THE **HORIZON** REPORT

2010 MUSEUM EDITION

a publication of
The Marcus Institute for Digital Education in the Arts
a program of
The New Media Consortium

The *2010 Horizon Report: Museum Edition* is
a publication of

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a program of

The NEW MEDIA CONSORTIUM

The Edward and Betty Marcus Institute for Digital Education in the Arts (MIDEA) provides timely, succinct and practical knowledge about emerging technologies that museums can use to advance their missions. Learn more at http://midea.nmc.org.

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EXECUTIVE SUMMARY

The internationally recognized series of *Horizon Reports* is part of the New Media Consortium's Horizon Project, a comprehensive research venture established in 2002 that identifies and describes emerging technologies likely to have a large impact over the coming five years on a variety of sectors around the globe. This volume, the *2010 Horizon Report: Museum Edition,* examines emerging technologies for their potential impact on and use in education and interpretation within the museum environment. The hope is that the report is useful to museums worldwide, and the international composition of the Advisory Board reflects the care with which a global perspective was assembled. While there are many local factors affecting the adoption and use of emerging technologies in museums, there are also issues that transcend regional boundaries and questions we all face. It was with these in mind that this report was created. The *2010 Horizon Report: Museum Edition* is the first in what will be an annual series of museum-focused reports.

To create the report, the Horizon Project's Museum Advisory Board, an international body of experts in museums, education, technology, and other fields, engaged in a discussion around a set of research questions intended to surface significant trends and challenges and to identify a wide array of potential technologies for the report. This dialog was enriched by a wide range of resources, current research, and practice that drew on the expertise of the NMC community and the communities of the members of the board. These interactions among the Advisory Board are the focus of the *Horizon Report* research, and this report details the areas in which these experts were in strong agreement.

Each edition of the *Horizon Report* introduces six emerging technologies or practices that are likely to enter mainstream use within three adoption horizons over the next five years. Key trends and challenges that will affect current practice over the

same time frame add context to these discussions. Over the course of just a few weeks, the Advisory Board came to a consensus about the six topics that appear here in the *2010 Museum Edition.* The examples and readings under each topic area are meant to provide practical models as well as access to more detailed information. Wherever possible, an effort was made to highlight the innovative work going on among museums around the world. The precise research methodology employed is detailed in the closing section of this report.

The report's format is consistent from year to year and edition to edition, and opens with a discussion of the trends and challenges identified by the Advisory Board as most important for the next five years. The format of the main section of this edition closely reflects the focus of the Horizon Project itself, centering on the applications of emerging technologies in museum settings. Each section is introduced with an overview that describes what the topic is, followed by a discussion of the particular relevance of the topic to museum education and interpretation. Several concrete examples of how the technology is being used are given. Finally, each section closes with an annotated list of suggested readings and additional examples that expand on the discussion in the report, including a link to the tagged resources collected during the research process by project staff, the Advisory Board, and others in the global Horizon Project community.

Key Trends

The technologies featured in this edition of the *Horizon Report* are embedded within a contemporary context that reflects the realities of the time, both in the sphere of museum education and in the world at large. To assure this context was well understood, the Advisory Board engaged in an extensive review of current articles, interviews, papers, and new research to identify and rank trends that were currently affecting the practice of museum education

and interpretation. Once detailed, the list of trends was then ranked according to how significant each was likely to be for museums in the next five years. The highest ranked of those trends had significant agreement among the Advisory Board members, who considered them to be key drivers of museum technology adoptions for the period 2010 through 2014. They are listed here in the order in which the Advisory Board ranked them.

- *"Rich" media — images, videos, audio, augmented reality, and animations — are becoming increasingly valuable assets in digital interpretation.* Museums understand the value in capturing high-quality media documentation related to their collections at every opportunity. Working more closely than ever with educators and researchers, museums are embracing opportunities for multimodal learning both online and in the galleries. High-quality media like images, videos, audio clips, augmented reality, 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.

- *Digitization and cataloguing projects will 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 especially high-quality media. This requires museums to plan strategically for the digitization and cataloging of collections. These projects frequently require hard choices in the allocation of money, personnel, and time, but are not likely to diminish in importance in the foreseeable future.

- *Increasingly, museum visitors (and staff) expect to be able to work, learn, study, and connect with their social networks in all places and at all times using whichever device they choose.* Wireless network access, mobile networks, and personal portable networks have made it easy to remain connected almost anywhere. Museum audiences have become accustomed to easy access to the network in other parts of their lives, and grow increasingly impatient with places where it is not possible (or where it is prohibitively expensive) to be connected using the device of their choosing.

- *The abundance of resources and relationships offered by open content repositories and social networks is challenging us to revisit our roles as educators.* Access to educational materials of all kinds has never been as easy or as open as it is today. The model of the museum curator or educator standing in front of an object interpreting meaning for a passive audience is no longer realistic in a world accustomed to instant access to virtually any kind of information. More important to today's audiences is advice on how to find, interpret, and make their own connections with collections and ideas.

Significant Challenges

Any discussion of technology adoption must also consider important constraints and challenges, and the Advisory Board drew deeply from a careful analysis of current events, papers, articles, and similar sources, as well as from personal experience in detailing a long list of challenges museums face in adopting any new technology. Several important challenges are detailed below, but it was clear that behind them all was a pervasive sense that individual museum constraints are likely the most important factors in any decision to adopt — or not to adopt — any given technology.

Even institutions that are eager to adopt new technologies may be critically constrained by the lack of necessary human resources and

financial wherewithal to realize their ideas. Still others are located within buildings that simply were not designed to provide the radio frequency transparency that wireless technologies require, and thus find themselves shut out of many potential technology options. While acknowledging that local barriers to technology adoptions are many and significant, the Advisory Board focused its discussions on challenges that are common to museums and the museum community as a whole.

The highest ranked challenges they identified are listed here, in the order of their perceived importance.

- *Far too few museums are crafting and following a comprehensive strategy to ensure that they can keep pace with even the most proven technologies.* A comprehensive digital strategy should include plans to use technology not only for learning and interpretation, but also for marketing, e-philanthropy, revenue generation, digitization, and digital preservation — as well as plans for the general technology infrastructure.

- *Funding for technology projects is too often done outside operational budgets.* The recent recession brought to an end what had been a promising trend of museums allocating ongoing operational funds (as opposed to capital or project funds) for both experimental and proven technology projects. Any museum that is not making reasoned continual investment in its technological future is putting the museum's ability to engage with ever more networked audiences at significant risk.

- *The relationships and synergies among technology use by a museum and its staff, the ways people and organizations use technology outside the museum, and the resources a museum has chosen to place online are not well understood.* Many in museums still fail to grasp the notion that 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 via the Internet and mobile networks is too often seen as frivolous or unnecessary.

- *Documentation of the impact of programs delivered via digital technologies is often expected as a prerequisite for adoption or even pilot efforts, creating a "chicken versus egg" conundrum.* Museums are good at traditional program evaluation, and expect it as a normal component of museum activities. Too often, however, it is the technology that is the presumed focus of assessment in digitally delivered programs rather than changes in knowledge, attitudes, or skills that may result from the activities of the program. Such a focus, while seemingly resonant with standard practice, can serve as a barrier to experimentation and innovation.

- *Advances in workflow and content production techniques in business and industry are largely absent from similar forms of content creation in museums.* Museum workflows are too often ill-suited to modern content production techniques in which content is created simultaneously for multiple delivery modes. Websites, videos, podcasts, social networks, and blogs should all pull from a content management system that allows any "story," critique, or analysis to be ported to any medium. Failure to align workflows with this model adds costs and limits publishing options for museums that are already operating under financial constraints.

- *At a time when their role is more important than ever, too many museum educators lack the training, resources or support to address the technological opportunities and challenges they face.* The lack of adequate preparation in the use of common digital technologies in university training for museum educators coupled with few

choices for ongoing professional development is creating a vacuum of skills just when they are needed most. Museum education departments must find ways to keep their staffs current in educational technologies and practices.

These trends and challenges are a reflection of the impact of technology in almost every aspect of our lives. They are indicative of the changing nature of the way we communicate, access information, connect with peers and colleagues, learn, and even socialize. Taken together, they provided the Advisory Board a frame through which to consider the potential impacts of nearly 50 emerging technologies and related practices that were analyzed and discussed for potential inclusion in this edition of the *Horizon Report.* Six of those were chosen as key; they are summarized below and detailed in the main body of the report.

Technologies to Watch

The six technologies featured in the *2010 Horizon Report: Museum Edition* are placed along three adoption horizons that indicate likely time frames for their entrance into mainstream use for museum education and interpretation. The near-term horizon assumes the likelihood of entry into the mainstream for museums within the next twelve months; the mid-term horizon, within two to three years; and the far-term, within four to five years. It should be noted at the outset that the *Horizon Report* is not a predictive tool. It is meant, rather, to highlight emerging technologies with considerable potential for our focus areas of education and interpretation. Each of the six is already the focus of work at a number of innovative organizations around the world, and the work we showcase here reveals the promise of a wider impact.

On the near-term horizon — that is, within the next 12 months — are *mobiles* and *social media.* These two topics appear on this first horizon because they are present and pervasive in everyday life, and audiences have ever-increasing expectations of what museums might offer via these two technologies.

