

Chapter 14

Personal Digital Collections: Involving Users in the Co-Creation of Digital Cultural Heritage

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ABSTRACT

Personal digital collections systems, which encourage visitors to museum websites to create their own personal collections out of a museum's online collections, are the latest trend in personalization technologies for museums and other cultural heritage organizations. This chapter explores the development, implementation, and evaluation of different types of personal digital collection interfaces on museum websites, from simple bookmarking applications to sophisticated tools that support high levels of interactivity and the sharing of collections. It examines the potential impact of these interfaces on the relationship between museums and their online visitors, explores the possible benefits of involving users as co-creators of digital cultural heritage, and offers an analysis of future research directions and best practices for system design, presenting lessons learned from more than a decade of design and development of personal digital collections systems on museum websites.

INTRODUCTION

Digital representations of cultural heritage have transformed the way museums and other cultural heritage organizations interact with their visitors. The widespread availability of digital collections has resulted in unprecedented levels of access,

offering museum visitors new opportunities for interactivity, many of which are unique to the online environment. One of the more innovative of these opportunities revolves around the ability of libraries, archives, and museums to involve users in the personalization and co-creation of digital collections of cultural heritage.

This ability is best exemplified by personal digital collections (also known as “my collection”

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or “my museum”) interfaces on museum websites, where online visitors are encouraged to build their own personal collections of the museum’s online artifacts, returning to view, modify, and interact with them at their leisure. The primary purpose and implementation of these tools range from simple bookmarking applications to extremely sophisticated interfaces that empower educators and researchers to construct new knowledge out of existing digital cultural content by customizing museum information resources to create new presentations, activities, reports, etc. In theory, the ability to create and manipulate personal collections encourages visitors to develop a personal relationship with collections, and helps them develop lifelong relationships with museums and other cultural heritage organizations. In reality, the success of these systems has been mixed, especially when viewed from the perspective of multiple audiences with diverse needs and expectations.

This chapter examines the development, implementation, and evaluation of personal digital collections systems over the past decade. It addresses such questions as: When do they succeed? When do they fail? What lessons have we learned that can inform the successful design of similar interfaces? How will emerging web 2.0 trends focusing on social media, mash-ups, and integration affect the future of these tools? It answers these questions by providing an overview of existing research about personal digital collections systems, a survey of select systems developed over the past decade, and a discussion of the best practices for the design and development of systems that encourage users to create their own personal collections of digital cultural heritage, thereby becoming co-creators of their own digital culture.

BACKGROUND

Revolutionary trends in personalization have occurred in the online museum environment over

the past two decades (Beardon & Worden, 1995; Bowen & Filippini Fantoni, 2004). As museums and other cultural heritage organizations explore new methods of making their collections available online, the focus has shifted from providing information about objects to providing visitors with new opportunities for interactivity. Many museums now encourage their visitors to draw connections between cultural artifacts, and share those connections with other museum visitors (Bearman & Trant, 2005; Dietz et al., 2004; cf. Borgman, 2003). Online visitors are encouraged to add value to digital collections of cultural heritage, contributing their knowledge to the museum’s collections by adding new connections and interpretations across user communities (cf. Lynch, 2002).

The popularity of such activities has raised a variety of questions about the consequences of allowing users to create and manipulate personal digital collections of cultural heritage. Some researchers have focused on the educational potential of allowing museum visitors to act as curators and design their own online collections and exhibits (Adams et al., 2001). Others have attempted to assess the effectiveness of these tools by examining the ability of personal digital collections to encourage museum visitors to feel more involved with or connected to digital cultural heritage (Filippini Fantoni & Bowen, 2007). This section addresses these and related research questions, providing an overview of the key findings from the literature on this topic.

Personalization and the Museum Visitor

Personal digital collections systems are just one of many tools available for museum professionals who are interested in personalizing the museum experience for their visitors. Many different technologies to support personalization, in the museum and online, have been developed over the past couple of decades (Marty & Jones, 2008;

Thomas & Mintz, 1998), ranging from interactive portals of museum information resources (e.g. “My Met Museum”) to interfaces capable of adapting information resources dynamically to meet the different needs of different users (Paterno & Mancini, 2000).

Perhaps the most common of the technologies museum visitors can use for personalization in the gallery are the handheld audio guides available in many museums to supplement gallery tours. Audio guides, whether they are developed for portable CD-players, iPods, or handheld computers, can provide visitors with the ability to access detailed descriptions of individual works of art and even create their own personal tours complete with online access to their favorite artifacts (Din & Hecht, 2007). In their latest incarnation, audio guides even support the co-construction of new digital knowledge, allowing museum visitors to work collaboratively to annotation collections with audio comments (Puig et al., 2009).

Like all new technologies, the development and use of these devices can be problematic, and the history of interactive tools for personalizing the museum visit has led many to question their success and relative value (Schwarzer, 2001). Some researchers question whether personalized, interactive technologies actually improve the process of visiting the museum. Studies demonstrating that visitors spend more time in galleries while using interactive technologies, for example, raise important questions about whether the additional time spent in the galleries by visitors using handheld computers is time constructively spent (Evans & Sterry, 1999). While visiting a museum with interactive technologies is clearly attractive to many museum visitors (witness the growing popularity of pod-casting museum audio tours (Samis & Pau, 2006)), it is possible that visitors using interactive devices may spend more time in galleries learning how to use these devices than actually learning from them.

