New Partnerships for Old Sibling Rivals: The Development of Integrated Access Systems for the Holdings of Archives, Libraries, and Museums*

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RÉSUMÉ Cet article décrit une piste de collaboration bénéfique et efficace pour les institutions du patrimoine culturel que sont les centres d'archives, les bibliothèques et les musées : la création de systèmes d'accès intégré. En cette ère numérique, il est plus facile et plus logique de mettre en commun les ressources pour fournir un service rationalisé pour les utilisateurs de ces institutions. Les chercheurs sont plus intéressés à accéder à une ressource qu'à se demander à qui elle appartient. Après avoir déterminé les perceptions, les similarités et les points de convergence existants entre les institutions culturelles, l'article explore les diverses options pour créer des systèmes d'accès intégré. Parmi celles-ci on trouve la recherche fédérée, les systèmes de métadonnées agrégées, la description au niveau de la collection et divers systèmes hybrides. Bien que certaines questions et certains problèmes nécessitent plus de travail, cet article conclut que ce genre de partenariat entre les institutions culturelles est souhaitable et qu'on devrait les poursuivre pour le bénéfice des utilisateurs.

ABSTRACT This paper describes one avenue for beneficial and effective collaboration between the cultural heritage siblings of archives, libraries, and museums: creating integrated access systems. In the digital era, it is easier and more sensible to pool resources to provide streamlined and richer service to the clients of these institutions. Researchers are more likely to care about having access to a resource than knowing who owns it. After discussing the perceptions, similarities, and existing points of convergence between these types of institutions, this paper discusses various options for creating integrated access systems. These include: federated searching, metadata aggregation systems, the collection-level description method, and various hybrid systems. Although some issues and complications may need further resolution, the conclusion of the paper is that this type of partnership between sibling institutions is desirable and should be pursued for the benefit of the users.

Introduction

In the digital realm where bits and bytes are all equal, the traditional boundaries between various cultural heritage institutions – archives, libraries, and museums – have become blurred. The current trend toward providing digital surrogates for objects "eliminates physical distinctions between types of records and thus, presumably, the need for organizational distinctions in the management of the systems within which these records are handled."[1] This is not necessarily to say that professional theories and their resultant methodologies for each discipline should be neglected when enabling digital access to collections. Rather, the digital realm can act as a meeting point where digital collections from all three types of cultural heritage institutions can intersect and coexist.

One way that cultural heritage institutions can co-operatively realign their service delivery mechanisms to meet the search needs of users is by providing broader networked access to collections and collections information. Networked access is not a new concept; archival information networks such as Archives Canada have been in operation for a number of years, and pre-on-line tools such as library union catalogues have been around for centuries.[2] Building integrated, on-line access systems cross-sectorally between archives, libraries, and museums is taking the next step from these single-sector access tools.

Descriptive records for cultural resources such as books, archival documents, and artifacts are necessary for internal administrative or managerial purposes, but their primary purpose is to enable users to search, find, access, and retrieve such resources. In today's "Amazoogle"[3] environment, many users would benefit from being able to perform these tasks across institutional boundaries as this would provide broader access overall as well as avoiding redundancy by streamlining the research process.[4] Building cross-sectoral

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1   W. Boyd Rayward, "Libraries, Museums, and Archives in the Digital Future: The Blurring of Institutional Distinctions," presentation, Brisbane, Australia, 28–30 November 1995, http://www.nla.gov.au/niac/meetings/npo95wr.html (accessed on 15 November 2008).

2   Archives Canada (formerly the Canadian Archival Information Network), was first established in 2001. See Archives Canada, "About Us," http://www.archivescanada.ca/english/about.html (accessed on 4 May 2009). For a discussion of union catalogues, see Susan K. Martin, "The Union Catalogue: Summary and Future Directions," *Cataloging & Classification Quarterly*, vol. 2, nos. 1&2 (June 1982), pp. 121–25.

3   "Amazoogle" is a term coined by Lorcan Dempsey, Vice President and Chief Strategist, OCLC Programs and Research. The term refers to how Web giants like Amazon, Google, Ebay, and others have an enormous impact on how the Web operates, and on how people expect to seek and retrieve information. In other words, consumers prefer transparent and nearly instantaneous access to what they seek. See Dempsey's blog, http://orweblog.oclc.org/archives/000562.html (accessed on 15 November 2008).

4   Stating that users would benefit from integrated access to the information found in collec-

integrated access networks with a more general user in mind does not necessarily compromise the needs of the expert user. Many of the systems are capable of burrowing down to home-repository sites where fuller contextual information is available. Specific methods for these systems and examples will be explored below.[5]

In addition to the expected benefits to users, there are sound practical reasons for collaborating with fellow cultural heritage partners. Uniting with fellow professionals who are fighting similar battles to maintain existing strategies (e.g., continued standards development and backlog management) or attempting to secure increased funding for heritage programs, enhances financial efficiency and strengthens political advocacy.[6]

Integrated, on-line access systems could exist both within single institutions as well as among institutions. Convergence in the cultural heritage sector and collaboration between sibling heritage partners neither necessitate nor depend upon institutional amalgamation. In fact, much of the research in this area, and the systems that have been developed as a result, has taken place in inter-institutional environments in the regional, national, and inter-

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tions is only a hypothesis due to a dearth of user studies on this specific issue. However, studies on the popularity of Google searching indicate user preference for easy and streamlined Web searching. See Karen Markey's article that outlines some of the reasons why researchers prefer Google when starting their search. "The On-line Library Catalog – Paradise Lost and Paradise Regained?" *D-Lib Magazine*, vol. 13, nos. 1/2 (Jan./Feb. 2007), http://www.dlib.org/dlib/january07/markey/01markey.html (accessed on 4 May 2009). For a more detailed investigation into user searching preferences as well as perceptions of information resources, see: Cathy De Rosa, Joanne Cantrell, Diane Cellentani, Janet Hawk, Lillie Jenkins, Alane Wilson, *Perceptions of Libraries and Information Resources: A Report to the OCLC Membership* (Dublin, Ohio, 2005), http://www.oclc.org/reports/pdfs/Percept_all.pdf (accessed on 4 May 2009). Some of the users' feedback in this report includes comments such as: "Make a way to search through all the databases with one search engine instead of having to search each database individually" (p. 1–19) and "Aim to become the one-stop-shopping, authoritative trustworthy source for information" (p. 1–28). While these comments may have originally pertained only to the library domain, it is reasonable to extrapolate that these user requests for access system functionality could relate to other information domains.

5   This paper will explore enabling integrated, on-line access systems for the holdings of archives, libraries, and museums, focusing on providing access to descriptive records; it is not concerned with providing integrated access to on-line collections of digitized objects, although the two activities may overlap.

6   For example, Library and Archives Canada acted upon this vision, explaining the merger of its two predecessor institutions, the National Library of Canada and the National Archives of Canada, as stemming from "dwindling resources and the technological revolution [which] underscored the need to create a single government focus for the management of Canadian documentary heritage" as well as acknowledging that "what archives and library professionals had in common with one another was greater and more important than what distinguished them." See Michelle Doucet, "Library and Archives Canada: A Case Study of a National Library, Archives and Museum Merger," *RBM: A Journal of Rare Books, Manuscripts, and Cultural Heritage*, vol. 8, no. 1 (Spring 2007), pp. 61–74.

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national arenas. Integrated access to cultural heritage information may be just one consideration in developing a larger framework for integrated information systems and infrastructure. It is a component of several countries' digital information management research and development projects including Canada's National Digital Information Strategy and the United Kingdom's Common Information Environment Project as well as one area of concern within the European Commission's ICT research frameworks.[7] Interest in improving the digital information infrastructure is common to many people and institutions in many contexts.