■ The story of **mobiles** is no longer about the devices themselves, but about the blurring of the boundary between cellular networks and the Internet. Increasingly, and more so in the developing world, the Internet is accessed from mobile devices using a cellular network that extends significantly beyond even the electric grid. Mobiles represent an untapped resource for reaching visitors and for bridging the gap between the experiences that happen in museums and those that happen out in the world. Museums are poised to use mobiles to create and deliver educational and interpretive experiences, supplying contextual information to engage the visitor and allow them to make connections between objects and ideas, people, places, and institutions.

■ **Social media** present an opportunity to reach new audiences and to create communities around museum collections. Social media are made social by tools that allow people to interact around ideas conveyed through images, video, audio, and animations. Social media have proven to be very effective in engaging audiences, not simply connecting them, and provide museums with real opportunities to dialog with audiences in new and substantive conversations and learning experiences.

The second adoption horizon is set two to three years out, where we will begin to see widespread adoptions of two technologies that are growing in popularity in the consumer sector: *augmented reality* and *location-based services.* Museum educators arguably have always been in the business of augmenting reality, creating bridges between objects, ideas, and visitors, but augmented reality technologies are now allowing this to happen more fluidly and easily than ever. Location-based services offer museums to extend conversations about history, art, science, and more out into their communities, effectively extending the galleries to include public works, historical sites, and much more. Within the next few years, the opportunities

offered to museums via the adoption and creative implementation of these two technologies will only expand. Consider a museum environment in which visitors can access deep, rich experiential learning, information, and services in a range of formats, each presented at the exact time and place when it is most meaningful — even beyond the boundaries of the museum itself.

- **Augmented reality** has become something anyone can use, thanks to the convergence of three technologies — GPS, video, and pattern recognition — and the applications seem endless. Already on a path of convergence with mobile technology, augmented reality is not bound to the desktop, but is also a portable tool for discovery-based learning that can enhance the information available to patrons when visiting galleries, exploring outdoor installations, or interacting with real-world objects.

- **Location-based services** provide consumers with services linked explicitly to their current location and often prioritized by the known interests of the user. From geographically targeted advertising to applications that suggest services, special offers, and activities in the immediate area, location-based services supply a growing demand for personalization. Mobiles are the logical platform for delivery of location-based services, and location-based services are one of the fastest growing areas for mobile applications.

On the far-term horizon, set at four to five years away from widespread adoption, are *gesture-based computing* and *the semantic web.* Both of these technologies are the focus of considerable development in both the consumer and industry sectors. The high level of interest and the significant research occurring in both areas indicate that they are worth following closely.

- **Gesture-based computing** is already strong in the consumer market and we are seeing a growing number of prototypical applications for training, research, and study, though this technology is still some time away from common educational use. Mobile devices controlled by natural movements of the finger, hand, arm, and body are common, and other devices incorporating these approaches soon will be. As we work with devices that respond to us rather than requiring us to learn to work with them, our understanding of what it means to interact with a computer is changing. For museums, gesture-based computing opens up interesting avenues for visitors to interact with information and objects in a physical as well as an intellectual way — an activity long denied to the typical visitor, who can only view the objects on display.

- **The semantic web** reveals relationships between concepts, people, and events that are embedded in the wealth of content on the web but not always easy to see using other means. Semantic-aware applications expose those relationships by determining the context in which information exists; such applications can aggregate related information much more quickly than it could be done by hand. Museums have a unique opportunity to expose and mine semantic information in their own collections, which would allow greater exposure of and context for vast collections of objects.

Each of these technologies is described in detail in the main body of the report, where a discussion of what the technology is and why it is relevant to museum education and interpretation may also be found. Given the practical focus of the report, a listing of examples of the technology in use, especially in museums, is a key component of each of the six main topics. Our research indicates that all six of these technologies, taken together, will have a significant impact on museums and other cultural institutions within the next five years.

The Horizon Project

Since March 2002, under the banner of the Horizon Project, the New Media Consortium has held an ongoing series of conversations and dialogs with hundreds of technology professionals, campus technologists, faculty leaders from colleges and universities, museum professionals, teachers and other school professionals, and representatives of leading corporations from more than two dozen countries. In the ensuing years, these conversations have been the impetus for a series of annual reports focused on emerging technologies relevant to higher education.

In 2008, the NMC embarked on a new series of regional and sector-based companion editions of the *Horizon Report,* with the dual goals of understanding how technology is being absorbed using a smaller lens, and also noting the contrasts between technology use in one area compared to another. This report, the *2010 Horizon Report: Museum Edition,* is the first in the series focusing on museum education and interpretation. To date, companion editions have been prepared that center on Australia and New Zealand, the region known as Iberoamerica, the K-12 sector, and small- to medium-sized businesses. The flagship *Horizon Report,* focused on higher education, is translated into multiple languages every year. Over all editions, the readership of the reports is estimated at over 500,000 worldwide, with readers in more than 70 countries.

Like the university-focused effort from which it emerged, the museum project used qualitative research methods to identify the technologies selected for inclusion in the report. The process began with a survey of the work of other organizations, a close examination of topics previously detailed in the *Horizon Report* series, and a review of the literature with an eye toward spotting interesting emerging technologies.

The 36 members of this year's Museum Advisory Board were purposely chosen to represent a broad spectrum of the museum sector; key writers and thinkers from education, business and industry rounded out the group. They engaged in a comprehensive review and analysis of research, articles, papers, blogs, and interviews; discussed existing applications, and brainstormed new ones; and ultimately ranked the items on the list of candidate technologies for their potential relevance to museum education and interpretation. This work took place entirely online and may be reviewed on the project wiki at http://museum.wiki.nmc.org.

The effort to produce the museum report began in late spring 2010 and concluded when the report was released in September 2010, a period of just over four months. The six technologies and applications that emerged at the top of the final rankings — two per adoption horizon — are detailed in the chapters that follow.

Each of those chapters includes detailed descriptions, links to active demonstration projects, and a wide array of additional resources related to the six profiled technologies. Those profiles are the heart of the *2010 Horizon Report: Museum Edition,* and will fuel the work of the Horizon Project throughout 2010-11. For those wanting to know more about the processes used to generate the *Horizon Reports,* many of which are ongoing and extend the work in the reports, we refer you to the report's final section on the research methodology.

MOBILES

Time-to-Adoption Horizon: One Year or Less

The mobile market today has more than 4 billion subscribers, two-thirds of whom live in developing countries. The global network supporting mobile devices of all kinds now covers more territory than the electrical grid. A massive and increasing number of people all over the world own and use computers that fit in their hand and are able to connect to the network wirelessly from virtually anywhere. Tens of thousands of applications designed to support a wide variety of tasks on a host of mobile devices and platforms are readily available, with more entering the market all the time. These mobile computing tools have become accepted aids in daily life for everything from business to personal productivity to social networking.

Overview

According to a recent Gartner Report, mobiles will be the most common way for people to access the Internet by 2013. Perhaps more important for museums, Internet-capable mobile devices will outnumber computers by 2011. Over 1.2 billion new phones are produced each year in an unprecedented flow of continuous enhancement and innovation. An outgrowth of this explosion of new devices is that museum visitors expect to be able to use them anywhere — including the public spaces and galleries at museums.

The available choices for staying connected while on the go are many — smart phones, tablets, laptops, and the newest class of devices like the iPad that blends the functions of all of them. Access to the Internet is less and less dependent on location, as users increasingly connect via 3G and similar networks. The devices we carry are more capable with each new release, and the boundaries between them more and more blurred. In the developed world, mobile computing has become an indispensable part of day-to-day life in the workforce, and a key driver is the increasing ease and speed with which it is possible to access the Internet from virtually anywhere in the world via the ever-expanding cellular network.

Users increasingly expect anytime, anywhere access to data and services that not very long ago were available only while sitting in front of a computer linked to the network via a cable. In addition to the typical software for email, communication, and calendaring, new tools allow users to manage personal information (such as Evernote, Nozbe, Wesabe, and TripIt), collaborate and easily access and share files (Dropbox and CalenGoo are two of many possible examples), or keep abreast of social networks (Limbo, Facebook, Twitter, or Foursquare). Together, these tools make checking and updating work, school, or personal information flows something easily done on the fly.

Thousands of applications designed to support a wide range of tasks on virtually any smart-phone operating system are readily available, with more entering the market all the time. These mobile computing tools have become increasingly essential aids in daily life, giving us on-the-go access to tools for business, capturing and editing audio or video, sensing and measurement, geolocation, social networking, personal productivity, references, just-in-time learning — indeed, virtually anything that can be done on a desktop.

Relevance for Museum Education and Interpretation

The relationship between mobiles and museums is a part of an ever-growing conversation around the topic of museum needs and visitor expectations. Visitors expect to play active rather than passive roles in their visits and museums with resources are scrambling to meet these expectations. Many museums have already started to leverage the capabilities of mobile computing to provide online

resources in terms of both rich content and general information. San Francisco's Museum of Modern Art (SFMOMA) and The Powerhouse Museum in Sydney, Australia, two of many possible examples, have recently completed redesigns of their websites based on the understanding that the majority of their virtual visitors will be viewing that information via their mobiles.

Museums have long felt that a major promise offered by the ubiquity of personal devices would be in terms of cost savings. If visitors brought their own devices with them to the museum, this would significantly reduce the cost of acquiring, operating, and maintaining devices for audio tours, and, to some extent, informational kiosks. Museums that were early adopters of mobile technologies for in-gallery experiences, like the Walker Art Center in Minneapolis, Minnesota, and the Tate Modern in London, have long used portable devices to deliver traditional audio or audio-visual tours of exhibitions and collections enhanced with rich media and interactive content. Mobile technology has developed at a staggering pace over the last few years and today affords many more opportunities for museums, such as tying content to location, or taking the museum experience out of the building and into the surrounding geography.

