

NMC Horizon Project: 2011 Museum Edition Short List

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Key Trends

Significant Challenges

Time-to-Adoption: One Year or Less

Crowd Sourcing

Crowd sourcing refers to a set of methods of marshalling a community to contribute ideas, information, or content that would otherwise remain undiscovered. Its rapidly growing appeal stems from its effectiveness in filling gaps that cannot be bridged by other means. (An example might be asking a community to name the people in a period photograph. Family members are often the most authoritative source of this kind of information, but there is no easy way to know who to ask — so the call is issued community wide.) In the museum and academic sectors, crowd sourcing refers to an institution drawing from public knowledge to provide missing links on specific subject matter, complete large-scale tasks, or solve inherently complex issues. For many tasks, institutions are finding that amateur scholars or even people whose lives simply were contemporary to the event, object, images, or other focus being documented are remarkably effective in providing deep level detail around a topic or in documenting a large body of materials. With tools like Kickstarter, crowd sourcing has even been applied to fundraising. Because crowd-sourcing processes typically work best at scale, most such projects typically access a large number of participants. While it does not directly overlap, crowd sourcing is related to “user-generated content” and “collective intelligence,” both of which have appeared in past *NMC Horizon Reports*.

Relevance for Museum Education and Interpretation

- Crowd sourcing has proven remarkably effective in capturing deep-level knowledge about a living culture or community; working with amateur scientists and historians, it can also be very effective in adding previously unavailable detail to scholarly sources of knowledge.
- Crowd sourcing is a way to engage audiences’ collaborative efforts with the museum, and can be used to accomplish a variety of needs, while blurring definitions between “us” and “them;” museum professional and museum visitor; and paid staff and volunteers.

Crowd Sourcing in Practice

- The U.S. Holocaust Memorial Museum partnered with Ancestry.com to launch the World Memory Project — a crowd sourced indexing of microfilm documents: <http://www.worldmemoryproject.org>.
- The Brooklyn Museum’s *Click!* is a crowd-curated exhibit in which artists submit their own photography in response to a theme. The public then evaluates the work and the photography is positioned in an installation by rank: <http://www.brooklynmuseum.org/exhibitions/click/>.
- National Geographic photographer Dave Yoder is using the funding platform Kickstarter to raise funds for the construction of a special Gamma Camera in *The Search for the Lost da Vinci*: <http://www.kickstarter.com/projects/704089843/the-search-for-the-lost-da-vinci>.

For Further Reading

How Europeana, Crowdsourcing & Wiki Principles are Preserving European History

<http://sociable.co/business/how-europeana-crowdsourcing-wiki-principles-are-preserving-european-history/>

(Piers Dillon Scott, *The Sociable*, June 2011). This major museum crowdsourcing project is helping people better acquaint themselves with their cultural heritages.

The Rise of Crowdsourcing

<http://www.wired.com/wired/archive/14.06/crowds.html>

(Jeff Howe, *Wired*, June 2006.) Jeff Howe, in a seminal article, discusses the power of institutions to outsource the collection of pertinent information to the general public.

Should We Trust the Wisdom of Crowds?

http://news.bbc.co.uk/2/hi/uk_news/magazine/8788780.stm

(Tom de Castella, *BBC News*, 5 July 2010.) This article explores both the potential and pitfalls of crowd sourcing new ideas from employees within large organizations.

Time-to-Adoption: One Year or Less

Mobiles

Mobile phones — distinct from new sorts of larger format mobile devices such as the iPad — have as a category proven more interesting and more capable with each passing year. According to a report from mobile manufacturer Ericsson, by 2015 80% of people accessing the Internet worldwide will be doing so from a mobile device. At the 2011 Mobile World Congress, Google CEO Eric Schmidt reaffirmed the prediction by revealing that for every baby born, 30 Android phones are activated. Mobiles are generally well understood by museums; there has been a significant amount of time spent finding creative ways to incorporate them both in the physical space and as a tool to help patrons stay connected to exhibits from a distance. The utility of mobiles in the museum has become very apparent, if not ubiquitous quite yet. Museum professionals continue to explore ways to best showcase rich content on small-screen devices, even as discussions around the use of mobiles in the galleries remain common. Also remaining are infrastructure issues that need to be resolved in buildings that were never designed to accommodate wireless technologies.

Relevance for Museum Education and Interpretation

- Museums continue to experiment with ways to take advantage of mobiles within and outside the museum.
- Museums are exploring how mobiles can be used to establish and recognize the identity of visitors and provide location-based services that anticipate the wants and needs of visitors, such as allowing them access to additional content, or even simple things like making payments or finding their way about.
- Mobiles are ubiquitous; virtually every visitor has one.

Mobiles in Practice

- Australian Museum conducted research on their visitors' use of smartphones and apps to gain insight into who was using mobiles and how they were being used: <http://australianmuseum.net.au/BlogPost/Web-2U/Smartphones-and-apps-research-findings>.
- Balboa Park's collection of mobile apps contains everything from turn-by-turn directions to immersive adventure games: <http://www.balboapark.org/mobileapps>.
- The MuseumMobile Wiki is a public space for museum professionals to share best practices and new ideas on the use of mobiles: <http://wiki.museummobile.info/>.
- The Nelson-Atkins Museum of Art launched a mobile-optimized website that allows users to more easily browse collections and other pertinent information on their smartphones: <http://www.nelson-atkins.org/mobileguide/>.