Comparing Archives, Libraries, and Museums: A Framework for Cross-sectoral Collaboration

What are some of the conceptual and procedural commonalities or differences between libraries, archives, and museums? In what ways do the domains of these institutions overlap or converge? A common thread is that they all belong to the cultural heritage family.[8] The role of such institutions is to "identify, collect, preserve, describe and make available the artifactual, intellectual and artistic products of the past and present in order that current and

7   Library and Archives Canada is spearheading Canada's National Digital Information Strategy. For more information, see http://www.collectionscanada.ca/scin/index-e.html (accessed on 15 November 2008). The Museums, Libraries, and Archives Council (MLA) is one sponsor of the United Kingdom's Common Information Environment Project, for which more information can be found at http://www.jisc.ac.uk/aboutus/committees/workinggroups/disbanded/commoninfoenvironment.aspx (with more details at http://web.archive.org/web/20070914005719/http://www.common-info.org.uk/) (both accessed on 15 November 2008). The European Union is currently funding its seventh Research Framework Program (2007–2013), and the Information and Communication Technologies (ICT) is responsible for several projects pertaining to managing and integrating digital information. See the Research Framework Program's main website at http://cordis.europa.eu/fp7/home_en.html and the ICT website at http://cordis.europa.eu/fp7/ict/ (both accessed on 15 November 2008). An investigation and analysis of the larger infrastructure underlying research into integration of digital information systems, including those that specifically address integrated, cultural heritage information systems, is outside the scope of this study.

8   Other institutions that belong to this family include art galleries and historical sites. It should be noted that although archives do fit within the cultural heritage sector as described in this paper, alliances with records management programs, and freedom of information and protection of privacy offices are also of import, particularly in relation to other values of archives apart from historical or cultural heritage values, specifically legal and administrative values. This paper focuses on archives' cultural heritage values because it is an area of commonality between archives, libraries and museums, and issues of evidence, public accountability, and privacy legislation are not necessarily as relevant to library and museum sectors. While this paper supports collaboration between libraries, archives, and museums because of their common cultural heritage related roles and identities, other partnerships and collaborations between archives and various records and information management professions may also be relevant for archives.

future generations may benefit from them."[9] These institutions have also been described as memory institutions, in that they contain, and therefore inherently are, the collected memory of humanity and society. Archives, libraries, and museums are memory institutions that

… organize the … cultural and intellectual record. Their collections contain the memory of people, communities, institutions and individuals, the scientific and cultural heritage, and the products throughout time of our imagination, craft and learning. They join us to our ancestors and are our legacy to future generations. They are used by the child, the scholar, and the citizen, by the business person, the tourist and the learner. These in turn are creating the heritage of the future. Memory institutions contribute directly and indirectly to prosperity through support for learning, commerce, tourism, and personal fulfillment.[10]

This definition introduces the similarity of purpose and function within society that archives, libraries, and museums share, more specifically, that they are loci of cultural knowledge, propagation, and transmission.

A second definition of the concept of memory institution refers to a digitized amalgamation of the collections of archives, libraries, and museums.

A memory institution combines digital surrogates of the collections of archives, libraries and museums in rich interactive environments and allows access to the content regardless of the nature of the institution. The goal of the memory institution is to preserve this content for future generations and support its use and management over time.[11]

In this instance, while the physical institutions may keep their individual identities, they unite in the digital environment and take on a new persona with the sole purpose of providing access to cultural heritage content. This particular definition treats the concept of memory institution as a digital evolution of the three traditional institutions, which have come to exist in an environment where their traditional differences have become less relevant, and their focus is on preserving and providing access to cultural heritage resources over time. In addition, these institutions share other core functions of education, research, and entertainment with varying degrees of emphasis

9   Nancy Elkington, "Cultural Heritage," *Archives, Libraries and Museums Convergence: 24th Library Systems Seminar [Paris, 12–14 April 2000]* (Paris, 2001), p. 207.

10   Lorcan Dempsey, "Scientific, Industrial, and Cultural Heritage: A Shared Approach: A Research Framework for Digital Libraries, Museums and Archives," *Ariadne* 22 (12 January 2000), http://www.ariadne.ac.uk/issue22/dempsey (accessed on 15 November 2008).

11   Werner Schweibenz, "The Development of Virtual Museums," *ICOM News* 3 (2004), p. 3, http://icom.museum/pdf/E_news2004/p3_2004-3.pdf (accessed on 15 November 2008).

and shades of interpretation as well as different approaches.[12]

In addition to sharing purposes and functions, archives, libraries, and museums share similar activities. More specifically, all three types of institution perform some version of the following: collecting new materials (i.e., appraisal and accessioning, including acquisition through donation or purchase); organizing and arranging collections (i.e., archival arrangement and description, or cataloguing and classification of books and artifacts); providing access (i.e., publicly accessible catalogues or finding aids, public programming and exhibits, reference services, and information literacy or educational sessions); and preserving and conserving collections.[13] That said,

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12 For example, from within the cultural heritage viewpoint, museums may be perceived to emphasize education and recreation over research while archives cater primarily to research and preservation. Libraries are perhaps perceived in a more balanced fashion as whole-heartedly belonging to both the research and recreation camps. For a discussion of Canadians' perceptions of their museums, see TeleResearch, Inc., *Canadians and their Museums: A Survey of Canadians and their Views about the Country's Museums: Report of Findings Prepared for Canadian Museums Association* (Toronto, 2003), http://www.museums.ca/media/Pdf/surveyanalysis2003.pdf (accessed on 15 November 2008). This report states that 68% of Canadians see their museums as fulfilling predominantly recreational and educational functions (p. 3). Regarding public perception of the worth of libraries and their role as part of society's infrastructure, at least 94% of Norwegians see it as their democratic right to have access to public libraries (see Haga Leikny Indergaard, "Cheers for the Public Library!," *Scandinavian Public Library Quarterly*, vol. 32, no. 2 [2005], http://www.splq.info/issues/vol38_2/01.htm [accessed on 15 November 2008]), and 75-90% of the population of such countries as the United Kingdom, the United States, and others make use of hybrid libraries (i.e., those that provide access to both digital and traditional resources). See Lisa Krolak, "The Role of Libraries in the Creation of Literate Environments," 2005, paper commissioned for *the EFA Global Monitoring Report 2006, Literacy for Life*, http://unesdoc.unesco.org/images/0014/001460/146057e.pdf (accessed on 15 November 2008). With respect to public perception of archives, Richard Barry conducted a survey about society's view of archives and archivists, which revealed that most people either do not have a formed view of the role and value of archives and archivists in society, or are mostly cognizant only of such secondary value of archives, that is, the values associated with historical research, but not with evidentiary value. See Richard E. Barry, "Report on the Society and Archivists Survey," 29 January 2003, http://www.mybestdocs.com/barry-r-soc-arc-surv-report-030129toc.htm (accessed on 15 November 2008).

13 An example of how the foci of the three types of institutions differ is how museums lead the way in the areas of public programming and exhibits, which are probably their most visible and important activities. Museums mass-market their materials to their audience, while public interaction with library and archival materials is on more of an individual basis. Because of their focus on exhibits and public programming, museums have had less interest than libraries and archives in providing access to collection information by means of databases and catalogues. In the Canadian context, for example, while many museums contribute to Artefacts Canada (http://www.chin.gc.ca/English/Artefacts_Canada/index.html), it is likely that such publicly accessible databases are not as well-known in the museum context as are library, on-line public access catalogues (OPACs) or archival finding aids or networks. On the other hand, public display of collections is far more prevalent in museums than in libraries or archives.

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there are significant differences in the methods used to fulfill these activities.[14]

Description – the primary focus of this article – is an activity shared by all three types of institution. Generally speaking, description entails creating a surrogate or representation of an entity to allow one to learn about – or locate – the entity without examining the entity itself. It is a necessary activity because people rely on descriptions to access cultural heritage holdings; it would be extremely difficult to find anything efficiently without descriptions.

In libraries, description predominantly entails cataloguing and classification activities. There are two types of cataloguing: descriptive cataloguing and subject analysis. Descriptive cataloguing involves recording bibliographic details of publications, with author and title information constituting the dominant access points for the item. Subject analysis involves analyzing the subject content of the works, assigning subject terms to describe and provide access to the publication, and often identifying an appropriate designation within a classification system. Classification involves creating a systematic and usually hierarchical ordering of subjects that in practical terms serves to collate publications on identical or similar subjects, both in an abstract sense (intellectually) as well as physically on the shelves, when applicable. Bibliographic description enables intellectual access to the resources and serves as an inventory of the holdings.[15]

14   A brief example is the method by which archives, libraries, and museums appraise or select new materials for their collections. Archival appraisal, which determines whether or not records have permanent value, is informed by several factors including provenance and context of creation, a research-based assessment of the significance of the functions they document, their authenticity and reliability, their order and degree of completeness, their condition and related preservation costs, their intrinsic value and their relation to institutional collecting mandates. See Society of American Archivists (SAA), *Glossary of Archival and Records Terminology*, s.v. "Appraisal," http://www.archivists.org/glossary (accessed on 15 November 2008). In contrast, library collections development involves identifying, selecting, acquiring, and evaluating collections of library resources in relation to communities of users. In other words, not only must the institutional mandate be addressed, but also the needs of the user community must be analyzed and understood. This assessment is then balanced against the collection budget and the best resources are selected. See Arizona State Library, Archives, and Public Records, *Overview of Collection Development*, http://www.lib.az.us/cdt/collman.aspx (accessed on 15 November 2008). Museological appraisal is similar in that the institutional mandate must be considered when developing collections. However, the basis of an appraisal decision is to first determine whether or not the object has historical significance, and if so, that it fits within the mandate and can be properly preserved over time. See Ontario Ministry of Culture, "Writing a Collections Management Policy for the Museum," *Museum Notes* 3, 2 August 2002, http://web.archive.org/web/20070403023336/http://www.culture.gov.on.ca/english/culdiv/heritage/munote3.htm (accessed on 15 November 2008).
15   The cataloguing policy of the National Library of Australia, for example, acknowledges both of these purposes; http://www.nla.gov.au/policy/cataloguing/NLACataloguingPolicy.html (accessed on 4 May 2009).

