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Using Augmented Reality as a Discovery Tool

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Abstract

Layar is an augmented reality (AR) platform that enables creators to tie online resources to physical objects or locations via mobile technologies. The authors detail their exploration of Layar's geolocation and interactive print abilities to aid the discovery of various resources in and around the College of Charleston campus pertaining to revered local artists William Halsey and Corrie McCallum. They explore opportunities for the added value of contextually situated information linking to vetted library and museum holdings. They detail some of the technical and technological requirements involved with coding and multimedia creation for AR, including the successes and pitfalls revealed in their testing. Issues noted include the problem of resolution in geolocation within the library's physical setting, the highly iterative nature of the design and development process, the highly ephemeral and fluid nature of the end products, and their ensuing need for maintenance and review.

Introduction

Augmented Reality (AR) refers to technologies that make use of computing, generally through mobile technologies, to enhance physical locations and objects with digital information. Information can come in various formats, including text, audio, video, web content and 3-D modeling. AR apps can overlay virtual images on the real world and lead users to new information using markers or "simple geometric shapes that could be 'seen' by desktop webcams and processed in real time," ([Un]seen Sculptures, 2012) and more recently, geolocation and geotagged entries or products using interactive print. Augmented reality technologies provide colocation of analog and digital information. As noted by the New Media Consortium Horizon Project, "while the most prevalent uses of augmented reality so far have been in the consumer sector (for marketing, social engagement, amusement, or location-based information), new uses seem to emerge almost daily, as tools for creating new applications become even easier to use" (NMC Horizon Project, 2013a).

A few common AR apps on the market today include Google Goggles and Wikitude, which use image recognition technology to deliver information about the world nearby in real time,

and Layar, which provides similar features as well as allows users to scan images in magazines for an interactive print experience and keep up with nearby social media posts on the go (DeepKnowHow, 2013). Junaio's Metaio Creator provides content creators with a drag-and-drop AR publishing tool feature as well as channels for users to access AR content from their mobile devices (Junaio, 2013). In addition to apps for end users and potential AR content creators, there are a number of both open-source and proprietary augmented reality platforms available for the creation and curation of augmented reality information. ARToolKit is an open-source library, originally developed by Dr. Hirokazu Kato, which has continued to be developed and supported by the Human Interface Technology Laboratory at the University of Washington. It can be used to overlay 3-D virtual objects on physical markers (Human Interface Technology Laboratory, n.d.). HP's Aurasma, both an app and a cloud interface, provides channels for users in the main Aurasma app and creator accounts in the Aurasma Studio interface (Aurasma, n.d.). Numerous fee-based AR services are also available, for example BuildAR, which allows users to select the number of locations, images, project length, branding options, and distribution channels for a set monthly fee (buildAR, n.d.). Hoppala's geolocation-based AR platform allows creators to publish content to AR browsers Layar, Junaio, and

Wikitude through a graphical web interface that does not require programming skills. The platform has been adopted by many educational professionals and university students (Hoppala, 2011). Aurasma and Layar have also worked to develop collaborative partnerships with artists, educators, and students. While this list is by no means exhaustive, for those unfamiliar with AR technologies, it can certainly provide a start. All of these providers have numerous examples of AR technology projects that can be scanned and viewed on their respective web sites.

Designing an Augmented Reality Library Experience

Our initial investigations started in 2011, using Layar's geolocation capabilities with the hopes of creating a library tour that could help patrons navigate the collections and locate resources (think books in the stacks) within the Library building. At that time, geolocation services were not robust enough to provide this functionality. Seeing that use within the library space was not satisfactory, we experimented with geolocation data for services at other centers and departments on campus. In 2012–2013, we had a renewed interest in reviewing developments in the technology and improvements in the Layar platform. We found that the state of geolocation capabilities within a building remained largely unchanged. The New Media Consortium discusses the hurdles associated with AR, citing AR's inability to tailor information to "exact locations within a building" as a key stumbling block to mainstream implementation and predicts increased adoption in the next 2–3 years when the technology develops to the point of being able to provide:

> indoor geolocation, which could provide visitors with very specific information tailored to their exact location within a building, allowing very fine-tuned information or services to be accessed that are very specific to where they are, not only relative the planet's surface, but in 3D space, so that different floors of a building can be resolved. (NMC Horizon, 2013b, p. 2)

It was in this context of addressing the inability of geolocation on users' mobile devices, which generally use a combination of cell tower or Wi-Fi triangulation and communication with GPS satellites referred to as Assisted GPS, or aGPS (Backcountry Navigator, 2011) to estimate locations within the library with respect to resources that we began exploring AR. Our second exploration has focused on using Layar's image scanning capabilities, generally intended for interactive print services, such as linking a printed page to video viewed on mobile devices or connecting viewers to shopping opportunities as a means of circumventing the limitations of GPS granularity by focusing on physical, visual resources located within the library instead of specific geolocation points. Our reasoning was that every library has static objects or materials on display that could be used to anchor explorations at key points within the library. Once determined, these visual references could be tied to further resources in the mobile catalog, digital collections, elsewhere on campus, the town, or on the wider web.