For Further Reading

2011 Mobile Technology Survey

http://www.aam-us.org/upload/AAM_Mobile_Technology_Survey.pdf

(American Association of Museums, December 2010.) This survey charts the use of mobile technology in museums and assesses the attitudes of museum professionals towards mobile devices.

Mobile for Museums

<http://chnm.gmu.edu/labs/mobile-for-museums/>

(Sharon Leon, George Mason University, 2010.) The director of public projects at the Center for History and New Media assesses the current state of the mobile for museums field.

Time-to-Adoption: One Year or Less

Social Media

Today's web users are prolific creators of content, and they upload photographs, audio, and video to the cloud by the billions. Producing, commenting, and classifying these media have become just as important as the more passive tasks of searching, reading, watching, and listening. Sites such as Flickr, Picassa, YouTube, Google Video, Vimeo, and others make it easy to find images, videos, and audio clips, but the real value of these sites lies in the way that users can share, tag, comment upon, and add to the content that is there. Over the past few years, the ways we produce, use, and think about our media have undergone a profound transformation. Billions of videos, podcasts, and other forms of social media are just a click away for any Internet-connected user. As the numbers and quality of user-produced clips have increased, our notions of what constitutes useful or engaging media have been redefined. Museums need to understand and develop strategic plans for leveraging social media and providing internally generated resources — images, audio, and multimedia — to make the process a rich, engaging, two-way dialog between audience and institution.

Relevance for Museum Education and Interpretation

- Engagement in social media either as producers of content, or consumers, or aggregators of user-generated content will allow museums to connect with audiences not only as consumers but as contributors as well.
- Museums can use social media to create ways for people to engage with and be part of the museum community.
- Museums can use tools like Flickr and YouTube and the user-produced content there to extend the museum beyond its walls, mapping art across cities and even countries.

Social Media in Practice

- The National Museum of American History hosted an online forum called *September 11: Conversations* in which small groups of participants from different parts of the country shared personal experiences and discussed video clips: <http://conversations.si.edu/>.
- The Guggenheim's successful YouTube Play, an online video art biennial, had 23,358 submissions from 91 countries, and garnered over 24 million viewers: <http://www.guggenheim.org/new-york/interact/participate/youtube-play>.
- *TAKE PART: Photograph the Barcelona of the 21st Century* compels participants to grab their cameras and photograph contemporary life in Barcelona to be displayed in an exhibit at the Contemporary Culture Center of Barcelona: <http://www.brangulivaseaqui.com/>.
- The Victoria and Albert Museum *World Beach Project* is an online global art project where users share photographs of interesting patterns they have discovered or created on beaches across the globe: http://www.vam.ac.uk/collections/textiles/lawty/world_beach/.

For Further Reading

The Audience is Dead — Let's Talk Participants Instead

http://www.museumnext.org/2010/blog/museum_audience_development

(Jim Richardson, MuseumNext, July 2011.) This post discusses how building projects that encourage online participation and contributions stimulate community growth and expand the definition of a museum "visitor."

The Spirit of Sharing

http://www.nytimes.com/2011/03/17/arts/design/museums-pursue-engagement-with-social-media.html?_r=2&pagewanted=all

(Carol Vogel, *The New York Times*, 16 March 2011.) An interview with Shelley Bernstein, CTO of Brooklyn Museum, explores how building a social media presence enables museum patrons to participate in the art.

Time-to-Adoption: One Year or Less

Tablet Computing

In the past year, advances in tablet computers have captured the imagination of educators and museum professionals around the world. Led by the incredible success of the iPad, which in 2011 was selling at the rate of more than 3 million units a month, other similar devices such as the Samsung Galaxy and Sony's Tablet S have also begun to enter this rapidly growing new market. In the process, tablets (a form that is distinct from tablet PCs) have come to be viewed as not just a new category of mobile devices, but indeed a new technology in its own right, one that blends features of laptops, smart phones, and earlier tablet computers with always connected Internet, and thousands of apps with which to personalize the experience. As these new devices have become more used and understood, it is clear that they are independent and distinct from other mobile devices such as smart phones, eReaders, or tablet PCs. With significantly larger screens and richer gestured-based interfaces than their smartphone predecessors, they are ideal tools for sharing content, videos, images and presentations because they are easy for anyone to use, visually compelling, and highly portable.

Relevance for Museum Education and Interpretation

- Docents can travel with the world's cultural heritage in their hands — ready to display the mysteries or the pyramids or the intricacies of lost-wax casting with a touch and a flip of the tablet.
- Tablets are conducive to engaging in learning outside the museum, with a suite of tools for capturing data in real-time and collaborating on projects, while offering a large, user-friendly interface.
- Tablets with their slim shapes, large high-resolution displays, and intuitive navigation, provide an elegant solution for museums that transcends audio-guides and clunky handhelds.

Tablet Computing in Practice

- As part of their Family Day series, the San Antonio Museum of Art designed a set of hands-on activities around the iPad where participants used a drawing app to create their perceptions of Buddha:
<http://midea.nmc.org/2011/06/sama-drawing-from-the-collection/>.
- The London Natural History Museum developed an interactive dinosaur film optimized for tablets that incorporates gesture-based manipulation and augmented reality:
<http://go.nmc.org/fdklq>.
- The Powerhouse Museum's *WaterWorx* in-gallery interactive allowed visitors to learn about managing urban water systems through a specially-designed iPad game:
<http://www.powerhousemuseum.com/dmsblog/index.php/2010/11/01/waterworx-our-first-in-gallery-ipad-interactive/>.

