WATCH YOUR MATERIALS PERFORM: SHATTERING CONVENTIONS AND DISPLAY CASES WITH AUGMENTED REALITY

Ashley Todd-Diaz and Earl Givens, Jr.
Emporia State University

Abstract

Emporia State University's (ESU) Special Collections and Archives and Technical Services Department have joined forces to achieve an innovate way to let delicate manuscripts and archival materials perform for patrons and visitors, while staying mindful of preservation and security, by utilizing mobile, augmented reality technology to bring these objects to life. Through free application mobile software, the ESU Special Collections and Archives has merged the boundary between the physical and virtual worlds, offering patrons the opportunity to go beyond walking through stationary exhibits of artifacts, to a full interactive experience.

Keywords: Archives, Augmented Reality, Exhibits, Mobile Technology, Special Collections, User Experience, Virtual Reality.

Introduction

Archivists and special collections librarians, like other information professionals, manage, organize and provide access to a variety of resources. A primary challenge these professionals face is balancing the preservation and security needs of the materials under their care with the accessibility their patrons expect. How often have you wished there was a better way to let delicate manuscripts, rare books and archival materials perform for patrons, while staying mindful of their care? Emporia State University's (ESU) Special Collections and Archives and Technical Services Department have joined forces to achieve this goal by utilizing mobile, augmented reality technology to bring these objects to life. Through free application mobile software, ESU Special Collections and Archives has merged the boundary between the physical and virtual worlds, offering patrons and visitors the opportunity to go beyond walking through stationary exhibits of artifacts, to a full interactive experience. Imagine an easy way for a handwritten music score or historic artifact to tell its story without requiring patrons to read any labels; a method that allows the object to break free of the display case in an explosion of audio, video and images.

Literature Review

What is augmented reality (AR)? Interestingly enough there is no universally accepted definition for the term "augmented reality." However, for the purposes of this study we will define AR using its basic principles and framework. Henceforth AR should be defined as "a computer-generated component that is added to the real environment" (Pence, 2011, p. 137). AR is not a new thing, as early as 1960 AR has been on the radar of many computer techs alike. Though, due to the limited processing power of computers, AR was seen as an enormous expense with little return (Sutherland, 1968, p. 757).

With the advancement of modern technology AR has reemerged in the U.S, military over the past 10 years in vehicles and aircraft (Shachtman, 2009). Beyond the military AR has laid dormant over the past few years. However, with the rise in mobile technology AR is emerging via smartphones and tablets through mobile applications (Pence, 2011, p. 138). Smartphones and tablets are the Swiss army knife of the 21st century, allowing users to experience our world in a variety of ways. With the development of mobile applications, the digital divide between software

developers and everyday users is rapidly closing. AR is now a reality to everyday users outside of the U.S military. As quoted from the 2010 Horizon report, "augmented reality has become simple, and is now poised to enter the mainstream in consumer sector" (Johnson et al., 2010, p. 21).

Enter libraries and archives. Today's patrons, particularly students, are increasingly tech-savvy and expect a certain level of convenience, immediacy and interactivity (Nagy, 2011, p. 8; Becker, 2012, p. 478-9). Considering that information is now readily available via the Internet, libraries and archives are challenged to compete technologically to maintain their patrons.

One way of maintaining patrons is to engage them and encourage them to feel partial ownership of the library or archives. One way to achieve this is through the development of exhibits that not only offer patrons the opportunity to learn something new, but also invite them to interact with materials. An important consideration and research topic for exhibit designers is how to develop exhibits that will not only attract visitors, but also hold their attention long enough for learning to begin (Boisvert & Slez, 1995; Sandifer, 2003). In a study of exhibit characteristics and corresponding visitor engagement, Boisvert and Slez (1995) noted that when comparing types of exhibits, visitors spent more time engaged by highly interactive, concrete, simple exhibits and staffed demonstrations (p. 515). While incorporating interactive elements is one thing, adding staff or volunteers within exhibit spaces to act as guides and interpreters would be fairly challenging considering that exhibits are not the primary aspect of libraries or archives.

