"Records in Context" in context:
A brief history of data modeling for archival description

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Abstract. The recent historical origins of data modeling practices in the context of archival description are explored, with a view to obtaining critical perspective on the ongoing work of ICA's EGAD in designing a new model of descriptive data. While the consensus within ICA appears to recommend a harmonization with library and museum models, a review of the unique characteristics of archival data lead the author to suggest caution.

1 Introduction

In this short paper, I attempt to identify some historical factors that combine to explain current differences in certain of the data modeling practices of the archives, libraries, and museums (ALM) communities. I am prompted to do this out of interest in the work of the International Council on Archives' Experts Group on Archival Description (ICA-EGAD; see Gueguen et al., 2013; Pitti et al., 2014). This group is engaged in the design of a new model of data that are descriptive of archival holdings, with the intention that eventually it shall supersede older models that are deemed less useful in contemporary contexts. Reading between the lines of EGAD's "Interim Report,"[1] some observers initially speculated that this new model may be more in line with those developed in the library and (in particular) the museum communities.

It occurred to me that a historical analysis might help us weigh up the pros and cons of adopting the new model. It certainly seems prudent to ask in what ways such a development might be construed as a positive one whose benefits outweigh its costs; and my assumption is that a historical analysis could help us answer that question. If we were to come to an understanding of the historical conditions for the distinctive direction taken by developers of archival standards since 1987 (so the argument goes), and compare them with advances made in libraries and museums, then that would help us to account for differences in the data models that have been produced in each domain, and perhaps also help us to understand the need for a new archival model.

[1] "As we develop the ontology, we are paying close attention to CIDOC CRM and the FRBR extension to CRM, FRBRoo, as one important objective in the work of the EGAD is to lay the foundation for aligning with these ontologies, at a high level. We also want to take advantage of this allied work, as there are major overlapping areas of description that conceptually align, if not always completely, with archival understanding." (Pitti et al., 2014, p. 9).

There is an ethical subtext to all of this, which arises from asking the question whether, *ceteris paribus*, data models should be (a) more like one another or (b) less like one another than they currently are. My characterization of this as an ethical question derives from a conviction that one's answer will depend on how much one values uniformity above or below diversity. I believe that this valuation will be a complicating factor in determining one's feelings about different data models.

At the same time, there are reasons why I should *not* have tried to write this paper. The history of archival data models does not extend back in time much further than the 1960s. This means that we are engaging in what is sometimes known as recent history, where the qualifier "recent" functions almost as a pejorative, if not oxymoronic term. Recent history is prone to criticism in several typical respects. For a start, we hear, it is way too soon to start thinking about the events in question from a distinctively historical point of view. Not only that, but I am way too close to the events in question to be able to think about them in the non-politicized way that good history requires. Supposedly, my temporality is problematic: I do not have hindsight yet; it is premature for me to assess the full impact of recent events; it is impossible for me to identify clear beginnings, ends, or turning points. Moreover, my positionality is problematic: I do not have perspective yet; my vision is obscured; it is impossible to be objective and unbiased, so my narrative inevitably becomes politicized. The other side to this argument is that, in these respects, recent history is hardly worse than history *tout court*. *All* narratives are constructed, as are *all* "turns" and "moments." Recognizing my subjectivity is not incompatible with engaging in critical reflection on the historical context of recent, even ongoing, events.

As a practice in which people participate in different ways at different times and in different places, archival data modeling is not special. It is a practice whose nature, purpose, and value are shaped by the specific historical and cultural conditions under which it is carried out. In turn, the kinds of narratives that may be constructed to explain the causal processes characteristic of various kinds of contexts are themselves many and various. In order to explain differences among data models designed for use by members of the library, archives, and museum communities, one might have reason to prefer an interactionist, agent-oriented theory that gives prominence to the interests and purposeful actions of human actors. For instance, one might observe that the specific groups of individuals who have been involved in the production of the different data models, and the respective sets of interests of those individuals, vary in relevant and systematic ways; and, given the tendency for people with different interests to make different decisions even in similar situations, one might choose to look no further for a plausible account of the variation in different groups' creations.

Alternatively, one might favor a functionalist, artifact-oriented theory that emphasizes the uses and contexts of particular kinds of objects; or a structuralist, domain-oriented theory that focuses on disciplinary traditions and customs. Taking a functionalist approach, one might consider the distinctive natures of the

specific kinds of artifacts that are modeled by different data models and of the contexts in which those artifacts are produced and used, and conclude that the differences among those data models are explained by the tendency for different kinds of artifacts to require different kinds of handling, even in similar kinds of situation. On a structuralist reading, recognizing that the specific domains or disciplines whose worldviews are modeled, and the traditions and customs (both theoretical and practical) developed in those domains, may be distinguished in relevant ways, one might conclude that data models vary in accordance with the different approaches to similar situations taken in different domains. Certainly there are yet other options. Categories such as these might in any case be construed as unproductively simplistic. Needless to say, most historical explanations involve factors of more than one type.