Conversations surrounding mobiles and the utility of smart phones and similar Internet devices for museums are often less about the devices themselves and more about the variety of content and services that can be delivered. Increasingly, those conversations center on how mobiles can be used to encourage deeper connections among individuals, institutions, and collections. The range of technologies converging in mobile devices is very broad, as is the variety of ways they can be applied: GPS and compasses allow sophisticated location and positioning; accelerometers and motion sensors enable completely new forms of control and interaction; digital capture and editing bring rich tools for high-resolution video, audio, and

image capture and even editing — more and more, mobiles encompass it all.

Museums are also discovering that simple mobile tools can be used to successfully engage visitors, particularly visitors to the physical spaces, and especially in urban environments that already cater to the tech-savvy visitor. New York City's Museum of Modern Art (MOMA) and the Brooklyn Museum have established large and loyal communities of patrons in social spaces that can be accessed from mobiles, including Twitter, Facebook, and Foursquare.

A sampling of mobile applications includes the following:

- **Education and Interpretation.** The Diamond Museum in Antwerp, Belgium recently launched a geolocation game that allows students to discover the history of the city. Players choose an identity and then receive a map of Antwerp and a crossword puzzle they must fill in; they then have two hours to visit and identify 10 different locations in the city in order to discover the true identity of Stefan De Beer, a descendent of the De Beers diamond family.

- **Exhibitions and Collections.** Increasingly, museums are taking advantage of the devices people carry, reducing overhead costs for services like audio tours by offering visitors self-paced tours on cell phones. The Tacoma Museum of Art website offers *Ear for Art: Chihuly Glass,* a cell phone walking tour of Chihuly's artwork in the Tacoma Washington Museum District. Visitors use their own phones and access the tour for free.

- **Communications and Marketing.** New ser-vices are springing up to assist museums in creating engaging in-gallery and mobile expe-riences for visitors. One such example is the open-source project Fluid Engage (http://www.fluidengage.org).

Mobiles in Practice

The following links provide examples of mobiles in use in museum settings.

Apps from the American Museum of Natural History

http://www.amnh.org/apps/

Two apps from AMNH bring visitors into intimate contact with the museum's collections. The Dinosaurs iPhone app engages visitors with the museum's dinosaur content through a mosaic of images. Viewers explore a range of information about the collection, including a rich history of how the fossils were found and preserved. The Explorer app for iPhone, iPod Touch, and iPad is an innovative tool that directs visitors to very specific places within the museum's complex facility and offers location-aware activities using the building's wifi network to enable GPS-like navigation.

Firefly Watch

https://www.mos.org/fireflywatch/

The Museum of Science in Boston, collaborating with researchers from Tufts University, has created a mobile application for visitors and native Bostonians that allows them to serve as local "citizen scientists" aiding real scientists in a large regional study of firefly populations.

Making Sense of Modern Art (MSoMA) Mobile

http://www.sfmoma.org/events/1556

The San Francisco Museum of Modern Art provides visitors with a handheld multimedia tour that includes rich audio and video, poems, and music.

MOMA Teen Audio

http://www.moma.org/explore/multimedia/audios/15

This collection contains podcasts created, written, and recorded by New York City high school students about works in the permanent collection of the Museum of Modern Art, New York (MOMA).

TAP – Indianapolis Museum of Art

http://www.imamuseum.org/interact/tap

The Indianapolis Museum of Art has begun offering in-gallery mobile tours designed for the iPod Touch. The tours give a very personalized, in-depth look at collections and exhibits using text, audio, video, and interactive polls.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about mobiles.

Five Reasons why TAP Should be your Museum's Next Mobile Platform

http://www.imamuseum.org/blog/2010/04/05/5-reasons-why-tap-should-be-your-museums-next-mobile-platform/

(Rob Stein, *Indianapolis Museum of Art (IMA) Blog,* 5 April 2010.) This post describes the open source platform, TAP, that was developed at the IMA. The tool is freely available for mobile tour development.

Mobile for Museums

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

(Sharon Leon, Director of Public Projects at Center for History and New Media, George Mason University, 2010.) This article assesses the current state of mobiles for the museum field.

Mobile Media for Cultural and Historical Heritage, Guidelines and Pilot Projects

http://themuseumofthefuture.com/2010/05/02/

(Jasper Visser, *The Museum of the Future,* 2 May 2010.) This blog post describes some guidelines for museum staff to consider when planning a mobile project. The guidelines emerged from a brainstorming meeting of the European staff from Dutch Digital Heritage, the Dutch Museum Association, the Stedelijk Museum (Denmark) and the Beeld en Geluid.

The Museum *Is* Mobile: Cross-Platform Content Design for Audiences on the Go
http://www.archimuse.com/mw2010/papers/proctor/proctor.html

(Nancy Proctor, *Museums and the Web 2010: Proceedings.* Toronto: Archives & Museum Informatics, 31 March 2010.) This paper, presented at Museums and the Web 2010, takes an in-depth look at how museums can design mobile projects for their institutions.

Teaching with Technology Face-Off: iPhones vs. PCs
https://chronicle.com/blogPost/Teaching-With-Technology/4547

(Jeffrey R. Young, *The Chronicle of Higher Education,* 25 February 2009.) One professor found that mobile devices increased student engagement with learning materials in his class.

***Delicious:* Mobiles**
http://delicious.com/tag/hz10mu+mobiles

(Tagged by Horizon Advisory Board and friends, 2010). Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hz10mu" and "mobiles" when you save them to *Delicious.*

SOCIAL MEDIA

Time-to-Adoption Horizon: One Year or Less

Social media tap an entire world of user-generated content created by new technologies and applications, readily available on our smart phones and computers, and easily disseminated and accessed via the Internet. Social media use video, audio, and other media as a catalyst to encourage, facilitate and provoke social interaction. Often erroneously combined with the notion of social networking, the use of social media is a distinct phenomenon in its own right. Social media engage others in conversations and interactions with, about, and through media. Collectively, social media are above all the voice of the audience, endlessly expressive and creative.

Overview

No longer satisfied to be consumers of content, today's audience creates content as well, and is uploading photographs, audio, and video to the cloud by the billions. Producing, commenting on, and classifying these media have become ends in themselves. Sites like YouTube, Flickr, Odeo, Google Video, and Ourmedia make it easy to find images, videos, and audio clips, but the real value of these sites lies in the way that they encourage a community around the media they host. Users can talk about, evaluate, critique, and augment the content that is there — and do so in tremendous numbers.

Using simple interfaces, social media allow visitors to build shared collections of resources, whether they be links, photos, videos, documents, or almost any other kind of media. These tools are readily available, at little or no cost, and are typically easy to use with a low learning threshold. Whether for organizing one's own social media or browsing someone else's, the tools that are available are small and flexible enough to be used on a variety of platforms.

Social media allow users and groups of users to collaborate and engage one another. Viewers can find and comment on items in other people's lists, sharing not only the resources themselves but also information and descriptive details about them. As a result, over the past few years, the ways we produce, use, and share our media have undergone a profound transformation. Content can be created and disseminated quickly to a global audience. There is an immediacy to the content created via

social media tools that is absent in more polished productions, and this immediacy encourages dialog.

Social media are enabled by their very simplicity. In the past, when production and editing tools were expensive, or when the skill sets required to complete tasks were complicated or not widely understood, it was difficult to make changes to produced media — video, images, and audio. Now changes can be made to such content easily and almost instantly. Once uploaded, another now trivial task, content can be used and edited, manipulated and repurposed to meet the needs of many different individuals and communities. Individual bits of content may be static, but their context — which is defined by the community and its contributions and interactions — is constantly changing.

Relevance for Museum Education and Interpretation

Social media provide a powerful construct with which to engage audiences. Museums want and need to engage their audiences to survive, and have a wealth of unique and interesting content that is ripe for a larger dialog. Social media tools like YouTube, Flickr, Google Media, and others make it a simple matter to get that content into online communities where people can find it.

One of the common features of social media is that the tools used to enable online communities also can be used to capture metrics of all sorts — making discussions around effectiveness a simple matter.

Museums, particularly science and history museums, can use social media to engage audiences in hands-on scientific inquiry. One key feature of social media is that they can tap the collective intelligence of a museum's community to uncover facts and stories that would otherwise be lost. That attribute was used by the Flickr Commons, where some of the world's premiere historical collections of photographs are augmented by information submitted by members of the public, such as the names of family members, or locations that may have previously been unknown.

The relevance of social media for museums is easy to establish — it simply requires a museum to go online to see what may already be happening. The odds are that even if a museum does not have an active presence itself in any of the major social media spaces, its visitors do and are probably already talking about their museum-related experiences there. By understanding who those online community members are, what they care about, and what they are saying, museums can reach out and touch their audience in strikingly effective ways that are simply not possible by any other means.

Social media in this context are often collectively thought of as a marketing tool — but one where visitors do most of the marketing on the museum's behalf.

A sampling of social media applications includes the following:

- **Education and Interpretation.** Museums can create conversations around videos and photographs of art, objects, and even the galleries and museums themselves. A preeminent example, the Flickr Commons (http://www.flickr.com/commons), has two key goals: to publicize the world's public photography archives, and to gather user-generated content to make these collections more accessible to everyone.

