XOBIS: The XML Organic Bibliographic Information Schema

Out of clutter, find Simplicity.
From discord, find Harmony.
In the middle of difficulty lies Opportunity.
-- Albert Einstein's three rules of work.

Smart data structures and dumb code work a lot better than the other way around.
-- Lesson 9 from Eric Steven Raymond's *The Cathedral and the Bazaar*.

La perfection est atteinte non quand il ne reste rien à ajouter, mais quand il ne reste rien à enlever. [You know you've achieved perfection in design, not when you have nothing more to add, but when you have nothing more to take away.]
--Antoine Saint-Exupéry.

To Make the Best Better
-- 4-H Club Motto.

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Introduction

XOBIS endeavors to restructure bibliographic and authority data in a consistent and unified manner using XML (1). Our objectives are to optimize integration and maximize the use of generalized solutions. The structure we have created provides a flexible framework for managing a broad array of information and reduces complexity without eliminating necessary granularity. We chose to broaden the scope of the "bibliographic" system in an attempt:

- To address problems that digital libraries are facing due to a broader array of content
- To recognize that the "community information" format is not inherently different from those for bibliographic and authority data
- To provide a potential vehicle for unifying museum and library information– too similar to remain forever separate

This also has the potential to facilitate improvement in the correlation of cataloging rules with the data encoding structure. XOBIS endeavors to address complex bibliographic problems, while providing a sturdy foundation to support future, integrated, advanced information retrieval and presentation systems. These goals are addressed in several ways as outlined next..

First, the delineation of fundamental XML elements creates homogeneous classes of information. Within these, crisp entry elements promote consistent identification of entities with a generalized provision for disambiguation when necessary. Secondly, rigorous separation of content from the information framework provides a mechanism for accommodating many types of change (e.g. adding new choice values without needing to revise the schema). Data types and their choice values are referenced generically in the schema to avoid prescribing values in the schema. This provides a degree of self-documentation and structural resilience. Thirdly, recognition of the importance and ubiquity of relationships is manifest in their unitary treatment as a special class of linking concepts. Relationship values are controlled in the data, not in the schema. Equivalence and variance relationships expressed within a record are treated identically to, but separately from, inter-record relationships. Overall, the schema is highly recursive in that there are multiple references to individual generically-defined elements, and in that choices are referenced as values occurring within the data. This affords a balance between richness of content accommodation and economy of expression. Each of these areas will be addressed in some detail.

The XOBIS schema can be interpreted very broadly, or very narrowly, to meet various needs. It permits many things, but prescribes few. While it could accommodate and potentially integrate entire dictionaries, directories, citation indexes, thesauri, catalogs, metadata sets, museum records, etc., it could just as easily be used for only a single type of data, such as a bibliography of books, with a minimal subset of data elements and no authority control of data content.

While XOBIS may appear at first to entail radical change, with few exceptions it only restructures existing data in an effort to achieve greater coherence, usability, and

efficiency. We have tried to avoid arbitrary departure from, and adherence to, convention. That there would be a set of correlative cataloging rules is implicit in the tightly integrated framework, albeit with the assumption that major revisions in current practice would be required for XOBIS to move successfully beyond its initial exploratory stage. It helps to keep in mind that content and presentation are discrete in XML, and that indexing may bridge content structures.

Perhaps the most difficult part of arriving at the current schema was attempting to resolve long-standing problems extant in the current bibliographic apparatus. Problems with cataloging rules and MARC were presented to a Joint Meeting of MARBI/CC:DA in 2000 (2-5). Grappling with such problems consumes valuable staff time and resources, competing with qualitative and/or quantitative efforts to improve databases, and vexes developers of library-related information storage and retrieval systems. Inversely applying the 80/20 rule, we have concentrated on the 20% that is problematical, mindful that 80% is generally not in contention. Difficult decisions had to be made in reaching a balance between structural coherence, policy implications, and the need to support envisioned functionality. Resultant solutions in the XOBIS synthesis are interdependent. Selected illustrations of these are interspersed below.

XOBIS is viewed as only one component of a suite of schemas, each optimized for a particular functional area of information management. Such a superstructure of independent, yet coordinated, schemas would provide a more open approach to "integrated" library systems. The best solution for a particular function at any given time may vary, as do a library's needs and ability to acquire an entirely new system. The wisdom of bulk replacement of systems, with sometime mixed results, is questionable as the scope of library automation continues to grow. Emulating the "Web services model", which emphasizes discrete modules and inter-communication between them as a design goal, would enhance the sustainability of our information systems in the future.

Related Efforts in the Community

The XOBIS approach differs in many ways from that found in current MARC structures and the Anglo-American cataloging rules. It also differs from other similar, but less comprehensive approaches to marking-up library information. We attempt to monitor developments in these other approaches and track them on the Medlane Project website (6). Cursory remarks about a few of these related efforts provide some context for XOBIS.

The National Library of Medicine (NLM) has demonstrated international leadership in its early, extensive, and rapid adoption of XML both as a format for dissemination of its millions of records and as an internal communications format (7-10). This began in 1999 with the creation of MEDLINE Document Type Definitions (DTDs), and continued more recently, with the development of a DTD for *Medical Subject Headings* (MeSH). Notably, in the transition to XML, the MEDLINE DTDs were enhanced to better support inter-record relationships. Although these are stunning developments, NLM's effort has focused on a unique library's special needs with a focus on indexing records, which are

less complex than MARC records, and the result is thus not readily adoptable by other libraries.

The Library of Congress (LC) has a long history of work with mark-up languages (11). Its recent flurry of XML activity further recognizes XML's growing importance in the library world. After exploration of SGML's possibilities from 1995-1998, LC's initial XML schema consisted of a literal mapping of each field in MARC to a counterpart element in XML, with each indicator becoming an attribute of that element. MODS, which appeared in 2002, regrouped some MARC fields and notably burst encoded fixed field values into meaningful terms (12). Similar to Dublin Core, ONIX from the publishing industry, and the Open Archives Initiative schema, MODS only covers a subset of MARC tags, lumps some elements, and is apparently intended for manipulating subsets of records for limited purposes (13-15). In June 2002, the official MARC XML format appeared, which is remarkably similar to the initial LC literal effort (16). Simply encasing MARC in XML does not take advantage of the strategic opportunity that XML affords libraries. It remains to be seen how useful this, or any of several other literal mappings of MARC, can be.

International interest has remained high since Lam's work in Hong Kong and the French BiblioML, released in 1999 (17-18). Korean acceptance has been phenomenal, especially since the selection of XML as the standard for electronic documentation for an e-Government project in 1999. A recent paper from Portugal is only the latest example indicating XML's value to libraries in a shrinking world (19).

MARC and cataloging rules have been under scrutiny recently, particularly in the *Functional Requirements of Bibliographic Records* (FRBR) (20-23). These admirable efforts provide an immense amount of information regarding the complex structure of MARC and cataloging rules. They identify many core concepts and issues, and while exhaustive and very informative, they seem to take a more traditional approach than might be warranted in the coming era of digital libraries. Attempts to resolve tensions between name/subject and subject/form are indicative of limitations in current structures (24-25).

We have not yet tried to correlate XOBIS with the FRBR. The treatment of series in appears problematic, but FRBR's emphasis on discrete entities and relationships is encouraging. The XOBIS **Work** element should not be confused with Work of FRBR (from Work/Expression/Manifestation/Item), although Item is likely the same. The XOBIS **Version** element can accommodate editions with nearly identical content, such as novels, by representing them as versions on a "single" record, while editions with different content, such as textbooks, could have separate records as their content is not substitutable. We hope to explore such issues more fully during our initial implementation.

The Dublin Core (DC) spearheaded by OCLC is useful in emphasizing that documents should contain basic, discrete metadata (e.g. date, title), but in our view is not sufficiently detailed to accommodate bibliographic information adequately (13). Perhaps its most interesting lesson comes from adjusting to change. After millions of records were created, optional attributes were added to compensate for insufficient detail. More

recently the recognition of overlap in its Creator, Contributor, and Publisher elements underscored the difficulties in altering a schema.

We are encouraged by many domain-specific efforts, such as HEAL, although they tend to be enumerative and prescriptive (26). Notable in this category is the Visual Resources Association's schema, which combines simplicity and the crisp delineation of fundamental elements, as well as better provision for relationships than is usual (27). It is also telling that many such efforts are not occurring in libraries. After a period of exploration and implementational analysis, we anticipate that emphasis will shift to coordination of the many related, exploratory efforts.

There's No Business, Like XOBIS: Background Material

XOBIS is a direct outcome of Lane Medical Library's earlier work, part of the ongoing Medlane Project (6, 28). In January of this year, an initial sketch of the unnamed schema was presented in a keynote address for a regional medical library meeting (29). It used our current structure, but had differing element names and interpretations. Lane's interest in XML is very pragmatic; we want to convert bibliographic and authority data into a Web-friendly format in order to integrate it with our other Web resources to facilitate Web-based initiatives. An open approach can help prevent important library resources from becoming marginalized, provide improved access and management of all our resources, and contribute strategically to the viability of libraries in an increasingly competitive milieu.

XOBIS represents one realization of the idea of *organic bibliography*, first posited in print in 2000, although brewing much earlier (30). In 1999, the Medlane Project produced the XMLMARC software, demonstrating the feasibility of flexibly converting MARC data to XML. However, it used an ad hoc DTD developed in about six weeks by two people and required more technical dexterity than desirable. While this represented only a cursory attempt to gather together various data elements dispersed in MARC, it helped bring into focus the problems of identifying elements for a more elegant representation of library information.

In contrast, Version 1.0a (alpha) of the XOBIS schema has taken over 6 months of part-time effort by roughly ten people to date, with work being delayed for a full year while implementing a new integrated library system at Lane (31). The RELAX NG schema, created by James Clark and Makoto Murata, was chosen primarily due to its simplicity in comparison with the XML Schema language, used by LC (32-34).

XMLMARC itself separates content from functionality by segregating software functions from transformational definitions recorded in a separate XML mapping document. In conjunction with the release of XOBIS, we are releasing Version 2.0 of XMLMARC (35). XMLMARC has been almost completely rewritten with changes to the mapping language, usability of the product, and underlying MARC application programming interface (API). Kevin Clarke recaps the program's design and functionality in recent publications (36-37). Default maps for "vanilla" MARC and several variations are envisioned. Custom mapping of any local practice and/or extensions to MARC could

take advantage of added features that the XOBIS structure affords. Of course, the XMLMARC software will continue to allow for the conversion of MARC to XML that can be validated by any DTD or schema as long as users are willing to develop the necessary mapping document. Due to the fundamental reorganization of data in XOBIS, we do not believe it is possible to provide lossless mapping from XOBIS back to MARC.

A note about methodology: While a more consultative approach might have been engineered, committee efforts are not particularly noted for speed or fostering creative solutions. We believe that a smaller, highly focused collaboration was needed initially to achieve the desired degree of synthesis and structural fidelity. In the spirit of Raymond's "The Cathedral and the Bazaar", we hope that XOBIS, following our necessarily restrictive origination phase, can be refined and further developed (or even rewritten at least once) using the open-source model (38). Medlane Project staff, based in a medium-sized library (large for a medical library), considered as broad a range of data as practicality permitted. We benefited from varying degrees of experience and from sharing a wide range of backgrounds. This was supplemented by conversations with invited guests regarding various aspects of the design. It is interesting to consider that medium-sized libraries make good testbeds; they are large enough to exhibit most complexities realistically, yet small enough to not become overwhelmed with scale issues. XOBIS is by no means complete or comprehensive. After testing the initial alpha version, we anticipate releasing a beta revision. Admittedly, more could be done to address bibliographic issues, which may not have surfaced, or which were crowded out during our deliberations. At the very least, we hope XOBIS will serve as a springboard for discussion and development of a robust schema to take advantage of the many previously extolled benefits of XML (39). For those interested, we invite participation in the new XOBIS listserv (40). For XML in libraries in general, we suggest the XML4Lib listserv (41).

Notes about conventions used:

- Element names below appear in boldface; in this overview document, strict hierarchical organization of element names is *not* shown in all cases, in order to emphasize selected aspects of the schema without undue emphasis on intervening levels.
- Italics have been used for emphasis, to distinguish some data values, and to identify relationship values.
- Attribute names within text appear in single quotes.
- Element values appear in markup, tables, or in double quotes within text.
- A question mark following a value indicates a possible value not currently found in major subject schemes.
- Capitalizes each word normalizes data values in examples; this is not prescribed in XOBIS.
- Post-qualifiers are shown in examples in parentheses, and where emphasis is needed, pre-qualifiers appear in brackets. Sample punctuation not inherently a part of a data value is included in examples for clarity; such punctuation is not prescribed and could be handled conditionally via a stylesheet.

XOBIS Root Element and General Organization

The XOBIS root element is **RecordList**. It was chosen to permit processing of both single records and record sets. It consists of one or more **Record** elements. Each record consists of three required components. First, **ControlData** contains metadata concerning the record itself. Information, such as date created and maintained, record type, and its status history, is included within **ControlData**'s three container elements: **ID**, **Types**, and **Actions**. This should not be confused with MARC's "fixed fields." Secondly, *Principal Elements* is a variable representing any one of 10 defined essential categories of information content generally recorded by archives, libraries, museums, and organizations performing similar roles in order to provide bibliographic/informational access and authority control to a wide variety of resources regardless of format. Thirdly, the **Relationships** element accommodates links between any pair of the Principal Elements. This single element replaces three different features of MARC: 1. "linking entries" associating different bibliographic records (76x-78x), 2. implicit relationships existing between traditional "access points" and the work represented by a record (65x, 7xx, etc.), and, 3. "see related" entries found in authority records (5xx). Thus, the tripartite **Record** element is central to the fundamental structure of XOBIS shown in Figure 1.

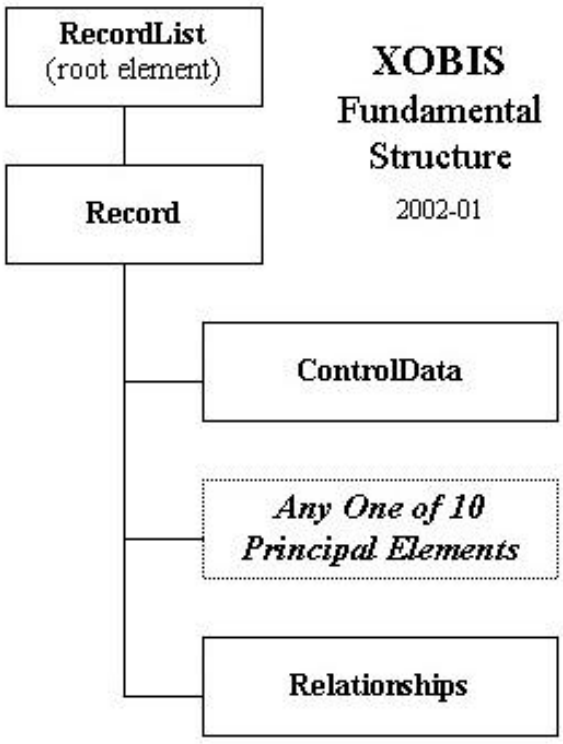

Figure 1. XOBIS Fundamental Structure

This basic arrangement provides a consistent framework, unifying all Principal Elements into a simple infrastructure, while delineating fundamental differences in the data characteristics, necessary to support envisioned functionality.

Principal Elements and Core Structure

Figure 2 provides the names and brief working definitions of the 10 Principal Elements of XOBIS, any one of which may serve as the nucleus of a particular **Record**. Each is discussed separately following the Attributes section.

Concept	Topical and/or categorical constructs (tangible or intangible) not otherwise instantiated
String	Individual or deliberately clustered words or phrases, including numbers, letters, etc.
Language	Specific spoken, written, or signed communication systems
Organization	Organized groups, including jurisdictional subdivisions
Event	Named macro-events, naturally-occurring or conducted by individuals or organizations
Time	Individual chronological values or ranges of values (periods)
Place	Structures, geographic locations, and jurisdictions, including extraterrestrial ones
Being	Specific identities of tangible or intangible beings (living or dead) and/or personifications
Object	Manufactured, crafted, or naturally-occurring things, excluding Place, Being, and Work carriers
Work	Artistic or intellectual creations, excluding those considered Place or Object

Figure 2. XOBIS Principal Elements

These 10 Principal Elements were isolated on the basis of their shared, homogeneous characteristics. This exercise was a lesson in linguistics and puzzle theory. The complex, frustrating, and sometimes-tortuous process of "slicing the pie" into fundamental categories appears to have achieved a coherent whole. The resulting structural consistency provides a foundation for potential optimization of indexing and for resolution of cataloging problems mentioned above. Since this document describes the alpha version of XOBIS, further review and practical application may necessitate redefinition or realignment of the various constituent elements. There are also some areas with potential for further simplification. As with any scheme, the need for associated rules or guidelines and the application of judgment will remain. However, XOBIS may potentially simplify these tasks.

The following prerequisites guided determination of elements in general. Retrieval ramifications informed the choice of necessary elements. Granularity of retrieval

parallels granularity of definition; indeed a fundamental purpose of XML is to describe content, precisely for this reason. Similarly, while XML separates content from presentation, distinctions in display rely on mark-up existing at the desired level of detail.

A third goal in the delineation of Principal Elements was a desire to support enhancement of the "browse" capability, one which benefits greatly from libraries' authority control efforts, but which is limited or lacking entirely in Web-oriented search engines. Careful dissection and consideration of each of the Principal Elements resulted in identification of shared characteristics, which could underpin envisioned *structured indexes*, discussed below.

Lastly, selection was guided by consideration of the definition and categorization of relationships between elements. For example, real and fictional people share the same genealogical relationships. Subjects were problematical until we cast these as relationships between Principal Elements, e.g. a **Concept** being the *topic* of a **Work**, or a **Being** serving as the *subject* of a **Work**. The **Relationships** section elaborates.

Ten Conceptual Records are envisioned to record the definition and scope of each Principal Element and its relationships within XOBIS. At this time, the diagram in Figure 3 best explains the rationale behind decisions relating to the choice of Principal Elements.

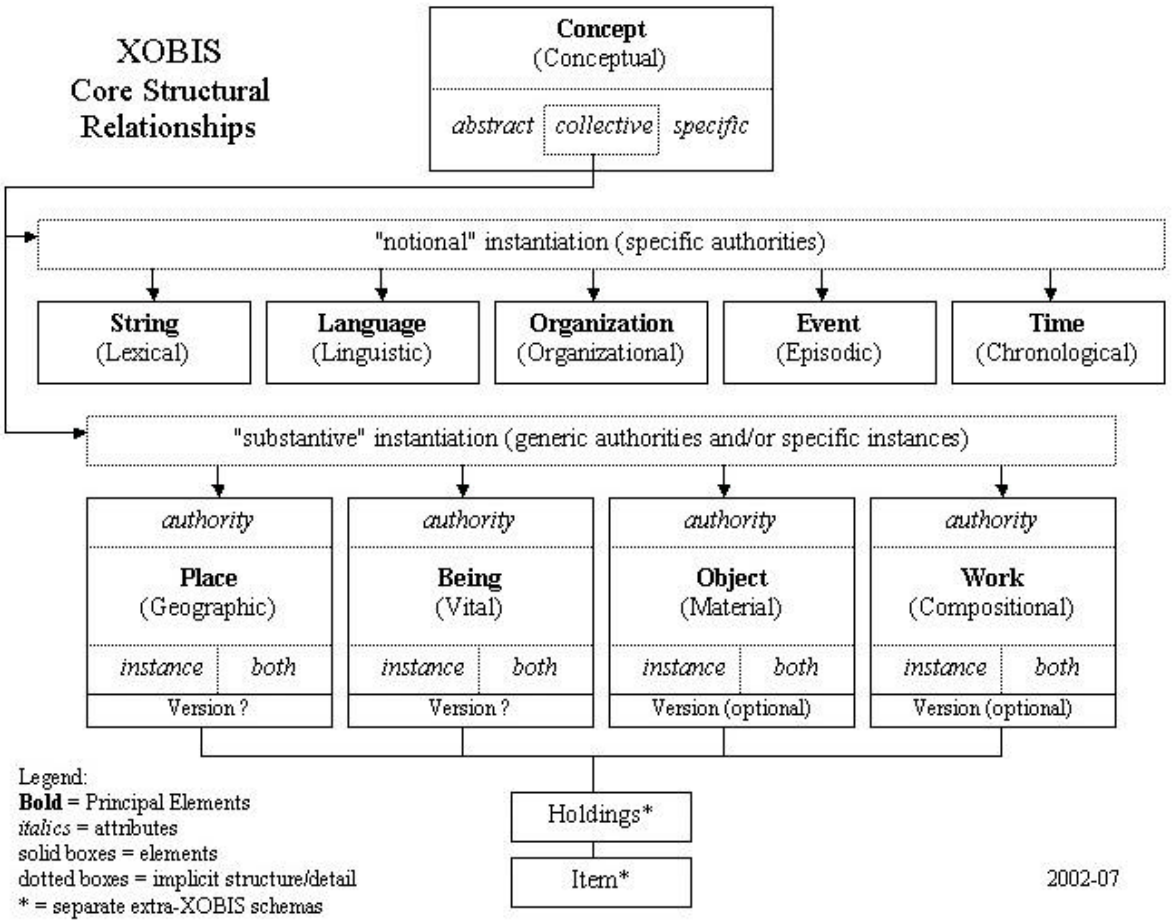

Figure 3. XOBIS Core Structural Relationships

The Principal Elements represent varying degrees of specificity/generality of concepts, broadly interpreted, with the aim of being comprehensive. Tangibility and grammatical factors, especially proper nouns, were major determinants. Each Principal Element may be considered as representing a selected subset of instantiations (real or fictional) of a *collective* **Concept** element, discussed further below. They roughly represent instances of "substantive" or "notional" concepts.

Place, **Being**, **Object**, and **Work** (considering its physical carrier or container) are "substantive" in that they often represent the tangible, and are potentially collectable or ownable entities. This is reflected by a 'role' attribute with the value of *instance*, while the value *authority* permits inclusion of unheld and/or parallel intangible cases to allow referencing them consistently. The value *authority/instance* allows the same record to serve either purpose. The arrangement is such that the dowager Empress Cixi, the Eiffel Tower, the Hope Diamond, and the Gutenberg Bible can populate virtual collections of beings, places, objects, and works, just as readily as mundane specimens are more likely to populate physical collections. The same record may serve either or both purposes. An optional **Version** element accommodates coverage of versions (e.g. print versus digital) on a single record and may have discrete relationships. Holdings, a projected separate schema, would link directly to these Principal Elements or to one of their versions. Item, also a separate schema, would link to Holdings.

String, **Language**, **Organization**, **Event**, and **Time** are "notional" in that they represent ideations or intangibles, separated from the mostly generic **Concept**. Exemplars of these are all authorities. **String** permits extension of authority control to keywords in order to support eventual improvement of this most popular type of searching. Juxtaposing this approach with controlled topical vocabularies should prove interesting. **Concept** includes remaining *abstract* concepts, tangibles in the *collective* sense, e.g. the general idea of the heart as an anatomical pump occurring ubiquitously, as opposed to a single preserved cardiac specimen (**Object**), as well as *specific* intangible concepts.

XOBIS' integrative approach adds greater precision and flexibility to the current bibliographic apparatus, better accommodating the limitless variety of information found in digital environments, and making the schema inclusive of collections found in museums and related institutions. Arbitrary compartmentalization of information is increasingly a disservice to users, whose needs do not necessarily follow disciplinary or institutional boundaries. Harmonization of various practices might yield to various agencies' differential application of depth of XML hierarchies based on their specialization, perceived need, or available resources–yet within the same structure. We hope that the recent establishment of the Institute of Museum and Library Services in the United States is fortuitous in promoting increased cooperation (42). The discussions of each Principal Element below include examples to illustrate their variety and to help clarify the rationale for their boundaries. These are preceded by coverage of Generic Elements and Attributes sections.

Generic Elements

Simplification of XOBIS was possible in part due to identification of recurrent patterns crossing the emergent "boundaries" between Principal Elements and/or their parallel relationships. Due to their generality, we call them Generic Elements; they are defined independently, or coordinated for consistency. Generic Elements are ones that are needed as sub-elements of more than one Principal Element, or which serve as unifying container elements, although with varying substructures. Selected Generic Elements are discussed here and later in the context of related Principal Elements.

Description
Notation

XOBIS uses the divide and conquer approach for descriptive aspects of cataloging, fundamentally by not mixing description and entry (e.g. MARC 245). Such information is carried in tandem with the **Entry** when needed to justify, amplify, or describe in more detail the applicable Principal Element, a parallel relationship grouping, or the specific **Relationship** to which it refers. Notes could be omitted when redundant and may occur on blind relationships. **Description** is a container element for notes and other descriptive information. Each instance is a **Notation**. This example illustrates a transcribed title, with correction, for a **Work**:

```
<Work type="intellectual" role="instance">
        <Entry class="individual">
                <Title>Railroad Employees Pension Plan</Title>
                <Qualifiers>
                        <Time>
                                <Year>1930</Year>
                        </Time>
                </Qualifiers>
        </Entry>
        …
        <Description>
                <Notation class="transcription">
                        <Value>Railroad employes [sic] pension plan</Value>
                </Notation>
        </Description>
</Work>
```

Initially, a single pattern encompasses descriptive information because it is generally for display and use in keyword indexing. Is there justification for all the detailed and variable subfielding found in notes in MARC? The XOBIS **Notation** element consists of a **Value** and may have an optional **Type** to specify a collective/group value for a **Concept** and a specific value, another **Concept**. The generic **Type** element, covered below, provides a mechanism to control groups and values associated with another element, possibly:

<Type set="Physical Description">Extent</Type>
<Type set="Physical Description">Dimension</Type>
<Type set="Notes">Application History</Type>
<Type set="Notes">Scope</Type>

Notation has a 'class' attribute to cover broad categories shown below and may have a 'language' attribute for use when this differs from the 'language' attribute of **Record**. For example, an author abstract is *transcription*, while one written by the cataloger is *annotation*. All of these classes are defined for each "substantive" Principal Element and **Relationship**. Two do not apply to "notional" Principal Elements or **Relationship**: *transcription* and *description*.

