Integrated Online Access to Objects and Archives[1]

JINFANG NIU

ABSTRACT In this study, 100 museums were randomly selected from the 4,184 members of the American Alliance of Museums. The websites of sampled museums were examined to identify the approaches used to provide integrated online access to objects and archives. It was found that many museums either made no mention of their collections on their websites or provided online access to either objects or archives but not to both. Some museums that allowed online access to both objects and archives did not integrate the access to the two types of collections. Only a small percentage of museums provided integrated online access to objects and archives. From these museums, five different approaches for integrated online access to objects and archives were identified. The findings show that museums in the United States are still in the early stages of providing integrated online access to disparate collections. However, integrated online access to disparate collections is likely to become more common in the future due to the merits of online access and the convergence of libraries, archives, and museums.

1 The author would like to acknowledge the efforts of her research assistant, Ashley Ickes, a master's student in the School of Information, University of South Florida, who helped gather data and improve this manuscript. This research is partially funded by Qatar Foundation and University College London (UCL), Qatar.

RÉSUMÉ Pour cette étude, nous avons choisi au hasard cent musées parmi les 4,184 membres de la American Alliance of Museums. Nous avons examiné les sites web des musées sélectionnés afin d'identifier les approches utilisées pour donner accès à leurs objets et à leurs archives en ligne de façon intégrée. Nous avons constaté que plusieurs musées ne font aucune mention de leurs collections sur leurs sites web, ou encore ne donnent accès qu'aux objets ou aux archives, mais pas aux deux. Certains musées qui donnent un accès tant aux objets qu'aux archives n'ont toutefois pas intégré les deux types. Seul un petit pourcentage des musées offre un accès en ligne aux objets et aux archives intégrés. De ces musées, cinq différentes approches à un accès intégré aux objets et aux archives en ligne ont été identifiées. Ces résultats révèlent que les musées aux États-Unis en sont toujours aux premières étapes visant à permettre un accès en ligne à leurs collections disparates de façon intégrée. Cependant, l'accès intégré en ligne aux collections disparates sera probablement plus fréquent à l'avenir étant donné les avantages de l'accès en ligne et la convergence des bibliothèques, des archives et des musées.

Introduction

Users have information needs that are purpose driven and subject based. They search for the types of resources that fulfill their needs and, in many cases, do not care whether the resources are records, objects, or publications.[2] Many users cannot clearly distinguish among these different types of information resources or among the different institutions that manage them.[3] This feature of users' information needs calls for integrated access to disparate information resources. Today, the Web and cutting-edge collection management technologies have made integrated online access to disparate resources possible. Accordingly, research and practical initiatives for the convergence of and integrated access to resources held by libraries, archives, and museums (LAMs) proliferate.

Most of the research and practical initiatives related to LAM convergence deal with inter-institutional integration and collaboration on regional, national, and international scales.[4] Access to LAM resources across institutions has been integrated mostly by aggregating metadata from multiple institutions into one database or by cross-searching various databases. For example, the Museums and the Online Archive of California (MOAC) project experimented with integrating museum and archive content using the encoded archival description (EAD) standard.[5] Research Library Group (RLG)'s Cultural Materials Initiative

2 W. Boyd Rayward, "Electronic Information and the Functional Integration of Libraries, Museums, and Archives," in *History and Electronic Artefacts*, ed. Edward Higgs (Oxford: Clarendon Press, 1998), 207–25; Deanna Marcum, "Archives, Libraries, Museums: Coming Back Together?" *Information & Culture* 49, no. 1 (2014): 74–89.

3 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* 8, no. 1 (2007): 61–66; Paul F. Marty, "Digital Convergence and the Information Profession in Cultural Heritage Organizations: Reconciling Internal and External Demands," *Library Trends* 62, no. 3 (2014): 613–27.

4 Hannah Gibson, Anne Morris, and Marigold Cleeve, "Links between Libraries and Museums: Investigating Museum–Library Collaboration in England and the USA," *Libri* 57, no. 2 (2007): 53–64; Alexandra Yarrow, Barbara Clubb, and Jennifer-Lynn Draper, *Public Libraries, Archives and Museums: Trends in Collaboration and Cooperation* (The Hague: International Federation of Library Associations and Institutions, 2008); Sanjica Faletar Tanackovic and Boris Badurina, "Collaboration of Croatian Cultural Heritage Institutions: Experiences from Museums," *Museum Management and Curatorship* 24, no. 4 (2009): 299–321; Helena Robinson, "'A Lot of People Going That Extra Mile': Professional Collaboration and Cross-Disciplinarity in Converged Collecting Institutions," *Museum Management and Curatorship* 31, no. 2 (2016): 141–58; Katherine Timms, "New Partnerships for Old Sibling Rivals: The Development of Integrated Access Systems for the Holdings of Archives, Libraries, and Museums," *Archivaria* 68 (2009): 67–95.

5 Richard Rinehart, "MOAC: A Report on Integrating Museum and Archive Access in the Online Archive of California," *D-Lib Magazine* 9, no. 1 (January 2003), accessed 20 August 2018, http://www.dlib.org/dlib/january03/rinehart/01rinehart.html.

mapped disparate metadata from museums, libraries, and archives into a common metadata schema used by RLG.[6] Another project, Linking Florida's Natural Heritage: Science & Citizenry, cross-searched museum specimen databases and bibliographic databases and thus integrated specimen records and bibliographic records about the same species.[7] The two most recent large-scale inter-institutional initiatives, Europeana and the Digital Public Library of America (DPLA), have integrated resources from LAMs and other cultural heritage organizations by mapping contributors' metadata to the Europeana data model (EDM) ontology and DPLA metadata application profile, respectively. Unlike previous projects that reduce contributors' metadata to a common denominator, EDM and DPLA metadata application profiles allow metadata enrichment and can accommodate different metadata for the same item from different sources. These two initiatives also provide online exhibitions that tell stories about themes based on disparate resources. In addition, they utilize linked open data and application programming interface (API) technologies, so that public users are able to access and/or download their metadata and create various applications based on those metadata.