For Further Reading

Find Out How an iPad Might Get People Back into Museums

<http://www.chron.com/news/houston-texas/article/Find-out-how-an-iPad-might-get-people-back-into-1684079.php>

(Douglas Britt, *Houston Chronicle*, 23 May 2011.) Through exploring several successful iPad projects, this article builds the case that this blockbuster tablet will help create more engagement among museum patrons and even entice new ones.

Using the iPad with Group Tours

http://www.youtube.com/watch?v=jHr_799DFII

(Scott Sayre, MIDEA, 3 May 2011.) One museum scholar shares creative ideas and best practices on integrating the iPad into docent tours.

Time-to-Adoption: Two to Three Years

Augmented Reality

Augmented reality, a capability that has been around for decades, is shifting from what was once seen as a gimmick to a tool with tremendous potential. The layering of information over 3D space produces a new experience of the world, sometimes referred to as “blended reality,” and is fueling the broader migration of computing from the desktop to the mobile device, bringing with it new expectations regarding access to information and new opportunities for learning. While the most prevalent uses of augmented reality so far have been in the consumer sector (for marketing, social engagement, amusement, or location-based information), new uses seem to emerge almost daily, as tools for creating new applications become ever easier to use. Specifically in the museum sector, AR provides patrons the opportunity to see how something is being done instead of listening to a docent’s explanation. As AR technologies and platforms become more readily available and affordable, museums will see the use of augmented reality and 3D technologies increase dramatically. As this happens, museums will need to consider how the level of immersion offered to patrons can balance against the desire of many visitors to have a quieter experience.

Relevance for Museum Education and Interpretation

- Augmented reality has strong potential to provide both powerful contextual, in situ learning experiences and serendipitous exploration.
- Augmented reality offers visitors the ability to call up structural, x-ray, or other scientific information on demand while having a minimal footprint on the physical space.
- Coupled with location-based services, augmented reality is already an important tool in taking a museum’s collections and content beyond the institution’s walls.

Augmented Reality in Practice

- Culture Clic offers a mobile AR experience of Paris that allows visitors to explore 500 paintings, photos and engravings via geolocation: <http://www.cultureclic.fr/>.
- The Getty Museum’s *Augsburg Display Cabinet* AR project enables users to interact with an intricate, historic object: <http://www.getty.edu/art/gettyguide/artObjectDetails?artobj=1404>.
- The Museum of Science, Boston’s *Star Wars: Where Science Meets Imagination* exhibit uses AR to bring to life important technological developments: http://www.mos.org/visitor_info/about_the_museum/enterprise_and_traveling_exhibits&p=sw.
- Powerhouse Museum’s Layar experience allows visitors to use their mobile phones to see Sydney, Australia as it was 100 years ago: <http://www.powerhousemuseum.com/layar/>.

For Further Reading

Augmented Reality in the Museum

<http://www.museumnext.org/2010/blog/augmented-reality-in-the-museum>

(Scott Billings, *MuseumNext*, 31 January 2011.) This post explores several museums’ projects that are incorporating augmented reality through mobile apps, virtual buildings, and more.

Museums and the Emerging AR Web

<http://museumvirtualworlds.org/?p=367>

(Rob Rothfarb, *Museum Virtual Worlds*, 14 April 2011.) This article is a great resource for discovering the current most effective AR programs at museums.

Visual Time Machine Offers Tourists a Glimpse of the Past

<http://www.sciencedaily.com/releases/2009/08/090812104219.htm>

(*ScienceDaily*, 17 August 2009.) New apps for smartphones offer augmented reality on the go. While on location, users view historical sites as they were hundreds of years ago.

Time-to-Adoption: Two to Three Years

Electronic Publishing

Now that it is firmly established in the consumer sector, electronic publishing is beginning to demonstrate capabilities that challenge not only traditional workflows, but also the boundaries between print and digital, still image and video, passive and interactive. For many museums, electronic publishing is seen as a way to trim costs — glossy printed books are expensive to produce and only sell in small quantities — but electronic publishing offers museums much more than fiscal savings. Modern digital workflows support traditional print, digital, web, video, and even interactive content. The idea is that building in the full spectrum of potential publishing avenues — print, web, video, tablets — from the beginning not only is a way to streamline production, but also to increase the reach of the materials produced by leveraging the content over a wide range of media. Modern media companies have been the vanguard of this conversion — magazine writers, for example, will produce a piece that will work in the magazine, on the web, and in video — and that may appear in any or all of those outlets. The reason electronic publishing resides on the mid-term horizon is because museums and publishers have not yet resolved all the issues with supplementary images and legal obligations.

Relevance for Museum Education and Interpretation

- Electronic publishing offers museums unprecedented opportunities of scale and richness by reorganizing the way images, audio and video content, and layers of textual data are conceptualized during the design process.
- Modifying publishing workflows brings museums in line with industry-standard practices.
- Electronic publications have the potential to reach entirely new audiences.

Electronic Publishing in Practice

- Editors at *The Knot* magazine are creating and tailoring content specifically for the iPad, integrating digital scrapbooking, advanced social features, and hundreds of videos: <http://wedding.theknot.com/special-wedding-features/ipad-wedding-application.aspx?MsdVisit=1>.
- National Museums Scotland recently rebuilt their website in HTML5, which has allowed them to more easily and dynamically share hi-resolution images and videos across all viewing platforms, including the iPad: <http://www.nms.ac.uk/default.aspx>.
- Treesaver has recently expanded their DIY services to include HTML5 app-building so that even smaller museums and organizations can create content once and publish it everywhere: <http://treesaver.net/>.

