, and the review rhetoric regarding the need for and value of standards in relation to the objective of a nationwide information transfer system. He points out that while much has been said or written about the need for and value of standards, the fact is that their adoption and use "has been spotty at best." Some people will view Wood's article as painting an overly bleak picture of the current state of affairs in standards adoption and use. The article is,
Introduction

rather, a well-reasoned examination of the political, economic and social factors that influence standards development and adoption, and it is a very important contribution to this issue.

Finally, let me say that no task worth doing is without some difficulty. I had planned one additional article for this issue dealing with standards for media and the housing of media. This subject area was intended to cover standards for paper, card stock, film, ink, and the like, as well as standards for temperature, humidity, light level, atmospheric content, and so on. Unfortunately, none of the people I contacted to write in this area were inclined to do so, hence the absence of an article in this subject area.

Despite this omission, I believe the papers in this issue of *Library Trends* represent one of the best, most comprehensive reviews of technical standards for the library and information sciences and related publishing practices ever published. I am pleased to have had the opportunity to work with all of the authors who contributed to this issue. Each and every one has devoted his or her considerable intellect, and has taken a great deal of time from an otherwise very full schedule, to prepare the articles in this issue, and I am grateful for their efforts.

I trust that you, the reader, will find the articles in this issue as informative as they are authoritative and comprehensive. But more than that, I hope that you will achieve a new appreciation for the importance of standards uniformly adopted and applied, as well as for the enormous effort required to develop them.
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Any discussion of standards-setting bodies inevitably brings up the question of definition of a standard. In any discipline there will be an assortment of shared practices that are set up and established by authority, custom or general use with more or less formal endorsement. Information science is no different, and "standards" take a variety of forms. While any shared practice may be called a standard, the key to proper use—or to the prevention of misuse—of a standard lies in the careful inspection of the scope of the standard before attempting to apply it. The scope should define the population for which the shared practice is intended to be a standard and the objectives that it is meant to further.

In this paper a variety of organizations will be described that promulgate standards—from those whose sole purpose is the setting of standards, such as the International Organization for Standardization (ISO), to those that develop standards as aids to their missions to provide specific services, such as the International Federation of Library Associations and Institutions (IFLA). The standards set by these bodies may be intended for nationwide or worldwide use in the information science area or for only limited use by a special segment.
Standards themselves take a variety of forms. They may be guidelines or models against which services, etc., are to be compared. Library service standards fall into this category. Other standards take the form of rules for activities that should be applied as consistently as possible but which, by their nature, will not necessarily produce the identical results even when followed. Cataloging rules are of this type. A third class of standards are specifications or "technical" standards for which strict observance is necessary if sharing is to take place. Format structure, character sets, and code list standards fall into this class.

Against this background, examination of the major standards-setting bodies that influence library standards reveals that they differ in the process by which the standards are developed, the user group for which the standards are intended, and the types of standards a particular organization undertakes. These points will be emphasized later along with an indication of formal and informal relationships between groups. No attempt has been made to be comprehensive, but leading examples of different types of organizations are discussed.

STANDARDS ORGANIZATIONS

The first two organizations described below are devoted totally to standards development. A part of each is responsible for standards for the library, information science and publishing community. Because of the breadth of this constituency, these standards groups usually work with standards that are useful to multiple communities, not just to libraries, and their draft standards are usually subject to a wider review than are those developed within, for example, IFLA.

American National Standards Institute

The American National Standards Institute (ANSI) is the primary nationwide standards-setting body in the United States. ANSI is a "voluntary" standards organization in that the members participate by choice, and the standards are used by choice—ANSI is not a government organization, and its standards have no legal force. The development of ANSI standards is firmly based on voluntary cooperative efforts by corporations and institutions. The members of ANSI are some 900 profit and not-for-profit companies and approximately 200 other standards-producing organizations (such as the many trade associations and institutes). In fact, ANSI, established in 1918, grew out of an industry-felt need to make standard setting more efficient in the United
States by avoiding the duplication and conflict of standards that different industry-related organizations were developing at that time.\(^1\)

The actual work in developing an American National Standard takes place through the American National Standards Committees (ANSC), which are organized by ANSI, and through other recognized standards groups, such as the Institute of Electrical and Electronics Engineers (IEEE), that follow procedures in standards development that meet ANSI requirements. These are all voluntary groups that are organized to develop standards in specific areas. The names and scopes of ANSI Committees that are of the most interest to libraries are the following.\(^2\)

**ANSC Z39—Library and Information Sciences and Related Publishing Practices.** Scope: Standards relevant to information systems, products and services, and to encourage their utilization in library, publishing, document delivery, information dissemination, information handling, data systems, and related activities in media.

**ANSC X3—Information Processing Systems.** Scope: Standardization in the areas of computers and information processing systems and peripheral equipment, devices, and media related thereto; standardization of functional characteristics of office machines and accessories for such machines, particularly in those areas that influence the operations of such machines.

**ANSC Z85—Standardization of Library Supplies and Equipment.** Scope: Definitions, specifications, dimensions, and methods of testing in the field of library supplies and equipment, exclusive of machine storage and retrieval.

**ANSC PH5—Micrographic Reproduction.** Scope: Standardization of terminology, definitions, sizes, formats, quality, apparatus, and procedures for the production and use of microform reproductions.

**ANSC X12—Business Data Interchange.** Scope: Standardization to facilitate the interbusiness and institutional electronic interchange relating to order placement and processing, shipment and receiving, invoicing, payment, and cash application data.

ANSC Z85 has as its secretariat the American Library Association (ALA), and its only standard to date is a key one for library sharing in the past decades—the specifications for permanent and durable library catalog cards. This standard set the size of cards and position of the rod hole, as well as the paper quality for catalog cards. ANSC PH5 has developed standards for microforms that have helped to stabilize both the size and reduction ratios of different types of microforms and to establish durability and quality specifications. While ANSC X3 standards affect many parts of library hardware and software, a prominent X3 standard used by the library community is the one for the basic Roman character set American Standard Code for Information Interchange (ASCII). The library community has also benefited from numerous X3 computer tape standards that are used with the library tape
exchange format. ANSC X12, which was organized in the late 1970s, will be establishing standards for invoicing and ordering that could affect library purchasing procedures.

ANSC Z39 is obviously, however, the standards-developing committee of ANSI that is most important to the library community. By combining into one committee library, information science, and publishing interests, Z39 standards frequently take into account wider interests than those developed by ALA for the library community. At the present time Z39 has fifty-six member institutions, of which approximately 53 percent are libraries or library support organizations, 20 percent are information services, and 27 percent are publishers. Z39 has been responsible for the development of a variety of standards, primarily of the rule and technical specifications type, including standards for the physical layout of library material, for Romanization, for collection of statistics, for citation through text and numbers, and for format structure in machine-readable data exchange.\(^3\)

ANSI monitors the scopes of the ANSCs and other ANSI-affiliated standards groups to avoid duplication of effort, and is currently in the process of increasing these information exchange activities. ANSI also provides the means for nationwide review of standards that are potential American National Standards. When all reviews are completed, ANSI checks the process by which a standard was developed, and only if it meets the ANSI consensus criteria will ANSI publish the standard. The approval process within ANSC Z39 and other ANSI groups emphasizes extensive review and agreement from all interested member organizations. The role of ANSI vis-à-vis the standards it publishes is one of oversight and publicity. It does not support the ANSCs financially nor dictate in any way the content of their standards.

International Organization for Standardization

ANSI coordinates the volunteer standards development efforts in the United States and many other countries likewise have nationally recognized volunteer standards organizations—British Standards Institute in Great Britain, Association Française de Normalisation in France, Deutsches Institut für Normung in the German Federal Republic, and Standardiseringskommissionen i Sverige in Sweden, to name a few. By the middle of this century the impact of “world shrinking” technology emphasized the need for coordination among these national standards bodies; thus, in 1947 the International Organization for Standardization (ISO) was created. The areas of standardization supported in ISO range from engineering to farming, covering all fields—except
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electronics and electrical engineering, which are handled by its counterpart in the electrical/electronics fields, the International Electrotechnical Commission. Like ANSI, ISO is a voluntary standards-developing organization. ISO sees use of its standards occurring through two channels: direct use of the standard by organizations, or incorporation of the standard into a national standard, the latter being as important as the former.

The ISO members are the national standards institutes from countries around the world. These national standards organizations may be governmental or may be voluntary, as is the U.S. member ANSI, but ANSI is an exception. The majority of the ISO member bodies are government-supported within their countries. At the present time there are over eighty member countries of ISO, approximately two-thirds of which are developing countries.

ISO has a hierarchical structure for its standards development work. It is administered by the General Assembly (all ISO members) and the Council (eighteen General Assembly members). Technical Committees (TC), with their supporting Subcommittees (SC) and Working Groups (WG), are formed to oversee the actual development of standards in specific areas. The most important Technical Committees to the library field are TC 6, Paper, Board and Pulp; TC 37, Terminology; TC 42, Photography; TC 46, Documentation; and TC 97, Information Processing Systems. The TC whose work most closely parallels that of ANS C239 is TC 46, with a scope of standardization of practices relating to libraries, documentation and information centers, indexing and abstracting services, archives, information science, and publishing. Accordingly, the following Subcommittees and Working Groups have been formed under TC 46.

SC 2, Conversion of written languages
SC 3, Terminology of documentation
SC 4, Automation in documentation
   WG 1, Character sets
   WG 3, Bibliographic filing
   WG 4, Format structure
   WG 5, Protocols
SC 5, Mono- and multi-lingual thesauri
SC 6, Bibliographic data elements
   WG 1, Data element directory
   WG 2, Codes and numbering systems
SC 7, Presentation of publications
While the central headquarters and staff of ISO are in Geneva, the administrations of the TCs are distributed among the member bodies and supported by those member bodies. At the present time Germany holds the secretariat for TC 46, and the United States for TC 97. Likewise, the Subcommittees and Working Groups are maintained in a decentralized fashion, and Sweden serves as secretariat for TC 46/SC 4, while Canada serves TC 46/SC 6.

The actual writing of standards usually takes place at the lowest hierarchical level—in the Subcommittees or Working Groups. When a standard is acceptable to the WG members, it is circulated to the members of the sponsoring Subcommittee as a draft proposal. Following approval of the draft proposal, the new standard undergoes a further ballot among members of the TC. After each ballot the standard goes back to the WG for resolution of negative aspects, as the lowest level body remains the active participant in the process. This review process is extensive, and a major factor in the time required for completion of an ISO standard, but it also leads to wider acceptance of the standard. Because of the expense and difficulty of holding meetings of members spread throughout the world, much of the work of TC 46 and its Subcommittees and Working Groups takes place through the mail. Every two years, however, a plenary meeting of TC 46 is held following which its SCs and WGs usually meet.

ANSI activity in ISO Working Groups takes place through the corresponding ANSI committees. Thus ANSC Z39 handles for ANSI recommendations concerning all standards activities that take place in TC 46.

ISO Standards

In the library and information areas, ISO standards have indeed been used and have influenced U.S. national standards. The International Standard Book Number (ISBN) and International Standard Serial Number (ISSN) were both standards activities that began in ISO (although early work in serial numbering did take place in ANSI). These two standards correspond to the subsequently developed ANSI Z39.21, “Book Numbering,” and ANSI Z39.9, “International Standard Serial Numbering.” Likewise, the ANSI standard for country codes is based on the ISO standard, and the two will become even more alike after the upcoming review. As was noted earlier, many ISO standards are derived from national standards, and ANSI has been responsible for a number of “seed” international standards including Z39.2, “Bibliographic Information Interchange on Magnetic Tape,” which gave rise
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to ISO 2709, "Format for Bibliographic Information Interchange on Magnetic Tape."

ISO and ANSI

One of the major organizational differences between ANSI and ISO is in the voting membership. In ANSI, members may be private firms, government departments, trade associations, or even other standards-making organizations; in ISO, the members must be the leading national standards body from each of the member countries of the world. The effect of this difference is that the American Library Association, the leading library organization in the United States, can be a member of ANSI and help formulate library comment on standards developed there, whereas IFLA, the international association of libraries, cannot be a voting member of ISO. The natural overlap of standards activities between ISO and IFLA are thus coordinated by liaison relationships, informal reports, and review of ISO draft standard drafts by IFLA.

LIBRARY ASSOCIATIONS

ANSI and ISO are the volunteer standards-setting groups that most affect libraries. However, the standards set by the library professional organizations, ALA and IFLA, have greater impact on libraries in many areas. ALA and IFLA concentrate their attention on library problems; thus, while they engage in many other activities besides standard development, the standards and guidelines that they do create are widely used.

American Library Association

The American Library Association is the largest library association in the United States, representing many types of libraries and many kinds of library activity. While development of standards is not its principal activity, practically any type of project undertaken by its diverse membership raises a need for standards.

Organizationally, ALA is divided into units (divisions, sections, round tables) that concentrate their attention on a specified area of librarianship and/or library service. The major units, the division, can be categorized as type-of-library or type-of-activity, with the Public Library Association exemplifying the former and the Resources and Technical Services Division representing the latter.
ALA Committee on Standards

Standards work in ALA is coordinated by the ALA Committee on Standards. Two factors led to the creation of a Committee on Standards at the ALA level approximately a decade ago: the awareness of the importance of standards to librarianship, and the possibility of confusion due to lack of a vehicle to coordinate the many efforts throughout the organization. Since the focus of the activity in each of the ALA units follows the area of interest of that unit, there was frequently an overlap of effort when different units isolated a need for a standard that was common to more than one unit. The Committee on Standards is thus responsible for ensuring that the many ALA units develop meaningful and useful standards with minimal duplication of effort.

In order to carry out its charge, the committee sets procedures for the preparation of standards that will ensure consistency with the policies established, reviews existing standards for their continuing relevance to libraries, recommends the establishment of new standards to appropriate units within ALA, and collects and disseminates standards to the community from within ALA and other national and international organizations. Basically the committee sets policy for standards developed in the ALA.

Standards developed within ALA may be prepared and officially adopted by ALA at two levels: the standard may be developed and adopted by a type-of-library unit, or any unit may develop a standard which is then forwarded to ALA Council for ALA-wide adoption. Thus, at the present time, only type-of-library units have the autonomy both to develop and to adopt standards. Adoption of a standard by a division may be carried out in various ways, among which are through vote of the division membership, through approval by an authorized committee of the division, or through the vote of the division board. In addition, all standards, regardless of whether they come from a type-of-library or type-of-activity unit, must be approved by the Committee on Standards. A revised handbook which sets forth the details for developing ALA standards, as well as describing the prescribed content, style and format of a standard, will be published by the Committee on Standards in 1983.5

ALA is involved in the development and adoption of all three types of standards—guidelines, rule and technical—but standards development activity concentrates on the first two. The many committees within the various professional units reflect this variety of activity, e.g., the Resources and Technical Services Division's (RTSD) Cataloging Description and Access Committee, which reviews and comments on any proposed revision to the Anglo-American Cataloging Rules; the
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American Association of School Librarians' Standards Program and Implementation Committee, which is active in school library media standards; the Association of College and Research Libraries' (ACRL) Standards and Accreditation Committee, which directs the development and maintenance of guidelines and standards for academic libraries; the Standards Committee of ACRL’s Rare Books and Manuscripts Section, that serves as the ALA body responsible for all matters involving standards of rare books and manuscript collections; the Library and Information Technology Association's (LITA) Technical Standards for Library Automation Committee, which supports the development of standards related to library automation; and the joint RTSD, LITA and Reference and Adult Services Division committee that reviews standards concerned with the exchange of machine-readable data. This latter committee is an example of the interunit cooperation on common standards that the Committee on Standards fosters.

ALA plays an important role in establishing service guidelines for different types of libraries—a logical concentration for the Association. ALA has over thirty guidelines for a variety of library areas, from minimum standards for public library systems, to national interlibrary loan code, to guidelines for library service programs to jails.6

ALA and ANSI

ALA has a long history of interaction with ANSI. In 1939, ALA, along with the American Association of Law Libraries, Medical Library Association and Special Libraries Association, petitioned ANSI (then called the American Standards Association) to establish a committee with primary interest in libraries. ANSI did form such a committee—ANSC Z39—and ALA served as its first secretariat from 1939 to 1951. (Since 1951, the Council of National Library Associations, of which ALA is a member, has held the secretariat.) ALA has also worked with ANSC Z85, for which ALA currently serves as secretariat. Because of its continuing involvement in ANSC Z39, ALA was asked in 1977 to serve on the National Commission on Libraries and Information Science task force that studied the scope, and organizational and financial structure of ANSC Z39.

ALA is a voting member of ANSCZ39 and takes an active interest in all library-related standards developed by the committee. The Resources and Technical Services Division serves ALA as the coordinator of ALA-wide reviews of ANSC Z39 proposed standards.
The International Federation of Library Associations and Institutions had its beginning in 1927. It is a nongovernmental, nonprofit association founded "to promote international understanding, cooperation, discussion, research, and development in all fields of library activity, including bibliography, information services and the education of personnel, and to provide a body through which librarianship can be represented in matters of international interest." These objectives are carried out through a variety of activities such as basic research studies, conferences and meetings, publications, collaboration with other international organizations, training, etc., in which standards continually play a major role. IFLA by its international nature must focus on standards that ease communications by normalizing the practices of various countries.

The membership of IFLA consists of association members such as library and library school associations, institutional members such as libraries and library schools, and honorary members such as past presidents or individuals recognized for outstanding services. IFLA also recognizes a status of "affiliation" for institutions not principally concerned with library activities but supporting the purposes of the organization, and for individuals also supporting the purposes of IFLA but not representing an association or institution.

A major part of the professional activity in IFLA is organized in divisions which are made up of member representatives. At the present time there are eight divisions which may be categorized, as with ALA, as type-of-library or type-of-activity divisions. These are: (1) General Research Libraries, (2) Special Libraries, (3) Libraries Serving the General Public, (4) Bibliographic Control, (5) Collections and Services, (6) Management and Technology, (7) Education and Research, and (8) Regional Activities. The IFLA divisions are made up of sections organized according to particular interests within the scope of the division. For example, the Division on Bibliographic Control contains the Section on Cataloging. Both divisions and sections may also establish round tables and working groups. The decisions to work on standardization in particular areas are usually made at the division and section levels, although the actual work is carried out in working groups. The sections provide general review of the work of the working groups.

IFLA has three major professional programs, namely, Universal Bibliographic Control (UBC), Universal Availability of Publications (UAP) and International MARC program. There presently exist UBC
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and UAP offices to support these programs, and funds are being sought to establish an International MARC office. There is also an IFLA Office for International Lending with the principal responsibility for facilitating international lending. These offices are staffed with full- or part-time IFLA employees.

The UBC office serves as a coordinating agency for the UBC program, the objective of which is "to make universally and promptly available, in a form which is internationally acceptable, basic bibliographic data on all publications issued in all countries"—a mission obviously dependent on standards. The office has within its purview concern with standards pertaining to bibliographic control, such as cataloging rules and practices and bibliographic descriptions. The UBC office thus serves as secretariat to IFLA divisions, sections and working groups developing cataloging or technical standards, and contributes significantly to the development of these standards. In addition, the office performs a variety of research tasks aimed toward further standardization in cataloging practices. The UBC office also undertakes a vigorous publishing program to assure wide dissemination of IFLA standards.

The objective of the UAP program is to make library material available wherever and whenever it is needed. The office has initially concentrated on research into the present situation in document access to identify problems and analyze possible solutions. UAP has just begun to work in the standards area, with development of guidelines for the compilation of union catalogs and union lists of serials currently underway.

A major set of standards developed by IFLA for the library community has been the International Standard Bibliographic Description (ISBD) which specifies the requirements and standardizes the presentation form of bibliographic descriptions. The sections on cataloging, geography and map libraries, serial publications, and rare and precious books and documents have produced the ISBD for many forms of material. The ISBD program is administered by the UBC office which is responsible for the review, maintenance and publication of the standard. The activities of the Section on Cataloging also include the establishment of the ISBD for Component Parts, preparation of an ISBD manual of examples illustrating problem areas, chairing the ISBD five-year review, and work on standardization of headings such as corporate headings and uniform titles.

Another major IFLA standardization effort was the development of UNIMARC, the format to be used by national bibliographic agencies.
It was a cooperative effort of the Section on Information Technology with the Section on Cataloging. Due to the lack of standard international cataloging codes and practices, the national MARC formats differed in data content and content designation, although most follow the ISO standard format structure. The UNIMARC format was built on ISO standards and on the IFLA ISBD standards. In these parts of the cataloging entry which are national in nature, such as name headings, or dependent on language, such as subject headings, standard content designation was imposed on top of national practices. Thus, the resultant record would uniquely identify an item in a standard way, and the recipient of the record would have an option of accepting or rejecting those elements of the record for which there are no international standards.

Both the sections on cataloging and information technology are also collaborating on the design of various aspects of an International Authority Control system. This latter effort includes a standard for a printed authority record, the design of an international authority number, and the extension of the UNIMARC format to facilitate the exchange of authority records.

From the foregoing it can be seen that IFLA concentrates on library community standards of the guideline and rules type—areas where agreement within the whole information community would be ideal but extremely difficult to obtain. IFLA itself has the task of reconciling national practices when developing standards, a factor that greatly influences the work it undertakes.

ALA is a member of IFLA and as such participates in the review of IFLA standards during development stages. The IFLA standards approval process includes extensive international reviews by its members and other standards organizations such as ISO.

IFLA also has liaison with ISO and encourages the use, within the library community, of ISO standards that are primarily technical but required for library work. Some of the areas of standardization in ISO TC 46 in which IFLA is also concerned are:

1. Format structure—IFLA adopted the ISO standard for UNIMARC and developed the content designation required for the library community.
2. Transliteration—IFLA reviews ISO efforts for the library community and accepts ISO standards.
3. Code lists—IFLA reviews the work and, where applicable to the library community, adopts the ISO standards.
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4. Character sets for bibliographic use—IFLA has adopted these sets for use with UNIMARC and will continue to review new sets as they are developed.
5. Data dictionary development—IFLA reviews this work to make certain library needs are considered.
6. Protocols—Since protocol standards are going to be needed for future computer-to-computer links between library systems, IFLA reviews the work in progress.

Other Library Associations

Standards work is also carried out within the specialized library associations such as Special Libraries Association, Music Library Association, and Medical Library Association. Each is influential in the establishment of standards for its constituencies and for providing special sector comment on ALA and ANSI standards.

COOPERATIVE STANDARDS ACTIVITIES

There are at least three major cooperative activities among national libraries that have an impact on library standards: (1) the Joint Steering Committee for Revision of Anglo-American Cataloging Rules; (2) the Conference of Directors of National Libraries, with its International MARC Network Study: Steering Committee; and (3) the Association of Bibliographic Agencies of Britain, Australia, Canada, and the United States. These groups differ from the organizations described earlier in that they are voluntary cooperative efforts among institutions rather than being institutions themselves. These activities and their influence on library standards are described below.

Joint Steering Committee for Revision of AACR

Cataloging rules are a key standard for libraries. The leading rules standard used by libraries in the United States and many other countries is the Anglo-American Cataloging Rules (AACR). A standards-making group came into being in the early 1970s expressly for the purpose of revising the 1967 edition of AACR. Following the publication of the second edition of AACR, it was decided to maintain this Joint Steering Committee for Revision of AACR (JSCAACR) as a permanent group to approve changes and interpretations to the rules. This standards group
thus acts as the maintenance body for the standard, as changes are not allowed without JSCAACR approval. The JSCAACR is made up of representatives of the primary library associations and national libraries of the United States, Great Britain, Canada, and Australia. The members of the group are responsible for soliciting the opinion of their constituencies in casting votes on the standard. Thus, ALA provides both review of the standard and recommendations for votes on the AACR standard.

**Conference of Directors of National Libraries**

In 1974 a group of national librarians met and formed the Conference of Directors of National Libraries (CDNL). From the beginning, a principal topic that concerned the group was the international exchange of bibliographic data in machine-readable form—an area in which pressure was building for additional standards. During the period 1967-75, MARC projects were begun in the national bibliographic agencies of many countries. As described earlier, all of these MARC systems follow the international format structure standard, thus providing a level of standardization among the various national systems, but each format differed in content designation. Early bilateral agreements were being made by several of these national agencies for the free exchange of MARC records for the imprints of their respective countries, but this exchange was hindered by both format differences and nonstandardization of exchange agreements. CDNL organized a steering committee, made up of staff from national libraries, that became known as the International MARC Network Study: Steering Committee (IMNS:SC). It is to study aspects of international data exchanges, develop suggestions for standardization, and report to the CDNL.

The results of several studies that were undertaken by IMNS:SC showed the need for standards for international cataloging rules and practices, the need for protocol standards to facilitate exchange of bibliographic records in machine-readable form via telecommunications, and the need to investigate the copyright issue as it affected the supply and receipt of machine-readable records between national agencies. It was found that because of national copyright laws and other national institutional considerations, a given agency could have a different exchange arrangement for each country with which it exchanged data. A further study reported that: (1) the national bibliographies of the various countries need to be protected against publication by any other organization; (2) national records need to be modified to the extent that
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basically a new record is created, if the record is to be distributed outside the exchange partner's institution; (3) there are significant problems in the determination of what constitutes a substantial modification; and (4) it is extremely difficult to monitor the use of records once these records are transferred to another computer-based system. The report suggested a model exchange agreement that embodied a set of guidelines to take account of these difficulties. This model exchange agreement, as modified by the IMNS:SC, was endorsed by CDNL. During the late 1970s, the CDNL came under the IFLA umbrella, and the IFLA UBC office now acts as secretariat to the IMNS:SC work.

The IMNS:SC continues to work on problems that are interfering with the exchange of data between national libraries through testing of the IFLA standard UNIMARC and encouragement to IFLA to establish an International MARC office. This latter office, if set up under IFLA, would be largely responsible for the development and maintenance of the standards required for successful international data exchange. It would be concerned with technical standards, such as protocols and format structures, and as such would need to maintain a close relationship to ISO.

Association of Bibliographic Agencies of Britain, Australia, Canada and the United States

The Association of Bibliographic Agencies of Britain, Australia, Canada, and the United States (ABACUS) was established in 1977 to facilitate international cooperation among the national bibliographic agencies of the four countries. The aim of the four national libraries is to ensure, insofar as possible, that common procedures, compatible guidelines, and standards are implemented by the individual agencies to make the most effective use of the exchange of bibliographic data.

While ABACUS itself is not a standards-setting body, international standards and guides emanating from such organizations as ISO and IFLA which are relevant to the national agencies and the libraries in each of its respective countries are considered, and the group becomes a strong force toward implementation of standards. The topics considered by ABACUS over the years have included implementation of the second edition of AACR, rule interpretation and acceptance of common options, filing rules, national MARC formats, UNIMARC, policies governing the exchange of machine-readable records, network protocols, a common thesaurus for geographic names, vernacular scripts, Romanization, transliteration standards, and Cataloging-in-Publication.
This work on standards implementation is important since the standards adopted by the national bibliographic agency of a country have an impact on its national constituency. Thus, the Library of Congress works closely with U.S. library associations such as ALA and the Association of Research Libraries, and also with ANSI. Likewise, the national bibliographic agency, because of its responsibility as a country's interface with other national bibliographic agencies, interacts with international institutions and international standards associations; for example, the Library of Congress works closely with IFLA and with ISO.

FEDERAL STANDARDS—NATIONAL BUREAU OF STANDARDS

The National Bureau of Standards (NBS) is the principal government-controlled standards organization of the United States and is included here because of its contribution to technical standards development. NBS is frequently a leader in setting standards, and because of the size of the federal sector, its standards are influential as a result of both direct use and input to standards subsequently developed by other organizations.

Established in 1901 as part of the U.S. Department of Commerce, the primary mission of NBS is to enhance scientific and technological developments within the United States and to facilitate the application of these developments in the best public interest. Included in this mandate is the development of standards needed by federal agencies. To achieve this goal, NBS performs research, conducts tests and provides various scientific and technological services, primarily for the federal government but also for industry.12

Of particular importance to the library and information science community is the work of the NBS Institute for Computer Science and Technology (ICST). Established in 1965, ICST provides advisory services to federal agencies to support the formulation and development of automatic data-processing functions and conducts research in computer science and technology. As an integral part of these activities, the institute develops and recommends federal information processing standards aimed at increasing the economy and effectiveness of government computer operations (particularly the improved compatibility, interchange and performance of machines and programs). In addition, ICST also participates in the development of voluntary commercial and
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private sector ADP standards through ANSI and other groups. The data-processing standards and guidelines developed by NBS for the federal government are issued by ICST in a standards series—Federal Information Processing Standards (FIPS). FIPS publications are available from the National Technical Information Service (NTIS) and cover numerous categories, including software, hardware, quality control, safety and security, character sets, and data transmission. These standards, often produced in cooperation with other government agencies, are extensively reviewed by government agencies and, following approval by the Secretary of Commerce, must be used in all federal installations (except by special waiver). While aimed primarily at federal computer use, the application of these conventions influences computer practices in the private sector as well.