Others raise concerns about the social implications of using interactive, personalized technolo-

gies while visiting museums. Does the widespread use of audio guides in galleries, for instance, enhance or detract from the social experience of visiting a museum with friends or family? Researchers have explored methods of making audio guides less socially isolating, allowing visitors to eavesdrop, for example, on their fellow visitors (Woodruff et al., 2002). Researchers have also explored ways of extending the social experience outside of the museum itself, allowing visitors within physical galleries to interact and converse with online visitors to those same galleries using the museum’s website (Galani & Chalmers, 2002). Other have studied the social interactions among museum visitors who co-visit museum websites in groups while online, taking virtual tours led by virtual docents over the internet (Paolini et al., 2000).

Recent research into personalization technologies has focused on ways of using pervasive or ubiquitous computing techniques to create personalized experiences in museums and on museum websites (Arts & Schoonhoven, 2005; Hsi & Fait, 2005; Silveira, et al., 2005). Nowhere have these technologies had a greater impact on the museum visitor than in the online world of museum websites. Recent technical advances have led to dynamic, adaptive virtual museum environments where the entire museum experience can be shaped by personalization technologies. Online visitors can take virtual tours that vary in content according to user-definable profiles selected by the virtual visitor (Paterno & Mancini, 2000), learn more about the role of the curator by curating and exhibiting their own personal galleries (Adams et al., 2001), and create their own personal digital collections (Bowen & Filippini Fantoni, 2004).

Personalization technologies on museum websites have become increasingly popular over the past decade. A recent study showed that online museum visitors strongly agreed that museum websites should take advantage of the online environment to present unique experiences that cannot be duplicated in museums (Marty, 2008).

In particular, this study showed that the majority of online museum visitors agreed or strongly agreed that museum websites should offer interfaces that can be customized to meet the needs of different online visitors (e.g. virtual tours that adapt to individual interests), as well as interfaces that can record and store personalized information for different online visitors (e.g. personal digital collections of selected museum artifacts).

Personal Digital Collections on Museum Websites

The latest trend in museum personalization is the development of “personal digital collections,” which allow virtual visitors to save selected objects from online collections on a personalized page available on a museum’s website (Filippini Fantoni & Bowen, 2007). These interfaces are becoming increasingly common; museums as diverse as the Boston Museum of Fine Arts, the National Museum of Australia, and the Tate Online offer visitors the ability to create their own personal collections of digital cultural heritage. Visitors can return to view their collections whenever they like, add and remove artifacts at will, and (with some of the more advanced systems) annotate their collections with personal observations (and even media in some cases) and share their collections with others online.

While implementations of these systems range from the simple to the complex, they all share the goal of allowing online museum visitors to arrange information of significance to them in some personal way. The Metropolitan Museum of Art, for instance, allows visitors to bookmark their favorites from a selection of available artifacts online. ArtsConnectEd, a joint project of the Minneapolis Institute of Arts and the Walker Art Center, offers visitors the ability to create multiple collections of cultural heritage and related digital resources (e.g. audio, video, texts, and multimedia), annotate them with textual descriptions, and then distribute them to others. The Fine Arts Mu-

seums of San Francisco allows online visitors to choose from over 80,000 works of art and arrange their selections into virtual galleries. The Getty encourages online visitors to create a collection of their favorite museum artifacts online, and then print out a customized map showing the location of these favorites in the museum itself.

Museum visitors have reacted generally positively to the development of these tools, and frequently use personal digital collections systems for reasons that go beyond making a simple list of favorite artifacts. Visitors planning a first-time visit to an unfamiliar museum may use such interfaces to create their own personal list of must-see artifacts. Educators preparing lectures may use such systems to replace more traditional slides and print media within a range of academic applications. Curators applying for jobs in a new museum may use personal digital collections systems to increase their understanding of the museum’s collections, generating their own lists of favorites to highlight in a presentation. In the age of web 2.0, online visitors of all types are primed to take advantage of the features offered by personal digital collections systems, especially those who use social computing and networking tools regularly to accomplish their tasks.

For museum professionals, personal digital collections systems provide a valuable tool that allows them to adapt their online products, services, and information in ways that better meet their visitors’ individual needs and characteristics. By integrating such systems into their websites, museum professionals can help support visitor choice and self-directed exploration, facilitate personal connections between visitors and content, sustain visitor participation, and offer even more opportunities for integration and engagement with collections. For some, the hope is that visitors who are encouraged to “save” their favorite artifacts online will develop a stronger interest in the collection. It is possible that the ability to create personal digital collections serves as a lure, encouraging visitor not only to explore these objects online,

but also to visit these objects in person. Excited by seeing their current favorites online and finding new ones at the museum, visitors will hopefully return to the website before and after each visit, looking up more information about their current favorites, and eventually adding new objects.

Unfortunately, current research shows that, with the exception of systems designed to meet specific educational needs, the success of these systems has so far been relatively limited (Filippini Fantoni & Bowen, 2007). Recent studies at the Tate Modern and the Getty Museum reveal that the use of personal digital collections tends to be quite superficial, and confined mainly to young people, experts, teachers, students, and frequent visitors (Filippini Fantoni, 2006a, 2006b). Visitors surveyed as part of these studies indicated a lack of time or interest as the primary reasons for not using these systems; in addition, many visitors did not feel the need to prepare for or follow up on their visit using systems that allow them to bookmark selected artifacts. Other factors that influence the limited success of personal digital collections tools included a fear of sharing personal information, and technical issues that can make it difficult for visitors to use new, and frequently unfamiliar systems.