In our case, the College of Charleston Libraries has a collection of 12 works by Charleston artists William Halsey and Corrie McCallum on permanent display in several areas of the building. The works were donated to the Library in 2010. Our Special Collections department has also photographed the paintings, and the digital images have been permanently archived in the Lowcountry Digital Library. Visitors pass by the paintings every day, many unaware of the artists' significant contributions. Although the paintings do have signs, there is not a way for patrons to interact with further information about the works as they view them, leaving them largely unaware of the significance of these works and the messages they communicate about local history.

William Halsey is of particular importance to our University and the Lowcountry area. He taught at the Gibbes Museum of Art and established the College of Charleston's studio art program in 1964. There, he served as assistant professor and artist-in-residence at the College for nearly 20 years. "Corrie McCallum, Halsey's wife, was also an American artist (1914–2009) who served as the

first Curator of Education at the Gibbes Art Gallery in the 1960s and established the Printmaking Department at the College of Charleston in the 1970s" (College of Charleston Libraries, n.d.).

Additional paintings are also available for viewing in the immediate area, including at the Gibbes Museum of Art, "which commissioned William Halsey for *The Plan of a Painting* exhibition in 1942, subsequently organized numerous exhibitions of both artists and produced five catalogs featuring their work. The Museum's permanent collection includes 34 works by William Halsey and 12 works by Corrie McCallum" (College of Charleston, n.d.). Another large painting is displayed at the Marion and Wayland H. Cato Jr. Center for the Arts, which features one of Halsey's best-known works and houses the Halsey Institute of Contemporary Art, administered by the School of the Arts at the College of Charleston. The Halsey Institute exists to advocate, exhibit, and interpret visual art, with an emphasis on contemporary art. In addition to producing exhibitions, lectures, a film series, publications, and a comprehensive web site, the Halsey serves as an extension of the undergraduate curricula at the College and a cultural resource for the region. (Halsey Institute of Contemporary Art, n.d.). These resources, among others also available in the near vicinity, provided an opportunity to further explore Layar's geolocation capabilities and tie-in geolocation points for other venues. The collection and related resources seemed a good match for testing Layar's image scanning capabilities on physical objects, reinvestigating Layar's geolocation capabilities and proved to provide an excellent opportunity to examine new possibilities for connecting users with information in context. The hopes and goals of the project were to serve as an example and lay the groundwork for future works of participatory, collaborative art that explore new connections between physical and virtual spaces.

Gathering Resources

Luckily, some promotional materials for a 2010 exhibition of the collection by the College of Charleston Friends of the Library, extant in a blog post announcing it, gave us a good place to start.

The post offered such a good introduction to the collection, as well as extensive "Notes about the Artists" by Caroline Cobb Wright, we wanted to adapt it for an audio voiceover (College of Charleston, n.d.). Halsey Institute director Mark Sloan gave us permission to use and adapt these materials for the project (e-mail message to author, September 30, 2013). The next step was to determine relative resources that could really illuminate the collection and the couple behind the works, whether they were resources in our catalog or elsewhere. The criteria for selection was that the resource put Halsey and McCallum's practices in context with their development in the Charleston community, their schooling in Boston, and their travels around the world.

Getting it Published

The design and development of the AR experience was exploratory and iterative. Layar updates frequently, which can be both a benefit and a drawback. Layar supports a variety of interactions, including basic Creator Pages and Geolocation that can be configured via accounts on the Layar web site, as well as more advanced interactions via the Layar SDK and Layar Connect API for high volume enterprise clients. Basic Creator Pages link various simple media, web resources by URL, or social media widgets. Layar advertises seamless integration of interactive print using content such as video and animations that appear to leap off the printed page or another scannable artifact, but these would seem to require more in-depth work with the SDK and ardent work with multimedia creation to achieve the illusion of virtual characters and objects interacting with physical objects.

The costs of each option had to be taken into account. Creator Pages cost one Layar "credit" per page to publish to the world at large. Testing unpublished pages is free. Credits can be purchased for $20 per page, or less if buying bundles. Considering the educational and nonprofit aspect of the project, we wrote to Layar explaining the project and asking for artist credits. Chris Cameron from Layar replied within a few days and granted us 12 credits (e-mail message to author, June 24, 2013)—more than enough as we only needed six for the six paintings accessible to

the public in the library. Publishing the scripts to access our geolocation data did not cost any credits. Though the higher end interactive print examples on Layar's web site were truly impressive, the $3,200 pricing of the SDK was outside of our range both in terms of upfront cost and the hours we could realistically devote to the project to learn the SDK and create content that would add to the user's experience.