With shrinking budgets and the demand to stay current with contemporary technology, libraries and archives are faced with ongoing frustration in trying to provide 21st century services to their tech-savvy patrons with 20th century budgets. Studies have shown patrons are interested in utilizing library resources on their smartphones, tablets and electronic devices, providing libraries and archives with an opportunity to reimagine their services if they are willing to pursue it (Dresselhaus & Shrode, 2012, p. 90; Wong, 2012, p.108). Similarly, studies have shown that incorporating novel and emerging technologies into exhibits is a way to increase visitor engagement (Sandifer, 2003). Over the years, these tactics have included audio, virtual, and mobile aspects. Considering today's emerging technologies and patrons' comfort level with mobile devices, incorporating free mobile and tablet technology into information resources and exhibits is an innovative and cost effective way to share materials while attracting patron interest and addressing their expectations.

On a continuum, AR exhibit design falls between traditional and virtual exhibits. It shows a lot of potential for engagement in that it provides a dynamic opportunity for patrons "to enjoy the sensory delights of seeing and handling original materials, while enhancing the learning experience by 'surrounding' the object with digital images, online learning resources and information on the items before them and on related objects held in the library" (Hodgson et al., 2012, p. 44). In this way archivists are able to bring patrons in for a closer look at materials on exhibit, while still maintaining their safety and security. Additionally, AR supports engagement through exploration, discovery, visualization, and immersion, which allows it to support a variety of learning styles and speeds, as well as the potential for deeper learning (Green et al., 2014; Yoon et al., 2014).

A handful of libraries and archives have begun to think outside of the box to utilize emerging augmented reality mobile and tablet technology as a means for making their collections more accessible and interactive for patrons. Some libraries are pursuing augmented reality as a way to assist patrons navigating through the stacks and browsing through resources by offering specific location information, circulation statistics and comments for each book on the shelf

(Hahn, 2012, 431).

The University of Manchester's John Rylands Library has been working on a project to introduce and familiarize students with manuscript materials through the use of AR. The project, called Scarlet (Special Collections using Augmented Reality to enhance Learning and Teaching), originally began with a goal of enhancing the use of specific resources by "surrounding" them with digital content through AR (Hodgson et al., 2012, p. 44). They have now expanded to begin developing educational AR toolkit that can be used by the wider community to further enhance learning and teaching.

Another use of augmented reality in libraries and archives has been to share historic photographs. The City Archives within the City of Philadelphia Department of Records created a website, PhillyHistory.org, utilizing geographic information systems (GIS) to share their geolocated digital photographs with patrons around the world. The website offers increased accessibility and searchability by geographic data, such as an address (Boyer et al., 2011, 564). In 2009 the Department of Records began collaborating with Azavea to develop a smartphone app for PhillyHistory.org to further increase its accessibility and include an augmented reality aspect. After receiving a grant from the National Endowment for the Humanities to assist with exploring the use of mobile augmented reality technology, a prototype app was released in 2011 that allowed smartphone users to scan a current Philadelphia location and see historic images overlaid on top of it (Boyer et al., 2011, 661).

Similarly, the University of Saskatchewan University Library and University of Louisville Photographic Archives (ULPA) have begun utilizing Historypin, a free website and smartphone app similar to PhillyHistory.org that allows users around the world to contribute, view and interact with geolocated digital photographs (Harkema & Nygren, 2012, 4; Reilly, 2012, 20). This app also provides patrons with the ability to scan a current scene with their mobile device and see historic photos laid over it; however, a major difference is Historypin is provided free of charge, allowing institutions to increase the overall accessibility of their collections with little financial expense (Harkema & Nygren, 2012, 5).

Methodology

In exploring how the ESU Special Collections and Archives might increase the accessibility of its collections to patrons and further engage them in exhibits, we began researching mobile technology. Layar is a free mobile app available for iOS, Android, and Blackberry mobile devices, as well as Google Glass, that allows patrons to experience a multimedia presentation by merely focusing their smartphone or tablet on a static image (Layar.com).

The app works in its simplest form by identifying a paired trigger image and video overlay thus creating a multimedia Layar campaign. This was appealing to us since it would allow us to embed mini-tours or tutorials of objects featured in our exhibits, simultaneously increasing accessibility to our rare objects and exposure to additional information without asking patrons to read long labels.