The author believes that integrated online access should also be provided for different resources of the same institution, so that when users visit the website of a particular institution, they can search for and discover information based on their subject interests, rather than having to search different parts of the website for relevant information. In light of this, this study looks at intra-institutional integrated online access to both museum objects and archives held in the same institution. Museum objects include natural objects (living and non-living) and cultural artifacts such as specimens, meteoroids, drawings, and paintings. Different kinds of museums manage different kinds of objects. Museums typically manage two different kinds of records or archives: institutional records and special collections. Institutional records are produced during the business activities of the museum. Some of these institutional records – such as human resource records, financial records, and marketing records – are not directly related to objects. Other institutional records are closely related to

6 Research Library Group, *Descriptive Metadata Guidelines for RLG Cultural Materials* (Mountain View, CA: Research Library Group, 2005), accessed 18 December 2017, https://www.oclc.org/content/dam/research/activities/culturalmaterials/RLG_desc_metadata.pdf.

7 Priscilla Caplan and Stephanie Haas, "Metadata Rematrixed: Merging Museum and Library Boundaries," *Library Hi Tech* 22, no. 3 (2004): 263–69.

objects; these are called object files[8] or supplemental files.[9] Examples of object records include donor agreements, accession forms, trustee approvals, receipts, conservation reports, letters from donors, and exhibition histories. The second type, special collections, are not produced by the museum but are acquired by the museum because they are valuable for the research related to museum objects or for fulfilling the mission of the museum. For example, the National Portrait Gallery in the United Kingdom acquires the papers of portrait artists because these inform both an understanding of the portraits themselves and research into portraiture more generally.[10] Both types of records are useful to internal and external researchers. While museums might restrict public access to certain object files due to privacy and security concerns, some records and archives can be made accessible online, which can benefit external researchers and the public greatly.

Research specifically about intra-institutional integrated online access to objects and archives is scarce. In 2007 and 2008, RLG organized a series of workshops to identify motivations and obstacles for successful collaboration among LAMs that belong to the same parent institutions.[11] Workshop attendees proposed collaborative projects related to integrated online access, which mostly involved cross-collection searching and shared digital asset management. The software ANCS+, used by the National Park Service, and the widely used commercial software PastPerfect both support integrated cataloguing and integrated access to objects and archives.[12] Reed suggests an approach to integrated access through exhibitions: exhibiting objects alongside the records and making the intimate connections

8 John M.A. Thompson, ed., *Manual of Curatorship: A Guide to Museum Practice*, 2nd ed. (London: Routledge, 2015).

9 Hilary Ericksen and Ingrid Unger, eds., *The Small Museums Cataloging Manual: A Guide to Cataloging Object and Image Collections*, 4th ed. (Carlton South, VIC: Museum Australia [Victoria], 2009).

10 Charlotte Brunskill and Sarah Demb, *Records Management for Museums and Galleries: An Introduction* (Oxford, Chandos Publishing, 2012), Elsevier Science e-book.

11 Diane Zorich, Günter Waibel, and Ricky Erway, *Beyond the Silos of LAMs: Collaboration Among Libraries, Archives and Museums* (Dublin, OH: OCLC Online Computer Library Center, Inc., 2008), accessed 18 December 2017, https://www.oclc.org/content/dam/research/publications/library/2008/2008-05.pdf.

12 United States National Park Service, "Chapter 3: Cataloging," in *NPS Museum Handbook, Part II: Museum Records* (Washington, DC: U.S. Department of the Interior, National Park Service, 2000), accessed 18 December 2017, https://www.nps.gov/museum/publications/MHII/mh2ch3.pdf; Betsy S. Witt, Jennifer C. Whitfield, and Adam J. Stepansky, *PastPerfect Software for Museum Collections: Version 5 User's Guide*, 3rd ed. (Exton, PA: PastPerfect Software, 2008), accessed 20 December 2017, http://museumsoftware.com/v5userguide.html.

between objects and archives apparent.[13] Several other authors talk about creating links between museum objects and associated records.[14] Links can be created, through pointers, from the object catalogue to associated records and also from archival finding aids to the object catalogue, so that users are able to find one from the other. The pointer can be the catalogue number or the accession number of the associated object, recorded on the folder of supplemental files, on the back of a photo, or recorded in the archival finding aids. In storage, a separation sheet can be used for objects that have been separated from the archival collection to which they belong. These approaches to integrated access have mostly been implemented in physical or non-Web environments.

This study attempts to identify the current approaches used for integrated online access to objects and archives within individual museums. It will discover how those approaches compare with large-scale, inter-institutional efforts such as DPLA and Europeana. In particular, the author is interested in learning whether some of the approaches used by individual museums can be adopted by large-scale, inter-institutional efforts and vice versa. The author is also interested in learning whether and how the physical and implicit links between objects and records have been converted into hyperlinks or semantic links and published on the Web.[15] Findings from this study will contribute to the research and practices of LAM convergence.

13 Anthony Reed, "Objects in the Archives," in *Museum Archives: An Introduction*, 2nd ed., ed. Deborah Wythe (Chicago: Society of American Archivists, 2004), 169-176.

14 Deborah Wythe, "Description," in Wythe, *Museum Archives*, 43-54; Deborah Wythe, "The Museum Context," in Wythe, Museum Archives, 9-19; Ann Marie Przybyla, "The Museum Archives Movement," in Wythe, *Museum Archives*, 3-8; Sarah R. Demb, "Accessioning," in Wythe, *Museum Archives*, 96-100; United States National Park Service, "Chapter 3: Cataloging," in *NPS Museum Handbook, Part II*; Reed, "Objects in the Archives" in Wythe, *Museum Archives*, 169-176; Ericksen and Unger, *The Small Museums Cataloging Manual*.

15 The paragraph above provides examples of physical and implicit links. For example, an accession number for the associated objects recorded on the back of an analog photo can be a link.