Many of these issues, however, are not limited to personalization tools; they also affect other technology-based applications in museums, which suffer from similarly disappointing results. It is likely, therefore, that the problem lies not so much with the notion of personalization, which remains relevant for museums and other cultural heritage organizations, but rather with the massive investment in new technologies that the implementation of personalization requires. This poses problems not only for museum professionals, who frequently face limited technical competencies and small technology budgets, but also for museum visitors, the majority of whom are unfamiliar with the more sophisticated technologies that drive personal digital collection tools. Museum professionals and visitors are struggling with the need to develop

new models of visiting and interacting, of awareness and marketing. Consequently, until museums find more effective ways of implementing new technologies, and until the use of technology becomes more widespread in their visitors' everyday lives, it will be necessary for museums to lower their expectations regarding the effective use of most technology-based applications, including personalization tools.

There is a strong need for more research examining how personal digital collections have been implemented by museum professionals, how they have been used by online museum visitors, and how effective they are at meeting the needs and expectations of visitors and professionals alike. Given the continuing interest that many museums have with personalization technologies, along with the increasing familiarity of museum visitors with new technologies, it is important that research on this subject continues, especially considering the significant financial and intellectual resources needed to develop and implement these applications. The next section of this chapter provides an overview of the design, development, and use of personal digital collections systems, and offers critical lessons learned for future systems design.

PERSONAL DIGITAL COLLECTIONS: PAST, PRESENT, AND FUTURE

The implementation of personal digital collections systems on museum websites has become increasingly popular over the past decade. While the majority of these systems are custom-designed for specific museums or for specific audiences, and thus essentially unique, they do share certain design elements in common, including the ability to identify, group, annotate, and share collections of digital culture.

This section of the chapter provides an overview of the past, present, and future of these systems, beginning with a discussion of the history and different types of personal digital collec-

tions tools on museum websites. It explores their most common interface features, and provides examples of the most popular systems, from simple bookmarking applications, to more complex “my museum” interfaces, to sophisticated personal digital collection systems that allow for and encourage high levels of interactivity and the sharing of collections among online museum visitors. It examines the potential impact of such systems on the relationship between museums and their online visitors, exploring the ability of personal digital collections to extend the museum visit beyond the gallery walls, and to encourage stronger relationships between museums and their visitors, in the galleries and online. Finally, it concludes with an analysis of best practices for system design, based on a recent case study of the ArtsConnectEd project, presenting lessons learned from more than a decade of design and development of personal digital collections systems on museum websites.

My Museum: Personal Collections and Personalized Environments

The concept of a personal digital collection was first introduced in the mid-1990s by Beardon & Worden (1995), who developed a prototype system called the virtual curator. Their prototype allowed users to construct an exhibition or display on their own, choosing the objects in which they were most interested and eventually writing comments about them, with the aim of drastically changing the underlying metaphor of pre-classified exhibitions. This project, which initially started as a tool that would enable design students to gain the intellectual benefits of curating a small exhibition without all of the resources required to stage a real one, paved the way for a series of initiatives that are now available on a growing number of museum websites (Bowen & Filippini Fantoni, 2004).

One of the first examples to be developed by a museum was “My Met Gallery,” which has been

available since 1999 on the Metropolitan’s website (http://www.metmuseum.org/Works_of_Art/gallery.asp). With this system, visitors can select their favorite works of art from the museum’s online collections and save them to a personal page that may be visited and updated later. This personal digital collection tool offers an excellent example of one of the simplest possible implementations; visitors may not have more than one personal collection, nor can they annotate or share their collection with others. They cannot even re-organize the artifacts in their collection; all they can do is add and remove artifacts (see Figure 1).

Since then, dozens of museums have introduced their own personal digital collections interfaces, many of them with increasingly sophisticated tools and technologies. Examples include the Cleveland Museum of Art’s Personal Collection (<http://www.clemusart.com/explore/collectionLogin.asp>), the Whitney Museum of American Art’s Your Collection (<http://www.whitney.org/Login>) and the recently redesigned Art Collector (<http://www.artsconnected.org/collector>), which provides access to the collections of the Minneapolis Institute of Art and the Walker Art Center as part of the ArtsConnectEd project.

Many of these newer systems allow visitors to create multiple collections, annotate the artifacts in their collections with comments, and share their collections with friends and families via email or on Facebook, Twitter, and other social network websites. Some even allow visitors to turn their collections into their own personal virtual exhibits, with the ability to zoom into digital images, compare multiple artifacts, and so on. ArtsConnectEd’s Art Collector provides an excellent example of these more complex functions; see Figure 2 for an example of a set created with Art Collector illustrating, among others, the ability to compare two separate works of art on one slide (see Mouse and Cat, lower left).

The availability of these tools is particularly helpful for individuals accessing online digital collections for research and educational purposes.