For Further Reading

Building a Magazine for the Digital Age

<http://mashable.com/2011/07/31/sports-illustrated-inside-look/>

(Lauren Indvik, *Mashable*, 31 July 2011.) While this article is focused on digitizing glossy magazines, it has implications for the museum world because of the amount of images and other complex features that are challenging to fully translate to digital formats.

How Yale Press Took Over Art Publishing

<http://www.yaledailynews.com/news/2011/apr/13/how-yale-press-took-over-art-publishing/?print>

(Edmund Downie, *Yale Daily News*, 13 April 2011.) This article discusses the art of electronic publishing and how Yale Press has successfully transitioned into the digital age.

In E-Books Publishers Have a New Rival: News Sites

http://www.nytimes.com/2011/09/19/business/media/in-e-books-publishing-houses-have-a-rival-in-news-sites.html?_r=1&partner=rss&emc=rss

(Julie Bosman and Jeremy Peters, 18 September 2011.) With the rapid growth of electronic publishing, traditional publishing houses are finding new competitors as ebooks can be produced by individuals and institutions, and the very definition of a “book” is changing.

Time-to-Adoption: Two to Three Years

Game-Based Learning

Game-based learning has gained considerable traction since 2003, when James Gee began to describe the impact of game play on cognitive development. Since then, research — and interest — in the potential of gaming on learning has exploded, as has the diversity of games themselves, with the emergence of serious games as a genre, the proliferation of gaming platforms, and the evolution of games on mobile devices. In the education and training realms, developers and researchers are working in every area of game-based learning, including games that are goal-oriented; social game environments; non-digital games that are easy to construct and play; games developed expressly for education; and commercial games that lend themselves to refining team and group skills. Role-playing, collaborative problem solving, and other forms of simulated experiences are recognized for having broad applicability across a wide range of topics. Museums, especially science and history museums, are uniquely positioned to add games to the range of experiences they offer visitors, and many increasingly are.

Relevance for Museum Education and Interpretation

- Educational games offer opportunities for both discovery-based and goal-oriented learning, and can be very effective ways to develop team-building skills.
- Games have the potential to be a more interactive and engaging way of learning some content, extending the learning experience geographically and temporally.
- Museums can use games as a way of introducing complex or controversial topics, to breakdown social and cultural boundaries, and to stimulate dialog and discussion.

Game-Based Learning in Practice

- *Ghosts of a Chance* allows visitors at the Smithsonian American Art Museum to decipher codes, follow treasure maps, and uncover hidden objects in a multimedia scavenger hunt: <http://ghostsofchance.com/>
- In the Science Museum of London's game, *Rizk*, players learn about climate change defense by growing and protecting their own plants. Participants can connect with their opponents on Facebook: <http://www.sciencemuseum.org.uk/ClimateChanging/Rizk.aspx>.
- Tate Modern's *Tate Trumps* is a game app that turns works of art into a version of the classic card game Top Trumps: <http://www.tate.org.uk/modern/information/tatetrumps.shtm>.
- *Parkman Murder* is a location-based game that was jointly produced by four museums in Boston. Players follow the app's map, view video clips at each stop, solve puzzles, and even ask local shop owners for hints along the way: <http://www.parkmanmurder.com/>.

For Further Reading

Cautionary Tales in Transmedia Storytelling

<http://www.wired.com/magazine/2011/03/cautionary-ales-in-transmedia-storytelling/>

(Michael Andersen, *Wired*, 30 March 2011.) Though game-based learning often fosters more engaging learning experiences, this article discusses potential challenges by comparing two different case studies on games.

Gaming Education

<http://radar.oreilly.com/2010/10/gaming-education.html>

(Elizabeth Corcoran, O'Reilly Radar, 27 October 2010.) This insightful post discusses the three predominate types of gaming in education: classic edu-tech games, build-your-own games, and the gamification approach to teaching in general.

Reality is Broken, Game Designers Can Fix It

<http://www.avantgame.com/>

(Dr. Jane McGonigal, Institute for the Future, 2010.) This TED talk video advocates incorporating principles of game design into the real world to effect social change.

Time-to-Adoption: Two to Three Years

Open Content

The movement toward open content reflects a growing shift in the way scholars in many parts of the world are conceptualizing education to a view that is more about the process of learning than the information conveyed. Information is everywhere; the challenge is to make effective use of it. Open content embraces not only the sharing of information, but also — especially for museums — the sharing of imagery. While open content has its roots in a number of academic efforts, including MIT's Open Courseware Initiative, its meaning in the museum sector differs, where early efforts in making content sharable have focused on creating image collections largely drawn from public domain photographs.

There are two sides to understanding open content — on the one side are institutions that are allowing content to be shared. On the other are those institutions that wish to make use of open content. Public institutions see themselves as having somewhat of an obligation to share their resources, but private institutions too often must sort through complicated rights and usage issues that inhibit sharing. For this reason, open content is seen as at least two to three years from mainstream use in museums. However, a number of large-scale European projects are finding success, as there has been more institutional support for open content outside of the United States.

Relevance for Museum Education and Interpretation

- Collaboration opportunities with Wikipedia give museums the means to guarantee the quality, accuracy, and authenticity of museum-related content, and extend the reach of the museum beyond the bricks and mortar establishment and the museum's own website.
- Communities of practice and learner groups that form around open content provide a source of support for independent or life-long learners.
- Open museum content generates opportunities for outside scholars, experts and even amateur scholars to have a voice in the cataloguing, research, and interpretation process. Open content can enable new kinds of scholarship, research, and collaboration both within and between institutions.