- **Exhibitions and Collections.** A collaboration between YouTube, the Guggenheim Museum, HP, and Intel, *YouTube Play: A Biennial of Creative Video* (http://www.youtube.com/play)

is a project focused on curating and displaying a new series of video art created by the public using social media.

- **Communications and Marketing.** Social media offer museums a way to reach out to new audiences in a two-way conversation. For example, AudioBoo (http://audioboo.fm/) is a free web and mobile platform that allows users to record and share "Boos" (audio recordings of up to 5 minutes in length) about their experiences.

Social Media in Practice

The following links provide examples of social media in use in museum settings.

ArtBabble
http://www.artbabble.org/

> ArtBabble is a cloud-based video hosting service for art content, built and hosted by the Indianapolis Museum of Art. The site pulls together visitor comments, a Twitter stream, and more in a social media environment.

Flickr World Museums
http://www.flickr.com/groups/
worldmuseumsgallery/

> The Flickr group, World Museums, has an active and growing membership. To date, more than 2,000 photos have been contributed showing popular exhibits, visitor interaction and behind-the-scenes shots taken by museum staff.

Freeze Tag!
http://www.brooklynmuseum.org/
opencollection/freeze_tag/start.php

> The Brooklyn Museum uses a social media game to correct questionable tags that have been applied to its online collection.

Make History: 9/11 Memorial Museum
http://makehistory.national911memorial.org

> Visitors to this online memorial are encouraged to contribute photos, videos, and stories about their experiences during the September 11 tragedy, creating a collective story of the event from many perspectives.

Museums and Social Media
http://gmoa.blogspot.com/2010/03/museums-and-social-media.html

(*Curator's Corner Blog,* Georgia Museum of Art, 26 March 2010.) This blog post summarizes the results of a survey that polled a range of American museums to find out how they are using social media.

Smithsonian: Voice Your Vision
http://www.youtube.com/group/SmithsonianVision

The Smithsonian Institution posted a YouTube video about their visioning process and asked for video responses from their audiences on where the Smithsonian staff and advisors should focus their energies.

World Beach Project
http://www.vam.ac.uk/collections/textiles/lawty/world_beach/

The Victoria and Albert Museum's "World Beach Project" is an online global art project in which visitors upload photographs of patterns made with stones on beaches around the world. The photographs are linked to a map showing where they were taken.

For Further Reading
The following articles and resources are recommended for those who wish to learn more about social media.

Five Insightful TED Talks on Social Media
http://mashable.com/2010/02/08/ted-talks-social-meida/

(Matt Silverman, *Mashable: The Social Media Guide,* 8 February 2010.) This blog post describes recent TED Talks given by leaders in the field of social media.

Generation M2: Media in the Lives of 8- to 18-Year–Olds
http://www.kff.org/entmedia/mh012010pkg.cfm

(Victoria J. Rideout, Ulla G. Foehr and Donald F. Roberts, Kaiser Family Foundation Study, January 2010.) This study provides a comprehensive overview of the ways children use media in their daily lives. The research here can give one an overview of what to expect in terms of media engagement with younger audiences when they visit museums.

Social Media Strategies for Museums
http://westmuse.wordpress.com/2009/09/22/social-media-strategies-for-museums/

(Stephanie Weaver, *Western Museums Association Blog,* 22 September 2009.) This post gives an overview of some of the social media challenges and trends as discussed at the Social Media Strategy for Museums conference held in September 2009.

The Social Web in 2010: The Emerging Standards and Technologies to Watch
http://blogs.zdnet.com/Hinchcliffe/?p=1152

(Dion Hinchcliffe, *ZDNet.com,* 20 January 2010.) This analyst gives an in-depth look at the technologies and integration of social media into our daily lives, especially as they relate to the work environment.

Teens and Social Media: An Overview
http://www.pewinternet.org/Reports/2007/Teens-and-Social-Media.aspx

(Amanda Lenhart, *Pew Internet and American Life Project,* 10 April 2009.) This 22-page report prepared as part of the larger Pew Internet Study describes how teens use and expect to use new technologies.

Delicious: Social Media
http://delicious.com/tag/hz10mu+socialmedia

(Tagged by Horizon Advisory Board and friends, 2010). Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hz10mu" and "socialmedia" when you save them to *Delicious.*

AUGMENTED REALITY

Time-to-Adoption Horizon: Two to Three Years

While the capability to deliver augmented reality experiences has been around for decades, it is only very recently that those experiences have become easy and portable. Advances in mobile devices as well as in the different technologies that combine the real world with virtual information have led to augmented reality applications that are as near to hand as any other application on a laptop or a smart phone. New uses for augmented reality are being explored and new experiments undertaken now that it is easy to do so. Emerging augmented reality tools to date have been mainly designed for marketing, social purposes, amusement, or location-based information, but new ones continue to appear as the technology becomes more popular. Augmented reality has become simple, and is now poised to enter the mainstream in the consumer sector.

Overview

The concept of blending (augmenting) data — information, rich media, and even live action — with what we see in the real world is a powerful one. Augmented reality aims to do just that as a means to enhance the information we can perceive with our senses. The first applications of augmented reality appeared in the late 1960s and 1970s, and by the 1990s, augmented reality was being put to use by a number of major companies for visualization, training, and other purposes. Now, the technologies that make augmented reality possible are powerful and compact enough to deliver augmented reality experiences to personal computers — and even mobile devices. Early mobile applications began to appear in 2008, and now many augmented reality applications and tools for mobiles are on the market.

Wireless applications are increasingly driving this technology into the mobile space where they offer a great deal of promise. Initially, augmented reality required unwieldy headsets and kept users largely tethered to their desktop computers. The camera and screen embedded in smart phones and other mobile devices now serve as the means to combine real world data with virtual data; using GPS capability, image recognition, and a compass, augmented reality applications can pinpoint where the mobile's camera is pointing and overlay relevant information at appropriate points on the screen.

Augmented reality applications can either be marker-based, which means that the camera must perceive a specific visual cue in order for the software to call up the correct information, or markerless. Markerless applications use positional data, such as a mobile's GPS and compass, or image recognition, where input to the camera is compared against a library of images to find a match. Markerless applications have wider applicability since they function anywhere without the need for special labeling or supplemental reference points.

Currently, many augmented reality efforts are focused on entertainment and marketing, but these will spill into other areas as the technology matures and becomes even more simplified. Layar (http://layar.com) has been a leader in this space with augmented reality applications for the Android and iPhone platforms. Layar's mobile application features content layers that may include ratings, reviews, advertising, or other such information to assist consumers on location in shopping or dining areas. Other mobile applications that make use of augmented reality for social or commercial purposes include Yelp, another review and rating service; Wikitude, which overlays information from Wikipedia and other sources onto a view of the real world; and a handful of Twitter clients. The mobile media company Ogmento develops augmented reality games for mobiles.

The improvement in technology has allowed more streamlined approaches and wider user adoption. Market projections for augmented reality on mobile

devices predict revenues of $2 million in 2010, rising to several hundred million by 2014 ($350 million, according to ABI Research; Juniper Research's projections are even higher). Augmented reality is already entering the mainstream in the consumer sector, and the social, gaming, and location-based applications that are emerging point to a strong potential for education and interpretation applications in the next few years.

Relevance for Museum Education and Interpretation

Museums are in a sense already in the augmented reality business — an animation of lost-wax casting, a map of Italy with Pompeii highlighted for an exhibition of archaeological artifacts, a photograph of Georgia O'Keefe silk-screened onto a label next to a painting, or layering multiple voices in the narration provided in an audio-guide — and cultural institutions readily understand the need to augment the reality of objects in a museum in order to help visitors better understand and connect with collections. The key affordance offered by digital technologies, especially mobile ones, is to provide a wider array of up-to-the-minute contextual information, wherever the viewer may be.

The ability to provide additional content related to objects and collections digitally presents a whole new set of possibilities for augmenting objects on display. Visitors are ready for such content. Most have already started to become accustomed to using their handheld devices as a sort of portable kiosk no matter where they are. They expect the museum to be no different.

Applications that convey information about a place can open the door to powerful forms of discovery-based learning. Students on field trips to historic sites, for example, might access augmented reality applications that overlay maps and information about how the location looked at different points of history. (For a real-life example of this, see the Museum of London's Street Museum application for the iPhone.)

An application currently in development by the EU-funded iTacitus project (http://itacitus.org/) will allow visitors to pan across an actual location — the Coliseum, say — and see what it looked like during an historical event, complete with cheering spectators and competing athletes. SREngine, another augmented reality application in development, will use object recognition to display information about things one encounters in the real world — describing the use of different pieces of equipment in museum display, for instance, or identifying plants in a rooftop garden.

Augmented books, now just beginning to enter the market, are another interesting application of this technology. The German company Metaio (http://www.metaio.com/demo) is developing books that include augmented reality elements, such as globes that pop up on the pages of a book about the earth. The books are printed normally, but include special visual markers at key points. After purchase, consumers install special software on their computers and point a webcam at the book to see the visualizations. An atlas featuring 3D views of geographic locations is currently in development — it is not difficult to picture augmented exhibition catalogs that include 3D views of the objects in the collection emerging very very soon.