Personal Digital Collections

Figure 1. A sample “My Met Gallery” at the Metropolitan Museum of Art website (<http://www.metmuseum.org>). ©2010. The Metropolitan Museum of Art. Used with permission

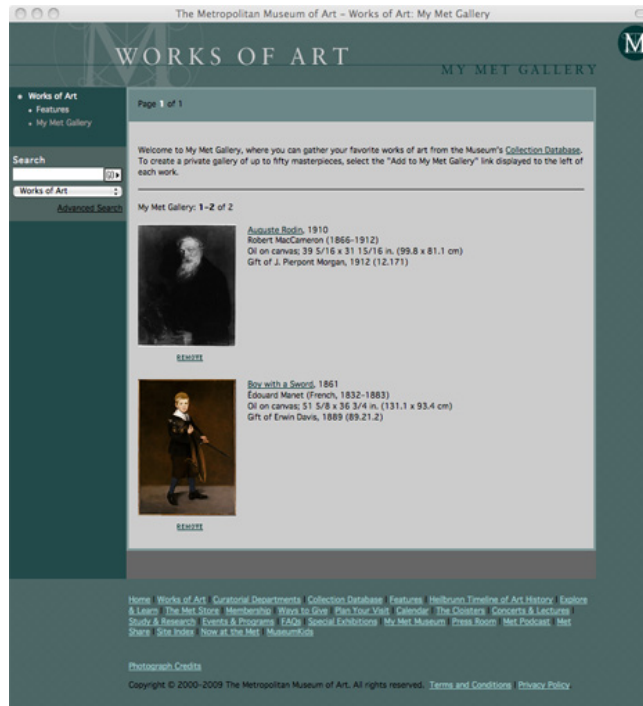
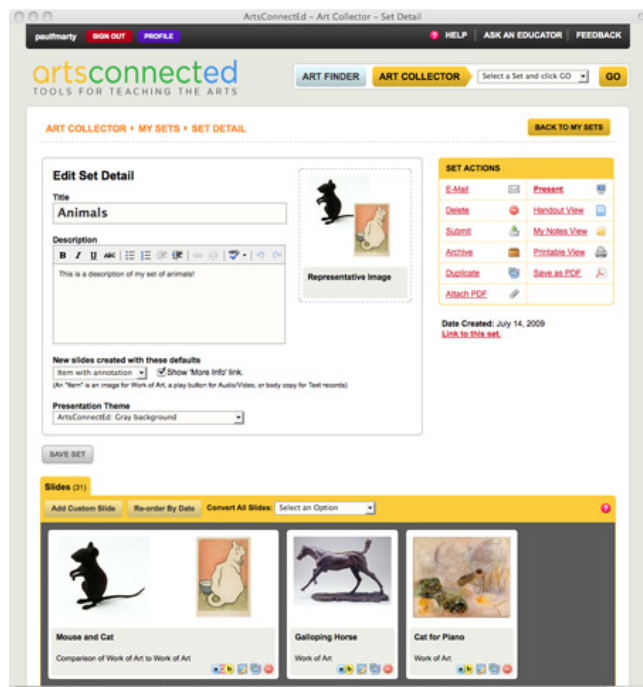


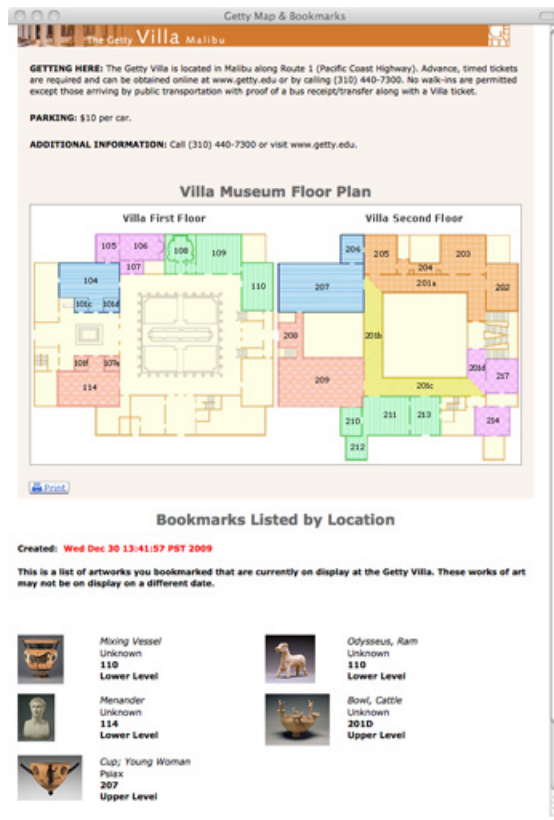
Figure 2. A sample set created using “Art Collector” at the ArtsConnectEd website (<http://www.artconnected.org>). ©2010. ArtsConnectEd. Used with permission



Educators, for example, can select a list of artifacts prior to a visit, set up study sets, provide personalized recommendations, and test knowledge acquired during a visit by asking their students to create personal collections. A teacher planning a field trip to a museum could create an online exhibit, including all the objects the students will see on their trip, complete with annotations that explain why each object is important and how it relates to the class's lesson plans. In some cases, teachers may assign students to use these tools as a means for generating their own class projects and presentations. By supporting visitors' individual interests, these solutions can be very useful in supporting the learning process regarding objects in the collection.