Methodology

As of 2014, there were 35,144 museums in the United States.[16] Of those museums, 4,184 were members of the American Alliance of Museums (AAM). In order to take a random sample of 100 museums,[17] in September 2017, names of all of the 4,184 member museums in the AAM online database were copied into an Excel spreadsheet, which automatically assigned an ID number for each museum. Random number–generating software was used to generate 100 random numbers within the range from 1 to 4,184. Names of museums whose ID numbers matched those random numbers were selected and saved in a second Excel spreadsheet. It was found that 30 of these 100 sample museums were accredited by AAM. These 100 museums were distributed in 43 states; the largest numbers of museums came from California (7), Massachusetts (6), New York (6), and Ohio (6). Table 1 shows the different types of museums sampled.

All of the 100 sampled museums have a web presence. However, one museum in the sample, the Museo de Historia, Antropología y Arte of Puerto Rico, does not have an English version of its website and therefore was excluded from this study. A graduate student assistant (GA) carefully examined the websites of the remaining 99 sampled museums and collected data using a questionnaire, which is provided in the appendix. Before data collection began, the author went through the questionnaire with the GA and explained the concepts that appeared in the questionnaire, such as linked data, finding aids, archives, and museum objects. After the GA finished collecting data for the first 10 museums in the sample, the author checked the data by examining the 10 websites again. Where the GA had answered a question differently from the author, the author deliberated with the GA to identify the reasons. In cases where errors occurred because questions were unclear or confusing, the author revised the relevant questions. In cases where the GA might have answered questions differently than the author because of a misunderstanding of certain concepts, the author explained concepts again to the GA using real examples from the museum

16 Institute of Museum and Library Services, "Government Doubles Official Estimate: There Are 35,000 Active Museums in the U.S.," news release, 19 May 2014, accessed 20 December 2017, https://www.imls.gov/news-events/news-releases/government-doubles-official-estimate-there-are-35000-active-museums-us.

17 This study involves thorough examination of the websites of all the sampled museums. If the sample size is too big, the project cannot be finished during a reasonable time period. A sample size of 100 is large enough to be representative and also small enough to be manageable.

TABLE 1 *Types of Museums Sampled*

Types of Museums	Number
Anthropology Museum	1
Children's or Youth Museum	3
Art Museum/Centre or Sculpture Garden	15
Ethnically/Culturally/Tribally Specific Museum	2
General or Multi-disciplinary Museum (Several Subjects)	6
Historic House/Site	21
Historical Society	4
History Museum	34
Military/Battlefield Museum	2
Natural History Museum	4
Other Non-Profit Museum	1
Science/Technology Centre/Museum	1
Specialized Museum (Single Topic)	5
Transportation Museum	1
Total	100

Note: The types are copied from the American Alliance of Museums website.[18]

websites. After issues in the first round of data collection were addressed, the GA gathered data for the second set of 10 museums in the sample. The author then checked that data by examining the same websites again and addressing the issues accordingly. After that, the GA gathered data for the remaining 79 museums. During the data collection process, the GA was instructed to try every means of uncovering the information needed to answer questions in the questionnaire. This included clicking any hyperlinks that could possibly be useful, searching the websites and catalogues of the museums, checking the browsing interface and introductions to the physical exhibitions, and exploring online exhibitions.

18 American Alliance of Museums, "Find a Member Museum," accessed 18 August 2018, http://ww2.aam-us.org/about-museums/find-a-museum.

In addition to the data collected by the GA, the author gathered additional data from the museum websites at different phases of the research process. First, in order to train the GA for data gathering, the author carefully examined the websites of the first 20 museums in the sample. The author also collected additional data when answering the GA's questions during the data collection process. For example, the GA found that the number of staff, size of collections, and financial information were reported differently by different museums and thus was not sure how to record them. The author checked that information on a number of websites and instructed the GA to copy the original information from the websites. During the process of training the GA and facilitating data collection, the author also identified areas where the GA was likely to have made mistakes – for example, on questions related to finding aids, catalogues, linked data, and online exhibitions. Therefore, after the GA finished collecting data for all 99 sampled museums, the author specifically checked the answers to those questions by examining the websites and correcting errors where they occurred. While exploring the museum websites, the author identified two types of additional findings that could not be recorded through the questionnaire. One type included details that supplemented questionnaire data. For example, questionnaire data recorded which museums provided online catalogues and online exhibitions. The author found that online catalogues were provided in various forms, such as searchable/browsable catalogues, downloadable datasets, and lists. In addition to fully online exhibitions, which had all of their components online, the author also found online introductions to physical exhibitions and partially online exhibitions, where only a small portion of the whole physical exhibition was published online. A second type was unanticipated findings; thus, no corresponding question was included in the questionnaire to capture that data. For example, the author found that neither the boundary between objects and archives nor the distinction between museums and archival institutions was clear-cut. Another unanticipated finding was that research guides were used as a means for integrating online access. Every time a new or surprising theme arose, the author recorded that theme as well as the supporting data under that theme. A great deal of this data, such as examples or quotations from the museum websites that could be used to support arguments, was qualitative. Quantitative data was also collected where necessary. For example, the author found that some museum websites did not mention anything about their collections and decided to find out how many museums of this kind existed in the sample.

Both types of findings were recorded separately from the questionnaire data and analyzed in combination with the questionnaire data.

Some museums in the sample are part of larger institutions. For example, the J. Paul Getty Museum is part of the Getty Trust; the Pioneer Museum in Arizona is one of the museums managed by the Arizona Historical Society; the Sullivan Brothers Iowa Veterans Museum is one of the museums belonging to the Grout Museum District; and several museums in the sample, such as the St. Louis Old Courthouse and the Springfield Armory National Historic Site, belong to the National Park Service. In this scenario, integrated online access is usually provided by the parent institution. Therefore, websites of parent institutions were explored as well.