In archives, description involves research into the context of the records and their creators, including identifying and documenting relationships between records and groups of records. Often archival description is based on this contextual research rather than on an examination of the physical records themselves. Records are rarely described at the item level due to their voluminous nature, especially in light of limited resources. Also, descriptions cannot be shared among archives because archival records are unique. This contrasts with bibliographic description. There are many copies of the same publication held by different libraries; consequently, libraries can benefit from sharing descriptions. Archival records are not usually classified by subject since the records are not really "about" subjects. They are created as the by-products of administrative activities or of the daily lives of people. As such, they may include numerous subjects within them.[16]

Archival descriptions are created for two primary reasons: for administrative control and for public access. A type of preliminary descriptive record is created as part of the accessioning process, a central part of establishing administrative control over new acquisitions. Much of the same information in the accession record is duplicated in the official descriptive record, but in a different format and for a different purpose. Unlike accession records, official descriptive records follow standards and principles, and are intended for public consumption.[17]

Museums also create preliminary descriptions as part of their accession files for internal administrative purposes. In addition, they catalogue and classify their collections. As in libraries, classification is commonly part of describing collections, and different classification schemes have been created for different types of collections, including historical collections and natural sciences collections. As in archives, researching and recording information about the history of the objects, and identifying and documenting relationships between objects is important. Also like archives, many museum collections are unique, eliminating the ability to share descriptions for cataloguing purposes (although sharing collections information for other purposes such as research and education is desirable). In museums, items are usually given item-level attention and described individually, but description at the collection-level can also be relevant. Museum classification schemes can be either subject-based or function-based and, as in library classification, one subject or

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16 Regardless, subject access points and subject-based resources (e.g., vertical files) are often created to aid in archival research.

17 For a discussion of the accessioning process and the type of descriptive information to include in an accession record, see Archives Association of British Columbia, "Accessioning: Getting Control," in *A Manual for Small Archives*, rev. 1994 (AABC, 1988), http://aabc.bc.ca/aabc/msa/3_bringing_material_into_your_ar.htm#Accessioning:%20getti ng%20control (accessed on 4 May 2009).

function is prioritized while others are captured through other access points, such as indexing terms or subject headings.

The boundaries between the descriptive systems of libraries, archives, and museums have been flexible. More specifically, archival descriptive standards, at least in North America, have borrowed heavily from bibliographic practices. Museological descriptive practices have also borrowed from the library domain, adapting the Dewey Decimal Classification (DDC) system for one, and utilizing card catalogues for another.[18] Bibliographic description has incorporated elements of archival and museological descriptive elements, especially in the case of describing rare books, in which physical qualities of the works and their history of creation are relevant considerations.[19]

Descriptive practices may vary between archives, libraries, and museums but they may also be complicated within single institutions themselves. Consider "hybrid" cultural heritage institutions that administer cross-sectoral collections (e.g., a library with archival holdings, an archives with a bibliographic collection, and so on). In light of this complexity, it is interesting to reflect on what constitutes a publication, record, or artifact. If a map or photo is framed or appears on a cookie tin, does it become an artifact? Is an old commercial film an archival record or publication? Is a rare book just a book or also an artifact or an archival document? Which designation takes precedence and why? Such questions draw attention to the fact that divisions between and within hybridized institutions are not always sharply drawn.

Figure 1 depicts the relationship between archives, libraries, and museums with respect to the conceptualization of "double-hybrid" institutions, where potential overlap between the three types of institutions has been illustrated. The central circle represents an area of unacknowledged convergence between these institutions. Overlapping all three sectors are holdings of traditional physical materials and holdings of digital objects. This illustration draws attention to the crossovers between the three sectors, prompting reflection as to how this conglomerate, cultural heritage, mega-institution or super-structure can best be managed and utilized.

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18 Bernadette Gabrielle Callery, "Evolutionary Change in the Accession Record in Three American Natural History Museums" (Ph.D. diss., University of Pittsburg, 2002), pp. 51–52.
19 For more information about rare book cataloguing, see John E. Alden, "Cataloging and Classification," in *Rare Book Collections*, ed. H. Richard Archer, ACRL Monograph Number 27 (Chicago, 1970), pp. 65–73 and Beth M. Russell, "Description and Access in Rare Books Cataloging: A Historical Survey," *Cataloging & Classification Quarterly*, vol. 35, nos. 3/4 (2003), pp. 491–523.
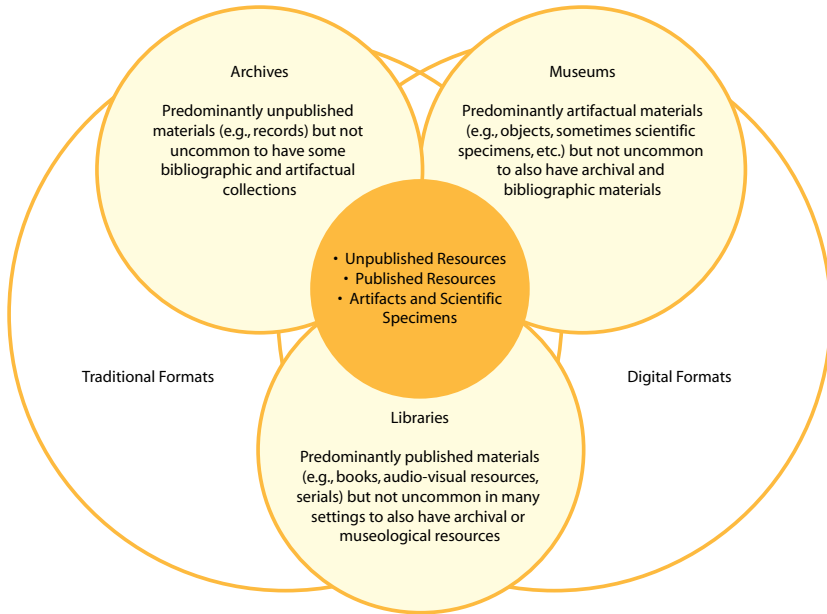
Figure 1: Visualizing the Double-hybrid Cultural Heritage Complex

Integrated Access Systems for Archives, Libraries, and Museums

Descriptive practices in all three disciplines are governed by standards. Three types of standards that are particularly relevant to descriptive systems are: 1) data content standards, which prescribe the type of content that should be included in the description; 2) data structure standards, which mandate how the content should be formatted within the descriptive record; and 3) data value standards, which help determine the preferred terms to use to describe specific concepts. These three types of standards are metadata standards, or those that specify the structure and content of metadata, which is "structured data about data," to be used in descriptive records.[20] Additionally, data interchange standards or protocols are also relevant; they enable and regulate how information systems communicate and exchange data with one another. The OAI-PMH (Open Archives Initiative – Protocol for Metadata Harvesting), which works with files encoded in XML and Z39.50 (which has traditionally been used to exchange bibliographic records in MARC though newer appli-

20 Dublin Core Metadata Initiative (DCMI), "DCMI Frequently Asked Questions: What is Metadata?" 2007, http://dublincore.org/resources/faq/#whatismetadata (accessed on 15 November 2008).

cations for XML have also been developed), are two examples of such data interchange protocols.[21]

In response to the demands of a global information market, various descriptive standards (content, value, structure, and interchange) were developed in each sector of the automated environment, along with increasingly sophisticated subject classification schemes, controlled vocabularies, or in the case of archives, innovative ways of dealing with challenging issues such as electronic records. These have served to increase the consistency of the information in descriptive products as well as enable such products to be shared and distributed remotely.