Personal online collections can also be helpful for museum visitors wishing to more carefully plan their trip to the museum. The J.P. Getty Museum's Getty Bookmarks (<https://www.getty.edu/mygetty/>), the Tate Britain's My Tour (<http://www.tate.org.uk/britain/explore/etb.jsp>), and the Musée d'Orsay's Plan Your Visit (<http://www.musee-orsay.fr/en/tools/my-selection/>) offer features that allow online visitors to identify the artifacts they want to see on their visit, and create a printable map of those selected artworks which they can bring with them to the museum. Figure 3 shows an example gallery map automatically generated by the Getty Museum's website, indicating the location of selected Greco-Roman artifacts currently on exhibit in the Getty Villa.

Figure 3. A sample map created using the "Getty Guide" at the Getty Museum website (<http://www.getty.edu>). ©2010. The J. Paul Getty Trust. All rights reserved



Existing systems can be even made more complex by adding tools that contribute to the creation of a “personal environment” within the museum’s website, which can be customized according to one’s needs. Visitors can select links to their favorite sections of the website, access their personalized agendas, and store links to images, information or articles for future research. These applications are primarily designed for frequent visitors or for special categories of visitors who use the website as a working tool, such as teachers, journalists, experts, students, or researchers. Once a page has been created and customized, visitors can log in every time they access the website to find all the information they need.

The Metropolitan Museum of Art, for example, provides a complete “My Met Museum” system, which includes the already mentioned “My Met Gallery” along with a “My Met Calendar,” a subscription to a free newsletter, and a “Rapid Check Out” option to facilitate purchases in “The Met Store” (<https://www.metmuseum.org/mymetmuseum/>). Similar “My Museum” applications—integrating personal digital collections systems with visit planning tools, online calendars, and the like—are available on the websites of the Philadelphia Museum of Art (<https://www.philamuseum.org/myMuseum/>), the Virtual Museum of Canada (<http://www.museevirtuel-virtualmuseum.ca/MyExhibits.do?lang=en>), the Museum of Modern Art (<http://www.moma.org/>), and the Musée du Louvre (<http://www.louvre.fr/llv/perso/>). The Louvre application, called “My Personal Space,” not only allows visitors to save artwork from the museum’s online collection but also allows them to subscribe to the *louvre.fr* newsletter, create personalized tour plans, and access many other educational resources.

In these ways, museum professionals have used a variety of new technologies to support the changing needs and expectations of their online visitors. While the features of these websites are constantly evolving, a summary of technologies

and capabilities at this point in time can be very helpful as we seek to improve our understanding of the role of personal digital collections on museum websites. Table 1 provides a list of some of the most popular systems currently available on museums websites, highlighting the different functionalities that they offer, including whether the application allows the visitor to create multiple collections, to publish, email, and annotate their collections, and create a printable map showing the location of their collections in the museum’s galleries. The most frequently occurring features include the ability to manage multiple collections and email them to others, while the least frequently occurring include the ability to publish collections and produce printable maps.

Personalization’s Potential: Extending the Visit Beyond the Museum Walls

Personal digital collections systems, originally designed for online use only, have recently been expanded to cross the boundaries between online and on site museum visits, thanks to the development of new technologies that allow visitors to save information from interactive kiosks and mobile devices while visiting the museum for use after their visit. Information bookmarked in this way can be retrieved either via links in an email sent to the visitor, or via a personal page on the museum’s website, accessible through a username and password (Filippini Fantoni & Bowen, 2007).

When well-integrated into the visitor experience, these applications can be a powerful tool to facilitate learning and to extend the visitors’ experience beyond the museum’s walls. Visitors can be overwhelmed by the vast amount of information presented in kiosks or on mobile guides, and the ability to save content and access it somewhere else offers visitors the flexibility to focus more on discovery and the aesthetic experience in the museum and to leave the more traditional didactic aspects for later. Research also indicates

Table 1. A comparative analysis of some of the most popular personal digital collection systems

Museum	PDC System	Multiple Collections	Publish Collections	Email Collections	Annotate Collections	Map Collections
Art Institute of Chicago	Art Explorer	X	X		X	
Metropolitan Museum of Art	My Met Gallery					
MFA Boston	My MFA Gallery	X				
MFA Boston	MFA Educators	X	X	X	X	
Minneapolis Institute of Art / Walker Art Center	Art Collector (ArtsConnectEd)	X	X	X	X	
MOMA	My Sets	X		X	X	
Musée d'Orsay	Personal Album / Plan your visit					X
Musée du Louvre	My Album	X		X		
Peabody Essex Museum	ArtScape	X		X		
Philadelphia Museum of Art	My Gallery	X		X		
Seattle Art Museum	My SAM Collection	X	X	X	X	
Tate Modern	My Selection	X				
Tate Britain	My Tour	X				X
Virtual Museum of Canada	My Images	X			X	
Whitney Museum of American Art	Your Collection		X	X	X	

that repetition is a major mechanism for retaining memories over time (Brown & Kulick, 1997), so these applications can play an important role in increasing visitors' knowledge about a collection or exhibition as well as stimulating a positive response and the intrinsic desire to learn more.

To take advantage of these potentials, museums have been incorporating bookmarking features in their kiosks and mobile guides over the past several years. The J. Paul Getty Museum, for instance, developed a series of multimedia kiosks (Filippini Fantoni, 2006b) in 2005; available at the Getty Center and the Getty Villa, these kiosks allow visitors to access and save content of interest (including videos, descriptions of artworks, and artist biographies) concerning the museum's collection, history, architecture, etc. Bookmarked

information can be accessed at the kiosk during subsequent visits or as a personal collection available on the museum's website. Similarly, the UK National Gallery's Art Start kiosks include an "Add it to My Tour" feature that allows visitors to bookmark objects from the collection, which can then be sent via email and/or printed out on a map highlighting their location in the museum so that visitors can find them more easily during the visit (Filippini Fantoni, 2006a).