It should be noted that the federal sector does not rely solely on NBS standards in its procurement processes. Rather, there is a concerted effort, as specified in Office of Management and Budget (OMB) Circular A-119 published in 1980, to use applicable voluntary standards where possible. This circular also calls for active participation by federal agencies in the development of private sector voluntary standards.\textsuperscript{13}

STANDARDS FOR INFORMATION SERVICES

Abstracting and indexing (A\&I) services such as Chemical Abstracts have always had a close relationship to libraries. They, like libraries, "catalog" texts and build tools for accessing these catalog citations. The citation services are supplied to users through libraries, and the texts that match the citations are supplied by libraries. Yet, A\&I services adhere to standards for preparing and arranging citations that vary from those followed by libraries. This results partly from basic differences in the material cited—A\&I services work primarily with journal article citation, and thus have only limited concern with physical description and item location information. Instead, they carry on a tradition of concentration on in-depth subject description of works. In addition, these services have tended toward subject specializations which result in little need for cooperation and interchange among them. There are, however, two associations of A\&I services described here whose activities include development and encouragement of use of standards, and these A\&I standards are potentially very important to libraries. In addition, the extensive internal standards activity of one of these services is described.
National Federation of Abstracting and Indexing Services

Established in 1958 as the National Federation of Science Abstracting and Indexing Services, the word science was dropped from the name in 1972—recognizing that abstracting and indexing problems or issues are common to all disciplines, not just science and technology. NFAIS takes as its primary purpose the encouragement and improvement of abstracting, indexing and analyzing of literature in all fields of knowledge. NFAIS thus functions as a communication forum, not only for its member services, but also between its membership and other information communities (both nationally and internationally).

NFAIS encourages cooperative efforts and coordinated programs within its membership. The growing production of large bibliographic services in machine-readable form has caused standardization to become a concern of abstracting and indexing services and their users, such as libraries, document delivery systems, and primary publishers. Acknowledging these concerns, NFAIS fosters the development of acceptable standards and encourages their implementation by its member organizations. This is accomplished in a number of ways, including active voting membership in ANSC Z39 as well as participation in ANSC Z39 subcommittees responsible for standards of interest to A&I services, such as journal article identification designations, journal title abbreviations, writing abstracts, format for the interchange of bibliographic information on magnetic tape, and the ISSN.

Of particular interest to the library community is encouragement by NFAIS of more widespread use of standard identifiers for serial publications, such as the ISSN, serial key title and journal title abbreviations, as these standards help provide the links between A&I citations and library catalogs. To facilitate more efficient cooperation between libraries and A&I services, NFAIS and the Association of Research Libraries are exploring ways for carrying this information more completely and accurately in the CONSER (Conversion of Serials) file.

Members of NFAIS also participate in international standards activities, including ISO and Unesco working groups. Thus NFAIS and its member services actively encourage the development and use of standards appropriate for their own requirements, as well as those that are needed for cooperative efforts between them and other members of the community.

International Council of Scientific Unions Abstracting Board

The International Council of Scientific Unions (ICSU), the parent body of the Abstracting Board (ICSU-AB), is a scientific organization
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that is international but nongovernmental in nature. It comprises several autonomous international scientific unions, such as the International Astronomical Union and the International Union of Pharmacology, and more than sixty national members, such as scientific academies, research councils, or similar scientific institutions. The National Research Council of the National Academy of Sciences represents the United States in this international forum. The main purpose of ICSU, to encourage international scientific activity, is accomplished primarily through the planning and coordinating of international scientific research programs, such as the International Geophysical Year (IGY), as well as through providing a forum for the exchange of ideas, the communications of scientific information and the development of standards.

Within the ICSU family, the Abstracting Board (ICSU-AB) provides an international focus for the work of the world's scientific and technical A&I services. Established in 1952 as an outgrowth of a joint Unesco and ICSU commission organized to study the problems related to abstracting the scientific literature, the member services include A&I organizations from all over the world. In addition, national members provide representation from those sectors of the information community that would not otherwise be represented on the board but whose policies and practices can be influenced by the board's decisions, such as libraries, document delivery centers, and publishers. In the United States, the national members form a group called the United States National Committee for ICSU-AB. NFAIS plays a role in identifying individuals to be appointed to this committee, and serves as an associate member of the ICSU-AB as well. Thus there are in place effective lines of communication between NFAIS and its international counterpart.

As an international forum for the world's A&I services, ICSU-AB plays a prominent role in the promulgation of standards needed by these organizations largely through participation in other standards-making groups. Representatives from the board are often members of ISO technical committees and Unesco working groups dealing with practices and conventions utilized by the A&I communities. Of particular note was the work performed by the ICSU-AB in the preparation of the initial edition of the Unesco-published *Reference Manual for Machine-Readable Bibliographic Descriptions*. The *Reference Manual* is a cataloging tool designed for use by A&I services. This was a valuable cooperative effort involving direct or indirect representation of all the ICSU-AB member services, together with representation from organizations having special interests in mechanized information processing (including ISO, IFLA and others). Subsequent to the publication of this
manual, ICSU-AB was instrumental in encouraging its use by the member services—thereby facilitating a more uniform approach to the handling of bibliographic data by these organizations.

ICSU-AB representatives are also very active in the formulation of other international standards, including the ISO standard for journal title abbreviations and the draft guidelines for the bibliographic strip for serial publications. Also within the arena of standards activities relating to the handling of serial publications, ICSU-AB was highly instrumental in the initial formulation of guidelines for the International Serials Data System (ISDS) and the ISSN. Due to the efforts of the board, the original base file, upon which the current ISDS database was built, was composed of bibliographic records contributed by a number of its member services. This in turn served to foster increased voluntary use of the ISSN as a standard serial identifier by the A&I community.

International Nuclear Information System

Most A&I services such as Chemical Abstracts largely operate from central facilities at which the indexing and database creation activities take place. They are thus working in an “in-house” environment with respect to cataloging rules and other standards. There are several services that are built in a decentralized fashion, the International Nuclear Information System (INIS) and the Agricultural Information System (AGRIS) being leading examples. The INIS system is designed to receive input of citations from centers all over the world—the cataloging and record creation take place at the point of origin. Tapes are sent from these centers to the International Atomic Energy Agency in Vienna where they are processed and merged to create the INIS index. INIS is thus highly dependent on the following of standards by the various centers if the citations are to merge easily.

Accordingly, INIS has developed and published a complete set of standards to be used by the cataloging centers—cataloging rules, record format, code lists, name authority lists, and Romanization rules—trying when possible to base these standards on existing national or international ones. Thus, the tape format is an implementation of ISO 2709. As cooperative efforts get underway in the A&I community, these strong standards programs of agencies like INIS will greatly influence the development of A&I standards.
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FUNDS FOR STANDARDS DEVELOPMENT

The final three organizations whose standards-fostering activities are described may be classed as participating chiefly through sponsorship or funding of standards activities. While each may also have been responsible on occasion for the development of particular standards, all three work largely through other groups such as ANSI, IFLA and ISO by contributing financial support to their efforts.

Unesco

The United Nations Educational, Scientific and Cultural Organization was established in 1946 for the purpose of advancing, through the educational, scientific and cultural relations of the peoples of the world, the objectives of international peace and the common welfare of mankind. Unesco’s activities fall into three general categories: promotion of peace, operational assistance (especially to member developing countries), and international intellectual cooperation.

A major program initiated to support these activities is the General Information Programme (GIP), which is established within Unesco’s Bureau of Studies and Programming. GIP is an intergovernmental program concerned specifically with the development and promotion of information systems and services in the areas of scientific and technological information, documentation, libraries, and archives at the national, regional and international levels—thus an important program to libraries. An outgrowth of the Universal System for Information in Science and Technology (UNISIST) (formulated by Unesco in the early 1970s as a world science information system), GIP is managed by a director-general and is guided in its planning by an intergovernmental council of thirty member states as well as an advisory committee of individual experts. The needs of the U.S. national information community are formulated for presentation to GIP through the United States National Committee for Unesco’s GIP.

The GIP promotes training of information specialists and application of modern techniques to data collection and processing, but the function of most interest here is the promotion and dissemination of methods, norms and standards for information handling. Through GIP, Unesco partially supported the development of the Reference Manual mentioned earlier and numerous other ISO and IFLA standards activities. In addition, the development and applications work that Unesco fosters adheres to Unesco-accepted standards.
An important project currently underway through GIP sponsorship is the work of the Ad Hoc Group on the Establishment of a Common Communications Format (CCF). This group was convened following an international symposium in 1978 that was organized by the UNISIST International Center for Bibliographic Descriptions (UNIBID), ICSU-AB, IFLA, and ISO—and also sponsored by Unesco. At this meeting, the conferees decided that it was desirable to have an international communications format to satisfy the needs of various segments of the information community such as libraries, national bibliographies, and A&I services. Thus Unesco undertook funding of this multicommmunity standard. The CCF working group is made up of representatives from a number of international standards organizations, including ICSU-AB; International Center for Scientific and Technical Information, located in Moscow; ISO; IMNS:SC; UNIBID; and the Inter-Organization Board for Information Systems.

While the guidelines for recommendations which emanate from the GIP as a result of its various activities are not mandatory for the member states, they, nevertheless, are often voluntarily followed and can be influential in the evolution of international standards within ISO.

National Commission on Libraries and Information Science

The National Commission on Libraries and Information Science (NCLIS) was established by Congress in 1970 and charged with the responsibility for developing and/or recommending plans to ensure that the people of the United States, for whatever purpose, are provided with adequate library and information services. To achieve this goal, in 1973 NCLIS began work on its program document Toward a National Program for Library and Information Services: Goals for Action. Among the stated objectives are the planning, developing and implementing of a national network of library and information service, and included in the text is a discussion of the importance of standards and the need to encourage and promulgate them. Thus, from its outset, NCLIS recognized the essentiality of standards to build a cost-effective library and information service network.

The NCLIS itself does not have the organization to develop standards, but through funding, administrative support and involvement in the work of other institutions such as ANSI and ALA, has been a strong supporter of the standards activity. NCLIS interest in encouraging the development of standards led it to sponsor and provide the major portion of the funds for the investigation of the scope of work and
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organizational and financial structure of ANSC Z39 in the late 1970s and, following that study, provided funding to the Secretariat of Z39 to initiate the recommendations resulting from the study.

In 1975 NCLIS, along with the National Science Foundation and the Council on Library Resources (CLR), established and funded for three years an experiment in cooperation among the various segments of the library and A&I communities, the Committee on the Coordination of National Bibliographic Control (CCNBC), with the aim of working toward common standards. The emphasis of this effort included the definition of a minimum bibliographic record for item identification, the design of record formats for journal articles and technical reports not then included in the MARC family of formats, and a study of the problems of subject access across the various segments of the bibliographic community.

As a result of the many studies and programs sponsored by NCLIS over the years, commission funds have been used to encourage the participation of organizations in standards activities and the development of a wide variety of standards. Three important examples are briefly described here.

In the mid-1970s NCLIS funded a study to determine the role of the Library of Congress in the evolving national library and information service network. One recommendation was that the Library of Congress should play a coordinating role in the evolving network, partly by continuing its major efforts in standards development and by encouraging the use of these standards nationally and internationally. Based on the preliminary results of this study, the Library's Network Development Office was established and the Network Advisory Committee was formed—both organizations instrumental in standards work.

The NCLIS has funded several of the background tasks concerned with building and maintaining a network database, most of them standards-related. The extension of the MARC formats to cover series data and current work to develop more precise guidelines for the assignment of LC subject headings by institutions other than the Library of Congress, the subject counterpart of the descriptive cataloging rules, are two such standards projects.

The Technical Communications Committee of the Information Science and Automation Division of ALA was concerned in the mid-1970s with the establishment of a standard communications protocol to transmit messages in an online library networking environment. NCLIS supplied the funds to accelerate this effort through a task force which became known as the NCLIS/NBS task force for computer network protocols. Its report describing a proposed computer-to-
computer protocol was a landmark standards document and has served as the basis for further protocol developments currently underway by ANSC Z39.

Council on Library Resources

The Council on Library Resources, a private foundation, was established in the mid-fifties and is principally supported by funds from private foundations. Although CLR has an interest in all types of libraries, its primary concern has been with academic and research libraries. Its program focus, since it concentrates on current problems and issues, is a changing one, although the theme is the same, namely, the solution of library problems. In its latest annual report, bibliographic services, library resources and their preservation, library operations and services, professional education and training, and research and analysis are among the topics receiving the greatest emphasis. It appears safe to assume these same topics will be carried over into 1982 and the future.

CLR has a long history of supporting the development of standards. From 1961 to 1979, CLR supported ANSC Z39 directly. Funds were provided to the committee or its sponsor, the Council of National Library and Information Associations (CNLIA), for general support of ANSC Z39 activities. During the same period of time, CLR (in some cases jointly with other organizations) was a major catalyst toward effective resource sharing through standardization by its financial support of: (1) projects such as MARC, Retrospective Conversion (RECON), Cooperative MARC (COMARC), and CONSER; (2) committees such as CCNBC, JSCAACR, and the Network Advisory Committee; and (3) staff participation in national and international standards committee work. A quick review of the CLR’s 1976 annual report is convincing of the impact of CLR on standards development.

In 1980 CLR ceased providing general support to ANSC Z39 and began a program of supporting the development of particular standards relevant to its program interests where this work was being carried out within projects or by individuals or groups associated with ANSC Z39. In some cases, CLR sought the services of consultants to study and report on some facet of what appeared to be a required but missing guideline or standard.

Currently the majority of CLR’s standards efforts falls under the consideration of the CLR Bibliographic Services Development Program (BSDP), a major activity with the goals “to provide effective
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bibliographic services for all who need them, to improve bibliographic products, and to stabilize costs (in constant dollars) of many bibliographic processes in individual libraries.' Among the many efforts currently funded by CLR are:

1. a joint Committee on Bibliographic Standards, established to advise the Library of Congress on rule interpretation under the second edition of AACR and impact of the interpretation on shared cataloging systems;
2. preparation of a manual to assist in the use of the rule specifications given in AACR for the cataloging of machine-readable data files;
3. a paper reviewing the state of the art and recommending a standard institution identification code;
4. a paper reporting on an investigation of the requirements for detailed holdings statements;
5. development of a standard method for recording and communicating serials cancellations in an online union list;
6. further development of the NCLIS/NBS application-level protocol for the computer-to-computer interchange of data; and
7. a study to identify further work required to develop a standard indexing vocabulary for the fields of art and architecture.

In addition, CLR has been a major contributor to IFLA, funding projects and professional units.

SUMMARY

A variety of institutions and groups that affect, directly or indirectly, the promulgation of library standards have been described in this article. These include full-time standards-making bodies, library associations, national and international committees, government agencies, abstracting and indexing services, and funding agencies. The work undertaken by each is guided or influenced by the constituencies it is commissioned to represent. Thus a number of interrelated mechanisms are in place and continually evolving to reflect adequately the needs and requirements of a varied and diverse community in the area of standards development.
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Procedures for Development and Access to Published Standards

ROBERT W. FRASE

Introduction

There are two kinds of national and international technical standards affecting libraries, information services and publishing: official or de jure standards developed under formal procedures, and de facto standards. Adherence to either type of standard is voluntary, unless compliance is requested by a government agency. The official U.S. standards are American National Standards approved by, but not necessarily published by, the American National Standards Institute (ANSI) (1430 Broadway, New York, NY 10018). The official international standards are both approved by and published by the International Organization for Standardization (ISO) in Geneva, Switzerland. There are also two Unesco documents which may be considered official international standards because they were developed under formal procedures.

It is easier to describe the procedures for developing official standards than those for de facto standards, because they are explicit and detailed and because fewer organizations produce them. A recent Unesco publication contains hundreds of standards and guidelines produced by scores of organizations relating to information handling. The official standards development procedures will be treated comprehensively and in detail; the discussion of procedures for developing de facto standards is more by way of illustration.

Robert W. Frase served as Executive Director, American National Standards Committee Z39, 1978-82.
Official American National Standards

American National Standards, of which there are now about 10,000, are developed in three ways: by the canvass method, by the accredited organization method, and by the standards committee method. In order to be approved by ANSI as American National Standards, detailed procedures published by ANSI must be followed. Since there are no American National Standards affecting libraries, information services and publishing which have been developed by the canvass method, this procedure will not be described. To become accredited, an organization must submit its procedures for standards development to ANSI for approval. The substance of the procedures ANSI requires of accredited organizations is similar to procedures which are described below for the standards committee method. ANSI may audit accredited organizations to confirm that the required procedures are followed. A good example of an accredited organization is the American Society for Testing and Materials (ASTM), which develops and publishes scores of new and revised American National Standards each year, primarily in engineering fields. ASTM publishes annual volumes of all of its current American National Standards. At least three ASTM standards dealing with the degree of acidity in paper have some interest to libraries, information services and publishing.

To establish an American National Standards Committee, the organizers must submit to ANSI for approval the name of an organization which will undertake the duties and responsibilities of serving as the secretariat for the proposed committee. These responsibilities include:

1. organizing the committee;
2. submitting a list of committee members for ANSI approval;
3. determining that the committee member organizations participate actively, and that all those having a substantial concern with, and competence in, standards within the committee's scope have the opportunity to participate;
4. submitting proposed revisions of the title and scope of the committee to ANSI for approval;
5. arranging for selection of committee officers;
6. appointing a committee secretary;
7. proposing programs of work, together with proposed completion dates, and giving direction and guidance to the committee;
8. ensuring that meetings of the committee are not closed to the concerned public;
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9. ensuring that ANSI procedures are followed when letter ballots are taken on proposed standards;
10. reporting results of voting on proposed standards to ANSI in accordance with its procedures;
11. maintaining standards within the scope of the committee in an up-to-date condition, arranging for publication of approved standards and ensuring that information on newly-published standards reaches the concerned public;
12. establishing a procedure within the secretariat to hear appeals of actions or inactions of the committee;
13. submitting status reports of the work in progress to ANSI, at least annually, and promptly announcing the initiation of new work;
14. encouraging the use of the ANSI Style Manual in drafting proposed standards; and
15. securing financial support for the committee.

If approved by ANSI, the secretariat may then organize a standards committee following the detailed requirements of the ANSI procedures. If product standards are to be developed, the committee membership must be "balanced," with appropriate representation of organizations concerned with the production and the consumption of the product and of the general public.

Several American National Standards Committees develop standards affecting libraries, information services and publishing: X3, Information Processing Systems; PH5, Micrographic Reproduction; Z85, Standardization of Library Supplies and Equipment; and Z39, Library and Information Sciences and Related Publishing Practices. Of these, Z39 has developed more standards directly related to these fields than others. There are thirty-eight American National Standards developed by Z39; fourteen others are in process of development. The procedures are followed by Z39 in developing standards conform to ANSI requirements and consist of the following principal stages, all of which are set forth in detail in the Z39 Bylaws4 and Handbook for Subcommittees.5

1. Officers of the committee are elected by the voting membership for staggered terms: chairperson, chairperson-elect; and nine members of the Executive Council, three each representing libraries, information services and publishing.
2. Organizations applying for Z39 voting membership are recommended by the Executive Council and approved by the Z39 Secretariat, the Council of National Library and Information Associations.
3. The Executive Council recommends and the voting membership must then approve the establishment of subcommittees to develop specific standards. Proposals for new standards may originate in the Z39 membership, the Executive Council, or outside sources.

4. The subcommittee chairs are appointed by the Z39 chair, and they in turn recommend other members to serve. The Z39 chair then appoints the remaining members of the subcommittees.

5. The subcommittee drafts a standard, which may be sent to the Z39 voting members for comment.

6. The subcommittee may then request a formal written ballot on a proposed draft standard. It may do this without going through the comment stage.

7. When authorized by the Z39 chair, the draft standard is mailed by the Z39 Executive Director to the membership with a written ballot, which must be returned within six weeks. Three types of votes are provided: approval (with or without comment), disapproval (with reasons required), or abstention. Member organizations not returning ballots must be reminded to do so ten days before the end of the voting period.

8. All comments and negative votes are supplied to the subcommittee chairs, who must then attempt to resolve objections. This process may result in substantive changes in the draft and thus require a reballot on a revised draft.

9. At some stage, either at the start of the ballot in Z39 or later, the text of the proposed standard must be submitted to ANSI for "public review;" publication of a notice of the proposed standard in the biweekly ANSI publication, Standards Action. Anyone wishing to review the proposed standard may request a copy from the originating organization and comment on it within a two-month period. Written response to comments thus received must be made by the originating organizations.

10. When the proposed standard is ready, it is then submitted to the ANSI Board of Standards Review through the secretariat. The submission of the text of the proposed standard must also include the following documentation:

   a. the title and designation of the proposed American National Standard;
   b. whether the submittal is a revision, reaffirmation, or withdrawal of an existing American National Standard;
   c. a copy of the proposed American National Standard as finally approved by Z39;
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d. final results of the letter ballot, including identification of those voting negative (with reasons therefore), abstaining, and those not responding (despite follow-up);
e. a list of the Z39 committee personnel at the time of balloting, as well as a list of the relevant Z39 subcommittee personnel, if the standard was developed or revised by a subcommittee.
f. identification of negative votes outstanding and a history of the attempts to resolve them, with copies of all related correspondence;
g. results of the ANSI public review, with copies of all related correspondence;
h. a brief history of the development of the standard; and
i. a confirmation that ANSI's procedures for the American National Standards Committee Method are followed.

The formal ANSI requirements for the submission of a proposed American National Standard to ANSI for approval provide that if at least a majority of the votes cast are affirmative, the secretariat may use its discretion as to whether a draft standard is ready for submission to the ANSI Board of Standards Review. However, if at least two-thirds of the total possible votes of the standards committee are affirmative, it is mandatory that the draft standard with the accompanying exhibits be submitted. As a practical matter, however, Z39 almost always succeeds in resolving all negative votes of Z39 members before submitting draft standards to the Board of Standards Review, even though this may require more than one ballot.

The same series of steps is usually followed for the mandatory reaffirmation, revision or withdrawal of standards, five years after the last ANSI approval. In the case of reaffirmation, however, Z39 on the recommendation of the Executive Council will send out a ballot on reaffirmation without setting up a subcommittee if there is no known reason for a revision.

It will be seen that the process of developing American National Standards is long, drawn-out, and provides ample opportunity for all interested parties to contribute expertise and to make their views known. In addition to the ANSI public review process with its notices published in Standards Action, Z39 makes every effort to keep its constituency informed by free subscriptions to its quarterly newsletter, the Voice of Z39, each issue of which contains a detailed account of the work being carried on in the development of new and revised standards.
Official International Standards

The two principal official international standardization bodies are the International Electrotechnical Commission (IEC) and the International Organization for Standardization (ISO). Only the latter is relevant to this article. The ISO membership consists of national bodies most representative of standardization in their countries. Standards development in ISO is carried out by numerous Technical Committees (TCs). Several ISO Technical Committees develop standards affecting libraries, information services and publishing, including TC 37, terminology; TC 46, documentation; TC 97, information systems; and TC 171, micrographics. Of these, TC 46 produces the most standards of direct interest to libraries, information services and publishing.

Each TC has a secretariat, a national standards body designated by ISO. The secretariat for TC 46, Documentation, is held by the Deutsches Institut für Normung E.V. (DIN), with headquarters in West Berlin. Any national member body of ISO may elect to become either a participating (voting) member of a technical committee or merely to be kept informed of the work of the committee by being registered for observer status. The United States has participating member status on TC 46, Documentation.

The procedures for developing ISO standards are set forth in the ISO publication, Directives for the Technical Work of ISO.\(^6\) ISO standards constitute agreements between the member bodies. These agreements must pass through a number of stages before they can be accepted as an international standard. The work toward an international standard generally begins with an initial working draft of the standard being circulated within a subcommittee or a working group of a subcommittee. Once agreement is reached, a draft proposal (DP) is prepared and circulated within the technical committee. An approved DP is then sent to the ISO Central Secretariat for registration as a draft international standard (DIS). The DIS is then circulated to all ISO member bodies for voting. If 75 percent vote in favor of the DIS, it is sent to the ISO Council for acceptance as an international standard. ISO standards are generally reviewed every five years to prevent them from becoming out of date due to technological evolution or the introduction of new methods, materials, quality, or safety requirements since the standard was approved.

Although ANSI is the U.S. participating member in ISO TC 46, the substantive work is carried on by an ANSI-appointed technical advisory group (TAG), which in this case is American National Standards Committee Z39. All requests for U.S. comments or votes on ISO draft proposals or draft international standards received by ANSI from the TC 46
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Secretariat or ISO are referred to Z39, which in turn sends them to experts in the subject matter involved—usually, but not always, chairs or members of Z39 subcommittees, present or past, or individuals in Z39 member organizations. Z39 then recommends to ANSI how the U.S. votes shall be cast or what comments should be submitted. Votes in ISO are similar to those in Z39: affirmative (with or without comments); negative (with reasons), or abstentions. TC 46 also sends out ballots on whether standards and proposed standards should be added to, or deleted from, the TC 46 program of work.

Unesco Recommendations

The United Nations Educational, Scientific and Cultural Organization (Unesco), with headquarters in Paris, has a procedure for making "Recommendations," which in effect are standards, to the nations which make up its membership. These recommendations are not binding on the member nations, but they carry substantial weight and are frequently followed, as is the case with two recommendations relevant to this article: "Recommendation Concerning the International Standardization of Statistics Relating to Book Production and Periodicals," 1964, and "Recommendation Concerning the International Standardization of Library Statistics," 1970.

The usual procedure for developing a Unesco Recommendation involves the following steps:

1. Provision for the development of a recommendation in the budget and the program of work.
2. Preparation of a draft by the Unesco staff.
3. Calling a small conference of invited technical experts to review and revise the staff draft.
4. Holding a formal conference of technical experts appointed by all member countries interested in doing so for the preparation of still another draft, which is approved by formal vote.
5. Transmission of the draft agreed to by the international conference of experts to Unesco member nations.
6. Debate, modification and vote on the international experts' conference draft at a Unesco General Conference held every two years.

ISO and national standards bodies may take Unesco Recommendations and make them, or parts of them, into an international or national standard. ISO 2789-1974, International Library Statistics, is identical to the 1970 Unesco Recommendation. American National Standard Z39.8-1968(R1977), "Compiling Book Publishing Statistics," is almost identi-
De Facto National Standards

The Library of Congress (LC) is undoubtedly the agency which has developed the largest number of de facto national standards affecting libraries, information services and publishing. One example is the three-by-five-inch dimension of a catalog card, which was adopted by LC when it began selling catalog cards to other libraries in 1901. These dimensions have now been incorporated into at least one American National Standard, Z99.30-1982, "Standard Order Form for Single Titles of Library Materials in three inch by five inch Format." Another example is the bibliographic content of the cataloging in Cataloging in Publication (CIP) Data prepared by LC and now printed annually in thousands of U.S. book titles as well as titles originating in other countries. LC ordinarily consults with the library and other affected communities in establishing programs such as CIP which it originates and administers, but there is no fixed procedure for consultation and no formal arrangements for voting.

The American Library Association (ALA) is another organization which has developed a number of de facto national standards. An example is the interlibrary loan form which is in widespread use. (This form is now being considered by American National Standards Committee Z39 for conversion through formal procedures into an American National Standard.) Like the Library of Congress, ALA does not have a uniform formal procedure for developing and voting upon its de facto standards.

De Facto International Standards

IFLA

The International Federation of Library Associations and Institutions (IFLA), with headquarters in The Hague, Netherlands, and an office for Universal Bibliographic Control (UBC) in London, is the principal developer and publisher of de facto international standards relating to libraries. The list of IFLA publications in the IFLA Directory 1980-81 includes a considerable number of publications of the IFLA Committee on Cataloguing (to 1976) and the International Office for UBC. Many of these documents may be considered to be de facto international standards, such as the following: ISBD(M), first standard.
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dition; List of Uniform Headings for Higher Legislative Bodies, second edition; Corporate Headings; The Arrangement of Entries for Complex Material; and List of Uniform Titles of Liturgical Works.