Findings

Size, Financial Capacity, and Integrated Online Access

This study attempted to discover whether larger and financially stronger museums were more likely to provide integrated online access to their archives and objects. The author believed that a museum's size and financial capacity could be measured based on the number of staff, size of collections, operating budget, endowment, and other financial information, and the questionnaire was designed to gather this information. However, although the GA and the author did receive the general impression that museums varied in terms of their staff numbers, collection sizes, and financial capacities, not all of the museums provided such information, and the information provided by the different museums was inconsistent and not comparable. In fact, 28 percent of the sampled websites did not mention the number of staff working for the museum. The numbers reported by some museums included only professional curators, while the numbers reported by others also included security guards or other supporting staff. Some numbers included only full-time employees, and others included part-time employees – sometimes including volunteers and contractors. There were also museums that only reported the number of people on the board of directors or trustees. Among the 39 percent of museums that reported the quantities of items in their collections, some reported numbers that included both objects and archival materials, such as "10,000 objects and archival materials." Others reported quantities in different kinds of collections

separately, such as "45 million documents including business, public and architectural records, maps, diaries and manuscripts; 2.5 million historic photographs; 1,700 oral histories; 1,500 films; 15,000 historic objects; and 7,000 items of historic clothing." Some numbers were rough estimates rather than accurate numbers, such as "over one million items." In addition, it was hard to compare across different kinds of collections; for example, it was hard to compare across reported numbers such as 10,000 archival items, 7,000 items of historical clothing, 27 wood and stone buildings, and 1,500 paintings and sculptures. Some of the museums (34 percent) reported similar financial information in several different ways – for example, as total operating budget, total expenditure, and total net assets and endowments. Since the numbers either did not exist or were not consistent, it was not possible, at least quantitatively, to decide whether larger and financially stronger museums were more likely to provide integrated online access to museum collections. However, the author found that the type of museum likely affected the probability that a museum provided online access or integrated online access to its collections.

Types of Museums and Integrated Online Access

This study intended to investigate integrated online access to objects and archives. However, it was found that 29 percent of the sampled museum's websites did not contain any information about their collections. This means their websites did not have online catalogues, browsing interfaces, finding aids, or databases for either objects or archives and did not mention the quantity of their collections; keyword searches for collection-related terms, including collection, archive, record, and artifact returned no valid results. A closer examination of these websites found that these museums focused on educational and entertaining experiences and paid much less attention to collection management. For example, children's museums tended to provide educational and fun experiences through interactive, hands-on, or participatory exhibitions, programs, and activities. For instance, the Chicago Children's Museum had exhibits like "Dinosaur Expedition, where children can dig for dinosaur bones in an authentic excavation pit; WaterWays, an interactive system of pulleys, pumps, and pipes showcasing the wonders of water; [and] Kids Town, an early learning exhibit featuring a real . . . bus, mini-grocery store and kid-sized cityscape."[19] In fact, none of the

19 "About Us," Chicago Children's Museum, accessed 20 December 2017, http://www.chicagochildrensmuseum.org

sampled children's museums provided an online catalogue of objects, nor did they mention anything about their archives on their websites. These museums included the Children's Museum of Indianapolis, the largest children's museum in the world, with a collection of more than 110,000 artifacts; the Oklahoma Contemporary Arts Center, with community arts programming and education including "adult classes and workshops, art camps and classes for local youth, art exhibitions, [and] lectures";[20] the Lace Museum in California, a museum for learning lacing and selling laces; the Fort Griffin State Historic Site, whose website states that its "campgrounds . . . provide visitors with an opportunity to relax under large shade trees, enjoy the playground, catch catfish in the river, or hike nature trails connected to the campground";[21] and the Lake Jackson Historical Association, whose mission is to "provide education relative to the history and culture of an area of . . . Lake Jackson."[22] The findings of the questionnaire thus showed that museums that focused on user experiences rather than collections were less likely to provide online access to collections.

Integrated Online Access to Objects and Archives

Integrated online access is characterized by online access to both objects and archives. The author defines online access to objects as the various mechanisms, such as catalogues and online exhibitions, that allow users to access information on the Web about individual objects. General overviews of object collections are not considered an approach for online access to objects. For example, the Tudor Place Historic House and Garden divided its object collection into several categories and provided an introduction to each category, but did not provide any means for users to access information about individual objects. Examples of online access to objects provided by the sampled museums suggest that a variety of methods could be employed. For example, the Biggs Museum of American Art used a timeline to organize its collections. In the timeline, for each time period, digital images and introductions of each object were shown. The Illinois State

/index.php/about/mission-history.

20 "Mission and History," Oklahoma Contemporary Arts Center, accessed 10 August 2018, http://oklahomacontemporary.org/about/mission-history/.

21 "Fort Griffin State Historic Site," Texas Historical Commission, accessed 20 December 2017, http://www.thc.texas.gov/historic-sites/fort-griffin-state-historic-site.

22 "About," Lake Jackson Museum, accessed 20 December 2017, http://www.lakejacksonmuseum.org/index.php?page=about-2.

Museum allowed users to browse its collections based on categories. Under each category, there was a digitized image, a narrative introduction, and structured metadata for each object. Another example was the browsing list for the 54 historic and recreated houses created by the Old Cowtown Museum.

Online access to archives is defined as the various mechanisms used to allow users to access either individual records or record aggregates – for example, publication of digitized records or archival finding aids on websites. The distinction between this definition and the definition of online access to objects exists because archives are usually managed as aggregates. As with the definition of online access to objects, a brief introduction to archive collections is not considered a means of providing online access to archives. For example, the Tudor Place Historic House and Garden provided a list of archive collections and a very brief one-paragraph introduction for each collection. It did not provide detailed online finding aids that allowed users to see the content in those collections. In another example, the Cumberland County Historical Society provided a very brief introduction about its collections. If a user wanted to get more detailed information, they had to fill out a request form, pay, and receive the results.