'class' attribute	Working Definition
transcription	Designates transcribed information and may contain supplied data in brackets; could be quoted in display
annotation	Data supplied by the cataloger for public display
documentation	Data supplied by the cataloger typically not for public display
description	A transitional value when description cannot be parsed for association with the proper Principal Element or Relationship
unspecified	Just in case

Because of XOBIS' emphasis on relationships between Principal Elements, the context of notes is clearer, and many cases may be superseded by **Relationships** themselves-- making the information more accessible. For example, the note "Sponsored by the Music Library Association" and an added entry for Music Library Association are more succinctly covered by a **Relationship** from a **Work** to an **Organization**: *Sponsor*: Music Library Association. Routine redundant description to justify an **Entry** is questioned; however, rules could be developed for targeted usage. Much more investigation and practical experience in applying XOBIS are needed before determining the need for additional patterns, realigned rules, and/or a better method of handling description.

Entry

Each Principal Element includes a container element, **Entry**, to delineate the composite sub-elements providing it with a relatively unique identity. Examples of entries occur at the beginning of their respective sections. An **Entry** may be undifferentiated from the **Entry** of another **Record**, since it may not always be desirable or possible to disambiguate entries readily. A small number of these duplicate "hits" is reasonable; a threshold in editing software could suggest needed disambiguation. The **Qualifiers** element below discusses routine preemptive disambiguation. **Entry** is repeated in **Relationships** to provide visual reinforcement (should a typographical error in a control number occur), to permit records to stand alone (not requiring related records for processing/display), and to permit blind links (optional creation of the indicated target record). **Entry** may be thought of as a concise disambiguated identity for each Principal Element.

While entries may vary in their substructural composition and attributes, they consist generally of two parts:

1. Basic *identification* (**Name**, **NameSegment**, **Title** or **TitleSegment**),
2. Optional *qualification* for disambiguation (**Qualifiers**).

Simply stated, works are titled and other Principal Elements are named. The distinction between identification and disambiguation also supports sorting and differential display. Additionally, **Type** and **Duration** elements optionally allow entries to carry *equivalence* designations (cf. **Varia** below). Basic examples introduce the section for each Principal Element below.

Entry Names

Name
NameSegment
Title
TitleSegment

A designated **Name** provides an anchor for the **Entry** of most Principal Elements, while **Title** usually serves in this role for **Work**. Either would often have **Qualifiers**. Various patterns of substructures provide flexibility, since the complexity exhibited by names and titles is often underestimated. For traditional personal names, **Forename**, **Surname**, and **Expansion** (spelled out version) can be used as needed with a **Qualifiers** substructure to handle other parts; **Name** handles personal names that do not fit this structure. Similarly, **Time** has a special chronological substructure for dates, while named time periods may be entered as a **Name**. Repeatable **NameSegment** or **TitleSegment** elements may serve as alternates for **Name** or **Title**. The **Title** or first **TitleSegment** may have a 'type' attribute to indicate whether it is *generic*, e.g. "Transactions". The 'type' of any additional TitleSegment may be *subtitle* (for short subtitles which should be part of the entry), *section* (for section titles), or *other* (just in case). Section numbers are handled as a **String** in **Qualifiers**. **NameSegment** does not have a 'type' attribute at this time. The 'nonfiling' attribute applies to names and titles and their segments (initial or subsequent), adding more flexibility. See Figure 4 for how these elements interrelate, and the Attributes section and the sections on individual Principal Elements for details.

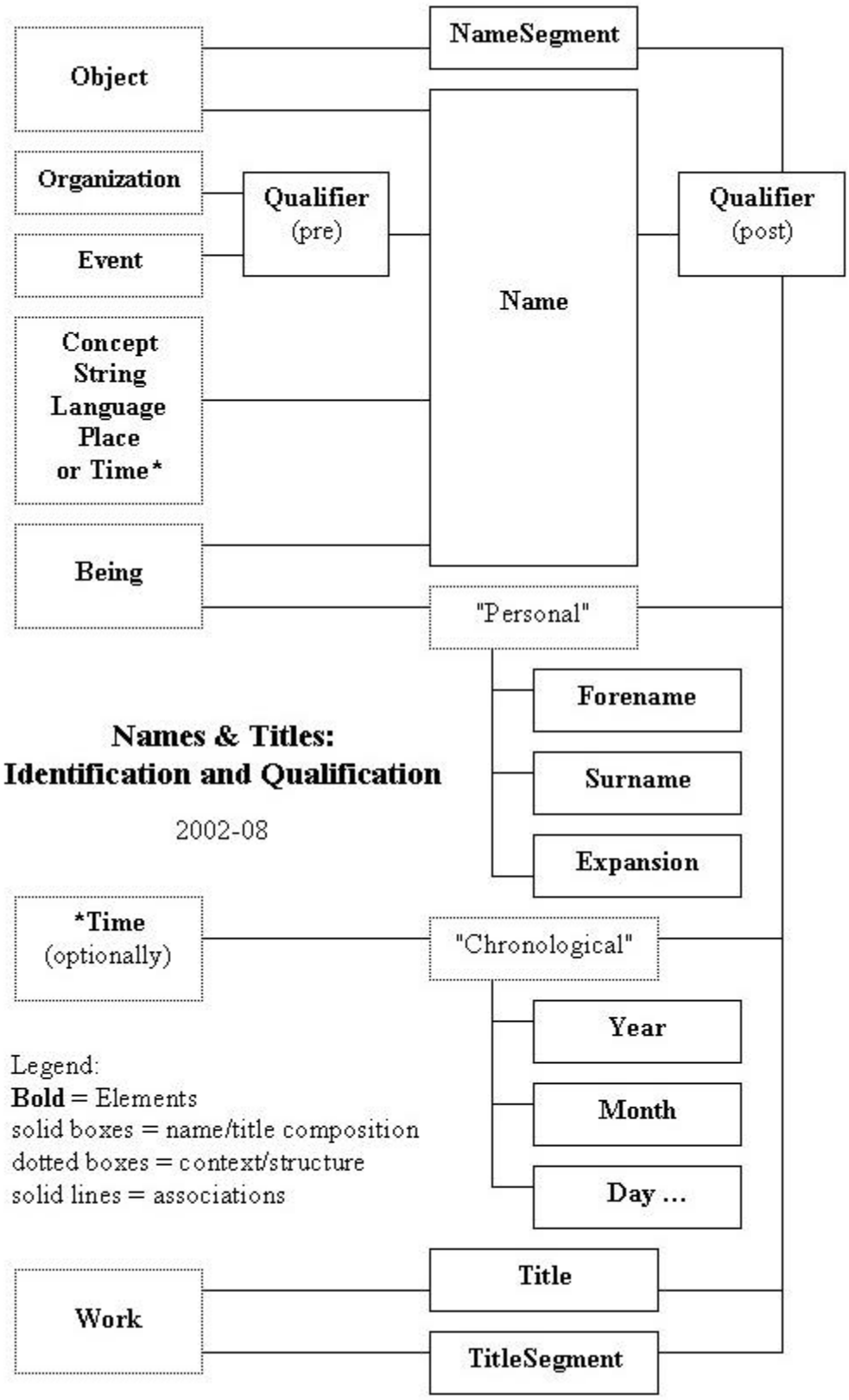

Figure 4. Names & Titles: Identification and Qualification

Entry Substitutes

Abbrev
Citation
Code
Singular

Entry Substitute elements represent a kind of internal authority control–shorthand versions of entries for Principal Elements, which may be used or referenced in place of the full **Entry** when conventionally or stylistically desirable, or per cataloging rules. The 'substitute' attribute on a Principal Element used in the context of **Qualifiers** or a **Type** value in a **Relationship** may have any one of these four element names as its value. The value of the chosen substitute, treated as just a text string, must then be used as a **Name** or **Title** instead of the **Entry**'s full substructure. An 'id' attribute must accompany the Entry Substitute. Validation would rely on editing software. Individual entry substitutes are not repeatable, as editing software could be confused if more than one **Code** existed for the same **Entry**. If additional values are needed, using **Varia** or **Relationships** to indicate that a value is associated with an authoritative code list or catalog, i.e. another **Work**, supports these.

Qualifier and form/genre terms are frequently singular, while topics are generally plural. Rather than establishing separate authorities for the same **Concept**, substitution permits a single authority to serve various purposes. The resulting juxtaposition reveals interesting variations in practice, which may or may not be deliberate. This technique could potentially permit integration of values from separate code lists with their appropriate Principal Element authority. Such integration should aid improving and maintaining filing consistency.

A **Code** could be used on Concept as a data entry form to reduce keying. **Code** is also used in support of the 'scheme' attribute to indicate which **Work** controls the particular term. While languages could be represented by their **Code** value, we recommend using the spelled out form consistent with XML's favoring verboseness. **Citation** indicates a preferred form for citing a **Work**, useful in display. The following examples illustrate some possibilities for substitute entries. The technique will benefit from testing. Without greater knowledge of the works, it is difficult to know whether **Work** with 'role' attribute of *authority* or *authority/instance* would serve better in particular cases.

	Concept	
Entry	Programming Languages (Electronic Computers)	[LCSH]
Singular	Computer Program Language	[LC qualifier]
Entry	Programming Languages	[MeSH]
Singular	Programming Language	
	Language	
Entry	Spanish	
Code	spa	

	Organization	
Entry	Lane Medical Library	
Code	CSt-L	
	Place	
Entry	Oklahoma	
Abbrev	Okla.	
Code	OK	
	Work	
Entry	Catalogue des Nébuleuses et Amas d'Étoiles **…**	[*instance*?]
Code	Messier	
Entry	Chronologisch-thematisches Verzeichnis sämtlicher **…**	[*authority*?]
Abbrev	K.	
Code	Köchel	
Entry	Medical Subject Headings	[*authority*?]
Code	MeSH	
Entry	Short Title Catalogue of Books Printed ... 1641-1700 **…**	[*instance*?]
Code	Wing	

Singular implies a categorical relationship (as one member of a collective **Concept**). This is reflected in its providing the preferred value for **Type**, cf. below, which should use **Singular** unless the value of **Entry** itself is suitable. Note that the 'substitute' attribute of **Qualifiers** must specify **Singular** if needed because they may be singular or plural.

A potential Entry Substitute, **Relational**, is under study. Often a *collective* **Concept** is similar or identical to a **Relationship**, particularly its **Singular** form, e.g. Translations/Translation and Translators/Translator. Contrast the *abstract* Translating as a third concept. **Relationship** currently may have a separate conceptual authority record for this purpose. There were too many unknowns to attempt to fold such relationships into the same **Concept** record at this early stage. In this example, note the similarities between the singular categories and the relational values of the same concept. The **Relationships** section elaborates.

Work A	**Relationship**
	Category: Translation (**Singular** of **Concept**)
(**Relational**)	*Translation [of?]*: **Work** B [reciprocal: *Translated as?*]
(**Relational**)	*Translator [Translated by?]*: **Being** (*Category*: Translator)

Qualifiers
Qualifier (each Principal Element may serve in this capacity)
Identifier

```
<Work type="artistic" role="authority">
        <Entry class="individual">
                <Title>Mercury</Title>
        </Entry>
        <Qualifiers>
                <Concept id="4567" substitute="Singular">
                        <Name>Choreographic Work</Name>
                </Concept>
                <Being id="7890" substitute="Code">
                        <Name>Ashton</Name>
                </Being>
                <Time>
                        <Year>1931</Year>
                </Time>
        </Qualifiers>
</Work>
```

Qualification is used extensively in bibliographic and authority records for contextual clarity and for conflict resolution of index entries using disambiguation. In MARC, such qualifiers are sometimes encoded and sometimes not (being considered "integral" parts of a heading). In XOBIS, **Qualifiers** offers an integrated, generalized solution with ample flexibility. This is key with our emphasis on title entry for **Work**, and extends to name entries for other Principal Elements. The technique, although verbose, provides the potential for tight integration, with homogeneous indexing of entries that lack matching authorities and simplified propagation of updates to qualifiers when entries are changed.

Although optional, routine inclusion of edition and/or date in qualifying an **Entry** amounts to preemptive disambiguation and simplifies display of names and titles. The same applies to distinguishing instances from authorities, cf. the 'role' attribute below, whereby a given qualifier can make the **Entry** for a particular *instance* unique from that of its otherwise identical *authority*. When an *instance* is subordinate to a qualified *authority*, the *instance* can be qualified separately; this maintains consistency by keeping the shared part of the **Entry** discrete from the part that varies by *instance*. This results in a double qualifier.

Another similar situation exists for some qualified **Object** entries. An additional special qualifier, **Identifier**, was defined for testing disambiguation using an **Organization** and **String** in such cases. Its use with **Being** is pending. For more information on these complexities, see the **Object** section below and the discussion of specimens in the **Being** section. **Being** also has a unique qualifier, **Expansion**, for spelled out initials (MARC's x00 ^q). Its use is limited to personal name structures. **Entry** above illustrates the structural placement of **Qualifiers**.

For any given Principal Element, a **Qualifiers** element serves as the container for one or more specific qualifiers used to amend the basic name or title. Each one of the Principal Elements may serve in the role of qualifier, although some rarely, e.g. **Work**. **Duration** is permitted as a

container for repeated **Time** elements. Other than this, only **Being**, **Organization**, and **String** have been designated as repeatable in the same **Qualifiers** container at this time. The order of these may vary as needed, although it could be enforced once fully defined. Inclusion of the related Principal Element's **ID** as an 'id' attribute is desirable, but optional to permit ad hoc values. The substructure of each qualifier is identical to the related **Entry**'s substructure, unless a substitute entry is used. In this case, the value of **Name** or **Title** should match the value of its parallel Principal Element's substitute entry, e.g. **Abbrev**, **Code**, or **Singular**, which serves to record the decision. An 'id' must be present to use a 'substitute'. To indicate the substitute entry used, the Principal Element used as a qualifier has a 'substitute' attribute matching the value chosen. The introductory example reflects that this is easier to grasp than this explanation sounds. When a qualifier itself has **Qualifiers**, these are retained in an embedded cascade.

Qualifiers itself is repeatable under certain conditions. When **NameSegment** or **TitleSegment** is used, each occurrence may be qualified. When an authority that has **Qualifiers** is used as the basis of the **Entry** for a derivative **Work**, it appears that an additional separate **Qualifiers** element referring to the derivative itself may be needed. The **Work** section addresses this issue, which might occur with other "substantive" elements.

The generalization of qualification bodes well for consistency. However, it also suggests that current rules for qualification need review. Because of routine title entry, some cases may not be automatically disambiguated via edition and date, especially for common or generic titles. For **Work**, the use of surname, especially one that is unique or well known in a field (e.g. Shostakovich in music) is viewed as most promising in such situations. Precedence for this is found in uniform titles for choreographic works, which may include surname, surname with initial, or a pair of surnames. XOBIS' **Qualifiers** provide a rich palette of options with a precise mechanism for providing greater control and flexibility than is presently available. These examples show Principal Elements' role in qualification:

1. *Post-Qualification*

Place (Concept)	Mercury (Planet)
Concept (Concept)	Mercury (Substance)
Work (Concept : Being : Time)	Mercury (Choreographic Work : Ashton : 1931)

Work (Place, Place : Time-Time)
Medical world (London, England : 1969-1987).
Medical world (London, England : 1913-1968).

Event (String : Time : Place, Place)
International World Wide Web Conference
(10th : 2001 : Hong Kong, China).
(11th : 2002 : Honolulu, Hawaii).

The first triad of entries illustrates disambiguation in case of homography. In the second example, there actually is a short-lived intervening title; note the provision for using a range of dates rather than just the initial date. The third case illustrates the alternative possibility of elimination of repetition in indexing. When the associated authority record exists, **Relationships**

to it are intended to take precedence over display of individual indexing entries. Further treatment of this topic appears in the **Place** section.

Traditionally, subordinate entry has been used for names implying subordination (Dept., Committee) and generic terms (Research Institute, Friends of). In XOBIS this has been recognized as pre-qualification to disambiguate the specific names:

2. *Pre-Qualification*

Place. Organization.
Alaska. Dept. of Education.
Michigan. Dept. of Education.

Organization. Organization.
University of Ibadan. Dept. of Education.
University of Oxford. Dept. of Education.

Treating these as pre-qualification provides a more comprehensive generic solution. Structurally, the only difference from post-qualification is order (i.e. before). Consult Figure 4 under Entry Names above, and the **Place** (particularly the Bartlesville example) and **Organization** sections below for details. We are continuing to study this area, as the possibility of using post-qualification solely is intriguing. Consider the following example:

Dept. of Education (Alaska)
Dept. of Education (Michigan)
Dept. of Education (University of Ibadan)
Dept. of Education (University of Oxford)

Telephone directories consistently transpose subordinate entries, e.g. "Education Dept.", when displayed under a parent entry. Such subordinate entries then subfile under their initial substantive component. It also offers the potential of collocating such organizations as shown (or perhaps hierarchically) to provide an added dimension to an organization index. **Qualifiers** could display when the **Entry** stands alone and be dropped as redundant in subordinate display. There is precedence in AACR2 for transposing parts of a name to the end in rule 24.5C2 and for conventionalized subheadings for political parties in rule 24.16. Cross-references help, but current entry subordination rules are not always easy to follow or advocate:

Institute of Chartered Accountants in Canada
Kent State University. Institute for CyberInformation
Botanic Garden (University of Oxford)
University of California, Berkeley. Botanical Garden

XOBIS handles both pre- and post-qualification. In the second example below, it is interesting to note the embedded relationship (*Lieutenant Governor of*:) with a temporal duration. The structural approach used in XOBIS had made analysis of such intricacies easier.

3. *Pre- and Post-Qualification Simultaneously*

Organization (Place, Place). Organization (Time-Time).
Columbia College (New York, NY). Medical Dept. (1784-1813).
Columbia College (New York, NY). Medical Dept. (1861-1897).

Place (Concept or **String). Organization (Time-Time : Being).**
New York (State). Lieutenant Governor (1761-1775 : Colden).

Organization. Organization (Place, Place)
American Institute of Architects. Portland Chapter (Portland, Oregon)

Using a group of elements to disambiguate the same elements is a challenging, yet worthwhile goal. XOBIS' use of atomism and recursion provides structural support for automated maintenance of qualifiers when related entries change. After attempting to define the substructure of each Principal Element's qualifier differently, we decided that a single, integrated **Qualifiers** element offered the most promise. While approximating the title qualification of current practice, it attempts the desirable harmonization of technique across the differing elements. More analysis is needed to determine the degree to which qualifiers can be honed to increase consistency and reduce complexity, and still accommodate needed distinctions and sequence of occurrence. Unification of the daunting array of related rules of current cataloging conventions holds potential for their needed simplification.

This pattern of qualification emerged slowly, in part due to the interplay with **Relationships**, where a separate **Modifier** acts in a similar, but less controlled way. For example, sequential position is commonly used for disambiguation, and such *enumeration* occurs throughout MARC, e.g. x00 ^b, x11 ^n, 245 ^n, 250 ^a, 4xx ^v, and 8xx ^v. While trying to distill enumeration as a separate element, we realized that some of these examples are **Qualifiers**, where the already defined **String** would function effectively, and the remaining ones are **Relationships**, where a **Modifier** "qualifies" the relationship. We elected not to distinguish instances of numeric values to support sorting in the belief that software should provide this without manual designation other than provision of the 'nonfiling' attribute in both cases. Double qualification (use of a qualified entry in **Qualifiers**) does not pose a problem.

Type

Rather than establish multiple elements in the schema with predetermined attribute choices, XOBIS uses the **Type** element in many cases to provide a flexible mechanism to identify both the allowable categories and their allowable values. **Type** permits using a single value from category of mutually exclusive ones. This is in contrast to the 'type' attribute, cf. under Attributes below, for cases where limited, fixed choice categorizations are handled.
Type is structured to provide a built-in validation mechanism to permit software enforcement of values occurring in the database. The category, a named **Concept**, is added via a **Relationship** to each **Concept** record to make it allowable. Currently, the value of **Type** should match the **Singular** Entry Substitute of the related **Concept**, or else default to the **Entry** itself. At present, freetext values provide additional flexibility. Consult the **Concept** section for the differentiation of categories.

This recursive technique provides flexibility whenever controlled choice values are desirable, without prescribing the values as part of the schema. The schema is thus insulated from changes due to new and evolving terminology, the database serving to self-document allowable choices by category and their definitions.

The technique is used widely. The 'set' attribute of **Type** identifies a conceptual category. These two examples typify the structure and show how this works in regard to **Varia**, discussed below.

Being <Type set="Name Variants">Pseudonym</Type>
String <Type set="Lexical Variants">Misspelling</Type>

In **ControlData** it handles assigning proposed categories of Action Types and Record Types of a **Record**. Although out of context, these examples further illustrate the generic nature of **Type**:

<Type set="Record Type">Suppressed Record</Type>
<Type set="Action Type" >Created</Type>

Requirement, retention, or replacement of specific Record Types or Action Types in **ControlData** is left to editing software. **Time** and **Notation** elements are available to complement **Type** for each **Action**. To accommodate repeatability, the container elements **Actions** and **Types** were defined. These are the only places where **Type** is repeatable. This was necessary because **ControlData** is outside the purview of **Relationships**, which otherwise handles repeatable categorical values.

The example under **Description** above shows how **Type** works with **Notation** to accommodate a wide range of data that may be changed flexibly without changing the schema. See the **Time** section for how implicit relationships such as birth date are handled using the same technique. We considered using the technique to assign each Principal Element to a single broad category. However, attributes appeared to work better at the general level for mutually exclusive values (cf. 'type' and 'class' attributes). Since a single record may belong to multiple specific categories, **Relationships** worked better to accommodate unknown numbers of potentially repeatable categories. See the **Relationships** section and the 'degree' attribute below for how an individual **Relationship** is categorized, refined, and referenced. In the remaining cases where a single categorization was needed, **Type** suited the situation best. More examples are dispersed in the text.

Type generally acts as a "field" authority, allowing much flexibility and ease of maintenance for record parts that are not of fundamental structural significance. The various category sets and values could be established as "seed" records with new ones issued much as LC now issues updates to MARC and new values for code lists from time to time–although it might be more desirable to make the new records available for downloading via FTP (File Transfer Protocol). Possible specific values have only been sketched since unilateral decisions would not be productive. However, we will have to make interim decisions in order to test mapping from MARC to XOBIS. Many values could be conscripted from MARC. An alternative would be to explicitly define separate elements, although this would make maintaining the schema more difficult.

Varia
Variant

```
<Entry class="individual">
        <Title>Data Structure Investigations</Title>
</Entry>
<Varia>
        <Variant>
                <Type set="Title Variant">Cover Title</Type>
                <Duration>
                        <Time>
                                <Type set="Temporal Type">Beginning Date</Type>
                                <Year>2003</Year>
                        </Time>
                </Duration>
                <Title>Investigating Data Structures</Title>
        </Variant>
</Varia>
```

Varia is a container element encompassing a special class of *intra*-**Record** relationships, unlike *inter*-**Record** ones which are handled as **Relationships** and discussed later. Each instance constitutes a separate **Variant**. They cover title variants (MARC 246) and "see" references for authorities (MARC 4xx), as both function identically and are integrated in XOBIS. They represent *equivalence* relationships to the **Entry** for the Principal Element within which they occur and create a recursive relationship. Their values would be controlled as **Concept**s designated via **Type** for this purpose.

Variant is also a container element. Its substructure incorporates that of **Entry** identically, including **Qualifiers**. Optionally, these are preceded by two separate elements expressing the nature of the equivalence:

Type (Categorical relationship; cf. above and **Concept** section)
Duration (Chronological length of the relationship; cf. **Time** section)

Type may be freetext to allow unrestricted flexibility at this stage. Although not prominent in MARC, **Duration** does occur (e.g. 246 ^f). For pragmatic reasons, **Varia** includes relationships that are quasi-equivalent and subsumptive (deliberately forced equivalency, e.g. MARC 247), reflecting pragmatic library practice. The distinction between when successive or latest entry is appropriate needs to be clearer; both are important for different reasons. Successive seems best suited for periodicals, which are cited as published and maintain that identity in perpetuity. Latest appears more appropriate for serials with revised content, as generally the latest version is the one cited/sought and creating separate records for titles hovering around a single identity creates clutter. Equivalence has been extended to **Entry** in one case so far (**Being**), due to complexities relating to multiple identities of persons (e.g. pseudonyms); cf. **Entry** above and **Being** below for explanation. See also Entry Substitutes above for how special variants are defined to permit enhanced functionality.

