
Digital Libraries and Electronic Publishing

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The Intellectual Foundation of Information Organization

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Introduction

A system for organizing information, if it is to be effective, must rest on an intellectual foundation. This intellectual foundation consists of several parts:

- An ideology, formulated in terms of purposes (the objectives to be achieved by a system for organizing information) and principles (the directives that guide their design);
- Formalizations of processes involved in the organization of information, such as those provided by linguistic conceptualizations and entity-attribute-relationship models;
- The knowledge gained through research, particularly that expressed in the form of high-level generalizations about the design and use of organizing systems; and
- Insofar as a discipline is defined by its research foci, the key problems that need to be solved if information is to be organized intelligently and information science is to advance.

Conceptual Framework

It is useful to begin by establishing a conceptual framework to ensure that the discussion does not become idiosyncratic and at the same time to bootstrap it to the level of theory. The conceptual framework adopted here looks at the organization of information in an historico-philosophical context. Its salient feature is that information is organized by describing it using a special-purpose language.

Historical Background

The relevant historical background is the tradition of Anglo-American descriptive and subject cataloging during the last century and a half. While some form of systematic information organization has been practiced since 2000 B.C.E.,¹ its modern history is usually regarded as beginning in the middle of the last century with Sir Anthony Panizzi's plan for organizing books in the British Library.² In the period following Panizzi, the groundwork was laid for the major bibliographic³ systems in use in libraries today: the Dewey Decimal Classification (DDC), the Library of Congress Classification (LCC), the Universal Decimal Classification (UDC), the Library of Congress Subject Headings (LCSH), and the Anglo-American Cataloguing Rules (AACR). Though strong, particularly in their ideologies, these systems were jolted in the twentieth century by information explosions, the computer revolution, the proliferation of new media, and the drive toward universal bibliographic control. How they have withstood these jolts, where they have remained firm, where they have cracked, and where cracked how they have been repaired or still await repair is a dramatic — and instructive — history for those interested in organizing information intelligently.

Santayana wrote that “when experience is not retained . . . infancy is perpetual. Those who cannot remember the past are condemned to repeat it.”⁴ To be so condemned would not be all bad, since reinventing what has been done in different times and circumstances reinvigorates a discipline, rids it of routinized procedures and ways of thinking, and energizes it by the influx of new ideas and new terminology. Nevertheless it is instructive — especially given the recent interest and activity directed toward organizing digital information — to understand certain features of traditional bibliographic systems. Two features in particular are worth considering. One is the solutions these systems have provided to the problems that obstruct efficient access to information. While today some access problems are caused by the new technology, others — such as those that stem from the variety of information, the many faces of its users, and the anomalies that characterize the language of retrieval — have been around a long time. For instance, whether users search library shelves or the Internet, some will retrieve too much, some too little, and some will be unable to formulate adequate search requests. The thought that has gone into addressing problems like these, cumulated over a century and a half — particularly the

thinking that deals with rationales for why things are done as they are — provides, independent of time and place, an informed context for systems design.

A second feature that makes traditional bibliographic systems worthy of continued interest is the vision expressed in their ideologies. A system's effectiveness in organizing information is in part a function of an ideology that states the ambitions of its creators and what they hope to achieve. The systems produced during the second half of the nineteenth century, a period regarded as a golden age of organizational activity,⁵ were ambitious, full-featured systems designed to meet the needs of the most demanding users. Some would argue that they were too ambitious — that there was no need to construct elaborate Victorian edifices since jerrybuilt systems could meet the needs of most users most of the time.⁶ However, good systems design begins by postulating visionary goals, if only to make users aware of the extent to which compromises are being made. The bibliographic systems of the past (in their ideologies, at least) reflect what can be achieved by intelligent information organization.

Philosophical Background

Relevant to the intellectual foundation of information organization are the points of view embraced by three philosophical movements that have permeated academic and popular thinking during the twentieth century: systems philosophy, the philosophy of science, and language philosophy.

Systems Philosophy

A philosophy of ancient origin, general systems theory was resurrected by Ludwig von Bertalanffy in the mid-twentieth century in an attempt to stop-gap what he perceived to be an increasing fragmentation of knowledge.⁷ General systems theory is a philosophical expression of holistic or big-picture thinking. Its credo encompasses a belief in purpose as opposed to chance processes, a way of looking at phenomena in terms of their organization and structure, and a conviction that general laws and principles underlie all phenomena. From this philosophy derives the practice of systems analysis, which in its most general form is the analysis of an object of study, based on viewing it as a system whose various parts are integrated into a coherent whole for the purpose of achieving certain objectives.

Systems thinking was introduced into the discipline of information organization by Charles A. Cutter in 1876.⁸ Dubbed the great “library systematizer,”⁹ Cutter was the first to recognize the importance of stating formal objectives for a catalog. He recognized as well the need to identify the means to achieve these objectives and principles to guide the choice of means when alternatives were available. Since Cutter’s time, systems thinking has assumed a variety of different expressions, tending to become more elaborate and increasingly formalized, as, for instance, in its articulation in the form of conceptual modeling. However expressed, the ultimate aim of systems analysis is to determine and validate practice. Why certain methods, techniques, rules, or procedures are adopted to the exclusion of others in the practice of organizing information requires explanation. One way to provide this is to show that a particular element of practice can be viewed as part of a system and as such contributes to fulfilling one or more of the system’s objectives.¹⁰ An improvised practice, one that is adventitious and not rationalized with respect to the big picture, is ineffective, inefficient, and, by definition, unsystematic.

Philosophy of Science

Scientific methodology has been a central focus for philosophical inquiry for nearly a century. In the first part of the twentieth century, the dominant philosophy of science was logical positivism, whose credo was expressed by the principle of verifiability. This principle states that to be meaningful a proposition must be capable of verification. A proposition to be verified must have concepts that can be operationalized, which means (in effect) interpreted as variables and defined in a way that admits of quantification.

To the extent that problems encountered in the organization of information are definitional in nature, solutions to them can be approached by introducing constructive or operational definitions. An example of such a definition relating to information organization is the dual precision-recall measure created by Cyril Cleverdon in the mid-1950s. The measure was introduced to quantify the objectives of information retrieval. Precision measures the degree to which a retrieval system delivers relevant documents; recall measures the degree to which it delivers all relevant documents.

Defining concepts operationally enables a discipline to advance, the most frequently cited illustration of which is Einstein’s use of them in his analy-

sis of simultaneity.¹¹ The power of operational definitions resides in their ability to provide empirical correlates for concepts in the form of variables, which, in turn allows variables to be related one to another.¹² For instance, quantifying the objectives of information retrieval in terms of the precision and recall variables makes it possible to establish propositions about the impact of various factors — such as specificity of indexing, depth of indexing, and vocabulary size — on retrieval effectiveness. Propositions that express relationships among variables are “scientific” in the sense that they represent high-level generalizations about the objects of study. This gives them an explanatory function: if verified, they assume the character of laws; if in the process of being verified, they have the status of hypotheses.

While some aspects of the philosophy of science are abstruse, its dictates are clear enough: quantify and generalize. To a greater or lesser degree all the social sciences have struggled to follow these dictates. In their striving for scientific respectability, they have pursued empirical research and undergone quantitative revolutions. Library “science” self-consciously embraced a scientific outlook in the 1930s at the Chicago Graduate Library School. This school, established for the express purpose of conducting research, had considerable influence on the field through its brand of scholarship, which encompassed theory, forced definitional clarity, and questioned assumptions.¹³ Increasingly since the 1930s, understanding of the information universe and, in particular, how it is organized and navigated has been pursued through “scientific” research.

Language Philosophy

Interest in language has dominated two twentieth-century philosophies. The first was the already mentioned logical positivism, which was a linguistic form of radical empiricism. Its principle of verifiability — which states that a proposition to be meaningful must be capable of being verified — is a linguistic principle.¹⁴ The philosophy of logical positivism was countered in the middle of the century by another language philosophy, the Wittgensteinian philosophy of linguistic analysis.¹⁵ A major tenet of this philosophy was that the meaning of a word is its use and this use is governed by rules much like the rules that govern moves in games. As there are many different special-purpose uses of language, so there are many different language games.

The act of organizing information can be looked on as a particular kind of language use. Julius Otto Kaiser, writing in the first decade of the twentieth century, was the first to adopt this point of view.¹⁶ Kaiser developed an index language, which he called *systematic indexing*, wherein simple terms were classed into semantic categories and compound terms were built using syntax rules defined with respect to these categories. Similar points of view have been adopted by theorists since Kaiser, mostly in the context of organizing information by subject but applicable as well to organizing by other attributes, such as author and title. The advantage to be gained by looking at the act of organizing information as the application of a special-purpose language is that linguistic constructs such as *vocabulary*, *semantics*, and *syntax* then can be used to generalize about, understand, and evaluate different methods of organizing information.¹⁷ Another advantage is that these constructs enable a conceptualization that can unify the heretofore disparate methods of organizing information — cataloging, classification, and indexing.

Philosophical movements constitute the backdrop against which scholarly disciplines develop. The impact of systems philosophy on the discipline of information organization is apparent insofar as this organization is regarded as effected by a system that has purposes and whose design is guided by conceptual modeling and the postulation of principles. It is apparent as well in the discipline's increasing reliance on operational definitions, in its use of algorithms for automating aspects of organization, in frameworks it establishes for empirical research, and in generalizations that build theory.

Information and Its Embodiments

Like *meaning* and *significance*, terms with which it is allied, *information* has many senses, nuances, and overtones. This makes reaching agreement about a general definition of the term difficult. Some special-purpose definitions of the term have relatively fixed meanings. The best known of these is the one that is used in information theory, which associates the amount of information in a message with the probability of its occurrence within the ensemble of all messages of the same length derivable from a given set of symbols.¹⁸ A definition like this, however, is too particular for use in discourse about organizing information. What is needed is one more conso-

nant with common usage, one that implies or references a person who is informed. The definition used in this book is developed in the next chapter, but as first approximation a gloss on a general dictionary meaning will do. One definition of *information* is “something received or obtained through informing.”¹⁹ Informing is done through the mechanisms of sending a message or communication; thus, *information* is “the content of a message” or “something that is communicated.”

Defining *information* as the content of a message is specific enough to exclude other definitions — for instance, the definition that equates information with “a piece of fact, a factual claim about the world presented as being true.”²⁰ This definition, which is positivistic in nature, conceptualizes *information* narrowly. Certain types of knowledge may be restricted to facts or true beliefs, but to apply such a restriction to information in general would rule out the possibility of false information or information that is neither true nor false, such as the information in a work of art or a piece of music, which when conveyed “informs” the emotions. Factual claims about the world constitute only a small subset of information broadly construed as the content of a message or communication.

Information is sometimes defined in terms of data, such as “data endowed with relevance and purpose.”²¹ A datum is a given; it could be a fact or, at a more elemental level, a sense perception. Either might be endowed with signatory meaning simply by focusing attention on it, as a certain smell is indicative of bread baking. While data in the form of sense perceptions and raw facts have the potentiality to inform, it cannot be rashly assumed that all information could be reduced to these. It is not possible, at least not without wincing, to refer to *The Iliad*, *The Messiah*, or the paintings in the Sistine Chapel as data, however endowed. The messages they convey represent highly refined symbolic transformations of experience,²² different in kind from data.

While message content is probably a good approximation of what information systems organize, not all message content falls under the purview of such systems. The content contained in ephemeral messages — such as the casual “Have a nice day!” — lies outside the domain of information systems. For the most part, these domains are limited to messages whose content is (1) created by humans, (2) recorded,²³ and (3) deemed worthy of being preserved. The question of which messages fall into the latter category

is sometimes begged by equating “worthy of being preserved” with what libraries, information centers, archives, and museums in fact collect. The collective domain of all systems for organizing information — all message content created by humans, recorded, and deemed worthy of being preserved — has been likened to the “diary of the human race.”²⁴ The purpose of these systems is to make this diary accessible to posterity.

The term *document* is easier to define and is used in this book to refer to an information-bearing message in recorded form.²⁵ This usage is warranted both by the information-science literature and by common usage.²⁶ Webster's Third gives as meanings of *document*:

- a piece of information
- a writing (as a book, report, or letter) conveying information
- a material having on it (as a coin or stone) a representation of the thoughts of men by means of some conventional mark or symbol.²⁷

The first two of these meanings are particularly apt in that they explicate *document* with respect to *information*: “a piece of information” and “conveying information.” The second is limited in that it instances “a writing,” whereas in contemporary bibliographic contexts documents include not only messages using alphanumeric characters but also those expressed using sounds and images.