The procedures followed by IFLA for developing these de facto standards vary and do not involve a formal voting process such as that required by ISO. A good description of the status of the IFLA standard-like documents, especially the series of International Standard Bibliographic Descriptions (ISBDs) has recently appeared in an article by Richard H.A. Cheffins, Project Officer, IFLA International Office for UBC:

These constitute the family of ISBDs. But what is their status, and by what authority are they issued? Although there has been some coyness about the matter, there can be no real doubt that their status is that of standards. Their authority rests on IFLA being the international body representative of librarianship throughout the world. But IFLA was not conceived as a standardizing authority and its constitution (revised as recently as 1976) makes no specific provision for this activity, though in defining its purpose there is a useful catch-all provision that...“(IFLA) shall undertake such other activities as will promote fulfillment of theoretical and practical objectives in every field of library activity.” The first ISBD (1971 edition of “M”) was issued as recommendations of a Working Group set up at the IMCE which in turn had been convened by IFLA; it was revised by an editorial group in accordance with the decisions of the Revision Meeting organized by the IFLA Committee on Cataloguing. Subsequent ISBDs were issued by other Working Groups set up by the IFLA Committee (later Section) on Cataloguing either alone or jointly with other Committee/Sections (or in the case of ISBD(PM) with IAML—the International Association of Music Libraries). More recently texts are specifically stated to have been approved by the Standing committees of the appropriate IFLA Sections.10

AACR

The second edition (1978) of the Anglo-American Cataloging Rules11 is a major example of a de facto international standard. However, the procedure for the development and approval of these rules was more formal than is ordinarily the case for de facto standards. The preface to the second edition contains a detailed description of the procedures used in formulating and voting upon the revised rules. Although many organizations and individuals contributed to the revision, the final text was approved by the Joint Steering Committee for Revision of AACR. This committee consisted of one voting and one non-voting delegate from each of the following participating organizations: the American Library Association, the British Library, the Cana-
dian Committee on Cataloguing, the Library Association, and the Library of Congress.

Access and Use of Standards

Bibliographic and physical access to official and *de facto* standards relating to libraries, information services and publishing varies widely and leaves much room for improvement.

Publication and Physical Access

Only one out of ten American National Standards (but all Z39 standards) are published by ANSI, but all published American National Standards are listed in the ANSI annual catalog\(^\text{12}\) and numbered supplements, and may be purchased from ANSI. In addition, ANSI publishes smaller catalogs or flyers for certain categories of American National Standards, including standards in the Z39 series. The ANSI catalogs and flyers are published in addition to catalogs produced by other organizations developing and publishing American National Standards, such as the National Micrographics Association. ISO\(^\text{13}\) and the IEC also publish annual catalogs, which in the United States may be purchased from ANSI along with the actual ISO and IEC standards. ISO in 1977 also published a compilation of texts of ISO standards relating to information transfer.\(^\text{14}\) *De facto* national and international standards are generally listed in publications of the originating organizations and must be purchased from them.

There are no depository libraries in the United States for national and international standards which are authorized to supply photocopies of individual standards. However, the Standards Information Service of the U.S. National Bureau of Standards will provide bibliographic information from its comprehensive collection of the U.S. and international standards and those of many individual countries.

Bibliographic Access

Bibliographic access to standards relating to libraries, information services and publishing, especially Z39 standards, has improved significantly since 1979, but further improvement needs to be made. In 1980, the American National Standards in the Z39 series became the first American National Standards to carry Library of Congress CIP Data. In 1981, American National Standards in the Z39 series became a monographic series assigned the International Standard Serial Number 1076-0762. Prior to 1980 even the American National Standards in the Z39
series were not cataloged promptly by the Library of Congress, but they are now as new standards and revisions are published as part of the CIP program.

Cataloging information on published standards in the Z39 series has been entered into the data banks of two Z39 member organizations: the National Technical Information Service and OCLC, Inc. ANSI does not have a data bank accessible online for its own standards or for those of ISO and IEC, but is designing such a data bank for published American National Standards and those in process of development. ANSI and ISO do not assign International Standard Book Numbers to American National Standards and ISO Standards. Some de facto standards, such as those published by ALA and IFLA, carry ISBNs and CIP or similar data. Only in 1980 did Unesco publish its excellent bibliography of standards and guidelines (normative materials) relating to information handling.15

Use of Standards

Evidence on the use of standards relating to libraries, information services and publishing has not been collected in any systematic way. Some widespread uses are readily apparent, such as the printing of ISSN in serials and ISBN in monographs, and adherence to American National Standard Z39.2, "Bibliographic Information Interchange on Magnetic Tape."16 A number of the standards developed by American National Standards Committee X3, Information Processing Systems, have been designated as Federal Information Processing Standards (FIPS), and thus have become mandatory for federal agencies. Evidence of uses of other Z39 standards is fragmentary, although individual examples are frequently brought to the attention of the Z39 office and are reported in the professional literature. Research on the use of Z39 and ISO standards relating to libraries, information services and publishing would make excellent dissertation topics for library school students and would be valuable to standards-developing and standards-approving bodies.

References

ROBERT FRASE

15. Vajda, UNISIST Guide.

Additional References

Bowker Annual of Library and Book Trade Information. New York: Bowker, (annual). The Bowker Annual has carried articles on ANSC Z39 in almost every annual edition since 1969, written by various authors associated with the committee. Beginning with the 1969 edition, the work of ISO TC 46, Documentation, has also been covered, either as a separate article or as a part of the article on Committee Z39.
A Proposed Model for the Development of an Integrated Set of Standards for Bibliographic and Related Data

JAMES E. RUSH

Introduction

 Standards for the representation, storage and manipulation of bibliographic data have been developed in a rather piecemeal fashion, without regard for the need for interconsistency or the potential for conflict. Moreover, no concerted plan for standards development in this area has been prepared which would guide and direct standards development.1 It is the purpose of this proposal to define a model that will serve as a basis for an integrated set of standards for the representation, storage and communication of bibliographic and related data. This proposal is directed to American National Standards Committee (ANSC) Z39, and it is intended that ANSC Z39 base its program of standards development upon the model and, where choices must be made, give preference to those standards at the more fundamental levels of the model.

It must be pointed out that the model presented in this paper is only one of a number that could be devised for the intended purpose. In fact, Park2 has drafted a model consisting of at least two dimensions (rather than the single dimension of the model proposed here), one dealing with messages and the other with transformations that may be effected on messages. There is merit in this approach, and it may be that a model embodying concepts of two or more models may eventually be developed. The model proposed herein is at least a start toward a more coherent program of standards development.

Background

Since its formation in 1939, ANSC Z39 has developed nearly forty standards, many of which have gained wide acceptance in the library, information science and related publishing areas, both nationally and internationally. More than two dozen other standards are in various stages of the development process.

While all of these standards are (or will become) relevant, useful tools in the information industry, their development has occurred in the absence of an overall framework within which to plan and guide the process, from recognition of the need for a standard to its implementation. Thus, both existing and proposed Z39 standards, regardless of their importance individually, tend collectively to attack information problems on a piecemeal basis. With limited resources, Z39 cannot sustain this approach to standards development.

The model proposed herein is intended to remedy this approach to standards development and to help those who develop standards to make clear precisely what each standard is intended for, so that those who use standards will not be led into erroneous application because of ambiguity (real or potential) in the purpose and scope of the standard.

One or two examples will serve to illustrate the potential for misapplication of standards. ANSI Z39.42-1980, "Serials Holdings Statements at the Summary Level," "defines requirements for identification, reporting, and display within data areas, at the summary level, of information about the bibliographic units of a serial held by a library or other institution." The standard identifies and defines data elements and their format (i.e., their sequential arrangement and punctuation), and specifies those sets of data elements that constitute a summary holdings statement at three alternative levels of specificity. This standard does not, however, deal with data structures within which to embed the summary holdings statement for storage, transmission, etc., nor does it prescribe the level of statement to be employed in any given application. Thus, anyone who attempts to use Z39.42-1980 as the basis for development of a data structure, for example, is incorrectly interpreting and applying the standard.

A second example of the potential for misinterpretation and use of standards can be found in ANSI Z39.43-1980, "Identification Code for the Book Industry." The purpose of this standard is to provide "a unique numeric identification for each address of each organization, in or served by the book industry, that is engaged in repetitive transactions with other members of this group, in order to facilitate communications among them." This standard defines a specific data element, its identifi-
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cation, structure, range, and domain of values. This standard does not
deal with display of the identification code beyond its basic format, nor
with any data structure in which it might appear. The standard does,
however, indicate that the specific functional meaning of the identifica-
tion code is context-dependent, so that it behooves the user to indicate
unambiguously its function in each particular instance of use. People
who attempt to apply Z39.43-1980 in any other way will again be in
error.

A Model for Representation, Storage and Communication
of Bibliographic and Related Data

The model proposed here is based upon the assumption that data
are represented, stored and communicated in the form of one or more
messages, where a message is defined as a string of characters (both text
characters and control characters). Each string of characters is so con-
structed (and interpreted) that the initial character, or characters, and
the terminal character, or characters, represent what amount to protocol
data. The remainder of the message consists of structural elements, data
element identifiers, data element values, and display (presentation)
format elements. The medium in which the message is carried, as well as
its housing, are also addressed by the model. This hierarchy of elements
of a message constitutes the model, which is depicted in figure 1.

The concept of a message is depicted in figure 2 in terms of destina-
tions and media. A generalized message structure is shown in figure 3.

The model comprises seven levels, numbered 0-6. Each level is,
from 0 to 6, decreasingly concerned with the formal content and struc-
ture of a message, and increasingly related to the human-sensible
aspects thereof.

Level 0 (Message Boundaries) deals with the boundaries of a mes-
sage. In a computer-manipulatable message, the boundaries are often
called protocol data. A protocol defines the precise way in which the
boundaries are delimited. In printed messages, the boundaries may
consist of such elements as the title page, masthead, index, and
afterword.

Level 1 (Data Structures) is concerned with the structure of the
message. In printed matter, structural elements include chapters, sec-
tions, pages, paragraphs, sentences, and so on. Some of these elements
are labeled (see level 2) and others are implicitly delimited. In machine-
readable data, structural elements include sections, fields, subfields, etc.
In any event, each structural element may be defined independently of
specific data elements or data element values that may be embedded in the structure.

Level 2 (Data Element Identifiers) deals with the identification of data elements within the context of a particular level-1 data structure. Data elements may be identified implicitly by relative position within a message, or they may be identified explicitly through use of labels or names of various kinds.

Level 3 of the model (Data Element Values) provides for specific values that a data element may take on. Typically, a standard would delimit the domain and range of values of each particular data element
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Level 4 (Display Formats) deals with the format and form in which a message is presented to a human receiver, i.e., the manner in which a message is rendered sensible to a human being.

Level 5 of the model (Media) provides for standards that relate to the medium in which a message is recorded, carried or displayed. Level 5 standards affect the way in which a message may be received and used. Such standards will frequently determine who can receive and use a
message, since many media require special equipment to render the message (rather than the medium) sensible to people.

Finally, level 6 of the model (Housing of Media) deals with the housing of media. Such factors as heat, light, humidity, atmospheric content, and other conditions that affect the integrity of the message over time fall within the domain of standards at level 6.

**Benefits of the Model**

The principal benefit of the model is that it provides a well-defined context within which related standards may be planned and developed. It provides a basis for decisions regarding priority of standards development, and it represents a framework for planning for future standards development. Moreover, it may tend to sharpen our understanding of the precise relationships among standards and it should make it possible for ANSC Z39 to coordinate and direct more adequately the development of standards in the areas governed by the model, whether these
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standards are developed by Z39 or by other standards-making bodies. It would be desirable to have the model itself accepted internationally.

Relationship of Existing Standards to the Model

A number of standards already exist that fit more or less with the model proposed here. Some of these standards have been developed by ANSC X3 (e.g., tape labels), by the International Organization for Standardization (ISO) (e.g., 2709), and by ALA (e.g., AACR2), as well as by Z39. Some are de facto (or informal) standards promulgated by manufacturers or other organizations. The relationships of some of these standards to the model are indicated in figure 4. A partial listing of Z39 standards is contained in table 1.

Fig. 4. Relationship of some existing standards to the proposed model
**TABLE 1**

**PARTIAL LIST OF EXISTING AND PROPOSED ANSC Z39 STANDARDS AND THEIR RELATIONSHIP(S) TO THE MODEL**

<table>
<thead>
<tr>
<th>Number</th>
<th>Name of Standard</th>
<th>Level</th>
<th>Value Type</th>
<th>Value Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Z39.2-1979</td>
<td>Bibliographic Information Interchange on Magnetic Tape</td>
<td>1</td>
<td>Unique, unambiguous</td>
<td>Description, Table, Range</td>
</tr>
<tr>
<td>Z39.5-1974</td>
<td>Abbreviation of Titles of Periodicals</td>
<td>3</td>
<td>Unambiguous, explicit</td>
<td>Procedure</td>
</tr>
<tr>
<td>Z39.14-1979</td>
<td>Writing Abstracts</td>
<td>3</td>
<td>Free form</td>
<td>Description</td>
</tr>
<tr>
<td>Z39.22-1974</td>
<td>Proof Corrections</td>
<td>2,3</td>
<td>Prescribed</td>
<td>List</td>
</tr>
<tr>
<td>Z39.37-1979</td>
<td>System for the Romanization of Armenian</td>
<td>3</td>
<td>Unique, unambiguous, prescribed</td>
<td>Table</td>
</tr>
<tr>
<td>Z39.41-1979</td>
<td>Book Spine Formats</td>
<td>4</td>
<td>Unambiguous, explicit</td>
<td>Description</td>
</tr>
<tr>
<td>Z39.43-1980</td>
<td>Identification Code for the Book Industry</td>
<td>2,3,4</td>
<td>Unique, unambiguous</td>
<td>Domain, Range, Algorithm</td>
</tr>
<tr>
<td>Z39 SC C</td>
<td>Language Codes</td>
<td>3</td>
<td>Unique, unambiguous</td>
<td>Table</td>
</tr>
<tr>
<td>Z39 SC 5</td>
<td>Romanization of Yiddish</td>
<td>3</td>
<td>Unique, unambiguous, prescribed</td>
<td>Table, Description</td>
</tr>
<tr>
<td>Z39 SC 36</td>
<td>Single Title Order Form (Books)</td>
<td>2-4</td>
<td>Unique, prescribed</td>
<td>Description, Procedure, Model</td>
</tr>
</tbody>
</table>

In this table, the columns headed "Level," "Value Type," and "Value Control" require further explanation. "Level" refers to one of the seven levels of the model (see figure 1). "Value Type" refers to the nature of the values the particular standard gives rise to. "Value Control" refers to the method provided in the standard for limiting the values of a particular data element or set of data elements. For example, ANSI Z39.43-1980, "Identification Code for the Book Industry," falls basically at level 3 of the model (that is, it is a standard for data element values). The values of the Standard Address Number (SAN) permitted by the standard are each uniquely associated with an address, and each address is associated with one SAN. Hence the standard provides for unique and unambiguous values of the SAN. The specific values the SAN may take on are governed by the standard through specification of...
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A domain (0-999,999). The range of values that the SAN will actually take on is determined by the assignment agency (so long as the domain is not violated). The standard (Z39.43) also specifies a data element identifier ("SAN") and a presentation format (in part implicitly), and prescribes the value of the check digit by algorithm. It will most often be the case that a given standard will relate to more than one level of the model, have more than one value type, and exercise value control in more than one way. Table 2 gives some common value types and methods of value control. Neither list is intended to be exhaustive. Figure 5 illustrates how ANSI Z39.43-1980 relates to the model.

<table>
<thead>
<tr>
<th>Value Types</th>
<th>Value Control Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ambiguous</td>
<td>Algorithm</td>
</tr>
<tr>
<td>Explicit</td>
<td>Description</td>
</tr>
<tr>
<td>Free Form</td>
<td>Domain</td>
</tr>
<tr>
<td>Implicit</td>
<td>Expression</td>
</tr>
<tr>
<td>Non-Unique</td>
<td>List</td>
</tr>
<tr>
<td>Prescribed</td>
<td>Model</td>
</tr>
<tr>
<td>Unambiguous</td>
<td>Procedure</td>
</tr>
<tr>
<td>Unique</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>Table</td>
</tr>
</tbody>
</table>

Discussion of the Model

The crux of the model proposed here is the notion of "message." Every message, whether it consists of one character or many, is wrapped in data which identify each unique message and which either explicitly or implicitly define the boundaries of the message (i.e., distinguish the message text from its enveloping data, and distinguish one message from the next). This notion holds whether one speaks of machine-readable messages, or of messages that are just readable by people. For instance, in character-oriented communication, each message (character) is preceded by a start-bit and terminated by one or two stop-bits. The data element is, in this example, the bit; each bit is positionally (implicitly) defined, and each may take on values of 0 or 1 (see figure 6). In block-mode communication, by contrast, a message header precedes the
<table>
<thead>
<tr>
<th>MODEL LEVEL</th>
<th>LEVEL NAME</th>
<th>Z39.43-1980 PROVIDES FOR:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Message Boundaries</td>
<td>n/a</td>
</tr>
<tr>
<td>1</td>
<td>Data Structures</td>
<td>n/a</td>
</tr>
<tr>
<td>2</td>
<td>Data Element Identifiers</td>
<td>SAN</td>
</tr>
<tr>
<td>3</td>
<td>Data Element Values</td>
<td>Value Type = unique &amp; unambiguous</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Domain = 1 - 999,999</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Range = as assigned</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Check digit algorithm</td>
</tr>
<tr>
<td>4</td>
<td>Display Formats</td>
<td>SAN nnn-nnnc (c = check digit)</td>
</tr>
<tr>
<td>5</td>
<td>Media</td>
<td>n/a</td>
</tr>
<tr>
<td>6</td>
<td>Housing of Media</td>
<td>n/a</td>
</tr>
</tbody>
</table>

Fig. 5. Illustration of the way ANSI Z39.43-1980 relates to the proposed model message text, and a trailer succeeds it. The data element here is the character; each is positionally defined (except the SYN character, which delimits blocks); and each may take on values in the range 0-255 (assuming 8-bit characters). Analogously, the covers of a book delimit the message text (book contents). In many instances, though, the message envelope is itself partially implicit. This can lead to ambiguity in message processing.
Most standards deal only with portions of a message or its envelope, medium or environment. Thus ANSI X3.22-1973 standardizes magnetic tape labels (envelope or message header and trailer); ANSI Z39.2-1979 defines a data structure for recording bibliographic data on magnetic tape; the various Library of Congress MARC formats define content designators (among other things) for use with Z39.2; X3.4-1977 prescribes a character representation (binary encoding) for the data; AACR2 defines some (if not all) of the data to be contained in various elements of a MARC record; Z39.21-1980 defines the permissible values of a single data element (ISBN); X3.39-1973 standardizes the medium (magnetic tape) on which the message is recorded; and, finally, no standard exists for the proper housing of the medium (hence the message). Obviously, for one or more bibliographic records contained on magnetic tape, several other existing standards may apply, and others may be envisioned.

The model illustrated in figures 1 and 4, and discussed in this paper, makes possible the foregoing analysis, and it helps to identify needed standards and how they would be related to existing standards. It is important to keep in mind that the model is recursive in the sense that it may apply in its entirety at each level of the model. This should prove to be an advantage. Standards makers may use the model to test whether any particular standard addresses the seven levels of the model and, if not, whether the proposed standard should be modified to do so.
Implementation of the Model

If the model is accepted by Z39, its implementation should occur in two phases. Initially, it will be necessary for the Program Committee to reexamine the present program of work of Z39 in light of the model. Each subcommittee charge should be reviewed to determine whether it is adequate or needs to be modified in order to clarify the level or levels at which the standard is aimed. This review will help to determine if the purpose and scope of a proposed standard is clear and unambiguous. The Program Committee should also explicitly identify the relationships among existing and proposed standards, paying particular attention to conflicts and overlaps. The development of a data element dictionary would be quite helpful.

Subsequently, all new standards work should be planned and directed using the model as a guide. The choice of standards upon which work is to be undertaken should be made within the framework of the model, and the charge to each new subcommittee that is formed to develop a selected, proposed standard should clearly state the level or levels the standard is to address. To the extent possible, the charge should also indicate the value type(s) and value control(s) to be embodied in the standard.

There are already some families of standards and/or proposed standards to which the model can fruitfully be applied, among which various aspects of the order process and various facets of the serials holdings problem are examples. Moreover, these two families are not disjoint: there is, for example, a clear tie between serials claiming and serials holdings. The model, together with a data element dictionary, can help to explicate such relationships throughout the body of Z39 standards and proposed standards, and thus lead to a more coherent, compatible set of standards.

Model Maintenance Procedures and Mechanics

The model, like standards, will require maintenance and revision from time to time. These chores should be handled by the ANSC Z39 Program Committee. Once initially implemented, the model should only be changed with care.
A Proposed Model

References


Communication Standards for Online Interchange of Library Information

THOMAS P. BROWN

Introduction

This paper presents a new perspective on computerized information interchange within the library community. First, a simple yet revealing model for linking computer systems is explained. The model is then used as a foundation for describing a solution for connecting three major bibliographic services in a cooperative, nationwide network.

The impetus for examining automated mechanisms for exchanging library information lies within a very fundamental precept of the library world—resource sharing. Information resources are shared not only between libraries but with the patrons themselves. As recognition of the value of information spreads within the political community, there will come a reassessment of existing library policies for resource sharing. One should expect not a dampening of cooperation but, on the contrary, an increased awareness of the assets which are presently being maintained by libraries. An automated mechanism for tracking and managing these assets will further facilitate the transformation of libraries into the information age.

In order for the increasing variety of computer systems which provide library services to be able to interconnect logically, communications standards must be specified. The computing community has been highly active in this area for the past ten years; their term for it is distributed data processing. In recent years the computer vendor parochial attitudes have been restructured by the popular acceptance of new telecommunication standards on an international scale. This has

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been very beneficial for all computer users and has broadened their expectations for computer system interconnectability. In this light the chance for the adoption of computer communication standards for the library community will not be constrained by technical issues; the responsibility rests most heavily on the effective automation of the existing library resource-sharing principles.

**Open Systems Interconnection Model**

A simple building-block approach to solving communication problems is being promoted by the International Organization for Standardization (ISO), the American National Standards Institute (ANSI), and the National Bureau of Standards (NBS). This Open Systems Interconnection model serves the purpose to "provide a common basis for the coordination of standards development that will enable computer systems to interconnect." The open nature of the model implies that standards development is not predicated on any single vendor of computer systems. However, the model can be applied to existing communication network architectures, such as IBM's Systems Network Architecture (SNA), Digital Equipment Corporation's DECnet, and the U.S. Department of Defense's Arpanet, as well as to new communications network architectures that are being developed based as satellite and cable systems.

There are two underlying assumptions built into the Open Systems Interconnection model. First, the communications between computer systems has bi-directional and real-time requirements; that is to say, it is online. For instance, the model does not pertain to the familiar exchange of magnetic tapes which contain bibliographic records. Secondly, the computer systems involved are treated as "peer" systems. No master/slave relationships are allowed within the model. Consequently, computer terminals to host computer system communications are not examined here. Host-computer to remote-host-computer communications is the major problem domain for the model, and that is the configuration which is discussed in this paper.

A prerequisite for computer communications is that both machines must be processing data for somewhat similar purposes. For example, it makes no sense to connect a weather-predicting computing machine to one that is solely processing income tax records. At this highest conceptual level, there must be some prior agreement that the applications being automated serve similar purposes. This can be true if there is a uniform definition of the data record, such as an existing communica-
Online Interchange

tions standard. Such is the case with the bibliographic services in this country—OCLC, Inc., the Research Libraries Group (RLG), the Washington Library Network (WLN)—and bibliographic services in other countries. The way in which the data are processed onto a database, how data are indexed and updated, and what transactions the terminal user issues are distinctly different in these three systems. However, all three provide the basic bibliographic cataloging application.

To interconnect online bibliographic services which differ in external and internal operation, a new application-to-application communication standard must be defined. This is much more than the standard MARC format for bibliographic data. It must standardize, at least on the communications link, the functions, sequencing, and meaning of the data. A new applications protocol for message and data interchange must be put into place.

Figure 1 represents two computer systems in the building-block Open Systems Interconnection model with the database applications residing at the highest level. Proceeding downward, the lower levels provide more rudimentary communications functions, until at the lowest level the physical interconnecting wire (or wires) is represented.

At each level there must be prior negotiation and agreement by the computer system designers as to the precise message and indication protocol to which the computers are to adhere. Logically, there are seven layers of protocols spanning the computer systems, viewed as horizontal layers in figure 1. A malfunction in any one of these layers will result in an interruption of the communications. For example, a termination of the database application on one computer will have the same effect, at least to the user, as disconnecting the physical telephone wire connecting the systems. The main benefits of the scheme are: (1) communication problems, whether design or operational, can be classified by layer and scientifically resolved; (2) standard design nomenclature is adopted for each layer; and (3) a change in the design of one layer has small impact on other layers.

At the junction of any two levels of the model is an interface which specifies how communications service requests and indications are transferred into the adjoining level. These interfaces must be physically traversed within a system to effect the logical horizontal layer communication.

The second highest layer, the presentation layer, deals primarily with data transformations into compatible syntax and character sets without loss of meaning. The transformations performed by either system at this level can even define a new computer language to repre-
sent the application data. For example, encryption/decryption transformations may be implemented for secure communications.

Below the presentation layer is the session layer, which manages multiple concurrent dialogues between the two remote applications. These dialogues may be taking place on behalf of persons using either computer system, or may be taking place as independent application-to-application communications. In either case the session layer controls characteristics of the dialogue, such as which computer system's "turn" it is to "speak." It also detects when an abnormal dialogue condition arises, so that the upper presentation and applications levels are posted with the problem status. Two of the basic operations to be performed at this level are session establishment and session disestablishment.
The transport layer responsibility entails the end-to-end delivery of complete and correct messages. It may select among various grade network services to deliver messages to a target system, and it may compensate for less reliable network layer services.

The network layer may potentially use many separate communications processors to deliver message packets. The services of a public packet switching network such as Telenet or Tymnet may be used at this level. Breaking messages into small packets requires sequencing control, flow control (so that network processors are not overworked), routing control, and time-multiplexing packets over network circuits. With processor and circuit redundancy, it is possible to improve network reliability while at the same time reducing costs by dynamic adjustment of the network node configurations upon component failure. Obviously there are many control messages built into a network control protocol between network nodes to enable this type of sophisticated message-delivery system.

The widely used Telenet and Tymnet packet switching systems both specify the CCITT X.25 standard network interface. They both meet the packet handling requirements of the model's network layer.

The data link layer specifies how streams of bits are delineated into manageable segments called frames. Certain bit patterns are specified to indicate the start of a frame and end of a frame. Most data link protocols such as BISYNC (Binary Synchronous) protocol and the ISO standard HDLC (High-Level Data Link Control) protocol provide for error-free transmission by including a bit pattern at the end of each frame, called a checksum, which is precisely derived from each preceding bit in the frame. If a communication line transient condition alters one or more bits within the frame, then the error is detected when the re-derived checksum is found to differ from the transmitted checksum. Errors are reported to the network level so that proper retransmission takes place without involving higher level layers.

Finally, the lowest level, the physical level, specifies how electrical signaling is used to transmit bit streams. The Electronics Industries Association RS232-C connection standard is the most popularly used physical-level interface standard. Newer standards are being developed for use with large band-width cable and satellite systems.

There is certain flexibility, at least conceptually, in applying the seven-level model as a new architecture for intersystem communications. Alternative implementations of the levels may be considered in either a top-down or bottom-up direction. Evaluation and negotiation of communications protocols may proceed in a structured fashion. And
finally, adoption of existing standards or development of new standards can be done stepwise by level.

This discussion has given only a cursory introduction to the Open Systems Interconnection model. There is substantially more detail to be found regarding the functioning of each of the seven layers of the model within the formal definition and in a recent paper entitled "Network Protocols" by Andrew S. Tanenbaum. Since the model is a relatively new concept in telecommunications, much more refinement in the model is expected as it is exercised in practical situations.

Linked System Project

Background

An ambitious computer linking project has been undertaken by the Library of Congress (LC), the RLG, and the WLN through funding from the Council on Library Resources (CLR) to begin the formulation of a national bibliographic network. New communications standards are being developed using Open Systems Interconnection methodology so that in the future other computer systems may be readily interfaced to the network on a peer basis. The first application to use the linkage will be a nationwide authority service drawing on the authority databases being maintained by each of the three organizations.