In order to test the effectiveness of the app at better engaging patrons with exhibits, we designed a mini-exhibit and created multimedia videos for each object that we linked to the exhibit through Layar. The objects we selected for the exhibit representeda range of media present in our collections, including a piece of artwork, a musical score, and a fraternity paddle from manuscript collections and a foundation stone from the University Archives. The objects were arranged as a

smaller version of a typical exhibit; two were mounted on the wall and two were displayed in cases. All were accompanied by labels, approximately 100-125 words long, so the mini-exhibit could stand on its own without the mobile technology aspect. Once the objects were installed, we took photographs and filmed 1-2 minute video tours of each one using an iPad 2 and then uploaded the image and video files to a desktop computer. We enhanced three of the four videos with Camtasia video editing software by overlaying photographs of related materials in our collections and additional audio tracks. The videos were then uploaded to Layar as overlays and linked to the corresponding trigger images, creating auras for each object in the exhibit. We then placed the auras in a channel we established for the ESU Special Collections and Archives so the content would be available to the public. A group of students was asked to experience the exhibit traditionally and provide feedback through a short survey. Once the survey was completed, the students were provided with an iPad or smartphone loaded with the Layar app and were asked to experience the exhibit again through the app. A second survey was then administered to gauge how the two experiences differed regarding engagement and dissemination of information.

Our Findings

The results of the first student survey revealed that students spent an average of 4.35 minutes experiencing the exhibit. The majority of the students (80%) read the labels, but 20% noted they were too long. When asked how engaging the exhibit was on a scale from 1-10, the average response was 7.1. A follow-up question asked students how they thought the exhibit could be enhanced to increase engagement; responses included offering a tour (25%), adding more items (20%) and incorporating an interactive element (20%). The second survey showed that students spent an average of 7.65 minutes experiencing the exhibits through Layar, a 76% increase in time. When asked how engaging the exhibit was with the added technological aspect, the average response was 8.25 out of 10. This represented a 16% in expressed engagement between the traditional and AR exhibits. Results revealed that 90% of students preferred the interactive augmented reality experience compared to a traditional exhibit. However, although augmented reality was preferred it still needs to be refined to keep student interest.

To ensure the proper feedback was received, three types of Layar campaigns were created for the exhibit. The campaigns consisted of: 1) a "tour" of the object, 2) a photo overlay, and 3) an on-camera "tour" with audio overlay. The "tour" of the object campaign focused on a close examination of the fraternity paddle, consisting of an off-camera narration and on-camera exploration of various features of the paddle and related objects. In a traditional exhibit, this type of behind the scenes tour would not be possible, and even an in-person tour begins and ends with the display case and verbal references to other artifacts. The "tour" of the object campaign shatters traditional norms and sets a new precedent for tours. The photo overlay campaign focused on discussions of the piece of artwork and the foundation stone, each consisting of off-camera narration and overlaid related photos. More so than the "tour" of the object, which is filmed in real-time, this method allowed the featured objects to expand into mini-exhibits through the inclusion of countless additional images fading in and out of the video. Finally, the third type of campaign further amplified the patron experience by bringing a seventy three-year-old musical score to life by combining on-camera narration with overlaid photos and music to give our patrons the full experience of not just seeing the music but hearing it as well. This hybrid effort combined different types of media overlays together, creating a campaign that yielded a new type of interactive experience.

Based on comments from surveys, there was a significant decline in exhibit engagement for videos lasting longer than one minute. However, not every video that spanned past the one-minute mark was considered non-engaging. The longest video recorded, that of the fraternity paddle, posted the greatest amount of interest despite its duration of two-minutes and forty seconds. Our surveys indicated that the students enjoyed seeing a hands-on, special examination of this object. Additionally, students responded positively to the appearance of a second, related object that shares history with the fraternity paddle.

Advantages

A primary advantage to utilizing the Layar app is it is free and easily downloadable to mobile devices. Patrons only have to download the app, scan an item that has been enhanced with a Layar campaign, and begin interacting with it. There is no need for them to create an account or set anything up. Considering that 90% of our respondents noted they own smartphones, 40% noted they own tablets, and the ESU University Libraries and Archives offer 30 tablets for patrons to borrow, the majority of our patrons have access to a mobile device of some kind. As our survey results showed, there was a strong trend in students being more engaged with the exhibit when using Layar. By offering the ability to overlay video, audio and photographs onto a real, though static, object in a display case, the app allows the patron to interact with and learn about the object in a way that is not possible by merely reading labels or taking a tour. Each object can expand into its own mini-exhibit by offering a virtual venue to introduce supporting images, audio and related objects.