Although there are significant differences in practices between these institutions as technology continues to become more sophisticated, it has become easier to capitalize upon the similarities and compromise on the differences in descriptive practices, or at least find ways to ensure that these differences do not interfere with collaborative descriptive efforts. Appendix 1 summarizes the basic concepts, systems, and structures of the current descriptive practices in libraries, archives, and museums. All three sectors – particularly during the information revolution of the past few decades – have been finding ways to better serve their clientele in a very challenging, large, distributed, global, digital environment, both in building networks within each respective domain and now also with building integrated access systems cross-sectorally.

Although metadata is often defined as "structured data about data," a more thorough definition is that it "is data which describes the attributes of a resource … [and] supports the processes of resource discovery, selection, evaluation, documentation and management."[22] Descriptive standards are types of metadata schema; metadata schema can be more specifically defined as providing

… a formal structure designed to identify the knowledge structure of a given discipline and to link that structure to the information of the discipline through the

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21 For more information about OAI-PMH see http://www.openarchives.org/pmh/ (accessed on 15 November 2008). Z39.50 is a protocol that regulates how information is searched and retrieved from remote databases and was originally developed for the library sector. See Library of Congress, Network Development & MARC Standards Office, "Z39.50 International Standard Maintenance Agency," 1 October 2007, http://www.loc.gov/z3950/agency/ (accessed on 15 November 2008). For information about Z39.50 for use with XML records, see Antony Corfield, Matthew Dovey, Richard Mawby, and Colin Tatham, "Z30.50 and XML – Bridging the Old and the New," presentation, Hawaii, 7–11 May 2002, http://www2002.org/CDROM/alternate/XS2/ (accessed on 15 November 2008).

22 Lorcan Dempsey, "Metadata: The UK HE [Higher Education] Perspective," in *Beyond the Beginning: The Global Digital Library*, ed. Marc Fresko Consultancy (United Kingdom, 1997), http://www.ukoln.ac.uk/services/papers/bl/blri078/content/repor~27.htm (accessed on 15 November 2008).

creation of an information system that will assist the identification, discovery, and use of information within that discipline.[23]

There are two primary components to metadata schema, or metadata element sets: semantically defining the meanings of their elements; and defining and providing instructions with respect to content, or how values are to be assigned to the elements.[24] The primary means of creating integrated access systems is through the management and exchange of metadata; this is done in accordance with methods that are both technologically and semantically interoperable.

Technological interoperability refers to the capability of different information technologies to work together. In the context of descriptive systems within the cultural heritage context, technological interoperability particularly pertains to the relationships between various metadata schemas, and the systems for their management and exchange within a networked environment. For several decades, there has been interest in capitalizing upon commonality in metadata and using it to optimize convergence, exemplified in various projects including that of the National Library of Australia, which in 1986 created a report that identified potential metadata in common between the three heritage sectors.[25] Similar fields were later codified in Dublin Core, first introduced in 1995.[26] Semantic interoperability refers to how the higher meaning of language used in any of the three respective disciplines has been analyzed to reveal the core underlying concepts, and how these fundamental concepts have been co-related or mapped to one another as being roughly analogous. For example, the concepts of author and creator can be considered to represent similar notions.[27] Technological and semantic interoperability have an

23   CC:DA (ALCTS/CCS/Committee on Cataloging: Description and Access), *Task Force on Metadata: Final Report*, 16 June 2000, http://www.libraries.psu.edu/tas/jca/ccda/tf-meta6.html (accessed on 15 November 2008).

24   Lois Mai Chan and Marcia Lei Zeng, "Metadata Interoperability and Standardization – A Study of Methodology, Part 1," *D-Lib Magazine*, vol. 12, no. 6 (June 2006), http://www.dlib.org/dlib/june06/chan/06chan.html (accessed on 15 November 2008).

25   Warwick Cathro, "Smashing the Silos: Towards Convergence in Information Management and Resource Discovery," presentation, Canberra, 5 April 2001, http://www.nla.gov.au/nla/staffpaper/2001/cathro2.html (accessed on November 15, 2008).

26   The Dublin Core Metadata Terms created by the Dublin Core Metadata Initiative are a standardized set of fifteen metadata elements used for cross-domain information resource description. For more information on Dublin Core, see http://dublincore.org/ (accessed on 15 November 2008).

27   While I posit that the concepts of a creator and an author are similar, I acknowledge that an archival creator and a bibliographic author are not the same. An author is a type of creator, and the term "creator" has a broader meaning. An archival creator could also be a producer, accumulator, or formulator. See SAA, *A Glossary*, s.v. "Creator." It is difficult to achieve pure, one-to-one semantic matches when mapping between disparate metadata schema, and this represents one possible example where a compromise over a "fuzzy" match may be

inter-related role to play in the creation of integrated descriptive systems; semantic analysis must underlie the creation of any technologically interoperable solutions. In practical terms, semantic analysis is most commonly used to elucidate system design, especially with respect to metadata management.

One particularly notable project to help develop greater semantic interoperability in the exchange of cultural heritage information is the Conceptual Reference Model of the International Committee for Documentation of the International Council on Museums (CIDOC CRM). The CIDOC CRM is "an object-oriented domain ontology for exchanging rich cultural heritage data … [which] employs object-oriented data modeling techniques to formalize the semantic concepts used in museum, library and archive documentation, with the aim of facilitating information interchange."[28] Essentially this means that the CIDOC CRM helps to specify and clarify the concepts that are needed to exchange cultural heritage information. It defines the relevant types of elements and how they interrelate within this information sector. Being expressed in an object-oriented model allows for relationships between entities to be more accurately expressed, whether they are hierarchical or other types of relationships. The CIDOC CRM is not a metadata model itself, but it is intended to inform other metadata models or influence the creation of new ones. It acts as a conceptual guideline to aid in developing integrated information systems with a higher level of semantic interoperability.[29] While metadata crosswalks, which will be discussed shortly, can aid in creating well-functioning integrated systems, because not all fields map directly to one another, semantic slippage can occur. The use of conceptual reference models, such as CIDOC CRM, as well as new technologies such as those related to the Semantic Web, will help to improve the level of semantic interoperability in integrated systems.

Options for integrated access systems incorporating elements of both technological and semantic interoperability include metadata crosswalks, federated searching (or meta-searching), metadata aggregation systems, and systems in which a common schema has been used to create new collection-level descriptions. In some contexts, combinations of these approaches have been employed. These options can be conceptualized as enabling interoper-

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needed.

28 Tony Gill, "Building Semantic Bridges between Museums, Libraries and Archives: The CIDOC Conceptual Reference Model," *First Monday*, vol. 9, no. 5 (May 2004), http://www.firstmonday.org/issues/issue9_5/gill (accessed on 15 November 2008).

29 For more information about CIDOC CRM see Nick Crofts, Martin Doerr, and Tony Gill, "The CIDOC Conceptual Reference Model: A Standard for Communicating Cultural Contents," *Cultivate Interactive* 9 (7 Feb. 2003), http://www.cultivate-int.org/issue9/chios/ (accessed on 15 November 2008). See the CIDOC CRM website at http://cidoc.ics.forth.gr (accessed on 15 November 2008).

ability at the schema level (e.g., mapping schemas in crosswalks), the record level (e.g., integrating records into new records after having used a metadata mapping process), and at the repository level (e.g., pooling harvested or integrated records from various sources).[30] Whatever option is chosen, the desired result of building integrated access systems for the holdings of archives, libraries, and museums is the same.