These examples, although out of context, indicate a few of the kinds of *equivalence* relationships that span the range of Principal Elements and would be governed by **Relationship** authorities:

	Type	**Variant** (**Name** or **Title**)
Work	*Spine Title*	Guia, Registros Hospitalarios
Being	*Nickname*	Parliament Joan
Organization	*Acronym/initialism*	ALA
Work	*Variant*	Warburton Anatomy Act of 1832

Version
Versions

```
<Entry>
        <Title>Academic Psychiatry</Title>
        <Qualifiers>
                <Time>
                        <Type set="Temporal Type">Beginning Date</Type>
                        <Year>1989</Year>
                </Time>
        </Qualifiers>
</Entry>
<Versions>
        <Version>
                <ID>7888</ID>
                <Qualifiers>
                        <Concept id="44444" substitute="Code">
                                <Name >Digital</Name>
                        </Concept>
                        <Organization id="3333">
                                <Name>Highwire Press</Name>
                        </Organization>
                </Qualifiers>
                <Relationships>
                        <Relationship class="geographic" type="associative">
                                <Name>Fulltext</Name>
                                <Place>
                                        <Name>http://ap.psychiatryonline.org</Name>
                                </Place>
                        </Relationship>
                </Relationships>
        </Version>
</Versions>
```

Controversy abounds regarding employment of single or multiple records to represent certain closely related types of bibliographic works, affectionately referred to as "multiple versions". The issue has continued to grow with advances in technology, escalating from various types of reprints and microforms to the nearly intractable situation with innumerable and volatile digital manifestations. The issue is central to

FRBR (20). Lane Medical Library attempted to implement the separate records policy, but after a few months found that it created an excessive workload and the proliferation of records made it more difficult to quickly ascertain serial holdings. This colored our decision to define **Version**, which is, however, optional.

The approach in XOBIS reflects the similarity evident in this milieu: relatively *constant content*. Would a user, aware of format differences, consider the versions equivalent? In such cases the practicality of separate records is questioned. There is the economic aspect, both in terms of redundancy and wasted effort. In effect, the "same" work must be recataloged, and worse yet, multiple records maintained. Change in content, rather an author's use of version vs. edition, would be a better gauge of the need for separate records. Determining the degree of variation to distinguish a **Version** from a separate **Work** is beyond the scope of this paper; previous work may have delineated needed distinctions. XOBIS attempts to provide a practical framework to explore whether this approach might be adequate and effective as many works exhibit a single expression.

As we begin mapping data into XOBIS, we will explore difficulties in implementation of this model. In particular, the intricacies of adding a new **Version** to the **Record** for a work previously cataloged independently is of interest. Our current integrated library system allows recording version specific information on holdings. However, since holdings records are not indexed, we must map the data back to the bibliographic record for this purpose. This process is automated. Ideally, only data shared by all versions should remain in the "base" record. We hope to learn more by comparing XOBIS and FRBR in this regard.

Both **Versions** and **Version** are container elements. They could apply to any "substantive" Principal Element to allow different versions of these to share a **Record**. It is interesting to consider possible implications, e.g. treating different identities for a **Being** as **Versions** rather than separate records. However, initially they are defined only for **Object** and **Work**, where cases are more obvious. This will allow us to test the technique. Examples of each appear in those sections below.

Each **Version** has an **ID** and **Qualifiers**, and may have discrete **Description**, **Varia**, and **Relationships**. The **ID**s are embedded ones in addition to **Record**'s own **ID**. All have equal status. The **Qualifiers** element functions as a qualifier to the **Record**'s **Entry**, due to its inherently subordinate role here. **Qualifiers** provide consistency and considerable flexibility in extending the **Entry**, which may itself be qualified (resulting in double qualification). Each **Version** would need to be indexed indirectly as part of this extended title. However, a **Version**'s **Varia** are identical to the **Entry**'s **Varia** and would be indexed directly.

Commonly, form may constitute the distinction in **Versions**, but organization, edition (e.g. British and American simultaneous editions of the same work), or other distinctions may also fulfill this role. The **Relationships** element serves as a container for each **Relationship**, functioning identically to the regular structure, discussed in the **Relationships** section below. For example, a periodical might be held in three different versions:

Entry	(**Qualifier**)
	Relationship: **Organization**
Version	(Digital : Highwire Press)
	Aggregator: Highwire Press
Version	(Digital : Ovid)
	Aggregator: Ovid Technologies
Version	(Microfilm)
	Publisher: University Microfilms

A **Holdings** element uses the regular XOBIS linking mechanism to the **ID**(s) of one or more Holdings records of an envisioned separate schema. These may link directly to the **Work** or **Object**, or to a specific **Version**. (The **Holdings** element is also available to **Place** and **Being** instances.) It is difficult at this stage to identify all the ramifications of some features of XOBIS. Clearly, more work is needed. We expect that a beta version, benefiting from testing and wider input, will address this area more fully.

Attributes

Deciding on an XML attribute versus an element can be difficult. Xobian attributes fall into two groups: 1. Those with limited choice values that are not expected to change, and: 2. Those with freetext values that would require an external program to present more extensive choices and/or validate values. Based on a configuration file, values of the 'language' attribute could be restricted to a particular subset, e.g. those from the **Name** of a **Language** whose **Entry** has a 'class' attribute value of *individual*. Attributes are potentially useful for search limits, permitting conditional display, and may aid indexing refinement. This partial alphabetic listing supplements discussion in the context of each Principal Element.

'calendar' Used on **Entry/Variant** of **Time** to indicate BC, or a calendar other than the default Gregorian one. The values represent the **Code** (Entry Substitute) of a **Work** authority for each calendar. They augment the international time standard to permit grouping of indexing entries by calendar. Cf. the **Time** section for details.

'class' Represents a broad category of **Entry**, often *individual*, *collective*, or *referential*, but varies by Principal Element. See each section for allowable values. Also used on **Notation** instead of 'type' to avoid confusion with **Type** element. Precise definitions are needed.

'degree' Used on a **Relationship** to indicate its relative strength, usually *primary* or *secondary*, but for conceptual ones, also *broad* and *tertiary*. See Relationships for further explanation.

'id' Used under **Qualifiers** on a Principal Element as qualifier or under **Relationships** on the Principal Element as the target of a **Relationship** to reference a related **Record**. It should match the related **Record**'s **ID** value. The intent is to support tight authority control and propagation of

changes, although it is optional to permit blind references (i.e. no target authority **Record**). Cf. 'xlink:href' below for replacing an 'id' during export.

'language' Optional; used on **Entry** (including those in **Relationships**), **Variant**, **Record** (for the language of cataloging) and/or **Notation** (and perhaps others) to indicate the language of a value. The 'transliteration' attribute depends upon the presence of a 'language' attribute.

'nonfiling' Used to record initial strings to be excluded from indexing. It may appear on any Entry Name (**Name, NameSegment, Title, TitleSegment**), including cases where these are used as a Qualifier, e.g. (The Hague, Netherlands), cf. Entry Name and **Qualifiers** under Generic Elements above. It also occurs on **Modifier** in **Relationships** to ignore enumerative labels, e.g. "v.". We see no reason to limit this feature to titles. The attribute must include any spaces to be maintained since some, such as L' abut the related value. See **Description** under Generic Elements for treatment of non-initial characters to be ignored in filing.

Being example:

```
<Entry class="individual">
        <Name nonfiling="The ">Rock</Name>
        <Qualifiers>
            <Concept id="24" substitute="Singular">Wrestler</Concept>
        </Qualifiers>
</Entry>
```

Place example:

```
<Entry class="jurisdictional">
        <Name nonfiling="Den ">Haag</Name>
</Entry>
```

Work example: The Short title: a subtitle. Part 3, Section title.

```
<Entry class="individual">
        <TitleSegment  nonfiling="The ">Short title</Title>
        <TitleSegment type="subtitle" nonfiling="a ">subtitle</Title>
        <Qualifiers>
                <String nonfiling="Part ">3</String>
        </Qualifiers>
        <TitleSegment type="section">Section title</Title>
</Entry>
```

'role' Used on "substantive" Principal Elements (**Place/Being/Object/Work**) to indicate the role(s) served by the record. Values: *authority*, *instance*, or *authority/instance*. Cf. **Qualifiers** above for treatment of instances that differ from an authority only due to a qualifier.

'scheme' Indicates the authoritative work containing the term used. **Code** (an entry substitute) for the **Entry** of a **Work** is used to control the value of another **Entry** or **Variant**, typically a **Concept**.

'set' Identifies the category for a set of values which may be included as **Type**. The value should correspond to an authority **Record**'s **Entry** used in a categorical relationship. See **Type** above for details.

'substitute' Indicates which Substitute Entry (**Abbrev/Citation/Code/Singular**) is used as a part of the **Qualifiers** element of another **Entry** or in a **Relationship**. Its absence means the **Entry** is used. This provides flexibility in referencing and display, yet retains unity. Substitute Entries control single optional values referenced by the 'substitute' attribute of **Type** or a Principal Element used as a **Qualifier**. The 'scheme' attribute uses **Code** by default. This is in contrast to **Variant**, where multiple **Varia** can be recorded, but not referenced formally due to their repeatability. Both are in effect intra-record equivalencies.

'transliteration' Optionally used on **Entry** (including entries in Relationships) or **Variant** to indicate the transliteration scheme used. The 'transliteration' attribute depends upon the presence of a 'language' attribute. Validation of a particular value would be based on its occurrence as the value of **Code** (an entry substitute) for a **Work** representing the transliteration scheme, and its having a categorical relationship to the **Concept** Transliteration Schemes.

'type' Indicates membership as one of a limited group of prescribed choices for various elements. It applies to each Principal Element, except **Language**. See those sections for values chosen initially. See **Title** and **TitleSegment** for its use in identifying generic titles and type of title segment. See **Description** above for its use with **Notation**. The **Entry** for **Event** and **Work** may have a 'type' of *generic*. See also 'class' for **Entry**.

'xlink:href' The XLink namespace with its 'href' attribute is used to identify "blind" references, i.e. pointing to a **Record** in another catalog using XOBIS. Additionally, an **ID** is converted to an 'xlink:href' on export to allow referencing the original **Record** from a remote system. This raises the possibility of automatically pulling an imported **Record**'s related authority **Record**s during import. This would be an implementational issue. Cf. 'id' above for intra-catalog **Record** linking.

Individual Principal Elements

0. A **Concept**, Car (Conceptual Records)

Concept	Topical and/or categorical constructs (tangible or intangible) not otherwise instantiated

```
<Concept type="collective">
        <Entry scheme="LCSH">
                <Name>Automobiles</Name>
        </Entry>
</Concept>
```

The **Concept** element may be thought of as a source element, since the other Principal Elements represent selected derivative concepts–**Place**, **Time**, etc. **Concept** encompasses both *topical* subjects ("aboutness") and generic *categorical* classes ("isness"), which may be instantiated by individual exemplars of another Principal Element. Concepts for classes of *tangibles* are collective, e.g. the notion of all "Liver" or all "Copper" everywhere. Their specifics, e.g. a single "Liver specimen" in a jar or "Copper sample", are instantiated by one of the "substantive" Principal Element, discussed earlier. Concepts for *intangibles* may be either collective or specific, with specific ones instantiated by a "notional" Principal Element or by another **Concept**, since these are also "notional." In XOBIS, proper nouns are often used as an inclusionary criterion for instantiation, while proper adjectives serve an exclusionary role. This was helpful in explaining why specific intangible concepts, such as processes (Krebs cycle), procedures (Heimlich maneuver), diseases (Alzheimer's disease), etc. remain with **Concept**.

Ironically, **Concept** began as a careful separation of topics and categories. Users seeking a novel to read, and those seeking information on the novel as a literary form, have quite different aims, despite the concept actually being the same. However, after grappling with redundancy and various conflicts, we realized that these could be delineated more elegantly using the separate **Relationships** element. Combining of topic with category and segregating selected "notional" Principal Elements greatly reduced complexity while adding structural cohesion. A crisper **Concept** element predominantly serves as a home for generic concepts and abstract ideas. This simplification may hold promise for development of informational ontologies or taxonomies used in knowledge management.

In XOBIS, the fundamental **Relationships** element itself represents a special type of concept, with *topic* and *category* representing instances of relationships. Thus, a topical subject relationship indicates that a **Work** is *about* the topic "Medical Colleges," and a categorical relationship indicates that an **Organization** *is* a member of the topical class "Medical Colleges"–with the topic and topical class being the same **Concept**. The chief problem seems to be that of singular versus plural referencing according to circumstance, discussed below. Non-topical subjects were considered **Relationships** from the outset, e.g. a **Being** or an **Event** serving as the *subject* of a **Work**. Coverage of the other Principal Elements and the **Relationships** section provide further explanation.

Concept has a 'type' attribute with values: *abstract, specific, collective, control,* and *subdivision*. The collective aspect is commonly encountered with terms representing form, genre, format, etc.,

but has been generalized to extend to include other classes, for example, "Artists" as a genre of people or "Banks" as a genre of business. The value *subdivision* indicates its suitability as a **Subdivision** value. This is discussed in the **Relationships** section. Its **Entry/Varia** may specify a 'scheme' attribute to indicate the **Code** of a **Work** controlling its **Name**, as well as optional 'language' and 'transliteration'. These examples illustrate the differences, distinctions between topical and categorical relationships, and the role of instantiation:

Concept (*abstract*; top or middle of hierarchy; topical relationships)

Artificial Intelligence
Beauty
Cataloging
Mythology
Statistical Hypothesis Testing
Surgery, Plastic
Transliteration
Truth

Concept (*specific*, subset of abstract; bottom of hierarchy; topical relationships)

Chi-Square Test
Dadaism
Heisenberg Uncertainty Principle
Red
Xenophobia

Concept (*collective*, subset of abstract; topical/category relationships), instantiated as:

Brand Name Products	**Object**
Bridges	**Place**
Buildings	**Place**
Cameras	**Object**
Cities	**Place**
Colors	**Concept**
Congresses ? Conferences ?	**Event**
Databases	**Work**
Dictionaries	**Work**
Fiction	**Work**
Fictional Characters ?	**Being**
Finno-Ugric Languages	**Language**
Gods, Hindu	**Being**
Gorilla gorilla	**Being**
Kidney	**Object**
Libraries	**Organization**
Monsters	**Being**
Numeration, Arabic	**String**
Palindromes	**String**
Phobias	**String** (if not established as *specific* **Concept**)

Piano Music	**Work**
Plastic Surgeons	**Being**
Radiographs	**Work**
Rare Books	**Work**
Seasons	**Time**
Silver Nitrate	**Object** (a sample of the chemical)
Streets	**Place**
War	**Event**
Words ?	**String**
Year	**Time**

Concept (*control*, subset of collective; categorical relationships only), instantiated as:

Pending Records ?	<any Principal Element>
Suppressed Records ?	<any Principal Element>
Subject Heading Schemes ?	**Work** (probably as authorities)
Transliteration Schemes ?	**Work** (probably as authorities)

These may occur when the corresponding *topic* is not desired/established, permitting display to vary from *collective*, perhaps "*Category*:" versus "*Record Type*:". Software could utilize selected values to enforce related functionality, e.g. record suppression.

Concept (*subdivision*; relationship indicated by subtype), not instantiated.

administration & dosage	[MeSH]
Social life and customs	[LCSH]

These govern the values that may be used in the **Subdivision** element, defined primarily to support topical subheadings due to their affinity to **Concept**. The technique was extended to other Principal Elements to explore coverage of other kinds of subheadings as a transitional strategy. The 'subtype' attribute for **Concept** has values: *general, form, topical,* and *unspecified* to indicate allowed usage, and the **Record**'s **ID** serves as the value of **Subdivision**'s 'id' attribute, cf. **Relationships** section below.

Specific entries for the various Principal Elements represented in the second column may have categorical relationships to the paired **Concept** in the first column. The collective attribute serves to control permitting this **Relationship**. For example, the **Being** Loch Ness Monster would have a categorical relationship to the **Concept** Monsters. The **Singular** element allows recording a singular version when a concept's **Entry** is plural in order to reference the substitute in a **Relationship** or as part of a **Qualifier**. See Substitute Entries in the Generic Elements section for more on how conditional display is supported.

The XOBIS structure appears sound, but challenges remain in instantiating concepts and understanding the ramifications of its rigor. The feasibility of mapping various conventional subject schemes to the XOBIS structure is unknown. Rather than trying to accommodate specific conventional subject and form/genre schemes, we elected to create a generic model

structure on which to investigate related issues. Improvements in various subject thesauri, the emergent emphasis on form/genre terminology, and the emphasis of NLM's Unified Medical Language System on multi-scheme synthesis and logical relationships are encouraging (43).

The XOBIS structure also implies differences from conventional subject schemes when defining concepts, and changes in the formulation of entries for other elements to reflect their instantial, rather than collective, nature. It also differs in some cases from LC's ambiguous headings decisions (44). For a given topic, it is interesting to note variation in terminology for the same concept– often within the same scheme or suite of schemes. Consider the LCSH form subheading (Congresses) versus the subject entry (Congresses and conventions), the *Thesaurus of Graphic Materials* term (Tombs & sepulchral monuments) versus separate topics (Sepulchral monuments; Tombs) in LCSH, the general material designator (sound recording) versus topic (Sound –Recording and reproducing), and the LCSH topical subject (Gods, Hindu) versus qualifier (Hindu deity). Some of this may be due to the recency of form/genre schemes. To fully realize the coherence in XOBIS, such variations would need to be reconciled. To avoid overkill, subsets from a superset could be designated to indicate adherence to a chosen hierarchical level in a particular institution commensurate with its aims and resources. More study is needed. Additional examples of conceptual instantiations appear under each Principal Element below. See also Entry Substitutes under Generic Elements.

Problem cases are succumbing to analysis so far. Although species names sound inherently specific, in XOBIS they represent concepts. Collected specimens constitute instances (**Being**), and both the genus and species are classes (**Concept**). The collective nature of scientific names is more obvious when considering ordinary nomenclature. Singular names for a class, e.g. the Whooper Swan, do not affect the distinction. Cf. the **Being** section.

	Concept	
	Scientific Name	(Common Name)
Genus:	Cygnus	(Swans)
Species:	Cygnus cygnus	(Whooper Swans)

Named groups of people represent concepts when a group's name employs a common noun in usage. If the group's name uses a proper noun, it is treated as a *collective* **Being**. These are considered instantiations of the first type (common noun). Currently, nationalities are included, although they may be thought of as **Relationships** of a person to a place. At this stage, XOBIS remains flexible in such areas, as the options are policy-related, and do not affect the general structure.

Concept	**Being** (*collective*)
Ethnic Groups	Asian Americans
Minorities	Blacks
Iron and Steel Workers	Hopi Indians
People with AIDS ?	Portuguese

The design of XOBIS supports the simpler, and we believe more powerful, post-coordinate approach, relying on reasonably discrete or atomic concepts, with a generalized emphasis on relationships between them. There appears to be a trend in this direction (45). Topical subheadings are relationally subordinate subsets of a given **Concept**. Consult the **Relationships**

section for how **Subdivision** attempts to deal with the reality of current practice. Indexing and presentation of this special structure, differing from that of other **Relationships**, is an implementational matter.

It is useful to look at the formulation of topical subject headings as an exercise in the *identification* and definition of concepts or entities, followed by their disambiguation or clarification by way of *qualification*. Coupled with greater emphasis on hierarchical relationships between concepts, such a systematic approach has much to offer in comparison to highly pre-coordinated and/or enumeration-oriented techniques. Instead of a single, fixed arrangement, there is the simplicity of fewer entries with more hits and the added flexibility to present search results sub-arranged by various criteria. Too many LCSH headings have a single hit. The FAST Project (46) offers encouragement in that its faceted approach more closely approximates XOBIS' structural breakdown. Recent changes to *Medical Subject Headings* (MeSH) introducing concept IDs portend that rigorous relationships similar to those in the UMLS will be supported in the future (43, 47). Further exploration is needed to realize the full potential of more robust and better-coordinated topical vocabularies.

1. **String** Theory? (Lexical Records)

String	Individual or deliberately clustered words or phrases, including numbers, letters, etc.

```
<String type="textual">
        <Entry class="word" language="French">
                <Name>écorché</Name>
        </Entry>
        <Description>
                <Notation type="annotation">
                        <Type substitute="Singular" set="Note Type">Definition</Type>
                        <Value>A painting or sculpture of a human or animal depicted
                        without skin in order to expose the muscles for anatomical
                        study.</Value>
                </Notation>
        </Description>
</String>
```

String, despite somewhat of a chicken and egg dilemma vis à vis **Concept**, offers similar benefits with more or less control adjustable. **String** values are mostly individual words– instantiations of the various values of the Principal Element **Language**, but also of Concept, e.g. "Words" or "Palindromes". While linguistic variants may be "lumped" on a Lexical Record, the intent is to link records for words in different languages. Inter-language relationships have the potential for use in aiding translation and in broadening searches selectively to include variants in other languages.

String has an optional 'type' attribute with values: *textual*, *numeric*, or *mixed*. Its **Entry** has four optional attributes: 'class' with values *word* or *phrase*, 'language' with values from **Language** authorities and dependent 'transliteration', and 'grammar' with a freetext value. They also apply

to **Variant**. The 'grammar' attribute permits designation of parts of speech other than the default assumption of noun, or *irregular plural* with default assumption of singular/regular plurals, not explicitly recorded. These are working definitions. Further categorization relies on **Varia** and **Relationships**, e.g. a **Variant** with <Type set="Lexical Type">Misspelling</Type>. See **Type** under Generic Elements for details. As with most details of XOBIS, these decisions are tentative.

Lexical Records provide authority control to individual words and phrases, including letters, numbers, their symbols, etc. and may be thought of as terms, keywords, freetext, textwords, lexical entries, etc. Clusters of closely related values result from adding equivalent **Varia**, cf. above under Generic Elements, with thesaural support coming from recorded **Relationships**, cf. the **Relationships** section below. Two sample word strings hint at the possibilities:

	czar		czarina
Variant:	tsar	*Variant*:	tsarina
Variant:	tzar	*Variant*:	tzarina
Related:	czarevich	*Related*:	czarevna
Related:	czarina	*Related*:	czar
Related:	king	*Related*:	queen
Broader:	sovereign	*Broader*:	sovereign

The examples below indicate the broad range and potential of the **String** element. The values given for **Relationship** and **Type** are for illustration. Consult **Varia**, **Relationships**, and **Type** sections for how these cases would be marked up. The **Language** section poses the issue of their serving in relationships. There are many pragmatic challenges in constituting a Lexical Record, choosing the **Entry** value, determining relationships, etc. Historical spelling reforms (e.g. Portuguese/Brazilian) present additional challenges. Consulting a dictionary reveals even more possibilities. Batch loads and sharing database development would improve the feasibility of building such a resource.

String	**Variant**	**Type**
airborne	airbourne	*Spelling variant*
airborne	air-borne	*Variant* (hyphenation)
Altertum	Alterthum	*Archaic/obsolete* (German)
ancient	antient	*Archaic/obsolete*
antenna	antennae	*Variant* (irregular plural)
borborygmus	borborygmi	*Variant* (irregular plural)
deoxyribonucleic acid	DNA	*Acronym/initialism*
dog	dawg	*Slang*
fever	febrile	*Variant* (adjective)
health care	healthcare	*Variant* (word elision)
hiccup	hiccough	*Spelling variant*
misspelling	mispelling	*Misspelling*
preoperative	preop	*Informal usage*
radar	radio detection and ranging	*Expansion*
supersede	supercede	*Misspelling*
two	2	*Symbol*

university	univeristy	*Typographical error*

String	**String**	**Relationship**
apple tree	jablon	*Czech* ?
car	automobile	*Synonym*
car	vehicle	*Broader*
mountebank	quack	*Related*
Electra complex	Oedipus complex	*Related*
tea	thé	*French* ?
truck	lorry	*English* (*British Usage*) ?

String is potentially concurrent with **Concept**. Their relative merits suggest the need for comparative study. They may work well reciprocally (one or the other in particular situations) or redundantly (both) separately. Lexical Records could link a word not established as a topical subject to related concepts, and/or vice versa. Integration of **String** with a keyword index is an implementational issue. The Indexing section below treats combining entries from different Principal Elements in the same index. By including relationships to Conceptual Records, a keyword search could broaden or narrow access to formally controlled vocabulary terms. For example,

String	**Relationship**	**Concept**
stevia	*Related*:	Sweetening Agents
		Herbs
		Plant Extracts

The **String** element accommodates emerging concepts well, and thus may be viewed as a transitional home or spawning ground for new concepts, perhaps based on frequency of occurrence or use in queries.

Otherwise, **String** is limited to entries not in the scope of other Principal Elements. Inclusion of strings with their associated Principal Element eliminates redundancy and promotes homogeneity. These often represent a **Variant** of a proper noun, but may just be abbreviations, codes, or variants representing concepts covered by another Principal Element, e.g.:

Principal Element	Excluded String	Element/**Variant**'s **Type** *Value*
Place	D.C.	**Abbrev**
Language	fre	**Code**
Being	Henrietta	**Forename**
Work (authority)	MeSH	**Code**
Organization	NATO	*Acronym/initialism*
Work (authority)	XML	*Acronym/initialism*
Time	Y2K	*Slang* ?

The **Qualifiers** element discussed under Generic Elements is available to **String** for clarification or disambiguation. How such distinctions are handled in indexing would be an implementational issue. Automated or semi-automated functions of an indexer and/or editor program could simplify this process, if posting to the specific entries is undertaken. Alternatively, Lexical Records could act as a filter before searches are passed to a traditional keyword index. It might

also be useful to suppress display of minor variants to avoid index clutter unless the variant matches the search query.

String (Qualifier)	Qualifier is:
base (Chemistry)	**Concept**
base (Military Art and Science)	**Concept**
invalid (infirm person)	**String**
invalid (not valid)	**String**

Sometimes a typographical error in one word results in the correct spelling of another (casual/causal). The **Relationships** section provides more information on **Relationships** that are dissociative, and **Varia**, under Generic Elements, covers equivalence relationships.

Lexical Records may only exist to provide definitions for selected, "uncontrolled" terminology. See **Description** under Generic Elements. An example of this appears at the beginning of this section. Adding a relationship to the **String** from a **Work** that does not include the text enriches access. Search access to the definition would aid both users and catalogers in identifying a search term that might not be known or easily recalled. Lane Medical Library's current public authority file demonstrates this functionality (48).