Experiments have been conducted on the interchange of bibliographic data between computer systems and have proved that a thorough and complete specification of application, presentation and session protocol must be done before reliable communication can take place. In 1976 an experimental online link was developed and tested between LC's computer and RLG's computer at the New York Public Library. Technically, the linkage worked on a simple basis; it was unidirectional. The message transport mechanism was implemented by having the New York Public Library computer put on the guise of an LC computer terminal. Although this terminal emulation-mode linkage was achieved in a speedy fashion, it was not reliable, efficient nor easy to manage. Furthermore, the emulation mode severely constrained the possibilities for expanding its usage.

Concurrent with this experiment, several efforts were proceeding to lay a better foundation for coordinated communications. Foremost was a task force cosponsored by the National Commission on Libraries and Information Science (NCLIS) and NBS to establish an applications-level protocol for library information. Indeed, this was conceived partly on the early work on the Open Systems Interconnection model.
Unfortunately, the NCLIS/NBS task force did not adequately address protocol functions in a database environment, leaving important protocol negotiation to a national registry which was never formed. However, the draft protocol did point out two very important problems to be resolved: (1) the need for a common presentation of a query language, and (2) the need to establish a session-level layer in the protocol model. Additionally, the NCLIS/NBS protocol was judged to be difficult to off-load onto minicomputer systems.

A second effort was initiated by the Library of Congress and the Network Technical Advisory Group to propose a Message Delivery System to be developed in a well-organized and thorough manner. The CLR-funded Linked Systems Project has taken over the pathway set out for the Message Delivery System.

Development

The need for a consistent national union catalog is obvious. Repeated use of data stored in a national union catalog would result in very large savings of librarian staff work. However, a consistent national union catalog presupposes a consistent and coordinated authority. Approximately 18 percent of bibliographic record data is authoritative in nature and requires more staff work to assemble and validate than the other 72 percent of the descriptive cataloging. This makes a shared nationwide authority file a principal objective of a national union catalog.

One of the key elements of the CLR Bibliographic Services Development Program's five-year plan is the development of an integrated consistent authority file service for nationwide use. To this end a task force was formed in 1979 to address the organizational issues and make recommendations for a Name Authority File Service (NAFS). The Linked Systems Project will develop the technical mechanisms by which the NAFS will be distributed in an online computerized mode. While the "master" NAFS file will reside at LC, the maintenance responsibilities will be distributed among many participating libraries at RLG and WLN. In addition, LC will fill the critical overseer role to ensure quality control as well as supply a large portion of the authority data. Future participation in the NAFS will be encouraged via standard linkage mechanisms defined by the Linked Systems Project.

There has been substantial work on revising the MARC Authority record format standard in anticipation of its use in linked, online communications. Simplifications in control subfield data and in updating images will reduce the implementation time for interfacing to the
standard. With the implementation of AACR2, the data content of authority records has been more closely aligned throughout the library world, enabling a wider base of participation in the creation of data. The revised MARC Authority format has been approved as a standard through the MARBI (Machine Readable Form of Bibliographic Information) American Library Association committee which controls all changes in MARC formats.  

Use of the Model

In order to negotiate decisions on the implementation of the link among the three organizations (LC, RLG and WLN), a classic cost/benefit analysis mechanism was attempted. Alternatives for the system components were developed, described and then weighed against a set of criteria to judge benefits. The vendor community was surveyed to determine what off-the-shelf software existed and what developmental services were available. Standards activities, especially at NBS, were studied to determine whether these activities were far enough advanced to be of use. Finally, the capabilities of the three organizations were examined to determine the level of development each could contribute to the project.

The following criteria were used for the evaluation of the telecommunication linking alternatives.

1. The reference model of Open Systems Interconnection should be followed in the design of the telecommunications link.
2. The link must support multiple simultaneous application-to-application interactions among host computers (i.e., it does not use a terminal-emulation protocol).
3. The software involved in the link must have available a sufficient level of support to ensure its operational reliability. The link should not require excessive operational personnel. Network management functions must not be dependent on any single node.
4. The software used must belong to a clear evolutionary software architecture to ensure longevity for software support.
5. The link should be cost-effective to operate.
6. The telecommunications system should be extendable to other computer systems (mainframe, minicomputer and perhaps microcomputer), following the "open" nature of Open Systems Interconnection.
7. The telecommunications system should support substantially higher traffic volume (such as would be generated by bibliographic exchange, interlibrary loan, etc.) without major redesign.

Based on these criteria, the vendor-dependent solutions, such as Systems Network Architecture (SNA), DECnet and Arpanet, were rejected. A minicomputer Network Front-End Processor (NFEP) approach was selected as the best solution for establishing the initial network, and local system development was selected to define the application. In terms of the Open Systems Interconnection model, the layers will be defined as follows:

**Authority Services:**
Application Layer—Develop new standards
Presentation Layer—Develop new standards and use MARC communications formats.

**Telecommunication Services:**
Session Layer—Use NBS proposed standard
Transport Layer—Use NBS proposed standard
Network Layer—Telenet X.25 level 3 service
Data Link Layer—Telenet X.25 level 2 service (LAP-B)
Physical Layer—Telenet X.25 level 1 service (RS232-C)

The authority services will define new application and presentation communication protocols for searching remote authority files and displaying results of the searches, and for intersystem maintenance of authority files. These standard protocols will be set in general terms to be independent of implementation, but will be usable as a specification for development at WLN, RLG and LC.

The telecommunications services will define a standard network interconnection for delivery of messages from one computer to another. It will accommodate authority messages, as well as messages from other applications that may eventually be created.

Figure 2 gives a schematic representation of the system components for two of the three computer systems. Since all three organizations make use of large IBM mainframe processors and front-end processors, the same logical system component diagram is applicable to each. However, nothing in the selection of the communications protocol standards requires a similar system component arrangement for future interfacing sites. In fact, the large effort that has been applied to standards development in the context of the Open Systems Interconnection model has assured independence of vendor and system component configurations.
Crucial to the success of the layer implementations are perfectly fitting system component interfaces. One technique that can be used is to focus on an interface and reapply a transport/session-level submodel which will help in analyzing how the interface is to be used. However, caution is due here in using this technique, since the interface is between two specific devices and does not follow the general model's requirement "openness."

In the broad picture, it is clear that the importance of the model has been to help establish a common vocabulary to negotiate the characteristics of the computer-to-computer protocol. The terminology defined by the model is growing in popularity as further agreement on the conceptual functioning of each layer is reached.
Search/Response Application

At the application level are two new application protocols being defined for interlibrary system communications; the first of these is the search/response protocol. Each of the three current participants in the Linked Systems Project operates its own authority database and query subsystems. A search is formulated by the computer system user according to the syntactic and semantic rules of the local system and the resulting display is structured in a manner that the user can understand. Of course, to link these three systems together in a fashion whereby a user on one system may obtain database services from the other systems, a translation function must be performed to reconcile the differing search and display syntaxes. It was decided that this translation function should not be performed by the user, but should be automated. This avoids the confusion that can be seen arising with the diversity of online reference services, and avoids the burden it places on the user to remember the proper computer command syntax for each system. A generalized search/response application-level protocol is being defined through funding from CLR to be used in the Linked Systems Project and for proposal as a national library standard.\(^{14}\) Initially this search/response protocol will be applied to authority database searching, but it will be formulated in a general way so that it can also be applied to bibliographic and other database searching.

There are two roles for a host system to play in the search/response protocol—the originator system for a search, and the target system for a search. As originator, the host system must translate the user's search into the communications search standard and direct the search to the specified target system. Records received in answer to the search will be in MARC communications format and will be used by the host system to format and present to the user a conventional display screen. On the other hand, a host functioning as the target system must receive the incoming search request, translate it into internal format, search its database according to the search criteria, extract the records satisfying the search, and send them in communications format to the originating system. The target system must retain search results during a search session so that further qualification or restoration of previous search results can be requested by the user. The originating system, on behalf of the user, establishes the start and end of the search session using services of the session layer in the Open Systems Interconnection architecture.
Intersystem File Maintenance Application

The second application protocol being developed is for record transfer and synchronization of databases between the host systems. Provisions are made for creation of new records, and for changes and deletions of existing records to be communicated between computer systems. Two types of online links have been defined to support two separate concepts of participation in the building of a national "logical" database. A record contribution link provides the ability to create new records and change existing records in the Name Authority File (NAF), while a record distribution link between the master NAF and a remote site ensures that all changes made on the NAF database are precisely communicated to the remote database. For each distribution link there is a duplication of disc storage at the remote site for each record in the NAF. However, the cost of extra storage is offset by the lower search/response communications traffic. The intersystem search/response protocol will be minimally used at a remote site which maintains a nearly synchronized database with the NAF. With the contribution link, editing and validation of records to be added to the NAF is done before acceptance of the records.

The Linked Systems Project will implement both types of online links. LC will support the Name Authority File. WLN and RLG will contribute records to the NAF via a contribution link, will subscribe to online distribution, and will extract selected records through the search/response protocol.

Software Standards

The final result of the Linked Systems Project will be an operating link between three dissimilar mainframe computer systems over which search requests and data records will be communicated. Minicomputer hardware will be installed, software will be written for the minicomputer, and software will be changed and added to the mainframe computers. As much as is feasible, high-level computer languages such as PL/I and Pascal will be used so that portions of the software, especially the minicomputer transport and network software, and the mainframe session-layer software may be available to future NAF participants and will be supported through periodic maintenance releases. In addition, WLN will include software developed in the Linked Systems Project into its standard licensed software package.
References


Library Standards for Data Structures and Element Identification: U.S. MARC in Theory and Practice

WALT CRAWFORD

Introduction

The most prominent standards for data structures and element identification in U.S. library automation are the U.S. MARC formats. This paper considers some aspects of building, maintaining and using U.S. MARC and other such standards. The first section considers the costs and methods of establishing and maintaining U.S. MARC, and some of its benefits. The second relates U.S. MARC to the underlying standard ANSI Z39.2-1979. The third considers the relationship between the standard, content, and processing, and includes some other examples of data structure and element identification standards. The fourth section considers levels of compatibility within U.S. MARC and standards in general. The final section gives a few notes on U.S. MARC in practice.

Some Definitions

Data structures provide explicit frameworks for data and (sometimes) data element identification. Without knowledge of the data structure, it is impossible to deal effectively with the data; in a machine context, it is frequently impossible even to read the data. Data structures may provide for subfields (or positions) within fields, within records, within either files or result sets. The discussion here is limited to the record and more detailed levels.
Data element identification as a term is self-explanatory. Data element identification can be of four varieties, which may be intermixed in a given record or data structure:

1. **Positional or implicit**, where the structure defines certain positions within a record (or within a field) as having specific meaning. Examples in MARC include leader positions, fixed-field elements, and indicator values (the latter two being positional elements within explicit higher-level structural elements).

2. **Explicit by code**, where the structure provides for coded content designation requiring external knowledge of the coded values. Most MARC data element identification is of this type, including fields and subfields.

3. **Explicit by label**, where the label is intended to be self-explanatory. This type is frequently called “self-contained identification.” ISSN usage within printed materials is of this type. The label “ISSN” identifies the data element.

4. **Self-identifying**, where the element requires no identification.

Content designation is used to differentiate those elements of a record which designate content from the content itself. The term is generally synonymous with explicit data element identification. In U.S. MARC, tags, indicators and subfields are all elements of content designation. The term is widely used in dealing with U.S. MARC.

Standards, as used in this paper, include not only those established by the American National Standards Institute (ANSI), International Organization for Standardization (ISO) or other standards agencies, but also other explicitly stated sets of rules, particularly those used in common by more than one agency.

The **U.S. MARC formats**, sometimes called LC MARC or simply MARC II, are the series of formats for bibliographic and authority data established and published by the Library of Congress (LC). The primary concern of this paper is the MARC Formats for Bibliographic Data (MFBD).²

**COSTS AND BENEFITS OF U.S. MARC**

Standards for data structures and element identification are like other standards. They cost money to develop, establish, maintain, and use; that cost should be justified by benefits. When a standard becomes too expensive to maintain or use, it should cease to exist.

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U.S. MARC

U.S. MARC, as specified by MFBD, is both an elaborate data element identification standard and a data structure standard. The data structure is a set of choices within the framework of ANSI Z39.2-1979, "Bibliographic Information Interchange on Magnetic Tape." "MARC" is frequently used to refer either to the data structure or to the data element identification standard. U.S. MARC is dynamic; the Library of Congress carries out a continuous maintenance program in cooperation with ALA, bibliographic services, and other interested parties.

Revision and Costs

U.S. MARC was originally developed by LC to distribute LC cataloging data to others. The story of that timely effort, headed by Henriette Avram, has been told elsewhere. Revision is an ongoing process, involving staff at LC, guidance and comment from many interested parties, and quarterly meetings to review proposed changes. Two of these meetings are held by representatives of ALA's Resources and Technical Services Division, Library and Information Technology Association, and Reference and Adult Services Division who compose the committee on Machine Readable Form of Bibliographic Information (MARBI). These are held at the ALA Annual Conference and Midwinter Meeting, and involve the committee, LC staff, representatives from the bibliographic services, and others. The other two meetings are held at LC in the spring and fall, and involve most of the same participants.

The direct cost of maintaining U.S. MARC is probably at least $250,000 per year, and that is counting only LC staff costs; direct costs to the bibliographic services, ALA divisions, and the National Library of Canada for the quarterly meeting; and costs of documenting and implementing changes. U.S. MARC is the most expensive content designation standard in the library community—unless AACR2 is considered a designation as well as content standard—and it is also the most beneficial.

Benefits of U.S. MARC

The most obvious benefit of U.S. MARC is the successful sharing of cataloging data. This started as a one-way sharing: LC, which had long provided printed catalog cards, began to provide information which users could manipulate for their own needs. The development cost of
U.S. MARC has probably been repaid through the benefits of the MARC Distribution Service alone.

The commonality of the communications format and data element identification standards also supported the growth of data sharing beyond LC. The development of OCLC and, later, of other bibliographic services has permanently altered the nature of technical processing in thousands of libraries. While each bibliographic service serves special needs in special ways, all have in common the data element identification standards of U.S. MARC (either directly or through mnemonic mapping), and all receive and distribute data in some compatible superset of U.S. MARC. The tens of millions of U.S. MARC-formatted records created and used through the resources of the services have certainly justified MARC revision costs many times over.

U.S. MARC formats are also widely used with local extensions, for a variety of local processes in libraries and library-related organizations. As early as 1972, the University of California at Berkeley began to use an extended U.S. MARC format for serials payment information. Research Libraries Group's Research Libraries Information Network II uses extended U.S. MARC for all batch processing, including production of acquisitions forms and special reports, as well as catalog cards. Library vendors also use U.S. MARC to provide a variety of services to even the smallest libraries.

The commonality of format has also allowed some sharing of computer software; as computers get cheaper and programmers get more expensive, this sharing seems likely to spread.

U.S. MARC has added a large and explicit vocabulary to library jargon, that of tags and subfields. While this may be a mixed blessing, it does allow rapid, unambiguous communication.

U.S. MARC AND ANSI Z39.2-1979

The data structure underlying the U.S. MARC formats is a formal ANSI standard—ANSI Z39.2-1979. That standard specifies the length of the record leader and significance of most of its positions. It further specifies the position and makeup of the record directory, the nature of field and subfield delimiters, and the length of tags. Finally, it specifies that only characters are used in records, never binary or other coded forms of data.

The current ANSI Z39.2 is generalized beyond that point, allowing for a wide range of implementations, or potentially for a single imple-
U.S. MARC

mentation with a range of record characteristics so wide that it would be quite difficult to process the records. The choices made for the underlying structure were all in the direction of flexibility and extendability, with the only real restriction being that tags are three characters long. That is not much of a restriction, since numeric and lowercase alphabetic characters may be used. There can be 46,656 distinct tags, and the structure allows for a wide range of element identification below the tag level.

As a data structure standard, ANSI Z39.2 is too flexible to use on its own in an efficient processing system. Potentially, each record could differ in: (1) number of indicators per field; (2) number of characters making up a subfield code; (3) length of "length of field" in directory entries; (4) length of "offset" in directory entries; and (5) length of the "implementation-defined portion" of directory entries, allowing subrecords or other structural extensions.

The generality of ANSI Z39.2-1979 allows implementation of sophisticated record structures. It is, however, a relatively difficult standard to process. The standard does not require that a given implementation include all of the options, and U.S. MARC does not. Limiting the options allows more efficient implementation.

The present U.S. MARC formats include only a single option for each record-controlling variable in ANSI Z39.2-1979. There are always two indicators per variable data field, subfield codes are always two characters long, "length of field" is always four characters long, "offset" is always five characters long, and there is no implementation-defined portion. These choices are a compromise between flexibility and practicality. They help to keep U.S. MARC efficient.

EFFECTS OF U.S. MARC ON CONTENT AND PROCESSING

Any information-carrying medium affects the information to be carried. A standard for data structure and element identification affects the data which can be included, how they are entered and maintained, how they can be processed, and how they can be retrieved. The following breakdown is one way of evaluating a standard for data structure and element identification. U.S. MARC is a comprehensive standard, so all elements of the breakdown are applicable.
Data Entry and Maintenance

Does the standard require a sophisticated data entry system? Does data entry require expert operators? How much manual coding of content designation is required? Can data be verified by computer? Is it easy to edit existing records?

U.S. MARC data can be entered using a simple system (for instance, Basic Fix/FIX at the University of California), but data entry then becomes tedious and difficult, with little or no verification and difficult editing. Systems allowing easy modification of existing records, good verification, and good editing require considerable sophistication.

U.S. MARC requires a good deal of human coding of content designation, but actual data entry does not require great expertise. Verification can be quite refined, up to and including full authority control, depending on the system. The format lends itself to editing.

Content Restrictions

Can the standard handle a wide variety of data? Must data be abbreviated to suit the format? Can a variety of relationships be stored? Is there room for future needs? Can simple records be entered? Can very complex records be entered?

U.S. MARC shines on almost all these counts, though ANSI Z39.2-1979 is potentially even stronger. Data abbreviation is almost never required by the standard, though most implementations must set some tighter limits. The format allows up to 9999 characters in a field, and 99,999 in a record. Realistically, no record can be over 32,000 characters (and some systems are far more restrictive: 8192 is a common limit), and few editing systems can handle a field of more than 1500 to 1800 characters. (LC has, in fact, distributed one or two MARC records with "505" fields which are too long to be processed by some systems.)

Simple records coexist with complex records in U.S. MARC. The formats have room for future needs, and reserve room for local extensions. Few standards for data structure and data element identification have the versatility and lack of content restriction found in U.S. MARC and other comparable MARC formats.

U.S. MARC does not support extensive internal data structuring: it is not possible to include a "record within a record," or to provide full content designation for more than one level of a multilevel record. U.S. MARC does handle a variety of data relationships and has room to handle more. A general technique has been adopted in U.S. MARC which expresses such relationships, where full content designation of
related bibliographic entities might be required. This technique avoids "nested records" or "subrecords," using instead record number linkages to separate U.S. MARC records.

**Storage and Processing**

Is there a computer-language bias? How much data overhead is involved? Can records be processed quickly? How large must the machine be? Can generalized, efficient software be written for record processing?

U.S. MARC requires strong string-handling languages, such as PL/1. Data overhead is fairly high. Record processing is fast, particularly for a format with such extended capabilities. It is possible to process U.S. MARC records on some microcomputers, but most U.S. MARC processing is done on large systems.

Because all data are stored as characters, and because data element identification techniques are consistent throughout (except for control fields), U.S. MARC allows generalized data-processing techniques where the task of extracting data is independent of the particular data to be extracted. Table-driven software works well for U.S. MARC, allowing programs and systems which can be maintained and modified quickly and safely. (This is true specifically for record analysis and retrieval; it is not as true for data entry or editing.)

**Data Retrieval and Manipulation**

Does the standard lend itself to multifunction records? Is selective (partial) retrieval possible and meaningful? Does the standard support varied and sophisticated retrieval? Does it support sorting and other manipulation?

U.S. MARC and various extended U.S. MARC formats allow for multifunction records. The format allows meaningful selective retrieval: if an application requires only the main entry, short title and physical description, these tags and subfields can be retrieved *without regard to any other tags or subfields in the record*. The high degree of content designation supports sophisticated retrieval techniques. While U.S. MARC records cannot be sorted without use of a sort key, the records do provide some support for sorting.
Summation and Other Examples

While not a "cheap" standard, U.S. MARC is unusually versatile and flexible, and, once built, the records can be processed efficiently and easily. Two examples follow of other data structure and element identification standards, one from the publishing and book trade and one from the abstracting and indexing community.

BISAC Order and Invoice Formats

The Book Industry Systems Advisory Committee (BISAC), a voluntary collaboration of publishers, booksellers, wholesalers, and librarians, was founded in 1975 "for the purpose of improving the interchange of technical information pertaining to the ordering, handling, and movement of published materials." BISAC has developed and published several standardized formats, designed for inexpensive data entry and processing, at some expense in flexibility.

The Purchase Order Tape Communications Format and the Invoice Communications Format are both made up of eighty character fields. Records are connected by a common area repeated in each field, and each field begins with a two-character identifier. All data element identification within a field is implicit (positional).

The BISAC formats are not designed to handle "difficult" situations, but are suited to the bulk of book trade transactions. They allow simple, cheap, "fill-in-the-blanks" data entry. They allow easy verification, and are single-purpose. Data must be abbreviated or coded in many cases.

Unlike U.S. MARC, the BISAC formats are single-purpose, efficient, and relatively simple. They could be characterized as "COBOL-biased," but could be processed easily using any business-oriented language. These are typical business formats, flexible enough for most transactions, simple enough for efficient use, but somewhat lacking in flexibility and versatility.

Chemical Abstracts Standard Distribution Format

There is no commonly used standard format in the abstracting and indexing community. Most producers have their own format, tailored to their own needs. These are probably cheaper than any common format could be, from the producer's perspective.

One such format, more versatile than many, is the Standard Distribution Format (SDF) used by Chemical Abstracts for its distribution services. SDF is well documented, flexible, and allows room for future data element identification. It is less flexible than U.S. MARC, and does
U.S. MARC

not allow equally generalized software, but it is a versatile, well-designed format, designed to minimize storage requirements.

Records are variable in length with a directory similar to MARC but with binary length and offset values, and with short data elements actually stored in the directory. A record may have up to 255 data elements (there is no lower level of element identification than the field), and may be up to 3520 characters long. SDF is strongly biased toward IBM Assembler; all control elements and fields begin at doubleword (eight-byte) boundaries, and the documentation includes IBM Assembler subroutines for data retrieval. Data overhead is unusually low for a directory-based format. There is heavy use of binary and bit-string data both in the directory and in fields. As a result, fully generalized data handling techniques are not suitable.

SDF appears cheaper to key, edit and store than U.S. MARC. It is a fairly versatile format, and is presumably cost-effective for Chemical Abstracts. SDF is a single-producer standard—more commonly termed a "format"—and it does serve typical standards purposes within the Chemical Abstracts family of distribution services.

COMPATIBILITY BETWEEN AND WITHIN STANDARDS

Compatibility is a frequently used term; the phrase "MARC compatible" is frequently abused. MARC compatibility is an important topic for library automation and is being addressed by a working group of the Technical Standards for Library Automation Committee (TESLA) of ALA/LITA. While the issue of MARC compatibility cannot be settled here, some discussion of levels of compatibility may be useful.

Identity: Precise Compatibility

The highest level of compatibility is identity. Identity normally results from common implementation of a single comprehensive standard by more than one agency. Identity implies that all processes working on one case will work the same on other cases. It requires that character set, record structure, content designation, data element identification, coded values, and rules for content be the same in all cases.

An implementation of U.S. MARC would be identical to U.S. MARC if it included all (and only) data elements contained in MFBD, stored in ALA Extended ASCII (American Standard Code for Informa-
Reversibility: Full Compatibility

Two standards are fully compatible if records using either can be algorithmically transformed to the other, and back again, without any loss of information whatsoever. This level of compatibility is full reversibility.

Alternate Character Set Usage—U.S. MARC is defined using an extended ASCII character set. Most large library-related computers use as a primary character set the IBM-defined Extended Binary Coded Decimal Interchange Code (EBCDIC) character set. Most users of MARC data define "extended EBCDIC" character sets, translate MARC data from ASCII to EBCDIC on receipt, and translate data from EBCDIC to ASCII on transmission.\(^\text{11}\)

Alternate Storage Mechanisms—MARC as a structural standard is well suited to sequential processing, but not to direct access (as in a bibliographic service or online catalog). Most online implementations transform MARC data into a different structure for online use, transforming data back to the MARC structure for sequential use or transmission.

Alternate Communications Technique—When using telecommunications to pass MARC data, a structure which uses fewer characters is highly desirable. Given the current U.S. MARC standard, it is possible to strip part of the leader and all of the directory, attaching each tag to its field; such a record can be transformed back to standard U.S. MARC by a simple program with no loss of data.

The OCLC MARC format and the RLIN MARC format are not compatible at this level. Both are supersets of U.S. MARC, and fall into the third level of compatibility, described next.

Superset Compatibility

One format is a superset of another (second) format if records in the second format can be algorithmically transformed into proper records of the first format, and later transformed back into the second format, without any loss of information at any level. In such a case, all records in the first, or superset, format should be algorithmically convertible into proper records of the second, or subset, format, but some information may be lost in the process. This level of compatibility differs from
simple convertibility in two respects: the converted record becomes a proper record of the superset (or at least a proper portion of a record), and the subset record can be reconverted without loss.

There are at least three types of supersets which can occur in dealing with U.S. MARC. A given superset could include elements of all three types.

1. **Content extensions.** The OCLC, RLIN and UTLAS communications formats maintain precise structural equivalence to U.S. MARC, and include all U.S. MARC content designation and data element identification. They also define additional data elements, such as local holdings fields or acquisitions fields and subfields.

These formats are Extended U.S. MARC formats. The U.S. MARC record can be algorithmically extracted without loss of designation or content, by a simple algorithm. Software which can process U.S. MARC will process the extended record, though it will not recognize the extended fields.

2. **Structural extensions.** A database management system could incorporate all content and content designation from U.S. MARC within an expanded structure. If it is possible to build the bibliographic core of a record in such a system directly from a U.S. MARC record, by program, and to rebuild the U.S. MARC record by program without loss of information, the structural extension represents a proper superset of U.S. MARC. Since programs to process U.S. MARC would probably fail in attempting to process the extended structure, the superset would not be called "Extended MARC."

3. **Character set extensions.** Until such time as non-Roman character sets are actually defined for the MARC formats, an implementation using them is a superset of U.S. MARC.

The preceding list deals with extensions to MARC. At a slightly lower level of MARC compatibility are proper subsets of U.S. MARC—formats which can be algorithmically converted to processable U.S. MARC records, and back again, but which cannot store full U.S. MARC records without loss of information.

That level edges over into the next level down, depending on what one considers to be a "proper" U.S. MARC record. A local format using a full "008" field, full indicators and subfields, but only allowing a subset of tags, would be a proper subset of U.S. MARC and could with some justification be labeled a "MARC subset."

On the other hand, a format which was all uppercase, had no stored subfields, only allowed up to thirty characters for author and sixty for title, had no coded values, and did not allow any other content designa-
WALT CRAWFORD

tion, would really belong in the next lower level, since the resulting “U.S. MARC” record would be almost useless.

Convertibility: Unidirectional Compatibility

A format is convertible from another format if it is possible to convert records from the second format into the first by program, but not to reverse the process without loss of information. This is unidirectional compatibility, and is what is commonly referred to as “MARC compatible.”

Unidirectional compatibility is the broadest level, and the most open to abuse. “MARC” is a selling point in library automation, and there is a tendency to stretch a point in calling something “MARC compatible.” Some fairly clear levels of convertible formats can be stated, based on extent of reversibility and data storage.

1. Reversible with loss of content designation. Such a format allows for all textual data within U.S. MARC to be stored in a meaningful manner, but may omit subfields, indicators and other forms of content designation. The “restored” MARC record would be less useful than a full U.S. MARC record, but would be intelligible, and might be restorable to full U.S. MARC information with some manual or intellectual assistance.