Another advantage of the app is the ability to accomplish all steps of incorporating augmented reality into your exhibit via a mobile device. Not only did we capture the trigger images and overlays with an iPad, but we also loaded them to Layar, linked them together to create auras and experienced them through the app with an iPad. Although we chose to enhance some of the overlays by adding photographs and audio tracks with the program Camtasia, this was an optional step. It is worth noting that the aura that appeared most often in the survey comments was one that was not enhanced with Camtasia, but instead featured an in-depth tour of the object.

Layar also integrates with Google Maps providing developers with the ability to create a simple geo-location Layar campaign. Part of the creation process requires a web server with PHP and a MySQL database. Advanced knowledge of modern programming languages and servers is a plus when developing a geo-location API Layar campaign. While using geo-location is optional, using Google Maps provides greater visibility to augmented reality Layar campaigns. Using the GPS location from any Android or Apple device the Layar application can locate any publically shared AR from around the world. Layar locations are visible within the application and also in Google maps. The added visibility through Google Maps offers users the opportunity to discover other Layar locations in their area or anywhere in the world. Geo-location through this application unlocks new possibilities for patrons, opening the world to them in a whole new way.

In addition to providing video and picture overlay. Layar campaigns can also be programmed to perform actions when tapped and/or double-tapped. Options include having the video fill the screen, pause/play, fade in/out, insert custom buttons, call phone numbers, image carousels, play audio on demand, email, tweet and link to a webpage. This offers opportunities for increased patron engagement by empowering them to control their interactive experience with

the objects. It also allows the institution to navigate patrons to websites, finding aids, digital feedback surveys, digital guestbooks, and/or social media.

Layar also provides statistics that allow the institution to track how many unique patrons have viewed and/or interacted with a Layar campaign, as well as reporting which countries your patrons are hailing from. This feature allows the institution to assess the impact of a particular exhibit on a broad level, as well as on a more granular, item level. Since the Layar application will work in person as well as in print and online, the international scope of the statistics assists in showing which patrons you are reaching through your exhibits. This information can be very useful when explaining the significance and the reach of an institution's outreach initiatives.

Challenges

With any new software there is always a slight learning curve; Layar offered a new challenge by merging the worlds of marketing and advertising with augmented reality. This forced us to think outside the box and look at ourselves as marketers and advertisers. This approach allowed us to work within the sphere of the Layar application, while opening up our institution to a whole new world. The Layar application has a cloud-based interface that is almost plug and play in its most basic form. However, to move beyond the basics requires advanced programming and server knowledge. To create dynamic Layar pages and campaigns that use geo-location and catalog application programming interface (API) features, an institution must reach out to those who have the expertise in this area. This opens the possibility of contracting out, which can be a budgetary concern. Consequently, this increases the amount of time for the initial set up of a Layar campaign.

Careful planning also needs to occur before trigger photos and video overlays are loaded into Layar pages. In order to publish a Layar campaign, you need to purchase credits. Once a trigger photo is uploaded, credits are subtracted from the account. While Layar pages can still be edited, Layer campaigns are unable to be modified once a trigger image is loaded. Therefore, before uploading anything to the program you need to be positive that you have chosen the right components for your Layar campaign.

Another consideration to keep in mind is storage space, since Layar does not provide storage space for the trigger images or video overlays that combine to create Layar campaigns. This means that the institution must provide storage on an open, server so that the app can pull the files that it needs to function. While the app does offer the option of housing this content on a video sharing site like YouTube if you are unable to place it on an open server, this downgrades the AR experience by redirecting your mobile device to a webpage when an object is scanned rather than enhancing the real object by layering the multimedia content directly on top of it.

The greatest challenge faced to date is the long-term availability of Layar campaigns. As the popularity of Layar has risen, so too has the cost of the product which limits access to Layar campaigns. Once a Layar page is created it remains accessible. However, Layar campaigns are only accessible for one year from the date of creation. To maintain access to created campaigns a fee must be paid to the vendor. The fee is tiered based on the desired length of access to your published Layer campaign. While there is a free version of Layar, campaigns created using the no cost version are only available for 60 days. Though most exhibition periods are less than a year, many are longer than 60 days due to the amount of work required to develop and install

the finished product. Once again, institutional budgets must be managed to deal with this expense.