Visitors and museum professionals alike can recognize the unique place and utility of augmented reality experiences currently in use by marketing and commercial interests. Museums have already been active in exploring the potential of QR codes (a simple marker-based application for mobiles) to engage the visitor. The Norsk Telemuseum, in Oslo Norway, working in conjunction with IBM, has piloted an interactive treasure hunt game for teens using personal camera phones and QR codes. The same museum encourages students to leave "secret messages" for their friends to find within the museum. IBM has helped to pilot similar projects in Venice and Rome and it is highly likely that more museums will soon take advantage of this relatively low-tech augmented reality application.

A sampling of applications of augmented reality includes the following:

- **Education and Interpretation.** Augmented reality can enhance interpretation by offering more, and more diverse, levels of interpretation. MEanderthal is an application for iPhone and Android from the Smithsonian National Museum of Natural History that allows users to transform their faces into those of early humans.

- **Exhibitions and Collections.** Within a culture in which visitors can rarely touch the objects in the collections, augmented reality has strong potential to provide a form of interaction with objects that otherwise would not be possible.

- **Marketing and Communications.** Augmented reality has the ability to radically reconfigure the visitor experience both on-site and beyond. The technology could be used, for example, to visualize artifacts as if they were in their original locations, inverting the idea of a museum entirely.

Augmented Reality in Practice
The following links provide examples of augmented reality in use in museums and other settings.

Chicago Museum of Science and Industry
http://www.msichicago.org/whats-here/exhibits/you/

An augmented reality musical game, featured in the Chicago Museum of Science and Industry's permanent exhibition *YOU! The Experience,* turns a 2D card into a virtual keyboard. The user repeats three rounds of increasingly difficult note sequences. Afterward, the card calls up a visualization of the brain, showing its activity during the game.

CultureClic
http://www.cultureclic.fr/

CultureClic is a free iPhone augmented reality application that allows visitors to explore more than 500 paintings, photographs, and engravings in Paris, Bordeaux, Lyon, and Marseilles — while standing in the location depicted in the artwork.

A Future for the Past (Video)
http://www.youtube.com/watch?v=0UODkvUTnAU

In 2009 the Allard Pierson Museum in Amsterdam presented an exhibition entitled *A Future for the Past* which included two prototype augmented reality applications: a virtual reconstruction of Satricum and an annotated landscape on a 1855 photograph of Forum Romanum. This video describes the exhibition.

Getty Museum: Augmented Reality of the Augsburg Display Cabinet
http://www.getty.edu/art/exhibitions/north_pavilion/ar/index.html

This augmented reality project enables viewers to take a detailed look at the intricately carved and decorated Augsburg Cabinet (1630), bringing this unique piece closer to visitors without risking harm to the object.

Metaio and Louvre-DNP Museum Lab (Video)
http://www.youtube.com/metaioar#p/u/40/RxSb4tjdTPk

This joint project between the Louvre and augmented reality development firm Metaio is developing material to enhance exhibits and collections. This video demonstrates a prototype device that overlays augmented reality content onto the museum's gallery spaces.

Pedro Morales
http://2d-code.co.uk/qr-code-artist-pedro-morales/

QR Code Artist Pedro Morales uses raffia mesh and fabric shapes to create organic works of art with content that can be read by simply pointing your mobile camera at them.

The Powerhouse Museum
http://www.powerhousemuseum.com/layar/

The Powerhouse Museum has developed an augmented reality application that allows visitors to use their mobile phones to see Sydney, Australia as it appeared one hundred years ago.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about augmented reality.

An Augmented Reality Presentation System for Remote Cultural Heritage Sites (PDF)
http://i.document.m05.de/wp-content/uploads/2008/04/09p103.pdf

> (M. Zöllner , J. Keil , H. Wüst and D. Pletinckx, *The 10th International Symposium on Virtual Reality, Archaeology and Cultural Heritage: VAST,* 2009.) This paper describes the technology used to produce the 2009 exhibition *A Future for the Past* at the Allard Pierson Museum in Amsterdam.

Augmented Reality Technology Brings Learning to Life
http://www.gse.harvard.edu/blog/uk/2009/09/augmented-reality-technology-brings-learning-to-life.html

> (Chris Dede, *Useable Knowledge Blog,* Harvard Graduate School of Education, September 2009.) This article outlines the value of augmented reality in educational settings and suggests why it is an attractive technology for learners (or visitors).

Civil War Augmented Reality Project Proposal
http://www.historyteachersattic.com/2010/06/my-civil-war-augmented-reality-proposal/

> (Jeff Mummert, *The History Teacher's Attic,* June 2010.) History teacher Jeff Mummert outlines a proposal for an augmented reality project for the Civil War. The proposal provides a model of how to describe a potential project from conception to development.

Getting Started with AR
http://blog.craigkapp.com/?page_id=1474

> (Craig Kapp, *The Pixel Farm,* July 2010.) Augmented reality developer Craig Kapp has compiled an excellent list of resources aimed at beginners who are interested in experimenting with augmented reality applications.

If You Are Not Seeing Data, You Are Not Seeing
http://www.wired.com/gadgetlab/2009/08/augmented-reality/

> (Brian Chen, *Wired Gadget Lab,* 25 August 2009.) This article gives a good overview of augmented reality, including where it currently is situated and what to expect in the future.

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.

Delicious: Augmented Reality
http://delicious.com/tag/hz10mu+augmentedreality

> (Tagged by Horizon Advisory Board and friends, 2010). Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hz10mu" and "augmentedreality" when you save them to *Delicious.*

LOCATION-BASED SERVICES

Time-to-Adoption Horizon: Two to Three Years

Location-based services provide content that is dynamically customized according to the user's location. These services are easily (and commonly) delivered to mobile devices, but can also be accessed from any Internet-capable device. Current common applications for location-based services include advertising, news, social networking, and similar services. A growing number of mobile applications are taking advantage of the built-in geolocation capability that is increasingly a standard feature in mobile devices. Media such as photos and video, as well as the simplicity of geotagging, will be important aspects of location-based services as they continue to develop.

Overview

Location-based services have some features in common with augmented reality (for example, they are commonly accessed via a mobile device), but they are distinct in that the services are not overlaid with the real world, but rather keyed to provide information and content about services available near one's current location. With the advent of mobile-embedded GPS technology, location-based services are among the fastest growing families of mobile tools. Early applications focused on marketing, advertising, and social networking: consumers could discover retailers and venues near them offering services of interest, and easily connect with friends and colleagues in the area. New tools are emerging that focus on tourism, public art, learning, jogging and other interest areas.

There are three ways that mobiles discern location, described here at decreasing levels of resolution: geolocation, cell tower triangulation, and wireless Internet access points. Tools for developers are lowering the bar to creating location-based applications; while programming skills are still required, systems like TransGo by TransFormat enable rapid development of location-based applications using GPS, RFID, network triangulation, and other technologies. Digital resources can be connected with physical locations and objects very easily, so that once location is established, tools can direct users to locations in a particular area that offer information, products, or services useful in that physical context.

Information about nearby stores, cafés, buildings, landmarks, or other fixed features is commonplace; a growing use of location-based services is to locate friends who may be nearby or who have common interests or experiences. Educational applications for location-based services are currently designed along the same lines, delivering relevant place-based information and allowing easy geotagging of captured data. Location-specific data can be displayed in a variety of ways: photographs, videos, or text overlaid on maps, photos, or live views of the area, for instance, or listed by location name and address. Contextual information can include historical data, weather reports, locations of nearby people, objects, and places, and so on.

Location-based services offer a number of interesting possibilities to engage in a deeper level of interactivity with visitors. Many museums are already taking advantage of location-based tools and applications. Foursquare (http://foursquare.com), for example, is a mobile application embraced by many museums that determines a user's location, suggests a list of nearby places, and awards points to users that check in from those and other venues. Users can add "to-do" items related to places they visit, and museum staff can add tips and to-do recommendations as well. By earning the most points in a single location, a person can become the "mayor" of that venue. A few innovative museums are using Foursquare to their advantage by offering store or café discounts to the current "mayor" and

by creating to-do items that lead visitors to their location in order to win the points associated with completing the activity.

It is readily apparent that there is some overlap among the technologies described in this report — mobiles, augmented reality, and location-based services in particular. Many of these applications are converging, as in mobile applications that use location-based information to deliver augmented reality content to the mobile's screen. Applications like Layar, for instance, might easily appear under any of those topics. It is also clear that applications that support augmented reality or location-based services are being developed so that the device upon which they run is not important. Many of these applications are available for desktop or laptop computers as well as for mobile devices of all kinds.

Relevance for Museum Education and Interpretation

Location-based services offer a ripe opportunity for museums to extend their reach into the community as well as improving their educational offerings to visitors in the galleries. With more GPS-enabled devices in the hands of consumers — consumers with the resources to own a smart phone — the market for location-based applications is growing. From helping visitors find the museum to providing customized contextual services in the museum or out in the community, museums now have the means to reach patrons when and where they are ready to engage with the world of art, history, culture, or science.

Some museums, for example, are using location-based services as a way to offer walking tours that point out locations where pieces were created, indicate what the city looked like centuries ago, or provide information on historic buildings or sites as the viewer stands in front of them. Others are helping the visitor interested in a particular painting or sculpture to discover other nearby works by the same artist, other pieces that feature the same subject matter — or related content in the museum store!

Services designed to support businesses, like Yowza!! (http://www.getyowza.com), work with merchants to offer coupons to mobile users; these can easily be adapted for museum use. Yowza!! lists and locates nearby restaurants and retailers that are advertising sales or offering coupons and tracks how many times each coupon is used, when it has expired or been used up, and how much was saved by using the coupons. Guides like these can direct visitors to a museum's location, suggest nearby venues for dining or shopping, and advertise special exhibitions or sales in the museum's store.