Fictional words can be thought of as instantiations of the Fictional Words collective **Concept**. They have a categorical relationship to the concept. While belonging to this category, they also represent relationships to a **Language**. This distinction prevents their being confused as "real" words. Whether qualifiers for fictional, fictitious or imaginary elements are justified routinely may depend on how adequately relationships serve in this regard. We have chosen the value *Fictional* to present such relationships.

String	**Reationship**	**Language**
mimsy	*Fictional*:	English
mümsige	*Fictional*:	German
enmîmés	*Fictional*:	French
xivilization	*Fictional*:	English

The possibility of using languages to present lexical relationships presents another opportunity to investigate XOBIS' broad potential, cf. the discussion under Entry Substitutes in the Generic Elements section above.

sweet sorrow	*Czech*:	krasosmutnení
heart	*Spanish*:	corazon
heart	*German*:	Herz

String was envisioned to support enhanced keyword retrieval due to the prevalence and popularity of this type of searching on the Web. This formalized infrastructure could support automatic and/or interactive inclusion of synonyms and variants to expand or hone keyword searches to help prevent errors of omission. The resulting improvement in recall complements XML's inherent support for limiting searches to prescribed elements, improving precision. Lexical Records would underpin automatic bursting of designated search strings, offering choices of known variants to users, and providing cross-referencing in a browsable keyword

index. Inclusion of definitions, etc. could incorporate dictionary features into indexes, parallel to including scope notes for Conceptual Records. The structure also could provide support for search formulation and enhancement prior to transmitting a request to other systems, including non-XOBIS databases. As part of an integrated interface, this could help harness problems in searching across heterogeneous information environments.

String provides a mechanism for integration of important lexical aspects of searching with mainstream bibliographic control. The specificity and relationships are tantalizing. However, the concept of lexical authority records needs more investigation, and we have not had time to fully explore the many possibilities. Issues such as directionality and how this might work in conjunction with algorithmic transformations, or other techniques is not known. Standalone products, such as the influential WordNet, HyperDic, LexicalFreenet, Wordsmyth, and the NLM's pioneering Specialist Lexicon, illustrate the real potential (49-53). The idea is also manifest in Lane's textword authorities that have accumulated almost 1,000 records mostly in the health sciences over several years with this purpose in mind (48). The next step is to integrate these with keyword indexing.

2. Watch Your **Language**! (Linguistic Records)

Language	Specific spoken, written, or signed communication systems

```
<Language>
        <Entry class="individual">
                <Name>Esperanto</Name>
        </Entry>
</Language>
```

The **Language** element refers to specific named languages, which are defined as verbal or nonverbal systems used by beings to express ideas and feelings. For working purposes, it encompasses spoken, written, and signed languages, as well as specific named dialects, subsets, and usages. Also in scope are artificial and fictional languages. Languages are instantiations of **Concept**, usually language families. Individual words and phrases of **Language** are instantiated using the Principal Element **String**. Currently, the optional 'usage' attribute is defined for **Language**, with the single value *subdivision*, indicating that it may be used as the value for **Subdivision**. See Entry Substitutes under the Generic Elements section above for accommodation of abbreviations and codes. See 'language' in the Attributes section for intra-record linguistic designations.

Language excludes computer programming languages, markup languages, scripts, shorthand systems, alphabets, fonts, etc., which are most likely *authorities* or *instances* of **Work**. These can be linked as necessary; see the **Work** section for further explanation. Also excluded are linguistic groups that employ a proper adjective, e.g. Indic languages, instead of proper noun, and are thus covered by **Concept**. This is consistent with XOBIS' reliance on the same technique as a guideline for determining cusps. See the Indexing section for combining entries from different Principal Elements.

The **Entry** for **Language** has four attributes: 'scheme' with value from **Code** of a **Work**, 'class', with working values: *individual*, *other*, and *referential*, 'language', and 'transliteration'. The value *individual* permits the current set of single languages allowed for assigning to works, while *other* covers dialects, etc. and *referential* covers informational entries.

Relationships are used to categorize languages and indicate other associations. Linguistic Records permit *conceptual* relationships in the form of categorical linking to record that a **Work** is in a particular language ("isness") and topical linking to treat a language as a subject ("aboutness"). This keeps a language and its literature discrete. There are many possibilities, e.g. *geographic* relationships as a basis for a linguistic map interface; *vital* relationships for identifying available translators, scholars of rare languages, and writers by language; *organizational* relationships for official languages; *chronological* relationships for when languages were extant; *linguistic* relationships to other languages (e.g. Old English being continued by Middle English); etc.

A **Relationship** may have an equivocation via its **Modifier**, e.g. "chiefly" British [usage]. This could also be used to indicate the fluency of a person's reading, writing, and/or speaking ability, although the 'degree' attribute is a potential alternative. Suggested categorical relationships and selected others are shown in these examples using italics:

Language	*Category*: (**Singular** of **Concept**)
Afrikaans	Germanic Language
American Sign Language	Sign Language
Related: English **Language**	
Basque	Language Isolate ?
Elvish	Language, Fictional ?
English	Germanic Language
Earlier: English, Middle	Extinct Language ?
Narrower or *Related*:	
American Sign Language	Sign Language
Basic English	Language Subset ?
Black English	Language Usage ?
English (American Usage) ?	Language Usage ?
English (British Usage) ?	Language Usage ?
Esperanto	Language, Artificial
Flash (Prisoners' Dialect)	Dialect / Slang
Related: Prisoners **Concept**	
Related: Australia **Place**	
Related: English **Language**	
Sea Islands Creole Dialect	Creole Dialect
Yoruba	Kwa Language

The World Wide Web indicates the need for internationalization in its name. Language-specific versions of software have resolved the problem only partially. Much data remains in one language or lumped in the same record without an indication of language. Worse yet, cataloging too frequently mixes languages in the same entry, either deliberately or from lack of information. XML offers an excellent foundation for addressing such problems due to its use of Unicode (54) for flexible character set support without special provisions. As an initial step in an effort to

address the data issue in XOBIS, 'language' and 'transliteration' attributes are available for **Entry**, **Varia**, and a number of other elements, cf. the Attributes section. We elected to resect an initial language clustering attempt in favor of further study and, hopefully, much needed input from the international community. The issues are nontrivial due the need to correlate **Entry**/**Varia**, their **Qualifiers**, and the references in **Relationships** to specific IDs. We envision user-selectable language preferences that would rely on a default mechanism when entries or references are not available in the selected language for a particular value. As a result, importing records using a different primary language should be easier to incorporate into a local file using a different primary one. We expect a beta version of XOBIS to benefit from further investigation in support of more sophisticated multi-lingual catalogs.

3. The **Organization**, Man! (Organizational Records)

Organization	Organized groups, including jurisdictional subdivisions

```
<Organization type="governmental">
        <Entry class="collective">
                <Name>Library of Congress</Name>
        </Entry>
</Organization>
```

The **Organization** element covers named organizations and corporate bodies–groups of deliberately organized people, with key distinctions from **Being** (for some less formal groups), **Event** (separate from their organizing committees or secretariats), and **Place** (for top-level political jurisdictions and places administered by organizations with the same or similar name). It also includes jurisdictional subdivisions. An Organizational Record reflects the *specific* organization or organizational subdivision for which a record is created without regard to its hierarchical dependency or uniqueness of name.

Art Gallery
Ben and Jerry's
Bureau voor de Statistiek
Center for Conservation Biology
Class of 1966
Dept. of Classics
Everly Brothers
Iris & B. Gerald Cantor Center for Visual Arts at Stanford University
National Library of Medicine
Princess Takamatsu Cancer Research Fund
Secretaria Regional do Turismo e Cultura
Select Committee on Pawnbroking in Ireland
Stanford Artificial Intelligence Laboratory
Welsh Arts Council

Using current cataloging rules, some of these names can stand alone, and others require either subordinate entry (pre-qualification) or post-qualification for proper identification. Thus

qualified, they would *appear* mostly identical to traditional headings, but with the significant structural difference. The specific, bald name alone represents the **Organization**. Consult **Qualifiers** under Generic Elements for XOBIS' principles of identification/disambiguation.

Currently, **Organization** has an optional 'type' attribute with values: *business*, *government*, *nonprofit*, or *other*. Its **Entry** currently has four optional attributes: 'class' with values: *individual*, *collective*, or *referential*, 'scheme' using **Code** from **Work**, 'language', and 'transliteration'. Most organizations are *collective*, but *individual* carries the overall pattern for 'class' to individual professional practices, performers, etc. as opposed those more often thought of as organizations. An **Entry** has a **Name** with optional **Qualifiers**.

Because of XOBIS' emphasis on relationships, recording an appropriate **Relationship** is preferred to adding a **Variant** (cf. under Generic Elements) that is actually a relationship. (MARC now supports this in authorities field 510 subfield "w" byte "0" with value "t".)

Moody Medical Library	**Organization**
Parent: University of Texas Medical Branch at Galveston	**Relationship: Organization**

instead of:
Moody Medical Library
University of Texas Medical Branch at Galveston. Moody Medical Library

Such inter-record relationships are covered by the **Relationships** element, whereas **Varia** are used for recording *equivalence* or intra-record relationships for the *same* organization:

Public Library and Museum of Dayton, Ohio	**Organization**
Dayton Public Library and Museum	**Variant**

The XOBIS **Qualifiers** element and distinguishing equivalence from other relationships supports an envisioned indexing mechanism with alphabetical entries and variants handled differently from other relationships. Hierarchical levels based on **Relationships** could be accessed by "drilling down" to the desired level, perhaps indicated by arrows within an alphabetic sequence. Selection of see also relationships would reposition the user in the same or another index.

- ▶ University of Aarhus.
- ▼ University of Akron.
  - ▶ Bierce Library.
  - ▶ Buchtel College of Arts and Sciences.
    Bureau of Business and Economic Research.
    Center for Peace Studies.
  - ▶ Center for Urban Studies.
  - …
- ▶ University of Alabama at Birmingham.
- …

Note that the indexing substructure would omit pre-qualifiers, e.g. subordinate display of Bureau of Business and Economic Research "entered under" University of Akron. A qualifier would defeat the purpose of this hierarchical display. Such pre-qualifiers would likely be included in

other displays. Further investigation of the relative merits and conditions for pre- and post-qualification are in order. See the Bartlesville example in the **Place** section below.

The same substructure could appear under any of an organization's **Varia** as well:

- Municipal University of Akron
  = University of Akron
  - Bierce Library
  - ...

When **Varia** should be disambiguated deserves further study, cf.:

- ALA
- AMA
  - Aerospace Medical Association
  - American Management Association (1923-1973)
  - American Management Association (1985-1997)
  - Australian Medical Association
  - ...
- ANA.

versus unique variants for each acronym:

AMA (Aerospace Medical Association)
AMA (American Management Association : 1923-1973)
AMA (American Management Association : 1985-1997)
AMA (Australian Medical Association)

In this case, the first indexing example mimics XOBIS' hierarchical structure, intended to allow users to avoid wading through screens of subordinate entries when they are not interested in the parent. However, the second may be more useful in other cases, and might support the same hierarchical display more consistently.

Geopolitical entities present a special challenge because of their duality of location and jurisdiction. Using **Place** as a pre-qualifier permits inclusion of jurisdictional subdivisions as purely organizational without blurring the boundary between **Place** and **Organization**. The parent is excluded as being a type of **Place** (i.e. political geography). Entries for a jurisdiction itself can appear in organizational or locational indexes based on their attributes. This allows a **Place** to have subordinate relationships to an **Organization** and/or another **Place** as needed. The Bureau example of the University of Akron discussed above highlights the technique. More information is included under the **Place** element.

Meetings have traditionally been treated as corporate bodies. To reinforce structural integrity in XOBIS, we elected to treat meetings, congresses, etc. as members of the broader **Event** element. The warrant for this is that such headings seldom reflect a corporate identity, and when they do, a secretariat, organizing committee, or the like fills that role, in relationship to the event itself. If an organization responsible for an event is bibliographically important, this information would

likely take the form of a sponsoring **Relationship** of an **Event** to an **Organization**. Instead of this subordinate form of entry:

> **Event** (**Qualifiers**) **Organization**.
> Olympic Games (17th : 1960 : Rome, Italy). Organizing Committee

In XOBIS, the event would have an "Organized by" **Relationship** to the committee:

> **Organization** (**Event**) (**Qualifiers**)
> Organizing Committee (Olympic Games) (17th : 1960 : Rome, Italy)

The other common situation is generic names entered subordinately to a corporate body because the parent body's name is embedded within a subordinate body's name. Linking the unsplit name to its parent is structurally sound, but consider how this functions in hierarchical displays, e.g. the University of Akron example above, and the Bartlesville example in the **Place** section.

> Stanford University Libraries
> *Parent*: Stanford University
> vs.
>
> Stanford University. Libraries

The **Event** section covers this and other information on the interplay between organizations and events. More exploration and testing is needed.

Organization excludes some groups depending on the variation in degree of organization. Families, dynasties, etc. are handled as collective records for **Being**, except for syndicated crime families that function like businesses, e.g. "Gambino Crime Family". Also excluded are top-level jurisdictions, e.g. Cherokee Nation, Peru, etc. that are treated as **Place**.

Businesses, such as sole proprietorships, partnerships, and professional practices, represent an **Organization** as well, although they may involve only one or two people, wearing a "business hat" so-to-speak. Fictitious business names (dba/doing business as) differ from fictional organizations, but share the relationship to individuals:

> **Organization**
> Caprino's Italian Restaurant
>
Category:	Restaurants	**Concept**
Owner:	Awad, Anthony Selem	**Being**
Owner:	Awad, Suzanne	**Being**
Located:	Belmont, California	**Place**

Embedded relationships in names representing a person acting in a corporate role deserve further study. Similar cases appear in the **Being** section. As constructed, such names are tenuous in nature and might be represented more accurately in XOBIS if their entry better reflected an

Organization (perhaps Presidency). This case indicates that Mitterand was *President of* France from 1981-1995:

> **Place**. **Organization** (**Time-Time** : **Being**)
> France. President (1981-1995 : Mitterrand)

Fictional entities in general express categorical **Relationships** to an implied **Concept**, Fictional Organizations, and **Relationships** to the **Concept** they fictionalize. These examples illustrate some relationships of fictional or imaginary organizations, using the **Singular** entry substitute for each **Concept**. Rather than using **Qualifiers** routinely, they may only be necessary to convey the sense of an organization, due to the presence of a fictional **Relationship**.

Organization	**Relationship**		
Bates Motel			
	Category:	Fictional Organization	**Concept**
	Fictional:	Motel	**Concept**
Galactic Library (Trantor)			
	Earlier:	Imperial Library (Trantor)	**Organization**
	Category:	Fictional Organization	**Concept**
	Fictional:	Library	**Concept**
	Located:	Trantor (Fictional Planet)	**Place**
Lard Information Council			
	Topic:	Lard	**Concept**
	Category:	Fictional Organization	**Concept**
	Fictional:	Trade Association	**Concept**
Section 31 (Fictional Organization)			
	Category:	Fictional Organization	**Concept**
	Fictional:	Intelligence Service	**Concept**

4. In Any **Event** … (Episodic Records)

Event	Named macro-events, naturally-occurring or conducted by individuals or organizations

```
<Event type="meeting">
        <Entry class="collective">
                <Name>Workshop on Discrete Event Systems</Name>
                <Qualifiers>
                        <String>
                                <Name>5th</Name>
                        </String>
                        <Time>
                                <Year>2000</Year>
                        </Time>
                        <Place id="375">
                                <Name>Ghent</Name>
                                <Qualifiers>
                                        <Place id="3876">
                                                <Name>Belgium</Name>
                                        </Place>
                                </Qualifiers>
                        </Place>
                </Qualifiers>
        </Entry>
</Event>
```

Event includes all sorts of named happenings or occurrences, deliberate or not. This expands upon meeting name (MARC x11) and also includes natural phenomena (perhaps defined as lacking deliberate human involvement/causation), all of which LC generally treats as subjects. The emphasis is on the event itself with organizational involvements treated as relationships. It excludes micro-events and named processes, etc. which are generally categorical, rather than referring to one specific occurrence. Specific events may be subordinate to an umbrella Episodic Record, allowing economy of cross-referencing and hierarchical displays as discussed in the **Organization** section.

- International Conference on World Peace
  - 13th : 1983 : Taipei, Taiwan
  - 14th : 1984 : Baguio, Philippines

Unnamed macro-events would usually be covered by a categorical relationship to a **Concept**, e.g. Voyages Around the World. However, some well-known historical events lack precise names/entries or they lack a consistent proper name. Not surprisingly, some are difficult to locate in catalogs. If an **Event** is frequently referenced, famous, or otherwise desirable as an entry, concocted event names with ample variants are worth considering:

Circumnavigation of Earth (1519-1522 : Magellan)
Circumnavigation of Earth (1577-1580 : Drake)

Circumnavigation of Earth (1768-1771 : Cook)
Circumnavigation of Earth (1895-1898 : Slocum)

San Francisco Earthquake (1906)
Loma Prieta Earthquake (1989)
Variant: San Francisco Earthquake (1989)

Event has an optional 'type' attribute with tentative values: *natural, meeting, journey, occurrence,* or *miscellaneous*. Its **Entry** may have an optional 'class' attribute with values: *individual, collective,* or *referential*. Attributes for 'scheme', 'language', and 'transliteration' are also optional, as well as 'type' with the sole value of *generic*. The **Entry** consists of a **Name** and optional **Qualifiers**. While events are typically *collective, individual* is offered in reference to solo performances and for single natural occurrences. The *referential* value serves informational records with indirect associations to actual events, as in this *generic* case:

Annual Meeting …
Related: Biennial Meeting …
Related: Meeting …
Related: Semi-Annual Meeting …

Event is broadly interpreted to include natural events such as astronomical, geological, meteorological, public health, etc. ones. The scope extends to all manner of convened endeavors, such as conventions, expeditions, fairs, festivals, launches, meetings, parades, parties, trials, voyages, etc. as well as other occurrences besetting society, e.g. accidents, battles, disputes, massacres, wars, etc. Entries for events benefit from qualification by place and time. If properly named, their duration may be lengthy.

The following examples include potential categorical **Relationships** in the right column. Some other selected relationships and **Varia** are indicated to help illustrate delineations and potential referencing. Some cases are discussed following the examples.

Event (*natural*)	*Category*: **Concept**
Cyclone Orissa (1999)	Cyclones
Hurricane Bonnie (1998).	Hurricanes
Variant: Bonnie (Hurricane : 1998)	
Influenza Pandemic (1918-1919)	Epidemics
Johnstown Flood (Pennsylvania : 1889)	Floods
Related: Johnstown Flood Museum (Pennsylvania) **Organization**	
Related: Johnstown Flood National Memorial (Pennsylvania) **Place**	
Topic: Dam Failures **Concept**	
Mount Saint Helens Eruption (1980)	Volcanic Eruptions ?
Related: Mount Saint Helens (Washington (State)) **Place**	
Perseid Meteor Shower (2002)	Meteor Streams
Parent: Comet 1862 III **Place**	
San Francisco Earthquake (1906)	Earthquakes / Fires ?
Variant: Great San Francisco Earthquake (1906)	
Solar Eclipse (1854)	Solar Eclipses

Tropical Storm Allison (2001)	Storms
Variant: Allison (Storm : 2001)	
Vesuvius Eruption (79)	Volcanic Eruptions ?
Vesuvius Eruption (1767)	
Vesuvius Eruption (1944)	
Related: Vesuvius (Italy)	Volcanoes / Mountains

Event (*meeting*)

Annual Meeting (Medical Library Association) (2002 : Dallas, Texas)
Sponsor: Medical Library Association **Organization**
International Conference on Cataloguing Principles (1961 : Paris, France)
School for Scanning Conference (The Hague, Netherlands : 2002)
Category: Library Institutes and Workshops **Concept**
Symposium (British Society for Cell Biology) (1986 : Norwich, England)
Symposium (Eugenics Society (London, England)) (11th : 1974 : London, England)
Sponsor: Eugenics Society (London, England) **Organization**
Symposium (Society for Developmental Biology) [*authority*]
Variant: Symposium of the Society for Developmental Biology
Symposium (Society for Developmental Biology) (32nd : 1973 : Manhattan, Kansas)
XOBIS Conference (2004 : projected) Conferences ?
Variant: X-Con

Event (*miscellaneous*)	*Category*:
Burning Man (Festival)	Art Festivals [*authority*]
Cambridge Folk Festival (Cambridge, England)	Folk Festivals [*authority*]
Cambridge Folk Festival (Cambridge, England : 2002)	
Communist Trial (New York, NY : 1949)	Communist Trials
Drowned World Tour (Madonna : 2001)	Concert Tours
Indianapolis Speedway Race (2002)	Automobile Races ?
Location: Indianapolis Motor Speedway **Place**	
Sponsor: Indianapolis Motor Speedway Corp. **Organization**	
Opera in the Park (Madison, Wisconsin : 2002)	Concerts
Renaissance Pleasure Faire of Northern California	Historical Reenactments
Topic: 1558-1600 **Time**	
Washington County Fair (Dewey, Oklahoma : 1966)	Agricultural Exhibitions
Woodstock Festival (Bethel, New York : 1969)	Art Festivals
Variant: Woodstock Aquarian Music and Art Fair	Music Festivals
Held: 1969-04-15/1969-04-17 **Time**	Summer Festivals
Woodstock Festival (Saugerties, New York : 1994)	Rock Concerts
World Series (Baseball) [*authority*]	Sports Events ?
	Athletic Contests ?

Event (*occurrence*)	*Category*:
Antietam (Battle : 1862)	Battles
Location: Sharpsburg, Maryland **Place**	
Namesake: Antietam Creek **Place**	
Parent: Civil War (United States : 1861-1865) **Event**	

Boxer Rebellion (China : 1899-1901)	Peasant Uprisings
Occurred: 1899-1901 **Time**	
Cold War (1945-1996?)	Wars / International Conflicts?
Related: Bay of Pigs Invasion (Cuba : 1961) **Event**	
Related: Berlin Airlift (Berlin, Germany : 1948-1949) **Event**	
Related: Berlin Wall (Berlin, Germany : 1961-1989) **Place**	
Related: Cuban Missle Crisis (1962-10) **Event**	
Related: Gorbachev, Mikhail Sergeevich, 1931- **Being** [and others]	
Related: Korean War (1950-1953) **Event**	
Related: Perestroika **Concept**	
Related: U-2 Incident (1960) **Event**	
Related: Vietnamese Conflict (1961-1975) **Event**	
Great Fire (Chicago, Illinois : 1871)	Fires
Holocaust, Jewish (Europe : 1939-1945)	Atrocities
Jacquerie (France : 1358)	Peasant Uprisings
Jonestown Mass Suicide (Jonestown, Guyana : 1978)	Massacres
Topic: Mass Suicide	
Peloponnesian War (431-404 BC)	Wars
Sino-Indian Border Dispute (1957-)	Boundary Disputes
Tay Bridge Disaster (Dundee, Scotland : 1879)	Bridge Failures Railroad Accidents
War of 1812.	Wars
Disputant: Canada **Place**	
Disputant: Great Britain **Place**	
Disputant: United States **Place**	
Occurred: 1812-1814 **Time**	
Watts Riot (Los Angeles, California : 1965)	Riots

Event (*journey*)	*Category*:
Apollo 11 (Space Flight : 1969)	Space Flights
Variant: Apollo 11 Lunar Landing Mission	
Related: Sea of Tranquility **Place**	
Beagle Expedition (1831-1836)	Scientific Expeditions
Related: Beagle (Ship) **Object**	
Harvard University-Museum of Fine Arts, Boston, Expedition (Egypt : 1936-1939)	Archaeological Expeditions

These examples depart markedly in some instances from those of LC's practice of pre-coordination sampled below. Each example is juxtaposed with comparable XOBIS Principal Elements to illustrate the irregularity and resultant scattering of events. Some of these may represent earlier cataloging rules. Consult the **Relationships** section for further implications.

Event, **Place**, **Place**, **Time**.
Watts Riot, Los Angeles, Calif., 1965.

Event (**Time** : **Place**, **Place**)
Seminar on Hospitalization of Children (1963 : Paris, France).

Place inverted (**Place**) **-- Event, Time**
Saint Helens, Mount (Wash.) -- Eruption, 1980
Vesuvius (Italy) -- Eruption, 1944.

Event, Place, Place, Time
Tay Bridge Disaster, Dundee, Scotland, 1879

Event, inverted, **Place, Time**
Antietam, Battle of, Md., 1862

Place -- Concept --Event embedded **Time**
United States -- History -- War of 1812.
Greece -- History -- Peloponnesian War, 431-404 B.C.

Event, Time
Jacquerie, 1358

Organization. Event (**Time** : **Place**, **Place**)
British Society for Cell Biology. Symposium (1986 : Norwich, England)

Each of the Principal Elements has its own set of issues. The most difficult one with **Event** relates to generic names of meeting sequences that incorporate an **Organization**'s name. Such names may vary considerably, with the variants tending to relate to a program committee's valiant attempt to thematically publicize the meeting and/or to varying editors making reference to the names in proceedings of the meetings. However, the names tend to hover around a single identity. Usually, the variations are recorded intermittently or omitted. Over time variations and varying references accumulate. If recorded comprehensively for individual meetings, indexes would become hopelessly cluttered. To make matters worse, too often these names blur the distinction between the **Organization** and the **Event**. "Are you going to MLA?" rarely refers to headquarters, but implies the annual meeting (and relies on topical context to boot). Consider a few of the possible variants that ignore capitalization and differing combinations by year:

Annual Meeting of the Medical Library Association
Annual Meeting - Medical Library Association
Annual Meeting MLA
Centennial MLA Meeting
MLA '02
MLA Annual Meeting
Medical Library Association Annual Meeting
Medical Library Association's … Annual Meeting

Reliance on such arbitrary usage may be counter-productive in establishing entries. Greater homogeneity of something akin to latest entry cataloging would better serve users. XOBIS avoids blurring the crisp ideas of **Event** and **Organization**. Its structure is such that literal text can be recorded as needed (cf. **Description** in the Generic Elements section). This can be done on an umbrella record, shown first below, and used for leveraging display flexibility and simplifying **Relationships**. Only in selected cases would it be necessary to provide authorities

for the constituent meetings, perhaps in the case of an occasional distinct name. The following illustrates a *generic collective authority* record for an **Event** record, followed by the **Entry** that would appear as an *episodic* relationship on a **Work**.