The paper is structured as follows. In Section 2, I attempt briefly to clarify some of the terminology that is a source of some confusion in this field. In Section 3, I construct a narrative of some of the significant events in the recent history of data modeling practices in the archives, library, and museum communities. In Section 4, I identify some of the ways in which archival data are traditionally treated differently from library and museum data. And in Section 5, I draw a few tentative conclusions from the observations made in the preceding sections.

2 Terminology

The term "data model" has at least two distinguishable senses (see, e.g., Simsion, 2007, pp. 12–13). One is the sense in which it has been used since the early 1970s to denote abstractions such as the relational model of data defined by E. F. Codd (Codd, 1970). In this sense, a data model is equivalent to what had come to be known in the late 1960s as a data structure class (see, e.g., Codasyl, 1969, pp. 7, 9)—i.e., a specified set of types of structural element, such as "item," "record," "relation," and "file," to be used in descriptions (a.k.a. schemata) of the structure of particular databases.[2] In a second sense, dating from the mid-1980s, "data model" has become loosely synonymous with "schema," as the term is increasingly frequently applied to descriptions of database structure rather than (or, more confusingly, as well as) to specifications of the kinds of elements that may be instantiated in those descriptions.

Some distinguish between conceptual schemata and schemata of other kinds. A conceptual schema (sometimes known as a conceptual model, or, indeed, a conceptual data model) is a representation of reality—specifically, a simplification that reduces the complexity of the real world to a specification of the classes (types) of things that are (considered to be) the most important in a given domain. Such classes might include classes of things that are agents and/or actions, artifacts and/or ideas, places and/or periods, properties and/or relations. For some, "data model" is not to be equated with "conceptual model," but

[2] See Haigh (2009) for an authoritative account of the fifteen-year period of conceptual development (1954–69) that culminated in Codasyl's specifications.

rather denotes a schema of a different kind: one that identifies not only classes of real-world things, but the kinds of data about those things that may be collected, stored, accessed, and used. Nevertheless, from now on, I shall be using the term "data model" as synonymous with "conceptual schema."

In the early stages of any given data management project, the establishment of a data model is necessary so that developers may be guided in defining the various tables and inter-table dependencies that combine to form a database. Each entity-type and relationship-type in an instance of the Entity–Relationship family of models, for example, would be represented in a database by a table made up of values for a set of specified attributes of each entity- or relationship-instance.

The very simple data model with which the developers of the databases underlying most library data management systems typically begin is one where a basic distinction is drawn between two entity-types: library (a.k.a. bibliographic) resources (e.g., editions of books), and authorities (e.g., authors and subjects). The common rationale for separating data of these two kinds is that certain efficiencies are thereby assured: redundancy is reduced; labor may be shared; updates are faster and more accurate; indexing is easier; etc.

Applying this conception of a resource/authority distinction to archival data management, while also taking into account variations (a) in the logical scope of archival resources at different levels of a part–whole hierarchy, and (b) in some of the types of authorities to be linked to resources, results in a relatively straightforward archival analog of the library data model (see Figure 1).

[Place Figure 1 here.]

3 An origin story

The idea that an internationally standardized data model, or models, might be useful for any group within the ALM communities was not seriously entertained before the mid-1980s. In the space of three years, 1987–90, meetings of interested parties were held that successively established separate needs for data models appropriate to museums, archives, and libraries.

In September 1987, at a meeting of the International Council of Museums' International Committee for Documentation (ICOM-CIDOC) in Cambridge, U.K., its Working Group on Data Standards began to discuss efforts to devise a data model that would identify and standardize "those data fields most essential for adequate documentation of collection objects" (Kley, 1988, p. 15). In time, the work begun in Cambridge was to produce ICOM-CIDOC's event-oriented Conceptual Reference Model (CRM). A precursor to the CRM, the Relational Data Model (RDM), is described by Reed (1995, p. iii) as a specification of "what the data is rather than how it is used." CIDOC's goals for the RDM were characteristically ambitious: "At the highest level of abstraction, there are five big entities which can be

defined and documented: People, Places, Things, Events, Concepts. These five entities and the relationships among them can document anything in the entire spectrum of human (or inhuman) experience." (Reed, 1995, p. 3). In 1995, a total of nineteen entity-types were defined in the RDM; twenty years on, version 6.2 of the CRM (International Council of Museums, 2015) includes declarations of 94 "classes" (entity-types) and 168 "properties" (attribute-types). See Figure 2 for an ultra-simplified top-level view of the CRM, with both Object and Event taking center-stage; a complete diagrammatic illustration of the CRM would require the reproduction of many pages of documentation.

[Place Figure 2 here.]