Metadata Crosswalks

A metadata crosswalk is "a specification for mapping one metadata standard to another" and it "provide[s] the ability to make the contents of elements defined in one metadata standard available to communities using related metadata standards."[31] Crosswalks can not only be used to enable interoperability between systems, but also for other purposes as well, including data conversion projects. Several metadata crosswalks that are relevant for potentially creating integrated access systems for archives, libraries, and museums have already been developed. These include mappings of Dublin Core to USMARC,[32] ISAD(G) to SPECTRUM,[33] and USMARC to EAD,[34] among others.[35]

The mapping process consists of harmonization to ensure consistency across metadata schema, semantic mappings of each of the elements within a specific metadata schema, the creation of rules to clarify procedures should metadata schema not map to each other in strictly one-to-one relationships, and algorithms to complete the mapping process by technically transforming the original metadata set to the other set.[36] The first two parts of the process

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30 Chan and Zeng.
31 Margaret St. Pierre and William P. LaPlant, Jr., *Issues in Crosswalking Content Metadata Standards* (NISO whitepaper, 15 October 1998), http://www.niso.org/publications/white_ papers/crosswalk/ (accessed on 15 November 2008).
32 Library of Congress, Network Development and MARC Standards Office, "Dublin Core to MARC Crosswalk," 23 April 2008, http://www.loc.gov/marc/dccross.html (accessed on 15 November 2008).
33 Elizabeth Shepherd and Rachel Pringle, "Mapping Descriptive Standards Across Domains: A Comparison of ISAD(G) and SPECTRUM," *Journal of the Society of Archivists*, vol. 23, no. 1 (2002), pp. 17–34.
34 Murtha Baca, Patricia Harpring, John Ward, and Antonio Beecroft, eds., "Metadata Standards Crosswalk," 2 January 2008, http://www.getty.edu/research/conducting_ research/standards/intrometadata/crosswalks.html (accessed on 15 November 2008).
35 Links to metadata crosswalks can be found at http://www.ukoln.ac.uk/metadata/intero perability/ and http://www.slis.kent.edu/~mzeng/metadata/crosswalks.htm (both accessed on 15 November 2008).
36 Ocean Teacher, "Metadata Crosswalks," 2006, http://web.archive.org/web/20070808175033/ http://ioc.unesco.org/oceanteacher/OceanTeacher2/02_InfTchSciCmm/02_Meta/07_ Crosswalks/MetadataCrosswalks.htm (accessed on 15 November 2008).

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are the most significant when ensuring that metadata schema are mapped consistently and accurately to one another. Mapping metadata schema to one another provides the ability to search across disparate databases. For example, if various fields have been identified as containing information about creatorship or authorship of an entity, regardless of the specific data container label, one would be able to search for creatorship or authorship information within descriptive records in various databases. This type of searching is known as federated searching (see next section).

Typically only the fields – or data containers – are mapped to one another, rather than the content contained within these fields. However, research in semantic mapping of data values is ongoing, for example, as a component of the Semantic Web and the Resource Description Framework (RDF). The Semantic Web "provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries," enabling machines as well as people to access the meaning of natural language content, and identifying semantic links between common elements.[37] Semantic Web technologies can be applied in a variety of contexts, such as aiding in data integration, resource discovery and classification, and describing the content of web-based resources.[38]

One of the formal specifications of the Semantic Web is RDF. It can be defined as:

an application of XML that imposes needed structural constraints to provide unambiguous methods of expressing semantics for the consistent encoding, exchange, and machine processing of metadata … [as well as providing a] means for publishing both a human-readable and a machine-processable vocabularies [*sic*] designed to encourage the exchange, use and extension of metadata semantics among disparate information communities.[39]

Using RDF involves applying an additional set of metadata tags that qualify the nature of the content. In other words, the natural language statement "Archives house records" could be tagged to identify the nature, meaning, and function of each of the words (or elements) of that sentence. Providing this level of analysis in a way that computers understand provides the potential to enable a higher level of semantic interoperability at various levels of descrip-

37 Ivan Herman, "W3C Technology and Society Domain, Semantic Web Activity – Semantic Web," 2 May 2007, http://www.w3.org/2001/sw/ (accessed on 15 November 2008).
38 Ivan Herman (Semantic Web Education and Outreach Interest Group), "W3C Semantic Web Frequently Asked Questions – W3C Semantic Web FAQ," 27 April 2007, http://www.w3.org/2001/sw/SW-FAQ#swgoals (accessed on 15 November 2008).
39 Eric Miller, "An Introduction to the Resource Description Framework," *D-Lib Magazine* (May 1998), http://www.dlib.org/dlib/may98/miller/05miller.html (accessed on 15 November 2008).

tion, particularly with respect to data content and data value information.

Although application of Semantic Web technologies, including RDF, is currently nascent in the cultural heritage context, there is much room for growth in this area, particularly as metadata standards and metadata management methods continue to evolve along with the World Wide Web itself.[40]

Federated Searching

Simultaneously searching multiple databases via a single interface or portal is known as federated searching or meta-searching. Depending on how the interface has been designed and how the search function has been configured, users can choose which databases to query as well as potentially make use of controlled vocabularies in one or more of the systems while searching. The results are generally displayed either in categories or in an integrated fashion.[41] The different databases would be queried using a commonly understood data exchange protocol like the previously mentioned OAI-PMH and Z39.50.[42]

Using federated searching to access heterogeneous descriptive records as a solution to providing integrated access to collections information from archives, libraries, and museums means that the original descriptive records and the traditional descriptive standards with which they were created remain unaltered. Archives, libraries, and museums can each employ and maintain their unique descriptive traditions without any compromise to the quality and richness of their descriptive records. Thus, this is an appealing option for those who wish to participate in collaborative descriptive projects without reducing or compromising the nature and quality of their traditional descriptions.

One prominent example of a federated search system is Library and Archives Canada's (LAC) new integrated holdings management system, AMICAN, which is an amalgamation of its former database for bibliographic

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40 For a recent study on the potential applications of Semantic Web technologies in the archival domain, see Ken Hawkins, "Reflections on InterPARES: A Pattern Language for Electronic Records" *Archivaria* 67 (Spring 2009), pp. 157–88.

41 Mary Woodley, "Crosswalks, Metadata Harvesting, Federated Searching, Metasearching: Using Metadata to Connect Users and Information," in *Introduction to Metadata*, On-line Edition Version 3.0, ed. Murtha Baca (Los Angeles, 2008), http://www.getty.edu/research/ conducting_research/standards/intrometadata/path.html (accessed on 15 November 2008). Examples of other federated search portals include: 1) Excelsior, New York State's Library/ Archives/Museum Catalog, http://nysl.nysed.gov/uhtbin/cgisirsi/Fri+Sep+22+13:16:33+EDT +2000/0/0/49 (accessed on 15 November 2008); and 2) British Columbia Archives' databases, which include various record formats as well as library items, http://search.bcarchives.gov. bc.ca/search (accessed in 15 November 2008).

42 See footnote 21.

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records (AMICUS) and archival descriptions database (MIKAN). AMICAN provides simultaneous access to the LAC's combined holdings of published and archival collections as well as bibliographic records of Canadian libraries. The descriptive standards originally in place in AMICUS and MIKAN have remained the same as before and are accessible via a single portal.[43]

Metadata Aggregation Systems

The basic idea underlying a metadata aggregation is that metadata, or descriptive records, are gathered and pooled together into a common repository. An Internet bot is used to search for new records at regularly specified intervals, and the records retrieved are stored in a central repository. The end user searches the records in this central repository, rather than simultaneously searching multiple databases as in a federated search. AlouetteCanada was designed in this fashion: records were harvested from external databases and centrally stored in AlouetteCanada's own repository. Smaller institutions also had the option of uploading digital content directly into the repository with the aid of on-line tools.[44] AlouetteCanada was built to serve as a meta-aggregator, as some of its sources included other aggregators such as ARCHEION (the Ontario provincial archival records digital repository) and Artefacts Canada (the national museum collections database).

AlouetteCanada took a decentralized approach, supported by co-operation between repositories, cultural heritage professional associations, and educational institutions. Metadata was collected in a variety of ways and once the records were inputted, URLs were attached to the records so that end-

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43 Library and Archives Canada, *Digital Information at Library and Archives Canada: An Overview of Progress and Issues*, 15 September 2005, http://www.collectionscanada.gc.ca/ cdis/012033-500-e.html (accessed on 15 November 2008). This product can be directly accessed at http://www.collectionscanada.ca/index-e.html under "Search All." The results are grouped by database, specifically, results found from the library, archives, and website databases. Further analysis and categorization of the initial search results are provided using the "show all" link for each list of results from each discrete database. For instance, archival search results can be further sorted by type of media, location within the descriptive hierarchy, and date.

44 For more information about AlouetteCanada, see its website at http://web.archive.org/web/ 20080214180326/http://www.alouettecanada.ca/home-e.php (accessed in 15 November 2008). Further information about the project can be found in Katherine McColgan's presentation at the Netspeed 2006 conference in Edmonton, Alberta, entitled "AlouetteCanada: Helping Canadians to FUSE and Tell their Story," http://web.archive.org/web/*/www. thealbertalibrary.ab.ca/files/Netspeed_06_Thurs_Lunch.ppt (accessed in 15 November 2008). Note that AlouetteCanada merged with the Canadian Institute for Historical Microreproductions (CIHM) to become Canadiana.org on 1 April 2008 (see the press release at http://www.canadiana.org/pdf/en/press_200804.pdf) (accessed on 15 November 2008).