Examples of online access to archives provided by the sampled museums again suggested that a variety of methods could be employed. For example, the Online Resource Center created by the Vermont Division for Historic Preservation was a digital repository that provided online access to all of its records related to historic preservation activities throughout the state since the 1960s. At the Cincinnati Museum Center and the San Diego History Center, library catalogues were linked to online archival finding aids, which then linked to records in digital repositories. The Minnesota Historical Society indexed its death records, birth records, state census, and register of veterans' graves and allowed users to find records relating to individual people. Likewise, the Connecticut Historical Society created a name index, regiment index, and index of residence for its civil war manuscripts and provided multiple access points for searching this collection.

A museum might provide online access to its objects but not to its archives, or vice versa. For instance, the Michigan History Center created various kinds of indexes to its archive collections. However, although it provided basic information about the various museums that it supervised, such as maps and details about opening dates and hours, locations, exhibitions, and events, it did not provide any introduction to its object collections, and there was no catalogue for its objects. In

contrast, deCordova Sculpture Park and Museum provided browsable, searchable catalogues for its objects but did not mention anything about its archives. Even if a museum provided online access to both its objects and archives, it might not integrate the online access to these two different kinds of collections. For example, the Connecticut Historical Society had separate catalogues for its archive collections and museum objects. The former was searchable through the HistoryCat Library Catalog, and the latter was searchable through eMuseum. There was no connection between the two catalogues.[23] In fact, sometimes there was not even integrated access to different kinds of objects. For example, the Illinois State Museum had separate online exhibitions for different kinds of objects, such as fine art, archaeology, botany, and geology. However, the author was not able to find a common searching or browsing interface for all of these different kinds of objects. It is worth noting that the fact that a museum provided online access to a collection did not mean that online access covered all of its collections. For example, the Cincinnati History Museum and the North Carolina Museum of Natural Sciences only had small portions of their collections catalogued. Similarly, the Klamath County Museum was in the process of putting digitized records online, and much of its collection was not yet digitized. The Putnam Museum and Science Center stated on its website, "We are currently working toward making our collections available online."[24] In fact, even the library collections of some museums were not catalogued. For example, the EAA AirVenture Museum did not have an online catalogue for its books and journals, and users needed to pay to request searches for books.

Despite the above facts, the majority of museums that provided online access to objects also provided online access to archives. The survey data showed that 21 out of the 22 online catalogues for objects included archives, and all of the 8 online exhibitions included both objects and archives. In total, 25 out of 99 museums (25 percent) were found to provide integrated online access to objects and archives. Each of the 25 museums used one or more of the five different approaches described below. Table 2 shows the distribution of types of museums that provided integrated online access.

23 This is a good example showing that two separate catalogues for different kinds of resources were not integrated. This museum, Connecticut Historical Society, in fact provided integrated access through subject guides.

24 "The Collections," Putnam Museum and Science Center, accessed 20 December 2017, http://www.putnam.org/Collections-(1)/Overview.

TABLE 2 *Types of Museums Providing Integrated Online Access*

Types of Museums	Number
Art Museum/Centre or Sculpture Garden	8
Historic House/Site	2
Historical Society	2
History Museum	11
Military/Battlefield Museum	1
Transportation Museum	1
Total	25

APPROACH A. ***Integrated Catalogues/Digital Repositories and Cross-Searching Interfaces***

This study found that 21 percent of the sampled museums included archives in their catalogues of objects. A close examination of these catalogues revealed two different ways of incorporating archives, the first of which can be called integrated catalogues/digital repositories and cross-searching interfaces. In this approach, integrated access was made possible either by a union catalogue, which included objects and archives that were described using the same metadata format, or by cross-searches of objects and archives that were described using different metadata formats and stored in different databases. For example, the Minnesota Historical Society had a cross-searching interface for several existing databases, including Collections Online, a death certificate index, a birth certificate index, a state census index, and a veterans' grave index. The Collections Online digital repository and other catalogues like it (for example, the collection catalogue of the Bowdoin College Museum of Art) commonly included digital images of objects and archives and thus were in fact digital repositories. In the Collections Online digital repository of the Minnesota Historical Society, metadata records for one individual archival record linked to the online finding aid and to the MARC record for the collection where the archival record belonged.

APPROACH B. ***Archives Used as Metadata for Objects***

Another way of incorporating archives in a catalogue for objects was to use archives as metadata for objects. In the catalogue of the National Park Service,

a metadata record for one object might have included several related historical records, usually photos. There was no separate description for each photo. In other words, those photos were not treated as separate targets of description; rather, they were used as metadata for the object to which they were related. For example, a metadata record for a rocket launcher contained a historic photo in which a soldier was carrying the rocket launcher on his shoulder. Likewise, a metadata record for a machine gun included several historical records. In the Kansas Aviation Museum, a metadata record for an aircraft included a number of photos of that aircraft, which were taken from the museum's photo archive. Some of these photos were black and white historical photos, while others were taken more recently. At the Massachusetts Institute of Technology (MIT) List Visual Arts Center, metadata for some public art objects included related historical photos and audio guides. These audio guides, although not historical, could be considered current records that provided contextual information for those art objects.

APPROACH C. *Online Exhibitions*

An exhibition is a collection of items that are "carefully chosen to illustrate a theme and tied together by a narrative or other relational threads."[25] In an exhibition, the items are "put together to convey a particular idea or tell a particular story and often feature original content."[26] Since items are selected and assembled based on themes, regardless of genres, all kinds of relevant materials, including archives and objects, can be included in an exhibition. An online or virtual exhibition "happen[s] online, making use of a range of digital media tools (video, photos, augmented reality, or animation), often capitalizing on the web's capacity for a personalized experience in which the user directs his or her own journey."[27] A full online exhibition has all of its content, such as digital images, labels, narratives, and any other information about individual objects, completely online. In this study, only eight of the sampled museums provided full online exhibitions. For example, the Chemung County Civil War Experience

25 Martin R. Kalfatovic, *Creating a Winning Online Exhibition: A Guide for Libraries, Archives, and Museums* (Chicago: American Library Association, 2002), 1.

26 Barry Lord and Maria Piacente, eds., *Manual of Museum Exhibitions*, 2nd ed. (Lanham, MD: Rowman & Littlefield, 2014), 154.