In October 1988, the International Council on Archives (ICA), in collaboration with the National Archives of Canada (NAC), organized an Invitational Meeting of Experts on Descriptive Standards (IMEDS) in Ottawa, Canada, at which prospects were discussed for the development of a set of standards for archival description based on a common understanding of the relevant data elements. "It was fitting that this meeting was held in Canada," observed Hugo Stibbe of the NAC, "because, during the 1980s, the Canadian archival professional community had devoted a great deal of attention to the issue of such standards and had created a national infrastructure to develop them" (Stibbe, 1993, p. vii). Stibbe's point was well taken: in 1985, the Bureau of Canadian Archivists (BCA) had issued *Toward Descriptive Standards* (Eastwood & Dryden, 1985), a report of its Working Group on Archival Descriptive Standards making thirty-five recommendations that collectively provided "a plan to develop descriptive standards for archival materials based on accepted archival theory and principles" (Dryden, 1993, p. 2); in the same year, the BCA established a Planning Committee on Descriptive Standards (PCDS), which followed up with the publication in 1987 of *Developing Description Standards: A Call to Action* (Dryden & Haworth, 1987).

Archivists in the USA had been just as busy in this area: a full decade earlier, in fact, the Society of American Archivists (SAA) had established its National Information Systems Task Force (NISTF), which recommended "that archivists agree on categories of descriptive information and employ common data elements to convey this information" (Gibbs Thibodeau, 1993, p. 92). By the time of the task force's disbandment in 1983 (and succession by a standing Committee on Archival Information Exchange, CAIE), an empirical survey of data elements in current usage by archival information systems had been completed, a comprehensive data element dictionary compiled, and a new Machine-Readable Cataloging format for archives and manuscript collections (MARC-AMC) implemented jointly by SAA and the Library of Congress (see, e.g., Lytle, 1984; Bearman, 1987). David Bearman was one of NISTF's eight original members, assuming the role of its full-time project director in 1981. Bearman had noted in 1979 that the goals of an automated archival system included not only the maintenance of "a data base containing all the information used by the archives in its administrative and service functions" (Bearman, 1979, p. 180), but also the "accommodat[ion of] data conforming to national and international standards" (p. 183) so that the system can "generate guides, link holdings of various collections, [and] produce authority files of names and

institutions indexed and thesaur[i] of subject terms" (p. 183).[3] Bearman was in attendance at IMEDS in 1988, and liked what he heard: "To me, the agreement around the table that a number of entities other than holdings—entities such as repositories, records-creating organizations, retention schedules, facilities, and users—might be promising areas for development of description standards was an exciting outcome of the meeting. Clearly archivists are ready to think about the possibility of sharing authority records of various sorts in order to realize the potential benefits of information exchange at the international level." (Bearman, 1988, p. 55).

In the UK, the goal of standardized description had emerged from a 1983 survey of archival automation conducted jointly by the British Library and the Society of Archivists, and a first edition of the *Manual of Archival Description* (MAD) had been published in 1985 (M. Cook & Grant, 1985; see also M. Cook, 1990; 1992). It is to Australia that we should turn, though, for what is now recognized as the earliest proposal for a separation of resource data and authority data. As early as 1966, in his "case for abandonment" of "the record group concept," Peter Scott had distinguished explicitly between "record control" and "context control," arguing that each could be achieved by keeping descriptions of organizations, agencies, families, and persons separate from descriptions of record series and their components, and inserting "inter-element links" between the two sets (Scott, 1966). With this and subsequent papers, as well as his implementation of such a "series system" at the Commonwealth Archives Office in Canberra, Scott anticipated the late-'80s surge of interest in archival data modeling by some twenty years.

As an immediate upshot of the 1988 meeting, the ICA confirmed that standards development was to be an important aspect of its overall mission. A "Statement of principles regarding archival description" was published in the Canadian journal *Archivaria* in 1992 (International Council on Archives, 1992), calling for the production of consistent, relevant, and explicit descriptions that would facilitate the retrieval and exchange of archival data and allow for the integration of descriptions from different repositories into a unified information system. The familiar illustration of a "model of the levels of arrangement of a fonds" (see Figure 3) appeared for the first time in this context. Over time, ICA's continuing work on standards has produced, inter alia, the General International Standard Archival Description (ISAD(G); 1994; 2nd ed., 2000), the International Standard Archival Authority Record for Corporate Bodies, Persons, and Families (ISAAR(CPF); 1996; 2nd ed., 2004), the International Standard for Describing Functions (ISDF; 2007), and the International Standard for Describing Institutions with Archival Holdings (ISDIAH; 2008). See Figure 4 for an overview of the relationships among these content standards, U.S. national standards, and encoding/structure standards, for both resource and authority description.

[Place Figures 3 and 4 here.]

[3] Not for nothing has Bearman been described as "the leading archival thinker of the late twentieth century" (T. Cook, 1997, p. 15; see also Gehrlich, 2002).