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users could navigate back to the host repository's website. AlouetteCanada made use of Lucene, an open-source, indexing software, various thesauri, and Canadian Gazetteer geographic names. Both item-level and collection-level records could be searched, and the metadata was gathered in such a way to support future migration to the next generation of system.[45]

A similar project on a provincial scale is KnowledgeOntario, formerly Ontario Digital Library. It is a publicly funded, multi-project program that aims to expand, transform, integrate, and enhance Ontario's digital information network to better enable Ontarians' access to information and education. OurOntario.ca, one of its programs, consists of an integrated search portal that provides access to the digital content (descriptions and/or digitized objects) produced by Ontario's various cultural heritage institutions including libraries, archives, museums, and historical societies. It uses bots to harvest records from other databases and store them in a central repository. It aids other repositories digitize and contribute their collections records to this central repository, which can be accessed by end users.[46] It is also important to point out that OurOntario.ca integrates access to both descriptive records from a variety of types of repositories as well as digitized items accompanied by descriptions.

Another example of an integrated access system using metadata aggregation is the Cultural Materials project of the former RLG (originally known as the Research Libraries Group).[47] The purpose of this project was to provide integrated access to digital cultural heritage collections information not only from various types of repositories in the United States, but also from others around the world. At the time of the project's demise in May 2007, fifty-four separate repositories had been participants.[48] The project included both a paid

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45 AlouetteCanada, "AlouetteCanada: Open Digitization Initiative," http://web.archive.org/web/20080214180326/http:/www.alouettecanada.ca/home-e.php (accessed on 15 November 2008).

46 For more information about OurOntario.ca, see its website at http://www.ourontario.ca/; its federated search portal is available at http://search.ourontario.ca/advsearch (both accessed on 15 November 2008). Further information about the project can be found in Brian Bell's presentation to the Ontario Association of Library Technicians (OALT/ABO) in May 2006 entitled, "National Information Strategy: Where Does Ontario Fit?, or, 2006: The Year of Convergence," www.oaltabo.on.ca/Brian_Bell_presentation2006_v2.ppt (accessed on 15 November 2008).

47 Research Libraries Group amalgamated with OCLC in June 2006, becoming part of OCLC's Programs and Research Division. For more information see http://www.oclc.org/programs/about/default.htm (accessed on 15 November 2008).

48 More information about the project's demise was previously found in an OCLC product service status bulletin, previously accessible at http://www.oclc.org/community/rlg/transitions/discontinued/rcm/rcm-future.pdf (accessed on 28 April 2007). On one front, RLG Cultural Materials had difficulty securing content from institutions, given the requirement to provide aggregate levels of description, which would have created additional work

subscription service (Cultural Materials) as well as a public access service known as Trove.net,[49] and its aim was to collaboratively enable cross-sectoral, integrated access to cultural heritage information in order to streamline research and enhance educational programming. Negotiating and sharing rights management costs was also an important goal.

RLG Cultural Materials accepted descriptive records that were constructed using a wide variety of standards and metadata formats, created according to individual repository standards, including Categories for Description of Works of Art (CDWA), Dublin Core (DC), Encoded Archival Description (EAD), MARC 21, and SPECTRUM, among others. One of the basic stipulations of participation, however, was that both collection descriptions and item-level descriptions had to be submitted.[50] A separate system model, database, XML DTD, and XML schema were developed to manage the received records. In order to best cope with heterogeneous cultural heritage collections information, the CIDOC CRM was consulted in the design phase of the project to help insure that the database designed would be able to accommodate different kinds of collections information that were organized and labelled in different fashions. The resultant system was flexible, scalable, and able to accommodate a plethora of collections description information.[51] From a technical standpoint, this project took a comprehensive approach to managing and providing access to digital, cultural heritage information, accommodating multiple descriptive standards and formats, and combining the benefits of providing collections descriptions as well as more detailed item-level information.

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for those institutions whose collections were dispersed. RLG Cultural Materials also had difficulty getting as many subscribers as was hoped, given that much of the digitized content was from previously released projects, and thus was of lower quality (lower resolution); little new digitization was undertaken for this project. In addition, given the breadth of themes in the site, there was no one specific audience, making it difficult to market the project to potential subscribers. Lastly, RLG Cultural Materials was unable to secure as many licensed content arrangements with websites as had been projected. These challenges made it difficult to recover costs associated with running this expensive project. Additional information about RLG Cultural Materials can be found at http://worldcat.org/arcviewer/1/OCC/2007/08/08/0000070513/viewer/file2871.html (accessed on 15 November 2008).

49 These are no longer accessible on-line. Archived versions of the former sites can be seen at http://web.archive.org/web/20061007220907/http://culturalmaterials.rlg.org/cmiprod/servlet/cmi.servlets.CMIStart?ACTION=LOGON&USERID=&PASSWORD= and http://web.archive.org/web/20070528164412/http://www.trove.net/ (both accessed on 15 November 2008).

50 This document was first released in 2005 and is accessible at http://www.rlg.org/en/pdfs/RLG_desc_metadata.pdf (accessed on 15 November 2008).

51 More information about the technical aspects of the project can be found in Tony Gill's article, "Touring the Information Landscape: Designing the Data Model for RLG Cultural Materials," *RLG Focus* 58 (Oct. 2002), http://web.archive.org/web/20070923023019/http://www.rlg.org/legacy/r-focus/i58.html (accessed on 15 November 2008).

Hybridized Systems

It is important to note that these methods need not be used in exclusion of one another; hybrid systems are also possible. PictureAustralia is an example of a hybrid system that incorporates both federated searching and metadata aggregation. It is a service hosted by the National Library of Australia that offers integrated access to hundreds of thousands of images held by over thirty repositories in Australia and New Zealand. It has a hybrid structure in that although it harvests collections metadata regularly and maintains an index of this metadata, it does not actually maintain copies of the digital images themselves. Instead, these remain with the home institution and are accessed via a federated search mechanism on demand. Accordingly, the home institution manages its own images and metadata, avoiding potentially difficult rights management issues with sharing and distributing digital collections content.

PictureAustralia uses Dublin Core as its requisite metadata schema; the host institution is responsible for either creating records in Dublin Core or converting its records into Dublin Core using crosswalks and other related tools. The Dublin Core metadata is harvested using OAI-PMH or a Web crawler (for smaller sites), then incorporated into the PictureAustralia metadata index on a weekly basis.[52] One acknowledged drawback to this system is that the descriptions of the pictures may be obscured through metadata mapping to the point that important contextual information about the image is lost.[53]

Collection Description Method

While some federated and metadata aggregation approaches involve exchanging collections descriptions, a separate specific methodology has been developed in the United Kingdom and Europe that places precedence on enabling access via collection-level description over providing integrated access to lower-level descriptive information. This method involves creating, pooling, and providing integrated access to collection-level descriptions, some of which have been newly created for this purpose, with an option to burrow deeper down into descriptions through links to home repositories.

While archives typically describe at the collection or fonds level, this level of description is less commonly used in museums and libraries, with the exception of special collections environments in libraries and digital exhib-

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52 National Library of Australia, "Technical Guide," http://www.pictureaustralia.org/contrib ute/metadata.html (accessed on 15 November 2008).