A sampling of applications of location-based services includes the following:

- **Education and Interpretation.** Location-based services allow a museum to extend its collection into the world beyond its walls. For example, simply geotagging public artworks can provide an easy mechanism to lead a visitor to the museum's website or establish waypoints on a walking tour that ties into a current exhibition.

- **Exhibitions and Collections.** Location-based services within museums can "pin" information to a given object or gallery location and have it pushed to a user once he or she has reached that location. (This approach to the delivery of location-based services is known as geocaching).

- **Marketing and Communications.** Museums can use location-based services to push information to audiences based on where they are within the city, building or grounds. Tourists, for instance, can access information about nearby cultural attractions, museums, and other points of interest using their mobiles, while gallery visitors can receive information tailored to the exhibit they are looking at.

Location-Based Services in Practice

The following links provide examples of location-based services.

Compass and Camera Used in Location-Based Apps for G1

http://www.wired.com/gadgetlab/2009/02/compass-and-cam

Museums and other cultural centers can benefit from apps like Nru ('near you'), which shows either a bird's eye view of the surroundings or detailed information on a particular building or structure, depending on how the mobile device is held.

Map.pr

http://map.pr/

This service shows popular locations by type — restaurant, entertainment, sights — giving an at-a-glance overview of which are the most frequented. Users can add tips and to-do items for a location as well, and see what others recommend.

MoMA – Museum of Modern Art

http://foursquare.com/venue/241470

Foursquare is a location-based social application that allows members to let their friends know where they are and what they are doing. MoMa has a large Foursquare following and helps its members to collect points and prize 'badges.'

Museum of the Phantom City

http://phantomcity.org/

This innovative project creates a virtual mosaic of architectural ideas for New York City proposed by leading architects and designers over the decades, offering a vision of what might have been. The museum is entirely virtual, with its content tied to the location where it might have been built.

Streetmuseum

http://www.museumoflondon.org.uk/MuseumOfLondon/Resources/app/you-are-here-app/index.html

In 2010 The Museum of London introduced a new, location-based application that allows the user to browse historical photographs as they travel around London.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about location-based services.

7 Things You Should Know about Location-Aware Applications

http://www.educause.edu/ELI/7ThingsYouShouldKnowAboutLocat/163839

(Educause, March 2009.) This brief report discusses how location-based services can be applied in the service of education.

2009: The Year of LBS (Location-Based Services)

http://www.readwriteweb.com/archives/2009_the_year_of_lbs_location-based_services.php

(Sarah Perez, *ReadWriteWeb,* 7 July 2009.) From finding the nearest coffee shop to tracking your children, location-based services offer a host of solutions to everyday problems.

The Era of Location-as-Platform Has Arrived

http://www.readwriteweb.com/archives/foursquare_location_platform.php

(Marshall Kirkpatrick, *ReadWriteWeb,* 25 January 2010.) This article discusses the potential of location-based services such as Foursquare, Twitter, and those offered by Google.

Location-Based Services in 2014: Part 1 and 2

http://geothought.blogspot.com/2009/10/location-based-services-in-2014-part-1.html

(Peter Batty, *Geothought,* 19 October 2009.) This article describes in detail the ways location-based services are expected to evolve in the next four to five years.

Place Your Bets 2010 – Location-Based Services + Augmented Reality

http://www.thetrendwatch.com/2010/01/18/place-your-bets-2010-location-based-services-augmented-reality/

(Luis Freitas, *The TrendWatch,* 18 January 2010.) This article considers the integration of augmented reality and location-based services

with an eye to searching and finding locations — in the physical world as well as the virtual.

Why Hasn't Location Reached the Mainstream Yet?

http://mashable.com/2010/05/13/location-mainstream/

(Leah Betancourt, *Mashable,* 13 May 2010.) This article reviews some of the challenges surrounding location-based services and describes how some of the larger social networks, such as Twitter and Facebook, are poised to push this technology into the mainstream. Betancourt also addresses the value of 'check-in' apps such as Foursquare, Gowalla, Yelp and BrightKite, proposing that these bring value to location within a social context.

Delicious: Location-Based Services

http://delicious.com/tag/ hz10mu+locationservices

(Tagged by Horizon Advisory Board and friends, 2010). Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hz10mu" and "locationservices" when you save them to *Delicious.*

GESTURE-BASED COMPUTING

Time-to-Adoption Horizon: Four to Five Years

For nearly forty years, the keyboard and mouse have been the primary means to interact with computers. The Nintendo Wii in 2006 and the Apple iPhone in 2007 signaled the beginning of widespread consumer interest in — and acceptance of — interfaces based on natural human gestures. Now, new devices are appearing on the market that take advantage of motions that are easy and intuitive to make, allowing us an unprecedented level of control over the devices around us. Cameras and sensors pick up the movements of our bodies without the need of remotes or handheld tracking tools. The full realization of the potential of gesture-based computing is still several years away, especially for education; but we are moving ever closer to a time when our gestures will speak for us, even to our machines.

Overview

It is already common to interact with a new class of devices entirely through the use of natural gestures. The Microsoft Surface, the iPhone and iPod Touch, the Nintendo Wii, and other gesture-based systems accept input in the form of taps, swipes, and other ways of touching, hand and arm motions, gentle shakes, or body movements. These are the first in a growing array of alternative input devices that allow computers to recognize and interpret natural physical gestures as a means of control and the start of a gradual shift towards interfaces that make sense of common human movements. Gestural interfaces allow users to engage in virtual activities with motion and movement similar to what they would use in the real world, manipulating content intuitively. The idea that natural, comfortable motions can be used to control computers is opening the way to a host of input devices that look and feel very different from the keyboard and mouse.

As the underlying technologies evolve, a variety of approaches to gesture-based input are being explored. The screens of the iPhone and the Surface, for instance, react to pressure, motion, and the number of fingers touching the devices. The iPhone additionally can react to manipulation of the device itself — shaking, rotating, tilting, or moving the device in space. The Wii and other emerging gaming systems use a combination of a handheld, accelerometer-based controller and stationary infrared sensor to determine position, acceleration, and direction. The technology to detect gestural movement and to display its results is improving very rapidly, increasing the opportunities for this kind of interaction. Two new gaming systems — the Sony PlayStation 3 Motion Controller and the Microsoft Kinect system — take a step closer to stripping the gesture-based interface of anything beyond the gesture and the machine, at least in terms of how it is experienced by the user.

Gesture-based interfaces are increasingly built into things we can already use; Logitech and Apple have brought gesture-based mice to market, and Microsoft is developing several similar models. Smart phones, remote controls, and touch-screen computers all accept gesture input. As more of these devices are developed and released, our options for controlling a host of electronic devices are expanding. We can make music louder or softer by moving a hand, or skip a track with the flick of a finger. Apple's *Remote* app for the iPhone turns the mobile device into a remote control for the Apple TV; users can search, play, pause, rewind, and so on, just by gliding a finger over the iPhone's surface. Instead of learning where to point and click and how to type, we are beginning to be able to expect our computers to respond to natural movements that make sense to us.

Currently, the most common applications of gesture-based computing are for computer games, file and media browsing, and simulation and training.

A number of simple mobile applications use gestures. *Mover* lets users "flick" photos and files from one phone to another; *Shut Up,* an app from Nokia, silences the phone when the user turns it upside down; *nAlertme,* an anti-theft app, sounds an alarm if the phone isn't shaken in a specific, preset way when it is switched on. Some companies are exploring further possibilities; for instance, Softkinetic (http://www.softkinetic.net) develops platforms that support gesture-based technology, as well as designing custom applications for clients, including interactive marketing and consumer electronics as well as games and entertainment.

Because gesture-based computing changes not only the physical and mechanical aspects of interacting with computers, but also our perception of what it means to work with a computer, it is a transformative technology.

Relevance for Museum Education and Interpretation

In certain respects, gesture-based computing is simply an extension of learning activities museums have always embraced; museums clearly understand the value of kinesthetic learning. It is not uncommon to find reproductions of manuscripts or scrolls in galleries that allow visitors to experience what it might be like to handle the real object. While gesture-based computing goes far beyond this, the experiences are related.

Gesture-based computing is important for museums particularly because they have created, for good reasons, an environment in which an audience is prevented from touching and manipulating objects — many of which could teach or be better understood if visitors could actually touch or manipulate them. What is missing in too many museum experiences is the direct and satisfying personal connection of an individual with the object.

The kinesthetic nature of gesture-based computing will very likely lead to new kinds of teaching or training simulations that look, feel, and operate almost exactly like their real-world counterparts. The very ease and intuitiveness of a gestural interface makes the experience seem very natural, and even fun. Already, medical students benefit from simulations that teach the use of specific tools through gesture-based interfaces, and it is easy to see how such interfaces could be applied in the visual arts and other fields where fine motor skills come into play. When combined with haptic (touch or motion-based) feedback, the overall effect is very compelling.

Gesture-based computing opens up unparalleled avenues of accessibility and interaction for visitors. Larger multi-touch displays support collaborative work, allowing multiple users to interact with content simultaneously, unlike a single-user mouse. Imagine an interface that allows the visitor to seamlessly explore a delicate silk scroll using the gestures of a Chinese scholar, determine or change the DNA of a fruit fly by piecing it together by hand, mix wine with water in an ancient Greek krater, page through an illuminated manuscript, or embroider a medieval altar frontal — with gestural interfaces, discovery-based learning opportunities like these become possible.