Open Content in Practice

- The Europeana Libraries project is making millions of digital objects available for free, in addition to providing API and web services that enable easy search and display of online collections: <http://www.europeana-libraries.eu/>.
- Yale University has made all of their cultural collections available for free online: <http://opac.yale.edu/news/article.aspx?id=8544>.
- The Victoria & Albert Museum offers audiences access to free web images and high-resolution images for both personal and academic use: <http://www.vam.ac.uk/>.

For Further Reading

Creative Commons

<http://www.creativecommons.org>

Creative Commons has created a set of legal tools consistent with the rules of copyright that make it not only possible but easy for people to share and build upon the work of others.

Museums & Wikipedia: The Future of Collaboration and Accessibility

<http://futureofmuseums.blogspot.com/2011/04/museums-wikipedia-future-of.html>

(Lori Byrd Phillips, *Future of Museums*, 21 April 2011.) One museum professional discusses the relationship between museums and open content resources as a means for gathering more robust information on works of art and facilitating platforms for easier discovery.

Time-to-Adoption: Four to Five Years

Collective Intelligence

Collective intelligence is a term for the knowledge embedded within societies or large groups of individuals. It can be explicit, in the form of knowledge gathered and recorded by many people (for example, the Wikipedia is the result of collective intelligence); but perhaps more interesting, and more powerful, is the tacit intelligence that results from the data generated by the activities of many people over time. Discovering and harnessing the intelligence in such data — revealed through analyses of patterns, correlations, and flows — is enabling ever more accurate predictions about people's preferences and behaviors, and helping researchers and everyday users understand and map relationships, and gauge the relative significance of ideas and events. The data in these new information stores has come to be called collective intelligence, and both forms have already proven to be compelling applications of the network. Explicit knowledge stores refine knowledge through the contributions of thousands of authors; implicit stores allow the discovery of entirely new knowledge by capturing trillions of key clicks and decisions as people use the network in the course of their everyday lives.

Relevance for Museum Education and Interpretation

- Collective intelligence can be used as an explicit way to build new resources in a manner similar to crowd sourcing.
- Tacit collective intelligence embedded in a community may include a multiplicity of perspectives and facts on a well-known work of art, a group of works, a proposed exhibition, a mounted exhibition, or a theme of exploration. Museum scholars can mine this knowledge for new insights and new relationships.
- Collective intelligence can be tapped to ensure that a museum is engaged in best practices across the range of its activities.

Collective Intelligence in Practice

- The Canadian Heritage Information Network's *Professional Exchange* is an online repository where museum professionals across Canada share best practices in implementing new technologies: <http://www.pro.rcip-chin.gc.ca/index-eng.jsp>.
- Oxford University's *City of the Sharp-Nosed Fish* is using collective intelligence to decipher ancient Greek texts written on papyri fragments discovered in Egypt: <http://ancientlives.org/>.
- The Wikipedia Public Art Project allows people to share information about important works of art in their communities that may otherwise be undocumented: http://en.wikipedia.org/wiki/Public_art.

For Further Reading

Learning Reimagined: Participatory, Peer, Global, Online

<http://dmlcentral.net/blog/howard-rheingold/learning-reimagined-participatory-peer-global-online>

(Howard Rheingold, DML Central, 22 July 2011.) This article addresses the implications of open educational resources to influence the pedagogy behind self-organizing peer learning groups.

The Participatory Museum: From Me to We

<http://www.participatorymuseum.org/chapter3/>

(Nina Simon, *The Participatory Museum*, Chapter 3, 2 March 2010.) Nina Simon discusses the importance of a well-designed collective intelligence model in museums as a means of creating more satisfying social experiences.

Time-to-Adoption: Four to Five Years

Digital Preservation

At the most basic level, digital preservation refers to the conservation of important objects, artifacts, and documents that exist in digital form. As technology continues to rapidly evolve and new software is propelled into mainstream use nearly every day, older tools and applications quickly become obsolete, all too often rendering files created with them unreadable. Museums have vast amounts of electronic media in their collections, and each one represents a unique challenge from a conservation standpoint. While museums have long employed art historians with specialties in artifact preservation, there is now the looming issue of finding professionals who understand preservation from a computer science perspective. Just like ancient objects, digital objects can be fragile and require special care, and the museum sector's growing dependence upon changing technologies puts these digital items at great risk. As museums, universities, libraries and other organizations start to support and develop processes and resources for digital preservation, a new science and toolset is emerging to support and inform the work.

Relevance for Museum Education and Interpretation

- Digital objects are also objects of cultural heritage, and the danger of losing the contributions of contemporary digital creators is great.
- Investing in digital preservation provides museums with a stronger guarantee that important electronic media objects will be available for patrons for many years to come.
- Advances in digital preservation can be shared between institutions and create opportunities for large-scale collaboration.

Digital Preservation in Practice

- The Digital Preservation Coalition is raising awareness on the importance of digital preservation and the accompanying cultural and technological issues: <http://www.dpconline.org/>.
- Launched by the Library of Congress, DigitalPreservation.gov is an online repository of resources, including video tutorials, tools, and services, to better educate people on digital preservation: <http://www.digitalpreservation.gov/videos/digipres/index.html>.
- Northeast Document Conservation Center is a non-profit devoted to the conservation of paper documents: <http://www.nedcc.org/>.