27 Ibid.

exhibition displayed various kinds of artifacts, historical photos, and records. Some online exhibitions also linked to interviews with related artists, brochures or video introductions about the exhibitions, or audio recordings of related lectures. These interviews, brochures, and lectures, which were current records, were not directly related to any particular object in an exhibition. Rather, they were related to the whole exhibition.

Most museums provided only online introductions to their physical exhibitions, or partial online exhibitions, in the sense that they displayed information about a small number of highlighted objects from the physical exhibitions or collections online – for example, the online image gallery of the artworks of deCordova Sculpture Park and Museum. There was also one museum that provided an exhibition in the form of a publication: a curator of the Moffatt-Ladd House & Garden published the article "Lesser Known Treasures of the Moffatt-Ladd House & Garden" in *Antiques & Fine Art Magazine*. This article was very much like an online exhibition because it provided digital images and detailed introductions for each individual object.

APPROACH D. *Entity- or Theme-Based Browsing*

The survey found only four museums that allowed for theme-based browsing of objects and archives together. For example, the Minnesota Historical Society provided the option of exploring its collections based on themes. Under each theme, various resources were provided or linked, including records, publications, photos, paintings, and other kinds of artifacts. For example, for the theme "In Honor of the People," users were able to explore the Bishop Whipple collections of American Indian culture, which included artifacts, documents, photos, maps, etc. The author also found an integrated browsing interface that was based on entities. The Artists Archives of The Western Reserve provided a browsing interface for artists named "Our Archived Artists." For each artist, it showed a biography in text or video format, a digital photo of the artist, digital images of the artist's artworks, and an oral history video of the artist, if available. In this case, archives and records, such as oral history videos and biographical videos, were displayed together with digital images of artworks. Entity- or theme-based browsing is very similar to online exhibitions, although not named as such.

APPROACH E. *Research Guides*

Many museum collections included multiple different types of resources. For instance, the Founders' Wing collection of the EAA AirVenture Museum was a personal collection of letters, pictures, artifacts, media clippings, and more from the founders of the museum. Another example was the St. Catherines Island Foundation Collection of the Fernbank Museum of Natural History. This collection included both artifacts and records produced during 30 years of archaeological research on St. Catherines Island. To facilitate access to these kinds of diverse collections, some museums had created research guides, which were similar but more comprehensive than archival finding aids. For example, the research guide for Alexander Ramsey and the Alexander Ramsey House, created by the Minnesota Historical Society, included a biography of Alexander Ramsey, links to online finding aids for the personal and family papers of Alexander Ramsey, links to individual digitized records and digital images of the artifacts of the family, and citations to related newspapers, books, and articles. Likewise, the Connecticut Historical Society had created a subject guide to African-American resources. The guide listed citations and digital images of various kinds of related resources, including printed materials, artifacts, cartoons, photos, and manuscripts.

Underutilization of Cutting-Edge Technologies and Crowdsourcing Power for Online Collection Access

Some museums used advanced technologies to provide interactive or immersive user experiences. For example, the XYZT exhibition provided by the Peabody Essex Museum in Massachusetts was

> an immersive art exhibition comprised of 10 interactive virtual environments generated using math and physics models. . . . . . The experience melds playful exploration with scientific reasoning, as each installation is accompanied by a video label on the nature of the underlying physical behavior, complete with excerpts from related dance performances.[28]

28 "XYZT: A Journey in E Dimensions," Peabody Essex Museum, accessed 20 December 2017, https://www.pem.org/exhibitions/xyzt-a-journey-in-4-dimensions.

However, this museum did not have a collection catalogue or a full online exhibition. Very rarely, evidence for using advanced technologies for accessing online collections could be found. One example was the North Carolina Museum of Natural Sciences, where objects in online catalogues were geo-referenced and discoverable on a map. Linked data and API technologies, which open the potential for various creative uses of metadata,[29] were not used by any of the sampled museums.

Crowdsourcing power has been widely discussed and implemented for transcribing manuscripts, creating metadata, and creating online collections.[30] However, only three of the sampled museums utilized crowdsourcing power to provide online access. The North Carolina Museum of Natural Sciences invited the public to transcribe handwritten catalogue records for specimens, and the Bowdoin College Museum of Art asked users to suggest keywords to add to the metadata records for its objects. The Minnesota Historical Society allowed users to add comments to the metadata records. It also provided users the option to create their own personal collections by assembling online resources based on their personal interests; this could be seen as a form of crowdsourcing because it essentially gave public users the opportunity to create their own online exhibitions, offering multiple perspectives on collection items.

Discussion

Early Stages of Development in Integrated Online Access

Museums in the United States are still in the early stages of providing integrated online access to their collections. This can be seen from the large percentage (29 percent) of sampled museums that did not even mention their collections on their websites; the relatively low percentage (25 percent) that provided integrated online collection access; the fact that the sampled museums that did provide online access might have only a small portion of their collections online; and the fact that cutting-edge technologies were underutilized for online

29 Jinfang Niu, "Linked Data for Archives," *Archivaria* 82, no. 1 (2016): 83–110.

30 Michael Lascarides and Ben Vershbow, "What's on the Menu?: Crowdsourcing at the New York Public Library," in *Crowdsourcing our Cultural Heritage*, ed. Mia Ridge (London: Routledge, 2016), 113–38; Katherine A. Mika, Joseph De Veer, and Constance Rinaldo, "Crowdsourcing Natural History Archives: Tools for Extracting Transcriptions and Data," *Biodiversity Informatics* 12 (2017), doi:10.17161/bi.v12i0.6646.

collection access. Before the study began, the author expected to see the types of relationships between objects and related records explicitly described using controlled terms. For example, the term "donor records" can be used to explicitly describe the relationship between a museum object and associated archival records. Further, the author expected to see that the semantics of the controlled terms were made machine-understandable and that the relationships represented by the terms could be processed by software in numerous ways. However, none of the five approaches of integrated online access discussed above provided such detailed and structured descriptions of relationships.