The third meaning of *document* introduces the concept of *material*. This underscores a distinction of great importance in the literature of information organization, one that is referenced repeatedly throughout this book: information is an abstract, but the documents that contain it are embodied in some medium, such as paper, canvas, stone, glass, floppy disks, or computer chips. Potentially any medium can serve as a carrier of information. While some media make information immediately accessible to the senses (for example, paper), others require an intermediate mechanism (such as a computer chip, a microfiche, or a compact disc). Organizing information to access it physically requires not only descriptions but also its material embodiments and the mechanisms needed for retrieval.

The distinction between information and its embodying documents is so important in the literature of information organization it warrants a brief history. It is claimed to have been recognized as early as 1674 by Thomas Hyde.²⁸ Certainly Panizzi in the middle of the nineteenth century acknowledged it implicitly in the design of his catalog and in certain passages of his

writing.²⁹ Julia Pettee in 1936 formulated the distinction explicitly, referring to a particular message content as a *literary unit* and its embodiment in a medium as a *book*.³⁰ In 1955 S. R. Ranganathan introduced the distinction, presenting it as the dichotomy between expressed thought and embodied thought: the former he referred to as a *work*, the latter as a *document*.³¹ In the 1960s, the significance of the distinction was brought to popular attention as a result of Seymour Lubetzky's eloquent juxtaposition of the work versus the book.³² He regarded a work as the intellectual creation of an author. A work is what in the preceding paragraphs has been characterized as (1) information, (2) the disembodied content of a message, or (3) expressed thought. It is a kind of Platonic object. A book, by contrast, is a particular physical object that embodies or manifests the work. One work can be manifested in many physical objects, and, conversely, one physical object can manifest several works.

Because of its centrality, the distinction between information and its embodiments has invited terminological confusion in the form of synonyms and near synonyms. *Literary unit*, *(message) content*, *expressed thought*, and *text* have been used either coextensively or as operationalizations of *work*. *Manifestation*, *expression*, *edition*, *version*, *publication*, and *carrier* have been used somewhat ambiguously to refer either to a slightly altered form of an original work, to its physical embodiment, or to both. In this book, *work* is used in the Ranganathan and Lubetzky sense to indicate a particular disembodied information content. Ranganathan's term *document*, rather than Lubetzky's *book*, is used to indicate a material embodiment of information — at least for the most part. Exceptions are made when citing the literature and introducing further distinctions.

Purposes, Principles, and Problems

In 1674 in the Preface to the *Catalogue for the Bodleian Library*, Sir Thomas Hyde lamented the lack of understanding shown by those who never had the opportunity to make a catalog:

“What can be more easy (those lacking understanding say), having looked at the title-pages than to write down the titles?” But these inexperienced people, who think making an index of their own few private books a pleasant task of a week or two, have no conception of the difficulties that rise or realize how carefully each book must be examined when the library numbers myriads of volumes. In the

colossal labor, which exhausts both body and soul, of making into a alphabetical catalog a multitude of books gathered from every corner of the earth there are many intricate and difficult problems that torture the mind.³³

Three centuries and many myriads of “books” later, the problems that torture the mind when attempting to organize information have increased exponentially. It has never been easy to explain why colossal labor should be needed to organize information. If not the most successful, at least the most passionate attempt to do so was made by Panizzi when before a Royal Commission he defended his plan for organizing books in the British Library (1847–1849). Many members of the Commission did not understand the plan and, not understanding it, found it too complicated. The most celebrated of the commissioners, Thomas Carlyle, went so far as to accuse Panizzi of trying to enhance his reputation by building a catalog that was “a vanity of bibliographical display.”³⁴ And this despite his reputation as a leading intellect of the time.

Organizing information would seem to be no different from organizing anything else. The assumption that this is the case has led to attempts to interpret it as a routine application of the database modeling techniques developed to organize entities like the employees, departments, and projects of a company. But there are important differences. One that is particularly important, because it is at the root of many of the complexities unique to organizing information, is that two distinct entities need to be organized in tandem and with respect to each other: works and the documents that embody them.

Organization can take many forms. Its prototypical form is classification. Classification brings like things together. In traditional classifications, like things are brought together with respect to one or more specified attributes. Any number of attributes can be used to form classes of documents embodying information, such as same size or color, same subject, or same author. However, the most important attribute for a system whose objective is to organize information is the attribute of “embodying the same work.” No other attribute can match it in collocating power because documents that share this attribute contain essentially the same information. Organizing information if it means nothing else means bringing all the same information together.

Normally bibliographic systems that organize information in documents do more than bring together *exactly* the same information; they aim also to bring together *almost* the same information. This introduces further complexity, particularly in trying to understand what is meant by “almost the same information.” Intuitively the concept is simple to grasp. A work like *David Copperfield* may appear in a number of editions, such as one illustrated by Phiz, one translated into French, and another a condensed version. Because they are editions of the same work, they share essentially, but not exactly, the same content, differing only in incidentals such as illustrations, language, size, and so on. But the attempt to operationalize the intuitive concept in a code of rules — to draw a line between differences that are incidental and those that are not — runs into definitional barriers: What is a work? What is meant by *information*?³⁵

Once editions containing almost the same information are brought together, their differences then need to be pinpointed. Panizzi insisted on this in his defense before the Royal Commission: “A reader may know the *work* he requires; he cannot be expected to know all the peculiarities of different *editions*; and this information he has a right to expect from the catalog.”³⁶ He then went on to argue for a full and accurate catalog, one that contained all the information needed to differentiate the various editions of a work. The task of differentiation has its mind-torturing challenges and can create what to an outsider might seem like a display of bibliographic vanity. But imagine the hundreds of editions of the Bible that might be held by a library. Not only must salient differences be identified, but they must be communicated intelligibly and quickly. Intelligible communication in part is accomplished by arranging records for the different editions in a helpful order. The placing a given edition in its organizational context within the bibliographic universe is not unlike making a definition: first one states its genus (the work to which it belongs) and then, in a systematic way, its *differentia*.

The essential and defining objective of a system for organizing information, then, is to bring essentially like information together and to differentiate what is not exactly alike. Designing a system to achieve this purpose is subject to various constraints: it should be economical, it should maintain continuity with the past (given the existence of more than 40 million

documents already organized), and it should take full advantage of current technologies.

In addition to constraints, certain principles inform systems design. Principles are desiderata that take the form of general specifications or directives for design decisions. They differ from objectives in that objectives state what a system is to accomplish, while principles determine the nature of the means to meet these objectives. An example of a principle used to design the rules used to create a bibliographic system states that these rules collectively should be necessary and sufficient to achieve system objectives. Others are that rules should be formulated with the user in mind, they should ensure accuracy, they should conform to international standards, and they should be general enough to encompass information in any of its embodiments.

What makes the labor of constructing a bibliographic system colossal are the problems that are encountered in the process of doing so. A major source of problems is the infinite and intriguing variety of the information universe. These kinds of problems are frequently definitional in nature: defining *work*, for example, is difficult because it amounts to defining *information*. Does *The Iliad* in the original Greek consist of the same information (represent the same work) as an English translation of it? Do two different English translations represent the same work? (The answer to these questions is usually yes.) Does translation to another medium abrogate workhood? Does a film version of *Hamlet* contain the same information content as its textual counterpart? (The answer to this kind of question is usually no.) Are two recordings of a symphony, one a CD and the other a video, the same work? (Here the answer seems to be pending.) The dictum that “the medium is the message”³⁷ suggests that there is significant value added (or subtracted) when an original work is adapted to another medium, so that information that is to be organized is a function of its symbolic expression. The definition of *work* has become the focus of recent attention, which is hardly surprising since it is important to come to grips with the meaning of information. This is something that needs to be grasped, since how information is defined determines what is organized and how it is organized.

Another significant source of problems in organizing information stems from the need to keep pace with political and technological progress. An

example of how technological progress poses problems is the invention and proliferation of new media, which has required bibliographic systems to generalize their scope from books to any kind of media that can carry information. An example of political progress requiring adaptation is the rise of internationalism, which has required these systems to extend their reach from local to universal bibliographical control. Political problems are for the most part settled through international agreements and the establishing of standards but are addressable technically at a systems level. An example is the problem that arises from a conflict between two principles — that of universal standardization and that of user convenience. Different cultures and subcultures classify differently, use different retrieval languages, and subscribe to different naming conventions. The technical problem to be solved is how to provide for local variation without abrogating the standards that facilitate universal bibliographical control.

The most dramatic twentieth-century event to affect the organization of information is, of course, the computer revolution. It has changed the nature of the entities to be organized and the means of their organization. It has provided solutions to certain problems but spawned a host others. One of the new problems relates to the nature of digital documents. A traditional document, like a book, tends to be coincident with a discrete physical object. It has a clearly identifiable beginning and end; the information it contains — a play, novel, or dissertation — is delimited by these; it is “all of a piece.”³⁸ By contrast, a digital document — such as a hypertext document or a connected e-mail message — can be unstable, dynamic, and without identifiable boundaries.

Documents with uncertain boundaries, which are ongoing, continually growing, or replacing parts of themselves, have identity problems. It is not possible to maintain identity through flux (“One cannot step twice into the same river”).³⁹ A single frame is not representative of a moving picture. A snapshot cannot accurately describe information that is dynamic. This is not simply a philosophical matter, since what is difficult to identify is difficult to describe and therefore difficult to organize.

The oldest and most enduring source of problems that frustrate the work of bibliographic control is the language used in attempting to access information. In a perfectly orderly language, each thing has only one name, and one name is used to refer to each single thing. Philosophers and linguists

have idealized such languages. Leibniz, for instance, imagined a language so free from obscurities that two people involved in an argument might resolve their differences simply by saying “Let us calculate.”⁴⁰ Such languages are artificial: they do not exist in nature. Natural languages are rife with ambiguities and redundancies; their robustness depends on these. But at the same time they cause problems when attempting to communicate with a retrieval system. It can happen, for instance, that a work is not found because it is known by several names and the user happens on the wrong one. Or a deluge of unwanted information may be retrieved because the user has entered a multivocal search term, one naming several different works, authors, or titles. It would seem that the most colossal labor of all involved in organizing information is that of having to construct an unambiguous language of description — a language that imposes system and method on natural language and at the same time allows users to find what they want by names they know.

2

Bibliographic Objectives

The first step in designing a bibliographic system is to state its objectives. Other design features — such as the entities, attributes, and relationships recognized by the system and the rules used to construct bibliographic descriptions — are warranted if and only if they contribute to the fulfillment of one or more of the objectives.

Traditional Objectives

Panizzi, writing in the middle of the nineteenth century, indirectly referenced bibliographic objectives when he argued in favor of the need for a catalog to bring together like items and differentiate among similar ones. It is Cutter, however, who in 1876 made the first explicit statement of the objectives of a bibliographic system.¹ According to Cutter, those objectives were

1. to enable a person to find a book of which either
 the author }
 the title } is known
 the subject }
2. to show what the library has
 by a given author
 on a given subject
 in a given kind of literature
3. to assist in the choice of a book
 as to its edition (bibliographically)
 as to its character (literary or topical).

Cutter formulated his objectives based on what the user needs and has in hand when coming to a catalog. The first objective, the *finding objective*, assumes a user has in hand author, title, or subject information and is

Introduction

Information to be organized needs to be described. *Descriptions* need to be made of it and its physical embodiments.¹ Traditionally, descriptions are recorded on bibliographic records, which stand in for or surrogate the documents embodying information. The language used to make such descriptions is a bibliographic language, a special-purpose language that is designed and applied in accordance with a special set of rules. Its function is to communicate to users information about information. In this role, it serves as a bridge connecting the language of documents with that of the users who seek them. It is an artificial language that, purged of the anomalies of natural language, is capable of providing systematic, as opposed to chancy, access to information in recorded form.