These applications have been extended to mobile technology that accompanies visitors through the galleries, capturing spontaneous interests and bursts of curiosity so that visitors can follow up later on what catches their attention during the visit. Guidebook, a project developed in 2000 by the Exploratorium Museum in San Francisco

in cooperation with the Concord Consortium and the Hewlett-Packard Laboratories in Palo Alto, provides an excellent example; while providing visitors with audiovisual information about the exhibits in the museum, this handheld device also “remembers” a visit to the museum, allowing visitors to bookmark exhibits of interest and to send user-captured souvenir photographs to a personalized webpage for viewing after the visit (Hsi, 2008). Similar projects have been developed at the Tate Modern (SMART guide), the Natural History Museum in London (Barry, 2006), the Cité des Sciences et de l’Industrie in Paris (Topalian, 2005), the Boston Science Museum (Reich & Chin, 2006), and the Dulwich Picture Gallery in London (Filippini Fantoni & Bowen, 2008).

Projects such as these have helped dramatically improve our overall understanding of the role of interactive technologies before and after museum visits, in the galleries and online (Marty, 2007). By orienting visitors prior to a visit, and offering opportunities to explore related ideas after a visit, personal digital collections systems can offer a level of continuity, not only between the different phases of the museum experience (i.e. before, during, and after visits), but also between online and onsite experiences. To describe this phenomenon, Ailsa Berry, Head of Interactive Media at the London Natural History Museum, has coined the term, the “virtuous circle” (Berry, 2006). Museums are only now recognizing the full potential of integrating these two key areas as well as the value this integration brings to the visitor experience. It is extremely important that museum professionals offer museum visitors a user experience that combines physical and virtual offerings, through a journey that extends from the web to the museum and vice versa. Personalization technologies in general, and personal digital collections systems in particular, can be very helpful in supporting the cycle of online and onsite experiences by providing an added value that encourages visitors to become more engaged in the museum experience.

Lessons Learned: Best Practices for System Design

The wide range of personal digital collection functions and applications offered by museums today provides an excellent snapshot of best practices in designing and implementing these systems. To document these best practices, as well as critical lessons learned from the design and development of personal digital collection tools over the past decade, this section presents a case study from the redesign of ArtsConnectEd (<http://artsconnected.org>) completed in 2008 (Dowden & Sayre, 2009).

This redesign project recruited museum professionals and public and professional end-users to review eighteen of the most current implementations as well as a number of commercial web 2.0 applications in order to identify their most important features and functionalities (see <http://ace2.artsconnected.org/> for a summary of their findings). The review, which focused on developing requirements for the redesign of ArtsConnectEd, generated well over fifty items. While not all of these features were implemented in the redesign of ArtsConnectEd, the range of identified items revealed some larger themes that can be used as an informal set of best practices for those seeking to develop similar systems. These themes range from user-specific functionality to larger issues of technical interoperability. The following provides an overview of the key discoveries, lessons learned, and best practices derived from this research.

Multiple Audiences and Applications. Personal digital collection tools should be designed for a wide variety of audiences and applications. While typically envisioned as a way to allow museum patrons to bookmark their favorite works, more specialized audiences will need more specific applications. Teachers may utilize personal digital collections for everything from building digital “slide sets” for class preparation to assigning students to create sophisticated multimedia projects. While museums tend to look at the end-user as

their primary audience for these tools, ArtsConnectEd's research found that there are many internal users as well. Museum educators, particularly tour guides and docents, utilize personal digital collections for tour design, research, and training. Educators focusing on school audiences use personal collections for creating thematic sets of media as well as for delivering structured instructional units. The needs of these audiences should be considered when developing personal digital collections systems.

Inter-Institutional/Resource Interoperability. Museum professionals clearly see the intellectual, physical, and legal boundaries of their physical collections, but the general public often does not understand or even care about these constraints. While the public often knows what they are looking for, or what they need when it comes to collection objects, their needs, particularly in today's networked information environment, often transcend the boundaries of one museum's collections, and many users express a desire to create collections from multiple museums regardless of institutional boundaries. ArtsConnectEd's integration of the collections of the Walker Art Center and the Minneapolis Institute of Arts is a start, but the understandable desire is to extend this integration to all museum collections. Technical interfaces and protocols such as Application Programming Interfaces "API" and the Open Archives Initiative Protocol for Metadata Harvesting "OAI-PMH" (adopted by ArtsConnectEd as a means of integrating disparate collections) can now easily facilitate this type of museum collection sharing, harvesting, ingestion, and integration. While a small number of museums have begun to make their collections broadly accessible through these interfaces, there is a long way to go before the open sharing of museum information meets the needs expressed by the general public. Achieving true inter-institutional interoperability can be very challenging, especially when dealing with different types of organizations.

Multimedia. Online visitors have grown accustomed to accessing and utilizing a wide range of media from YouTube videos and audio podcasts to PDF documents and SlideShare presentations. Simultaneously, many museums have begun to produce and publish these forms of rich media as a part of their standard operations. Users of personal digital collections tools increasingly expect to be able to collect and organize a wide range of heterogeneous media types, and rich media assets (whether internally and externally produced) can be of equal or greater value to museum users than more traditional images and supporting text. ArtsConnectEd users, for example, expressed a need to link to or attach a wide range of documents types to their collections (in addition to presentation media) to be used as instructions, worksheets, lesson plans, etc.