In approach A (integrated catalogues/digital repositories and cross-searching interfaces), although objects and archives were discoverable through the same interface, there was no explicit link between objects and related records. It was up to the user to figure out which objects were associated with which records. Although metadata in the catalogue might include identifiers and accession numbers, which could serve as links between objects and associated records, these links were not made explicit to external researchers who did not know the functions and construction of those numbers; the links might have made sense only to internal staff. In approach B (archives used as metadata for objects), objects and associated records were clearly and closely bound together. However, users had to interpret the specific kinds of relationships between archival records and museum objects based on their own understanding. In addition, this relationship information – tacit knowledge within the human brain – was not available for other people to reuse or for software to process. In approaches C (online exhibitions), D (theme- or entity-based browsing), and E (research guides), objects and records were indirectly related through certain themes or provenances. In other words, objects and archives appeared in the same online exhibition, browsing interface, or research guide because they both were related to a certain topic or shared the same provenance. A user might be able to see or interpret the direct relationship between certain objects and records through the narratives provided in the exhibition or research guide. However, that relationship was not described in a structured way, so it might not be apparent to some users, and it was also difficult for software to process.

Nevertheless, the fact that online access and even integrated online access does exist shows great improvement from a decade ago, when people believed that museum collection data was designed primarily for internal use and was

generally not a ready fit for the Web.[31] In addition, some of the approaches of integrated online access found in this study have not been used by DPLA and Europeana, which are large-scale, inter-institutional initiatives. DPLA and Europeana are essentially two integrated online catalogues. They also provide online exhibitions and allow multiple ways to browse and access integrated resources, such as through maps, timelines, and subjects. Europeana and DPLA might also consider using digital/digitized archives as metadata for museum objects. Research guides created by individual museums might be submitted to DPLA and augmented with similar resources from other institutions.

Driving Forces for Online and Integrated Online Access to Disparate Resources

Online access and integrated online access to disparate museum collections are likely to become more common in the future. One driving force toward this direction is the advantage of online access compared with physical access. Creating an exhibition requires in-depth research of the collections. However, this expensively constructed product is often discarded after the physical exhibition is finished. Even if exhibition records are preserved, they are difficult for the public to access. In contrast, online exhibitions do not take up much physical space and can remain online permanently. In addition, they can be available around the world and reach much wider audiences than physical exhibitions. Online catalogues are even more useful than online exhibitions in certain aspects. An exhibition, by definition, demonstrates only a portion of a collection based on a certain theme, whereas a catalogue can potentially cover a full collection. In addition, catalogues are based on structured data. In an era of linked open data, catalogue data can be exported from the database, published as linked open data, and subjected to various data manipulations, such as statistical analysis, visualization, aggregation, and integration with other sources to produce various creative applications and services (mash-ups).[32] Museums usually have inventories, documentation files, or catalogues for internal use.[33] They also traditionally publish exhibition catalogues or collection catalogues for

31 Paul F. Marty and Katherine Burton Jones, *Museum Informatics: People, Information, and Technology in Museums*, vol. 2. (New York: Taylor & Francis, 2008).

32 Gustavo Candela, Pilar Escobar, Rafael C. Carrasco, and Manuel Marco-Such, "Migration of a Library Catalogue into RDA Linked Open Data," *Semantic Web* Preprint (2017): 1–11; Niu, "Linked Data for Archives."

33 Polly Darnell, "Arrangement," in Wythe, *Museum Archives*, 35-42.

public use. Today, many exhibition catalogues are produced in digital format and are made accessible online. For example, the Artists Archives of The Western Reserve publishes its exhibition catalogue as a PDF file. The Bowdoin College Museum of Art has digitized print collection catalogues and exhibition catalogues. These existing collection management tools can be a good foundation for creating searchable online catalogues that are permanently online.

The LAM convergence trend will also push forward integrated online access. Other than the aforementioned research and practical initiatives on integrated online access to disparate resources, there are other indicators of LAM convergence: librarians are hired to catalogue museum objects, and museum curators are trained with library and information science (LIS) skills. In the past, the majority of museum professionals did not have formal training in information organization and management.[34] Instead, they were trained in museum studies or particular subject fields. For example, curators in art museums are usually trained in art history, and curators in natural history museums are usually scientists in relevant fields. Without LIS training, and with a long tradition of providing access through physical exhibitions, many museum professionals may not have sufficient cataloguing skills or may not know that online catalogues or online exhibitions are powerful tools for fulfilling their missions. However, this situation is likely to change. Some museums have started to hire librarians to catalogue objects.[35] LIS schools such as Kent State University and Florida State University have started to offer training in museum studies. Students who are trained in these programs will have both LIS skills and museum management skills. As more and more of these students enter the workforce, they are likely to improve collection management in museums.

Unclear Boundaries between Museums and Archives and Further LAM Convergence

Findings from this study suggest that the boundary between museums and archives, as two different kinds of institutions, is far from distinct. Some of the sampled museums, such as the Klamath County Museums and the Calhoun

34 Paul F. Marty, "So You Want To Work in a Museum . . . Guiding the Careers of Future Museum Information Professionals," *Journal of Education for Library and Information Science* (2005): 115–33.

35 Gabriela Zoller and Katie DeMarsh, "For the Record: Museum Cataloging from a Library and Information Science Perspective," *Art Documentation: Journal of the Art Libraries Society of North America* 32, no. 1 (2013): 54–70.

County Museum, although named as museums, in fact primarily manage archival materials and/or publications. On the other hand, the Artists Archives of The Western Reserve is named as an archive, but it is a member of AAM and its website describes it as both an archival facility and a museum. Correspondingly, the St. Mary's County Historical Society states that its collections "are primarily composed of documentary and archival materials with a focus on the county's people, places, and events."[36] Still, it is a member of AAM and thus considered a museum. Some institutions, such as the Ukrainian Museum-Archives and the Stonewall National Museum & Archives, include both museum and archives in their names, indicating their strong collection focus on both objects and archival materials.