A description is “a statement of the properties of a thing or its relations to other things serving to identify it.”² The things described by bibliographic languages are information entities. As a first cut, bibliographic languages can be divided into those that describe information and those that describe its documentary embodiments — that is, those that describe works and those that describe their particular space-time manifestations in the form of books, videos, CDs, and so on. A *work language* describes information in terms of its attributes, such as author, title, edition, and subject. These are intellectual attributes independent of any space-time manifestation of the information. Thus, in addition to being an information-content language, a work language can be characterized as an intellectual-attributes language. By contrast, a *document language* describes attributes that are specific to particular manifestations of works — publication attributes

(such as publisher, place, and date of publication), physical attributes (such as size, color, and medium), and location attributes (such as a journal, website, or library).

Bibliographic languages can be further subdivided by attribute. Thus, an author language is one whose objects of description are persons and corporate bodies³ associated with works. A classification by attribute of work and document languages into sublanguages can be constructed as follows:⁴

Work language

- Author language
- Title language
- Edition language
- Subject language
 - Classification language
 - Index language
- Document language
 - Production language
 - Carrier language
 - Location language

In a work language, an author is treated as an attribute of information. In an author language, an author is treated as an entity — as an object of description in its own right. As noted in the previous chapter, how a thing is represented in a model, whether as an attribute or an entity, depends on the cataloger's point of view or purpose. Traditional bibliographic practice has regarded certain of its fundamental constructs, like authors and subjects, *both* as attributes and entities. Thus, they figure in bibliographic descriptions as metadata referencing attributes of works and as independent objects of description. (Descriptions of author entities are called *authority records*, rather than *bibliographic records*.) The chapters in the second half of this book discuss, accordingly, document, work, and subject languages. Although subject languages properly form a subclass of work languages, they are singled out for special treatment by reason of literary warrant. Since the beginning of the twentieth century, subjects of works have been treated separately from other work attributes, like author and title, and a large literature has developed around subject analysis and description.

Components of a Bibliographic Language

A language consists of a vocabulary, semantics, syntax, and pragmatics. The vocabulary of a bibliographic language consists of the simple and complex expressions used to name the values of the three variables: entities, attributes, and relationships. Its semantics consists of the relationships among these names, such as the equivalence relationships that exist between author names like Mark Twain and Samuel Clemens and subject names like Bulbous domes and Onion domes.* Its syntax consists of the ordering relationships among the component elements of complex expressions in the language. Its pragmatics consists of specifications and conditions for the application of the language, such as a specification indicating how much description should be given or the conditions under which a given descriptive term can be applied to a work.

Different bibliographic languages have developed differing degrees of sophistication in their vocabulary, semantics, syntax, and pragmatics. All use a specialized vocabulary. All work languages employ some sort of semantics. Both work and document languages employ syntax, with subject languages being the most linguistically advanced and document languages the least. Most languages are fairly underdeveloped in their pragmatics, an exception being the Dewey Decimal Classification (DDC).

Vocabulary

A vocabulary is a “list or collection of terms or codes available for use (as in an indexing system).”⁵ The terms or codes of a bibliographic language are called by various names. In subject languages they are called *keywords*, *descriptors*, *index terms*, or *classification numbers*. In work languages and the languages used to describe the physical and production attributes of documents, they are referred to simply as *data elements* or *metadata*.

The rules governing the vocabulary of a bibliographic language state criteria for its use, such as the source from which vocabulary elements should be drawn and the form these should take. The purpose of source rules is to provide warrant or justification for admitting terms into the vocabulary. A term may be admitted on the basis of literary warrant, use warrant, or, in

* It is conventional practice when referring to the terms of a subject language to capitalize the initial letter of a term and not to use italics.

the case of classification languages, structural warrant. The purpose of form rules is to ensure the consistency in description that is required for systematic access to bibliographic information. Form rules specify how to select from among alternative vocabulary elements, such as between an author's real name and a pseudonym. They specify as well the linguistic form of the name, its abbreviation and capitalization style, and the language and script to be used. Vocabulary rules can be simple (such as a rule stating that the title of a document should be rendered in the form in which it appears on the piece) or complex (such as a rule that states the title of a work should be its original title or the title by which it is best known, except that introductory phrases and statements of responsibility that are part of the title should be omitted, at least under certain conditions).

The terms that constitute the vocabulary of a bibliographic language are of two sorts: *derived terms* and *assigned terms*. The former are taken as-is from documents, while the latter consist of normalizations of the as-is raw terms. The former describe an entity in its own terms, i.e., in the author's own language; the latter describe it in normalized terms, using a controlled vocabulary that facilitates the establishing of relationships among entities. The former are descriptive metadata elements; the latter are organizing metadata, whose *raison d'être* is to structure the bibliographic universe.⁶

Semantics

Semantics is the study of meaning, but in an extended sense it refers to the different meaning structures found in languages. The rules governing bibliographic semantics specify three such structures: a relational semantics, a referential semantics, and a category semantics.⁷ To implement these structures requires normalizing natural language by introducing vocabulary or authority control. Vocabulary control is the chief means by which a natural language is processed to rid it of surface-structure inconsistencies that obstruct effective information retrieval.

Relational semantics treats of meaning relationships among terms. Chief among these is the relationship of synonymy, which holds between two or more terms that refer to the same thing. Without rules to control vocabulary for *synonymy*, documents containing the same information would be scattered, which would cause recall failures in retrieval. The usual, but not the only, way of dealing with the synonym problem is to establish one of the

synonyms as authoritative and to refer to it from the other(s), using *See* or *Use* references — such as Samuel Clemens. *See* Mark Twain.

In addition to synonymy, bibliographic languages exhibit hierarchical and other relationships. (The "other" are often lumped together as *related-term relationships*.) Author and title languages employ a few hierarchical and related-term linkages — for instance, in relating the subordinate-superordinate and earlier-later names of a corporate body. Subject languages, by contrast, make extensive use of them. Indeed, there is virtually no limit to the kind or number of semantic linkages a subject language can exhibit. The most elaborate edifices constructed using hierarchical and related-term relationships are the universal classificatory languages that are used to map the universe of knowledge.

Referential semantics deals with the techniques used to limit the meanings or referents of terms. The rules specifying these techniques are a further means of controlling vocabulary. They do this by ensuring that each term refers to only one thing. A bibliographic language that contains multireferential terms — homonyms like Mercury, which can refer to a car, a planet, a metal, or a Greek god; or John Smith, which can refer to many different authors — causes poor precision when used in retrieval. The usual, but not the only, method of dealing with such terms is to split them up into several singly referring terms using qualifiers. Thus, the single-term Mercury becomes Mercury (car), Mercury (planet), Mercury (metal), and Mercury (Greek god), and Smith, John becomes Smith, John, 1832–1900, Smith, John, 1903–1986, and so on.

Category semantics has to do with the facets or grammatical categories into which the vocabulary is partitioned. Just as the vocabulary of a natural language is categorized by grammatical function, like subject and predicate, or by parts of speech, like noun and verb, so the vocabulary of a bibliographic language is categorized in terms of facets. Facets are the grammatical categories of a bibliographic language. Examples of facets are the topic, place, and form categories used by the Library of Congress Subject Headings (LCSH) and the type of composition, medium of performance, instrumentation, and key categories used to formulate uniform titles for musical works. There are a number of reasons for classifying or faceting a vocabulary, one of the most important being that facets can be used to formulate syntax rules.⁸ A well-formed expression in a bibliographic language

can be defined in terms of facets (for example, topic followed by place is a well-formed subject statement), much as a well-formed expression in a natural language can be defined in terms of grammatical or part-of-speech categories (subject followed by predicate is a well-formed sentence).

Syntax

The *syntax* rules of a language specify the order in which individual vocabulary elements of the language are concatenated to form larger expressions. In a natural language these larger expressions are phrases or sentences; in a subject-indexing language they may be called *statements*, *strings*, or *subject headings*; in an author or title language they are usually referred to as *identifiers* or *uniform headings*. In a natural language like English, a grammatically correct sentence is one that obeys a natural-language syntax rule. In a bibliographic language, a well-formed string or heading is one that is authorized by a bibliographic syntax rule. One of the syntax rules used by Kaiser in his *Systematic Indexing* is “concrete:process,” by which is meant that a term from a concrete facet (that is, a term designating an object) can be followed by or concatenated with a term from a process facet (a term designating an action).⁹ Coal:Mining is an example of an index language statement constructed using this syntax. It is grammatically correct and therefore constitutes a well-formed string in the index language.

Pragmatics

The *pragmatics* of a language deals with its use or application. An example of a rule governing the application of a bibliographic language is the cataloging rule that instructs that if an edition statement does not appear on a document being described, the cataloger is not to make one up. Another is the indexing rule that requires a cataloger to use the most specific heading appropriate in designating the subject of a work. Rules stating the conditions under which a new record can be made belong to the pragmatics of a bibliographic language, as do rules that specify the amount of detail to be included in a description or the number of subject descriptors to be assigned to documents. As remarked above, of all the bibliographic languages, the one with the best-developed pragmatics is the DDC. It uses hundreds of “class here and class elsewhere” instructions, often accompanied by extensive explanatory definitions, to guide classifiers in the application of class numbers.

Implementation

The design of a formal language of description occurs at a conceptual level and at an implementation level. At the *conceptual level* objectives and principles are formulated; also at this level entities, attributes, and relationships are specified. At the *implementation level* the rules used by the language to create descriptions are formulated. Also at this level it is determined how these descriptions should be recorded — that is, how bibliographic records should be designed. The conceptual level is the level of ideology; the implementation level, that of technology. Between the two a delicate balance obtains, a balance that is sometimes upset when technology, theoretically at the service of ideology, loses its direction and subverts it.

Rules

The *rules* for the design and application of a bibliographic language are typically contained in codes and standards.¹⁰ There are literally hundreds of these. They include general author-title codes and their interpretations; material-specific codes for describing archival materials, cartographic materials, films, music, graphics, and so on; manuals for the interpretation and application of universal classifications; international general standards for thesaurus construction and indexing; subject-specific thesaurus and indexing standards; and formatting standards for machine encoding and bibliographic exchange. A representative sample of internationally or widely used codes and standards would include the following:

- The International Standard Bibliographic Description (General)
- The ISO Standard for Thesaurus Construction (ISO 2788)
- The ISO Standard for Indexing (ISO 5963)
- The ISO Standard for Bibliographic Exchange on Magnetic Tape (ISO 2709)
- Dewey Decimal Classification and Relative Index
- Library of Congress Classification Schedules
- Library of Congress Subject Headings
- Library of Congress Subject Cataloging Manual: Subject Headings
- Anglo-American Cataloguing Rules*, second edition, revised (AACR2R)¹¹

In this text codes of rules are introduced chiefly to show how bibliographic languages are implemented. The Anglo-American Cataloging Rules

are used to illustrate work and document languages.¹² The current edition of these rules (*AACR2R*) is divided into two parts. The rules in Part 1 apply mostly to the description of documents; those in Part 2 to the description of works. To illustrate subject languages, the codes used are the Dewey Decimal Classification (DDC), the Library of Congress Subject Headings (LCSH), together with the accompanying manuals for their use, and various thesaurus standards. The rules that make up a code can be viewed as constituting a system that can be characterized and evaluated. How they are characterized and evaluated is discussed in the following sections.

Classification of Rules

The characterization of a rule system frequently takes the form of *classification*, which usually is the first step in a systematic research. The *AACR2R* rules have been classified in terms of their use, function, and the objects they describe:

- **Use** It has been shown that the AACR rules follow a Bradford-like distribution: a few rules account for most of the code's use, or, conversely, most rules are seldom used.¹³ Infrequently used rules do not require high visibility in the sense of being immediately accessible. Whether a rule is core or peripheral becomes of practical significance in contexts such as learning the rules, revising them, automating them, and developing interfaces to them.¹⁴ It is generally the case that user convenience is served by limiting the amount of information presented and suppressing information not of immediate use.
- **Function** There have been several classifications of AACR rules with respect to the functions they perform. This book classifies them by linguistic function, whether rules pertain to vocabulary, semantics, syntax, or pragmatics. Another classification using an entity-relationship approach divides them as specifying content, format, and sources of information; establishing entities, relationships, and attributes; supplying valid values of attributes; and specifying access points.¹⁵ Still another, this one designed for use of *AACR2R* in electronic form, classifies them as to source, choice, form, and definition.¹⁶ It is difficult to create a mutually exclusive and totally exhaustive classification of AACR rules, since the language used in the code mixes rules of different types in one expression. Besides being theoretically unsatisfactory, this is an obstacle in practical applications such as constructing interfaces and expert systems for cataloging.
- **Objects described** A recent object-oriented approach to deconstructing the bibliographic record looks at *AACR2R* rules from the point of view

of the bibliographic entities they describe, whether works (texts), publications (manifestations), or items.¹⁷

A classification of rules, applicable not only to AACR but to rule systems in general, looks at them according to whether they are algorithmic in nature (thus amenable to automation) or intellectual in nature (thus the eminent domain of thinking beings). From the point of view of intellectual foundations, this is an especially interesting classification in that it contributes to understanding the mechanics of bibliographic description and, at the same time, points to how these mechanics might be automated.