Personal Media Integration. Along with the users' need to access and integrate multimedia assets from a range of online sources, users also expect to be able to utilize their own media assets within their personal digital collections. Many members of the public, particularly teachers and students, cannot make full use of museum collections if they are constrained to work only with museum-provided/sanctioned resources. When museums fail to provide a mechanism for integrating external resources, users are more inclined to download museum media for personal use, breaking all connections to its original context and connections to the museum itself. Users who regularly store their personal images on photo sharing sites like Flickr or Picasa and their videos on YouTube or Vimeo see personal media integration as extending beyond the standard uploading of files. To meet the needs of these users, personal digital collections systems need to be able to interface with their personal media wherever it resides.

Serendipity and Personal Relationships. While search and browse tend to be the bedrock of museum information discovery and retrieval, many users of museum collections express a desire to go beyond the targeted, linear constraints of this

functionality. ArtsConnectEd research found that users desired additional layers of discovery based on purely on randomization of returns or on user-generated tags. Randomization allows users to elude the constraints of familiarity by showing them items they may never have otherwise discovered. Randomized collections of objects can also provide a wide range of possibilities for student activities and projects. User-generated tags provide an additional, more casual mechanism for discovering relationships, often of a less traditional/scholarly nature. Tag cloud interfaces for both items and collections can dynamically extend the user experience in previously unforeseen directions. In addition, user-generated tags can benefit the museum by providing greater insight into how users describe, find and generate useful content (see Future Research Directions below).

Share, Copy, and Modify. Today's users live in a world of clones, mash-ups, and personalization, and they expect that a museum's personal digital collections systems will facilitate these activities. ArtsConnectEd research showed that users often wanted to acquire another user's collection only to modify it to better meet their own needs. While they could build an identical collection from scratch, they desired tools that easily facilitated the sharing, copying, modification, and re-sharing of collections (based on the Creative Commons share and share-alike license). Museum professionals and visitors expressed interest in this functionality for everything from sharing thematic collections of images and slide sets to complex lesson plans and rich media presentations.

Social Tools. Perhaps contrary to expectations, personal digital collections are not always intended to be personal. ArtsConnectEd research showed that many users desired social media tools that facilitated the sharing, rating, and commenting on personal collections. Sharing collections through publication and email was deemed critical to many applications of personal collections. While sharing in itself is useful, many felt that the ability to collect community comments and ratings was

essential as a means to filter and acknowledge useful content. Such tools—along with integration with social sites such as Twitter, Facebook, and Google Wave—can also benefit the museum by providing free marketing and direct connections to personally relevant content.

Multiple Forms of Output. Supporting the needs of different audiences requires a range of views and outputs of collected resources. While light tables and virtual galleries may satisfy the casual user, many specialized end-users require a greater range of options. ArtsConnectEd research found that users appreciated a wide variety of outputs for the individual items in their collections as well as for the collections themselves. At the item level, users need to be able to view full screen, zoom, print a full-page image, and print an information page containing all primary information. At the collection level, user requests ranged from the need to cut and save image details, arrange items chronologically into timelines, and place two pieces of media side by side for comparison. Requests also included the need to present media with or without supporting metadata (e.g., for use in quizzes or research assignments). As with onscreen presentations, there was also a need for a range of printable options for different applications. Collections may need to be printed as a series of thumbnails with metadata as well as space for audience note taking, a set of thumbnails and presenter notes, or as a full-page, book-like presentation of each of item in an author's collection. Finally, authors need a way to save their collections locally so they may carry them with them and access them offline—particularly important as a backup for professionals where internet access may not always be available.

Physical Connections. While virtual collections of digital material can stand on their own, extending these items to the physical world can further expand their application. ArtsConnectEd research found that museum professionals and visitors desired up-to-date location information for each physical object to be associated with its

digital media. Including these data allows users to compile collections around works within specific galleries and design printable walking tours based on the current locations of objects throughout the physical museum. Addressing this user need is particularly important for museums who wish to maintain and market their physical relevance and accessibility in the digital domain.

FUTURE RESEARCH DIRECTIONS

The development and implementation of personal digital collections on museum websites has really only just begun. Museum professionals continue to grapple with the technologies required to implement these systems, while online museum visitors struggle to determine how (and whether) these systems meet their changing needs and expectations. There is a critical need for future research into the potential use of these tools, and today's researchers and developers have a great opportunity to shape the future directions and development of personal digital collections systems, and to help museums redefine their relationships with their visitors as well as their roles as digital entities in the information age.

More research is needed to increase our understanding of the current incarnations of personal digital collections and the way they are used by museum visitors. Studies are needed that compare the experiences of visitors who use personalization technologies with those who do not. The artworks or artifacts that visitors choose add to their personal collections should be compared, along with the way they are used to augment the museum visit and the amount of information visitors retain about them. A comparative analysis of personalized and non-personalized, pre- and post-visit experiences could also be useful. In addition, future studies should examine whether the use of personal digital collections strengthens the museum's relationship with its visitors, through

studies that attempt to capture visitor behavior over time, online and onsite.