Event (**Organization**)
Annual Meeting (Medical Library Association)
Sponsor: Medical Library Association *Relationship*: **Organization**

Event (**Organization**) ([**String**] : **Time** : **Place**, **Place**)
Annual Meeting (Medical Library Association) (2002 : Dallas, Texas)

Such "formal" entries would require rule modification. Punctuation is for illustration only. More investigation is needed.

Language issues also apply to **Event**. The German and Italian names of this festival appear on a pair of posters. An English translation might be supplied in an English-language catalog and designated the **Entry** for the event; an Italian or German catalog could prefer those languages instead. Note the linguistic integrity of each **Entry**. A discussion of how this may be addressed in a later version of XOBIS is included in the **Language** section.

Music Week in Memory of Gustav Mahler (1984 : Dobbiaco, Italy) [*Translated*:]
Settimana Musicale in Memoria di Gustav Mahler (1984 : Dobbiaco, Italia)
Musikwoche in Memoriam Gustav Mahler (1984 : Toblach, Italien)

See the **Time** section next for discussion of special days, years, etc., specific instances of which may constitute **Event**s.

5. It's About **Time**! (Chronological Records)

Time	Individual chronological values or ranges of values (periods)

```
<Time>
    <Entry class="individual">
        <Year>1776</Year>
        <Month>07</Month>
        <Day>04</Day>
    </Entry>
</Time>
```

Time is handled homogeneously throughout XOBIS, with the obvious exception of **Description**. The date of publication, date of a conference, death date of an author, date qualifier in a title, creation date of a record, etc. are marked up identically. Although somewhat verbose, this provides a consistency that holds considerable potential for generalizing, and thus improving, chronological access in regard to other Principal Elements and their **Relationships**. While **Time** may be recorded without regard to the existence of a temporal authority record, a hierarchical arrangement of controlled Chronological Records with their **Entry/Varia** linked in a rich array

of **Relationships** is envisioned. Some temporal values are recorded systematically in MARC, but current practice prevents catalogs from moving much beyond the simple limiting by date of publication. This is difficult to understand in view of the fundamental universality of **Time**.

Instantive aspects of **Time** differ from those of other Principal Elements. First, there are an infinite number of instants possible. Individual temporal instances or periods are identified commonly by numeric designations, e.g. 2001, instead of by proper names. However, proper names occur sporadically and vary from representing a single day (VE Day) to an entire era (the Renaissance). Regardless of duration, most ordinary temporal values are collective, e.g. a century contains years, years contain months, and so forth. It is helpful to consider that a day, an hour, etc. have a start and stop times. Lastly, all such designations are human constructs, systems of dating called calendars, each of which may be considered a **Work**, itself promulgated at a time related to a cosmic cyclic event, an historical event, or to another scheme. To keep things interesting, calendars overlap in a most peculiar assortment of ways.

Thus, with the goal of providing a unified treatment of dates and times in XOBIS, **Time** broadly represents instantiation of various calendars, individually or collectively, each preferably identified by a **Work** authority. Values may stand alone, although a remote goal would be to harmonize the major calendars to the extent that synonymy can be identified. After all, they all represent the same intangible. Specific values are virtual instantiations of a given **Concept**, e.g. the abstract solar year, or in its collective form, years. The "isness" of categorization discussed earlier applies here as well, e.g. 1948 *is* a Year. Whether considered "specific" or "collective", all such values are necessarily **Time** and may have implicit or explicit **Relationships** both to other values of **Time** and/or to **Concept**. Regarding relativity and extraterrestrial aspects … ?

Time currently has a 'usage' attribute with the sole value of *subdivision*, to indicate that it may be used as a **Subdivision** in a **Relationship**. Its **Entry** has a 'class' attribute with values: *individual* (one value), *collective* (a range), and *referential*. There is also an optional 'calendar' attribute on **Entry** or **Variant**, discussed below, as well as a 'scheme' attribute. Attributes for 'language' and 'transliteration' are also optional.

Currently, the following options appear to handle all patterns identified to date. Fortunately, the more complex structures occur less frequently.

A "single" time:

Time

or:

Times
- **Time**
- **Time**

A "range" of time:

Duration
- **Time**
- **Time**

or:

Duration
- **Times**
  - **Time**
  - **Time**
- **Times**
  - **Time**
  - **Time**

In all cases, **Time** includes either a **Name** or a special chronological substructure. See Figure 4 for an overview of this in context. This substructure is based on ISO 8601:2000, the International Organization for Standardization's standard for date and time (55). Its elements include:

Year	**Hour**
Month	**Minute**
Day	**Second …**

See the schema itself for how this is used for **ControlData** and for treatment of time zones. XOBIS relies on XSL (XML Stylesheet Language) to render display values in accordance with the standard, e.g. the date from the introductory example should display thusly:

1776-07-04 and a time: 12:34:03

Some extensions to the standard were needed to accommodate added structural and/or qualitative factors. Basically, a temporal value may consist of one or a pair of **Time** elements, as shown above. Two container elements, **Times** and **Duration**, permit grouping these values to describe a "single" time (e.g. 2000/2001), or a "range" of time (e.g. 1830-1839) with a maximum of four values per instance (e.g. 1966/1967-1969/1970). Containment, unusual for a Principal Element, was structurally necessary. This organization and two additional elements, **Type** and **Certainty** discussed next, provide considerable flexibility in representing time. There are differences in applicability of this arrangement depending on whether the value(s) occur on the Principal Element **Time**'s **Entry/Varia**, as part of **Qualifiers** anywhere, or as the target of a **Relationship**.

The generic **Type** element is currently used with **Time**, **Times**, or **Duration** to express implicit relationships, e.g. b. 1975, or naming, e.g. Bulk Dates for archival materials. Likewise, **Certainty** may indicate the degree of confidence in a value. Together, these can be used to control punctuation and labeling shown in the examples below and supplied via XSL. Implicit relationships should not be confused with the **Relationships** element, where birth and death dates differing from an entry's could be recorded, although this practice is questioned. The **Type**'s 'set' attribute value is currently Temporal Type with Single understood, and **Certainty**'s 'set' attribute is Certainty Type with Exact implied. It is necessary to use **Type** and **Certainty** at the appropriate level to avoid duplicate labels due to the repeatability of **Time**. Experience will dictate whether attributes would better serve here. The current method provides greater flexibility during this initial phase.

Type supports the following potential display values. Rules would need to be determined and might differ depending on whether the value is in **Entry/Varia** or elsewhere. Currently the Entry Substitute **Code** is envisioned as the value for the 'set' attribute for **Type**, as each of these cases is a **Concept**. The examples are grouped by element:

Duration

Display?	**Type**	
-	Start	[trailing hyphen]
-	Stop	[leading hyphen and trailing period/full stop]

Note that only one of these **Type** values is necessary to effect the desired punctuation (i.e. prevent duplicate hyphens). While perhaps more common in Holdings, intermittency is supported by the repeatability of **Duration**, e.g. 1975-1976, 1980-1981, which is useful in relationships.

Times		
Display?	**Type**	
/	Slash	[trailing hyphen in preference to "or"?, cf. below]

The slash/virgule is useful in displaying a range when a **Time** value would display with the ISO recommended hyphen in punctuation. The unusual value 1919 Feb. 11-15 (distinguished from 1919 Mar. 17-19) in a conference **Qualifier** could be accommodated as 1919-02-11/1919-02-15. We are continuing to study ISO display issues.

Time		
Display?	**Type**	
	Single	[implied; no display constant]
fl.	Flourished	[leading fl. and trailing period]
b.	Born	[leading b. and trailing period]
d.	Died	[leading d. and trailing period]
f.	Founded	[leading f. and trailing period]
pre-	Before	[leading pre- and trailing period]
post-	After	[leading post- and trailing period]
early	Early	[leading early and trailing period]
mid-	Mid	[leading mid- and trailing period]
late	Late	[leading late and trailing period]

The **Certainty** element permits equivocation of the precise values included in **Time**, **Times**, or **Duration**, indicating the sureness or reliability of a particular value. It is structured like **Type** and also relies on XSL to provide punctuation. An attribute may replace this after we have more experience/input. Lack of **Certainty** implies an Exact date, although this can be explicit.

	Certainty	
Display?	'set' **Code**	
	Exact	[implied; no display constant]
?	Questionable	[trailing question mark]
< >	Temporary	[leading < and trailing >]
ca.	Circa	[leading ca.]
approx.	Approx	[leading approx.; consider ~]
or	Alternative	[trailing or; necessary?, cf. above]
[unknown]	Unknown	[as shown?]
!	Emphatic	[trailing !; necessary?]
[ ]	Supplied	[leading bracket and trailing bracket; policy?, cf. **Description**]

Decades, centuries, and millennia represent **Certainty** as well, e.g. 1860s, 1900s, and 1000s, although these often are referred to by other names, e.g. 20th century. Ordinal

numbers (1st, 2nd, 3rd, nth) add considerable variety. As coded values, MARC indicates uncertainty with the filler "u", e.g. 19uu. In this situation we considered using **Type** with a **Code**, such as Decade, to indicate display of a trailing "s" on the bald whole value, e.g. 1860. Because XOBIS posits **Time** authorities, the many ordinal cases may be handled preferably in that context, cf. a likely named **Time**:

Entry	Twentieth Century	
Abbrev	20th Cent.	[or 20th cent.?]
Code	1900s	
Variant	1900-1999	

The **Code** can be addressed using the 'substitute' attribute on a Principal Element as a qualifier or on **Duration** of a **Variant** or **Relationship**.

Time has the most complex markup in XOBIS. Chronological details remain under study as some more exotic values are likely to occur. Roman numerals as dates are probably best treated as **Description**, although they may be additionally included as **Varia** for **Time**. We have not had time to consider geologic times adequately, although BC is handled by the 'calendar' attribute, cf. below. These techniques allow dates to be indexed by value, but displayed with trappings. An alternative would be to define 'prefix' and 'suffix' attributes similar to 'nonfiling'. This example illustrates current markup for the value: <1948>-1959?

```
<Duration>
        <Time>
                <Type set="Temporal Type">Begin</Type>
                <Certainty set="Time Certainty">Temporary</Certainty>
                <Year>1948</Year>
        </Time>
        <Time>
                <Type set="Temporal Type">End</Type>
                <Certainty set="Time Certainty>Questionable</Certainty>
                <Year>1959</Year>
        </Time>
</Duration>
```

Because a specific calendar may apply to **Entry** or **Variant** and because a particular case only has one calendar, using an attribute worked best. The 'calendar' attribute is optional. The currently prevalent Gregorian calendar for the Common Era (CE/AD) represents a base, or default, and is omitted. Chronological Records from any calendar may standalone, e.g. 1026 FE for Asimov's fictional First Empire dating, but linking values to the Gregorian calendar as **Varia** when possible lends uniformity. The values of 'calendar' represent the **Code** on the authority for the parallel **Work**, and are intended to group index entries by calendar and/or BC. Due to the characteristics of ASCII, bald numeric values for Gregorian entries would file first. Some suggested codes:

Code	**Work** (*authority*)	**Variant**
AH	Islamic Calendar	Anno Hegira
AM	Jewish Calendar	Anno Mundi
BC	Before the Common Era	Before Christ
FR	French Revolutionary Calendar	
JU	Julian Calendar	

Structuring a chronological index would take advantage of the hierarchical nature of values for the chronological "names" of **Entry/Varia**, cf. Figure 4. This example suggests the underpinning arrangement and indicates some textual **Varia** on the right:

- 1900-1999 — 20th Century 20th Cent. 1900s
  - *Related*: 2000
  - *Earlier*: 1800-1899 — 19th Century
  - *Later*: 2000-2999 — 21st Century
  - *Narrower*:
    - 1900-1909
    - 1910-1919
    - 1920-1929 — Roaring Twenties
      - 1920
      - 1921
      - 1922
      - …
    - 1930-1939
    - …

The pattern continues as individual years have earlier and later **Relationships**, and are composed of individual dates, e.g. 1948-01-02, continued by 1948-01-03. Records to populate this structure could be built algorithmically and/or added gradually when considered significant. With increasing granularity the need is sporadic. Cusp problems appear solvable.

Entry/Varia for **Time** may also have a textual **Name**. Whether a chronological or textual name should be the **Entry** remains in question. These examples indicate selected **Varia** and **Relationships**, and treat text as **Entry** in contrast to the above example:

3rd Millennium
  Variant: 2000-2999
Fabulous Fifties
  Variant: 1950-1959
Juneteenth
  Variant: 1865-06-19
Middle Ages
  Variant: Medieval Period ?
  Covers: approx. 500-1450 **Time**
Pearl Harbor Day
  Variant: 1941-12-07
  Related: Pearl Harbor Attack (1941-12-07) **Event**

VE Day
Variant: 1945-05-08
Variant: Victory Europe Day
Variant: V-E Day

Various temporal issues remain for interpretation within XOBIS' framework. **Time** differs from **Event**, which occupies time, but refers primarily to the occurrence (what happened) rather than the time period itself (when it happened). Anniversaries of events (e.g. Juneteenth), holidays (e.g. Labor Day is the first Monday in September), zodiacal signs (e.g. Capricorn), Chinese horoscopic terms (Year of the Horse), etc. are under review. Holidays and other named periods may also vary by **Place**. Entries not subordinate to years must rely on indexing convention; it is anticipated they would file preceding any specific year. Three examples:

Entry	**Concept** *Category*:
Ides of March	Day
Variant: 03-15	
September	Month
Variant: 09	
Spring	Season
Begins: 03-20/03-21	
Ends: 06-20/06-21	

Note: The coded values would not contain leading zeros; these are part of display. Displaying the range for Spring as a **Variant** as in the other two examples is problematic, and thus shown as two cases of **Relationship**.

Special days, weeks, years, decades, etc. sometimes bear proper names. An initial review of some LCSH headings used as umbrella terms suggests that some may represent a single **Time** (e.g. National Recycling Day = 1992-04-15) or actually indicate a topical **Concept**. Gay Pride Day is collective, including Gay Pride Week, etc. and might better be expressed as Gay Pride Events, which in turn could be instantiated by specific individual named **Event**s as needed. Whether or not the International Year of the Ocean is synonymous with 1998 is questionable. Such names tend to function as a temporal umbrella for various named or unnamed activities and events. Policies would need to be refined.

Relationships of all sorts may be *chronological,* and **Time** relates to other Principal Elements. The **Concept** Leap Year could have a categorical link to each applicable **Year**. Named generations (**Being**) reference definable periods. The **Organization** America Recycles Day, Inc. may merit a **Relationship**. Increased use of **Relationships** lessens the need for **Description**. Consider the maritime example of a ship (**Object**), which may have dates of delivery, keel laying, launch, commissioning, recommissioning, decommissioning, transfer, etc. See the **Relationships** section for scope.

6. There's a **Place** for Us … (Geographic Records)

Place	Structures, geographic locations, and jurisdictions, including extraterrestrial ones

```
<Place type="natural" role="authority">
        <Entry class="individual">
                <Name>Earth</Name>
        </Entry>
</Place>
```

The **Place** element encompasses both physical geography (astronomical and terrestrial locations, including their topographic and structural features) and political geography (geopolitical jurisdictions of governments). The emphasis is on the name of an area and/or its government, which may change. Currently, **Place** has a required 'role' attribute with values of *authority*, *instance*, or *authority/instance*. It also has an optional 'type' attribute with values: *natural*, *constructed*, or *jurisdictional*. It may also have a 'usage' attribute with the single value of *subdivision*, to indicate suitability as a value of **Subdivision** in **Relationships**. Its **Entry** has an optional 'class' attribute with values: *individual*, *collective*, or *referential*, as well as 'language' and 'transliteration', and may have a 'scheme' attribute.

Similar to current practice, an **Entry** may serve as an anchor for both organizational and geographic subordinate **Relationships**. The post-ordinate **Qualifiers** are common. **Place** is a "substantive" Principal Element in that real estate (land and structures) may be held, owned, controlled, etc. Differing from LC's ambiguous headings (44), buildings are included here as they occupy space, have spatial relationships, and have rooms within them. While mostly useful for subject relationships, they also find expression in literal holdings of parks and living history museums, as well as in the context of the National Register of Historic Places, the United Nations World Heritage Sites, etc. There is potential for improving access to historical and geographic information. These examples illustrate the wide variety:

Andes	Mountains
Andromeda Galaxy	Galaxies
Blue Ridge Parkway (North Carolina/Virginia)	Parkways
Coolidge Auditorium (Library of Congress)	Auditoriums ?
Dazuizi Site (China)	Archaeological Sites
Diaoyu Cheng (Extinct City)	Extinct Cities
Earth	Planets
Georgetown (Washington, D.C.)	Neighborhoods ?
Halley's Comet	Comets
House of Dionysus (Paphos, Cyprus)	Dwellings
La Brea Pits (California)	Holes
Thomas Jefferson Building (Library of Congress)	Buildings
Old Sturbridge Village (Sturbridge, Massachusetts)	Living History Museums ?
Ruby Gulch Mine (Montana)	Mines
San Jose International Airport	Airports
Santorini Volcano (Greece)	Volcanoes [needs xref Volcanos]
Shenandoah National Park (Virginia)	National Parks & Reserves

Uluru (Ayers Rock)	Mountains ?
Waitomo Cave (New Zealand)	Caves

The chief difficulty in managing the duality between place and government is resolved by means of **Relationships**, both *geographic* and *organizational.* The following examples are not meant to be actual displays, but attempt to reveal structural relationships that could underpin presentation of such an arrangement. Details of how indexes and display options would work are left to implementation software. Note the potential for conditional display by omitting of pre- and post-qualifiers in subordinate positions. The effect of jurisdictions' being treated as intrinsic parts of a name (i.e. embedded), such as for public libraries is evident in this example:

Place
Bartlesville (Oklahoma)
Subordinate: **Organization**
[Bartlesville, Oklahoma] Fire Dept.
[Bartlesville, Oklahoma] Human Resources Dept.
[Bartlesville, Oklahoma] Police Dept.
Bartlesville Public Library (Bartlesville, Oklahoma)
Subordinate: **Place**
Frank Phillips Boulevard (Bartlesville, Oklahoma)
Johnstone Park (Bartlesville, Oklahoma)
Sooner Park (Bartlesville, Oklahoma)
Yale Avenue (Bartlesville, Oklahoma)

The following example extends this idea to show how **Relationships** (in italics) could be used more extensively in geographic organization. The **Relationships** section discusses the intriguing issue of relationship names versus categorical membership. Note the accommodation of overlapping periods (Jacobin) via nested subsets, which is useful in cases of dispute or uncertainty. This example also partially illustrates the optional display of entries by language, English in this case.

Place **Place**
France
Cities:
Paris (France)
Points of Interest:
Arch of Triumph (Paris, France)
Eiffel Tower (Paris, France)
Streets:
Champs-Elysees (Paris, France)
Rue Paul Appel (Paris, France)
Lyon (France)
Versailles (France)
…

Governments:
France (1461-1792 : Kingdom)
France (1792-1804 : Republic : 1st)
France (1792-1795 : Convention)
France (1792-1794 : Jacobin Republic)
France (1795-1799 : Directory)
France (1799-1804 : Consulate)
France (1804-1815 : Empire : 1st)
France (1815-1848 : Kingdom)
France (1848-1852 : Republic : 2nd)
France (1852-1870 : Empire : 2nd)
France (1870-1940 : Republic : 3rd)
France (1940-1944 : German Occupation)
France (1944-1946 : Provisional Government)
France (1946-1958 : Republic : 4th)
France (1959- : Republic : 5th)
Regions:
Aquitaine (France)
Brittany (France)
Burgundy (France)
Corsica (France)
…

Related events can link reciprocally:

Event
French Revolution (1789-1799)
Related: **Place**
France (1461-1792 : Kingdom)
France (1792-1794 : Jacobin Republic)
France (1792-1804 : Republic : 1st)
France (1795-1799 : Directory)

Place includes individual top-level jurisdictions, even if space is not coterminous with the jurisdiction. It excludes inter-governmental organizations, e.g. United Nations. **Being** covers proper names for inhabitants:

Place	**Being** (*collective*)
Cherokee Nation.	Cherokee Indians
KwaNdebele (South Africa)	Ndebele (African People)
Tonga	Tongans
Zululand (South Africa)	Zulu (African People)

Place excludes jurisdictional subdivisions treated as **Organization** and organizations which administer spaces (e.g. airports, parks). Sometimes the names are quite similar, but the distinction is an important one. When the names are identical, **Qualifiers** can be added to make them unique, although the Principal Elements' names reflect the difference. In practice, this

distinction may not be problematic in terms of redundancy. We intend to continue studying the issue and welcome feedback. See also LC's ambiguous headings for similar categories (44).

Place ***Relationship*: Organization**
Logan International Airport
Administered by: Massachusetts Port Authority
Missouri Botanical Garden (Place)
Related: Missouri Botanical Garden (Organization)
Raleigh-Durham International Airport
Code: RDU
Administered by: Raleigh-Durham Airport Authority
San Jose International Airport
Administered by: San Jose International Airport, Inc.
Stanford Campus
Related: Stanford University

Place also excludes sculpture regardless of size (**Work**) and mobile structures, such as ships and trains, which are handled by **Object**. Whether or not an **Object** should exhibit internal *geographic* relationships needs study; consider the condominium ship World. The "isness" and "aboutness" issue raised earlier applies to **Place**, with the mixing of **Concept**s in some LCSH headings causing instantiation problems, e.g. Mines and mineral resources. Divide and conquer is a reliable principle.

Addresses merit further study, especially since they would be used in multiple schemas. They appear to represent a cluster of **Relationships**, primarily between a **Being** or an **Organization** and a **Place**. Cascading/embedding and **Qualifiers** complicate the picture, although a street number clearly represents a sequential aspect of a relationship to the street.

Fictional **Relationships** also apply to **Place**. For consistency, we have used "Fictional" in all cases, although LCSH uses "Fictitious" and "Imaginary" variously in qualifiers, e.g. (Imaginary place), although "Legendary" and "Mythical" represent a discrete idea(s). All of these examples belong to the *Category*: Fictional Place.

Place	**Relationship** *Fictional*: **Concept**
Atlantis	Continent
Elbonia	Country ? or Nation ?
Gaia (Fictional Planet)	Planet
Lake Wobegon (Minnesota)	Town ? or Populated Place ?
Shangri-La	Utopia
South Park (Colorado)	Town ? or Populated Place ?

7. **Being** and Nothingness? (Vital Records)

Being	Specific identities of tangible or intangible beings (living or dead) and/or personifications

```
<Being type="human" role="authority">
        <Entry class="individual">
                <Type set="Personal Name Type">Assumed Name</Type>
                <Forename>Shirley</Forename>
                <Surname>Ellis</Surname>
        </Entry>
</Being>
```

The **Being** element is broadly interpreted to accommodate authorities for proper names of identified beings or groups of beings and personifications, whether human or otherwise, real or imagined, living or dead/extinct, as well as concocted names used to identify collected specimens of organisms. In contrast, generic categories of beings without proper names, such as bassoonists or species, are covered by **Concept**. Although the broad scope of life forms and their spiritual manifestations may appear unseemly at first, attributes that serve to zone these into practical categories are under consideration. Indexing may be configured to take these into account.

This outline of the main elements includes current attributes and their values or sources. Most of this structure has been discussed previously. See Figure 4 for how **Being** fits into overall naming and how either a **Name** or a "Personal" name structure may be used as appropriate.

Being (optional 'type': *human, specimen, special*)
(required 'role': *authority*, *instance*, *authority/instance*)
Entry (optional 'class': *individual, familial, collective, undifferentiated, referential*)
(optional 'language': <value from **Entry** of **Language**>)
(dependent 'transliteration': <value from **Code** of **Work**>)
(optional 'scheme': <value from **Code** of **Work**>)
Type (optional; e.g. Pseudonym, Assumed Name, etc.)
Duration (optional)
Name (or **Forename/Surname/Expansion**)/**Qualifiers** (optional)
Varia
Variant (repeatable)
Type (optional; same as for **Entry**)
Duration (optional)
Name (or **Forename/Surname/Expansion**)/**Qualifiers** (optional)

XOBIS expands conventional entries to include names for beings that LC treats only as topical subjects. Because both subjects and authors represent **Relationships** to a **Work**, neither was selected as a Principal Element. LC stopped adding subject headings to name authorities around 1986; this was akin to adding **Conceptual** relationships. See the **Relationships** section for discussion of the role they have in determining Principal Elements. For **Being**, similarities in

genealogical relationships are evident for people, animals, gods, and characters, especially in contrast to other Principal Elements, for instance, **Object**.

XOBIS emphasizes identities and relies considerably on their being reflected in proper names to distinguish a particular **Being** from a class (**Concept**). This extends to intangible spirits, characters (fictional, legendary, and mythological), deities, etc. Additionally, the same **Being** may have more than one **Record**; the issue of separate identities needs further investigation as they change over time and may overlap. **Name** excludes unqualified scientific names, etc., which refer to a class (e.g. all members of a species are a **Concept**) rather than to an individual specimen. However, groups with proper names are treated as *collective* instantiations of **Being**. Although anthropomorphism extends to the inanimate, named things are covered by **Object**, as are separate anatomical specimens.