Evaluation of Rules

The *evaluation* of a code of rules is a necessary undertaking in a practical discipline whose products are expected to be effective and efficient. A code of rules, regarded as a system designed to achieve certain objectives can be evaluated with respect to how well it achieves these objectives. Effectiveness and cost are both at issue. A code can be faulted on one or both grounds if

- Its rules are excessive in number or overly complex, creating a code Andrew Osborn labeled "legalistic" and Pettee called "an encyclopedia of pedantic distinctions."¹⁸
- There is overlap in the functionality of different rules, such as rules for added entries and cross-references.¹⁹
- Similar situations are treated differently, such as the variety of devices for indicating part-whole relationships in AACR and the former LCSH rules responsible for inconsistencies like Libraries, Catholic, but Jewish libraries; Libraries, Children's, but School libraries.
- Its rules are redundant, appearing in more than one place in a code, such as a DDC rule in the schedules that is repeated in manual notes or a general rule that is repeated for each of its special cases.²⁰
- Its rules are formulated using an inconsistent, ambiguous, or complex syntax.²¹
- It fails to keep pace with changing technology.²²
- It fails to promote reasonable uniformity in practice.²³
- It fails to provide general guidance. No code of rules can anticipate all situations it might be expected to cover. The cataloger in such situations needs guidance in the form of objectives and principles. The omission of a statement of objectives and principles is a serious ground on which a code can be faulted, likened by Lubetzky to an attempt "to chart a map without a compass indicating the cardinal points."²⁴

Bibliographic Records

History

A bibliographic record is a description of a bibliographic entity that is formatted and inscribed on a medium. Over time the forms of bibliographic records have changed, primarily in response to changes in technology. In modern times (since Panizzi), bibliographic technology has been revolutionized twice — first at the beginning of the twentieth century when card catalogs replaced book catalogs and then again in the latter third of the century when online catalogs began replacing card catalogs.

The Panizzi Era In Panizzi's time bibliographic descriptions took the form of handwritten entries in book catalogs. Entries were displayed hierarchically.²⁵ Under each (main) author's name were listed alphabetically by title the works written by him. The first edition of a work held by the library was described in full. If the library held a second edition, its entry was listed under that for the first as: “—— Another edition.” If needed, information that served to distinguish it from the first would be given. If the library held more than one copy of an edition, it was described as: “—— Another copy.” This arrangement ensured that each document would be integrated into the catalog in the sense that it would display in the context of all the editions, translations, and adaptations of the work it manifested. For any given document, fullness of description varied according to how many of its features could be inherited by hierarchical force. Hierarchical displays not only ensured integration; they also achieved economy of expression in limiting what had to be said about an entity to only those features that could not be derived using membership and inclusion relationships.

In book catalogs, relationships of a nonhierarchical kind (that is, other than membership and inclusion) were indicated by cross-references. *See* cross-references linked related works, such as the Bible and a commentary on it. They were also used to achieve work collocation when access was sought through secondary attributes. For instance, if a document was authored by two persons, the main description (or main entry) would be made for the first author, and under the name of the secondary author a *See* reference would direct the user to the main description, which would display the document in its integrated context. The need for bibliographical references of the nonhierarchical kind to assist in navigation and colloca-

tion was well understood by Panizzi, who observed that the more numerous those references were, the more useful a catalog would be.²⁶

The Card-Catalog Era Supplementing and maintaining a book catalog was laborious. Space had to be left for new entries, and when space eventually ran out, sheets had to be interleaved in the catalog, with the overcrowding sometimes getting so out of hand that entries had to be inserted in nonalphabetical order. In the face of such difficulties, the card catalog came as a panacea. Making it even more welcome was that cards made possible the centralization, and thereby the mass production, of bibliographic descriptions. In 1901, through the agency of the Library of Congress, card-catalog copy began to be distributed to libraries throughout the United States. This was a landmark event in marking the beginning of shared cataloging — a giant step forward in the economizing of bibliographic effort, in actualizing the ideal of “once-only cataloging” and in realizing the possibility of universal bibliographical control through standardization.

The card catalog also brought with it some disadvantages. With the move from book to card catalogs, it was necessary to change the way bibliographic information was represented. Specifically, dashed entries no longer were appropriate; instead each document had to be described in full, using (normally) one card per document.²⁷ As a result some of the economy and structure afforded by hierarchical representation was lost, and so it became necessary to find new ways to depict inclusion and membership relationships. Elaborate filing rules were created for this purpose, so that the order of records in a card catalog mimicked the hierarchical ordering of entries in a book catalog. Each document was described in itself and also emblematically as manifesting a particular edition of a particular work. The latter was accomplished by including in the description of a document the name of the work it manifests, providing thus its bibliographic context. Added entries were introduced to indicate relationships and in part replaced cross-references. However, neither singly nor collectively could these devices restore the full relational power of book catalogs.²⁸

The Electronic Era The transition from card to online catalogs, though ongoing for over thirty years now, is still in its initial stages. This slow transition is due in part to difficulty in understanding the function of the bibliographic

record in an electronic environment. Some obvious adaptations have been made. Bibliographic records have been converted from card to Machine Readable Cataloging (MARC) format and the individual metadata elements in them have been coded. But there has been a loss of bibliographic structure. The tiered structure, so neatly displayed in book catalogs and more or less preserved by strict filing rules in card catalogs, has been lost almost altogether with the inevitable move to computer filing. Also in many online catalogs the syndetic structure, the structure used to guide users from the language they know to the language used in organizing information, has not been implemented. This is not a necessary consequence of computerization but has come about due to factors concomitant with it such as high costs, difficulties in execution, and misunderstandings of catalog functions.²⁹ In any case, technological advance has brought with it a steady deterioration in the integrity of bibliographic structures since the time of Panizzi and, with it, an undermining of bibliographic objectives.³⁰

Form and Function of the Bibliographic Record

The role of the bibliographic record in a digital environment is not yet clear. Especially unclear is what exactly a bibliographic record should describe. As observed above, a bibliographic record has served both as a surrogate for a physical document and as a description of an edition as a manifestation of a work. It has thus simultaneously (and fortuitously) served an inventory function and a conceptual or information function. But this is beginning to work less effectively. The increasing incidence of media in new formats has led to a divergence of the two functions, so that records designed for one function do not suffice for the other. It is hardly surprising that using one device to serve several functions should lead to trouble in times of technological change.

Suggestions are not lacking as to what ideally should be the objects represented by bibliographic records. Wilson argues that since the collocating of like information is the most important of all the bibliographic objectives, it follows that the entities described by bibliographic records should be works.³¹ Michael Heaney concurs, arguing that the major access to information is by the abstract work, then goes even further to propose making document or publication records and copy or individual item records in addition to work records.³²

Several suggestions as to how bibliographic records might be designed emanated from a forum convened to discuss the multiple-versions problem.³³ One was to make a composite record for an edition that would fully describe aspects common to all its versions and less fully describe (but do so to the extent necessary for disambiguation) other versions.³⁴ Another was to make a separate but full record for one version (a focal version) and partial records for the different versions pointing to the focal edition. A third was to make bibliographically independent records for versions and to link them. Using any of these means, hierarchical structures could be created for displaying work-level metadata followed by metadata pertaining to editions, followed by those pertaining to versions.

Complicating the question of the object of the bibliographic record is that in addition to its traditional inventory and conceptual functions, the technological revolution has imposed on it two other functions: that of communicating bibliographic information in a global environment and that of supplying data for the internal computer operations needed to create and maintain online catalogs. Having bibliographic records in a machine-readable form that is designed to be communicated globally can cause problems when these records are adapted for local library use. For instance, were a multiversion or multiedition record to be designed, it could happen that a given library would own some but not all the documents represented by it. Either the library would use the record as-is, which would confuse its users, complicate the inventorying of its holdings, and create difficulties in the exchange of bibliographic information, or it would customize it to its own holdings, which would be costly. Similar considerations apply to the bibliographic relationships represented on global bibliographic records. In adapting such a record to a local environment, should all these relationships be permitted to stand, showing the user all the bibliographic contexts in which a given document participates? Or should they be pruned and tailored to the locality, showing only those reflected in local holdings? Or should the bibliographic record show two different views, the universal and the particular?³⁵ These questions, caused by the incompatible demands put on the record to describe what exists in the bibliographic universe and what exists in a local library, need to be addressed in determining the record's form and function.³⁶

Bibliographic records in MARC format are fairly well suited to communicating bibliographic data, at least within the parameters discussed

above. However, they are not well designed for computer manipulation of this data. They have been criticized for their fixed-length, flat-file formats; for not presenting the kind of unified view of data required for efficient database design; and for being fraught with insertion, deletion, and update quirks that cause inefficiency in storing, maintaining, and performing retrieval operations on data.³⁷ To completely overhaul the MARC record, a standard that has been in force since the mid-1960s, is unthinkable for its economic, political, and bibliographical consequences. While MARC data can be refigured to streamline computer operations, consensus seems to be lacking on how to do this effectively and at a reasonable cost.

Given the burden put on it by the new media and the technological revolution, the traditional bibliographic record has so far remained surprisingly robust. This may yet change. Digital documents open the possibility of a radical deconstruction of the bibliographic record. Instead of gaining access to such documents indirectly through metadata on a surrogate record, access can be directly to the documents themselves, through the use of coding. Coding schemes, like the *Guidelines for Electronic Text Encoding and Interchange* and Standard Generalized Markup Language (SGML) guidelines, provide for identifying document attributes when and as they occur in the machine-readable text.³⁸ Where attributes essential for retrieval do not occur in the text, provision is made to supply them in document headers. The effect of this is to dispense with descriptions of documents as independent records and instead to distribute and embed the elements of description in the documents themselves.

An even more radical deconstruction is to dispense even with coding and to rely on documents to be self-describing. A system that relies on documents to be self-describing is founded on the supposition that the design of search algorithms can substitute for the crafting of individual bibliographic descriptions. The algorithms used in search engines today are still fairly primitive; many are based on keyword searching alone. As yet such systems have not been able to deal with the scatter and clog of information caused by the synonymy and homonymy of natural language, nor can they provide semantically useful displays of bibliographic data. But they have the potential to do so, transforming the theory of bibliographic description into a theory of bibliographic searching.

5

Principles of Description

Introduction

In the literature of bibliographic description the word *principle* has been used to refer to the objectives of a bibliographic system, to general rules in a bibliographic code, and to directives that guide the construction of a bibliographic language. It is the last sense that is used in this text, the sense Lubetzky used in noting that

One cannot undertake to outline a code of rules without directive principles anymore than one could undertake to chart a map without a compass indicating the cardinal points. Nor can one approach and apply intelligently a code of rules, however well constructed, without a knowledge of its underlying principles . . . without a knowledge of its cardinal direction.¹

This is also the sense of the word *principle* used in the International Federation of Library Associations and Institutions' (IFLA) *Principles Underlying Subject Heading Languages (SHLs)*, where *principles* are defined as "general directives for determining the construction and application of subject heading languages."² More generally, viewed as a directive for action (designing a bibliographic language is an action), *principle* falls under the *Oxford English Dictionary's* sense of "a general law or rule adopted or professed as a guide to action; a settled ground or basis of conduct or practice; a fundamental motive or reason of action, esp. one consciously recognized and followed."³

Bibliographic principles are different from bibliographic objectives and bibliographic rules. Objectives codify what a user can expect of a bibliographic system — to find a document, to find all manifestations of a work contiguously displayed, and so forth. Principles, on the other hand, are directives for the design of the bibliographic language used to create such

a system. This language normally takes the form of a code of rules. However, principles themselves are not rules but rather guidelines for the design of a set of rules.