Future research must also go beyond the use of personal digital collections by museum visitors in their own lives to examine how museum professionals can take advantage of the use of these systems by their visitors in order to add value to their own understandings of their collections. It is possible that the arrangements of artifacts created by online visitors reflects new, previously unrecorded knowledge of digital culture—information that may be known only to the visitor and unobtainable through any other means. By recording these collections as they are created, and deciphering the reasons behind these new arrangements (with or without the assistance of the creator), museum professionals can realize the benefits of involving users as co-creators of digital cultural heritage.

Researchers interested in these questions can benefit from current work exploring social tagging and collaborative annotation in art museums (Bearman & Trant, 2005; Trant, Bearman, & Chun, 2007; Trant, 2009). The efforts of the Steve researchers and participants over the past few years have clearly demonstrated the potential value of capturing user data by encouraging online visitors to tag works of art (<http://steve.museum/>). The success of the Steve project illustrates the willingness of the general public to play an active role in distributed knowledge creation, and to help improve access to cultural heritage resources. The development of personal digital collections is a logical next step for those visitors who are already engaged in the collaborative annotation and co-creation of digital cultural heritage, and future researchers should capitalize on these initiatives and reach out to those audiences to help them build the next generation of personal digital collections systems.

The ultimate goal of future research in this area should be to help designers, developers, museum professionals, and museum visitors better understand how to create online tools that involve

users in the co-creation of digital collections of cultural heritage. By encouraging their visitors to become actively involved in the creating, shaping, and sharing of digital cultural heritage, museums and other cultural heritage institutions have the unique opportunity to help their visitors develop a personal interest in documenting and exploring their own culture. Such efforts will benefit cultural agencies around the world, and encourage an improved understanding of all cultures worldwide.

Achieving this goal will require researchers and developers to take a close look at existing web 2.0 applications, with a focus on understanding how the popularity of tools such as YouTube, Flickr, and Delicious has influenced user expectations about the features and capabilities of personal collections interfaces. The design and use of existing social computing applications—especially those used by millions of people around the world—will have significant implications and opportunities for the future design and development of personal digital collections systems in museums. At the very least, museum visitors will increasingly expect features such as tagging, sharing, and commenting, and will demand that museum-developed tools function as smoothly, seamlessly and effortlessly as other tools they use online in their daily lives.

Given these demands, researchers and developers will have to weigh the relative merits of museums developing their own personal digital collections systems with the possibility of the museums contributing their digital images and other cultural materials to pre-existing online tools such as Flickr; several museums worldwide are already using Flickr for this purpose (Kalfatovic et al., 2009). While such efforts do not require the technical development or expertise required of those who wish to create their own systems, they do raise additional questions of control, copyright, and intellectual property—questions that ultimately may prove more difficult to address than the technical ones. Nevertheless, these are important issues to consider, especially in light of increasing user expectations in the online

world. It is difficult for most museums to compete with the features of social computing tools such as Flickr, which comes complete with tagging, commenting, and sharing built into its interface. It is even more difficult when one considers the inherent challenge of building systems that can cut across multiple institutions and allow users to create personal collections that draw upon the resources of more than one museum—something Flickr already allows easily.

Finally, researchers and developers will also need to examine the potential integration of personal digital collections systems with increasingly ubiquitous handheld devices. As personal collection tools expand their reach to span multiple collections, and standards for aggregating cultural heritage from multiple institutions overcome the barriers that currently make sharing difficult, everyone with a handheld computer will demand anytime, anywhere access to their personal digital collections. One's personal device will become one's butterfly net and showcase in one, as visitors to museums the world over—in person and online—use their iPhones and iPods to collect digital culture as people today collect postcards, and show pictures of their collections to their friends as people today show off their family photos.

CONCLUSION

This chapter provided an overview of personal digital collection tools in museums, examining their past, present, and probable future. Despite having been implemented in various forms by different museums for more than a decade, much remains to be learned about their use by museum visitors. The study of personalization technologies in museums remains ripe for future research, and today's researchers and developers have a tremendous opportunity to help shape tomorrow's personal digital collections systems. Museum professionals and researchers alike have the opportunity to look closely at how the

design, development, and use of personal digital collections interfaces encourage museum visitors to help construct new digital knowledge by taking existing digital artifacts and collections and re-shaping them into new forms and new interpretations. Future researchers will continue to illuminate the role of the museum in encouraging the co-creation of digital cultural heritage, just as future developers will continue to design personal digital collections systems with new features and new capabilities. It is our hope that this chapter has helped improve our current understanding of how social computing technologies can shape the future of digital knowledge creation in museums and all cultural heritage organizations.

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KEY TERMS AND DEFINITIONS

Adaptive Interfaces: Online systems, tools, or interfaces that adapt to individual interests according to user-definable profiles selected by virtual visitors.

Customization Technologies: Digital systems, tools, or interfaces that allow for the customization of online interfaces to meet the different needs of museum visitors, in the galleries and online.

Personal Digital Collections: Online systems, tools, or interfaces allowing museum visitors to save selected objects from an online collection on a personalized page available from a museum's website.

Personal Environments: Online systems, tools, or interfaces allowing museum visitors to save links to their favorite sections of a museum website, access personalized calendars and agendas, and store links to artifacts, images, information, or articles for future research.

Personalization Technologies: Digital systems, tools, or interfaces that record and store personalized information for different museum visitors, in the galleries and online.