Two years after IMEDS, in August 1990, the International Federation of Library Associations and Institutions' program on Universal Bibliographic Control and International Machine-Readable Cataloging (IFLA-UBCIM), in collaboration with IFLA's Division of Bibliographic Control, held a Seminar on Bibliographic Records in Stockholm, Sweden, initiating a process that would eventually produce the Functional Requirements for Bibliographic Records (FRBR), underpinned by a data model that distinguished explicitly between works, expressions (versions), manifestations (editions), and items (copies) on the one hand, and between corporate bodies and persons (and later families) on the other. (See the canonical diagrams from the 1998 *Final Report* on FRBR reproduced in Figures 5, 6, and 7.) Delegates attending the Stockholm seminar called for a study of the basic functions performed by the bibliographic record, resulting in a project whose terms of reference included, by 1992, the development of a conceptual model that "identifies and clearly defines the entities of interest to users of bibliographic records, the attributes of each entity, and the types of relationships that operate between entities" (International Federation of Library Associations and Institutions, 1998, p. 3). IFLA's *Final Report* on FRBR was issued in 1998, to be followed later by separate reports on Functional Requirements for Authority Data (FRAD; 2009) and Functional Requirements for Subject Authority Data (FRSAD; 2011).

[Place Figures 5, 6, and 7 here.]

The history of each of these three data models—ICOM-CIDOC's event-oriented CRM, the collection-oriented archival model underlying ICA's ISAD(G) and related standards,[4] and the work-oriented library model underlying IFLA's FRBR and related standards—is well documented in the technical literature of its particular domain (see, for example, Doerr, 2003; Bunn, 2013; Coyle, 2015). However, such narratives struggle to explain the considerable inter-domain differences in the forms taken by the various products.

4 Archives are different

An artifact that proves rather useful for those wishing to develop a fuller sense of the archival community's unique take on data modeling is a compilation of the papers that were presented at IMEDS. From the evidence provided in these papers, all written in 1988 or earlier but not published until five years after the fact (International Council on Archives, 1993), we can make several inferences about the context for the IMEDS discussion.

Firstly, it is clear that few attendees had given more than cursory prior thought to archival data modeling. "The archival profession traditionally has balked at rigorously examining archival description …" notes

[4] Here, and on several subsequent occasions, I am self-consciously flouting the Jenkinsonian injunction to reserve the term "collection" only for materials that are *not* accumulated in the course of regular business activity. The sense in which I use "collection" (and, I believe, the sense meant by others whom I quote) is the broad one of "aggregation."

Lisa Weber (Weber, 1993, p. 107). She continues: "Archivists do not have clearly articulated, precise statements about descriptive requirements. Quite frankly, the profession's understanding of the role of archival description is unclear. We do not know what the purpose of our descriptive systems is other than the broadly defined goal of improving access to materials." (Weber, 1993, p. 113). Much like Bearman (1993), Weber identifies data structure, content, and value standards … but no data model standards.

At the same time, it is possible to see the first small steps being taken in the direction of data modeling. The British archivist Michael Cook, for instance, was eloquent about his understanding of the relation of computer science to archival science: "The arrival of computers has revealed that much traditional archival practice has been based upon theories and assumptions common to computer work. … In the light of computer practice, we can for the first time see what we were always trying to do; and, for the first time, we have a strong motive for doing it effectively." (M. Cook, 1993, p. 122). He continues: "For example, sets of archival descriptions are files in a database. The information within the database is an assembly of data elements, each with a special characteristic: these are the values associated with fields within the record. The way in which the various fields are linked within records is a data structure." (M. Cook, 1993, p. 122).

A second major inference we can draw relates to the pervasiveness, at the time, of the perception that archival data are qualitatively very different from the sorts of data that are generated in libraries and museums. Resistance to the broader application of library data content standards such as the *Anglo-American Cataloging Rules*, the second edition of which had been published in 1978, was already widespread: "Toward the end of the 1970s, descriptive standards in librarianship … began to become much more codified. … At least some archivists began to feel pressure to conform to these standards. The first response of these was principally rejection. The challenge and the response revealed that there was little common ground in professional language and terminology, in common practice, or in the understanding of professional aims." (M. Cook, 1993, p. 121).

Lisa Weber was speaking for many, of course, when she argued that archival description is about providing access primarily to collections, rather than to item-level objects: "Cataloging is the library function most analogous to archival description, although the two processes are not the same. Archival description encompasses a lengthy process of providing access to collections or groups of materials. … Creating library-like catalog records for archival materials is only one activity in the process and usually not the most important one. Comparatively, library cataloging is generally at the item level, takes less time per item, and is the primary means of providing access to publishing materials." (Weber, 1993, p. 108).

For Weber, not only is the general orientation of archival description quite different from that of library cataloging, quite different sets of data elements are constitutive of useful archival resource records and useful bibliographic records respectively: "Even assuming that some library standards can accommodate archival needs, clear distinctions exist between library and archival materials. Common sense suggests that

archival descriptive systems will need to answer different kinds of questions beyond the ones intended to be answered by the four objectives of the library catalog. … For example, if provenance is often more important than authorship in the context of archival materials, how can archival descriptive systems improve access to the corporate entity that created the records? Does an archival descriptive system need to provide access to the functions of a creating agency or body? … The answers to these questions should determine the categories of data that archivists include in an archival description. To determine the answers, we must study users to determine how they discover the archival materials that they seek." (Weber, 1993, p. 109). Weber drove the point home later in the same paper: "One of the most valuable lessons U.S. archivists learned from developing the data element dictionary and the USMARC AMC format was the recognition that archivists collect and distribute different categories of information. These categories include data about provenance or context, content, physical aspects of the materials, access to the materials, and actions, or what archivists do to the materials. The ability to separate these categories is helping to articulate just what we do and to see new options and possibilities in how we do things." (Weber, 1993, p. 115).