Certain general principles govern the design of all systems, bibliographic and otherwise. Two of particular relevance to the design of a bibliographic language are the principle of sufficient reason and the principle of parsimony. Originally identified by Leibniz, and called by Ranganathan the canon of impartiality,⁴ the principle of sufficient reason requires that the grounds for each design decision be defensible and not arbitrary. The principle of parsimony, another of Ranganathan's canons,⁵ requires that where alternative ways exist to achieve a design goal, the way that best furthers overall economy is to be preferred.

In addition to general design principles are principles specific to the design of a bibliographic language. Those that have been recognized in the Anglo-American cataloging literature and followed in practice include the following:

- *Principle of user convenience* Decisions taken in the making of descriptions should be made with the user in mind. A subprinciple is the
- Principle of common usage* Normalized vocabulary used in descriptions should accord with that of the majority of users.
- *Principle of representation* Descriptions should be based on the way an information entity describes itself. A subprinciple is the
- Principle of accuracy* Descriptions should faithfully portray the entity described.
- *Principle of sufficiency and necessity* Descriptions should be sufficient to achieve stated objectives and should not include elements not required for this purpose. A subprinciple is the
- Principle of significance* Descriptions should include only those elements that are bibliographically significant.
- *Principle of standardization* Descriptions should be standardized, to the extent and level possible.
- *Principle of integration* Descriptions for all types of materials should be based on a common set of rules, to the extent possible.

User Convenience

The principle of user convenience requires that bibliographic descriptions be designed with the user in mind. It requires the user to be the focus in all

design decisions, no matter how minor.⁶ Cutter, the user's greatest champion, elevated this principle to a categorical imperative in his often quoted dictum that "the convenience of the user must be put before the ease of the cataloger."⁷ Cutter practiced what he preached. A striking example of this is his consideration for the unsophisticated user — children, the desultory user, and the man on the street who needs information quickly.⁸ This consideration led him to reject the traditional European classified catalog, which was designed for scholars, and to create a whole new subject approach to information — an alphabetic approach that would allow unsophisticated users to get what they want by a name that they know, without any guesswork.⁹

It was in the context of an alphabetic-subject catalog that Cutter introduced the principle of common usage. He called usage "the supreme arbitrar,"¹⁰ by which he meant that when things have alternative names (for instance, Cats and Felines), the choice between them should favor "the most usual name . . . , the one under which most people would be likely to look."¹¹ The common-usage principle was also recognized by Ranganathan, who called it the canon of the sought heading.¹² It is the cardinal principle governing the choice of terminology in all controlled vocabularies. In the current cataloging rules it is referenced by phrases like "commonly known," "predominantly identified," "most frequently identified," and "generally identified." The IFLA document on subject-heading principles calls it simply the "User Principle."¹³

Despite its preeminence as a directive, the common usage principle is both vague and unscientific.¹⁴ Cutter himself recognized this. The problem comes with trying to ascertain what usage might be common. There is no single public, no user writ large; rather there are many users, and the way they verbalize their search requests represents many different language usages. In an operationalization of common usage, AACR2R interprets a "predominantly identified" form of name to mean "the form found in 80 per cent of the author's works."¹⁵ This operationalization provides a decision rule; however, its validity can be questioned, as it represents the usage of publishers rather than that of the public. It identifies as "prominently identified" names such as Andersen, H. C. (rather than Andersen, Hans Christian) and Maugham, W. Somerset (William Somerset), rather than Maugham, Somerset.

The fact that language usage varies over place and time presents a dilemma insofar as vocabulary control has traditionally required a fixed usage. English-speaking users would expect to find Tchaikovsky's ballet listed as *Sleeping Beauty*, not under *Spışashchaia Krasavitsa*, which is its internationally accepted uniform title. The fact that this is a dilemma is illustrated by a request once made to the British Library that it assign two uniform titles to works: one formulated to conform to the international standard and the other formulated to be familiar to local users.¹⁶ Relevant to this dilemma is another of Ranganathan's canons, that of local variation, which requires that the needs of local constituencies not be ignored.¹⁷ In a digital environment, it is relatively easy to honor this canon as it applies to usage, since such an environment permits the automatic linking of various forms of names. Automatic or transparent linking allows unity to be achieved without sacrificing diversity. If all the different names by which something can be called are linked transparently, so that whichever a user chooses will make a direct match in retrieval, all usages are served, common and otherwise. Technological advance makes it possible to replace authority control with what Tillett calls "access control."¹⁸

During the last third of the twentieth century the principle of user convenience and its subprinciple of common usage have been the objects of research. Dozens of studies have been undertaken to determine how users search for information and what problems they encounter. While the existence of such studies underscores the importance attached to the principle of user convenience, the findings themselves are not unexpected. One finding is that users tend to use a very limited set of metadata, usually those found in bibliographic citations, such as author, title, edition number, publisher, place of publication, and date.¹⁹ This finding could have been predicted as an instantiation of the general law that human selection from any kind of store of items tends to follow a Bradfordian distribution.²⁰ Another finding is that in subject searches users tend to retrieve too many or not enough citations,²¹ which, again, is not unexpected insofar as it is anticipated by, and its antidote hypostasized in, the collocation objective. Another finding is that users have trouble matching their own vocabulary against that of the retrieval system they are using.²² This is not surprising as it illustrates the above-mentioned, well-understood problem of attempting to determine a single common usage.

Representation

The principle of representation requires bibliographic descriptions to be constructed to reflect the way bibliographic entities represent themselves. This principle is used primarily to ensure accuracy of description, though it is used as well to contain costs, to prevent idiosyncratic descriptions, and to assist in the construction of operational definitions.

Accuracy

A description is inaccurate if it in any way misrepresents an entity, making it seem what it is not. In bibliographic contexts, accuracy, in the sense of honest portrayal, is equated with truth in transcription.²³ Truthfully transcribing how a document represents itself is necessary for the identification and communication of bibliographic information. The metadata in a description are truthfully transcribed, or warranted, if (1) they come from a specified source and (2) they are copied in the form in which they appear there, except for capitalization and punctuation. These two conditions ensure the likelihood that two people describing the same bibliographic entity will create identical descriptions.

Prescribing a source of information from which data elements should be derived is a way of specifying how an entity can represent itself. In simpler times, when bibliographic entities were for the most part books published in Western countries, the choice of source was obviously the title page, the "face of the book."²⁴ In 1884 Charles Blackburn wrote: "It is I believe one of the laws of bibliography that catalog titles should be copies of the title pages of books."²⁵ Lubetzky wrote regarding the title page that "the most important characteristic of a book for the purposes of cataloging is the fact that it is provided with a prominent identification tag in the form of a title page."²⁶ Ravilious expressed the same thought in referring to a title page as "a magnet at which bibliographic minutiae collect like iron filings."²⁷ Cutter spoke of "the cult of the title page" and how "its slightest peculiarities are noted; it is followed religiously, with dots for omissions, brackets for insertions and uprights to mark the ends of lines; it is even imitated by the facsimile type or photographic copying."²⁸

The title page of a book is a reliable source, since it, together with its verso, usually contains all bibliographically significant data. Most nonbook

materials, however, lack a convenient identification tag in the form of a title page. This difficulty has been met by specifying for each of the different kinds of nonbook materials title-page analogs — that is, the chief source from which data can be taken. Though the sources vary, depending on material type, an attempt at uniformity was made by specifying common criteria for the selection of sources. In 1975 C. P. Ravilious identified three such criteria as a result of surveying codes specifically geared to the description of nonbook materials.²⁹ These criteria, along with some of the problems attending them, are

- *Comprehensiveness* Given a choice of several sources, data are to be taken from the source that gives the fullest, clearest, and most authoritative information — that is, from the source that most adequately identifies the item. A problem with this criterion is that sources do not always behave in such a manner that it is possible to identify one that is most comprehensive.
- *Proximity* Given a choice of several sources, data are to be taken from the source that is nearest the item's content, such as an internal source. There are at least three reasons why this criterion is an uncertain guide: (1) the data on the item itself may not be complete, (2) the data may not be authoritative, and (3) it may be difficult or time consuming to get to the data (for example, when the source is unreadable without processing, as is the case with compressed or printer-formatted-data in an electronic resource).
- *Persistence* Given a choice of several sources, data are to be taken from the source that is most enduring (for example, from the item itself) rather than its packaging. Taken literally, this criterion would require taking data from a sound recording rather than the label affixed to it and from the title and end frames of a video or from the internal screens of an electronic resource, rather than from containers for these items, labels on the items, or accompanying documentation. This makes the criterion subject to the same problems as those afflicting the proximity criterion.

With modification, Ravilious's criteria were used for the various nonbook International Standard Bibliographic Descriptions (ISBDs) to develop a preference ranking of sources for bibliographic data. But ranking does not address the major problem, which is that often no single source is comprehensive. Data from a chosen source can always be supplemented with data from other sources, bracketed to signify their nonstandard origin. There is a danger, however, of too often gravitating toward the default position, where data are taken from anywhere in an item — in effect, treating several sources as a unitary source. This could imperil accuracy (the reason

for prescribing a source in the first place), since a given datum, such as a title, can appear in different forms in different places on a document. The only way accuracy could be ensured would be to accompany each datum with a location-where-found annotation. Truth in transcription was once relatively easily ensured by faithfully copied title pages, but with the influx of nonbook materials it has become troublesome and has raised to a theoretical level questions about the limits and purpose of accuracy and the conditions required to ensure it.

In some cases data may be accurately transcribed from a document, and yet the resulting description is not truthful. For instance, a document may announce itself as a second edition, whereas in reality it is only a reprinting of a first edition; or it may purport to be by a given author, whereas in reality it is the work of a ghost writer; or it may be attributed to a corporate body and yet be written by a person. What is to be done in such cases? Lubetzky suggests that one can be guided by the principle of representation:

It must be recognized that it is really not “the writer of a book” or the creator of a work who will generally be regarded as the author or the one “chiefly responsible” for it, but the one who lent his name and authority to it — the one *represented* as the writer of the book or as the creator of the work, who presumably formally assumed responsibility for it.³⁰

When bibliographic reality conflicts with existential reality, the former has the stronger claim. The reason for this is primarily economic. In-depth bibliographic research of the sort that pursues questions of attribution is a luxury affordable only in special situations, such as in the description of art works or rare books, not in the day-to-day work of introducing order into the bibliographic universe. Some small indulgences are permitted. When ambiguous, unintelligible, or obviously inaccurate statements appear on documents, these may be explained or corrected, within brackets and to a reasonable extent.³¹ Nevertheless limitations must be set, and here the principle of representation becomes an injunction to eschew brooding over the true nature of a bibliographic entity — and, not incidentally, to eschew the temptation to make idiosyncratic descriptions.

Definitional Role of the Principle of Representation

In chapter 2 it was seen that difficulties in defining terms such as *edition* and *author* can sometimes be resolved by enumerating character strings on documents that are indicative of editionhood or authorship. A given

document is a second edition if it says it is. A person is an author if that person is represented as such. The principle of representation thus has a role to play in resolving definitional ambiguities. In those cases where it is not clear how an entity (x) represents itself, conditions can be enumerated under which x is represented as y . For instance, in the classic case of a report prepared by a personal author and issued in the name of a corporate body, conditions are stated under which the report can be said to emanate from the body — for example, the report is of an administrative nature or records the collective thought of the body. A fully operational definition would go a step further to specify just which character strings on the report are indicative of “being of an administrative nature” or “representing collective thought.” Presently there is considerable interest in how bibliographic information is represented on documents, and this may be expected to continue. Both standardization and automation assume that a document is what it represents itself to be and that clues in and on them can be used to infer in a mechanical or semimechanical way what a document’s title is, who its authors and publishers are, and even what it is about.

Limitations of the Principle of Representation

The principle of representation if carried too far would result in bibliographic descriptions that individually are correct but when taken collectively are inconsistent. It would go against the principle of user convenience if bibliographic records — say, for books — were literal copies of their title pages. Title pages vary considerably. They contain differing amounts of information, not all of it of interest; the order in which the information is presented varies, with the author appearing either before or after the title; different conventions are used for punctuation, abbreviation, and capitalization; and so on. If bibliographic descriptions mirrored title pages, the information they impart would be difficult to grasp quickly; the eye would never know where to find a given kind of datum, such as an author or title. To facilitate scanning, certain aspects of descriptions need to be made uniform. These include the selection of data elements, the order in which they are displayed, and their punctuation, capitalization, and abbreviation. Thus, the principle of representation is curtailed by the need for consistently formatted bibliographic records.