2. Reversible with loss of content. Here, “reversible” is really a sales pitch. All-capital formats, formats with short maximum lengths for data elements, and formats allowing only certain data elements to be stored all fall into this category. Theoretically, if the program is sufficiently tailored, you can “reverse” almost anything, down to and including a format where the full bibliographic record appears on an 80-column punched card. Except where the loss of content is along clear subset lines (for instance, dropping all added entries), such implementations more properly belong in the next category.

3. Nonreversible. A format labeled as such is an honest attempt to incorporate MARC data into a simpler record. In this case, the claim is that U.S. MARC records can be read and data derived to build local records. There is nothing wrong with nonreversible formats, probably the most frequent non-MARC use of MARC records. What is wrong is blithely labeling such formats “MARC compatible,” when the only “compatibility” is that the data elements in the record can be algorithmically derived from U.S. MARC records.
Pseudo-compatibility

The distinction between pseudo-compatibility and incompatibility is a subtle one, based on appearance or lack of information. Pseudo-compatible and incompatible formats are alike in that records in either format cannot be algorithmically converted into the other format without unrecoverable loss of information.

U.S. MARC IN PRACTICE: SOME NOTES

Mnemonics and Tags

Some early system designers felt that MARC tags were too foreign to library practice, and that subfielding would be difficult. Some systems were designed using mnemonics for fields and subfields, with the system providing the tagging. One example is the BALLOTS system, which totally excluded numeric tags.13

Use of mnemonics for fields and subfields grew more difficult as the format expanded, and became cumbersome with the serials format. Use of mnemonics for subfields was effectively impossible by the middle to late seventies.

Surprisingly, the MARC tags and subfields have become common usage in the library field. This is partly due to their brevity and precision: “1 11” is shorter than “Main Entry—Conference or Meeting Name,” and “x11” is a brief way of saying “Conference or Meeting Name, whether Main, Subject, Series, or Other Added Entry.”

Newer systems and revisions of older systems (such as RLIN II) tend to use tags and subfields, using mnemonics only for fixed fields and local extensions of U.S. MARC. The language of MARC has become part of library jargon.

Complexity of the Formats

As early as MARC I and as recently as 1981, it has been claimed that the complexity of content designation in U.S. MARC makes it too expensive to enter data, that the cost of assigning fields and subfields is a substantial addition to the cost of cataloging.

It was recently suggested that libraries could save money and get by just as well if all “name” fields were collapsed to a single field (i.e., 100, 600, 700, and 800) and most subfields were eliminated. Technical processing staff at a variety of libraries consistently said that the extra time
required for proper content designation is a small part of the overall flow of original cataloging. It is, of course, nonexistent in online copy cataloging, which provides 90 percent or more of the cataloging for all but the largest libraries.

Retrieval and manipulation depend heavily on the existing level of content designation. Personal name searching can use a different technique than corporate or conference name searching.

**MARC as a Communications-Only Structure**

MARC was designed for tape transmission of bibliographic records—originally, for transmission from the Library of Congress to others. At the time, many assumed that any user or builder of such records would use them in a different structure, translating to or from MARC only at system boundaries.

An informal survey at the LITA ISAS (Information Science and Automation Section) Programmer's Discussion Group (involving fifteen institutions) showed that eight of the fifteen institutions made active use of the MARC structure as an *internal processing format*. This is not surprising, speaking from the perspective of personal experience at UC-Berkeley and now at RLG; MARC, with minor extensions but no substantive changes, is an effective, efficient and flexible batch-processing format.

The greatest advantage of using MARC with extensions but without major revisions is, of course, that the processing software is resistant to change in data element definitions. The MARC directory is efficient for individual item retrieval within a batch environment. If you are looking for one set of fields, you don't need to know what other fields have been added.

Use of the structure is not restricted to catalog card production. At RLG/RLIN, all acquisitions product generation (e.g., orders, claims, cancellations) is based on MARC structured records. UC-Berkeley has been driving its acquisitions and product generation systems from MARC structured records for nearly a decade now, at low cost and with high flexibility.

The MARC structure is principally useful for batch processing. Interactive online use usually requires transformation to some database structure.
The LC-Centrism of U.S. MARC

U.S. MARC has been "LC-centric," concentrating on the needs of the Library of Congress. Most U.S. MARC development since the early years has avoided additional LC-centrism. In recent years, there has been movement away from existing LC-centrism—studies have been done, the MARC review process is focusing on the issue, and the Library of Congress itself is working to lessen the bias. In the course of this movement, it has become clear that many libraries want some LC-centrism. In some cases, they want to distinguish between data elements actually assigned by LC and those assigned by others. Moves to generalize the format will leave in some LC-centrism, at the request of other libraries, even when the Library of Congress would prefer to see the bias eliminated.

U.S. MARC and Analytics

An analytics technique for U.S. MARC was approved at the ALA Midwinter 1981 MARBI meeting. It adds field 773—"In"—to the existing formats (and adds some other supporting codes). While not the sophisticated structural solution which was originally proposed, the current solution is easy to implement, easy to use, and allows full extendability for complex situations.

U.S. MARC and Structured Data

ANSI Z39.2-1979 allows implementations which store several levels of fully content-designated bibliographic entries within a single record (for instance, a set of maps with entries for each map). This "subrecord technique" was considered as a possible change to U.S. MARC.

The decision to use linkages to separate U.S. MARC records was made largely because of the expense and difficulty of subrecords. All users of systems reflecting U.S. MARC, whether they ever used subrecords or not, would pay a high ongoing price for the technique, in addition to the extremely high price of initial implementation.

Some intended uses of the subrecord technique could not have been handled. A record of more than 32,000 characters, including all overhead, is essentially unprocessable on any current business computer.

*The development of analytics capability in U.S. MARC has been a complex and difficult one stretching over many years and showing, in its final phases, the historic changes in attitudes toward MARC. It would be impossible to give even a brief version of that development here.
Intricate multipart records would have exceeded this limit frequently enough to cause a continuing problem.

The Three-by-Five-Inch Card Orientation of U.S. MARC

U.S. MARC does have features which specifically serve card-oriented needs, and does retain the concept of "main entry." Many of those features are required for any unified single-record display.

U.S. MARC uses the same subfielding and other content designation for main entries and equivalent added entries. The same level of information may be provided, and systems which do not use a "main entry" are well served by U.S. MARC. While U.S. MARC supports the three-by-five-inch card, it does not do so to the detriment of other uses.

Conclusion

Standards for data structure and element identification can range from small and simple standards to those as large and complex as U.S. MARC. Any such standard should be judged by its cost/benefit ratio. U.S. MARC has benefited libraries far beyond its costs.

Thousands of libraries of all sizes use tens of millions of U.S. MARC and extended U.S. MARC records, directly and indirectly. U.S. MARC has served these libraries well, and continues to do so. U.S. MARC continues to evolve, making the formats more useful while retaining the worth of existing records and processing systems. The evolution is sometimes slow and painful, but is done with concern for the past and present, as well as for the future.

The future is longer than the past, but is based on that past. Existing U.S. MARC-formatted records are as relevant to future library needs as existing books are to future readers; those who would scrap either must be able to justify the change.

The future may bring a format, not evolved from present U.S. MARC, which is so superior as to make mass conversion worthwhile. No such format has yet appeared, and no convincing case has been made to this point for radical change in U.S. MARC. Those who attack U.S. MARC should bear the burden of proof: showing a superior alternative, and showing its economic validity. The case for MARC III (?) may be made, but it has not been made yet.
U.S. MARC

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Standards and Bibliographic Data Representation

ROBERT S. TANNEHILL, JR.
CHARLES W. HUSBANDS

Purpose and Scope

CODED INFORMATION HAS BECOME commonplace in everyday life. A telephone number representing the physical location of a specific individual or organization, a U.S. Postal Service ZIP Code representing a particular postal delivery area, a Social Security Number identifying a person—these are among the most ubiquitous examples. The codes that surround us are intended to make life more convenient by facilitating communication.

What are the purposes of representing data in coded form? They include, but are not limited to, saving space, reducing data transmission time and cost, concealing informational content, achieving efficiency in database searching, protecting the integrity of transmitted data, and increasing efficiency and accuracy of data entry. To these purposes for data representation must be added uniform understanding and consistency in data interpretation. For, without fixing norms to reduce unnecessary variation, confusion prevails, resulting in avoidable wastage of time and labor, lack of uniformity, inefficiency, and poor communication.1

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sentation in data systems." Uniform understanding can only be achieved through standardization.

This article deals with data representation conventions and standards for bibliographic data elements. It does not attempt to treat representations based on the physical characteristics of specific electromagnetic media, record structure format and content designations (e.g., MARC, ISO 2709, ANSI Z39.2), codes of practice (e.g., AACR2), natural-language subject terms (e.g., MeSH), or data compression methods.

Background and Philosophy

The process of data representation encompasses two activities—establishing representational conventions and applying them. Components of establishment include development of standard representation rules specific to each application, creation of preassigned value tables or data files necessary for value assignment (encoding) and translation back to the primary message (decoding), preparation and maintenance of the standard procedures for applying the rules and preassigned representative values, establishment of any needed maintenance agencies, and promulgation of the data representation schemes and procedures. Application involves identifying and selecting the set of symbols to which representation values can be assigned, matching selected messages to standard value tables, and replacing selected messages with the equivalent codes or other data value representations based on standard rules of application.

Coding involves the replacement of one set of symbols (e.g., a word, a phrase, an entire sentence, a variable-length sequence of alphabetic characters) with another set of symbols, usually in an ordered, shortened, fixed-length set form, with the purpose of providing unique identification of the data to be coded; for example, converting the serial title *Journal of the American Chemical Society* to the CODEN: JAC-SAT or the ISSN 0002-7863; converting a pair of geodetic coordinates into a code for input to a geographic reference file; or converting the name of a country, e.g., the Union of Soviet Socialist Republics, into the three-character ISO alphabetic code SUN. A distinction is frequently made between codes and ciphers. To state the difference over-simply, a cipher replaces each individual symbol (or fixed-length unit of symbols) with a coded equivalent, while in a code the substitution is based on linguistic or semantic units. In this article the terms *code* and *coding* will frequently be used in a general sense without distinguishing between the use of encoding and enciphering techniques.
Bibliographic Data Representation

The use of codes and ciphers appears to be as old as recorded history. Exclusive of systems of stenography or shorthand, codes appear to have been used primarily to conceal the meaning of messages. For example, the ancient Jewish Talmudic scholars practiced cryptography as a part of their Cabala, and Lacedemonians of ancient Greece employed a cryptographic device, called the scytal, for secret communications during their military operations.4

Until the mid-1800s cryptology remained relatively stable in terms of technique and volume of use. At that time, the invention and growing use of electromagnetic telegraphy caused a significant expansion in the repertory of codes, one of which, of course, was the internationally accepted Morse code, the most generally used code from the 1840s until the mid-1920s. Radiotelephony, which permitted voice as well as coded transmission of data, eventually supplanted telegraphy as the communication medium of choice. In 1874, J.G. Bloomer published a code directory of frequently used sentences and statements to reduce the cost of cabling and to provide some message security.5 Here can be seen a combination of techniques, with coding (in the narrow sense) and encipherment being employed simultaneously.

Two important points should be kept in mind. First, advances in technology have been a major factor in the increasing need for codes and other data value representations. Second, secrecy as the primary purpose of codes does not hold the preeminent position it occupied historically. As David Kahn has stated, "secrecy is the antithesis of communication,"6 and in today's "information society" rapid communication and accurate information transfer have reached the highest levels of importance. While secrecy is still required for its traditional purposes, requirements such as speed and reliability are far more generally applicable.

Although the electromagnetic telegraph ushered in a new era for data transmission, development of the computer has made the data transmission volume, speed and versatility of the telegraph seem paltry.

Though it seems paradoxical, the power of computers has made the need for efficient data representation even more important, since the complexity of modern communication and information systems magnifies inefficiencies by repeating them in the systems' many components. Ambiguity, which the use of codes does much to alleviate, is a great source of inefficiency. Reviewing the historical employment of codes and other forms of data representation in the bibliographic community, there can be no doubt that automation has provided great impetus, if not the impetus, toward their proliferation and increased use because of the savings in storage they provide and the economy afforded by using compact, unambiguous keys for automated retrieval.
Until well into the twentieth century, the only codes broadly used within the bibliographic community were the Dewey Decimal Classification system, devised in 1873, Cutter's Expansive Classification of 1891, the Cutter tables of 1899-1901, the Library of Congress Classification system of 1899-1920, and the National Union Catalog code, devised in 1932. Admittedly, consideration of classification systems as codes extends the concept to its limits. Even though abbreviations were used, none of these were standardized. It was not until the development of the computer and its application on a broad scale within the bibliographic community that the need for codes and other forms of data representation became critical. In fact, the first American National Standard for a data value representation was not approved until 1971, ANSI Z39.9-1971, "Identification Number for Serial Publications." (The international equivalent followed in 1975, ISO 3279-1975.) Since that time, numerous American and international standards for data representation have been developed.

**CODE CHARACTERISTICS**

Codes involve two fundamental concepts: symbol and position. Symbols include alphabetic characters from which words are formed, decimal digits from which numbers are formed, binary digits, and alphanumeric strings of characters. One might also consider certain graphic symbols to be codes, for example, currency symbols, or the symbol ©, representing the concept of copyright. Position can be defined by direction (e.g., the convention of left to right for words or characters in a word); relationship to a fixed point (e.g., a decimal point); temporally (e.g., the sequence in time of transmitted data); or by coordinates (e.g., row and column on a punched card, or latitude and longitude on a map).

In Federal Information Processing Standard (FIPS) 45, codes are categorized as "nonsignificant codes" and "significant codes." Nonsignificant codes are those whose individual values are meaningless and which are assigned to provide unique identification to the entities coded. Two basic types are sequential-number codes and random-number codes. One of the best examples of a nonsignificant code is the International Standard Serial Number (ISSN), composed of eight numeric digits with no specific meaning except for an arbitrarily assigned correspondence to a particular serial title. Significant codes, on the other hand, are "designed to provide unique identification of the words or phrases being coded" and to provide "additional meaning."
The basic types of significant codes are: logical (code values based on a consistent, well-defined algorithm); collating (used to place coded items in a predetermined sequence); and mnemonic (code values derived from and suggestive of the coded information itself). Examples of these are the Universal Standard Book Code (USBC) (logical), the numeric codes for states specified in ANSI X3.38 (collating), and the CODEN (mnemonic).

Just as codes can be categorized, at the more generic level there are various types or classes of data representation. For example, in addition to the previously mentioned codes, there are abbreviations and script conversion schemes. Abbreviation, as a technique of representation, is generally applicable to alphabetic strings of characters only, and is achieved by two methods: truncation (i.e., dropping a continuous group of the final letters of an alphabetic string), and contraction (i.e., omitting internal letters). Script conversion is "the operation of replacing the script and writing system of a language by a different script and writing system." Two techniques can be used to achieve the conversion: transcription, in which the conversion is based on the phonemes or morphemes of the source language; and transliteration, in which the conversion is based on the characters of the source script. Of particular interest in English-speaking countries are Romanization schemes for converting data in a non-Roman alphabet script into a Roman alphabet equivalent.

Script conversion and abbreviation are types of data representation which usually lack a characteristic commonly known as reversibility. That is, the converted or abbreviated text frequently cannot be restored unambiguously to its original form. For example, the abbreviation for "Drive" is "Dr.," but it is also the abbreviation for "Doctor." In these and other such cases, the context in which the abbreviation is used determines the correct natural word. Even in cases where context is available, determining the correct natural word may be difficult. For example, the abbreviation phys. may represent "physich-,” “physicien,” “physicus,” “physic-,” etc.

Resorting to context can usually resolve ambiguities of abbreviation, just as resorting to knowledge of the source language can usually resolve ambiguities of script conversion. It is worth noting that these stratagems are much better suited to direct human effort than they are to automation. These are precisely the kinds of things which computers do not do well.

Lack of reversibility is a characteristic which separates abbreviation and script conversion schemes from true codes, for which one-to-one correspondence between the code values and the entities represented is a
principal desideratum. Hayes and Becker state that a code system should involve "the assignment of codes, based on symbols from a specified set of symbols at positions in a defined set of positions, to the items being coded." The assignment is given by a "code book" which allows "the transformation from item to code and vice versa" (emphasis added). Implied in this statement are standard symbols, a standard set of positions, the use of a standard directory or catalog of codes, a maintenance agency for the directory, and reversibility. Hayes and Becker further state that in evaluating a particular code system, one should look for reliability, efficiency, ease of use (convenience), special properties (e.g., simplifying an operation), and statistical manipulability.

Working together, the U.S. National Bureau of Standards (NBS) and ANSI's Committee X3, Computers and Information Processing, have identified the ten characteristics of a sound coding system:

1. uniqueness 6. versatility
2. expandability 7. sortability
3. conciseness 8. stability
4. uniform size and format 9. meaningfulness
5. simplicity 10. operability

These characteristics may seem abstract, but they are important in achieving the purposes of encoding, and they affect design decisions which may seem to be only matters of detail. For example, it is desirable that the set of symbols used in code values not only be limited to characters widely available on keyboards, but also distinguish between commonly confused symbols (such as the digit 1 and the letters I (uppercase) and l (lowercase), the digit 0 and the letter O). For codes intended for international use, it is helpful to have values which are linguistically neutral. Numerical values meet this requirement exceptionally well.

Information redundancy can enhance code operability. Standard value length, punctuation and labeling can be used as cross checks on correct encoding. A code may incorporate a check digit computed from the values and/or position of the code symbols. Algorithms used for the generation of check digits are designed to yield different results for similar strings of symbols so that there is a high probability of being able to detect transcription errors. Codes frequently have a hierarchical substructure. In whatever manner the code values are constructed, it is important for many applications that the semantic elements be completely defined and predictably formatted, that is, that they be processable by fairly simple algorithms.
American National Standards Committee Z39 brought together some of the issues involved in the creation and implementation of identification codes in "Development of Identification Codes for Use by the Bibliographic Community," ANSI Z39.33. This standard is unusual in that it is a standard for the creation of other standards. In addition to treating the format and content of the code itself, Z39.33 addresses code administration, stressing the necessity for a maintenance agency to be responsible for the assignment of code values and the promulgation of the code through publication of the necessary code books and other explanatory and promotional material.

REPRESENTATIVE CODES FOR THE BIBLIOGRAPHIC COMMUNITY

As the American National Standards Institute (ANSI) and the International Organization for Standardization (ISO) are generally considered to be the authoritative standards-setting bodies for the United States in the areas of library science, information systems and science, and publishing. This article focuses on the efforts of these two organizations. However, considering that there are over 72,000 U.S. government and industry standards and specifications issued by over 430 organizations, other standards-issuing bodies cannot be ignored, for, in many cases, their standards may be more current or the only standard extant in a particular area. The appendix to this paper lists extant ANSI and ISO standards that represent bibliographically related data values. Not only are ANSI Committee Z39, Library and Information Sciences and Related Publishing Practices, standards shown, but also those of ANSI Committee X3, Information Processing Systems, and the ISO counterparts ISO TC46, Documentation, and ISO TC97, Computers and Information Processing, as well as Federal Information Processing Standards issued by the National Bureau of Standards. It should be noted that where practicable, FIPS are consistent with corresponding ANSI and ISO standards.

Also listed in the appendix are a number of de facto standards used within the bibliographic community to code or otherwise represent data. The appendix is not intended to be exhaustive. Rather, it is indicative of various types of data representation standards that are available. Excluded from the appendix are many codes or data value representations that are used locally or may, indeed, be de facto standards in their own right. Examples of these exclusions are language codes; frequency of publication codes; bibliographic record identifica-
tion codes (e.g., the OCLC Record Number); U.S. state, Canadian province, and other geographic area codes; the Universal Product Code (UPC); the Universal Standard Book Code (USBC); the European Article Number (EAN); the cataloging category of the Research Libraries Group (RLG); and many more. In fact, the very proliferation of such codes emphasizes more clearly than any amount of rhetoric the need for standardization.

To attempt an exhaustive survey of this formidable array of standards and conventions would bewilder authors and readers alike. Instead, four areas of continuing interest have been chosen for discussion. These include identifiers of bibliographic entities; identifiers of geographic, political and corporate entities; binary codes and character sets; and script conversion schemes. Even here the goal is not comprehensive description, but rather illustration of various aspects of the standards-making process and issues of code development and use.

Identifiers of Bibliographic Entities

The International Standard Book Number (ISBN) was developed from the Standard Book Number (SBN), a British effort begun in 1967. Components of the SBN were a publisher's number, a book number, and a check digit, totaling nine digits. To extend the scope of the SBN internationally, a language/geographic group element was added to the beginning of the number, lengthening it to ten digits. Since all extant nine-digit codes belonged to the same language group, the expansion raised no ambiguity. The code had met one test against the criterion of expandability.

The structure of the ISBN is orderly in that the length of each ISBN is fixed at ten digits, and, while the length of the components is not fixed, it is determined according to an algorithm based on the first digits of the code. It is possible, in theory, to insert hyphens correctly between the various ISBN components for display without having to store this punctuation, thus reducing required storage space by 23 percent. The punctuation definitely assists visual parsing of the numbers, but is redundant semantically. This structure is imposed on the code at some cost, for there are publishers who will eventually exhaust their assigned range of specific book numbers, while others never will. The structure causes the actual number of usable codes to be significantly but indeterminably smaller than the theoretical maximum of 1 billion. It is difficult to assess the effect this will have on the useful life of the code. The first cases of overflow will probably be met by the assignment of a second
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publisher prefix to the prolific entities, but this tactic will have its practical limits.

The ISBN is administered internationally by the International ISBN Agency under the auspices of the Staatsbibliothek Preussischer Kulturbesitz in Berlin, and in the United States by the R.R. Bowker Company, which assigns codes to U.S. publishers, delegating the assignment of book-specific ISBN elements to the publishers themselves. This dispersion of control is a notable feature of ISBN implementation.

In the book trade and for library acquisitions, use of the ISBN has been widely adopted. Codes have been assigned to over 55,000 publishers and number ranges assigned to seventeen countries and Unesco.24

Difficulties with the use of the ISBN have resulted occasionally from inconsistent practices in assigning numbers to multivolume or multiedition works, and the assignment through carelessness or misunderstanding of duplicate numbers or of numbers whose check digits are in error. More frequent problems have arisen from mistranscription of correctly assigned numbers in crucial places such as bibliographies and title pages. Another problem has been the zealous assignment of ISBN by publishers to all their products, whether or not they are books.25

Unlike the ISBN, the International Standard Serial Number (ISSN) did not see American implementation until the international administrative structure for ISSN assignment was in place. The ISSN comprises eight digits, of which the last is a check digit. A hyphen is displayed between the fourth and fifth digits. The ISSN is not structured to encode information on geographical areas or publisher. It is, according to the FIPS criteria discussed previously, a nonsignificant code. An important success for the ISSN in the United States occurred in 1978 when the U.S. Postal Service required the inclusion of the ISSN on all U.S. serial publications.26 The International Serials Data System, which administers the ISSN, operates under the aegis of UNISIST. Assignment of ISSN is delegated to various national centers, of which forty-six are currently operational. ISSNs for U.S. publications are assigned by the National Serials Data Program at the Library of Congress.

Some early proponents of standard identification numbers had unrealistic expectations about their universality of application. Now that the ISBN and ISSN have been in use for approximately a decade, it is easier to assess their place among the indicia employed for bibliographic information exchange. Their being codes determines their strengths and limitations as retrieval mechanisms. The numbers must be assigned. There is no way that the value appropriate to an item can be
inferred by looking at it, since the code values are extrinsic to the items they represent. The process of assignment means that the entity must be identified in sufficient detail to permit the code value to have an unambiguous reference. The assignment of values implies maintenance of a code book whose use will enable an encoder to assign the correct coded representation for a known entity and a decoder to discover the entity corresponding to a known code value. Once assignments have been made, very little judgment is required beyond that necessary for the encoder to identify the desired entity in a code book (for example, for acquisitions staff to match a patron request for a title with a publisher's trade catalog entry). From that point, identification is unambiguous. Distinctions which may require many words have been made and can be communicated concisely and with precision. This is a splendid arrangement as long as there is exactly one entity that fills the need. But what has been gained in precision has been paid for in recall. The criteria used by a reader for selecting a book frequently differ from those used to determine code value assignment. The ISBN illustrates this. The information content of a book issued in hard cover is likely to be identical to that of the same title simultaneously issued in paperback, but these have separate ISBNs. The same item may appear in another part of the world under another imprint. There also may be translations. Someone wanting to look at the book is fairly likely to know, more or less accurately, its author and title. It is less likely that the user will know an ISBN, at least without a special search, and far less likely that the entire set of applicable ISBNs will be known if more than one applies. The distinctions made to facilitate operations of the book trade are not useful, and may actually impede retrieval of information. This difficulty has provoked a proposal to designate one ISBN, when multiples exist, as a "Bibliographic ISBN," identifying the "title" instead of the "book." 27

Another response to this problem, but more especially to the error-susceptible process of ISBN assignment, is the invention of the Universal Standard Book Code (USBC). 28 The USBC has been developed primarily at the University of Bradford, England. It is designed to be, in FIPS 45 terminology, a logical, significant code, derived by algorithm from a machine-readable cataloging record. In the process of refining the algorithm to be properly discriminating, it has become so complex that manual code assignment is admitted to be impossible. 29 Thus the chance of human error in code assignment is eliminated. However, the USBC is highly dependent on the content of the cataloging record for the work being represented. Since creation of cataloging records is susceptible not only to error but to differences of opinion, it is not
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surprising that specification of the USBC algorithm is not yet complete. Inclusion of the word *standard* in the name of this code is highly presumptuous.

Many of the problems of the ISBN and the USBC are not entirely their own, but exemplify the intractability of the reality they attempt to organize. Concepts such as title, edition and volume turn out to be less simple than they seem intuitively to be. Any bibliographic control system makes simplifying assumptions, often implicitly, which work quite well in natural-language discourse but suffer when subjected to codification.

The Library of Congress card order number (LCCN) provides another example of this phenomenon. The staff of the Library of Congress has quite consistently maintained that this number represents not a bibliographic entity, but a specific surrogate for one—that is, a catalog card printed by LC. But the long-established practice of including LCCN on the verso of title pages, hence of assigning card numbers to works before publication, has led quite naturally to widespread association of the numbers with books instead of cards. The situation has been further complicated by the use of the LCCN as a record number for machine-readable cataloging during a period when the printed card and the machine-readable record were separate products of traditional processing operations. The meaning of the LCCN is undergoing redefinition, largely through implicit processes, and the Library of Congress appears to be moving to acknowledge and accommodate this transition. Throughout, the LCCN has served as an important link between a bibliographic entity and its cataloging.

Call numbers themselves resemble codes for bibliographic entities. This is especially true, because of their wide availability, of the call numbers assigned by the Library of Congress to its own holdings. Since LC assigns unique call numbers to the entities cataloged, there appears to be an authoritative agency at work. But, in fact, because LC's classification schedules are published and its Cuttering techniques widely known, this is not the case. Each library using the classification is the authority for numbers assigned to its own holdings, and conflicting assignments made by different institutions are common. Hence, the universe within which a call number serves as an unambiguous code for a bibliographic entity is bounded by institutional walls. Within an institution this coding assumes paramount importance. It should be remarked, however, that in the development of automated systems (such as circulation systems) that might be expected to make use of the call number, other identification numbers have frequently been invented.
There are two reasons for this. An LC call number contains a great deal more information than the minimum required simply to distinguish bibliographic records or physical volumes. In consequence, the numbers are long. Beyond that, however, the notation of LC call numbers is cumbersome for automated application. Short of the improbable measure of adopting a wholly new notation, the best way to improve this situation is for LC to develop, promulgate and use rules for its own call-number building which would specify for each portion of the classification the elements that must or may be present, and the number and kind of characters they must or may contain.

Codes for Geographical, Political and Corporate Entities

Because of the immense variety of its potential applications, the most important code of this type is ISO 3166-1981. This standard specifies codes for identifying "entities of special geopolitical interest," a phrase normally construed to mean "countries," although the formulation permits the assignment of codes to identifiable entities while avoiding the need to pass judgment on an entity's political status. Three sets of codes are provided: two-character alphabetic (to be preferred), three-character alphabetic, and three-digit numeric. The maintenance agency for ISO 3166 is extraordinary, created especially for the purpose and composed of representatives from five international agencies (the International Atomic Energy Agency, International Telecommunications Union, United Nations Statistical Office, Universal Postal Union, and United Nations Conference on Trade and Development/Economic Commission for Europe) and from standards agencies in five countries (France, Sweden, United Kingdom, United States, and West Germany).