Again expressing a view that had for long been mainstream among archival theorists, Weber recognized that not only were archival data primarily about different kinds of things (collections rather than items), and not only were those things more usefully described primarily by different kinds of data (data about context rather than data about content), but also that archival data were most usefully arranged in a different way from that used to organize bibliographic data. Weber invoked what she called "the principle of levels" in specifying that archival data are characteristically arranged on a hierarchical basis: "Both the British and Canadian archival communities are examining archival description from 'first principles'; that is, they are establishing principles of archival description from which archival descriptive standards follow. One result is the central principle of levels of records and the subsequent identification of categories of information for each specific level." (Weber, 1993, p. 107). Further on: "British and Canadian archivists are approaching standards development from the perspective of levels of arrangement and description. Though American archivists are concentrating on less hierarchically confined levels of access, all archivists must be concerned about these issues." (Weber, 1993, pp. 113–114). Michael Cook also spoke of the significance of the concept of hierarchical level: "Data management by automated systems is quite amenable to the idea of linked files arranged in hierarchical levels of dependence. … [T]he principal objection to using library standards in archival management is that library cataloguing systems do not accommodate the concept of level (especially where changes of level require different models of description)." (M. Cook, 1993, p. 124).

To summarize, then, mid-1980s archival science can be characterized as hosting three unique perspectives on the kinds of things, and the kinds of data about things, that are important to its theorists and practitioners (see Figure 8). Archival data are typically collection-oriented, rather than work- or event-oriented; they are typically provenance-oriented, rather than content- or location-oriented; and core

archival entity-types are typically related to one another hierarchically, according to their status as parts of wholes, rather than as instances of ideas or as points on a timeline.

[Place Figure 8 here.]

When these three ideas are considered together, a distinctive data model emerges—viz., the data model that is implicitly assumed to lie at the heart of the ICA's suite of ISAD-related standards. Indeed, we might say that this is the data model that is implicit in archival science, since there is no single standard in existence that merges (a) a basic resource–authority model of the type presented in Figure 1, with (b) the model of the levels of arrangement of a fonds that is presented in ISAD(G) (see Figure 3), and (c) a model that relates descriptions of logical resources to descriptions of physical instances, as in Figure 9—all in the context of (d) a map of the relationships among content and encoding/structure standards (see Figure 4).

[Place Figure 9 here.]

Although its contours have yet to be drawn precisely, such a model is simultaneously more granular than the data model specified in the librarians' FRBR, and less granular than that forming the museologists' CRM.

5 From ISAD(G) to EGAD

The data model underlying the ISAD family of standards is not codified explicitly in any official document. Recognizing this absence, an Experts Group on Archival Description (EGAD) was formed by the ICA in 2012 with the charge "to develop a conceptual model for archival description" (Pitti et al., 2014, p. 2) with "clearly defined entities and … relationships" (p. 3). The product of EGAD's work is a model called "Records in Context," developed with the stated goal of close alignment with ICOM-CIDOC's CRM and $FRBR_{OO}$. In the light of the preceding discussion, a question we might wish to ask ourselves is this: Will harmonization with CRM require wholesale replacement of a well-established family of standards, developed over a two-decade period, in which data elements for the description of records and their contexts are already clearly defined? In other words, is there a risk of throwing the baby out with the bathwater?[5]

[5] Michael Cook (1993, p. 128) alluded to this kind of risk in his 1988 commentary on then-current developments in the U.K.: "Because of the MDA's [Museum Documentation Association's] interest in archival materials associated with museum collections, it is quite likely … that in Britain, the development of national databases will occur through collaboration between archives and museum services rather than between archives and libraries. This divergence of tradition may well have serious consequences for the long-term development of the profession." David Bearman (1993, p. 166) also advised against wholesale change: "New description standards should not be totally revolutionary, because they need to connect to existing practice, not only to convince people to follow them but also to link past descriptions with future descriptions. New standards could simply be a codification of existing practice; indeed, the simplest way to make behavior conform to a standard is to declare a current practice as the standard. If current practice embodies a range of approaches, a standard can be defined to encompass them all."

The historical approach conducted in previous sections represents one way of addressing this question. Does our analysis reveal that there are clear, predictable, persistent, pervasive differences in the opinions of leadership groups in each domain? Or in the types of resources handled, and the techniques used to handle them, in each domain? Or in the dominant theoretical traditions of each domain? If so, then what is to be gained by replacing any existing data model with one that is better aligned with others?