53 Roy Tennant, "Digital Libraries – Different Paths to Interoperability," *Library Journal* (15 Feb. 2001), http://www.libraryjournal.com/article/CA156525.html (accessed on 29 April 2009).

its in both libraries and museums.[54] In the collection description method, a collection is defined in a generalized and inclusive sense as an aggregation of individual items of any type, including digital objects. The collection may also be of any size and level of permanence as well as being comprised of physical objects, digital objects, or both. Various criteria to define and delineate collections can be identified for all three cultural heritage contexts including provenance, subject, and media, among others. Thus, although collection-level descriptions are not typically used in library and museum environments, it is still possible to conceptualize museum and library resources at this level.[55]

Dublin Core, a relatively simple descriptive standard, is usable for creating collection-level descriptions in a collaborative environment. Its elements are essentially common to all three cultural heritage sectors and are semantically straightforward to understand. Thus, Dublin Core can be used to enable integrated access by serving as the standard to which descriptions can be mapped using crosswalks when building integrated systems. Dublin Core has also been used as the basis for a more sophisticated schema that has been developed specifically for the purpose of cross-sectoral collaborative projects: the Research Libraries Support Program Collection-Level Description schema (RLSP CLD).[56] This schema's design has taken into account the traditional theoretical and methodological treatment of collection-level description in all three disciplines. It includes descriptive attributes about the collection and its location, information about the owner of the collection and administrator of the location, and information about external relationships the collection may have with other related resources.[57] For archival records, rather than create

54   Heather Dunn discusses the use of collection-level description in conjunction with museum collections in her article "Collection Level Description – The Museum Perspective," *D-Lib Magazine*, vol. 6, no. 9 (September 2000), http://www.dlib.org/dlib/september00/dunn/09dunn.html (accessed on 15 November 2008). She explains that the museum world has been working toward devising standards for such descriptions, but that broad standardization is still being developed. Although there is no standard definition, understanding, or use of the collection-level of description in museological contexts, Dunn argues that the push toward networked access, and particularly toward creating integrated access systems, has inspired research and development in this area.

55   See Peter Johnston and Bridget Robinson, "Collections and Collection Description," in *Collection Description Focus – Briefing paper 1* (Jan. 2002), http://www.ukoln.ac.uk/cd-focus/briefings/bp1/bp1.pdf (accessed on 15 November 2008).

56   Tools for creating metadata in Dublin Core can be found at http://dublincore.org/tools/ (accessed on 15 November 2008). An example of a system employing Dublin Core in a manner different from the RSLP CLD was the aforementioned PictureAustralia.

57   Andy Powell, "RSLP Collection Description," *D-Lib Magazine* (Sept. 2000), http://www.dlib.org/dlib/september00/powell/09powell.html (accessed on 15 November 2008). See the project website for RSLP's CLD at http://www.ukoln.ac.uk/metadata/rslp (accessed on 15 November 2008). The Research Support Libraries System was a three-year, national, British initiative that developed new forms of access to library information especially for research purposes. RSLP's work on collection description was subsequently taken up by

new collection-level descriptions using RSLP CLD, archivists can simply map their existing collection or fonds-level descriptions to the RSLP CLD schema using a metadata crosswalk.[58]

Creating this type of system would be an excellent starting point for work on collaborative descriptions, particularly between a group of separately managed organizations. Multiple access points could be created, including name, time, place, and subject. In addition to the collections information, institutional information could be included so that researchers would know how to proceed should they desire more in-depth information. Cornucopia, a British project, is an example of such a system where the search results not only include information about the individual collections, but also information about the repository and its overall collections.[59] Other projects employing the RSLP CLD are also based in the United Kingdom, likely because the original research and development was funded through British organizations. A strong joint administrative structure – the aforementioned Museums, Libraries, and Archives Council (MLA) – is in place, and it supports cross-sectoral collaboration in the United Kingdom as a whole. Other examples of projects that have employed the RSLP CLD include: RASCAL (Research and Special Collections Available Locally); a Web-based directory of special collections materials located in Northern Ireland[60]; Backstage, a portal for performing arts, cultural heritage collections in the United Kingdom[61]; and Cecilia, an on-line guide to information about music collections from archives, libraries, and museums across the United Kingdom.[62]

Research on developing collection description schemas is ongoing and has not ended with the RSLP CLD. Experience with implementing the RSLP CLD has helped to inform the current research into creating a Dublin Core

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UKOLN, a British research, development, and services office that addresses the informa-tion management community. See UKOLN's collection description project website at http://www.ukoln.ac.uk/cd-focus (active 2001–2004); for help with implementing this type of system, UKOLN has an on-line tutorial at http://www.ukoln.ac.uk/cd-focus/cdfocus-tutorial/intro.html (both accessed on 15 November 2008).

58 Ann Chapman, "Collection-level Description: Joining up the Domains," *Journal of the Society of Archivists*, vol. 25, no. 2 (2004), p. 155.

59 Available at http://www.cornucopia.org.uk/ (accessed on 15 November 2008). For further information on the project, see: Chris Turner, "Cornucopia: An Open Collection Description Service," *Ariadne* 40 (July 2004), http://www.ariadne.ac.uk/issue40/turner/intro.html (accessed on 15 November 2008).

60 Available at http://www.rascal.ac.uk; for more information see the project's website at http://web.archive.org/web/20051129124740/http://www.qub.ac.uk/rascal/index.html (both accessed on 15 November 2008).

61 Available at http://www.backstage.ac.uk (accessed on 15 November 2008).

62 Available at http://www.cecilia-uk.org (accessed on 15 November 2008). It should be noted that although the collection-level records have been created using RSLP CLD, Cecilia also contains item-level records for some collections catalogued in ISAD(G) format.

Application Profile for collection description. This application profile would formally specify which set of terms are to be used in creating collection-level descriptions as well how they should be applied.[63]

There have been other subsequent projects and data schema that developed out of RSLP CLD as well. For instance, MICHAEL (Multilingual Inventory of Cultural Heritage in Europe) is a project that provides a single portal to access collection descriptions, developed using a model specific to MICHAEL based on the RSLP schema. It has portals for both European collections and collections from repositories located in the United Kingdom. Its focus is to provide access to digital cultural heritage collections. MICHAEL provides many access points into its collections information, including keyword or thematic searching as well as searching by repository, project audience, time period, and more.[64] MICHAEL-UK and Cornucopia, along with a registry of all cultural heritage institutions in the United Kingdom, comprise the three initiatives of the National Collection Description Service of the MLA. To help organizations participate, the MLA has created on-line resources, including a tutorial that helps to explain collection-level descriptions in the context of their initiatives and how to participate in the projects.[65]

Providing access to collection descriptions would enable high-level navigation of a large and heterogeneous resource base. Researchers would have broad access to information about collections that, in some cases, would not otherwise be described. It would not be used in place of traditional descriptive systems, but rather as an additional point of access. As an initial contact point, researchers would have access to a broad array of collections information from which they might follow links to other traditionally structured descriptive systems in which they could pinpoint more detailed information. Although some re-description might be necessary to participate in such projects (by libraries and museums that may not already have collection-level descriptions for their resources), it may provide an opportunity to create a basic level of access for backlogged or previously uncatalogued collections.[66]

63   Dublin Core Metadata Initiative – Dublin Core Collection Description Task Group, "Dublin Core Collections Application Profile," 9 March 2007, http://dublincore.org/groups/collections/collection-application-profile (accessed on 15 November 2008).

64   Accessible at http://www.michael-culture.eu (accessed on 15 November 2008).

65   The tutorial is accessible at http://www.michael-culture.org.uk/manual/intro.htm; information about MLA's Collection Description program is accessible at http://www.mla.gov.uk/webdav/harmonise?Page/@id=73&Section[@stateId_eq_left_hand_root]/@id=4332&Section[@stateId_eq_selected]/@id=5284 (both accessed on 15 November 2008).

66   More information about the pros and cons of collection-level description can be found in Paul Miller's article, "Collected Wisdom: Some Cross-domain Issues of Collection Level Description," *D-Lib Magazine*, vol. 6, no. 9 (September 2000), http://www.dlib.org/dlib/september00/miller/09miller.html (accessed on 15 November 2008).

Weighing the Options

Each of the various options for creating integrated access systems for collections information from archives, libraries, and museums has advantages and disadvantages. Federated systems can often offer integrated access to collections information that has been maintained in its original descriptive form according to the standards for that type of medium. These systems do not require compromise in how descriptive standards are applied within any one of the three disciplines. In addition, they provide one-stop-shopping and simultaneous access to multiple databases, which may be popular with users who are already accustomed to this type of access through mainstream avenues such as Google or Amazon. However, it should be noted that retrieval time might be extended during searches; it takes more time to query multiple databases than one single database.

The advantage of the collection description method is that it provides an opportunity for users to browse the information landscape, benefiting from a broad view of what resources are available. After finding an applicable collection description, the researcher can then narrow the search. Metadata aggregation systems enable the same breadth of access to lower-level records as federated systems, but system response times are reduced because only one central repository is being queried at a time; however, rights management issues concerning the pooling together of separately managed digital records in one repository may become an issue. A hybrid system, such as PictureAustralia, may solve this problem by incorporating elements of both federated searching as well as a central repository of metadata records.