Like UKMARC, and unlike MARC, **Forename** and **Surname** are separate elements of the substructure to support improved retrieval. Consider that Albert, Alexander, Ashley, Curtis, Frank, Henry, John, Julia, Kaye, Kelly, Oliver, Rose, Ruth, Scott, and Thomas, to mention only a few, are often *surnames*. (In 2002, Medline began making this distinction.) **Expansion** covers spelled out initials (MARC x00 ^q). For other components of **Name**, see the generic **Qualifiers** above, which treats enumeration (MARC x00 ^n) and appellation (MARC x00 ^c) as repeated instances of **String**. Currently, **Being** is the only case where **Type** has been extended to **Entry**; cf. **Type** in the Generic Elements section and later in this section. See the **Object** section's discussion of **Identifier** that could be extended to **Being**.

The aim of the other examples is to illustrate the variety in naming, the range of categories and attributes, and other related issues. The attributes are emergent and perhaps a different breakdown would work better. The value *human* intends to subset ordinary flesh and blood people. The value *specimen* represents collected whole specimens, regardless of organism (cf. Otzi below) or alternation for mounting. Beyond these two, mutually exclusive categorization becomes more difficult. Using **Relationships**, any number of specific groupings can be established, leaving attributes for broad groupings. The value *special* intends to cover all intangible beings. Due to differing cultural or religious interpretations and historical obscurity, *special* is currently broadly interpreted to include cases that are "in doubt" or ambiguous. Plurals for **Concept** are used in these examples, except as qualifiers. See also **Singular** for Entry Substitutes under Generic Elements above. An asterisk (*) indicates a "Personal" name structure, cf. the earlier Figure 4. Rules for delineating **Name**, **Surname** and **Forename** would need to be devised, which consider how *referential* names are handled in indexing. A degree sign (°) indicates some specimens likely to be authorities only in most catalogs.

	Being Entry	**Concept**
type	*(class)*	*Category*: (plural)
human	*(individual)*	
	Hippocrates	Physicians
	Geronimo, 1829-1909	Chiricahua Indians / Indian Chiefs ?
	*Jordan, Barbara, 1936- *Died*: 1996 **Time**	African American Legislators
	*Lee, C. P. (Chuan-Pu), 1931-	Biochemists

*Preston, Walter (Baritone)	Baritones (Singers)
River (Writer)	Authors
The Rock (Wrestler)	Wrestlers
*Sargis, Saint, 4th Cent.	Christian Saints
*Sitwell, Edith, Dame, 1887-1964	Poets
*Þórður Jónsson	Physicists
*Williams, Ted, 1918-	Baseball Players
Died: 2002 **Time**	

human (familial)

*Breckinridge (Family)	Families ?
*Medici (House of)	Dynasties ?

human (collective)

Aborigines, Australian	Indigenous Peoples
Asian-Americans	Ethnic Groups
Cherokee Indians	Ethnic Groups
Zulu (African People)	Ethnic Groups

human (undifferentiated)

*Müller, Heinrich	[none]

human (referential) [none]

Mc	[see also M' and Mac]
Owen	[see also John]
Owens	[see also Johnson, Jonsson, etc.]
St.	[see also Saint]

specimen (individual)

°Ain't Misbehavin' (Race Horse), 1993-	Race Horses
Bonsai (Phytecellobrium dulce : 1936)	Bonsai
°Bucephalas (Horse), d. 326 BC	Horses
Cygnus cygnus (Specimen)	Whooper Swan
°General Grant Tree	Giant Sequoia
°Koko (Gorilla), 1971-	Gorillas
°Otzi (Ice Mummy)	Ice Mummies
Variant: Oetzi the Ice Man	
Nickname: Frozen Fritz	
Quercus alba L. (Herbarial Specimen)	White Oak
Yersinia pestis (Microscope Slide)	Yersinia pestis

specimen (familial)

°The F Family (Chimpanzees)	Chimpanzees
Related: Gombe State (Nigeria) **Place**	

specimen (collective)

Butterflies and Moths (Collection)	Butterflies / Moths
Flamingo Colony	Flamingos
°Porqupine Caribou Herd	Barren Ground Caribou

special (individual)

*Arthur, King	Legendary Characters ?
Agamemnon (Greek Mythology)	Mythological Figures ?
Audrey II (Fictional Plant)	Fictional Characters
Fictional: Plants	
Bambi (Fictional Character)	Fictional Characters
Fictional: Deer	
*Brigit (Celtic Deity)	Godesses, Celtic
Caspar (Fictional Character)	Fictional Characters
Fictional: Ghosts	
Chiron (Greek Mythology)	Centaurs / Mythological Figures ?
Devil	Demons ?
Eru (Fictional God : Tolkien)	Fictional Gods ?
John Henry (Legendary Character)	Legendary Characters ?
Loch Ness Monster	Monsters
Papageno (Operatic Character)	Operatic Characters ?
Phoenix (Mythical Bird)	Mythical Creatures ?
Fictional: Birds	
Pinocchio (Fictional Character)	Fictional Characters
Fictional: Marionettes	
*Ruth (Biblical Figure)	Biblical Figures ?
*Sartoris, Bayard, 1893-1920.	Fictional Characters
Spider-Man	Fictional Characters
Fictional: Heroes	Comic Strip Characters
*Twain, Mark, 1835-1910 (Spirit)	Spirits ?
Vikalen (Angel)	Angels
*Weaver, Kerry (Fictional Character)	Fictional Characters
Fictional: Physician	
Fictional: Physicians with Disabilities [Disabled Physician **Singular**?]	
Portrayed by: Innes, Laura, 1959-	

special (familial)

Hardy Boys	Fictional Characters
Fictional: Brothers	
*Sartoris (Family)	Fictional Characters
Fictional: Families ?	

special (collective)

Ewoks (Fictional Creatures)	Fictional Creatures
Muses (Greek Deities)	Goddesses, Greek

The above examples illustrate a broad range of issues. The examples are not meant to be comprehensive, conclusive, or necessarily consistent. Some values are borrowed from LCSH to illustrate the inconsistency between qualifiers and topical subject headings. For example, LCSH's reference Fictitious animals see Animals, Mythical does not work well with Bambi. Precoordination also interferes with XOBIS' structure; contrast Operatic Characters above with LCSH's Operas --Characters. Routine qualification for fictional beings is questioned, especially

when relationships convey the information more accessibly. Punctuation, left to XSL, needs study especially in regard to the **Expansion** and **Qualifiers** elements. Some liberties were taken in the examples to illustrate potential alternatives.

Cusp issues occur in any schema. Contrast the *collective* or *familial* **Being** above with an *individual* **Organization** (e.g. the Everly Brothers, an individual incorporated for professional practice, or the organized Gambino Crime Family), where the emphasis in on corporate identity. Gradations appear to be the rule, leaving distinctions to be forged by definition. See the **Object** section for fossils of life forms. Nationalities reflect a **Relationship** in their affinity with **Place**, although *collective* **Being** may be a viable alternative.

Most entries formulated according to AACR2 are not problematical, despite its emphasis on authorship. The delineation of different identities for the same person in separate records, such as for pseudonyms, stage names, impersonations, etc., is important in XOBIS in that such names may have separate/different **Relationships** to a specific **Work** or other Principal Element. In order to accommodate *multiple and changing identities* flexibly, **Type** and **Duration** may be assigned to either the **Entry** or any individual **Variant**, since it is relative to the choice of entry made. In effect, this extends *equivalence relationships* (cf. **Varia** under Generic Elements above) to the **Entry**, allowing for example, an **Entry** to be designated a "Pseudonym," instead of, or in addition to, a **Variant**.

	Being	**Type**	**Duration**
Entry	Mishima, Yukio, 1925-1970	Pseudonym	1944-1970
Variant	Hiraoka, Kimitake, 1925-1970		
Entry	Lacks, Henrietta, d. 1951		
Variant	Lane, Helen.	Anonym	1951-

Although technically acceptable, *embedded relationships* in names are awkward in XOBIS. Since the relationships do not always appear necessary for disambiguation (using **Qualifiers**), they deserve review in the context of having **Relationships** recorded separately, at least in some cases.

> Aleksei Nikolaevich, ***Czarevitch***, ***son of*** Nicholas II, ***Emperor of*** Russia, 1904-1918
> Diana, ***Princess of*** Wales, 1961-1997
> *Princess of* (1981-1996): Wales
> Elizabeth, Queen, ***consort of*** George VI, ***King of*** Great Britain, 1900-2002
> Tutankhamen, ***King of*** Egypt, fl. 1300s BC [Optionally, fl. 14th Cent. BC]
> *Nickname*: King Tut
> *Reigned*: 1333-1323 BC

Also using **Relationships**, chronological distinctions between reign and lifespan add clarity. Others cases are more complex (cf. **Qualifiers** and **Organization**, both above):

> ***Author of*** Allons au ciel
> Albert, ***of*** Brandenburg, ***Archbishop and Elector of*** Mainz, Cardinal, 1490-1545
> Reynolds, Joshua, Sir, 1723-1792, ***Pupil of***

Titles in entries are problematic in that they may change and overlap. The last example above includes an attribution qualifier (x00 ^j), which is essentially a **Relationship** from an anonymous person. Potentially, entries for "difficult" names could be better-structured using identification and qualification, and by not burdening them with extraneous information better left to **Relationships**.

8. An **Object** of Desire? (Material Records)

Object	Manufactured, crafted, or naturally-occurring things, excluding Place, Being, and Work carriers

```
<Object type="manufactured" role="instance">
        <Entry class="individual">
                <Name>Camera Lucida</Name>
                <Qualifiers>
                        <String id="123456" substitute="Code">
                                <Name>Leitz</Name>
                        </String>
                        <Time>
                                <Year>1940</Year>
                        </Time>
                </Qualifiers>
        </Entry>
</Object>
```

Object is a "substantive" Principal Element. It is broadly defined to comprise tangible exemplars of most three-dimensional entities and their fictional counterparts, excepting those covered by other Principal Elements. They include specimens of naturally occurring objects and samples of materials or substances, as well as crafted or manufactured artifacts and samples of processed or refined materials or substances. Material Records usually have supplied names to represent individual specimens/samples or assembled collections, but sometimes an **Object** has a proper name, which may be used also as an authority, when the actual item is not held.

Currently, there are several important exclusions from **Object**. Notably, the abstract idea of a physical thing or the generic class to which it belongs (i.e. all baskets or all gold everywhere) is a **Concept**. Globes and three-dimensional maps are considered **Work** due to their intellectual content. Likewise, sculpture and other art objects are treated as **Work** due to the artistic purpose or intent behind them. The distinction is based on the original intended purpose; thus an ancient teapot, despite exhibiting its maker's skill/talent, its antiquity, its aesthetic appeal, or its being collected by an art museum, remains an **Object**. This differs from AACR2's three-dimensional artefacts and realia. Containers or carriers for works, e.g. a book or a cassette, may legitimately be thought of as **Object**, but these are usually appended to bibliographic descriptions, and in XOBIS more properly belong to the projected schemas for holdings and items. Due to scale (large) and attachment (not collectable), topographic features (e.g. Ayres Rock) and fixed/permanent structures (e.g. Parthenon) belong to **Place**. Despite scale, structure and much discussion of geopositioning, mobility currently determines that vehicles and other mobile structures are treated as **Object**. "Whole" organisms belong to **Being**, while separated

anatomical specimens (cells, tissues, and organs) and fossils are **Object** in the sense that they are divorced from their once vital existence. See the separate sections for these related Principal Elements for further clarification of our current interpretations, as definitions continue to emerge.

Currently, **Object** has an optional 'type' attribute with values: *natural*, *crafted*, or *manufactured*. It also has a 'role' attribute to indicate *authority*, *instance*, or *authority/instance*, with tangibility determining *instance*. Its **Entry** has an optional 'class' attribute with values: *individual*, *collective*, or *referential*, and may have 'language' and 'transliteration'. The optional **Version** element applies to **Object**, as defined under Generic Elements above. It supports a degree of variation, often found in manufactured products, without the need to create separate records. Policies would be needed; cf. a suggested role in the BMW example toward the end of this section. It is not intended to house component parts of objects, as these should be handled as **Relationships** between objects where needed. Routine inclusion of date and edition as **Qualifiers**, when applicable, helps prevent entry collisions.

The interpretation of **Object** in XOBIS gives objects parity with other "substantive" Principal Elements. This results in a fairly cohesive grouping, despite the many distinctions. Defining how to delineate *authorities* from *instances* is challenging. The *manufactured* attribute value proves useful in this regard, although an agreed definition would be critical for consistency in application (e.g. hand-sewn versus machine-sewn, original prototype versus mass-produced copy, or workshop versus factory). Manufacture parallels the situation of the ordinary printed **Work**, where all holdings can be linked to the *same* **Record**. In this regard, holdings provide disambiguation for the same item held by various institutions or individuals. As *natural* and *crafted* objects tend to be inherently different, they theoretically would require a separate **Record** with a *unique* **Entry**. This is parallel to an archival collection or a manuscript, each of which has a separate identity.

To enforce this kind of extra-catalog uniqueness, a special, non-repeatable "qualifier", **Identifier**, is provided separately from the **Qualifiers** element. It consists of an **Organization** and **String**, which could be borrowed from holdings. In local displays, the **Identifier** could be omitted, as well as when the **Entry** is unique without the **Identifier**. Names should be clear enough to be understood independently; either an **Organization**'s Entry or Substitute Entry may be used. The mockups reflecting this are poor, as we lack practical examples and have tried to save space, but attempt to illustrate the distinction. **Identifier** is shown in brackets for clarity. Other ideas regarding conveying the distinction may emerge. Expert subject advice is needed. For contrast: The container element **Qualifiers** is repeatable when needed for the identification of an *instance* ('role' attribute) of such *natural* or *crafted* objects. Disambiguation at the Principal Element level is only needed for a *manufactured* **Object** when its name conflicts with that of another, whereas the state of our current thinking suggests that each unique **Object** should have an unambiguous **Entry** to prevent confusion in virtual catalogs or the Web environment, hence **Identifier**.

In these examples, potential **Relationships** on the right are **Conceptual** unless otherwise indicated. Other selected **Relationships** and **Varia** are indented. Values are based mostly on LCSH and are included to indicate possibilities and broad issues, rather than rigorous fidelity. A bullet (•) indicates that the **Object** is likely to be only an *authority* in most databases.

	Object Entry (**Qualifiers**) [**Identifier**]	**Concept**
type	*(class)*	*Category*: (plural)
natural	*(collective)*	
	Diamonds, Uncut (Collection) [CSt-L : 310]	Diamonds
	Minerals of Oklahoma (Collection) [Lane : 3847]	Minerals
natural	*(individual)*	
	•Lunar Rock Sample (No. 70017). Gift to Honduras	Lunar Rocks ?
	[Note: sample divided for presentation]	
	Collected: 1972-12 **Time**	
	Presented to (1973-03): Honduras **Place**	
	Purchased by (1995): Rosen, Alan **Being**	
	Related: Apollo 17 (Space Flight : 1972) **Event**	
	Related: United States v. Lucite Ball Containing Lunar Material **Work**	
	Related: Operation Lunar Eclipse (Sting Operation : 1998) **Event**	
	Human Brain Preserved in Formaldehyde [Lane Medical Library : 4798]	Anatomical Specimens / Brain
	•Lucy (Hominid)	Fossil Hominids
	•Sue (Dinosaur)	Dinosaurs
	Discovered by (1990): Hendrickson, Sue, 1949-	
	Purchased by (1997): Field Museum of Natural History	
	Simosthenurus occidentalis (Fossil) [ABC : 123]	Marsupials, Fossil / Extinct Animals
	Simosthenurus occidentalis (Fossil) [XYZ : 789]	Marsupials, Fossil / Extinct Animals
	Coelacanth (Fossil) [British Museum : 345782]	Coelacanthiformes, Fossil
	Latimeria chalumnae (Smith : 1939) [ANM : 387]	Coelacanthiformes, Fossil
	Amber with Fly Inclusion [Amber Museum : no. 8]	Amber Fossils / Flies, Fossil

Natural objects need work, especially regarding identity and supplied names. Fossils are problematical in being surrogates for organisms, with which they have parallel or identical names, which is reflected in LCSH. It is assumed that such entries would have **Relationships** between the fossil **Concept** and the non-fossil **Concept**, e.g. Fossil Hominids and Hominids. In contrast to the fossil Coelacanth represented above, an **Entry** for **Being** would be needed to represent a captured specimen, perhaps: Coelacanth (Specimen) [Fish Museum : no. 352] with *Category*: Coelacanthiformes. More specificity is needed in some areas, e.g. Tyranosaurus rex. With closer cooperation, there is potential for at least some specimens of *natural* objects to effectively share a **Record**, with distinctions limited to **Version** or Holdings. In any case, much more investigation is needed.

	Object Entry (**Qualifiers**) [**Identifier**]	**Concept**
type	*(class)*	*Category*: (plural)
crafted	*(collective)*	
	Collection of Teapots [Bartlett : #3222]	Ceramic Teapots
	Tea Service (Frost, V. : undated) [Gilcrease Museum : no. 1856]	Solitaires (Tableware)
crafted	*(individual)*	
	Apothecary Jar with Lid (<1740-1760>) [Louvre : 37581]	Delftware Jars ? Apothercary Jars ?
	•ASIMO (Android : 2000) *Variant*: Advanced Step in Innovative Mobility	Androids
	Grand Piano (ca. 1815 : Thÿm) [National Music Museum (University of South Dakota) : No. 3587]	Piano
	•Hope Diamond	Diamonds
	Harpsichord (1694 : DeQuoco) *Maker*: DeQuoco, Nicolaus **Being**	Harpsichord
	Mace-head Inscribed in Sumerian with the Name of Mesilim, King of Kish, and Dedicated to the God Ningirsu (ca. 2550 BC) [Metropolitan Museum of Art : 1956-1234]	Ceremonial Maces Antiquities ? Sumerian and Akkadian Royal Inscriptions
	•Niña II (Caravel : Replica : 1962)	Caravels / Replicas ?
	Tankard with "Four-Flower" Decoration (ca. 1565-1575) [Gulbenkian Museum : 3456]	Tankards Fritware ? Islamic Antiquities ?
	Teapot (Japan : 1700s) [Tokyo National Museum : 1234]	Ceramic Teapots
	•Vasa (Warship : 1628) *Built*: Stockholm, Sweden **Place** *Builder*: Hybertsson, Henrik **Being** *Launched*: 1628-08-10 **Time** *Sank*: 1628-08-10 **Time** *Salvaged*: 1961 **Time** *Exhibited*: Vasa Museet **Organization** [Swedish]	Warships
	Wooden Figure of a Chief, Ndengese Tribe (1900s) [Museum of African Art : 3789]	African Art (Congolese) ?

Crafted objects share the problem of identity and disambiguation (and our lack of familiarity with museum practice) with the previous examples. Some of the examples may belong in the *manufactured* group, but it is difficult to decide without guidelines. The value *mixed* may be needed to cover collections containing both *manufactured* and *crafted* items. The same is true of the need for a definition of *collective.* Is one set with 100 pieces *individual* and a collection with ten items *collective*?

	Object Entry (**Qualifiers**)	**Concept**
type	*(class)*	*Category*: (plural)
manufactured (collective)		
	China Service (Lenox : Eternal)	Ceramic Tableware
manufactured (individual)		
	•Excalibur III (Airplane)	Mustang (Fighter Plane)
		Object
	•Haven (Hospital Ship : 1945-1957)	Hospital Ships
	•Hubble Space Telescope	Telescopes
	•Kodak	? [Product Brand]
	Instamatic Camera	Cameras [Trademark]
	•Mercury (Ship)	Ships
	•Model T (Automobile)	Ford (Automobile Make) ?
	•Mustang (Fighter Plane)	Fighter Planes
	•Nellybelle (Automobile)	Jeep (Automobile Make) ? **Object**
	•Scrabble (Game)	Board Games / Word Games
	•Scrabble (Game : Deluxe ed. : 1985)	Board Games / Word Games
	•Scrabble (Game : Travel ed. : 1977)	Board Games / Word Games
	Copyright: 1977 **Time**	
	•Spirit of St. Louis (Airplane)	Airplanes
	Stethoscope (Miltex : 1960s)	Stethoscopes
	Stethoscope (Pilling : 1900s)	Stethosocpes
	Teddy Bear (Steiff : 1990s : Mr. Cinnamon)	Teddy Bears
	Replica: Teddy Bear (Steiff : 1903)	

Manufactured products may require some special rules regarding naming. Note that instantiations of some concepts as objects, e.g. airplanes and automobiles, may be further instantiated by other objects as shown above. XOBIS largely relies on proper nouns for such distinctions as discussed in other sections. Brands and trademarks need further investigation. Correlation with LCSH is difficult in this area; for example, the heading "Business names" is used for "Brands (Commerce)", "Firm names", and "Trade names", mixing the concepts of **Organization** and **Object**. Further study of the literature and involvement of the museum community is needed to refine the **Object** element.

Instead of establishing subjects for instantiations of Concept, XOBIS uses a **Relationship** to establish the connection between the **Object** and the **Concept**, or between two different **Object**s. Consider these LCSH headings:

BMW automobiles
    BMW Z3 automobile
Ford automobile
    Mustang automobile

Contrast this with treating these as Material Records, eliminating the precoordination, treating this as a case of disambiguation, and using **NameSegment** for more granularity. Note that each segment has a separate qualifier. For more specificity, a **Version** may also be added, which

should be weighed against repeating **NameSegment** again. The overall structure provides flexibility in building indexes as shown in earlier examples.

- BMW (Automobile Make)
  - Z3 (Automobile Model)
    - Z3 (Automobile Model). Roadster (2000). [2.3 potentially **Version**]
    - Z3 (Automobile Model). Coupe (2002). [3.0i potentially **Version**]
  - Z4 (Automobile Model)
    - Z4 (Automobile Model). Roadster (2002) [3.0i potentially **Version**]
- Ford (Automobile Make)

For fictional things, the same issues apply as with other Principal Elements. An **Object** is an instantiation of some category (**Concept**) that represents fictionality, and it has a *Fictional* or similar **Relationship** to its real counterpart, usually a *collective* **Concept**. The *Fictional* **Relationship** is akin to the *Depiction, Portrayal* or *Artificial* ones. See the discussions of fiction under each Principal Element and the **Relationships** section for more information.

Object Entry	*Category*: **Relationship**
Data (Android)	Fictional Objects ?
Fictional: Androids	
Assembled: ca. 2336	
Excalibur (Legendary Sword)	Legendary Objects ?
Fictional: Swords	
Grail	Lengendary Objects ?
Variant: Holy Grail	
Legendary: Chalices	
Powdermilk Biscuits (Fictional Product)	Fictional Products ?
Fictional: Processed Foods	
Related: Corporate Sponsorship	
Vitameatavegemin (Fictional Product)	Fictional Products ?
Fictional: Elixirs	

To complete the circle, *conceptual* **Relationships** would be in order:

Concept
Androids
Related: Humans **Concept**
Humans
Related: Androids **Concept**

The treatment of **Object** in XOBIS combines collected exemplars and authorities for unheld ones (and fictional ones) because they have close affinity to each other, separated only by mutable ownership. This provides additional structural integrity to XOBIS and facilitates establishing **Relationships**. It should also simplify authority work. Once umbrella concepts and objects are established, adding additional exemplars should be relatively easy.

9. **Work** It Baby! (Compositional Records)

Work	Artistic or intellectual creations, excluding those considered Place or Object

```
<Work type="intellectual" role="instance">
        <Entry class="individual">
                <Title>Anglo-American Cataloguing Rules</Title>
                <Qualifiers>
                        <String>
                                <Name>2nd ed.</Name>
                        </String>
                        <Time>
                                <Year>1988</Year>
                        </Time>
                </Qualifiers>
        </Entry>
        <Varia>
                <Variant>
                        <Type set="Title Type">Other Title</Type>
                        <Title>AACR2</Title>
                        <Qualifiers>
                                <Time>
                                        <Year>1988</Year>
                                </Time>
                        </Qualifiers>
                </Variant>
        </Varia>
</Work>
```

The **Work** element is an instantiation of some collective **Concept**, e.g. *Category*: Paintings. It distinguishes artistic or intellectual creations from crafted or manufactured ones (covered by **Object**) or by **Place** for immobile structures. **Work** is one of the "substantive" Principal Elements due to its common manifestation in a physical "carrier" and the fact that it can be copyrighted, owned, licensed, circulated, etc. Although a three-dimensional division was attractive, the current interpretation allows more consistent inclusion of tangible art, especially sculpture, and three-dimensional cartographic material as **Work**. Although a lesser factor, works, regardless of dimension, also tend to share *titles* rather than names. This approach is not a major departure from current cataloging rules, but excludes some realia to permit the differing emphases needed for each Principal Element.

The **Work** element covers all types of compositions, regardless of format or representation (manuscript, print, or digital), including art, written text, audio (including music), video, software, maps, etc. The emphasis is on the work itself, its identification and delineation from other works. **Work** currently has two attributes: 'type', tentatively with *artistic* and *intellectual* as values, and: 'role', with values of *instance*, *authority*, or *authority/instance*. The 'role' attribute delineates XOBIS' amalgamation of instances of "substantive" Principal Elements with their "authorities". **Work** has been broadened to include "authorities" for works (uniform titles,

including series), which are in essence virtual works. These provide umbrella records in hierarchies of works (typically serial-analytic-component and collection-subunit, but also monograph-component-component and the *collective* authority-title *instance* situation) and provide for a flexible and unified **Work** element. The current separation of these is questioned, especially having a uniform title record for numbered series and/or a separate record for a serial. XOBIS follows the integrative German cataloging model to enable **Relationships** to work more effectively. See the **Relationships** section for the full range of possibilities. Later in this section, certain limitation and expansion of the role for authorities is put forth to illustrate the issue more clearly.