Accuracy in description does not by itself ensure effective retrieval. Thus, the principle of representation is of limited scope in that it deals only with those aspects of description based on derived vocabulary. Descriptions cannot consist of derived data alone because the language in which a document represents itself is not necessarily the one a user would use to look for the document. A user cannot be expected to guess the name or form of name by which an author is represented on a document. To gear the language of users to the language of documents, a normalized vocabulary must be introduced to supplement vocabulary derived from documents. The principle of representation is useful in developing means to achieve the finding and identification objectives, but here its usefulness stops.

Sufficiency and Necessity

Since Aristotle’s time, philosophers have debated the nature of description, attempting to distinguish the attributes of things that are essential from those that are accidental. In the context of bibliographic description, the endeavor is the same; the attempt here is to distinguish attributes that are bibliographically significant from those that are not. The directive that guides determinations of bibliographic significance is the principle of sufficiency and necessity. This principle requires a bibliographic description to be full enough to meet the objectives of a system for organizing information and, at the same time, contain no data elements extraneous to these objectives.

Panizzi implicitly tied considerations of sufficiency and necessity to the bibliographic objectives when he argued that descriptions must be full enough to distinguish one edition of a work from another and to enable a choice to be made from among similar editions.³² Lubetzky made the connection explicit. Up until the 1940s it was generally assumed that the description of a book should faithfully reproduce all data elements on its title page. Lubetzky objected to this, arguing that objectives, not title pages, should determine what was and what was not essential in a description. If data elements on a title page did not further a bibliographic objective, they were to be excluded; if data elements were not on a title page and yet were necessary to meet one of the objectives, they were to be introduced.³³ Relying on objectives rather than on an unthinking adherence to the principle of representation was a revolutionary concept at the time (1946) and

was opposed on the ground that omitting title-page elements in a bibliographic description would make it impossible to distinguish various editions of a work. This argument proved to be not valid.³⁴

Nevertheless, a problem arises in referencing bibliographic objectives to determine essential data elements, at least as the objectives are currently formulated. The problem is caused by the open-ended objectives. The choice objective in encouraging the inclusion of any data element that might be useful in the selection of a document can lead to the proliferation of expensive detail. The same is true of the navigation objective and even the collocation objective. As was earlier observed, containing bibliographic detail needs to be addressed at the level of objectives — in particular, the open-ended objectives. Only when this is done can the objectives be used to settle questions of necessity and sufficiency.

Cutter was one of the first to face the problem of necessary versus unnecessary data elements. He viewed appropriate fullness of description as a variable, depending on local needs and circumstances, such as library size. Accordingly, he distinguished three kinds of catalogs — short, medium, and full. This distinction continues to be carried in cataloging codes to the present day, but it is becoming less useful as global cataloging renders distinctions based on library size irrelevant. The goal of reducing bibliographic effort so that one item need be described only once worldwide necessarily assumes adherence to a uniform level of description, one deemed adequate for national libraries.

Occam's Razor

The principle of sufficiency and necessity at times acts like the principle of parsimony, a brake limiting the metadata admissible in description. It is generally, though not quite accurately, assumed that the cost of making descriptions increases in proportion to the number of data elements they contain.³⁵ This leads to the conclusion that data should not be multiplied unnecessarily, which in turn leads to taking up Occam's razor and slashing elements deemed bibliographically insignificant. Decisions as to which these are have been justified on various grounds, among them reason, empirical warrant, and expert opinion.

The most celebrated wielding of Occam's razor followed on Lubetzky's "Is this rule necessary?" campaign of 1953.³⁶ Having achieved earlier suc-

cess in eliminating title-page data not required by the bibliographic objectives, Lubetzky, as a further step in his reform to simplify cataloging, set about eliminating redundancy in the rules for providing identifiers for bibliographic entities. Observing that many of these rules were designed to fit specific cases rather than general conditions,³⁷ he subjected them one by one to stringent review. Was a given rule part of a larger rule already included in the code? If so, it was redundant and had to be eliminated. Was it consistent with other rules? If not, it had to be revised. A tour de force of rational argument, Lubetzky's campaign was successful, and the consequent simplification of the rules for identifying bibliographic entities was heralded as a return to principle.

The problem how to simplify bibliographic description by eliminating unnecessary metadata has been approached through empirical research. Following Lubetzky's call to eliminate unnecessary title-page data elements, a study was conducted at the Library of Congress to assess the effectiveness of page count in distinguishing one edition of a book from another.³⁸ (The study was needed to refute the argument that full title-page transcription was necessary to identify a document.) Though the sample was small, page count, along with author and title data, did in fact prove a reliable indicator of bibliographic uniqueness. Half a century later, in a bibliographic world significantly more complex, Ed O'Neill and others conducted a similar study at the Online Computer Library Center (OCLC).³⁹ For the purpose of weeding out duplicate records on the OCLC database, they developed a duplicate detection algorithm based on thirteen weighted data elements, which they then tested for efficacy. These data elements proved to be sufficient for meeting the identifying objective for a bibliographic database of over 36 million records.

Empirical research has also been used to explore the necessity and sufficiency of bibliographic data elements from a users' point of view. The Seal study mentioned earlier, which surveyed catalog use in a polytechnic library of 320,000 books and 160 nonbook materials, pitted an experimental catalog containing only brief bibliographic records against a normal catalog containing full records.⁴⁰ Participants in the experiment were asked first to search in the experimental catalog and then, only if they could not find what they wanted, to use the normal catalog. It was found that in 92 percent of the searches there was no need to resort to full records.

Several observations can be made about this and other such studies. First, as already has been observed, the results are to be expected in that the frequent use of a few data elements obeys the Bradfordian law of selection. Second, because of their limited scope and the simplifying assumption that only user-identified data elements need be included in descriptions, the studies lack external validity. In a global bibliographic environment, the act of uniquely distinguishing one information entity from another is no longer a local matter. The few metadata elements needed to distinguish 480,000 documents hardly suffice to distinguish a hundred times that many. Third, such studies, in their intent to understand the user, as represented by J. Q. Public, overlook the often more complicated needs of another class of users — those involved in database construction and maintenance. J. Q. Public may seldom need to distinguish nearly identical documents, but acquisition librarians need to do so on a daily basis. Moreover, even a sophisticated J. Q. Public may have only a limited understanding of his needs, unaware of the guidance that is given by full rather than abbreviated bibliographic records.

The most usual approach to data element elimination has been to rely on expert opinion. An example is the expert opinion lodged at the Library of Congress and promulgated in its rule interpretations. Many of the Library of Congress rule interpretations (LCRIs) are indeed interpretations in the sense of clarifying ambiguity, but some have the sole purpose of cost-cutting. LCRI 1.1F1 limits statements of responsibility by ruling on the bibliographic significance of persons whose names appear on a document (book-jacket designers are out). LCRI 2.5C1 and 2.5C2 override the AACR2R rule suggesting that various types of illustration be named (such as coats of arms, facsimiles, forms, genealogical tables, maps, music, plans, and portraits), recommending instead that all illustrative matter regardless of type be indicated by *ill.*⁴¹

Because of the need to standardize bibliographic descriptions, the expert opinion relied on for decisions of sufficiency and necessity frequently is lodged in political bodies like task forces working under the aegis of national and international associations. Through cooperative efforts such bodies work toward a consensus on minimal data-element sets. An example is the Program for Cooperative Cataloging's core-level record standard for books.⁴² Others are the Cooperative Online Serials Program (CONSER)

standard for serials⁴³ and the data-element set produced through an exercise in bibliographic modeling by the IFLA Study Group on Functional Requirements for Bibliographic Records.⁴⁴

The principle of sufficiency and necessity can be used to justify either expanding the number of data elements in a description, as was done by Panizzi, or reducing them, as was done in the polytechnic experiment. Decisions relating to bibliographic significance are difficult but are not entirely a matter of the opinion of users or experts. An objective determination can be made of the data elements needed to identify a bibliographic entity and distinguish it from other like entities.⁴⁵ It is where the objectives are open-ended that decisions must be left to those who are able to balance user needs and bottom lines.⁴⁶

Standardization

It has been observed that “the entire history of bibliographic control is that of the establishment of standards and their subsequent modification.”⁴⁷ In the mid-nineteenth century Charles C. Jewett saw standardization as a necessary condition for the union catalog he was advocating to be housed at the Smithsonian Institution. He envisioned this catalog as containing records for the holdings of all public libraries in the United States. Such a catalog would be an instrument for national bibliographical control, facilitate the exchange of bibliographic information, and reduce duplication of effort through cooperation. For such a catalog to be made actual, bibliographic records would have to be constructed according to a uniform style. Accordingly, he wrote: “The rules for cataloguing must be stringent, and should meet, as far as possible all difficulties of detail. Nothing, so far as can be avoided should be left to the individual taste or judgment of the cataloger.”⁴⁸

Jewett did not live to see a union catalog realized. The requisite technology to mass produce and distribute bibliographic records did not exist until card catalogs began replacing book catalogs. The year the Library of Congress began its card-distribution program, 1901, marks a technological advance and the beginning of union catalog building in the United States. During periods of technological advance, cooperative fervor and activity tend to accelerate, and the drive toward standardization is strong.

The beginning and end of the twentieth century were two such periods — first when card catalogs were introduced to replace book catalogs, and then again when online catalogs superseded card catalogs.

To standardize means to bring into conformity with “something established by authority, custom or general consent.”⁴⁹ A natural language is only partially standardized through the force of custom; a bibliographic language, on the other hand, is strictly standardized through the general consent of those involved in building international codes. The development of a standardized lingua franca for bibliographic description is a twentieth-century achievement, due in large part to IFLA’s ability to provide the infrastructure by which representatives from countries worldwide could meet and hammer out consensual accords.⁵⁰ A milestone in IFLA’s standardization activities was the 1961 International Conference on Cataloging Principles. At this conference fifty-three countries and twelve international organizations met to agree on principles for the selection and normalization of metadata for accessing bibliographic information. Eight years later, another important conference, the International Meeting of Cataloging Experts (IMCE), led to the establishment of international standards for bibliographic description. Eleven years after this still another historic international meeting was convened, this time to develop a universal Machine Readable Cataloging (MARC) format (UNIMARC).

Standardization admits of degree. Some, such as Jewett and the IMCE experts, would argue that the international exchange of bibliographic information requires maximum standardization of bibliographic descriptions,⁵¹ but others are concerned that standardization can be carried to excess. One danger of excessive standardization is conflict with the principle of user convenience. Cutter wrote that

strict consistency in a rule and uniformity in its application sometimes lead to practices which clash with the public’s habitual way of looking at things. When these habits are general and deeply rooted, it is unwise for the cataloger to ignore them, even if they demand a sacrifice of system and simplicity.⁵²

Prophetically he observed that “no code of cataloging can be adopted in all points by everyone,”⁵³ an observation echoed fifty years later by J. C. M. Hanson: “Should an international code ever become a reality, many librarians would refuse to subscribe to it in its entirety.”⁵⁴

A second danger of standardization carried too far is that the reasons and principles underlying a bibliographic code become obscured. Andrew

D. Osborn argued this point, using the term *legalistic* to damn a code that attempts to include rules and definitions to govern every point that arises.⁵⁵ Lubetzky did as well, finding himself unable to “view with equanimity the continuous proliferation of the rules, their growing complexity, and the obscurement of the objectives and design of the code as a whole.” This led him to ask his riveting question: “Are all these rules necessary? are all the complexities inevitable? is there an underlying design which gives our code unity and purpose?”⁵⁶ To which his answer was that cataloging should be done by principle rather than by a slavish following of rules. Paul Dunkin in his *Cataloging U.S.A.*, a history of Anglo-American cataloging, relates how over the years the pendulum has swung between the opposing forces of legalism (the law, as represented by Jewett) and romanticism (the prophets, as represented by Cutter, Osborn, and Lubetzky).⁵⁷

A third danger of overstandardization is its tendency to inhibit change. Bibliographic change is necessarily conservative. Where technological, political, and economic forces make change seem desirable, expense of money, spirit, and effort is often sufficient to counter it. For example, while it might be desirable to modify the present MARC format to make it more suitable for communicating bibliographic information and for database design, so entrenched is this standard, so hard-won through years of cooperative effort, that to set in motion the elaborate and time-consuming political mechanisms needed to effect a major change is hardly an option. Where changes to bibliographic codes and formats are introduced, they are normally minimal and incremental, which sometimes leads to sacrificing conceptual consistency for a quick Band-Aid fix.⁵⁸

Given that standardization in bibliographic description can be excessive, the question arises of how to limit it — how to determine just which aspects of description need to be standardized. Ron Hagler suggests limiting standardization to only those aspects that are essential for the identification of works and documents. While the rules governing these should be prescriptive, those governing other aspects of description could well be discretionary.⁵⁹ The suggestion has merit, not the least because it can be acted on, since it is in fact possible to ascertain those data elements essential for identification.⁶⁰

- One aspect of bibliographic description that does not require standardization in the traditional sense has already been mentioned. This is the standardization achieved by normalizing of names for works, authors, and

subjects. Whereas in a card-catalog environment, normalization required the choice of one authoritative name, in an digital environment, transparent linking allows authorized names to be replaced by compatible names.⁶¹ This does not mean that rules for normalizing can be dispensed with entirely but only that different rules are needed to ensure a uniform practice. In any case, the principles of standardization and common usage need no longer conflict. Insofar as universalism in any endeavor is furthered by the preservation of diversity, standardization that does not abrogate the need for local variation is a giant step forward in universal bibliographic control.