The maintenance agency has been active in promoting the use of the standard both within the bibliographic community and beyond. One of its primary concerns is registration of code applications. Registration has two immediate objectives affecting code design and maintenance. The first is to monitor methods being employed to identify subdivisions such as states and provinces. The second is to gather information on use of the various forms of the code. As of December 1981, responses to requests for this information showed uses of the two-letter and three-letter versions of the code to be roughly the same in number.

Among known users of the code, the maintenance agency counts libraries, information and documentation centers, publishers, government institutions, international organizations, industries, and private...
associations and enterprises. Many of the specific nonbibliographic applications are related to transportation.

In the United States, the equivalent of ISO 3166 is American National Standard Z39.27-1976, which refers explicitly to the international standard (in its first version of 1974, which lacked the three-digit numeric code). The National Bureau of Standards has principal maintenance responsibility for ANSI Z39.27.

The country of publication code found in MARC formats is a precursor of the two-letter style ISO 3166. Values used are in general agreement with the international standard, except that provision has been made to represent individual U.S. states, Canadian provinces, and republics of the Soviet Union with their own three-letter symbols—an extension of exactly the kind in which the ISO 3166 maintenance agency is interested. The codes for the U.S. states (with the exception of Nebraska) are composed of ANSI X3.38 standard two-letter codes followed by the letter U.

The MARC format provides for other geographical coding as well. The geographic area code is hierarchically structured using the country of publication codes (hence, ISO 3166) at the country level, and X3.38 codes (except Nebraska) at the state level. The geography classification code is derived from the Library of Congress G classification schedule.

The opportunities for application and interaction of geographic coding can be seen from these few examples to be numerous and varied. One derivative of ISO 3166 has already become another international standard, ISO 4127, which identifies currencies by using the two-letter version of ISO 3166 with a third symbol appended. One more related endeavor with significant implications is the publication by the International Federation of Library Associations and Institutions (IFLA) of an authority list for catalog entries for the names of countries, which is keyed to the ISO 3166 two-letter code. The main objective of the list is to aid the creation of authority files to facilitate exchange of data from one language to another in machine-readable form. It seems probable that additional corporate (and perhaps even personal) identification standards will be proposed as automated approaches to name authority control are pursued.

Among coded identifiers for libraries, the National Union Catalog (NUC) symbol is venerable, having been first published in 1932. A design problem long observed in the NUC code is the semantic importance of the case of the letters. COC, COc and CoCare distinct and valid code values. As the application of the NUC code to automated systems was contemplated, this difficulty loomed large—very large in the early days, when six-bit computing was the norm and upper- and lowercase
output was rare. The varying length of the NUC code values, which ranges from two characters to at least nine, was also unattractive to data processors since the longer codes, though few in number, would require the reservation of sufficient space in every data format.

OCLC, Inc. (Online Computer Library Center) developed for its internal use a three-character institution identifier. Since OCLC-using institutions have been allowed to propose their own symbols, many of the values have a mnemonic characteristic, but because the population is large and each code value short, mnemonic opportunity is limited. Approximately 3,200 OCLC institution symbols have been assigned, making this code second in coverage only to the NUC. The OCLC institutional symbol was designed to meet the specific processing needs of that system, and it is not well suited to serve as a basis for a system of general library identifiers. For example, the capacity of the OCLC institution code is a crucial limitation. If letters alone are used, as they are today, only 17,576 code values are available. The number of libraries in the United States far exceeds this.

The newest standard institutional identifier, by contrast, is specifically intended to meet the needs of intersystem communication. The Standard Account Number (SAN), described in ANSI Z39.43-1980, "Identification Code for the Book Industry," provides identification of all parties involved in book trade transactions—publishers, jobbers, retail stores, and libraries. The R.R. Bowker Company is the principal maintenance agent for the standard. The assignment of SAN is well underway, and applications are appearing, but it is too soon to evaluate the success of the code. The SAN is a seven-digit, nonsignificant code representing a specific name and address. Entities using more than one address will have multiple SANs. The specificity of the SAN is somewhat analogous to that of the ISBN, both numbers clearly exhibiting their orientation to the needs of the book trade.

The current repertory of coded library identifiers lacks a system or scheme that combines the human intelligibility of NUC symbols with suitable data-processing characteristics. The possible development of such a code is the principal focus of the newly-established Z39 subcommittee V on standard identification numbers for libraries, library items and library patrons.

Binary Codes and Character Sets for Information Interchange

Binary codes and script conversion schemes differ from the codes discussed previously in that they function as ciphers by substituting
values at the level of single letters or, at most, of phonemes, rather than encoding more complex entities such as titles, books, libraries, or countries. Two binary codes predominate in bibliographic data today. The first is the American Standard Code for Information Interchange (ASCII).\textsuperscript{45} The second is the Extended Binary Coded Decimal Interchange Code (EBCDIC).\textsuperscript{46}

ASCII is an American standard corresponding very closely to the international standard ISO 646.\textsuperscript{47} EBCDIC is the code developed by IBM for its System 360 computer series in the 1960s. EBCDIC continues to be used by IBM and by other manufacturers of hardware compatible with IBM equipment. The stability and widespread use of EBCDIC give it the semblance of a standard, though it has no official national or international standing as such. All standardization efforts have been based on ASCII. ASCII was adopted as a Federal Information Processing Standard in 1968, ensuring its use for data interchange between government computing systems even though these systems might use EBCDIC internally. The number of machine cycles used daily to perform conversion between EBCDIC and ASCII is wonderful to contemplate. This inefficiency is regrettable, but it has become a way of life for IBM users, and is preferable to the cataclysmic impact that abandonment of EBCDIC would have.

EBCDIC is an eight-bit code, giving it a repertory of 256 possible characters. ASCII is a seven-bit code, with a repertory of 128 characters. One-fourth of each set is reserved for control characters. The remaining code values can be used to define graphic characters. All ninety-six graphics available in ASCII have been defined. A similar number of graphics were originally defined for EBCDIC, leaving nearly 100 undefined code values. Many of these have since been appropriated by IBM or various users for application-specific character definitions. Such consistency as may exist among these applications is largely fortuitous—a factor inhibiting both data transmission in EBCDIC and software transfer between users of EBCDIC-based computing systems when extended character sets are involved.\textsuperscript{48}

The potential need for a larger character repertory was recognized by the designers of ASCII, and techniques for extending the code were developed and approved as ISO 2022-1973 and as ANSI X3.41-1974.\textsuperscript{49} The technique involves the use of pairs of 128-character sets—a strategy particularly convenient in an eight-bit environment, since the eighth bit can be used to distinguish the various pairs. In every set there can be ninety-four graphics plus the constantly defined \textit{space} and \textit{delete} characters. In each pair the basic set of graphics is known as $G0$, and the auxiliary set as $GI$. For varying purposes, different $GI$ sets might be
associated with the same $G0$ set. Escape procedures enable the replacement of either the $G0$ or the $GI$ set as the situation may require. Registration of the coded escape sequences necessary to address various character sets is provided by ISO 2375, for which the European Computer Manufacturers Association currently serves as maintenance agency.\footnote{50}

ISO 2022 and ANSI X3.41 also provide for a different sort of code extension by allowing definition of sets of characters comprising multiple bytes. This technique enables the definition of standard codes for even the logographic scripts of East Asia.\footnote{51}

Two types of considerations, not wholly separable, govern interchange character set design. First, the repertory of characters must be determined. Then, specific values must be assigned to the chosen characters.

Whether a proposed character set is expected to function primarily as a $G0$ or $GI$ set plays a significant part in character selection. The inclusion of numerals and basic punctuation, for example, is redundant in a set which will probably be used as a $GI$ set with a $G0$ which already defines them.

A recurrent issue is whether characters are to be identified by their shapes or their meanings. Mathematical symbols are a very troublesome group in this respect, though abundant problems can be found elsewhere. Proposals for Hebrew character sets have generally included separate values for the final forms of the half-dozen letters which change shape, and in Greek the final-form sigma has regularly been separately represented. Current thinking about Arabic, however, appears not to favor assigning separate interchange codes to the positional variations of letters, but relying on display software to supply the correct form by algorithm. The inability of ASCII to distinguish between opening and closing quotation marks or between an apostrophe and a single quote is another manifestation of the same general issue of shape and meaning.

Factors affecting the arrangement of characters are frequently related to filing considerations. Hence, grouping of functionally similar characters and retention of traditional collating sequences are desirable. For example, digits should be arranged from 0 to 9, and letters should appear in alphabetic order without other characters being interpolated. Using a single bit to distinguish between upper- and lowercase versions of letters is a stratagem which may enable "folding" of the character set to facilitate either sorting or display on a single-case device.

In character set design, the difficulties of standards work are manifestly present as divergent needs contend for satisfaction in the 94-character matrix. Despite the problems, progress can be made. The
even before code extension techniques had been standardized, a
major extended character set had been defined and implemented in the
united states. ala and lc had, by march 1969, designed a character set
for the marc distribution service which incorporated in essence a gi
set to be used with standard ascii.52 values for all the characters were
defined not only in an eight-bit extended ascii, but also in ebcdic.53
unfortunately, a number of diacritical marks were assigned values in
the ebcdic control character range, making this set of assignments
unsuitable for use by ibm when it marketed a print train for the
character set in the following year.

the marc character set has provided a stable character repertory
for bibliographic data interchange in the united states for the last
thirteen years. within the last year, changes have been proposed to add
superscripts, subscripts, alpha, beta, and gamma to the set.54 these
characters, added to the original repertory to meet needs of the national
library of medicine, have long been included in marc records, but
only through use of escape sequences. bringing them into the gi
set simplifies the processing of this established repertory and will facilitate
the use of standard escape sequences to reach other character sets, such as
those required for non-roman script data.

unhappily, the iso extended latin standard and the marc extension
differ both in character repertory and in the codes used for characters
they have in common. the discrepancy renders the prospect
certain for approval of an american national standard roman
alphabet extension.

the prevailing attitude in the united states toward non-roman
character set development is to encourage and participate in the work of
iso in hopes that the resultant international standards can be adopted
as american national standards, minimizing discrepancy between
national and international practice. interest in the processing of non-
Roman data is growing, and several new standard character sets can be expected in the next few years.

**Script Conversion**

*Script conversion* is a general term encompassing the more familiar terms *transliteration*, which specifies one process by which a script is represented in the characters of another script, and *Romanization*, which specifies that the conversion be into characters of the Roman alphabet. There are many misconceptions about the process, arising partially from imprecise vocabulary, but more fundamentally from failure to recognize that script conversion is undertaken for a variety of purposes having requirements which may conflict. The problems are treated at length by Wellisch. Familiarity with his work is essential to any discussion of script conversion. Wellisch identifies pronounceability, traditionality, reversibility, general applicability, and economy of space as requirements of varying importance to different applications. Conflicts between these requirements can occur even within a single application. When conflicts arise, certain requirements, notably pronounceability and traditionality, tend to dominate. The result is that script conversion schemes (it is significant that they are commonly referred to as "schemes" rather than "systems") almost inevitably entail compromise among conflicting requirements. They nearly always employ both transliteration (favored by the requirement of reversibility), and transcription (favored by pronounceability). It is in this milieu of inevitable compromise, with tradition and pronunciation dominating, that existing Romanization schemes were developed.

Current ISO and ANSI standards for Romanization are shown in table 1. Examples of nonstandard but widely used Romanization schemes include the Wade-Giles and Pin Yin schemes for Chinese, the McCune-Reischauer scheme for Korean, the Library of Congress system for modern Greek, and the modified Hepburn system for Japanese.

Pronounceability has been a major obstacle to the development of international script conversion standards because of the variety of phonetic values one letter may have in different languages. Yet the continual need to convert information (especially names) from one script to another (usually the Roman alphabet) has sustained interest in the development of such standards.

In recent years the burgeoning use of computers for processing and exchange of nonnumeric data has intensified interest in reversibility.
The international standards-making community has seized upon reversibility as a way to resolve the conundrum of pronounceability. A set of principles derived from Wellisch has been adopted and applied to new proposed standards for Slavic Cyrillic and Greek. Examination of these proposals is sufficient to demonstrate that stressing reversibility does not perfect the script conversion process, but only evaluates the tradeoffs among conflicting requirements in a new way. The ISO proposals also lack a property which one might expect to find in a scheme stressing reversibility, viz., the ability to use either script as the source script. It is impossible, for example, to use the proposed schemes to Cyrillize information originally published in the Roman alphabet, because no provision exists for the letters Q and W.

Among the ANSI standards, the standard for Romanization of Hebrew shows the greatest awareness of conflicting requirements, providing four Romanization styles to meet varying purposes. This standard has been criticized for allowing too much opportunity for variation, and in fact, the various styles do conflict with each other in certain distressing particulars. Nevertheless, this standard is important because it refuses to oversimplify the problems to be faced.

The fourth of the styles in the Hebrew standard is called "keypunch-compatible transliteration." It provides a method for input, storage and/or display of Hebrew script data where a Hebrew character set is not available, functioning almost as a surrogate character set. As a transliteration scheme for Hebrew must do, it sacrifices pronounceability completely, at least so far as the nonspeaker of Hebrew is concerned.
This style is suggestive of the direction script conversion schemes may take to facilitate automated processing. Transliteration and reversibility will likely be emphasized.

The pressure in this direction arises from consideration of processing economy, a script conversion requirement which becomes more noticeable in an automated environment. Without automation, script conversion proceeds directly from source script to target script, but computerized conversion requires three steps—conversion from source script to binary code for source script, thence to binary code for target script, and finally to target script. The work of conversion takes place between the two binary codes. Hence, the development of script conversion schemes and character set development become intimately involved.

From the standpoint of processing economy, the ideal would be to do no work in conversion. This could be achieved by allowing the target script representation to be determined entirely by the binary code of the source script, thus eliminating the second of the three steps. It is doubtful that this extreme solution would ever be generally accepted, though it is certainly adequate for some purposes.

The second-simplest solution would be to translate invariably one source code value to a target code value. If no two target code values were the same, the requirement of reversibility would still be met. Algorithms of greater complexity could approximate traditional script conversion, at the expense of processing economy and reversibility.

Without an understanding of the way in which automated script conversion will be implemented, it is not clear how these tradeoffs ought to be evaluated. Recognition of the interaction between character set design and script conversion is a useful first step toward the requisite understanding. This issue is currently under study by the appropriate subgroups of ISO TC46, as well as by their national counterparts. In the United States these include Z39 subcommittees L for Romanization and N for coded character sets.

THE STANDARDIZATION PROCESS: PROBLEMS

The need for codes and other data representations is clear. The use of computers within the bibliographic community was a harbinger of the need for greater consistency in order to achieve common understanding and use, improved production and communication efficiencies, and accurate data transfer. The employment of computers is expanding
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rapidly, causing even greater pressure for standardization. Unfortunately, a variety of factors associated with the standardization process have caused users to develop their own parochial codes and data representations.

One of the major factors is time. The standardization process is often agonizingly slow, sometimes taking years to develop an approved standard. This can be frustrating to systems developers who have immediate needs for usable data element values. Necessity outweighing universality and consistency, local codes are devised and employed. Another aspect of the time problem concerns maintenance agencies. Even when approved standards that fully meet local needs for data representation have been developed and implemented, if a central maintenance agency must be contacted for each code assignment, acquisition of standard codes can be delayed, thus causing slowdowns in production or operations dependent on those codes. Requests to the International Serials Data System International Center in Paris for ISSN assignments have taken several years in some cases. Few systems or operations can afford to wait such a period of time. Consequently, local codes and coding systems—perhaps temporary, perhaps permanent—are devised and implemented.

The "voluntary use" aspect of ANSI and ISO standards can also cause problems. On the one hand, given the factor of local autonomy, it can be difficult to convince the bibliographic community that a particular standard must be employed. Yet, the increasing use of computer systems dictates that bibliographic data must be consistent, accurate and employ commonly accepted values—points that argue in favor of standardization. What should be standardized and how standards are to be promulgated require a delicate balance between the broader needs of the bibliographic community and the individual interests and needs of its members. This balancing act is expected to continue in the foreseeable future. Amelioration of this situation has occurred as members of the bibliographic community have: (1) identified specific standards as meeting requirements for data storage, transfer, display; and (2) incorporated the use of such standards in data sets for processing by computer-based or manual systems. Thus, the promulgation of these standards becomes user-driven. The promulgation takes the form: "If you want to participate in this system, you must follow our rules." Even at the user level, then, use does not necessarily involve a democratic process.

To ensure adequate support for their adoption, standards sometimes incorporate "options" designed to accommodate preexisting
applications. While in the short term this may be necessary, it tends to be antithetical to the purpose of standardization, as it officially authorizes divergent practices. There are situations in which differing application purposes do require the specification of standard styles or alternatives. A good example is offered by ANSI X3.38-1972, which specifies both alphabetic and numeric codes for the states of the United States.\(^6\) The numeric codes correspond to an alphabetic collating sequence for the names of the states. The alphabetic codes do not. The specification of the standard numeric codes forestalls the definition of local codes to serve the function of collation. In general, though, options and alternatives should be avoided in standards if at all possible.

A fourth problem is communication and common understanding. While hardly a problem unique to the standardization process, communication is critical if compatible standards are to be developed by the various standards-setting bodies. Knoerdel mentions this in her survey of standardization efforts of coded character sets when she notes that while "considerable work has been and is currently being done, both nationally and internationally, in the area of standard coded character sets, the relationship of such standards efforts among the standards organizations is not immediately apparent" (emphasis added).\(^6\)

The standardization process must also contend with a market or field of implementation that is highly dynamic. For example, the ISBN was developed to identify "books" (printed books and pamphlets, microfilm publications, braille publications, and mixed-media publications). By 1978 it was observed that ISBNs were being assigned to nonbook materials by publishers who ignored the ISBN instructions. Special and separate codes were either being employed or developed for specific categories of published material (e.g., technical reports, music, and sound recordings), and requests for ISBN prefixes were being received from producers who do not publish books. This example points to the need for the standardization process to consider carefully such factors as control and changes within a standardized area. If these aspects are not accommodated, confusion and improper use of a standard will occur, negating the benefits of standardization.

Even though the standardization process can be arduous, it must be pursued. There is no reason that the process cannot be improved and made more streamlined and responsive to the needs of the bibliographic community. Relative to pursuing the standardization process, work continues within ANSI and ISO on data representation standards. For example, ISO currently has under consideration the International Standard Music Number and the International Standard Record
Bibliographic Data Representation

Number, while ANSI is working on language codes, bibliographic data source file identification, coded character sets, and standard identification numbers for libraries, library items and library patrons.

CONCLUSION

This paper has reviewed the use of codes and other data value representations within the bibliographic community in terms of their history, characteristics and standardization. The primary impetus for development of data representations has been technological, with the computer being the primary causal factor.

The expanding employment of computers within the bibliographic community indicates that the use of codes, abbreviations and other forms of data representation will increase. This, in turn, raises the question of the role of standardization. A number of standards have had a significant effect on the bibliographic community, and most of these are of the data representation type. Broad use of such standards appears to be user-driven rather than standards-body-driven. Strengthening of the existing standardization process would appear to be in order if standards are to play the viable role that is needed in order to achieve consistency, accuracy and efficiencies in bibliographic data transmission and use.

ACKNOWLEDGMENT

The authors' sincere appreciation is extended to Linda K. Bartley, Serial Record Division, Library of Congress, for her significant level of help in developing this paper, from editorial assistance, to securing references, to setting directions and emphasis.
Appendix

Standards for Representing Bibliographic Data Values
(A Selected List of Official and De Facto Standards)

<table>
<thead>
<tr>
<th>Name</th>
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<td>Character Set and Print Quality for Optical Character Recognition (OCR-A)</td>
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<td>ANSI X3.38-1972 (R1977)</td>
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<td>(STRN)</td>
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<td>and United States Time Zone</td>
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FALL 1982
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Bibliographic Data Representation

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<td>Library of Congress Classification System</td>
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<td>Universal Decimal Classification System</td>
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Sources of Standards

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<td>ANSI</td>
<td>American National Standards Institute 1340 Broadway New York, NY 10018</td>
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<td>ASTM</td>
<td>American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103</td>
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<td>LC</td>
<td>Library of Congress Cataloging Distribution Service Washington, DC 20541</td>
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<td>National Technical Information Service 5285 Port Royal Road Springfield, VA 22161</td>
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<td>United States Postal Service Retail Operations Division Delivery Services Department Washington, DC 20260-7232</td>
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<td>WIPO</td>
<td>World Intellectual Property Organization 34, Chemin des Colombettes 1211 Geneva 20, SWITZERLAND</td>
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References

16. Ibid., p. 31.
18. Ibid., p. 220.
Bibliographic Data Representation

29. Ibid., p. 46.
37. ibid., Field 052, p. 1.


53. Ibid., pp. 71-76.


55. Wellsch, Conversion of Scripts.

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Additional References


Bibliographic Data Representation


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Standards for Information Display

THOMAS B. HICKEY
PHYLLIS B. SPIES

This paper will discuss standards regulating how information is formatted and presented to the end user. The emphasis is on the presentation of text and bibliographic information in data entry, interactive processing, information retrieval, report preparation, and library settings.

Video Display of Information

Video display is the "soft" display of information other than in "hard" copy on paper. This includes video display units (VDUs) such as cathode-ray computer terminals, plasma panels and video discs. Microfilm formats are also covered in this section.

Display Standards and the Marketplace

At a key meeting on library automation standards held in June 1981 it was noted that standards for graphic display of bibliographic data were not available and should be developed.1 It is becoming more and more apparent that improvement of the user interface is reaching a point of urgency: "because the type of user typical of a computing system is changing rapidly. The far less experienced user who will soon make up the principal proportion of all users will have, it appears, even greater dissatisfaction with existing computing systems and their dissatisfaction is likely to become rapidly more vocal."2

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Library and information systems that begin to apply effective presentation format standards or guidelines will very likely become leaders in the field. "Human convenience is known to be a major factor in many areas for determining buying of products and continued use of repetitive services. There is every reason to expect a successful assault on this area to result in an increased market share...." Reinforcing this idea, Smith, Vice-President of Technology for CBS, Inc., has said that it takes a standard to create a market. Without some standardization, the marketplace becomes fragmented. Information services and products will not break through on any large scale unless the user is assured of easy, trouble-free use. It is, therefore, important to standardize various aspects of the presentation format component of library and information systems to the extent to which they will meet the requirements of the majority of potential users.

*Video Display Standards*

A review of the literature on standards for video displays indicates the obvious absence of standards for system designers. "While standards involving technological factors have been successfully developed and implemented, those involving human factors, policy, and management perogatives still lag behind." Granda of IBM Corporation has assessed the situation quite well: "For the most part, the aim of computer system design and development effort is the optimization of system performance. Users are only one part of the overall system architecture; and they are not often considered the most important part." Historically, research efforts have resulted in a preponderance of theories concerning human psychology (see reports of studies by Archer, Coffey, and Eriksen), but little effort has been made to translate the theories into practical guidelines. In the majority of those cases where guidelines have been developed, they tend to be qualitative and not quantitative. However, a new trend of increased attention to human factors is beginning. Human factors "are mentioned with increasing regularity in the computer industry as operators, system planners, union management, government agencies and equipment manufacturers struggle to assess the physiological and psychological impact computers have on the people who use them." The international academic human factors community in Germany and the Scandinavian countries, and large equipment manufacturers like IBM are taking the lead in the development of standards and guidelines.

A good detailed guide for the design of interactive computing system displays was developed by Engel and Granda at IBM.
Informat ion Display

authors make specific recommendations about display frame layout, frame content, command languages, error prevention and recovery, response time, and behavioral principles. For the most part, their guidelines are based on observable, reported evidence and are measurable. However, Engel and Granda state quite clearly that their guidelines are not standards. Although designers are encouraged to follow them, software or hardware constraints may force tradeoffs in certain situations.14

Several authors have attempted to set down design “principles.” Morse15 has derived several principles for the effective display of data from the human factors engineering literature on instrumentation displays. His two key principles are the principle of proportional effect and the principle of least effort. Similarly, Stewart16 has identified six factors that contribute to good display design. They are: logical sequencing, spaciousness, relevance, consistency, grouping, and simplicity.

In several European countries there are efforts underway to establish human factors standards for the design and use of visual display terminals. Most of the standards are aimed at ergonomic considerations like keyboard layout, work-station environment, radiation hazards, and lighting requirements. However, the Deutsches Institut für Normung (DIN), which is the German standards organization, is now working to develop standards for the display of data on terminals.17 Draft DIN Standard 66234, “Characteristic Values for the Adaptation of Work Stations With Fluorescent Screens to Humans,” does cover several aspects of data display format; “it is the intent of the German standards group to propose the final draft of this material for consideration as an ISO standard.”18

Videotex Standards

In May 1981 AT&T issued a Presentation Level Protocol (PLP) for videotex. The proposed standard governs the display of computer-encoded textual and graphic information. “This protocol conforms to the architecture defined in ISO’s multi-layered reference model of open systems interconnection, and is one of seven protocol specifications that would be required to completely define a videotex standard.”19

In November 1981 AT&T proposed a Session Level Protocol (SLP) standard. The Session Level Protocol defines how to set up and terminate sessions.20 The SLP contains a very useful feature which allows a user to suspend one display session—holding all information from the session unchanged—and initiate another session. When the second session is completed, the user can then return to the suspended first session.21
Since the provisional Session Level Protocol is at this writing only three months old, acceptance of it is unclear. "The key issue here is the fact that nobody else has arrived at a point in their thinking whereby a Session Level approach to videotex can be coherently defined. AT&T has stolen the march on everyone in this respect...."\textsuperscript{22}

By developing a Presentation Level Protocol and a provisional Session Level Protocol, AT&T has assured itself a position of leadership—perhaps an insurmountable position—in the videotex industry. The PLP format allows the transmission of pictures and figures in enormously compressed form. This in turn allows the transmission of high-quality graphics over low-speed or moderate-speed data lines.\textsuperscript{23} Although none of these proposals have been accepted by any standards organization, they may well become \textit{de facto} standards. Through the introduction of these proposals, AT&T seems to have shifted the balance in videotex services toward telephone network-based systems.

\textbf{Microform Standards}

To date, very few nations have adopted microform standards, and where standards have been adopted, they depend upon voluntary participation. Allan Veaner summarized quite well the driving force behind acceptance of microform standards: "In the long run, standards get accepted because everyone recognizes an advantage to them: results are better, cheaper, more consistent; products and information are interchangeable."\textsuperscript{24}

In the United States, the National Micrographics Association (NMA) produces industry standards, and the American National Standards Institute (ANSI) produces national standards. Usually, industry standards are submitted to ANSI for consideration as national standards.

There are three ANSI standards concerned with microform presentation format. Two levels of detail are addressed. ANSI PH5.9-1975, "Microfiche of Documents," addresses the physical characteristics of microfiche reduction: pagination, frame identification and quality requirements for resolution and reproducibility. Comparable considerations for COM-produced microfiche are dealt with in ANSI/NMA MS2-1978 (formerly ANSI PH5.18). This standard addresses computer output microforms (16mm and 35mm roll film and microfiche products). Specifications are included for dimensions, reduction and magnification ratios, image orientations, film travel, and reserved areas for image coding.
Information Display

ANSI Z39.32-1981, "Information on Microfiche Headings," addresses standardization on a level below that of the previous two standards. It specifies the minimal set of eye-legible information that should be included in microfiche headings. The following areas are defined: location, order of elements in each location, size of type, and contrast between character and background. The purpose of the standard is: "to specify the elements necessary or desirable for basic identification and retrieval. Additional bibliographic information for other purposes, for example, ordering and cataloging, may be given in the microimage area."

Printed Display of Information

This section covers standards related to the presentation of information in hard copy, printed on paper. It should be kept in mind, however, that with the proliferation of video terminals, many of these standards could be profitably employed when designing presentation formats which will be primarily displayed on computer terminals. In fact, the increasing resolution and capabilities of video terminals will gradually narrow the difference between what can be printed and what can be displayed in "soft" copy. Many publications now available only on paper may well migrate to video with little change in their design.

In contrast to standards for video display, the standards discussed here are usually only slightly concerned with legibility requirements. If mentioned at all, these standards will cite a minimum type size, as in "Guidelines for Format and Production of Scientific and Technical Reports: 3.1.1 Size of Type." "The size of type used...should provide for final page copy...at least as large as 8-point type. Ten-point type, or the equivalent, is recommended." Other legibility requirements are limited to general guidelines for illustrations in ANSI Y15.1-1979.