For Further Reading

Digital Archaeology: Recovering Digital Objects from Audio Waveforms

http://www.planets-project.eu/docs/papers/Guttenbrunner_DigitalArcheology_iPres2009.pdf

(Mark Guttenbrunner, Mihai Ghete, Annu John, Chrisanth Lederer, Andreas Rauber, Vienna University of Technology, 5 October 2009.) This paper addresses the preparation necessary to store and read media as technology advances.

Digital Preservation and Workflows for Museums

<http://vimeo.com/15055960>

(Michael Ashley, *Life Is Not Still*, 2010.) This video explores the digital preservation framework and demonstrates proven workflows.

Small Steps: Long View

<http://go.nmc.org/ptvgd>

(Glasgow Museum, September 2010.) This case study illustrates digital preservation in practice at Glasgow Museums Resource Centre and their task of conserving 1.2 million historic objects.

Time-to-Adoption: Four to Five Years

Gesture-Based Computing

Thanks in part to the Nintendo Wii, the Apple iPhone, and the iPad, many people now have some basis of experience with gesture-based computing as a means for interacting with a computer. The proliferation of games and devices that incorporate easy and intuitive gestural interactions will certainly continue, bringing with it a new era of user interface design that moves well beyond the keyboard and mouse. While the full realization of the potential of gesture-based computing remains several years away for museums, its significance cannot be underestimated, especially for a new generation accustomed to touching, tapping, swiping, jumping, and moving as a means of engaging with information. Emerging devices like the G-Speak track hand movements and allow users to manipulate 3D objects in space. G-Speak, as well as SixthSense, developed by Pranav Mistry while at the MIT Media Lab, uses visual markers and gesture recognition to allow interaction with real-time information, and in the process, has ignited the cultural imagination regarding the implications for gesture-based computing. Gaming systems like the Wii and the Kinect system for the Xbox continue to explore the potential of human movement as a way of controlling devices. For museums, gesture-based computing represents a new frontier for presenting information that may prove to be much more compatible with both visitor needs and the gallery itself.

Relevance for Museum Education and Interpretation

- Gesture-based computing could allow for the integration of kinesthetic-based learning practices into the more passive and sedate kinds of learning typically done in museums.
- Gesture-based computing could enable visitors to interact with works in a way that is more intuitive and holistic.
- The integration and penetration of more and more gesture-based computing features into handheld devices offers considerable potential for understanding scientific processes, moving quickly through visual materials, and even virtual control of instruments and specialized equipment.

Gesture-Based Computing in Practice

- "Epidemik" is a game-base exhibit at Cite de Sciences et de L'industrie Paris where visitors can experience how epidemics spread by moving through the space with each other: <http://vimeo.com/8529072>.
- Mehmet Akton's "Body Paint" installation lets visitors paint on virtual canvases using their bodies: http://www.msavisuals.com/body_paint.
- Vancouver Aquarium's "Arctic Choices" is a glass table where multiple users can interact simultaneously to change and manipulate maps that depict the changing features of the Artic: <http://www.ideum.com/interactive-exhibits/arctic-choices-multitouch-multiuser-mapping-exhibit/>.

For Further Reading

The Best Computer Interfaces: Past, Present, and Future

<http://www.technologyreview.com/computing/22393/page1>

(Duncan Graham-Rowe, *Technology Review*, 6 April 2009.) This article discusses a variety of interfaces, including gesture-sensing, voice recognition, and multi-touch surfaces.

Waving to the Screen

<http://blogs.gartner.com/angela-mcintyre/2011/09/20/waving-to-the-screen>

(Angela McIntyre, *CNN*, 20 September 2011.) This article reviews gesture-based computing platforms and discusses their potential power for kiosks.

Time-to-Adoption: Four to Five Years

Smart Objects

A smart object is simply any physical object that includes a unique identifier that can track information about the object. There are a number of technologies that support smart objects: radio-frequency identification (RFID) tags, quick response (QR) codes, near-field communications, and smartcards are some of the most common. Objects that carry information with them have long been used for monitoring of sensitive equipment or materials, point-of-sale purchases, passport tracking, inventory management, identification, and similar applications.

RFID tags and smartchips “know” about a certain kind of information, such as temperature, color, pressure, or humidity — or how much money is available in a user’s account and how to transfer the correct amount to a retailer for a given purchase — or which book is being checked out at a library, who the patron is, and whether that patron has any currently overdue materials. Smart objects connect the physical world with the world of information and will power the “Internet of Things”. They can be used to digitally manage physical objects, track them throughout their lifespan, alert someone when they are in danger of being damaged or spoiled — or even to annotate them with descriptions, instructions, warranties, tutorials, photographs, connections to other objects, and any other kind of contextual information imaginable.

Relevance for Museum Education and Interpretation

- Near field communication is non-intrusive inherently secure technology that allows easy payment and identification — and is increasingly included in mobile devices.
- Smart objects do not require installation of third-party apps. The interlinking museums and smart object is direct and two-way. It carries a full array of possibilities, from administration of collections to interfacing with and by museum.
- Smart objects are already being used to monitor the health and welfare of objects in the collection and are an increasingly important tool in the care and preservation of objects and artifacts.

Smart Objects in Practice

- The Modern Museum of Art’s *Talk to Me* exhibit explores the possibilities for communication between people and technology: <http://moma.org/talktome>.
- The UCL Grant Museum of Zoology’s QRator project incorporates QR codes into exhibits that link to a rich database of curated content and allow users to share their own interpretations: <http://www.ucl.ac.uk/public-engagement/projects/innovation/Warwick>.