A sampling of applications for gesture-based computing includes the following:

- **Education and Interpretation.** Educational games built on gesture-based platforms can allow visitors to explore relevant techniques, actions, and interactions in a playful manner.

- **Exhibitions and Collections.** Gesture-based interfaces and tools may help visitors to more intuitively understand the operational aesthetic of objects, including how they function, how they are created, and related information. An example of how this might be done can be seen in the iPad application *Elements,* which allows users to manipulate and "touch" chemical compounds, metals, and even radioactive substances in a fun, engaging way.

- **Visitor Services and Accessibility.** Gesture-based tools are especially easy for the very

young, who need almost no instruction in their use. On the other end of the spectrum, gesture-based tools could allow the elderly and infirm to participate in activities and increase their ability to access collections.

Gesture-Based Computing in Practice

The following links provide examples of gesture-based computing.

The Hybridiser
http://vimeo.com/6580702

This innovative project at the Auckland Museum uses touch-screen interfaces to allow visitors to create custom virtual orchids in lifelike detail. Such screens can provide an immersive, interactive experience that directly engages the visitor.

Lisbon Oceanarium Sea Monster Exhibit
http://www.ydreams.com/#/en/projects/ eventsexhibitions/interactivechildrensexhibition lisbonaceanario/

In this immersive, touch-screen exhibit, visitors use both their hands and their feet to interact with — and control — the exhibit.

Mapping Application Magnifies California's Rich History
http://www.ideum.com/interactive-exhibits/ omca-mapping-app/

Installed in the Oakland Museum in California, this exhibit offers visitors a rich, immersive experience with the maps of California in order to see how land distribution and changes occurred through time.

Oil Spill Multitouch Map Mashup
http://www.ideum.com/blog/2010/06/bp-oil-spill-multitouch-mashup/

This application, created for display at natural science museums and aquariums, highlights the June 2010 oil spill disaster in the Gulf of Mexico. While engaging visitors with its touch-based controls, the display helps them understand how the event has unfolded.

Uffizi Touch Project
http://www.uffizitouch.it/?cat=3

The Uffizi Gallery in Florence has incorporated gesture-based interfaces in their space to allow visitors to explore centuries of art using immersive touch screen imaging technology similar in some respects to Apple's CoverFlow interface.

Virtual Ercolano (Video)
http://www.youtube.com/user/MuseoMavTV#p/ a/u/1/muDBWr0AP8g

The Museo Archeologico Virtuale, in Ercolano, Italy, has integrated several gesture-based technologies in its galleries. This video shows an exhibit covered with virtual dust that scatters, revealing mosaics, when visitors disturb the dust with their hands or feet.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about gesture-based computing.

The Best Computer Interfaces: Past, Present, and Future
http://www.technologyreview.com/computing/ 22393/

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

Haptics Brings A Personal Touch To Technology
http://news.bbc.co.uk/2/hi/technology/10373923. stm

(Michael Fitzpatrick, *BBC News,* 5 July 2010.) This article outlines the types of haptic interfaces and technologies that will be forthcoming as touch-based interfaces and flexible displays become more common.

'Imaginary' Interface Could Replace Real Thing
http://www.msnbc.msn.com/id/37580233/ns/ technology_and_science-innovation/

(Adam Hadhazy, *MSNBC,* 8 June 2010.) This post outlines some of the emerging

technologies that will have impact on gesture-based computing as it continues to develop.

Towards Interactive Museum: Mapping Cultural Contexts to Historical Objects (PDF)
http://mirw09.offis.de/paper/Towards%20Interactive%20Museum%20Mapping%20Cultural%20Contexts%20to%20Historical%20Objects.pdf

(Ki-Woong Park, Sung Kyu Park, Jong-Woon Yoo, Kyu Ho Park, MIRW Workshop '09, Bonn, Germany, 15 September 2009.) This paper outlines technologies that could be used by visitors to interact with exhibits and collections, including a wearable computer system that is controlled largely by the gestures of the user.

Why Desktop Touch Screens Don't Really Work Well For Humans
http://www.washingtonpost.com/wp-dyn/content/article/2009/10/13/AR2009101300113.html

(Michael Arrington, *The Washington Post,* 12 October 2009.) Desktop touch screens are available but difficult to use over long periods. This article suggests another design approach.

***Delicious:* Gesture-Based Computing**
http://delicious.com/tag/hz10mu+gesturecomputing

(Tagged by Horizon Advisory Board and friends, 2010). Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hz10mu" and "gesturecomputing" when you save them to *Delicious.*

THE SEMANTIC WEB
Time-to-Adoption Horizon: Four to Five Years

The idea behind the semantic web is that although online data might be easily available for searching, their meaning is not: computers are very good at returning keywords, but very bad at understanding the context in which keywords are used. A typical search on the term "turkey," for instance, might return traditional recipes, information about the bird, and information about the country; the search engine can only pick out keywords, and cannot distinguish among different uses of the words. Similarly, although the information required to answer the question "Which original paintings by Arthur Dove are housed in the United States?" is readily available to a search engine, it is scattered among many different pages and sources. Semantic-aware applications allow meaning to be automatically inferred from content and context and structured in a useful way. The promise of these applications is to help us see connections that already exist, but that are invisible to current search algorithms.

Overview

The vision for the semantic web, originally advanced by Sir Tim Berners-Lee, is that eventually it might be able to help people solve very difficult problems by presenting connections between apparently unrelated concepts, individuals, events, or things — connections that it would take many people many years to perceive, but that could become obvious through the kinds of associations made possible when the semantics of the data are exposed. There are currently two theoretical approaches to developing the semantic capacity of the web. One, the bottom-up approach, is problematic in that it assumes metadata will be added to each piece of content to include information about its context; tagging at the concept level, if you will. The top-down approach appears to have a far greater likelihood of success, as it focuses on developing natural language search capability that can make those same kinds of determinations without any special metadata. (Museums, notably, are one of the few areas where the bottom-up approach is perceived as actually ideal.)

Semantic-aware applications infer the meaning, or semantics, of information on the Internet to make connections and provide answers without the need for tedious labeling or annotation. New applications use the context of information as well as the content to make determinations about relationships between bits of data; examples like TripIt, SemaPlorer, and Xobni organize information about travel plans, places, or email contacts and display it in convenient formats based on semantic connections. For instance, TripIt is a social semantic-aware application for travelers that organizes travel plans and makes useful connections based on the information it extracts from these plans; a TripIt user simply forwards a confirmation email from any travel provider — airlines, hotels, car rentals, event tickets — and TripIt automatically creates an itinerary by interpreting and organizing the information in the email according to its semantic context.

Most currently available semantic-aware applications are intended to assist with searching and finding, with making intellectual or social connections, or with advertising. Semantic searching is currently used primarily to streamline scientific inquiries, allowing researchers to find relevant information without having to deal with apparently similar, but irrelevant, information. For instance, Noesis, a new semantic web search engine developed at the University of Alabama in Huntsville, is designed to filter out search hits that are off-topic. The search engine uses a discipline-specific semantic ontology to match search terms with relevant results, ensuring that a search on "tropical cyclones" will not turn up information on sports teams or roller coasters.

Tools for making connections between concepts or people are also entering the market. Calais is a toolkit of applications that makes it easier to integrate semantic functionality in blogs, websites, and other web content; for instance, Calais' Tagaroo is a plug-in for WordPress that suggests tags and Flickr images related to a post as the author composes it. Zemanta is a similar tool, also for bloggers. SemanticProxy, another Calais tool, automatically generates semantic metadata tags for a given website that are readable by semantic-aware applications, without the content creator's needing to do it by hand. Calais includes an open API, so developers can create custom semantic-aware applications.

Advertisers are also finding a use for semantic-aware applications. Tools like Dapper MashupAds extract information from the page the user is browsing and tailor sidebar advertisements to that content. If you are browsing flights to Orlando, for instance, MashupAds might show a sidebar with Orlando hotels; if you are shopping for a home, the ad might show you sample mortgage rates for comparable properties in that particular area. BooRah is a tool that pulls information from restaurant reviews all over the web, analyzing the tone of the reviews to assign positive or negative ratings to restaurants. The links, ads, and recommendations on a BooRah detail page are all local to the restaurant's area as well.

Relevance for Museum Education and Interpretation

Museums are in a unique position to benefit from the increased exposure and contextualization that semantic tools can bring to their collections. Because of the relatively homogenous nature of museum collections, the extensive and well-understood set of information that is maintained for each piece, and the necessarily finite number of pieces in any given collection, museums are perfect candidates for semantic tools. While the evolution of the semantic web is still in its infancy, we can expect to see semantic systems relatively soon that

will glean information from collections databases — as well as from visitor-contributed data sets, like tag collections — and draw connections between them in new and interesting ways.

An increasing number of museums are beginning to recognize the importance of sharing information about collections across institutions. The better contextualized a collection is, the greater the chance of exposure within the larger museum and scholarly communities. While libraries have long recognized the importance of standardized descriptive information, museums have traditionally resisted attempts to standardize descriptions of what are considered culturally unique objects; the business model for museums has emphasized the creation of the unique record, and contextualization and exposure were secondary concerns. The semantic web offers the museum community the best of both worlds — the opportunity to document the unique while also exposing connections between works and opening them to a wider audience.