According to the International Council of Museums (ICOM), the definition of a museum has evolved in line with developments in society. The ICOM's current definition of a museum is "a non-profit, permanent institution in the service of society and its development, open to the public, which acquires, conserves, researches, communicates and exhibits the tangible and intangible heritage of humanity and its environment for the purposes of education, study and enjoyment."[37] While this definition covers many features of museums, from the collection management perspective, it does not seem to differentiate very much between museums and archival institutions, which also acquire, conserve, research, communicate, and exhibit the tangible and intangible heritage of humanity.

Findings also suggest that the boundary between objects and archives, as two different kinds of resources, is often unclear. Archival materials are often managed as aggregates. It is uncommon for individual archival records to be catalogued and described. In contrast, museum objects are usually managed as individual items, although collection-level management does exist. However, when individual archival records are examined, some of them can also be considered as objects. In fact, manuscripts and photos, which are usually managed by archival institutions, are often catalogued in the same manner as objects in museums. For example, at the J. Paul Getty Museum, manuscripts and photos are catalogued using the same metadata format as antiquities, paintings, sculptures, decorative

36 "Mission Statement," St. Mary's County Historical Society, accessed 20 December 2017, https://stmaryshistory.org/about.php.

37 Museum Definition," International Council of Museums, accessed 20 December 2017, http://icom.museum/the-vision/museum-definition/.

arts, and drawings. The collection catalogues examined in this study include mostly physical objects and digitized records. In the future, when a large portion of museum collections are comprised of born-digital objects and records, which lack physical attributes such as dimensions and material types, the boundary between objects and archives/records might become even less clear.

These unclear boundaries show commonalities between museums and archives as institutions as well as similarities between objects and records as resource types. These commonalities and similarities provide a basis for the integrated description of and access to objects and archives, and they also serve as rationales and facilitators for LAM convergence.

Limitations and Future Research

The author and the GA tried their best to explore the websites of the museums to identify related information. However, they might have missed some information or made unintentional mistakes. For example, they might have missed a hyperlink on the website of a museum and thus might have been unable to find an online digital repository. The author takes all responsibility for any errors in this article.

This study examined the websites of museums and discovered whether and how integrated access was represented on the user interface. It did not tell us why some museums did not provide online access or integrated online access. The author plans to conduct a future study to interview museum workers to identify the barriers and facilitators of online access to museum collections.

Conclusion

It would greatly benefit users if they could find disparate resources in an integrated manner, rather than having to search for archives, museum objects, and other types of resources in different places. In light of this, a great deal of research has been conducted on integrated access to disparate resources across many institutions on the regional, national, and international scales. However, research on integrated access to disparate resources within individual institutions is scarce. This study was conducted in order to fill this gap and to find out to what extent integrated online access has been provided by

individual museums in the United States. It has found that less than one-third of the sampled museums have provided integrated online access to objects and archives. Although this is far from ideal, much progress has been made since a decade ago, when people believed that museum collection data should not be shared on the Web. In the future, integrated online access to disparate resources is likely to be more common due to the merits of online access and the trend toward LAM convergence.

BIOGRAPHY Jinfang Niu is an associate professor at the School of Information, University of South Florida. She received her PhD from the University of Michigan, Ann Arbor. Prior to that, she worked as a librarian at the Tsinghua University Library, Beijing, for three years. She is recently interested in the convergence between library science, archival science, and museum studies, and more specifically, the integrated access to various kinds of cultural heritage materials through innovative means.

Appendix: Questionnaire

1. Name of the museum:

2. Does the museum have a website?
   - ○ Yes
   - ○ No online presence at all
   - ○ Online presence is provided through other means, such as Facebook page, etc. Please record the specific types of online presence.

3. How many staff members does this museum have?

4. How many objects does this museum have?

5. What is the operating budget or endowment or other financial information?

6. Does the museum have an online catalogue for museum objects?
   - ○ Yes
   - ○ No

7. Does the catalogue include records/archives?
   - ○ Yes
   - ○ No
   - ○ Not sure

   Please explain why.

8. Does the museum website contain finding aids for its records/archive collections?
   - ○ Yes
   - ○ No

9. Is the catalogue linked with the finding aids?
   - ○ Yes. There is a direct link from museum objects and records/archives and vice versa.
   - ○ Yes. There is an indirect link through another kind of entity. For example, a link is provided from the object to the artist, and then to the personal records of the artist.
   - ○ No
   - ○ Not applicable

10. Does the museum website contain or link to digital/digitized records/archives?
   - ○ Yes
   - ○ No

11. Are the museum objects linked with digital/digitized records/archives?
   - ○ Yes. There is a direct link from museum objects and records/archives and vice versa.
   - ○ Yes. There is an indirect through another kind of entity. For example, a link is provided from the object to the artist, and then to the personal records of the artist.
   - ○ No

12. If museum objects are linked with records/archives, are the relationships between museum objects and records explicitly described?
   - ○ Yes
   - ○ No

13. Are museum objects and records/archives searchable through a common entry point?
   - ○ Yes
   - ○ No

14. Does the museum website allow browsing of theme-based digital collections that include both museum objects and records?
   - ○ Yes
   - ○ No

15. Does the museum utilize linked data for museum data?
    - ○ Yes
    - ○ No

16. Does the linked data include both museum objects and records/archives?
    - ○ Yes
    - ○ No

17. Is crowdsourcing power, such as user tagging and comments, utilized for describing museum objects or records/archives?
    - ○ Yes
    - ○ No

18. Does the museum website allow users to create their own online collections of objects and records?
    - ○ Yes
    - ○ No

19. Does the website contain online exhibitions? (An online exhibition includes only digitized/digital objects. An introduction of an exhibition does not count as an online exhibition.)
    - ○ Yes
    - ○ No

20. Do the online exhibitions contain both museum objects and records/archives?
    - ○ Yes
    - ○ No

21. Do you think this museum website provides integrated online access between museum objects and records/archives?
    - ○ Yes
    - ○ No

    Please use your own words to describe how integrated online access is provided for museum objects and records/archives.