Conclusion

Apps like Layar allow patrons to experience an interactive, multimedia exhibit by simply focusing their mobile device on a static object. This offers new opportunities for special collections and archives to safely invite patrons behind the walls of display cases to actively engage in learning more about the objects on exhibit. Every object or place tells a story that is lost without exploration. Augmented reality gives patrons the opportunity to view specialized content not available to the general public. Watching how students interacted with their space while using Layar in the ESU Special Collections and Archives raises new questions about the use of augmented reality beyond libraries and archives.

Further study is needed to realize the full potential of augmented reality in higher education. Moving forward, Layar could conceivably change how students learn and interact with their environment by shattering traditional learning models, where students are receivers of information, to instead empower students to become gatherers of information who actively contribute to the creation of knowledge. We believe that the future of education depends on change. With education budgets rapidly diminishing, Layar offers the possibility of a low-cost, curricular-wide enhancement to education. Just as the ESU Special Collections and Archives enhanced student interaction and learning through augmented reality, higher education has the opportunity to connect students to new ways of learning and processing information. Therefore, although Layar requires a time commitment to film videos and to learn the intricacies of the app, it is worth the time and effort to potentially discover a new information transfer model based around augmented reality. Layar combines familiar technology with location and space to innovatively attain the next level of human interaction and learning.

Bibliography

BECKER, Charles H. (2012). "Student values and research: Are Millennials really changing the future of reference and research?" *Journal of Library Administration*. v. 52. n. 6/7, 474-497.

BOISVERT, Dorothy, L. (1995). "The relationship between exhibit characteristics and learning-associated behaviors in a science museum discovery space". *Science Education*. v. 79. n. 5, 503-518.

BOYER, Deborah, et al. (2011). "Using GIS to manage Philadelphia's archival photographs". *American Archivist* . v. 74. n. 2, 652-663.

DRESSELHAUS, Angela, et al. (2012). "Mobile technologies & academics: Do students use mobile technologies in their academic lives and are librarians ready to meet this challenge?" *Information Technology & Libraries*. v. 31. n. 2, 82-101.

GREEN, Marybeth, et al. (2014). "Reality check: Augmented reality for school libraries". *Teacher Librarian*. v. 41. n. 5, 28-34.

HAHN, Jim. (2012). "Mobile augmented reality applications for library services". *New Library World*. v. 113. n. 9/10, 429-438.

HARKEMA, Craig, et al. (2012). "Historypin for library image collections: New modes of access for unique materials at the University of Saskatchewan Library". *Partnership: The Canadian Journal of Library & Information Practice & Research*. v. 7, 1-11.

HODGSON, John, et al. (2012). "Augmented reality: A new vision for special collections". *CILIP Update*. v. 11. n. 2, 43-45.

JOHNSON, Larry, et al. (2010). "2010 horizon report". *New Media Consortium*: 1-35. <http://www.nmc.org/pdf/2010-Horizon-Report.pdf>. [Last accessed: 03/06/2013].

LAYAR.COM. (2014). "Home page". <https://www.layar.com/>. [LAST accessed: 08/28/2014].

NAGY, Andrew. (2011). "Chapter 2: Next-generation service in the library". *Library Technology Reports.* v. 47. n. 7, 8-10.

PENCE, Harry E. (2011). "Smartphones, smart objects, and augmented reality". *Reference Librarian*. v. 52. n. 1/2,136-145.

REILLY, Elizabeth E. (2012). "Expanding access to archive photographs through Historypin". *MAC Newsletter.* v. 40. n. 2, 20-22.

SANDIFER, C. (2003). "Technological novelty and open-endedness: Two characteristics of interactive exhibits that contribute to the holding of visitor attention in a science museum". *Journal of Research in Science Teaching.* v. 40. n. 2, 121-137.

Shachtman, Noah. (2009). "The army's new land warrior gear: Why soldiers don't like it". *Popular Mechanics*. <http://www.popularmechanics.com>. [Last accessed: 03/06/2013].

SUTHERLAND, Ivan E. (1968). "A head-mounted three dimensional display". In *Proceedings of the December 9-11, 1968, The fall joint computer conference, part I* (AFIPS '68 (Fall, part I)): 757-764.. Web. 3 June 2013.

WONG, Shun Han Rebekah. (2012). "Which platform do our users prefer: Website or mobile app?" *Reference Services Review*. v. 40. n. 1, 103-115.

YOON, Susan A. et al. (2014). "Making the invisible visible in science museums through augmented reality devices". *TechTrends.* v. 58. n. 1, 49-55.