Two types of material are covered by these standards: primary and secondary. Standards related to primary materials include ANSI Z39.1-1977, "Periodicals—Format and Arrangement," and ISO/R 8-1954, "Layout of Periodicals." These standards are considerably shorter and more straightforward than those describing the layout of secondary material which are references to primary material. Secondary material standards are typified by ANSI Z39.29-1977, "Bibliographic References."

Standards Relating to Primary Materials

These standards are fairly simple and seem to be directed at two distinct groups—publishers and authors. Standards designed for pub-
lishers typically consist of one or two pages of definitions of terms followed by a few, usually fewer than five, pages of recommendations. ANSI Z39.1-1977, "Periodicals: Format and Arrangement," mentioned above is a good example. It gives short, one- or two-sentence definitions of some sixty-two terms ranging from article to zip code. The recommendations follow in eleven sections.37

3.1 Title—content and display, 3.2 Cover and Spine,
3.3 Table of Contents,
3.4 Masthead,
3.5 Pages,
3.6 Articles in Installments,
3.7 Instructions to Authors,
3.8 Supplements,
3.9 Volumes,
3.10 Changes or Irregularities, and
3.11 Translation Periodicals.

The standard then ends with references to several other ANSI and ISO standards.

Some other standards which fall into this same category of recommendations for publishers are:

1. ANSI Z39.6-1965(R1977), "Trade Catalogs;"
5. ANSI Z39.41-1979, "Book Spine Formats;"
6. ANSI Z39.31-1976, "Format for Scientific and Technical Translations;" and

These standards try to encompass wide ranges of materials and are therefore written in free form, giving users the latitude needed while insisting that at least certain information be included in some way.

Standards directed at authors tend to go into greater detail and to be more prescriptive in their recommendations. ANSI Z39.18-1974, "Guidelines for Format and Production of Scientific and Technical Reports," includes as section 2.3.1: "Include one report documentation page as the first right-hand page following the front cover in each volume."28

A rather odd standard, which is nevertheless worth reading, is ANSI Z39.16-1979, "Standard for the Preparation of Scientific Papers for
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Written or Oral Presentation." Its purpose is "to help scientists in all disciplines to prepare papers that will have a high probability of being accepted for publication and of being noticed, read, and completely understood when they are published." With the exception of sections 5.7.1—5.7.5 on guidelines for illustrations, most of this standard is concerned with content, not presentation, and is probably the most "free form" of any of the Z39 standards.

A related standard is ANSI Y15.1-1979, "Illustrations for Publication and Projection," which is referenced in the two preceding standards. This standard gives very specific guidelines on legibility of different types of lettering and the amount of information which can reasonably be fitted into one chart.

Standards for References

Compared with the standards for primary materials, those for references are much longer and more complex, but are fewer in number. In terms of the model presented by Rush in this issue, these standards are a combination of level three (data element values) and level four (presentation).

The largest standard in this group produced by ANSI is Z39.29-1977, "Bibliographic References." This standard as published is ninety-two pages in length, although nearly sixty pages of this are appendixes which "are not a part of American National Standard for Bibliographic References, Z39.29-1977, but are included for information purposes only." The sections dealing primarily with presentation of references are:

4.5 Sequence of Bibliographic Elements within Standard References. Introduces the concepts of a Standard Reference, Bibliographic Group, and Bibliographic Level;
4.6 Punctuation and Format. Punctuation includes . , ; () [ ] : = and space; and
4.7 Representation of Data. Including Capitalization, Typography, Authors, Abbreviations, Pagination, Titles, and In-Text Reference.

The library world is, of course, deeply involved in providing people with references in an easily readable form. The most familiar of these is the card catalog, rapidly being supplanted by computerized systems. Somewhat surprisingly, although cataloging standards have long existed, a standard for the layout of catalog cards does not exist other than the de facto standard provided by cards printed by the Library of any move to develop standard card layouts, but has prompted standardi-
zation at a lower level through a series of standards termed International Standard Bibliographic Descriptions (ISBDs). The ISBDs are produced by the International Federation of Library Associations and Institutions (IFLA), and there is now a whole series of them:

ISBD(A): ISBD for Older Monographic Publications (Antiquarian), 1980;
ISBD(CM): ISBD for Cartographic Materials, 1977;
ISBD(G): General ISBD: Annotated Text, 1977;
ISBD(NBM): ISBD for Non-Book Materials, 1977;
ISBD(PM): ISBD for Printed Music, 1980; and
ISBD(S): ISBD for Serials.

Each of these standards has an introduction giving the history of the standard.

The ISBDs introduce a somewhat complicated, very systematic and much-criticized system of punctuation to achieve their aims as set out in the preliminary notes of ISBD(G):

The primary purpose of the ISBDs is to aid international communication of bibliographic information by (i) making records from different sources interchangeable, so that records produced in one country can be accepted easily in library catalogues or other bibliographic lists in any other country; (ii) assisting in the interpretation of records across language barriers, so that records produced for users of one language can be interpreted by users of other languages; and (iii) assisting in the conversion of bibliographic records to machine readable form.

The representation format developed by the ISBD standards has been incorporated into the latest Anglo-American Cataloging Rules as much as possible. Several people, notably Michael Gorman, have been deeply involved in both these standardization projects. The Library of Congress has produced a standard for the Bibliographic Description of Rare Books, which incorporates AACR2 and ISBD(S).

References

Information Display


10. Ibid.


12. Ibid., p. 56.


14. Ibid.


18. See ibid., p. 63.


22. ATT Document for OCLC, p. iii.

23. ATT Document for Videotex, p. 28.


Standards Viewed from the Applications Perspective

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INTRODUCTION

The application of technical standards has an impact on the transfer of information. This includes creative and scholarly writing, publishing, abstracting, indexing, and library services. The results of this application affect authors, publishers, librarians, library users, and other readers in ways which are both direct and indirect. This review considers how the individuals involved use formal and informal standards both intentionally and unwittingly in order to succeed in their various endeavors. Its scope covers the broad range of applications within the areas mentioned, with some particular emphasis on the process of book publishing and librarianship. It reviews the use of technical standards by the various constituencies concerned, examines the relationship of the user to the development of standards, and identifies some needs of the future which will improve the application of both informal and officially adopted standards.

A search of the literature reveals almost no discussion on the application of standards from the user's point of view. This presentation is based on experience with processes and services which have been affected by the application of technical standards. An analysis and interpretation of the factors which make up the milieu surrounding the development of standards is used as a method to establish current trends.

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The Use of Standards

Author/Publisher Relationship

Authors often are considered brilliant and creative, albeit idiosyncratic. In contrast to this image, actually they do make extensive use of those “rigid rules” called standards and, were it not for the existence of standards, many would find it impossible to create their works.

Before setting pen to paper or fingers to the word processor, authors must spend time researching the area about which they intend to write. This is important for those who are writing nonfiction or scholarly, scientific and technical works or textbooks. All American National Standards Institute (ANSI) Z39 standards which allow materials to be cataloged easily by librarians and which establish the framework for abstracting and indexing services provide road maps into publications. These help the author engaged in research. Two specific Z39 standards simplify the research process. They are the standards for "Bibliographic References," Z39.29, and "Synoptics," Z39.34. Both allow the researcher to move from one article of concern to the next with ease.

Authors no longer necessarily are restricted to the holdings in their local libraries or obliged to travel to the location of the research information they want and need. In today's information-rich society, the standard for "Bibliographic Information Interchange on Magnetic Tape," Z39.2 facilitates easy access to information available in libraries throughout the country. Elsewhere in this issue the importance of that standard to the library community is discussed. A standard which makes sharing this bibliographic information in machine-readable form possible among all researchers of the country has an immeasurable value to authors.

Once authors have enough research completed to begin writing, many will do so on a typewriter, text processor or computer. The ability to find the keys with ease is due to the standardized typewriter keyboard. This is one example of the benefits authors enjoy with little awareness that standards, official or de facto, provide the facilitation. Other examples are numerous of the benefits derived by the user from the requirements standards place on the manufacturer of machines and related equipment.

After a work has taken shape, the manuscript is submitted to a publisher. The author seeks a commitment for publication through the drawing of a contract between the two. Although there is no official or formal standard for a contract, informal standards exist. They allow authors and their agents to locate specifics of concern within that legal
contractual document and to determine if its terms are acceptable or are to be further negotiated. Official standardization for contract form, if developed and required, might be frowned upon by the Justice Department as "collusion."

Several other ANSI Z39 standards are necessary aids to the author in creating a work for publication. Two general ones are "Basic Criteria for Indexes," Z39.4; and "Writing Abstracts," Z39.14. When appropriate, others equally important are the "Preparation of Scientific Papers for Written or Oral Presentation," Z39.16; the "Guidelines for Format and Production of Scientific and Technical Reports," Z39.18; and "Format for Scientific and Technical Translations," Z39.31.

One area in which no standard yet exists is in text editing and formatting. This is an annoyance to many authors and book publishers. Today, an author using one of a variety of word or text processors, or even a micro-, mini- or maxicomputer, likely finds the publisher unable to accept the manuscript in machine-readable form because the output of the author's hardware is incompatible with technical capabilities of the publisher's hardware. Seldom does word processing, text editing or computer-composition hardware exist at all in a book publisher's office. These publishers are reluctant to invest in a particular manufacturer's system of hardware until standardization will assure the capability of being able to accept machine-readable manuscripts from the wide variety of hardware used by their authors. A text editing standard is being prepared by American National Standards Committee (ANSC) X3 Subcommittee J6. The expected completion date is 1983, with implementation by most equipment manufacturers and/or publishers and printers improbable before 1985. Compatibility by standardization in hardware and operating software design is the step that is necessary to solve today's wasted key strokes in the author/book publisher interface during manuscript development and editing.

This problem has less importance to newspaper and journal publishers, where writers often function as staff employees. These writers can be provided with a piece of equipment that is compatible with the system used by their publisher.

The Book Publishing Process

A number of formal standards are used by those individuals in a publishing house responsible for editing the manuscript, establishing the design specifications and arranging for setting the words in type. One that is common to all types of print publishing is "Proof Corrections," Z39.22, the "rule" for all proofreaders, copy editors and typeset-

Publishers also make use of standards from the Library Binding Institute when they place orders with book manufacturers. There now is under development a standard for permanent durable paper by ANSC Z39 Subcommittee S. Journal and book publishers should make great use of it if they expect to meet the needs of libraries.

Once the work has been written, edited, copyedited, and set in type, it is the responsibility of the publicity, advertising, sales, and marketing departments of a book publishing house to make the work known to the public. In the course of their activities, these departments make use of a number of formal Z39 standards, as well as a variety of informal ones.

From the start of its life in a publishing house, the work should be, and generally is, assigned an identification number that allows it to be located internally. This identification number is used by potential buyers to ensure receiving the specific book requested for purchase. These numbers are the International Standard Book Number (ISBN), defined by ANSI Z39.21; the International Standard Serial Number (ISSN), ANSI Z39.9; and the Technical Report Number (STRN), specified by ANSI Z39.23.


There are other marketing tools which are available and are either based on or reflected in Z39 standards. The first is Cataloging in Publication (CIP). Participation in this process provides two services for the publisher. It makes available the data that will appear on the verso of the title page and sends prepublication information about the title to wholesalers and librarians through its appearance on the Machine Readable Cataloging (MARC) tapes issued by the Library of Congress (LC). The second marketing tool used by publishers is a direct derivative of Z39 standards. All books in the United States should carry the ISBN in a specific OCR-A type font (ANSI X3.17-1977), according to the ISBN standard (Z39.21). In addition, books sold through grocery, convenience and drugstores must carry the Universal Product Code (UPC) for scanning equipment used in that environment. In an attempt to satisfy the point-of-sale scanning needs of their customers, many publishers
already have initiated printing one or both of the two codes on the covers or jackets of their books.


**Book Purchasers**

If one looks at the information transfer process from the perspective of the purchaser, there are several steps one may take. The first is to learn about the work and/or identify it as a distinct unit when its existence is known. For books, the appearance of CIP cataloging on the LC MARC tapes stimulates preparation of cataloging cards by wholesalers, confirms the existence of the publication to librarians, and starts the recognition process. Individual journal articles achieve recognition through abstracting and indexing service products.

Once a person or organization decides to purchase a book, the order must be executed in a way which makes certain that the publisher will supply precisely the edition and binding of the work desired, shipping it as quickly as possible. Because most major publishers and wholesalers have automated their order processing activities, the purchaser should make use of the numerical codes assigned by publishers—the ISBNs—to guarantee accuracy and speed in receiving the order. Other tools useful to the ordering process are derivatives of standards developed in the past and/or in process. Three of them are: the American National Standard for "Single Title Order Form for Library Materials in three by five Format," Z39.80-1982; the form for multiple title orders under development by ANSC Z39 Subcommittee T; and the standard under development by the Z39 Subcommittee U for transmitting orders in machine-readable form via telecommunications links.

Two other standardized computer-to-computer communication formats have not yet reached sufficient acceptance within the publishing/wholesaling/library/bookselling communities to become active work items for Z39. Both are products of the Book Industry Systems Advisory Committee (BISAC) of the Book Industry Study Group, Inc. The Title Update Format allows publishers to send monthly machine-
readable notifications to their customers of price changes, new publications, out-of-print declarations for the future, delays in anticipated publication dates, and other similar order-status information. The second format provides for transmission of electronic invoices from the vendor to the purchaser of books. These two formats are expected to reach the stage of formal standard preparation in 1983.

**Book Readers**

One class of book reader is the employee of an abstracting and indexing (A&I) service. The tasks of indexing, abstracting and cataloging are not only possible because the publisher has provided information that the indexer and abstractor need in the standardized places within the book or journal, but they can be accomplished in a timely manner because of this ease of location. Lockheed, BRS, SDC, Mead Data Central, and other information services take the abstracts, indexes, or the machine-readable version of the work itself and provide the researcher or librarian with that information in an easily accessible form.

One major problem for those who use the services of these brokers is the lack of standardization among their systems. To become proficient on any system, one must learn the unique specialized codes, keywords and parameters of that system. No two are identical. To overcome this apparent lack of agreement to standardize, "black box" accessing devices are the current answer. Preparation of a standard for these uses, "Terms and Symbols Used in Form Functional Areas of Interactive Retrieval Systems," is underway by the Z39 Subcommittee G.

The services of the information broker to the information user are dependent largely upon the "traditional" activities of abstracting and indexing, which initially had their beginning in the print format. The uses of standard abbreviations and the ISSN for journal identification are the strongest applications of standards within the A&I services. The American Geological Institute, in its publication GeoRef, is recognized as the organization in the A&I community that stays knowledgeable and current on the standards which have been approved, and is consistent and rigid about applying them in its publishing services. The institute's almost singular use of the Reference Manual for Machine-readable Bibliographic Description (2d rev. ed.), edited by Harold Dierickx and Ellen Hopkinson and developed by Unesco, a standard widely used in Europe, dramatizes the fact that, however functional the standards may be when developed, often they are used less in the United States than internationally.
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The Common Practices and Standards Committee of the National Federation of Abstracting and Information Services (NFAIS) surveyed its member organizations in 1979 to determine which standards pertaining to the content and format of bibliographic citations, abstracts and indexes were used, and how closely these standards were followed. A summary report has been published in the NFAIS Newsletter. Based upon the responses to some questions, certain standards appear to be used more widely than others among those member organizations. Examples of these are the use made by respondents of ISSN, CODEN, ISBN, and the ISO and ANSI standards for abbreviations of serial titles. Many standards were reported used, and in-house standards seem to be preferred by about one-third of the respondents over those developed externally. Survey reports indicated that when standards are used, they are followed exactly or very closely.

Librarians

Most procedures and services which librarians perform are prescribed, influenced or derived from official or de facto technical standards. Table 1 presents the 239 published standards as of April 1982. Each one affects some part of the information services librarians provide. Almost all of the writing in the literature which discusses technical standards is focused on the relationship standards have with library processes. In this presentation only selected references are made.

Librarians at every staff level abide by professional and process requirements, which many of them accept with almost no recognition that they are specified in officially approved standards. Seldom are the requirements which are based on informally adopted standards distinguished from those resulting from official standards directly regulating the activities of the library world or the world of other professions and service providers. This interrelationship of both intent and use makes it difficult to trace the direct use librarians make of many standards.

Almost any standard can serve as an example of this common importance which the results of a standards application can have. Regardless of the primary audience for which the focus of standardization is directed, the derivative effects can be powerful, e.g., "Information on Microfiche Headings," Z39.32; or "Title Leaves of a Book," Z39.15. The complexity becomes apparent when attempting to determine whether the primary intent in developing a standard is that it be used by the producer of the product to which it refers, or that the results of its application benefit the librarian and information provider engaged in the access and interpretation processes. Equally unclear in tracing the
application of standards is whether application has a greater direct
effect on the manufacturer or producer in the information process, or on
the information provider making access possible. This lack of a direct
line of cause and effect may be somewhat responsible for the limited
involvement librarians as a group have given to the development of
technical standards.

Since librarians sometimes are authors and, with somewhat less
frequency, even may be involved in the actual production of informa-
tion, multiple uses of the requirements traceable to standards are made
in the profession. Multiple uses also are made by authors, publishers,
editors, and others who have been considered in this presentation, but
because of the scope of activities librarians engage in for the production
and provision of information services, librarians seem to be involved in
the broadest scope of interwoven complexities.

THE USER AND THE DEVELOPMENT OF STANDARDS

User Participation

One element which generally is considered fundamental to the
successful development of standards is participation of the various
constituencies which will use or be affected by the standards. A commit-
ted group of librarians, publishers and abstracting/indexing service
providers represent the respective professions in efforts to develop tech-
nical standards. The list on the following page presents the Z39 member
organizations as of April 1982. The representation from each consti-
tuency is small in proportion to total membership of the group. Each
devotes considerable time and ability in the development and promo-
tion of the responsibilities assumed by ANSC Z39. Authors have no
official professional group representing them by direct participation,
although they individually participate through personal membership
in existing ANSC Z39 member organizations.

This contribution goes practically unnoticed, even to other
members in the very groups these dedicated workers represent. The
somewhat limited recognition of the responsibilities and accomplish-
ments of those involved appears to result both from a failure by ANSC
Z39 to make major efforts in earlier years to publicize its work, and
because the tasks and outcomes have utilitarian value with limited
professional glamour. ANSC Z39 has recognized that its policy of mak-
ing information freely available has not been enough. To correct this
breakdown in communications, ANSC Z39 is engaged in a focused effort to increase and improve information dissemination.

The report of the Publicity Committee at the Z39 Annual Meeting, April 1982, included a range of activities:

1. Regular publicity releases in addition to the information published in *The Bowker Annual of Library and Book Trade Information* and in the *ALA Yearbook*.
2. Quarterly publication of the *Voice of Z39*, with free mailing to a list of 1400.
4. Plans to provide library schools with information and offers of speakers.
6. A publicity campaign for the Single Title Order Form for Library Materials.

Concurrently, effort is being intensified to enlarge member participation from the constituencies which do have representation and to recruit those which should have.

**Z39 MEMBER ORGANIZATIONS AS OF APRIL 1982**

- American Association of Law Libraries
- American Chemical Society
- American Institute of Physics
- American Library Association
- American Nuclear Society
- American Psychological Association
- American Society for Information Science
- American Society of Indexers
- American Theological Library Association
- AMIGOS Bibliographic Council, Inc.
- Association of American Library Schools
- Association of American Publishers
- Association of American University Presses
- Association of Earth Science Editors

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Association of Jewish Libraries
Association of Research Libraries
Association of Scientific Information Dissemination Centers
Aztex Corporation
Book Manufacturers Institute, Inc.
R.R. Bowker Company, Inc.
Catholic Library Association
Council of Biology Editors
Council of National Library and Information Associations
Engineering Information, Inc.
Engineering Societies Library
F.W. Faxon Company, Inc.
Indiana Cooperative Library Services Authority (INCOLSA)
Information Industry Association
Library Binding Institute
Library of Congress
Medical Library Association
Music Library Association
National Agricultural Library
National Bureau of Standards, Library and Information Services Division
National Commission on Libraries and Information Science (NCLIS)
National Federation ofAbstracting and Indexing Services (NFAIS)
National Library of Medicine
OCLC, Inc.
OHIONET
PALINET
Pittsburgh Regional Library Center
Research Libraries Group, Inc.
Society for Scholarly Publishing
Society for Technical Communication
Special Libraries Association
State University of New York, SUNY/OCLC Network
U.S. Board of Geographic Names
U.S. Department of Commerce, National Technical Information Service
U.S. Department of Commerce, Printing and Packaging Division
U.S. Department of Defense
U.S. Department of Education, Office of Libraries and Learning Technologies
U.S. Department of Energy, Technical Information Center
U.S. Department of Interior, Office of Water Research and Technology
U.S. National Archives and Records Service
University of California-Los Angeles Library

Economic Effects of Standards

Every profession involved in information services today is influenced by the constant changes and rapid developments in technology. It is difficult to focus on either defining the need for the process of developing a standard when hardware, software and communications
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TABLE 1 Z39 Published Standards

| Z39.1-1977 | Periodicals: Format and Arrangement | # |
| Z39.2-1979 | Bibliographic Information Interchange on Magnetic Tape | # |
| ** Z39.4-1968 | Basic Criteria for Indexes (R1974) | # |
| ** Z39.5-1969 | Abbreviation of Titles of Periodicals (R1974) | # |
| Z39.6-1965 | Trade Catalogs (R1977) | # |
| ** Z39.7-1968 | Library Statistics (R1974) | # |
| Z39.8-1977 | Compiling Book Publishing Statistics | # |
| Z39.9-1979 | International Standard Serial Numbering | # |
| Z39.10-1971 | Directories of Libraries and Information Centers (R1977) | # |
| Z39.11-1972 | System for the Romanization of Japanese (R1978) | # |
| Z39.12-1972 | System for the Romanization of Arabic (R1978) | # |
| Z39.13-1979 | Describing Books in Advertisements, Catalogs, Promotional Materials, and Book Jackets | # |
| Z39.14-1979 | Writing Abstracts | # |
| * Z39.15-1980 | Title Leaves of a Book | # |
| Z39.16-1979 | Preparation of Scientific Papers for Written or Oral Presentation | # |
| ** Z39.18-1974 | Guidelines for Format and Production of Scientific and Technical Reports | # |
| * Z39.19-1980 | Guidelines for Thesaurus Structure, Construction, and Use | # |
| ** Z39.20-1974 | Criteria for Price Indexes for Library Materials | # |
| * Z39.21-1980 | Book Numbering | # |
| Z39.22-1981 | Proof Corrections | # |
| ** Z39.23-1974 | Technical Report Number (STRN) | # |
| Z39.24-1976 | System for the Romanization of Slavic Cyrillic Characters | # |
| Z39.25-1975 | Romanization of Hebrew | # |
| * Z39.26-1981 | Advertising of Micropublications | # |
| ** Z39.27-1976 | Structure for the Identification of Countries of the World for Information Interchange | # |
| Z39.29-1977 | Bibliographic References | # |
| Z39.30-1982 | Single Title Order Form for Library Materials in three by five Format | # |
| Z39.31-1976 | Format for Scientific and Technical Translations | # |
| * Z39.32-1981 | Information on Microfiche Headings | # |
| Z39.33-1977 | Development of Identification Codes for Use by the Bibliographic Community | # |
| Z39.34-1977 | Synoptics | # |
| Z39.35-1979 | System for the Romanization of Lao, Khmer, and Pali | # |
| Z39.37-1979 | System for the Romanization of Armenian | # |
| * Z39.41-1979 | Book Spine Formats | # |
| * Z39.42-1980 | Serial Holdings Statements at the Summary Level | # |
| * Z39.43-1980 | Identification Code for the Book Industry (SAN) | # |

* Includes LC Cataloging in Publication Data
** Published standard in process of revision
R Date of reaffirmation of standard
# Standard cited in this paper
capabilities change as rapidly as they now are. Even an awareness update is almost impossible for many. Any effort to influence the pattern of change requires additional resource commitment. This increases the importance standards and their effects have on services and programs.

In the commercial world the development and application of standards without governmental intervention have been successful generally only when the projected result has yielded an economic incentive. Traditionally, in efforts at standardization there has been an underlying conflict between the freedom and independence of competitive design in the free enterprise system and the objective to respond to the low-cost market demand. The desire for economic advantage by capitalizing on assembly-line production benefits and the capability to mass-produce replacement parts for equipment and systems manufactured by others (e.g., the light bulb that fits most lamps and chandeliers) have been dominant influences on past standardization in the commercial world. Ultimately the consumer has played a prevailing role.

In movements to develop standards, participants from not-for-profit organizations have been able generally to concern themselves with the purpose of ensuring quality control and providing for compatibility of processes more than with economic factors. The economic impact, when evident, has been manifest at the point of application and has influenced the frequency of application rather than the support for development.

Emerging from that environment, librarians are acquiring a new awareness. Until they began to face a no-growth economy and static budgets, they gave little consideration to the costs of implementing guidelines and requirements specified by standards or the effects on other related activities resulting from the implementation of standards. Cost has an important impact not only on the successful adoption of a standard after it is developed, but also on the quality of performance the user is willing to accept in the development of the standard. Commercial producers and providers of information long have been aware of this, especially in the application of standards to technology.

One area in which this is especially evident for librarians is the development of online databases for network use. Initial response from librarians has been to require both a high quality of bibliographic data in the database and completeness of entry record for all uses and users. The value of this level of quality control can hardly be questioned as the official database for research bibliographic reference. Standards for bibliographic entry in machine-readable form have been developed to produce such an acceptable quality.
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The emergence of state and even intrastate networks increases the number of participants from different types of libraries. This expansion produces uses of database information from participants with varying fiscal capabilities and representing users with differing levels of bibliographic information need. The cost of accessing full bibliographic entries and using the complete record formed according to a nationally accepted standard is being questioned with increasing frequency. Even administrators of libraries generally identified as holding research collections are beginning to look at the percentage of total uses made which represents classical research use and which requires access to a comprehensive bibliographic entry.

Concurrent with the discussion of user fees and their appropriateness is the emergence of discussions on fees for levels of use in accessing bibliographic information. As online catalogs increase in use, the capability of purchasing the level of bibliographic information required by a specified group of users or for a particular use (e.g., circulation records for a small- to medium-sized public library) may be a viable way of ensuring cost-effective uses coordinated with the application of standards which will not weaken quality control.

Specifically, this is applicable to the development of databases and the accessing of them in network configurations. When one defines the user as being the library representing the information end user, probably every library user has need for accessing a shared database at differing levels of bibliographic completeness for different uses. When documenting cost justification for participation in a service, pricing structures by which the user accessing the information pays in proportion to the level of use made may be a way in which wide acceptance of standards application can be accomplished.

The accessing of databases is only one example from many of the unexplored areas in technological developments which are and will have effects on the information consumer's response to the cost of applying standards. If a balance is to occur between the desirability to maintain a high level of quality control and service costs which are affordable in developing standards for hardware, software, communications capabilities, and accessing of services, the information consumer must recognize the importance of participation in the total process of developing standards.
NEEDS OF THE FUTURE

Many pressing needs of the future have been included as each constituency using standards has been discussed. These needs generally are accentuated by the development and use of technology in the production, storage, accessing, and provision of information. The role of ANSC Z39 is becoming increasingly important. Some of the priority needs include:

1. Continued and expanded efforts to involve in the total process of developing standards increasing numbers of individuals and groups representing those constituencies affected by standards;
2. Priority recognition given to the fact that in both the profit and not-for-profit constituency groups, financial incentives are increasing in importance as factors affecting not only the acceptance and application of standards but also the level of quality control which can be required when standards are developed;
3. Sensitivity to the perception by some groups using standards that development in the past has focused on library user needs, and that they, the other constituencies, have a feeling of being out of so-called participation control and consequently have lost interest in participating in the development process;
4. Recognition that application of requirements resulting from official adoption of a standard likely will be incorporated by commercial constituencies when a major production change is being made rather than immediately following adoption;
5. Awareness that acceptance of standards for application by the producer of products and services likely will lag behind the needs and desires of information users for quality control and cost-effective production, unless user groups organize and coordinate their articulation of needs in ways that show economic benefits to the producers, individually and in groups; and
6. Educational efforts focused on developing wide understanding among user constituencies that international exchange of information is imminent, and the need to cooperate in accommodation of transfer compatibility reduces the level of independence that can be maintained separate from the development of standards by the International Organization for Standardization (ISO) and the international communities of users.