For Further Reading

Going Multilingual with QRpedia

<http://midea.nmc.org/2011/06/qrpedia/>

(Lori Byrd Phillips, MIDEA, 15 June 2011.) One museum professional explores the efficiency of using QR codes to seamlessly digitize and organize exhibits.

Internetting Every Thing, Everywhere, All the Time

<http://edition.cnn.com/2008/TECH/11/02/digitalbiz.rfid/>

(Cherise Fong, *CNN*, November 2008.) This article describes the Internet of things and illustrates some current examples of smart object technology.

NFC Technology: 6 Ways it Could Change Our Lives

<http://mashable.com/2010/05/06/near-field-communication/>

(Sarah Kessler, *Mashable*, 6 May 2010). Contactless payment and infotags containing schedules and announcement are both cited in this article as two of the most potentially transformative features of near field communications.

The abundance of resources and relationships made easily accessible via the Internet is increasingly challenging us to revisit our roles as educators. Access to educational materials of all kinds has never been so easy or so open as it is today, and this trend is only increasing. The model of the museum curator or museum educator who stands in front of an object and interprets meaning for a passive audience is simply no longer realistic in this world of instant access. Museum professionals must respond by changing their roles to reflect the new need to guide and coach visitors in finding, interpreting, and making their own connections with collections and ideas. Museums must also be more willing to see themselves as learners, taking advantage of user-generated content to enhance the overall understanding of collections. [Carried forward from the 2010 Short List]

As devices become much smaller and lighter, are wearable or implanted, and require low energy levels to operate, human beings are becoming mobile computing platforms. The personal cyber-environment is a growing trend that currently is expressed by the fact that many people carry with them a variety of devices that allow them mobile access to information, entertainment, and social interaction. These devices are already beginning to coalesce into combined multipurpose systems that provide the range of capabilities that current smart phones, laptops, iPods, and tablet devices do, and more. As the devices become much smaller and lighter, are wearable or implanted, and require low energy levels to operate, human beings will become mobile computing platforms that services such as augmented reality, gesture-based interactivity, location-based services, and many others will provision.

Collection-related rich media are becoming increasingly valuable assets in digital interpretation. Museums are beginning to see the value in developing formal strategies for capturing high-quality media documentation at every opportunity. Working more closely than ever with educators and researchers, museums are embracing the opportunities provided by rich media to enhance multimodal learning both online and in the galleries. Video, audio, and animations are no longer seen as afterthoughts in interpretation but increasingly as necessary components of an interpretive plan. This trend is beneficial to museum professionals and visitors alike as it encourages a deeper understanding of objects, ideas, and audiences. [Carried forward from the 2010 Short List]

Cross-institution collaboration is growing as an important way to share resources. Museums are increasingly aware of the ways in which content including, but not limited to, unmediated collections data, may be seen and used in the broader networked environment. The days of gigantic, multi-year, foundation-funded collaborative projects are probably on the wane. Increasingly, multi-institutional collaboration will probably occur at the data level with institutions being collaborative partners only in a passive sense, and the real work of pulling multiple resources together being accomplished downstream, possibly by third-party organizations. [Carried forward from the 2010 Short List]

Digitization and cataloguing projects continue to require a significant share of museum resources. Museums are distinguished by the content they keep and interpret. There is an increasing understanding among museum professionals that visitors expect to be able to readily access accurate and interesting information and high-quality media. This requires museums to plan strategically for the digitization and cataloging of collections. These projects frequently require sacrifices in terms of scarce resources (money, personnel, and time) in order to meet long-term goals. [Carried forward from the 2010 Short List]

Expectations for civic and social engagement are profoundly changing museums' scope, reach, and relationships. More and more, museums are integrating emerging technologies and approaches such as social media, open content, and crowd sourcing as a means of engaging their communities both internally and externally on a deeper level. Embracing these innovations means that museums are providing patrons with more immersive opportunities to become part of the art. Suddenly, people who live far away from the museum are able to access its collections and respond and contribute to them as well without ever stepping foot in the physical space. This is redefining what it means to be a museum patron. In this respect, museums are being more open and social places.

Increasingly, visitors and staff expect a seamless experience across devices. Whether viewing curated galleries centered around objects and ideas or making a virtual visit to a museum's website, visitors expect museums to provide content. More and more, patrons want the experience of interacting with that content using the device of their choice, wherever and whenever they choose to do so. Virtual visitors in particular expect to be able to perform certain tasks online, and to be able to accomplish them on the device of their — and not the museum's — choosing, but this is increasingly true of visitors to the physical space as well. [Carried forward from the 2010 Short List]

Increasingly, we expect to be connected wherever we go. Wireless network access, mobile networks, and personal portable networks have made it easy to remain connected almost anywhere. We are increasingly impatient with places where it is not possible, or where it is prohibitively expensive to be connected, such as airplanes in flight, bus and train travel, and countries outside our own mobile networks. The places where we cannot connect are shrinking, however — some flights provide wireless access, for instance — and our expectations of immediate access to our personal information, multi-level communication, and interaction with the world are more frequently met. [Carried forward from the 2010 Short List]

More and more, people expect to be able to work, learn, study, and connect with their social networks wherever and whenever they want to. We are not tied to desks anymore when we wish to use computers. Workers increasingly expect to be able to work from home or from the road, and most everyone expects to be able to get information, addresses, directions, reviews, and answers whenever they want, this is a key trend for both museum professionals and museum visitors. Mobile access to information is changing the way we plan everything from outings to errands. A corollary of this trend is the expectation that people will be available and online, anywhere and anytime. [Carried forward from the 2010 Short List]

There is a growing chorus of voices advocating a more active role for visitors in shaping what museums do. As people become accustomed to tools that allow them to do things that previously required a great deal of expertise (eg, video editing, or publishing to the web), they begin to appreciate the creative skills involved in actually producing science or art or the like. "Makers" are an emerging category of museum visitors who want to not only appreciate what they see in historical or other contexts, but to also understand how it was created. Increasingly, visitors want to have an experience that they are part of, not one that they passively watch. "Maker" experiences which engage visitors of all ages in individual and collective experiences of tinkering, making, and discovery are a growing trend, and there is a role for museums in supporting and encouraging such experiences.