Integration

The principle of integration is a directive to use a common set of rules for all media, with exceptions being made only for material-specific attributes. Both the principle of standardization and the principle of integration mandate uniformity in description — the former across space and time and the latter across material type. Uniformity in describing bibliographic entities, irrespective of the medium in which they are embodied, is desirable for several reasons: it serves the objectives of the catalog, particularly the collecting objective; it serves user convenience in providing a common interface to bibliographic information; and it serves the principle of parsimony in achieving economy of expression.

Since Panizzi's time, descriptive codes have had to deal with documents in some way out of the ordinary — for example, those using typography other than alphanumeric characters, such as musical notation, or those not packaged in book form, like a single map. For documents such as these, special rules had to be developed. Panizzi and Cutter both sought the help of experts to develop rules for music materials. In the 1940s and 1950s, the Library of Congress also turned to specialists to draft rules for its growing collections of motion pictures, sound recordings, and pictures. The Library of Congress rules proved difficult to use and, as a result, were rejected by most school and public libraries. This led to a proliferation of locally developed manuals to describe nonbook materials, simultaneously abrogating the standardization principle and that of integration.

Early in the 1970s reaction set in, and a swing began away from specialization and toward integration. Committees first in Canada and then in

England and the United States began to formulate rules for nonbook materials that would be compatible with those used for books. As might be expected, some opposition to this was voiced, with one critic complaining that "what was good for monographs and serials suddenly seemed equally desirable for cartographic materials, old or rare books, music and non-book materials in general."⁶² Particularly strong opposition came from the Association for Educational and Communications Technology, which, though it has since come round somewhat, still today favors an anti-integration stance.⁶³ Despite the opposition, the drive toward integration gathered steam, culminating in the early 1980s with the publication of AACR2, which was hailed as "a major breakthrough" in integration.⁶⁴ Belief that integration was a good thing elevated it to a principle.

The attempt to extend a bibliographic language originally designed to describe documents in one medium to encompass all media tests the theoretical soundness of the language. The language becomes strained as problems are encountered and its flexibility is challenged. Some problems are relatively easy to solve. The fact that nonbook entities lack authoritative sources of information such as title pages is a problem; but (as has been seen) means for designating title-page substitutes can be devised. The fact that many nonbook entities lack titles is a problem;⁶⁵ but this can be dealt with by generalizing already existing rules devised for books that lack titles. The fact that many nonbook entities require special equipment to be experienced is a problem; but it can be handled by requiring technical specifications and summaries in bibliographic descriptions.

Problems not easy to handle in generalizing a book-oriented language are definitional in nature. The definitions of *publication* and *publisher* are examples of this. The concept of *publication* may be extended beyond its traditional connotation of formal publication to its broader etymological meaning of "to make public" and that of *publisher* to "any release agent." However, doing so results in the loss of useful distinctions, spawns difficult-to-decide cases, and causes inconsistencies. Take the case of electronic documents. The *International Standard Bibliographic Description for Electronic Resources (ISBD(ER))* considers these to be published.⁶⁶ But it is a question whether they are any more "made public" than manuscripts and original works of art, which, though they may be viewed by many people, are not technically published.

As for the concept of publisher, when defined broadly it assumes a chameleon quality. For instance, if an electronic document is not identified as having a formal publisher (in a traditional sense), the author, regarded as “release agent,” might be taken as publisher; if the same document happens to bear not only the author’s name but also that of a distributor, then the distributor might be taken as publisher; if the same document bears the name of the author, distributor, and also that of a publisher — well, of course, the publisher is the publisher. But when the concept of publisher varies with what happens to be written on the document, it begins then to lack intrinsic meaning.⁶⁷

Even more serious are the definitional problems attaching to the concepts of work and edition. The difficulty of interpreting these concepts for nonbook materials (discussed in chapter 3) is the kind that strikes at ontological commitment and shakes theoretical foundations. If it is not clear how these concepts are to be defined, then it follows that it is not clear what is meant by the bibliographic objective that calls for bringing together the various editions of a work. In other words, it is not clear what it is that is supposed to be organized.

The concept of author is also problematic in translating a book language to a multimedia language. For the century and a half since Panizzi, it has been assumed that users search for information by author. However, this assumption is not valid for many nonbook materials, particularly those of mixed authorship that involve numerous people performing different kinds of functions. In the creation of moving-image materials, for instance, many people are engaged in a variety of artistic and intellectual roles, no one of whom is an author in the commonly understood sense. For these and other nonbook materials, the concept of author wobbles, and when this happens, so too does the objective that requires collocation by author. When in a theory something as high-level as an objective begins to lose some of its universality, then the foundation of that theory begins to crack.

It is possible that the definitional problems raised by nonbook materials are serious enough to tilt the integration-nonintegration balance back toward nonintegration. An indication that this may be happening is another acceleration in the publication of manuals for nonbook materials. While these purport to be interpretations of the *Anglo-American Catalog Rules*, second edition, revised (AACR2R), they clearly extend its

reach. It remains to be seen whether this phenomenon is significant enough to represent a move away from a common bibliographic language that integrates rules for documents in all media, to a family of loosely related, medium-specific languages.

The principle of integration, like the principles of user convenience, representation, sufficiency and necessity, and standardization, functions as a directive guiding the construction of bibliographic languages. Principles direct in the sense of providing a rationale for design decisions. Other things being equal, where there are design alternatives, one that references a principle is to be preferred to one that does not. But this is obvious — a textbook maxim. Frequently other things, notably costs, are not equal, and frequently one principle vies with another in decision making. The following chapters on the design of specific languages illustrate conflicts of this sort and provide additional examples of how principles function — their usefulness, viability, and internal conflict — in bibliographic description.

organize documents on the Internet and particularly as they might do this using a universal bibliographic language.

4. Automation research raises the question of which aspects of the procedures used to organize information are algorithmic in nature (and thus amenable to automation) and which are truly intellectual (and thus the domain of thinking beings). This question, formulated half a century ago, still awaits a satisfactory answer. In partial answer, it can be said that automation efforts can proceed only so far before coming up against a semantic barrier. At this barrier questions of meaning and significance intrude, which means that efforts to automate the organization of information must then fall back on lexical information intellectually compiled and structured. While it is possible to build semantic structures from scratch, doing so would take a long time — as long as it has taken to create the authority files, multilingual thesauri, and classificatory structures developed in the context of traditional bibliographic systems. It would make better economic sense to adapt traditional structures to this purpose, but, however it is done, it will have either to reference or to recreate the intellectual foundation of information organization.

Notes

Chapter 1

1. Carpenter (1994, 107).
2. Brault (1972, 3–11).
3. *Bibliographic* is used in this book in an extended sense. Bibliographic objects are all objects embodying information and not just those in biblio or book form. Bibliographic systems for organizing information include the traditional systems for cataloging, classification, and indexing, as well as modern systems for automatic clustering, partitioning, and indexing.
4. Santayana (1932, 1:284).
5. Cutter (1904, 5).
6. Coffman (1998).
7. Bertalanffy, von (1972).
8. Cutter (1876a, 1876b).
9. Miksa (1977).
10. In the context of cataloging rules, this concept has recently been expressed by Taniguchi as “oriented-ness.” Taniguchi (1999).
11. Bridgman (1938).
12. Eddington (1929, 251).
13. Waples (1931).
14. See *The Encyclopedia of Philosophy* (7 and 8: 240–246).
15. Wittgenstein (1953).
16. Kaiser (1911).
17. See, for instance, Foskett (1996).
18. Like the statistical concept significance, information is associated with improbability and the removal of uncertainty. Various attempts have been made to incorporate the Shannon-Weaver definition of information into other disciplines, but since it is statistical, rather than semantic, most have been unproductive.

19. Webster's Third New International Dictionary, s.v. "information."
20. Wilson (1968, 17).
21. Drucker (1988, 46).
22. Langer (1949).
23. There are of course exceptions. The AACR2R presents rules for describing realia, which includes "naturally occurring entities."
24. Quoted in Lubetzky (1969, 1) from *The Home Book of Quotations*, 6th ed., rev., edited by Burton Stevenson (New York: Dodd, Mead, 1949), attributed to the Rev. George Dawson, who used it in his *Address on Opening the Birmingham Free Library*, October 26, 1866.
25. Since this book is concerned with messages that are recorded (that is, documents), the term *message*, having served its purpose by bringing the discussion to this point, will not be used much in the rest of the book.
26. As early as 1907, Paul Otlet defined a document as "whatever represents or expresses an object, a fact, an impression by means of any sign whatever (writing, picture, diagrams, symbols)." See Rayward (1997, 32).
27. Webster's Third New International Dictionary, s.v. "document."
28. Pettee (1936, 80). Pettee's statement has been challenged by de Rijk (1991).
29. For instance, it may be inferred from this statement: "A reader may know the work he requires; he cannot be expected to know all the peculiarities of different editions; and this information he has a right to expect from the catalog." Commissioners Appointed . . . (1850), Q 9814. Note: Question numbers reference the *Minutes of Evidence*.
30. Pettee (1936).
31. Ranganathan (1955).
32. In the early 1960s Lubetzky opposed works sometimes to editions and sometimes to publications. His most forceful expression of the work-versus-book distinction is in his *Principles of Cataloging* (1969, 11–15).
33. Quoted in Pettee (1936, 79).
34. Commissioners Appointed . . . (1850), Q 5103.
35. The problem of operationalizing work is discussed further in Chapter 3.
36. Commissioners Appointed . . . (1850), Q 9814.
37. McLuhan (1964).
38. Exceptions always cause problems, as when a long document runs over several physical objects or one physical object contains several different documents. But problems like these are relatively easy to handle.
39. Attributed to Heraclitus. *The Encyclopedia of Philosophy* (3 and 4: 479).
40. Leibniz (1951).

Chapter 2

1. Cutter (1876b, 10).
2. In a note to the second edition of his *Rules*, Cutter observes that his statement of objectives, which he followed also by a statement of means, "has been criticized; but as it has also been frequently quoted, usually without change or credit, in the prefaces of catalogs and elsewhere," he supposes it has on the whole been approved. The fact that this statement of objectives is also quoted frequently today, more than 100 years later, testifies to their stability and to the endurance of their intellectual foundations.
3. Lubetzky (1960, ix).
4. IFLA (1962, 91–92).
5. IFLA (1998, 82).
6. Wilson (1983, 6–8).
7. The IFLA model distinguishes also other entities not recognized in earlier statement of objectives. One of these is expression, which is the set of all intellectual, as opposed to physical, realizations of a work "in the form of alpha-numeric, musical, or choreographic notation, sound, image, object movement, etc., or any combination of such forms" (IFLA, 1998, 18).
8. Butler (1953, 7). The concept of navigating the bibliographic universe, if not the word "navigation," has figured in the library and information science literature throughout the twentieth century. See, for instance, Rayward (1997, 27).
9. Belkin (1982).
10. Identified as a group first in 1980, the navigation rules in the Anglo-American Cataloging Rules (AACR) have several times since been the focus of empirical study. In their doctoral theses, Barbara Tillett (1987), Richard Smiraglia (1992), and Sherry Vellucci (1995) have studied and classified them not only as represented by AACR rules but also in terms of their frequency of cooccurrence in bibliographic descriptions. Michèle Hudon has written about subject relationships in her dissertation (1998, 612–667); Margaret Willets has written an article about them (1975).
11. The IFLA model distinguishes also other entities not recognized in earlier statements of objectives. One of these is expression, which is the set of all intellectual, as opposed to physical, realizations of a work "in the form of alpha-numeric, musical, or choreographic notation, sound, image, object movement, etc., or any combination of such forms." IFLA (1998, 18).
12. O'Neill, Rogers, and Oskins (1993).
13. Cleverdon (1962).
14. Carlyle (1994).
15. Cutter (1904, 15).
16. See, for instance, Cromwell (1994).