Put another way: In current archival theory and practice, is there any less of a focus on collections, or logical scope of description, or fonds, series, files, and items, than there was in earlier periods? Is there any more of a focus on events or objects, or relative location in space-time or role played by resource, or relationships between events or between works, expressions, manifestations, and items? If the obvious answer were "Yes" in any of these cases, then I could see how a realignment of the standard archival data model with CRM might be desirable. My sense, however, is that the onus lies on EGAD to present a convincing argument in support of such an answer. In 1988, Lisa Weber (1993, p. 106) made a compelling distinction between pseudo-standards—"practices that appear to be standards but are not"—and *de facto* standards—"standards that arise through common practice without any formal agreement." The current archival data model may well be a *de facto* standard; EGAD's task is to avoid an outcome in which "Records in Context" becomes a pseudo-standard.

The argument presented in this paper was developed in the course of constructing a particular narrative of events. To create this narrative, I have primarily drawn on existing secondary literature, some of which might plausibly be considered to rise to the status of eyewitness reports. Other methods—those of oral history or discourse analysis, for example—might have been used to produce results of greater validity and reliability. Ultimately, the most productive method may well be that of evaluation—i.e., the evaluation of model-as-theory or model-as-tool against time-honored criteria such as correspondence with reality, internal coherence, and usefulness. "… [W]e must always subject our standards to the test of use," wrote Bearman in 1988, with customary prescience:

> "Whoever the users are for whom the standards were designed, we must study their use of the descriptions and the implementations we offer, and be ready to evolve these standards and implementations in response to needs. … No standards deserve to be implemented as a strategy to improve access unless they can be shown to work. … Only empirical evidence should be accepted as an argument for standards if the standards are intended to promote access through automated systems. In all aspects of the standardization process, we must stoutly resist introducing requirements that have no warrant in archival practices and that will return few, if any, benefits." (Bearman, 1993, p. 168).

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Figure 1. Basic archival data model.

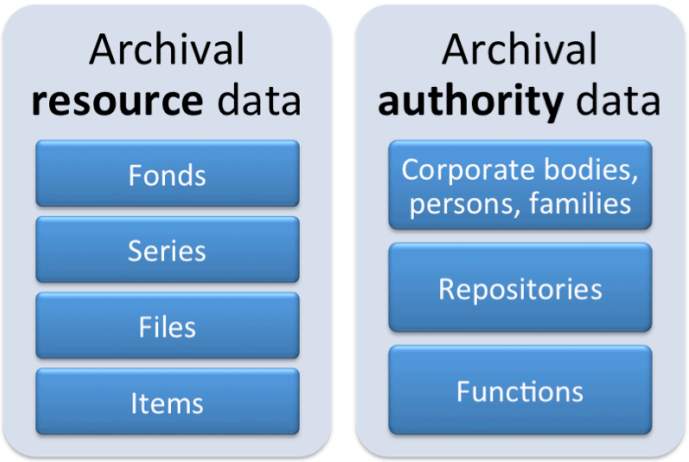

Figure 2. Ultra-simplified CIDOC CRM.

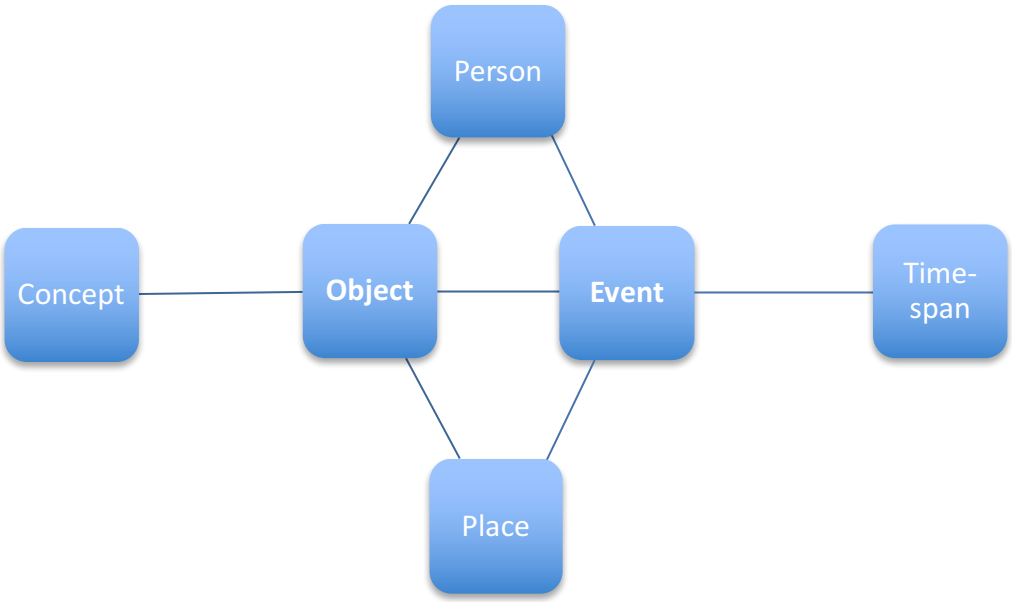

Figure 3. Model of the levels of arrangement of a fonds (ISAD(G), 2nd. ed., 2000, p. 36).