These can be grouped under the need for greater dissemination of information about the work of such bodies as ANSC Z39, a sensitivity to
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The economic results of applying standards to all types of information services, and the desirability of encouraging compatibility among systems and services in order to make cost-effective use of both hardware and software in computer systems.

Dissemination of Information

The work of the Z39 Committee needs to have greater visibility and member participation within the organizations which now are not actively represented. Until recently the perception widely held has been that a select group of participants have functioned as something of a closed society. Regardless of the incorrectness of this interpretation, ANSC Z39 is wise to devote effort to changing the impression. Future response to the development of standards will be strengthened by a wider base of understanding as well as participation. ANSC Z39 should coordinate its activities to capitalize on those which are appearing in the word processing industry to interest user participation at the grassroots level in development of standards.

Flexibility for Economic Capabilities

No longer can the desire to maintain good quality control take precedence over an acceptance that cost effectiveness is an important requirement for decision-making in not-for-profit organizations as well as in the commercial world. Standards are the public statement of quality and are used in the control of it. When standards exist solely as a statement with limited application, they have minimal value. Future costs may well reduce the voluntary acceptance which has been achieved in the past. Specific attention to the cost of application in relation to the needs of specific user groups for a product or service must be an integral part of developments and revisions currently being considered, as well as those of the future. Expansion of the participation base in developing standards should make cost consideration easier and improve the response to standards application by the user.

Compatibility

A need for compatibility exists nationally as well as internationally. One example of national need is similar to the one cited for accessing data files of the information services. The absence of compatibility is obvious among those vendors offering circulation systems to
libraries. Each vendor has created a custom-designed scheme for numbering the holdings of individual library customers. It is unlikely that an identified title carries the same number in any two systems—or even in two or more libraries within a single vendor's system. The machine-readable codes used on the labels for books, the numbers assigned to patrons and the fonts for those codes reflect the same absence of common identity as the title identification. Z39 Subcommittee V is attempting to determine the best approach to indicate library item and patron identifiers, in an effort to develop a standard that can be accepted both by those organizations whose systems have been on the market for some time, as well as by the newcomers.

A larger challenge faces Subcommittee V—the responsibility for developing a coding structure for libraries themselves. None of these standards will be determined easily nor will any be inexpensively implemented. However, their implementation during the 1980s will preclude the unfortunate development of a nation made up of automated information centers, none of which can communicate or interchange information about its patrons or collections with ease. If compatibility for communication or interchange of information cannot be effected nationally, there is little reason to expect that progress will be speedy in developing the capability internationally.

Summary

Tracing the use of technical standards by various constituencies within the information world reveals multiple and complex interactive uses. Uses made by librarians appear to be less distinct than those for any other group. Often the users themselves are unaware that the processes and procedures they follow regularly are the results of informal or officially adopted standards.

Acceptance and application of standards follow voluntary participation rather than regulated requirement. Economic incentives always have been strong factors affecting the acceptance and application of standards. Developments in the application of technology and economic conditions generally are minimizing the economic difference which formerly existed between the profit and not-for-profit constituency groups.

The contribution from representatives of member groups in the activities of ANSCZ39 is of great value. The lack of recognition awarded this contribution both from organizations and individuals is regrettable. Attention by ANSCZ39 in the future to information dissemination,
The Applications Perspective

The economic impact of standards development, and the need for expediting the development of compatibility within communications capabilities both nationally and internationally is a priority. The work of the Z39 Committee in the future will demand participation of the user to a degree greater than has been achieved in the past if the challenges of the future are to be met.

The impact of technological advances is only now being recognized and responses formulated. Development and application of standards in any area have both values and limitations for users. A concerted effort by users is necessary. User groups must take the initiative at the grassroots level. Only through this effort can the information needs of this decade and those of the twenty-first century be accommodated with effectiveness and efficiency.

ACKNOWLEDGMENTS

The authors acknowledge with thanks the contributions of Maureen C. Kelly, John G. Mulvihill, and Margaret K. Park made during phone conversations in April, May and June 1982.

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Factors Influencing the Use of Technical Standards in a Nationwide Library and Information Service Network

JAMES L. WOOD


A REVIEW OF NATIONAL LIBRARY AND INFORMATION SERVICE ACTIVITIES THAT HAVE TAKEN PLACE DURING THE TWELVE YEARS SINCE THAT ARTICLE WAS PUBLISHED DISCLOSES THAT ATTENTION HAS CONTINUED TO BE FOCUSED ON THE NEED FOR A NATIONAL INFORMATION TRANSFER SYSTEM, AND EMPHASIS HAS CONTINUED TO BE PLACED ON THE STANDARDIZATION REQUIREMENTS. THERE HAS ALSO BEEN AN INCREASING AWARENESS OF THE SOCIOECONOMIC ISSUES WHICH ARE INFLUENCING THE USE OR LACK OF USE OF THE TECHNICAL STANDARDS NEEDED TO SUPPORT NETWORK DEVELOPMENT.

Acknowledging the Importance of Standards

In April 1974 the National Science Foundation (NSF) and the Council on Library Resources (CLR) sponsored a four-day meeting of representatives of the library and information services communities to

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establish a framework of objectives for the bibliographic control component of a national program for information transfer. The meeting attendees recommend the establishment of a "mechanism to monitor and facilitate the attainment of national bibliographic control." The National Commission on Libraries and Information Science (NCLIS), NSF and CLR responded to that recommendation by establishing an Advisory Group on National Bibliographic Control which was renamed the Committee for the Coordination of National Bibliographic Control (CCNBC). The CCNBC members were charged with "such tasks as developing national strategies, identifying areas for standardization, protecting systems integrity, providing national direction for international participation, and assigning responsibility to accomplish specific tasks." The group first met in February 1975 and continued to serve as a forum for discussion and studies relating to bibliographic control and standardization until 1979, when its members concluded that more formal mechanisms for national-level planning had come into existence.

In 1975 NCLIS issued Toward a National Program for Library and Information Services: Goals for Action which set forth "the Commission's conclusions and goals for action which can be taken toward the formulation of a national policy." In delineating the nationwide network concept, NCLIS identified a major responsibility of the federal government to be the encouragement and promulgation of standards. Their program document stated:

Without doubt, an essential function, to be performed by the agency responsible for implementing the nationwide network, will be that of encouraging and guiding the development and adoption of common standards and common practices, adherence to which is implicit in system design and implementation of a nationwide information network....Careful attention to standards problems and requirements at the design stage can significantly reduce the incompatibilities and interconnection problems that arise when independently developed systems are integrated into a coherent operating network.

The NCLIS program document also outlined areas for which the Library of Congress should be responsible. Central to many of these was a corpus of reliable technical standards. To identify its responsibilities more specifically, the Library of Congress commissioned a study by Inforonics, Inc. The resulting 1978 report, entitled The Role of the Library of Congress in the Evolving National Network, again focused on the need for technical standards by recommending that "the Library of Congress should assume leadership of network development activities by performing the major coordinating role in applying technology..."
and acquiring funding for the technical and standards-related tasks required to link federal, multistate, state, and local systems into the national network.  

During 1976 the Deputy Librarian of Congress invited senior representatives of several major library networks to form a Network Advisory Group to advise the Library of Congress (LC) Network Development Office on the development of an initial blueprint for nationwide library network planning. In 1977 the Network Advisory Group disseminated the results of its deliberations in a report entitled Toward a National Library and Information Service Network: The Library Bibliographic Component. Again the role of LC in the development and promulgation of technical standards was stressed. Also in 1977 the Network Advisory Group became the Library of Congress Network Advisory Committee, with an expanded membership to include nonlibrary organizations, and with the charge to advise LC on matters related to nationwide network planning. During the process of addressing the technical aspects of library networking, the Network Advisory Committee encountered issues even more basic to networking, the issues of network governance and bibliographic data ownership and distribution.

As a separate issue the NCLIS program document also recommended making unique and major resource collections available nationwide. In support of this recommendation, NCLIS established the Task Force on a National Periodicals System in November 1975. The task force, consisting of eighteen persons selected for their stature, experience and position in the library and information communities, met during 1976. Their report, Effective Access to the Periodical Literature: A National Program, proposed a program with a National Periodicals Center (NPC), highly dependent upon accepted technical standards, to be under the management of the Library of Congress.

In the fall of 1977 the Library of Congress requested the Council on Library Resources to undertake the preparation of a technical development plan for the NPC. This was done, and in August 1978 CLR published A National Periodicals Center: Technical Development Plan. The plan brought into sharp focus the need for a considerable amount of compromise on the part of the library community insofar as the adoption of technical standards was concerned. In that section of the plan dealing with the identification of serials within the NPC, the designers wrote:

The NPC will require libraries to use the ISSN [International Standard Serial Number] on all orders as a means of uniquely identifying a
specific title. Since the emerging national bibliographic system for serials in the U.S. will approximate the ISDS [International Serials Data System] in many important ways, it will be to the NPC's advantage to also use other ISDS data elements from the beginning. While this method of control is not consistent with past cataloging practices in American libraries, it is fairly consistent with existing and proposed practices. It also is similar to the treatment of periodicals by abstracting and indexing services. Any system of control selected—and ISDS is no exception—will create some problems for libraries because of their inconsistent application of standards. The use of the ISDS will, however, capitalize on its international acceptance as a powerful force for standardization and cement it more firmly into the foundation upon which the U.S. will build a strong system of national bibliographic control.13

In its continuing effort to encourage the development of an emerging national library and information system, CLR in 1979 began the Bibliographic Services Development Program (BSDP). This five-year (1979-84) program includes as a key issue the promulgation of standards to facilitate information interchange. The program principals reiterated this in November 1980 by their recognition that "Standards underpin any effort to share bibliographic records and products, particularly if they are in machine-readable form,"14 and in August 1981, when they wrote, "Pressures by libraries and users to reduce barriers that impede the flow of bibliographic information also will influence the development of standards."15

*Information for the 1980's*, the final report of the 1979 White House Conference on Library and Information Services, contains further evidence of the recognition of the need for technical standards. In her testimony at the open hearing, Henriette Avram stated:

With the proliferation of information systems nationally and internationally, the need for increased information sharing becomes apparent as the worldwide economic situation becomes increasingly difficult. Present technology, and the marriage of the computer with telecommunications, increase the potential for information sharing while, at the same time, increasing the need for standardization. Effective and economic use of the technology and compatibility through standardization become more and more urgent. It can be said that standards are the sine qua non of information systems.16

Three important resolutions were approved by the conference delegates in support of technical standards. Resolution C-1, Technology and Uniform Standards, calls on the federal government to:

Direct all federally supported libraries and information services and other appropriate Federal agencies to support the development, review, and adoption of national and international standards for
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publishing, producing, organizing, storing, and transmitting information, using established and recognized procedures and institutions, and...that high priority be given to establishing or extending standards which address hardware and software compatibility, computer and communications network protocols, and machine-readable information; and...that the private sector be encouraged to participate and to support the development of such standards.17

Resolution C-8, Technology Standards Research, stipulates “that the private and the public sectors join in furthering research directed toward the development of technological standards.” Resolution C-14, Cooperative Standards and Networking, calls for “uniform standards for national bibliographic records universally adopted [to] be implemented.”

Current Circumstances

Much has been written and said during the past twelve years about the need for technical standards. Indeed, the number of such standards available today is much larger than in 1970 when Wigington and Wood outlined the standardization requirements (thirty-seven ANSI Z39 standards as of November 1981 versus only five in April 1970). Yet the task of inventorying and developing the needed new standards remains largely undone and the adoption of existing standards by the existing information agencies has been spotty at best. Libraries and information services have demonstrated a willingness to devote both time and money to the development and promulgation of standards, yet uniform adoption and use of standards remains an elusive goal. Little compatibility exists among the bibliographic records produced by information services or information services and libraries. Two activities in particular have served to exemplify these disparities. The first revealed differences in bibliographic practices among members of the abstracting and indexing (A&I) community, and the second, the differences between A&I and library community practices.

In 1978 a survey was conducted by the National Federation of Abstracting and Indexing Services (NFAIS) Common Practices and Standards Committee. For this survey each NFAIS member service was asked to provide information on the standards used in its production of the printed and machine-readable bibliographic descriptions it distributes. The unpublished findings of the survey indicated very little commonality in practice, an uneven adherence to national and international standards, and virtually no compliance with the UNI-
SIST Reference Manual,\textsuperscript{21} which had been developed by the international A\&I community for the purpose of fostering standardization.

Also in 1978, Unesco convened an ad hoc group of experts to establish a common communication format derived from the UNISIST Reference Manual and UNIMARC.\textsuperscript{22} The members of the group represented the International Federation of Library Associations and Institutions (IFLA), International Organization for Standardization (ISO), International MARC Network Study (IMNS), UNISIST International Centre for Bibliographic Descriptions (UNIBID), Inter-Organizatio-n Board for Information Systems (IOB), International Centre for Scientific and Technical Information (ICSTI), International Serials Data System (ISDS), International Development Research Centre (IDRC), and International Council of Scientific Unions—Abstracting Board (ICSU-AB). The group, after four meetings during 1979 and 1980, was unable to reconcile the differences in bibliographic data handling practices and requirements between the library and A\&I communities except by devising a completely new set of conventions for both communities to use.\textsuperscript{23}

Both the NFAIS survey and the Unesco Common Communication Format (CCF) endeavor served as catalysts to initiate a subsequent examination of factors that influence and control the use, misuse and lack of use of technical standards. The NFAIS survey clearly pointed out the fact that the bibliographic records prepared by the A\&I services were totally incompatible for all practical networking purposes. The Unesco CCF work determined that the needs served by the bibliographic records generated by libraries and A\&I services were so varied that any attempt to reconcile them was virtually impossible. Even records produced by national libraries and national bibliographies are different because they serve different needs.\textsuperscript{24}

Such revelations have not been welcome to those who believed that having technical standards would somehow ensure bibliographic control, enable the interlinking of bibliographic databases, and provide the basis for the envisioned nationwide library and information services network. Having standards and using standards are two separate issues.

Because the practicality of the Unesco CCF was being questioned, four members of the ad hoc group, the representatives of IFLA, ICSU-AB, ISO, and the International MARC Network Study, turned their attention to an attempt to understand and articulate the similarities and differences between the library and A\&I communities.

Their analysis found that, fundamentally, both communities are alike in that both are concerned with the representation of document
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descriptions in a brief record form which can then be used to identify documents relevant to the needs of users of the service. A major difference has been that the library community expects to provide the user with the actual documents that are identified, while most A&I services generally only identify documents to the user, who is expected to go to another source, usually a library, to obtain the actual items.

Another basic difference between the two communities is the degree of motivation to adopt standards and common practices. In the library community the overlap of collections has always served as an impetus to share catalog records in order to avoid costly duplication of cataloging and record creation. Consequently, a great deal of standardization of record content and record formatting has taken place. Within the library community, efforts to standardize have resulted in near worldwide acceptance of MARC- and ISBD-based conventions for the generation of computer-readable bibliographic records. The high motivation for sharing is what led to the development of UNIMARC, and the plans to use it for international exchange by national bibliographic agencies.

In the A&I community, there has not been this same motivation to adopt standards across agencies. There has been no concerted effort on the part of the A&I database producers to standardize their distribution files. The main reason for this is that there has been no widespread customer demand for the A&I community to standardize their bibliographic record creation practices. Recipients of the A&I services' information files have been willing to develop reformatting programs for each file subscribed to, in order to derive the benefits of having access to the information contained in the various source files. Without the external demand for standardized handling, the A&I services have not been willing to expend the funds needed to change what they are doing. Also, the A&I services' customers seem reluctant to ask the services to change. Such changes, they believe, would be expensive for them, as additional programming effort would be required.

In addition, the A&I agencies have not been much interested in sharing data among themselves. Most major A&I services are discipline-oriented, and their attitudes toward comprehensiveness, timeliness and record content vary widely. Since the users of these services are discipline-oriented as well, they are unlikely to demand that the source data distributed by numerous A&I agencies be interchanged or merged. Thus the interchange of computer-readable bibliographic records among A&I services is generally not viewed as a viable economic option. Where one service does obtain records from another, the involved services generally have bilateral agreements on the format conventions.
Usually the service producing the records has adopted the conventions of the service purchasing the records.

Another significant difference between libraries and A&I services in regard to record interchange has to do with copyright restrictions which apply to the data. Libraries that provide computer-readable bibliographic records generally do not place restrictions on how and where those records may be used. Indeed, third-party use is often actively encouraged. However, A&I services either limit or discourage third-party use without special contractual agreements.

Another factor which influences how libraries and A&I services view interchange deals with pricing policies. The prices one library charges another for computer-readable bibliographic records are generally not based on the cost of producing the records. In fact, the revenues a library derives from the sale of such records are usually much less than the production cost. Interchanges among national libraries and bibliographies are rarely accompanied by an associated transfer of funds. Such interchanges are usually on a quid pro quo basis. A&I services, on the other hand, attempt to recover costs and often include a margin of profit in their pricing policies.

Factors Which Influence Use

Although this review of similarities and differences presented no new findings, it did help to bring into focus some of the reasons why more and more useful technical standards by themselves will not assure the uniformity a nationwide library and information services network requires. Issues such as governance, economics, culture, and perceived value exert greater influence on decisions to adopt and use technical standards than mere availability. Promulgators of technical standards have in the past frequently failed to take this into account.

The LC Network Advisory Committee (NAC) envisaged the evolution of a nationwide network as a result of linkages of bibliographic services; negotiated relationships among services and state, regional and federal groups; and similar connecting of special interest groups, with the negotiations extending to technical standards and the standards-setting processes. NAC members also envisaged the governance of the nationwide network evolving as the network itself evolved. 25

Governance

In the United States, as in many other countries, the adoption and use of technical standards is largely voluntary. There is no practical mechanism available to force the adoption and use of standards. When-
ever the decisions to develop and promulgate standards intended for use by many communities are vested in a single community, the resulting standards may find limited acceptance. Governance issues, e.g., control of programs of work of standards committees, determination of the scopes of standards, and selection of the individuals that will actually draft the standards, are important and need more attention than afforded in the past. Dynamic standards such as the ISSN, International Standard Book Number (ISBN), title word abbreviations, and country codes require continued maintenance. The selection and oversight of agencies responsible for such maintenance activities also involves issues of governance. If some segments of the library or information service communities believe they have little or no control over either the development or maintenance of standards, they may feel little if any obligation to use those standards.

One early example of an issue of governance is to be found in the history of the development of the Z39 standard for periodical title abbreviations. In 1962 the chair of the Z39 subcommittee responsible for developing that standard passed from the library community to the A&I community. Members of the library community voiced concern over that action. It was feared that the needs of libraries would not be adequately considered. The officers of Z39 at that time recognized this as a potential obstacle to achieving approval of a proposed standard. To overcome this, they instructed the new chairperson to ensure equal representation of both communities on the reconstituted subcommittee.

Another example of the relationship of governance and use is to be found in the development of codes for serial titles, namely CODEN and ISSN. CODEN emanated from the A&I community with little early participation in its development by librarians. Consequently, the level of bibliographic control required for such code assignment was initially inadequate, and the early CODEN files contained numerous duplicate assignments. Also, the initial four-character CODEN, which had no check character, did not provide for a sufficient number of codes for the full range of serials of interest to librarians and once used, CODEN could not be computer-checked. Had the development of CODEN been shared by both communities of potential users, the need for a standard serial number as a national code might have never arisen. Consequently, two serial title code standards, one from ANSI, the other from the American Society for Testing and Materials, are in use. CODEN is used primarily by the subject access database producers (A&I services), and ISSN by the library community as well as some A&I services.
Still another example of standards developed under the control of one community, applicable in principle to (but not used by) both, is the MARC family of formats. These formats were developed with little input from the A&I services. Since the A&I services were not involved, few follow the MARC conventions. Had the A&I services been more involved, the MARC formats might have been made more specifically applicable to A&I needs and would probably have been adopted by more of the A&I services.

Control of the implementation of standards is also a governance issue. The administration of the assignment of codes such as ISSN, ISBN and codes for institutional addresses and country names is performed by maintenance agencies, not the standards-setting bodies. Genuine attempts are made to align the actual implementation of a standard with the intent of its developers, but the implementation group or maintenance agency may nevertheless apply the standard in a manner not fully consistent with the intentions of the developers. When this occurs, the question of who controls the implementation arises. A case in point was the machine assignment of ISSNs to entries in *New Serial Titles* (NST). The ISSN standard specifies only one ISSN per serial. However, the company that assigned ISSNs to NST failed to follow that rule. Because the 21-year cumulation of NST contained multiple entries for some serials, those serials were assigned more than a single ISSN as specified in the standard. Subsequent cancellation of the duplicate ISSN resolved this problem, but at an added expense to the organizations involved.

It is the maintenance agencies that are incurring the expenses of implementing them. Because of this, the agencies are inclined to handle the implementation by methods most cost effective for themselves. Whenever there are differences in interpretation of the intent of a standard between the standard-setting body and the maintenance agency, there is an issue of governance. Because of this, the ANSC Z39 Executive Council prepared a position paper covering its relationship and interactions with maintenance agencies. The position paper calls for formal agreements between Z39 and the agencies which implement Z39 standards for the continuous monitoring of these agencies.

Issues of governance need to be recognized and reconciled in advance to expedite the development of the standards. Potential conflicts that might arise as the result of questions of participation, ownership, control, and distribution need to be understood and minimized so that the resulting standard will have the widest possible applicability and acceptance.
The economic issues that influence the development and use of standards are exceptionally difficult to deal with. Many of the components of a nationwide library and information service network are already in place. Changing established practices at these institutions to accommodate the use of standards may be very costly. Regardless of the value of any given standard to the network as a whole, the decision-makers at the component institutions will have to be presented clear economic justifications to change their established practices. In 1981, when Online Computer Library Center, Inc. (OCLC) converted name headings and uniform titles in its online union catalog to conform with the second edition of *Anglo-American Cataloging Rules* (AACR2), it did so to reduce library costs, which might have increased dramatically as users attempted to resolve conflicts created under various cataloging guidelines. While this constituted a short-term economic loss for OCLC, the decision to take this loss was based on a projected long-term economic gain. By implementing AACR2, OCLC provided a great benefit to its member libraries, significantly speeding up their cataloging operations. The decisions made at the Library of Congress to use compatible headings in lieu of following AACR2 were not arbitrary. They were based on cost factors.

Considerable attention has been paid over the years to the funding of standards development. Much of the effort of the Z39 Executive Council during 1978-80 was devoted to establishing a funding mechanism that would permit a viable standards program. The concern for adequate funding of Z39 will continue as additional standards required for a nationwide network are identified. However, somewhat less attention has been given to the expenses inherent in the adoption and use of technical standards. As resources are committed to developing standards, it would seem prudent to consider how their implementation and use is to be financed. For example, were a group of A&I services to adopt the full range of standards and conventions needed to achieve compatibility with the record structure, content and content designation of the LC MARC formats, a major investment would be required. In all probability, the costs would be passed through to the subscribers of the services. Since a large number of these subscribers are service providers (e.g., Bibliographic Retrieval Service and Dialog Information Retrieval Service), they too would incur new expenses adapting their systems and user aids to the changed formats. Would these service providers absorb these costs or pass them along to their users? Probably the latter.

The Universal System for Information in Science and Technology (UNISIST) Ad Hoc Group to Develop a Common Communication
Format proposed that ISO Technical Committee 46, Documentation (TC 46) standardize the use and content of character positions six through nine of the record leader of the international standard for bibliographic information interchange on magnetic tape. ISO TC 46 spent two years working on this item before deciding such a standard was not needed. However, had this effort resulted in new ISO and, subsequently, ANSI standards, would the Library of Congress have been able to justify its adoption economically? Would the bibliographic services have converted the millions of records in their databases? How would they have recovered their costs? It seems highly unlikely that adoption of such a standard could be economically justified.

The economic issues associated with the use of technical standards in a networking environment are without question the most serious that network planners have to face. The use of standards cannot place unbearable economic burdens on network components.

Culture

Organizational culture, that “synergistic set of shared ideas and beliefs that are associated with a way of life in an organization,” influences decisions relating to the adoption of technical standards. Each organization associated with a nationwide library and information service network will have its own unique organizational culture. Since few, if any, network standards will be applicable to a single node or subset of a nationwide network, the utility and need for a given standard may be viewed quite differently by various network components. Organizational cultures are difficult to change. Frequently those who are proponents of standardization are not the decision-makers who can commit the resources needed to make the changes network standardization will require.

To minimize the degree or level of change at their own institutions, members of standards-setting groups will often seek to write standards containing alternative specifications. This leads to standards that are subject to various interpretations and, while providing for the retention of local practices, are not satisfactory in a network environment. An example of such a standard is the ANSI Z39 standard for the abbreviation of titles of periodicals, which permits word abbreviation by truncation or contraction and the retention or deletion of diacritical marks. The developers of this standard came from very different organizational cultures, none of whom could compromise local practice, so alternatives were included. Such cultural or environmental differences need to be recognized as potential hindrances to producing standards of high specificity.
Technical Standards Use

Perceived Value

Network planners need to be able to articulate and demonstrate the value of technical standards in order to assure their use. The value of technical standards is not equally perceived or shared across the full range of potential users. Some may view standards as detrimental to competition, as illustrated by the development of bar code technology, which the Planning Committee on Automated Identification Systems of the CCNBC described as "the competitive scramble for a piece of the market, resulting in a multitude of diverse formats and accompanying hardware, and competing technologies...." Others may believe that a given standard impedes progress, as was the case with the ANSI standard for bibliographic information interchange on magnetic tape. This standard was viewed as not being applicable to the distribution of bibliographic data through online telecommunications, so that some other record structure would be needed. The Library of Congress Network Development Office sponsored a study conducted by the Mitre Corporation in order to determine whether this was a valid concern. Mitre found that "current MARC format structure is functionally valid for the online transmission of bibliographic data."

The perceived value of existing technical standards may also be diminished by the lack of standards needed in related network applications. Where no official (i.e., ISO or ANSI) standards exist, local practices are employed. As use of a local practice spreads, it becomes a de facto standard, such as the MARC language codes have become within the library community where no official language code standard exists. Not having ANSC Z39 or ISO TC 46 standard codes for languages—one of the most frequently used elements of bibliographic data—perpetuates the use of local practices and can even discourage adoption of existing Z39 or TC 46 standards.

Conclusions

The nationwide library and information service network is developing. Technological advances and economic pressures are changing its overall design. The design will continue to evolve as linkages, programs and concepts are tested and adopted or abandoned. The questions of governance and support and bibliographic data ownership and distribution are being addressed both within and outside the library community. The role of and need for technical standards in the evolving network is appropriately recognized by responsible individuals. The difficulties imposed by the widespread use of common practices by
diverse groups, each with its own interests, are beginning to be understood. Shaw summarized this when he wrote:

Public and private sector libraries, telecommunication vendors, hardware manufacturers, legislative agencies, various utilities, existing and planned network organizations, and others must have a stake in a national network, not to mention end users, who have the largest stake of all. Each group will have different goals and each will promote its own interest. Each group, as a component of a national network, will have to modify its immediate interest to some degree for the benefit of the whole.45

The important work of developing technical standards for the nationwide library and information services network continues. ANSC Z39 subcommittees are developing standards for computer-to-computer protocols; terminal commands; library, patron and item identification; and character sets, to list but a few. The composition of these subcommittees illustrates how librarians, information specialists, computer scientists, and publishers are working collectively to develop networking-oriented technical standards.

Concurrent with the recognition of the importance of technical standards to library and information service networking, and the increased awareness of the factors influencing their development and use, has come the further realization that the nationwide network configuration will involve much more than pairs of twisted wires strung between existing bibliographic services. Avram and McCallum have noted: "While technology in the early 1970s pushed the community toward centralized automated systems, it is now pulling toward decentralization."46 Indeed, the network may be many networks providing various services and converging only at the users' terminals.

The standardization requirements of a nationwide network of networks will be different, but no smaller in scope than envisioned twelve years ago. There will be increased emphasis placed on standard methods to bridge among functions, databases, and host computers, and increased needs for standardized accounting practices and funds transfer. Improving the economics of information creation, transfer and use will be the motivating force behind the standardization efforts of the next decade.

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Library Trends

Forthcoming numbers are as follows:


Fall 1983, *Current Problems in Copyright*. Editors: Walter C. Allen, Associate Professor, and Jerome K. Miller, Assistant Professor, Graduate School of Library and Information Science, University of Illinois at Urbana-Champaign.