Significant Challenges

Boards of Trustees and executive management too often do not recognize the importance of technology in generating financial or mission return on investment. Integrating and recognizing the role of technology in garnering visitors, keeping their interest, and in financial support of the enterprise is critical to every museum's success in the world today. There is a prominent fear amongst Boards of Trustees and executive management teams that the cost of investing in emerging technologies (training, implementation, etc.) will not be repaid. However, practical and creative applications such as distance learning courses, digital collections, apps, and more have the proven ability to generate new audiences and new revenue streams.

Content production has failed to keep up with technology in an era when audiences expect to consume information whenever and wherever they want. Museums incur unneeded costs in repurposing information already created as they try to meet demands. Museums should be creating content aimed at multiple delivery modes, including web, print, small screen, video, and social media. Museums should be leaders in the creation of substantive, engaging, and interesting content. [Adapted from the 2010 Short List]

Embracing change as a constant remains a challenge. Museums are, in general, conservative institutions and because of this, and a variety of other reasons, they often lag behind commercial entities and educational institutions in the adoption of new technologies. Money and staff resources are always cited as reasons for not participating, yet in general the reluctance has more to do with the fear of change. Adopting technologies may well enable museums to better accomplish their missions and serve their audiences but the community needs to become more flexible in its response to emerging trends. [Carried forward from the 2010 Short List]

Funding for technology projects, even those for interpretation and exhibition, continues to fall outside core operational budgets. The recent recession virtually brought to an end what had been a promising trend in museums allocating ongoing operational funds (as opposed to capital or project funds) for both experimental and ongoing technology projects. Museums need institutionalized strategic planning initiatives for technology infrastructure and technology-related projects, and information technology staff need better skills and opportunities to communicate the importance of a proper digital strategy. Open lines of communication and a common vocabulary might give administrators a clearer understanding of exactly what should be operationalized rather than left to project funds. [Carried forward from the 2010 Short List]

Greater understanding of the relationships and synergies between onsite technology, offsite technology use, and online access to museum resources is needed. Many in museum administration still fail to grasp the notion that a virtual museum visitor is indeed a museum visitor and that our audiences have high expectations with regard to online access to services and information. It is often difficult enough for museums with scarce resources to serve their physical visitors and to keep audiences in their geographical region satisfied; the notion that museums must, in addition, provide information and services to the entire world is often too big a project to contemplate. Museums need help to better understand these mutable relationships. [Carried forward from the 2010 Short List]

Improving our ability to measure impact using new digital technologies is a critical need. Museums are good at traditional program evaluation, but determining the impact of new technologies on knowledge, attitudes, skills is more challenging, especially when museum educators are attempting to measure the success of technologies that are unfamiliar to them, are a part of the standard tool-kit to the digital native. In order to improve our ability to measure, we need to be willing to learn as well as to teach. [Carried forward from the 2010 Short List]

In many cases, museums may not have the necessary technical infrastructure in place to realize their vision for digital learning. In the United States alone there are close to 17,000 institutions that self-identify as museums; many of these institutions have few staff and fewer resources. While it is practically impossible not to recognize the value of digital learning in today's connected world, the reality for museums is that the vast majority of institutions do not have the necessary technical infrastructure to successfully pursue goals for digital learning, and often have little time to dedicate to articulating, much less realizing their vision. Museums that do have resources may have to choose to reallocate funds from non-digital education efforts in order to implement the necessary technical infrastructure. [Carried forward from the 2010 Short List]

Museums need to create digital strategies for long-term institutional sustainability. Creating a digital strategy is critical for institutions today, and is only one part of a comprehensive digital strategy, which should also include e-marketing, e-philanthropy, revenue generation, digitization, digital preservation, and issues with regard to general technology infrastructure. Digital learning has linkages to many of these other areas of museum operation. As technology continues to evolve, museums must embrace new approaches to maintain its communities and attract a new generation of patrons.

The move away from a print- and gallery-focused culture to more and more online, social, rich-media-infused offerings presents challenges across the range of museum activity. Exhibitions, both in their gallery manifestations and in their online counterparts, are carefully curated, yet too often miss the mark in capitalizing on ways to leverage content across the range of media visitors expect today. Rare are the experiences that bring cultural heritage content together across institutions online. Similarly missing is the chance to engage curators in a workflow that can produce content across a wide range of media, from print to web to video to interactive to apps on tablets.

We should be doing more evaluation, and better, both qualitative and quantitative. Evaluation is critical and should be the starting point of every content/experience design process. Audience evaluation skills are fundamental to the museum profession and should be part of all of our toolkits and standard practices, and not something we do merely to secure funding. Good evaluation practices and meaningful metrics, agreed upon and broadly accepted by the museum community, will enable us to recognize and build upon successes, and learn from our mistakes and failures. [Carried forward from the 2010 Short List]