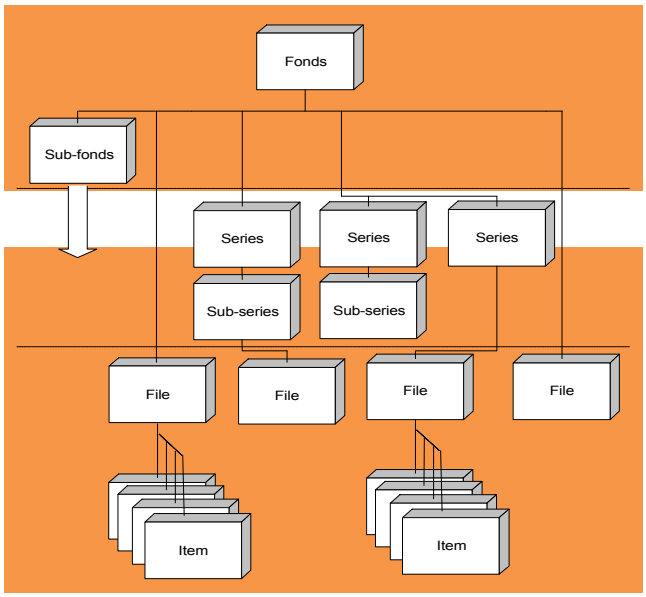

Figure 4. Archival content and encoding/structure standards.

	Archival **resource** records	Archival **authority** records: **Creators**	Archival **authority** records: **Repositories**	Archival **authority** records: **Functions**
International **content** standards	ISAD(G)	ISAAR(CPF)	ISDIAH	ISDF
U.S. national **content** standards	DACS2	DACS2	DACS3?	DACS3?
International **encoding/ structure** standards	EAD	EAC-CPF	EAG	EAC-F?

Figure 5. Group 1 entities and primary relationships (FRBR *Final report*, 1998; corr. 2009, p. 14).

Figure 3.1: Group 1 Entities and Primary Relationships

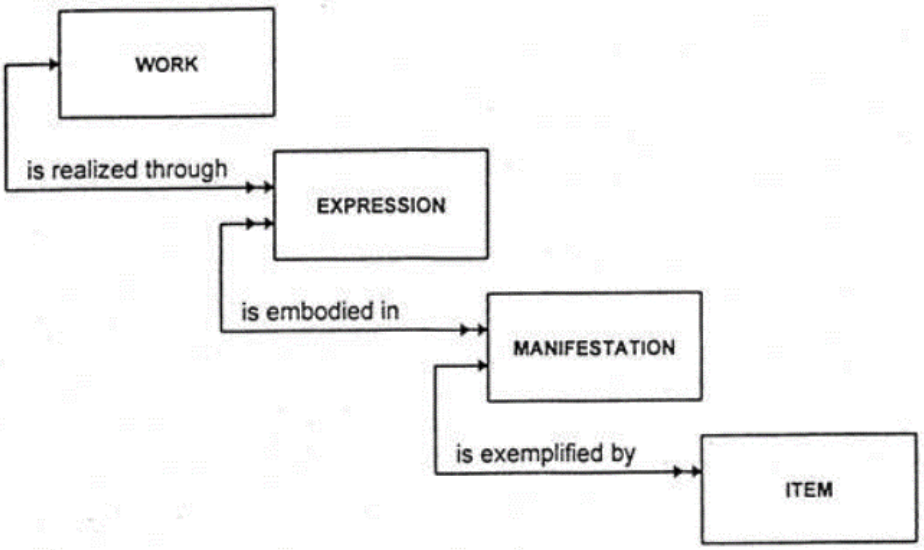

Figure 6. Group 2 entities and "responsibility" relationships (FRBR *Final report*, 1998; corr. 2009, p. 15).