The European museum community is poised to make real strides into the world of the semantic web with projects like LIDO, which outlines a standardized format for describing works of art and is due to be launched in the spring of 2011 for museums across Europe. The goal of the LIDO project is to enable museums to agree upon a common standard to express, deliver, exchange, and harvest information in machine-readable format and to be able to upload data automatically to Europeana, an online collection of millions of images. The LIDO standard will be able to express a wide variety of information that identifies unique objects and understands why a particular object is held in any specific museum. Semantic applications that understand the LIDO format would be able to easily access collections that are so organized.

A sampling of applications of the semantic web includes the following:

- **Education and Interpretation.** Museums of all kinds are filled with collections of objects

taken out of context. The semantic web and its applications allow museums to virtually re-contextualize collections in a way that is much more meaningful to the museum visitor and offers some promise in resolving issues related to exploiting this rich knowledge. The result of this contextualization will provide visitors with a deeper understanding of collections.

- **Exhibitions and Collections.** Because museums are a logical place for semantic web-related work to occur — their collections are bounded and increasingly being enriched with tags that expand the ways in which objects within them can be found — the semantic web has the potential to improve the workflow and process of organizing exhibitions and collections. Implementing agreed-upon standards and applications that allow content to be discoverable via its context could potentially eliminate much duplication of effort in terms of data entry and back-and-forth communication that occurs as a result of institution-specific collections information records.

- **Curation.** Traditionally curatorial departments have organized information based upon the scholarly perspectives of curators for whom organizing and conveying information was not a primary objective. Semantic web applications that can glean information from relevant sources may be useful in providing access to basic contextual information without involving tremendous amounts of effort and time.

The Semantic Web in Practice

The following links provide use-case examples for the semantic web.

Apture
http://www.apture.com

Apture is a free semantic application that allows users to find and add relevant multimedia easily to blogs.

CHIP Project at the Rijksmuseum Amsterdam
http://www.chip-project.org

The goal of the Cultural Heritage Information Presentation (CHIP) project is to enrich a visitor's experience using semantic technologies to enable better browsing, searching and recommendations on a very personalized level.

CultureSampo
http://www.seco.tkk.fi/applications/ kulttuurisampo/

CultureSampo is a semantic web 2.0 portal and a publication channel for Finnish cultural heritage based on the semantic web.

The Modigliani Test:
The Semantic Web's Tipping Point
http://www.readwriteweb.com/archives/the_ modigliani_test_semantic_web_tipping_point. php

This brief article discusses how the semantic web could be used to link web-based informa-tion about art — in this case, for artist Amedeo Modigliani.

National Semantic Web Ontology Project in Finland (FinnONTO), 2003-2012
http://www.seco.tkk.fi/projects/finnonto/

This national initiative will lay the foundation for a semantic ontology that can be used for linked data in Finland across its cultural and scientific institutions.

For Further Reading

The following articles and resources are recommended for those who wish to learn more about the semantic web.

Geospatio-temporal Semantic Web for Cultural Heritage (PDF)
http://www.seco.tkk.fi/publications/2010/ kauppinen-et-al-geospatio-temporal-2010.pdf

(Tomi Kauppinen et al., in *Digital Culture and E-Tourism: Technologies, Applications and Management Approaches.* Militadis Lytras, Ernesto Damiani, Lily Diaz and Patricia Ordonez

De Pablos (eds.), IGI Global 2010.) This book chapter outlines approaches to semantic technologies for geospatial information and focuses on tailoring visitor experiences using semantic ontologies.

The Semantic Web
http://www.scientificamerican.com/article.cfm?id=the-semantic-web

> (Tim Berners-Lee, James Hendler and Ora Lassila, *Scientific American,* May 2001.) Though nearly ten years old, this seminal publication is still relevant. It explains the semantic web in lay terms by the founder of the web and provides a solid foundation for understanding this technology, how it applies to the larger ecosystem of the web, and the implications it will have in the future.

Semantic Web at Data.gov
http://www.data.gov/semantic

> This site provides a number of examples of how the semantic web could be used to analyze government data in a visual context.

Talis' *Nodalities* Magazine
http://www.talis.com/nodalities/

> This free publication is a good resource for staying up to date on current and emerging semantic web technologies. The articles provide many examples and case studies.

Tim Berners-Lee on the Next Web
http://www.ted.com/talks/tim_berners_lee_on_the_next_web.html

> (*TED Talks,* February 2009.) Sir Tim Berners-Lee discusses the history and future of the web.

Delicious: The Semantic Web
http://delicious.com/tag/hz10mu+semanticweb

> (Tagged by Horizon Advisory Board and friends, 2010). Follow this link to find additional resources tagged for this topic and this edition of the *Horizon Report.* To add to this list, simply tag resources with "hz10mu" and "semanticweb" when you save them to *Delicious.*

METHODOLOGY

The process used to research and create the *2010 Horizon Report: Museum Edition* is very much rooted in the methods used throughout the Horizon Project. All editions of the *Horizon Report* are produced using a carefully constructed process that is informed by both primary and secondary research. Dozens of technologies, meaningful trends, and critical challenges are examined for possible inclusion in the report for each edition. Every report draws on the considerable expertise of an internationally renowned Advisory Board that first considers a broad set of important emerging technologies, challenges, and trends, and then examines each of them in progressively more detail, reducing the set until the final listing of technologies, trends, and challenges is selected.

Much of the process takes place online, where it is captured and placed in the Horizon Project wiki. This wiki is intended to be a completely transparent window onto the work of the project, and contains the entire record of the research for each of the various editions.

The section of the wiki used for the Museum Edition can be found at http://museum.wiki.nmc.org.

The procedure for selecting the topics that will be in the report includes a modified Delphi process now refined over years of producing *Horizon Reports,* and it begins with the assembly of the Advisory Board. The board as a whole is intended to represent a wide range of backgrounds, nationalities, and interests, yet each member brings a particularly relevant expertise. To date, hundreds of internationally recognized practitioners and experts have participated in the Horizon Project Advisory Boards; in any given year, a third of Advisory Board members are new, ensuring a flow of fresh perspectives each year.

Once the Advisory Board for a particular edition is constituted, their work begins with a systematic review of the literature — press clippings, reports, essays, and other materials — that pertains to emerging technology. Advisory Board members are provided with an extensive set of background materials when the project begins, and are then asked to comment on them, identify those that seem especially worthwhile, and add to the set. The group discusses existing applications of emerging technology and brainstorms new ones. A key criterion for the inclusion of a topic in this edition is its potential relevance to museum education or interpretation. A carefully selected set of RSS feeds from dozens of relevant publications ensures that background resources stay current as the project progresses. They are used to inform the thinking of the participants throughout the process.

Following the review of the literature, each Advisory Board engages in the central focus of the research — the research questions that are at the core of the Horizon Project. These questions are tailored to the focus of each edition and are designed to elicit a comprehensive listing of interesting technologies, challenges, and trends from the Advisory Board:

1 *Which of the key technologies catalogued in the Horizon Project Listing will be most important to museum education and interpretation within the next five years?*

2 *What key technologies are missing from our list? Consider these related questions:*

  a. *What would you list among the established technologies that some institutions are using today that arguably all museums should be using broadly to support or enhance museum education and interpretation?*

  b. *What technologies that have a solid user base in consumer, entertainment, or other industries should museums be actively looking for ways to apply?*

  c. *What are the key emerging technologies you see developing to the point that museums*

should begin to take notice during the next four to five years?

3 *What do you see as the key challenges related to education and interpretation that museums will face during the next five years?*

4 *What trends do you expect will have a significant impact on the ways in which museums use technologies in the service of mission-mandated goals related to education and interpretation?*

One of the Advisory Board's most important tasks is to answer these questions as systematically and broadly as possible, so as to ensure that the range of relevant topics is considered. Once this work is done, a process that moves quickly over just a few days, the Advisory Board moves to a unique consensus-building process based on an iterative Delphi-based methodology.

In the first step of this approach, the responses to the research questions are systematically ranked and placed into adoption horizons by each Advisory Board member using a multi-vote system that allows members to weight their selections. Each member is asked to also identify the timeframe during which they feel the technology would enter mainstream use — defined for the purpose of the project as about 20% of institutions adopting it within the period discussed. (This figure is based on the research of Geoffrey A. Moore and refers to the critical mass of adoptions needed for a technology to have a chance of entering broad use.) These rankings are compiled into a collective set of responses, and inevitably, the ones around which there is the most agreement are quickly apparent.

From the comprehensive list of technologies originally considered for any report, the twelve that emerge at the top of the initial ranking process — four per adoption horizon — are further researched and expanded. Once this "short list" is identified, the group, working with both NMC staff and practitioners in the field, begins to explore the ways in which these twelve important technologies might be used for museum education and interpretation. A significant amount of time is spent researching real and potential applications for each of the areas that would be of interest to practitioners.

For every edition, when that work is done, each of these twelve "short list" items is written up in the format of the *Horizon Report.* With the benefit of the full picture of how the topic will look in the report, the "short list" is then ranked yet again, this time in reverse. The six technologies and applications that emerge are those detailed in the *Horizon Report.*

For additional detail on the project methodology or to review the actual instrumentation, the ranking, and the interim products behind the report, please visit http://museum.wiki.nmc.org.

2010 HORIZON.MUSEUM PROJECT ADVISORY BOARD