Work is represented by an **Entry** that is basically a "formal" title, usually, literally incorporating the descriptive one. This is intended to distinguish it largely from other works. **Entry** has an optional 'class' attribute with values: *individual* (includes monographic), *serial*, *collective*, and *referential*. It also may have 'scheme', 'language' and 'transliteration' attributes. It follows the pattern of **Name** for other elements, replacing it with **Title** and **Qualifiers** or the repeatable **TitleSegment** and **Qualifiers**. The provision for qualification by any other Principal Element provides flexibility in dealing with unanticipated needs. The **Entry** may be designated *generic* with a 'type' attribute to identify generic titles such as Annual Report. The **TitleSegment** may have a 'type' attribute to specify *subtitle* or *section* title. Various types of equivalent titles are handled by **Varia**. For more information on these ideas, consult the Generic Elements section above under Entry Names (particularly for context), **Qualifiers**, Notes and Description, and **Varia**. An outline below details the substructure.

General rules regulating **Qualifiers** would be necessary to establish consistent practice. It is postulated that routine qualification by edition and date would resolve the majority of conflicting entries without resorting to other factors. Basic edition, including an inferred first edition, and date of content would help prevent ambiguity and to signify basic sequential and chronological context. For serials, this extends to the range of years published, although open dates on titles not currently subscribed to may mislead some to think these are holdings.

Because AACR2's General Material Designators (GMDs) are so similar to form/genre terms used as values for **Qualifiers** in XOBIS, they have been merged in this alpha version. This raises the question of whether such a qualifier (of any Principal Element) should be broad like GMDs, e.g. Computer File, or should match the most specific hierarchical level available, e.g. Word Processor, as is found in uniform title qualifiers. Another issue is whether to routinely qualify a unique title by form or to only do so in resolving conflicts. Contrast the K-PAX and Summer of '42 examples below. When the motion picture is added, does it imply the need to add a qualifier for the book? Consistency in subarrangement would suggest this is desirable. There are many issues in music and art that have not been considered thoroughly, not the least of which is that the performance of a **Work** is an **Event**. A common pattern for **Entry** is shown in the introductory example above. Some additional cases are delineated below illustrating how qualification might be rendered, although this is not meant to be a complete display. A few **Relationships** are indicated for contrast.

Title (**Qualifiers**)
Acta Neurochirurgica (1950-)
The Bit and the Pendulum (2000)
Departing from Deviance (2002)
The Dismissal of Miss Ruth Brown (2000)
Encyclopedia Galactica (117th ed. : 1026 FE)
Category: Fictional Works ?
Handbook of Pain Assessment (1st ed. : 1992) [supplied edition]
Handbook of Pain Assessment (2nd ed. : 2001) [c2001]
K-PAX (1st ed. : 1995) [with selected substructure]
Variant: K-PAX (I : 1995)
Sequel: On a Beam of Light (1st ed. : 2001)
Variant: K-PAX (II) On a Beam of Light (1st ed. : 2001)
Sequel: K-PAX (III) The Worlds of Prot (2002)
Derivative: K-PAX (Motion Picture : 2001)
King Menkaure and Queen (Statue : Egypt : ca. 2532–2510 BC)
Legend of Love (Choreographic Work : Danilova, N : 1958)
Original title: Legenda o Liubvi (Choreographic Work : Danilova, N : 1958)
Legend of Love (Choreographic Work : Grigorovich : 1961)
Original title: Legenda o Liubvi (Choreographic Work : Grigorovich : 1961)
Medical Bulletin (Baltimore, Maryland : 1868-1870)
Medical Bulletin (Paris, France : 1917-1918)
Medical Bulletin (Philadelphia, Pennsylvania : 1879-1908)
Medical Bulletin (Stanford University. School of Medicine : 1913-1927)
Medical Bulletin (United States. Veterans' Bureau : 1925-1931)
Mona Lisa (Painting : Leonardo, da Vinci : 1503-1506)
Parthenon Marbles (Sculpture : 400s BC) [BC is **Code** for calendar]
Subset: Elgin Marbles (Sculpture : 400s BC) [LCSH: Elgin marbles]
A Prairie Home Companion (Radio Program : 1969-1987) [resumed later]
Secret Agent (Motion Picture : 1996) [LCSH]
Summer of '39 (1999)
Summer of '42 (Novel : 1971)
Category: Romance Fiction ? **Concept**
Subject: 1942 **Time**
Subject: Summer ? **Time**
Summer of '42 (Motion Picture : 1971)
Summer of '42 (Sound Recording : Capitol : 1972)
Summer of '42 (Sound Recording : Columbia : 1971)
Textbook … [referential]
Related: Text-book …
The Thomas Crown Affair (Motion Picture : 1968)
The Thomas Crown Affair (Motion Picture : 1999)

When a **Title** has more than one part, **TitleSegment** is used instead. This occurs in the related titles for K-PAX above and is illustrated below. Distinguishing subtitle as part of **Entry** from lengthy subtitles of **Description**, not needed for disambiguation or clarification, is proposed. Some additional examples illustrate subtitles and section titles:

TitleSegment(s) (**Qualifiers**)
Acta Neurochirurgica. Supplementum (1950-)
Bible. Old Testament. Chronicles
His Bundle: Electrocardiography and Clinical Electrophysiology (1975)
Homo Sapiens: the Novel (2001)
The Story of Civilization (5) The Renaissance (1953)

Title and **TitleSegment** of **Entry**, **Varia,** or **Qualifier** elements may carry initial non-filing characters as a string value in their 'nonfiling' attribute. This must include the space when the non-filing characters do not abut the value. This is markup for the example shown above:

```
<Entry>
        <TitleSegment>K-PAX</TitleSegment>
        <Qualifiers>
                <String>III</String>
        </Qualifiers>
        <TitleSegment type="section" nonfiling="The ">Worlds of Prot</TitleSegment>
        <Qualifiers>
                <Time>
                        <Year>2002</Year>
                </Time>
        </Qualifiers>
</Entry
```

This example illustrates how the 'type' attribute of the repeatable **TitleSegment** element allows a title to be treated as a sequence of segments, each qualified as needed. Each segment (base, *subtitle*, and repeatable *section*) may have initial character strings disregarded using the 'nonfiling' attribute. Internal non-filing characters can be treated as **Description** with the corrected form appearing in the **Entry**. Roman numerals could be included as is, and converted to an Arabic **Variant** to file correctly.

The potential for title authorities is unrealized. They are essentially *collective* umbrella works where traditional uniform titles and unnumbered series are concerned. Numbered series are structurally identical to serials, and *serial* may be thought of as a subset of *collective* where sequence is explicit. It is mostly a matter of this being reflected as an *authority*, which typically would not have holdings, instead of hierarchical **Relationships** to *instances of* other **Work**s that can or do have holdings. Due to these fundamental characteristics, the initial definition of the 'type' attribute of **Entry** for **Work** has four values: *individual*, *serial*, *collective*, and *referential*, with the last covering references not specific to any given work (i.e. "uncontrolled heading"). Assembled collections are *collective*, as are "integrative" works. The need for an *integrative* value is questioned in that more specific categories of any 'class' can be recorded as **Relationships** to the collective **Concept**, e.g. Database, Loose-Leaf Service, Website, etc. Integrative could be added as an attribute value or established as an umbrella **Concept**. The specific terms may be more relevant to users' inquiries than the abstract "integrative" aggregation. In any case, top-level attributes need to be thought of in terms of categorical relationships to collective concepts as one part of a larger structure, possibly along these lines:

Works/Compositions? [node]
- Artistic Works [node]
  - Art Works
  - Choreographic Works
  - Musical Works
  - Theatrical Works
- Intellectual Works/Writings? [node]
  - Bibliographic Form [node]
    - Monographs
      - Collected Works (Monographic)
      - Monographic Sets
      - Pamphlets
    - Collective Works
      - Collections
      - Databases
      - Loose-leaf Services
      - Series (Unnumbered)
      - Websites
    - Serials
    - *Variant*: Series (Numbered)
      - Newspapers
      - Periodicals
      - Serials (Other) [lacking monographic volume titles?]
      - Series (Monographic)
  - Literary Works [node]
  - Nonfiction Works [node]
  - Physical Form [node]

XOBIS' rich system of **Relationships** allows knitting together polyhierarchies of concepts, and linking amongst these as necessary, e.g. Collective Works to Collected Works. Evolving delineation of form/genre points in this direction. The overall structure may be one of considerable debate, but the implications of failing to correlate collective concepts with top-level attributes of a schema should not be ignored. Repeatable categorical **Relationships** can link into a structure, while attributes allow only a single mutually exclusive value and are not repeatable. The two should not conflict. The **Singular** element is also available as an **Entry** substitute to address the conflict between singular and plural usage.

The formal XOBIS **Entry** is envisioned as alleviating the need for separate authorities in some cases, as a 'role' attribute can allow a **Work** to serve both roles. In any case, authorities essentially identifying a single work (e.g. a translation of a version in a specific year that is unlikely to duplicate), rather than establishing a class could follow the model of an umbrella authority for its Entry (or a Variant) and be linked to the umbrella. The individual works could be linked to an authority and sequentially to one another to provide richer access and less repetition, instead of relying solely on co-filing in an alphabetical sequence.

Similarly, there are cases (e.g. multiple editions) where lacking authorities could provide valuable umbrellas for sequences of editions to avoid repeating the same information.

Relationships from the individual editions to the umbrella, and sequential links between the editions could provide a richer navigational landscape. This example may help sketch the general idea, illustrating structural issues, not display. Subordinate **Relationships** are indicated here by indention, although they would be formally linked, cf. the **Relationships** section and **Entry** under Generic Elements. **Duration** is allowed for both **Entry** and **Variant**.

Duration	**Title**	(**Code** as Qualifier)
1950-1966:	**Entry** Principles of Internal Medicine (Harrison)	
1970-	*Variant*: Harrison's Principles of Internal Medicine	
	Entry Principles of Internal Medicine (Harrison : 14th ed. : 1998).	
	…	
	Entry Principles of Internal Medicine (Harrison : 1st ed. : 1950).	

The use of surnames as qualifiers is found in Finnish uniform title practice and in uniform titles for choreographic works. This, in combination with edition and date, should reduce the need for more contrived distinctions between ordinary publications. There are many issues when it comes to relationships between various media. One area of special interest is how derivative works should be entered. Relationships can certainly link between a uniform entry for an original and a multitude of derivatives. Similarities of name, however, suggest potential uniform entries to emphasize clarity over descriptive fidelity (which can be handled by **Description**). These might involve **TitleSegment**s, or as shown here, double qualifiers on the same **Title**:

La Dame de Pique (Opera : Tchaikovsky : 1890) (Piano Score : 1910s)

Performance adds a twist in that the actual staging, etc. would be an **Event**, perhaps only an informational authority to provide context and catalog enrichment. **Title** currently does not extend to **Event**, but the double qualifier structure seems promising in this regard as well:

La Dame de Pique (Opera : Tchaikovsky : 1890) (Performance : 1906 : La Scala : Italian)

The scope of **Work** is broad in XOBIS. In delineating the Principal Elements, a number of problems appear to be resolved by recognizing that "intellectual" extends to works that may have gradually evolved and been shaped by various creators not necessarily in concert. Nonetheless, they have been concocted by people and seem to have proper names for the most part, and thus meet the criteria for **Work**. The following examples include some familiar uniform titles and several virtual works that currently appear to be handled separately or not in a decidedly consistent way. XOBIS attempts to integrate these, and uses Entry Substitutes, cf. the Generic Elements section above, to reference some in the role of authorities, e.g. calendars, classification schemes, and transliteration schemes. More specificity is possible by inclusion of known dates or editions in **Qualifiers** as appropriate.

Work Entry *authority* 'role'	**Concept** *Category*:
Arabic (Alphabet)	Alphabets
[Instantiated as **String**, e.g. X (The Letter)]	Letters (Alphabet) ?
Computer Science (271 : Stanford). Computer-Based Medical Decision Making	
[The **Entry** structure is: **Title** (**String Code**) **Title**]	Academic Courses ?
Offered by: Stanford University. Computer Science Dept. **Organization**	

Cyrillic (Alphabet)	Alphabets
Dewey Decimal Classification	Classification Schemes ?
[Currently **Code** DDC suggested as 'scheme' attribute]	
French Revolutionary Calendar ?	Calendars
[Currently**, Code** value FR used as 'scheme' attribute for **Time**]	
Gregg Shorthand (Simplified)	Shorthand
Gregg Shorthand (Diamond Jubilee)	Shorthand
Java (Computer Programming Language)	Computer Programming Languages ?
Lucinda Sans Unicode (Computer Font)	Computer Fonts
Medical Library Assistance Act (United States : 1965)	Laws ? [Legislation?]
Naskhi (Script)	Scripts
Language: Arabic	
Naturally Speaking (Computer Program)	Translators (Computer Programs)
Romanization of the Korean Language (McCune-Reischauer)	Transliteration Schemes ?
[Currently "Code" McCune-Reischauer suggested as 'scheme' attribute]	

To provide some context for how XOBIS attempts to reduce complexity, this outline of the elements of **Work** summarizes substructure and serves to introduce **Versions**, discussed next.

Work ('role': "instance" or "authority/instance")
- **Entry** ('class': "individual" or "serial" or "collective")
  - ('type': "generic" if applicable)
  - (optional 'language': <value from **Entry** of **Language>**)
  - (dependent 'transliteration': <value from **Code** of **Work**>)
  - (optional 'scheme': <value from Code of Work>)
  - **Title** or **TitleSegment** (type="subtitle" or "section"; repeatable)
  - **Qualifiers**
- Entry Substitutes (**Abbrev**, **Citation**, **Code**, **Singular**)
- **Varia**
  - **Variant** (repeatable)
    - **Type**
    - **Duration**
    - **Work** (optional 'language' and 'transliteration')
      - **Title** or **TitleSegment** (repeatable)
      - **Qualifiers** (for either)
- **Description**
- **Holdings** (including Rights)
- **Versions**
  - **Version**
    - **ID**
    - **Qualifiers**
    - **Varia**
      - **Variant** (repeatable)
        - **Type**
        - **Duration**

Work (optional 'language' and 'transliteration')
Title or **TitleSegment** (repeatable)
Qualifiers (for either)
Description
Holdings (including Rights)
Relationships (including Rights)
Relationships

Work ('role': "authority")
Entry ('class': "referential" or same values as above)
Varia
Variant (repeatable)
Title or **TitleSegment** (repeatable)
Qualifiers
Relationships (including Rights)
Description

The **Holdings** element uses XOBIS' **ID** technique to refer to a separate Holdings schema. The "including Rights" parenthetic above refers to our acknowledgement of the need for sophisticated access control both in relation to Holdings, but also when works are only referenced in **Relationships**. Rather than reinventing the wheel, we anticipate incorporating work done by others, and expect that a standard will emerge based on XML Access Control Language (XACL).

Holdings may link directly to a **Work** or to an individual **Version** as shown in the outline above. To provide further clarity with economy of expression, the *optional* **Versions** element distinguishes very similar works within a single Compositional Record. See **Version** in the Generic Elements section for details. This is both pragmatic and less confusing to users than finding multiple, difficult to distinguish records. Often digital, microform, print, and reprint versions of the same content do not merit separate cataloging. Rules could be established for lumping/splitting based on degree of variation. Each **Version** also carries a separate unique **ID** and permits direct linkage to other **Record**s in the identical fashion provided for other **Relationships** discussed below. For example, a serial with digital and reprint versions might record *organizational* **Relationships** separately for each version:

	Organization
Aggregator:	Highwire Press
Printer:	Johnson Reprint Corporation

Precise definitions for the various ideas presented are not attempted, and many case-related decisions must necessarily be tentative to illustrate problems. Instead of attempting to provide all the answers, we offer a structural framework within which it may be possible to better address the many complexities found in cataloging in a integrated fashion. Key to this effort is that works have distinctive title entries to stand alone, and that authorities function as virtual umbrella works, rather than identifying specific individual works, and that these are integrated into a single structure, potentially sharing the same **Record**.

One final example provides a segue into **Relationships**. Embedded relationships occur in entries for **Work**s, although less commonly than for **Being** and **Organization**, discussed earlier.

Don Quixote (Choreographic Work : Radchenko ***after*** Petipa, M : 2001)

Relationships

0. The Relationships Element and its Substructure

```
<Work type="intellectual" role="instance">
        <Entry class="individual"
                <TitleSegment>XOBIS</TitleSegment>
                <TitleSegment type="subtitle" nonfiling="The ">XML Organic
                        Bibliographic Information Schema</TitleSegment>
                <Qualifiers>
                        <Time id="77735>
                                <Year>2002</Year>
                        </Time>
                </Qualifiers>
        </Entry>
</Work>
<Relationships>
        <Relationship class="compositional" type="associative" degree="primary">
                <Name>Subject</Name>
                <Work id="1234">
                        <Title>XOBIS</Title>
                        <Qualifiers>
                                <Concept id="5678" substitute="Singular">
                                        <Name>Schema</Name>
                                </Concept>
                                <String>
                                        <Name nonfiling="Version ">1.0a</Name>
                                </String>
                                <Time id ="56635">
                                        <Year>2002</Year>
                                </Time>
                        </Qualifiers>
                </Work>
        </Relationship>
</Relationships>
```

The **Relationships** element is one of the core structural features of XOBIS. It serves as a container for individual *inter*-**Record** relationships. Each of these may be represented by special type of **Concept** (Relationship Authority), indicated by a **Relationship** element, or established on an ad hoc basis, on any given **Record** (the Source). The **Relationship** identifies the **Record** for another Principal Element (the Target) and carries information unique to the **Relationship**. This contrasts with the special type of *intra*-**Record**

relationship that handles *equivalence* (**Varia**). **Relationships** also occur under the **Versions** element to permit delineating version-specific relationships to other records. Both of these aspects are discussed in the Generic Elements section. Following an overview of the substructure of **Relationships**, their broader integrative role and functional implications are treated in sections providing three perspectives: Source-Target, Navigational, and General. The overall arrangement provides consistency and versatility with the intention of unifying a wider variety of linkages, both within and beyond a particular XOBIS implementation, than is found in existing structures.

The substructure of **Relationships** is shown in the outline below. Each **Relationship** has a required 'class' attribute with values parallel to each Principal Element: *conceptual, lexical, linguistic, organizational, episodic, chronological, geographic, vital, material,* or *compositional*. These would be useful in organizing the display of record content. It also has a currently optional 'type' attribute to indicate the Navigational Type, discussed below, with values: *subordinate, superordinate, preordinate, postordinate, associative, dissociative,* and *unspecified*. An optional 'degree' attribute has values to indicate the relative strength of the relationship to a given Target, usually *primary* or *secondary* (similar to MARC 650 1st indicator); conceptual relationships have the additional values of *broad* (e.g. to indicate broad topics for a serials list) and *tertiary* (for routine links such as NLM's check tags) at present.

Name intends to duplicate the **Entry** of a related *authority* **Concept**, which constitutes a Relationship Authority (also a **Concept**), discussed below. **Modifier** permits adding a parenthetic **String** to the **Name** to indicate a limitation, restriction, or nuance of the relationship. Commonly, this will be labeled enumeration, e.g. "pt. 3"; the 'nonfiling' attribute applies here. The **Duration** of the relationship uses the identical structure defined in the **Time** section. **Duration** and **Modifier** deserve wider attention to provide improved accuracy. The implications are broader than are immediately apparent. For example, when the subject emphasis of an organization changes, but its name remains the same, false "hits" on an "old" topic that is still valid can appear peculiar. By indicating, for example, that the Boston University School of Medicine's **Relationship** to Homeopathy was during the initial part of its history eliminates the anachronism. The same applies to serials which change subject emphasis while retaining the same title.

Next, the Target is identified by incorporation of a Principal Element matching the **Relationship**'s 'class' attribute. The Target's **Entry** carries its 'scheme', 'language', and 'transliteration' attributes in the **Relationship** to avoid having to reference the related record for this information useful to display/processing.

Optionally, a **Subdivision** element may reference a Principal Element that has a 'usage' attribute with value *subdivision* to indicate this is allowable. The kind of **Subdivision** is inherent in the Principal Element for *chronological, geographic,* and *linguistic,* while **Concept** specifies a 'subtype' attribute with values *general, form, topical,* or *unspecified*. **Subdivision** was defined primarily to accommodate a single topical subheading for simplicity and homogeneity of the **Concept** element. However, making it repeatable and including chronological, form, topical, and geographic attributes may accommodate the precoordinate approach as a transitional device. (Note that subdivisions of organizations

and events are treated differently.) To permit descriptive or explanatory information **Description**, cf. Generic Elements above, completes the substructure of **Relationships**.

Relationships
Relationship
('class': <value based on Target>)
('type': <value based on Navigational Type>)
('degree': *primary, secondary; tertiary* or *broad* with restrictions)
Name
Modifier ('nonfiling')
Duration
<Principal Element>
('id': <**ID** of Target)
('substitute': <Target's Entry Substitute referenced>)
from Principal Element itself:
(optional 'language': <value from **Entry** of **Language**>)
(dependent 'transliteration': <value from **Code** of **Work**>)
(optional 'scheme': <value from **Code** of **Work**)
<Principal Element's **Entry** Substructure>
Subdivision
('id': <**ID** of Target)
('substitute': <Target's Entry Substitute referenced>)
Description

The introductory example illustrates how *this* documentation (a **Work**) has XOBIS (Schema : Version 1.0a : 2002) (also a **Work**) as its "Subject" (a **Relationship**). The **Name** "Subject" should be under authority control to indicate when it is applicable, provide **Varia**, etc. Similarly, an **Organization** could be linked simply by this **Relationship** on the **Record** for an **Event** (Source):

Relationship (**Duration**): Target **Organization**
Sponsored by (1995-): Council on Library and Information Resources.

Other sponsors at different times could be added as necessary. The **Relationships** structure in XOBIS accommodates many types of information not currently recorded. Whether or not cataloging rules should be changed to require or option various possibilities is a separate question. The following discussion attempts to illustrate how XOBIS' simple technique serves as a vehicle for integration for all types of information defined.

1. Source-Target Relationships

Definition of the values of the 'class' attribute of a **Relationship** to parallel each Principal Element serves to organize **Relationships** as Source-Target pairs (aka Principal Relationship Classes). This arrangement contributes to XOBIS' symmetrical structure and also supports organization and display of these ubiquitous, binary relationships by Target category. These corresponding "hard-wired" choices enforce structural integrity:

Relationship 'class'	Parallel Principal Element
0. *conceptual*	**Concept**
1. *lexical*	**String**
2. *linguistic*	**Language**
3. *organizational*	**Organization**
4. *episodic*	**Event**
5. *chronological*	**Time**
6. *geographic*	**Place**
7. *vital*	**Being**
8. *material*	**Object**
9. *compositional*	**Work**

The 100 possible Source-Target pairs are shown in Figure 5.

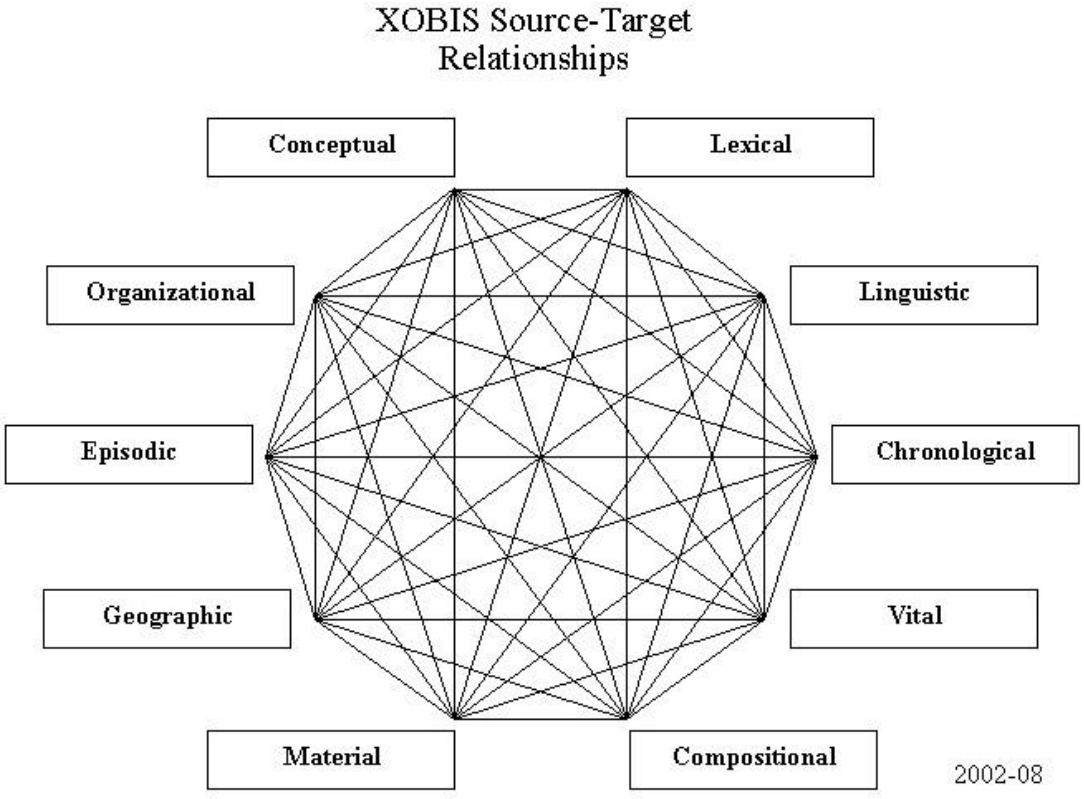

Figure 5. XOBIS Source-Target Relationships

Each of the 100 Principal Relationship Classes used is envisioned to have a **Concept** authority to manage specific values belonging to that class. Each value would also be established as a Relationship Authority (also a **Concept**). The class would not be assigned when using the specific values, as the 'class' attribute of the **Relationship** is required to carry this information. Legitimate examples of most of the possible combinations are known to exist. Some are likely rare. Source-Target pairs provide convenient names:

Compositional-Compositional Relationship	(Work to Work)
Compositional-Geographic Relationship	(Work to Place)
Geographic-Compositional Relationship	(Place to Work)
Conceptual-Chronological Relationship	(Concept to Time)
Lexical-Vital Relationship	(String to Being)
Vital-Organizational Relationship	(Being to Organization)
etc.	