Figure 3.2: Group 2 Entities and "Responsibility" Relationships

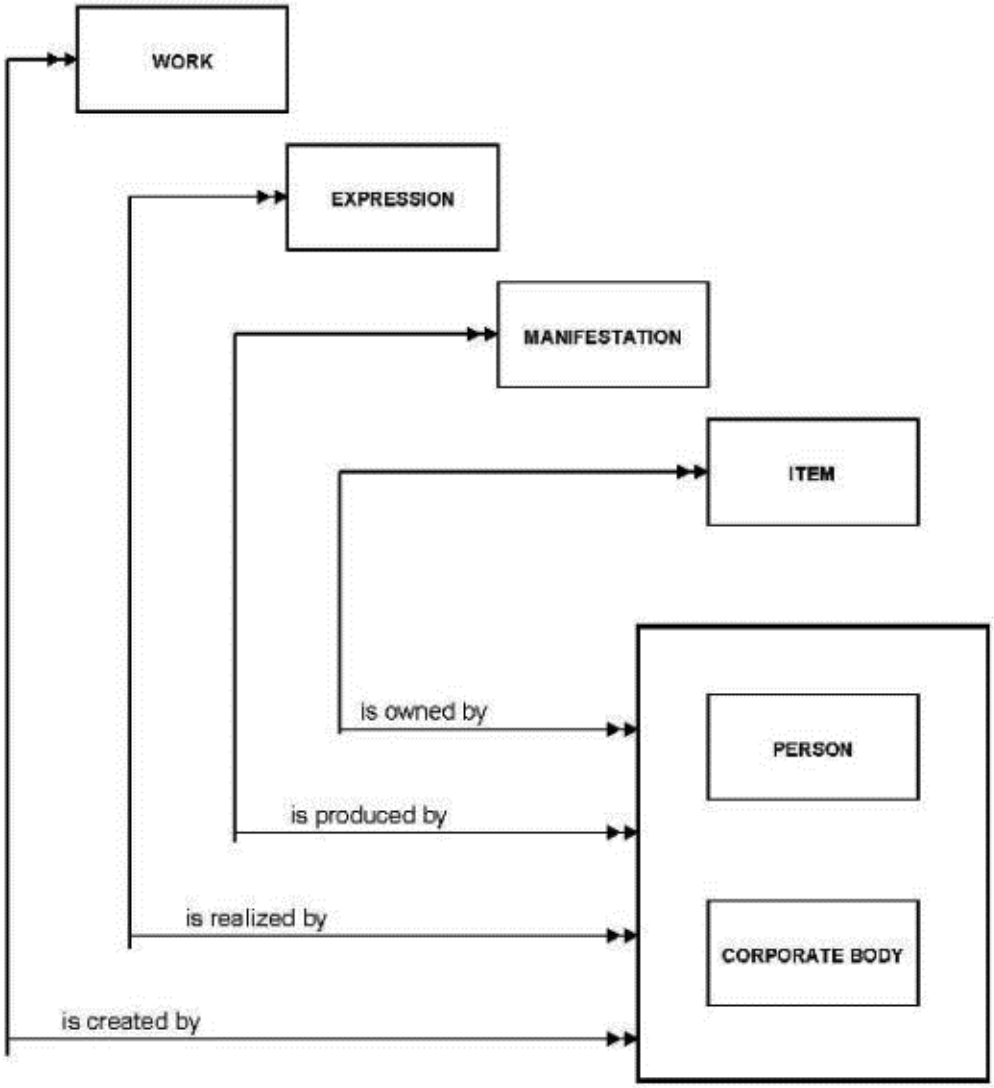

Figure 7. Group 3 entities and "subject" relationships (FRBR *Final report*, 1998; corr. 2009, p. 16).

Figure 3.3: Group 3 Entities and "Subject" Relationships

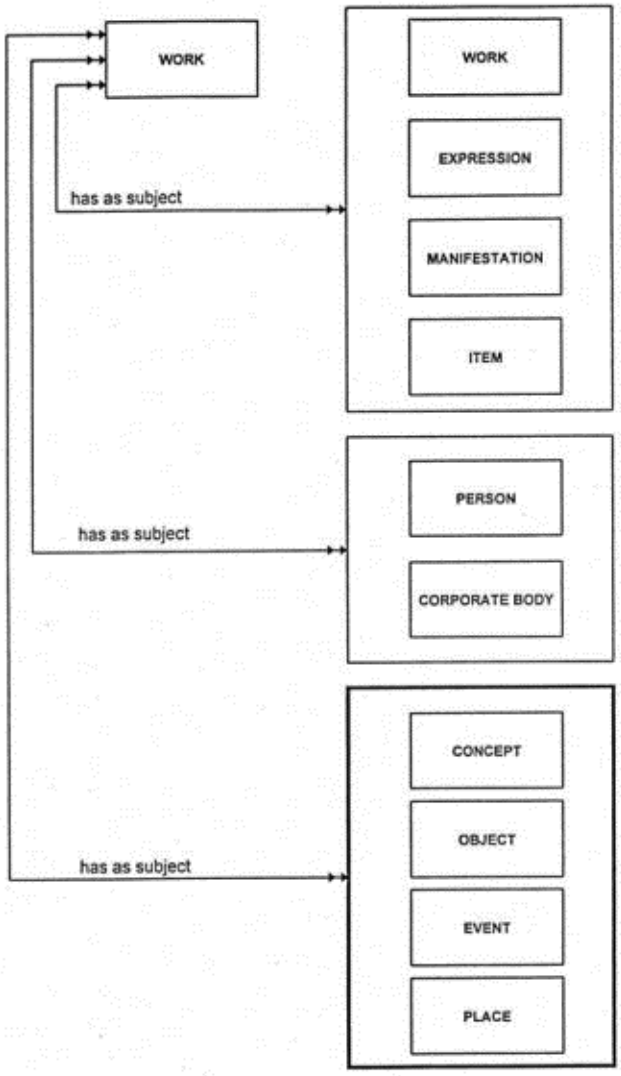

Figure 8. Properties of ALM data models.

	Primary entity-type	Primary attribute-type	Basis for structuring entity-types
Archives	collection	provenance	partitive relation
Libraries	work	content	instantiation
Museums	event	relative location in space-time	succession

Figure 9. Four different ways of categorizing archival descriptions.