58. Bhattacharyya (1979).
59. Kaiser (1911).
60. Vickery (1966, 132).
61. Kintsch and Van Dijk (1978).
62. Wilson (1968, 77).
63. Hutchins (1975, 80).
64. Wittgenstein (1953, 19).
65. Normally the word *language* is understood to mean verbal language, either written or spoken. However, because language is a system of symbols used for communication, it is possible to speak of other languages, such as the language of flowers and the language of music. See Svenonius (1994) for a discussion of the visual and musical languages.
66. Ryle (1959).
67. Carlyle (1902, 78).
68. Gopinath (1970, 58).
69. Cutter (1904, 67).
70. Miksa (1983, 38 ff).
71. An exception is when a novel is clearly focused on a nameable topic, such as the Civil War in the case of *Gone with the Wind*.
72. *Genre* is a difficult term to define. It tends to be defined differently for different types of materials. In fiction books and films, it is often defined in terms of story type or approach, such as mystery, western, or *film noir*. In painting, it may be defined in terms of material used (oil painting), object that is painted (still life), the period of creation (modern), or painterly approach (cubist). For a discussion of indexable attributes of images, see Layne (1994).
73. Ranganathan (1957, 25).
74. Wilson (1968, 9 ff).

Chapter 4

1. There is an essential difference between organizing information to compile an encyclopedic compendium of knowledge and organizing it for the purpose of information retrieval. In the former, what is ordered and arranged is the information itself; in the latter, it is the documents embodying information (such as books systematically arranged on library shelves) or their surrogates (such as catalog cards alphabetically arranged in a catalog). In the context of information retrieval, the modus operandi of information organization is not compilation but description.
2. *Webster's Third New International Dictionary*, s.v. "description."
3. The current view on authors is that they do not include corporate bodies. Corporate bodies are rather regarded as emanators. For economy of expression, in

- this text the term *author* will be used in an extended and generic sense to include both persons and corporate bodies.
4. Analogously, work and document languages could be subdivided by the bibliographic relationships each recognizes.
 5. *Webster's Third New International Dictionary*, s.v. "vocabulary."
 6. Svenonius (1992, 8).
 7. Svenonius (1990c, 92–100).
 8. In a subject language, facets are also used to define vocabulary domains. As such they determine what a document can be about. They are used as well in constructing the relational semantics for a subject language insofar as relationships are defined as holding within or across facets.
 9. Kaiser (1911).
 10. An exception to this statement is keyword languages.
 11. For exact citations see the Bibliography under International Federation of Library Associations and Institutions; International Organization for Standards; Library of Congress; and Online Computer Library Center.
 12. Throughout the text AACR will be used to mean the Anglo-American cataloging rules generically understood and not the publication that constitutes the first edition of these rules. This is because the points being made for the most part apply to traditional Anglo-American cataloging generally and not to a particular manifestation of it. When specific reference to the current edition of the rules is needed, AACR2R (*Anglo-American Cataloging Rules*, second edition, revised) will be used.
 13. That Bradfordian distribution characterizes the use of cataloging rules was first noticed by Ann Fox in 1972. More recently, it has been demonstrated in a small study by Abrera and Shaw (1992).
 14. Molto and Svenonius (1998).
 15. Fidel and Crandall (1988); see also Molto and Svenonius (1991).
 16. *Ibid.*
 17. Using an object-oriented approach Michael Heaney (1995) suggests segregating attributes pertaining to works (texts), publications (manifestations), and items, respectively, and, by implication, the rules specifying them.
 18. Osborn (1941, 395–399); Pettee (1936, 290).
 19. Tillett (1987); Svenonius (1996); Lubetzky (2000). Another example of role confusion is the treatment of the part-whole relationship, which in present online catalogs (admittedly in card catalogs as well) are shown in some instances by added entries, in some instances by cross-references, in some instances by analytic entries, in some instances by multilevel records, in some instances in holdings records, in some instances implicitly in the physical description of an item, in some instances in listings of contents, in some instances as links in linking entry fields, and in (many) instances not at all.

20. In the interest of catalog-code reform, Lubetzky launched a campaign for eschewing *sui generis* rules and returning to principle, heralding it with the celebrated question “Is this Rule Necessary?” (Lubetzky, 1953, 1).
21. Tadayoshi (1989).
22. See, e.g., Tillett (1997). See also the essays in Svenonius (1989).
23. The word *reasonable* is key. An often quoted remark is the first sentence in Cutter’s *Rules*: “a code of cataloging rules could never be adopted on all points by everyone.” Still, standardization requires a reasonable amount of uniformity. For an example of an evaluation that focuses on uniformity, see Cook (1977).
24. Lubetzky (1953, 61–62).
25. *Catalogue of Printed Books in the British Museum*, vol. 1 (1841).
26. Commissioners Appointed . . . (1850, 389).
27. Sometimes several cards were used in the description of one document, and occasionally one card with dashed-on entries was used to describe several documents.
28. Lubetzky (2000).
29. Yee, M. M., and Layne, S. S. (1998), pp. 144–45.
30. Lubetzky (2000).
31. Wilson (1989a).
32. Heaney (1995).
33. Multiple Versions Forum (1990).
34. Ibid.
35. Attig (1989).
36. To deal with the problem, it has been suggested that records should be embedded in or linked to multientity records to show what a given library has. Multiple Versions Forum (1990).
37. Green (1996).
38. Sperberg-McQueen and Burnard (1994); ISO (1986b).

Chapter 5

1. Lubetzky (1953, 61–62).
2. IFLA (1999, 9).
3. *Oxford English Dictionary*, s.v. “principle,” 7th meaning.
4. Ranganathan (1957, 52).
5. Ibid.
6. Haykin (1951, 7–9) uses the expression “The Reader as Focus” and “Usage” to express the user convenience principle.

7. Cutter (1904, 6). Miksa (1983, 73) suggests that Cutter did not intend usage alone to guide practice, there being situations where practice was better served not by the vagaries of usage but by systematic rules.
8. Cutter (1876a, 541, 548).
9. See Metcalfe (1959, 51). For an extended discussion of Cutter’s psychology of the public, see Miksa (1983, 77–82).
10. Cutter (1904, 69).
11. Cutter (1876a, 537).
12. Ranganathan (1957, 35, 36).
13. IFLA (1997, 8). This document also illustrates the use of this principle in various subject heading languages (145 ff). Many theorists have written about this principle. See, for instance, Hanson (1909), Haykin (1951), and Miksa (1983).
14. Cutter (1876a, 536–537).
15. Library of Congress, Cataloging Distribution Service (1989–, LCRI 22.3).
16. Skrobela (1980, 2).
17. Ranganathan (1957, 52).
18. Tillett (1990, 1997); Gorman (1992). The dilemma is not avoided entirely, since even in a sophisticated online catalog a single form of name would continue to be needed for display and citation.
19. See, for instance, Krikelas (1980).
20. Bradford (1948). A Bradford distribution is one characterizing the use of a set of objects — such as letters of the alphabet, books in a library, journals cited in a bibliography, or objects for sale in a grocery store — so that a few of the objects account for a majority of the use, and most are used infrequently.
21. Matthews, Lawrence, and Ferguson (1983).
22. See, for instance, Carlyle (1989) and the bibliography at the end of her article.
23. A description can be regarded as inaccurate for reasons other than transcription failures. For instance, it can be too brief, or it can be a result of the misapplication of rules.
24. Library of Congress, Processing Department (1946, 26).
25. Blackburn (1884, v).
26. Lubetzky (1953, 41).
27. Ravilious (1975, 33).
28. Cutter (1904, 24).
29. Ravilious (1975).
30. Lubetzky illustrates his point by saying how when Winston Churchill brought a draft to King George VI for him to use as his Speech from the Throne, the King “reflected wistfully upon his delivery of a prime-ministerial statement as a Speech from the Throne.” Churchill is said to have replied sensitively: “Your

- Majesty, anyone can write a check, but only the one who signs it can validate it." See Lubetzky (1969, 28).
31. See Wajenberg (1989). Wajenberg brings up the interesting case of a document purporting to be written by a computer.
32. Commissioners Appointed . . ., Q 4100. Quoted in Brault (1972, 42).
33. Library of Congress, Processing Department (1946). Both Herman H. Henkle and Luther Evans credit Lubetzky with the substance of this report.
34. See the discussion on empirical methods of determining necessity in the next section.
35. This is not necessarily true. Some data elements are more expensive than others: for example, assigned or organizing data elements are more expensive than derived data elements that are merely descriptive. See Svenonius (1992).
36. Lubetzky (1953, 1).
37. Lubetzky (1953).
38. Library of Congress, Processing Department (1946, app. D).
39. O'Neill, Rogers, and Oskins (1993).
40. Seal (1983).
41. Library of Congress, Cataloging Distribution Service (1989–, LCRI 2.5C1, 2.5C2).
42. Library of Congress, Program for Cooperative Cataloging (1999).
43. Library of Congress, Serial Record Division (1994).
44. IFLA (1998).
45. O'Neill, Rogers, and Oskins (1993).
46. Ranganathan (1957, 55).
47. Hagler (1989, 199).
48. Jewett (1852, 8).
49. *Webster's Third New International Dictionary*, s.v. "standardize."
50. Delsey (1989).
51. IMCE (1970, 15–16).
52. Cutter (1904, 6).
53. Cutter (1904, 11).
54. Hanson (1939, 134).
55. Osborn (1941).
56. Lubetzky (1953, 1).
57. Dunkin (1969).
58. This has happened, for instance, in the changes introduced to bring about format integration. See chapter 7.
59. Hagler (1977, 611).

60. See the discussion in the section on sufficiency and necessity.
61. See the discussion in the section on common usage.
62. Hagler (1977, 617).
63. National Education Association, Department of Audiovisual Instruction (1968).
64. Gorman (1980, 42).
65. It has been found that of the art works that would be relevant to the work of art historians, 29 percent lack distinctive titles in the sense of having proper names. See Layne (1997).
66. IFLA (1997, 61).
67. See chapter 7 for a further discussion of these issues.

Chapter 6

- According to Michael Gorman, Sumner Spalding used the term *nominal* to refer to such attributes (Personal communication, April 18, 1998).
- An exception is assigned vocabulary in the form of ID and control numbers.
- The activity of introducing vocabulary control is, in the context of descriptive cataloging, called *authority work* and its output an *authority record*. The authority record shows the established or authorized name for a given entity, as well as all other names it is known to have. In accordance with the principle of accuracy, the record also shows the source from which the authoritative form of the name is taken.
- AACR2R (1988, 381).
- AACR2R (1988, 381–382).
- AACR2R (1988, 449).
- Ibid.
- AACR2R (1988, 450).
- While not linked using the device of a uniform title in conjunction with a *See* reference, the two titles would presumably be linked in a note in the bibliographic description. See the final section of this chapter on bibliographic relationships.
- AACR2R contains an optional rule suggesting that birth-date qualification might be used even if the name is distinctive. This is a useful hedge against the name becoming nondistinctive in the future. AACR2R (1988, 415).
- Wendler (1995, 5).
- Wendler (1995, 7).
- Thomas (1984, 397).
- When AACR2R was first published in 1981, the need for distinctive serial titles was overlooked. Rules for supplying them were added in the form of rule interpretations.

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- American Library Association, Australian Committee on Cataloguing, British Library, Canadian Committee on Cataloguing, The Library Association, and The Library of Congress. (1988). *Anglo-American Cataloguing Rules*, 2nd ed. rev., edited by Michael Gorman and Paul W. Winkler. Chicago: American Library Association.
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