There are many conceptual and procedural similarities between all of these options. In each option, various types of descriptive records, created and stored in separate databases, can be accessed jointly via a federated search portal, an aggregated metadata repository, collection descriptions, or some hybridized variation of these options. In these scenarios, the original descriptive records remain intact in their own repositories and a procedure is enacted to jointly access them. The procedure and result are conceptually similar in all three scenarios or their hybridized variations.

In a broader sense, these solutions involve similar tasks and activities. Descriptive records are created according to the standards devised for a certain discipline; some compromise may be involved in order to participate in an integrated system. A middle manager – often a publicly funded project such as OurOntario.ca or Cornucopia – is required to receive, collate, or provide the portal or access point at which these descriptions can be accessed. The end user interacts with one interface that provides integrated access to the collections information.

Aside from the technical aspects of creating integrated descriptions, there are some other issues to consider with respect to collaborative projects.

For instance, the ability to organize and manage large projects is dependent on the infrastructure in place, including availability of administrative and financial support. Further, as noted with cross-repository projects such as PictureAustralia and RLG Cultural Materials, licensing issues affect how cultural heritage information can be re-packaged and distributed. PictureAustralia used a federated system perhaps partly because it bypassed licensing issues; downloading the pictures in real-time through federated search enables the host institution to control its digital rights. Comparatively, RLG Cultural Materials negotiated rights management issues with each contributor and anticipated potential joint licensing ventures with websites, publishing houses, and other commercial partners. These efforts, however, as well as its subscription-based service model were not successful with respect to cost recovery.

The best option will depend upon the available resources and infrastructure in place. The goal in all instances is to provide integrated access to collections information, without compromising the high quality of traditional descriptive records that are developed in each sector. It is true that in some scenarios a degree of compromise is required to participate in a system, for example, creating Dublin Core versions of descriptive records; this is not to say, however, that traditional descriptive practices will cease. Rather, an additional layer of access will be provided.

Conclusion

While archives, libraries, and museums have significant differences, they share significant similarities in their cultural heritage mandates: to protect, preserve, and provide access to cultural heritage resources. Engaging in collaborative efforts to build cross-sectoral, on-line access systems to collections information may be a wise use of human and financial resources while potentially assisting users to better access those heritage resources. There are a variety of types of integrated access systems, all based on methods for managing and manipulating collections metadata, which do not necessarily threaten the autonomy or unique traditions of each of the sectors. It is not necessary to amalgamate institutions and professions into one converged unit; rather, all three sectors can maintain and build upon their unique traditions as well as embark on new collaborative endeavours. These endeavours would capitalize upon the similarities among the three sectors, building a new information superstructure above and beyond the regular level of descriptive activities in each of the sectors. Collaboration would be in addition to traditional descriptive activities rather than in place of them. In other words, collections metadata would be constructed in accordance with each sector's unique descriptive standards, and then various methods would be employed, such as federated searching or metadata aggregation.

It is fair to hypothesize that over time, collaboration between the archives, library, and museum sectors may lead to a reconceptualization of the heritage sector overall. As interest in these systems and collaborative projects continues to grow, it is possible that the cultural heritage sector and its resident professions will see a greater level of interdisciplinary or cross-sectoral knowledge and expertise. Mary W. Elings and Günter Waibel have suggested that materials should be described according to the standard appropriate for their media rather than in accordance to the repository within which they reside.[67] In other words, archival materials, for example, should be described using archival descriptive standards, whether they reside in an archives, library, or museum. Likewise, library materials and museum artifacts should be described using bibliographic description standards and museological descriptive standards, respectively, regardless of the type of institution in which they reside. Such a re-conceptualization could lead to more openness and cross-pollination of ideas and methods. Perhaps we need a re-envisioning of professional education for cultural heritage professionals where we develop descriptive specialists who are versed in descriptive standards from all three sectors.[68] As the public continues to demand greater access to heritage information in the digital environment, embracing cross-sectoral collaboration, such as integrated access systems, is a smart way to proceed in the twenty-first century, making the most of communal resources to serve and support the overall shared mandate of the cultural heritage sector.

67   Mary W. Elings and Günter Waibel, "Metadata for All: Descriptive Standards and Metadata Sharing across Libraries, Archives and Museums," *First Monday*, vol. 12, no. 3 (March 2007), http://www.firstmonday.org/issues/issue12_3/elings/ (accessed on 15 November 2008).
68   Although the professional momentum is not necessarily moving toward a single information profession, recent research has determined that information professionals from these three areas share common skills and core competencies, and could benefit from learning more about one another during their training years. For more information see Zinaida Manžuch, Isto Huvila, and Tatjana Aparac-Jelusic, "Digitization of Cultural Heritage," in *European Curriculum Reflections on Library and Information Science Education*, eds. Leif Kajberg and Leif Lørring (Copenhagen, 2005), pp. 37–64, http://www.fbi.fh-koeln.de/aktuelles/European_Curriculum_LIS.pdf (accessed on 15 November 2008).

Appendix 1: Comparison of Current Descriptive Practices in the Archives, Library, and Museum Sectors

	Archives Sector	**Library Sector**	**Museum Sector**
Type of Descriptive Activity	Arrangement and description activities	Cataloguing and classification activities	Cataloguing and classification activities
Method of Descriptive Activity	Arrangement is done according to the provenance or origin of the records; description involves research into the history and context of the records and their creation, including the history of their creators	Cataloguing includes both bibliographic description (describing the main attributes of the publication) and subject analysis (assigning subject headings to describe the publication)	Catalogue records are created and describe the physical characteristics, provenance or origin, and other related information pertinent to the object at hand
Classification	No classification of archival records	Classification using Library of Congress Classification (LCC) or Dewey Decimal Classification (DDC) is common	Classification using the most appropriate system according to type of artifact (e.g., historical, archaeological, scientific); classification systems include Nomenclature and Social History and Industrial Classification (SHIC)
Typical Level of Detail for Description	Usually description is done at the group or collection level, though item-level description is sometimes done for certain media, particularly photographs, maps, and other special media	Primarily item-level description of resources for which multiple copies exist; in the case of special collections, however, there is less likelihood of there being many copies in existence and collection-level description may be relevant (i.e., in the case of thematic collections or groups of resources donated from a single donor)	Usually item-level treatment of unique resources, although collection-level description is being incorporated more often into distributed databases to provide a first point of contact for the user when browsing collections prior to viewing individual item records

Copying or Sharing Descriptions with Other Institutions of the Same Type	Unlikely that sharing descriptive records for copy-cataloguing would be possible, given that each repository has unique records	Copy-cataloguing (i.e., sharing catalogue records) is common practice	Unlikely that sharing descriptive records for copy-cataloguing would be possible, given that each museum has unique artifacts
Importance of Concept of Provenance	Provenance is of utmost importance when devising arrangement structures, and the descriptive function succeeds arrangement; describing the historical context of records is necessary in order to understand them	Provenance of the publication being described is usually of limited relevance, except in the case of rare book description	Provenance is an important factor to include at the item or collection-level although it is not as crucial to organize collection descriptions in hierarchies based on provenance as in archival description
New Systems, Models, or Research Interests	Functional analysis precedes the descriptive function; little interest so far in developing user-driven participative descriptive systems	Development of a new functional model for description, Functional Requirements for Bibliographic Records (FRBR); interest in participative descriptive systems like folksonomies	Development of higher-level conceptual reference model, the CIDOC-CRM, which takes a semantic approach to description to provide a framework for integrating or mapping disparate cultural heritage descriptions (in museums and other types of heritage institutions) together
Data Content Standards	Describing Archives: a Content Standard (DACS); Rules for Archival Description (RAD)	Anglo-American Cataloguing Rules, second revision (AACR2r)	Cataloguing Cultural Objects (CCO)
Data Structure Standards	Encoded Archival Description (EAD) (using an XML DTD); MARC-AMC (Machine Readable Cataloguing for Archives and Manuscripts Control)	Machine Readable Cataloguing (MARC) (including an XML format); Metadata Object Description Schema (MODS)	SPECTRUM; Categories for the Description of Works of Art (CDWA)

Data Value Standards	Authority records (Library of Congress, Library and Archives Canada [AMICUS])	Library of Congress Subject Headings (LCSH); authority records (Library of Congress, Library and Archives Canada [AMICUS])	CHIN data diction-aries; MDA data dictionary; Art & Architecture Thesaurus (AAT) and other thesauri
Data Interchange Standards	XML OAI	XML Z39.50	XML OAI