Counting bi-directional pairs as one (as the second/third examples illustrate), the number of Principal Relationship Classes is reduced to 55. In either case, this provides a rich palette of structurally inherent categories of relationships without becoming too unwieldy. Source-Target Relationship Classes are integral to the structure of XOBIS and are useful for determining context when establishing new specific **Relationship** values. They also are intended for use by editing software to control allowable values.

A specific, individual **Relationship** serves as the representation of the link between one **Record** and another, each reflecting a primary categorization by one of the Principal Elements. The **ID** of the Target should be included when known to provide a concrete link, with the **Entry** and its attributes serving as visual backup and convenience for display. Ad hoc values are permissible, but they must be categorized.

Using XLink technology to extend this linkage outside a given implementation of XOBIS is tantalizing to consider. Any linking 'id' could be converted to an 'xlink' during an export process to identify its source. This would allow the recipient to link directly back to the originating XOBIS implementation if desired. There is the potential for individual implementations to have the choice of carrying a particular **Record** or referring to a national or other external resource's **Record**. It may not be necessary to carry an authority for every instance that may occur in a given system. Interested parties could create domain-specific national or international resource files to serve in this capacity. We hope to test this idea after converting test data.

2. Navigational Relationships

Relationships are multi-dimensional. While Source-Target Relationship Classes are most useful for control and presentation, enhanced management of relationships holds even greater potential for online navigation. XOBIS incorporates a set of Navigational Relationship Types to provide for directional (up/down/back/forth) and coordinate relationships. In this regard, it is useful to think of a link's destination as the *referential* record, and the record a user is viewing as the *focal* record. Navigational Relationship Types are intended to permit offering users a choice of

referential record sets relative to their focal record. For example, if chapter 3 is a **Work** represented by the focal record, a user should be able to navigate up to the book containing the chapter, back to records cited or back to chapter 2, forward to records citing the chapter or forward to chapter 4, as well as to any other content-based linked works. Likewise, all the other Principal Relationships would be "hotlinked," to contextualize the work. Some of these relationships are covered in current library systems, some in various fulltext digital resources. XOBIS endeavors to unify all relationships into a single, integrated structure. Consult Bean and Green (56) for an excellent compilation of the many types of relationships in the bibliographic milieu.

XOBIS provides for six mutually exclusive Navigational Relationship Types, recorded as 'type' attributes of **Relationship**: *subordinate, superordinate, preordinate, postordinate, associative,* and *dissociative.* An additional value, *unspecified*, was added for mapping convenience. Many of the values could be determined algorithmically in mapping, but since other may not be, we elected to make this attribute optional for now. The Navigational Types are grouped below in super-categories to make their organization more apparent. The specific examples indicated are illustrative only, and not prescriptive. Note how these also fall into various Source-Target Relationship Classes. They may exhibit all the characteristics of any authority, for example, "Preceded by" as a **Variant** of "Continues". Complex relationships can be broken into binary form, with subtleties recorded as **Description** as necessary.

<Hierarchical>
- Subordinate
  - **Concept** Narrower **Concept**
  - **Organization** Subsidiary **Organization**
- Superordinate
  - **Concept** Broader **Concept**
  - **Work** Parent title **Work**

<Sequential/Chronological>
- Preordinate
  - **Work** Continues **Work**
  - **Organization** Earlier **Organization**
- Postordinate
  - **Work** Continued by **Work**
  - **Work** Translated as **Work**
  - **Organization** Later **Organization**

<Coordinate>
- Associative
  - **Work** Composer **Being**
  - **Work** Publisher **Organization**
  - **Concept** Namesake **Being**
  - **Organization** Founder **Being**
- Dissociative
  - **String** Antonym **String**
  - **String** Homonym **String**
  - **Concept** Distinguish from **Concept**

Note that the special **Subdivision** element discussed above represents a precoordinated *subordinate* Navigational Relationship. The *subdivision* attribute value of various Principal Elements indicate its applicability Each **Subdivision** is just another **Concept** designated as being eligible to serve in this capacity. This seemed compatible with XOBIS' structure when we analyzed *topica*l subheadings with *topical* headings in MeSH and was envisioned as only occurring in **Relationships**, where two 'id' values could link the extended **Entry** to two **Concept** authorities. Essentially, it still works this way, but we realized that the technique could be extended to other Principal Elements because LCSH terms would be dispersed in XOBIS. Since Lane Medical Library does not use LCSH, we are ill-equipped to test whether this late addition can handle the great variety of LCSH non-topical subheadings. **Subdivision** itself may be questioned once we have experience in testing subordinate MeSH topical subheadings as alternative *Subdivision* **Relationships**.

3. General Relationships

The third kind of **Relationships** in XOBIS is designated General Relationship Types. These may be defined as needed and are not restricted to single Source-Target Relationship Classes or Navigational Relationship Types. They are idea-oriented and represent *collective* **Concept** classes, with individual values belonging to a class reflecting instantiation or "isness" in relationship to it. This represents a broader interpretation of form/genre (MARC 655). In examples throughout this text, these have been illustrated with the label "*Category*:". General Relationships Types might also be called Categorical Relationships. At Lane Medical Library we have found the working definition or litmus test of "is, includes, or represents" helpful in determining applicability. This provides flexibility in applying a specific value by considering the **Record** a surrogate for the real thing, considering subsumption equivalence (discussed under **Varia** in the Generic Elements section), etc. A whole book could be written on this (56).

Because General Relationships are content, only a few possibilities in one area are sketched. Various Web sites have recognized the importance more tenuous relationships, especially in historic contexts, and emphasize them via hotlinks, e.g. who influenced another's work. These should be incorporated in the more comprehensive environment of libraries and museums. Below are a few Types that might be established to apply to **Being** (*vital*); note that they may overlap. The various Principal Elements to which they point is left to the imagination.

General Relationship Type	Potential **Relationship** Values
Ecclesiastical	Priest, archbishop, postulant, metropolitan, etc.
Educational	Faculty, student, teacher, praeses, course director, etc.
Genealogical	Cousin, mother, brother, spouse, grandniece, etc.
	Printer's widows were covered in a recent LC rule interpretation.
Legal	Plaintiff, witness, contestee-appellant, etc.
Military	Corporal, general, admiral, sergeant, etc.
Reciprocal	Sibling, spouse, colleague, etc.
	Note that cousin is not reciprocal in French (cousin/cousine).
Responsibility	Artist, author, composer, illustrator, printer, etc.
	Recently in the news: Artist: Ramona (Elephant), 1995-

Royal	Empress, king, suzeraine, infanta, maharani, etc. Cf. **Being** and **Organization** regarding establishing corporate headings for president's, etc.

Some **Relationships** are sufficiently inherent that they are not always thought of as such. Uniform Resource Identifiers (MARC 856) present a twist in representing the link between metadata (a **Record** serving as a surrogate for a **Work**) and the **Place** where the fulltext, database, online version, etc. resides. The American Psychiatry **Version** example, under Generic Elements above, illustrates how XOBIS treats URLs like any other relationship. We chose the **Name** of the General Relationship to be *Fulltext* and the **Name** of the **Place** to be the URL. This is also a *compositional-geographic* Source-Target Relationship. An implementation issue might involve whether to display the URL or not; the **Name** value could serve as the hotlink.

This technique of dealing with URLs raises interesting possibilities. The **Relationship** may be blind in the sense that an authority record for a URL as **Place** is unlikely. However, XOBIS' hierarchical structure and the URL's (domain, machine, institution, path, and fragment) imply that authorities for selected upper level components of the URL might be useful in improving management of these, particularly in case of name changes. Individual URLs would be instantiations of a *collective* **Place**. Contrast this with the role of XLinks discussed under Source-Targets Relationships above.

Another case took us awhile to realize. "Fictional" appears to be a universal General Relationship, reflecting illusory membership in a class (Fictional whatever). This **Relationship** applies to all Principal Elements as shown in earlier examples. Shades of meaning, such as legendary, mythical, imaginary, projected (especially in futurism), spurious, satirical, etc. (LCSH usage varies), suggest the need for establishing additional relationships. Whether the deception is intentional or not, such as when ideas do not pan out (e.g. Phlogiston, Cold Fusion), may make a difference in delineating such relationships. Even fictitious, versus fictional, reflects a subtle dishonesty. In contrast, "fictitious" business names (dba/doing business as) actually occur in the real world. Specific Principal Elements sections above expand on the general relationships indicated by these examples:

Fictional	Value
Concept	Time Travel
String	borogroves
Language	Romulan
Organization	San Serriffe Publishing Company
Event	World War III
Time	1026 FE [Refers to First Empire in Asimov's Foundation series]
Place	Oz
Being	Jabba, the Hutt
Object	Excalibur
Work	Necronomicon

Fictional relationships are analogous to the *categorical* and *topical* relationships discussed under **Concept**. Minnie Mouse *is* a member of the category Fictional Characters, whereas she has a *fictional* relationship to the topic Mice. Both are concepts, but her not being an actual mouse is an important distinction to avoid adulterating the **Concept** Mice. This is closely akin to the

depictional relationship, made famous by Magritte's noting "Ceci n'est pas une Pipe." on a painting of a pipe, and recently added to MARC relator codes (58). Fiction itself, benefiting from the recent emphasis on both topical and categorical access, may also exhibit fictional relationships, e.g. Wilde's Picture of Dorian Gray.

Whether it is necessary to qualify names routinely to indicate their fictive nature is debatable. Relationships alone may suffice in cases where qualification is not necessary for disambiguation or clarification when a name or title does not convey the idea of membership in its given class. At least, such information should assist in policy development.

4. It's All About Relationships: Instantiation, Recursion, and Authorities

A few other factors will help round out the treatment of **Relationships** in XOBIS and indicate potential mapping ideas from MARC. Explicit Relationships in MARC can be mapped directly in many cases. Implicit Relationships have been discussed in the context of being embedded in some entries, cf. **Being** and **Organization**. However, many other ones have the potential of being derived algorithmically from MARC. Some examples of this are: next/previous in sequence of volumes in a series, the subordinate relationship of instances of uniform titles series relating to their parent authorities, component part siblings, etc.

While making many **Relationships** explicit in XOBIS improves navigation and accessibility, it is not practicable or desirable to do this in all cases. We envision a third group of "one to many" Virtual Relationships, which would be displayed, but calculated "on the fly" to give the appearance of being explicit. Examples of this are links to subordinate levels of topics with many exemplars, contents of a periodical, components of a book, etc. This extends to bibliographies at the end of works, although these are considered part of the work; one of the successes of the Web has been linking these. Further analysis of which **Relationships** should be Explicit or Virtual is needed.

Integration of **Relationships** into a Web-oriented "bibliographic" apparatus revealed certain repeating themes or principles during our protracted exercise of schema development. Although the ideas are simple, teasing out all the details was tedious. The most interesting themes involved instantiation, recursion, and integration of Authorities, particularly our projected Relationship Authorities.

Instantiation, or distinguishing a specific instance from a category, became the primary method of delineating Principal Elements in XOBIS. In the discussion under **Concept**, we began with everything as *abstract*, recognized categories of the abstract as *collective*, and from these separated the "atomic" *instance*, refined by notion versus substance. Each of these decisions prescribed a now structurally implicit, hierarchically subordinate, "isness" relationship. The result produced cascades of **Concept**s, a specific **Concept**, or a class of specifics– the other Principal Elements. Despite the complexities of the real world, this seemed to provide a reasonable framework. One example for each Principal Element recaps the overall effect:

Generic/Collective	*Specific/Instantive*	Principal Element
Concept		
Theories	Relativity	**Concept**
Palindromes	madam	**String**
Romance Languages	Italian	**Language**
Hospitals	Bethlem Royal Hospital	**Organization**
War	World War II	**Event**
Year	2001	**Time**
Sultanates	Oman	**Place**
Artists	Klimt, Gustav	**Being**
Diamonds	Hope Diamond	**Object**
Books	Behold Man	**Work**

At the outset, we recognized **Relationships** as "special" and treated them accordingly. However, as the schema unfolded, this partitioning created somewhat of a dilemma. Their use was extended to **Versions**, cf. Generic Elements section above, to provide more flexibility. Many relationships**,** depending on how they are named, are identical or very similar to the **Concept** from which they are obviously derived. Consider this example of a Navigational Relationship Type with a potential specific **Relationship** for each Principal Element. Note that many relationships can cross the "boundaries" between Principal Elements, permitting a very flexible framework for describing and controlling them (e.g. both an Organization and a Work may be "Continued by" another, if so defined).

Concept	**Relationship**	Principal Element
Associative Relationships	(**Concept**?)	
	Related [to]	**Concept**
	Synonym [of]	**String**
	Dialect [of]	**Language**
	Subsidiary [of]	**Organization**
	Satellite [of]	**Event**
	Held [on]	**Time**
	Colony [of]	**Place**
	Sibling [of]	**Being**
	Copy [of]	**Object**
	Translation [of]	**Work**

As a working solution to resolve the tension, the **Relationship** element was integrated as a special kind of **Concept**, e.g. the *collective* Associate Relationships (**Concept**) has *specific* instances, e.g. Synonym (**Concept**). Three other concepts signify this the special role of **Relationships** as categorical relationships to three suggested authorities: Relationship Classes (for source-target), Relationship Types (for navigational), and Relationship Authority (for specifics). Currently, this is the only distinction from other concepts. There are implementation issues, such as whether to include such records in **Concept** retrievals or to segregate them. Distinctions from "regular" concepts with the same or similar names might be necessary, e.g. "Synonyms" vs. "Synonym" perhaps displayed with a colon. See also the discussion of **Singular** under Entry Substitutes. Display issues may be likened to incorporating some "display

constants" suggested in MARC or typical OPAC display labels (e.g. Subject:) as part of a Relationship Authority. Adding punctuation, deduping repeated label values, etc. are in the purview of XSL. In a later version of XOBIS, we plan to explore the issue of **Relationships** sharing the same **Concept** authority as its parallel topic.

The implicit degree of control and flexibility in dealing with **Relationships** in this manner is fascinating, although the implications have not been fully digested. In a presentation to the 2000 MARBI/CC:DA joint meeting, Miller asked the rhetorical question: "Have relationship authorities been considered?" (1). Efforts to get a handle on **Relationships** are gaining momentum. An excellent example is the delineations made in dealing with graphical material's depiction versus subject (57). MARC's growing relator codes list is a natural fit (58). These and other explicit relationships in MARC, e.g. subject fielding (6xx), linking entries (67x-68x), authority links (5xx), and some specific fields and indicators provide a rich resource on which to build. It is important to aggregate this key information, which is often obscured in coding, relegated to documentation, and/or left to OPAC display vagaries. Determining the most appropriate specific relationship values and their references is a necessary, yet challenging endeavor that will occupy us for some time. XOBIS illustrates the value of formalizing **Relationships** as fundamental building blocks of a comprehensive informational apparatus.

Recursion (self-referencing) is almost as prominent in XOBIS as are **Relationships**. In an effort to balance complexity and simplicity, we erred on the side of simplicity, perhaps due to the siren song of elegance. As Generic Elements surfaced (cf. that section), we realized that key ones mirrored the 10 Principal Elements, e.g. qualifying an **Event** with a **Place**. Rather than dealing with them repeatedly in various contexts, we elected to reuse core structures. The dogged elimination of redundancy resulted in a more tightly unified and symmetrical structure than would have been possible otherwise. While greatly simplifying the schema, recursion does introduce its own complexity. It is necessary to consider the context of a core structure due to subtle differences, e.g. applying different attributes in **Relationships** vs. **Qualifiers** for a given **Entry**. With experience these may appear to be common sense, but trying to describe them abstractly requires mental agility.

The delineation of the Principal Elements above illustrates recursion, but **Entry** provides a more accessible example. A coordinated **Entry** substructure for each Principal Element is used in all cases where the **Entry** is referenced, e.g. as the **Entry** for an authority, as a **Variant** of the authority, as one of the **Qualifiers** as part of another **Entry**, or as the target of a **Relationship**. This is mirrored in the **ID** structure, whereby its value is included in the 'id' attribute in each of these capacities. To achieve this degree of synthesis implied that some rules or conventions would need adjustment. The design reflects an emphasis on postcoordination, although there is some provision for precoordination. NLM's recent change in cataloging policy in this direction is encouraging. It is hoped that some adjustment to cataloging rules will be considered more reasonable than building idiosyncratic structures to handle relatively minor departures. An added benefit is that some data not previously coded, e.g. qualifiers in titles, is accommodated seamlessly. Propagation of authority changes should be easier as well.

Another method of allowing variation without prescribing specific structures is manifest in Entry Substitutes, cf. the Generic Elements section. **Abbrev**, **Citation**, **Code**, and **Singular** elements provide alternative or substitute versions of an **Entry**, which can be referenced wherever the

'substitute' attribute is defined. These were segregated from **Varia** expressly in order to be individually addressable and to build some give into the structure.

A last example of recursion is a self-documenting technique of relying on database content rather than building everything into the schema. In this manner software may control values according to criteria defined outside of the schema, while valid values occur as data in the schema. This way it is easy to update choices without changing the schema. See the **Type** element in the Generic Elements section as the chief exemplar.

XOBIS' crisp uniform entries, tightly woven structuring of relationships, and other recursive features aim to balance rigor with flexibility. Much as XML separates content from display to maximize flexibility and information reuse, XOBIS strives to keep its framework separate from changeable data values, while permitting external software to use these to control what can be entered as data.

Indexing Implications

Relationships provide an interesting segue into indexing. In view of the discussion above concerning **Concept/Relationship** interplay, it is necessary to consider the impact this would have on index construction. Since the same **Concept** supports Topic and Category, each a **Relationship**, it is the **Relationship** that would determine how to separate the two into topical and categorical indexes. Alternatively, they could be distinguished in the same index, drawing attention to the distinction. This simple example parallels MARC (650 and 655); other cases are likely to be less predictable. The 'degree' attribute (e.g. primary/secondary) supports an important distinction, especially in cases of high postings. This section's goal is to introduce issues, rather than provide solutions. More study is needed.

XOBIS provides a structured framework for many kinds of information. While this structure is intended to support improved indexing due to improved organization, it is not prescriptive regarding how derivative indexes should be built. The Principal Elements provide a point of departure. Regardless of how the pie was cut, troubling divisions always resulted. To alleviate problem categories that fall on the "wrong" side of a cusp vis à vis a particular index, overlap could be defined. Since automating, Lane Medical Library has included conference names in both the name and title indexes for this reason. When librarians have difficulty deciding where to assign a particular value, it is likely that users will have difficulty in choosing the "right" index. Some of the Principal Elements may be expansive enough to split; others might be lumped. A third option would be to include subsets from one or more of these in a various cross-Principal Element indexes. These examples suggest some possibilities with potential subsets listed under an index and their Principal Element of origin on the right.

Organization Index

Family names	**Name**
Organization names	**Organization**
Jurisdictions	**Place**

Title Index (**Entry/Varia**)

Titles of works	**Work**
Meeting names	**Event**
Object names	**Object**

Language Index

Computer languages	**Work**
Languages	**Language**
Markup Languages ?	**Work**
Scripts	**Work**

Keyword Index

Words and phrases	**String**
Acronyms, codes, etc.*	<other Principal Elements>

* Cf. the String element, Entry Substitutes and Varia for the distinction.

We envision another type of browse index, a structured, smart or value-added one, building upon hierarchical relationships indicated in various places in the foregoing text. Due to the uniformity of structure, these could be optimized for each Principal Element. A topical index could display subdivisions and relationships as optional substructure, eliminating clutter from a purely alphabetical listing. Similarly, geographic and organizational substructure could be displayed hierarchically in multiple tiers. Personal names present interesting possibilities. Both forename and surname entries could be included in the same index, distinguished from and subarranged by their reciprocal. Titles may offer the most promise in this regard. Series or periodical titles could offer up their relationships, especially subordinate ones such as articles and chapters in highly organized structures. Time also offers intriguing possibilities and challenges. The same hierarchical structure would allow "drilling down" chronologically, but provision for "bursting" ranges of values and considering differences of usage by relationship need to be considered. The basic idea is to hide substructure until the user exhibits interest by choosing particular value. Navigational Relationships above provides the underpinnings for this indexing functionality.

Indexing is a complex issue. As a temporary way to test these ideas, we will consider building separate XML documents containing index entries that could be updated by editing software when XOBIS records change. Other indexing options may prove more effective. In any case, libraries should no longer settle for raw alphabetical listings. We can do better. Our goal should be to move this functionality onto the Web more effectively. We hope that XOBIS might play a role in this endeavor.

Another important issue in indexing relates to language. Our temporarily aborted Clustering technique is discussed at the end of the **Language** section. Current features in XOBIS supporting language distinctions need testing and broader input before deciding upon the best technique to support these robustly. Tillett and international community have pioneered in this area (59). We are encouraged that flexible solutions are possible to improve user options and index coordination and clarity.

Conclusion

Inquiries regarding the future of AACR2, suitability of MARC, and efforts to cope with Web resources have been accelerating recently as evidenced by a few of the key related papers and conferences (20-23, 60-63). The emergence of "digital libraries" has brought metadata into contention with cataloging data; the distinction between the two easily blurs. XML's concurrent success has thrust these developments into a new light. The Library of Congress, of course, has been heavily involved. The hallmark of LC's response seems to be encapsulation–literally in the case of the MARC XML schema and as a subset in the case of the MODS schema (16, 12). These and other schemes, that focus more on digital materials in contrast to physical materials, are in turn incorporated by the Metadata Encoding & Transmission Standard (METS) (64). The METS schema, also in XML, is a standard for encoding descriptive (including MARC), administrative, and structural metadata regarding objects within a digital library. It is MARC's role in this environment that gives pause. MARC is not Web-oriented despite being gussied up in XML.

Against this backdrop, XOBIS is offered as an experimental model and as proof of concept– to illustrate the feasibility of replacing MARC with an XML schema (not just uncritically translating MARC's existing structure into XML), and to evaluate its benefits in supporting future system capabilities. This should not be interpreted as minimizing potential problems, but intends to emphasize that these issues need to be identified and explored in a spirit of inquiry and with a desire for the betterment of our profession. Development and implementation of a core XML schema presents an opportunity for librarians to provide leadership in information management, and to regain influence, which has been hemorrhaging to other sectors in the wake of the introduction of the World Wide Web. The strategic opportunity afforded by XML will not last forever (39). The defensive strategy of isolating the traditional from the digital and clinging to an outmoded data format is counterproductive. The best standards enable rather than confine (65).

Although XOBIS constitutes a structural whole, it is still very much a work in progress. There are many avenues for refinement and further pursuit of its ideals. One area for further study is how different XOBIS-based systems could interact. Another is using XML namespaces to incorporate local or vendor specific customization. Its implication for changes to existing cataloging codes needs review. The projected suite of related schemas needs further consideration. XOBIS extends the current scope of cataloging without prescribing rigid data requirements. Data collection development policies might help ensure that what is of significance or scholarly value goes into systems as part of a distributed effort.

At this time, we recommend XOBIS for experimentation only. It is likely that flaws will emerge during testing, but we are hopeful that the structure will be strengthened through increased scrutiny. We recognize that for wide-scale application, further analysis and consensus building will be necessary. We want to keep XOBIS from getting too rigid before being vetted in the library, museum, and XML communities. Many worthwhile efforts are underway; it is important that a variety of approaches be considered. Reaching agreement is a worthwhile goal, although often difficult.

In developing XOBIS, we have aspired to balance many factors, e.g. the:

digital/physical
simple/complex
typical/exotic
generic/specific
practical/ideal
bibliographic/material
descriptive/authoritative
prescribed/optional
custom/scalable
temporary/maintainable
relational/autonomous
recursive/discrete
synthesized/fragmented
structural/functional
organic/artificial
local/global

Advantages and disadvantages occurred with each decision we faced. Repeated iterations of XOBIS attempted to reconcile newly recognized patterns, which intriguingly seem to be organic in nature. How successfully XOBIS reflects our attempt, and how effective our effort to magnify a small library's perspective while keeping a medical library perspective in check, await review. Lastly, we have tried to balance passion with dispassion. To move XOBIS from an individual to a community effort, we actively seek partners to continue this fascinating exploration.

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Note: In XOBIS, these references would be mostly either *compositional-compositional* or *compositional-organizational* **Relationships**.

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Disclaimer

This document began as a general introduction to XOBIS and got out of control as we struggled to keep track of haphazardly recorded decisions. It was difficult to propagate changes in this documentation due to the uneven course of the evolution of XOBIS, and sometimes vice versa. In the event of discrepancy between the documentation and the schema, we reserve the right to squabble amongst ourselves in private before determining whether either has precedence.