More simple Creator Pages activated by scanning the publicly accessible paintings with the Layar app on phones or tablets were to be our bread and butter. We set out to match particular resources to each painting in the interest of threading both a useful narrative about the artists and a sensible navigation through library holdings

and area points of interest. Layar refers to a group of related Creator Pages as a "Campaign." Campaigns can be built and tested without publishing both in the Creator interface and through the mobile app if registered to a developer account. This allows builders to create and fine tune experiences without spending funds on republishing each change.

Though our first round of resources were available for scanning paintings in Addlestone Library, it quickly became apparent to us that we could still make use of Layar's geolocation abilities to provide notice to users in the general area of downtown Charleston, at scales where its granularity was more useful than inside the library itself.

Work	Artist	Resources and Links
Serengeti	William Halsey	Initial audio by van Arnhem, adapted from "Notes about the Artists" by Caroline Cobb Wright, on our servers Slideshow of Halsey holdings in Lowcountry Digital Library
Blue Depths	William Halsey	Initial audio by van Arnhem, adapted from "Notes about the Artists" by Caroline Cobb Wright, on our servers Interview with Halsey Institute Director Mark Sloan YouTube
African Patchwork with Violet	William Halsey	Initial audio by van Arnhem, adapted from "Notes about the Artists" by Caroline Cobb Wright, on our servers Link to Lowcountry Digital Library Oral History
Stones in Time VII	William Halsey	Initial audio by van Arnhem, adapted from "Notes about the Artists" by Caroline Cobb Wright, on our servers Link to Gibbes Museum Spotlight on Halsey
Arabesque	Corrie McCallum	Initial audio by van Arnhem, adapted from "Notes about the Artists" by Caroline Cobb Wright, on our servers, including directions from painting to Special Collections Link to artists' Travel Sketchbook entry (Encore) Link to Gibbes Museum Spotlight on McCallum
Panorama of the City of Charleston and Harbor	Corrie McCallum	Initial audio by van Arnhem, adapted from "Notes about the Artists" by Caroline Cobb Wright, on our servers Link to Smithsonian Oral History Interview with McCallum and Halsey

Table 1. Initial Painting and Resource Pairings

Since we last worked with the platform, the company had changed its API more than once. This had a big effect on our previously collected geolocation data on College points of interest (POIs). The capabilities were similar, but the Layar API calls and expected database structure used to feed the POI data to Layar's services had changed. Our earlier foray had made use of an intermediate PHP and MySQL layer called LightRod. This program was no longer compatible with the API, requiring a new MySQL database and accompanying PHP scripts. As before, these were hosted again on our personal server for the time being.

Layar offered a helpful tutorial on setting up a web service to provide POI data. Layar developer Xuan Wang even put up a PBWorks wiki page with easily modified PHP scripts and an example MySQL file that could be imported into a MySQL management tool such as PHPMyAdmin and populated with project data (Wang, 2009). Only one table is needed, and PHP modifications can be as simple as replacing the connection script with your own database's name and credentials. The table's required fields are *id*, *footnote*, *title*, *lat*, *lon*, *imageURL*, *description*, *blwStyle*, *alt*, *doNotIndex*, *showSmallBlw*, *showBlwOnClick,* and *poiType*. The POI latitude, longitude, description, and the URL to the icon image on your server do most of the work.

Like the rest of the design process, selecting and modifying images took place in iterative rounds of

editing and testing. In keeping with the spirit of the project, we sought open source icons to serve as the marker for the POIs. After examining several sets of icons, we decided on the BSD-licensed Maki set by Mapbox (Benrud, 2012). These images, provided in SVG format, needed to be scaled up in Adobe Illustrator (or another vector art program) and exported in PNG format for the web service. After testing, we decided to modify the Maki icons or create new ones as needed, using color rather than the initial gray icons to help differentiate the points in the Layar app's Geo Layers interface. We especially wanted to modify the generic Library and Museum icons, so the end user could more easily distinguish the two libraries, Addlestone Library at the College of Charleston and the South Carolina Historical Society Library. We further decided to use a variation on the Maki gallery icon for the Halsey Institute and to create a new museum icon for the Gibbes. We made a new icon to represent the Stern Center, focusing on its red brick color and prominent stairwell, visible through wide windows even to those unfamiliar with its location on campus. Colors were taken from the same palette, generated from Halsey's work, used in the Creator Pages.

With the geolocation data in place and testing successful in the field, we added a Geo Layer prompt to the Creator Pages for direct scanning as well. In final testing, we unfortunately found that cell reception in the building was generally not

Figure 1. Maki and Custom Icons

sufficient to pull up the Geo Layar data. The Geo Layer component works well outside the building, but putting these prompts on Creator Pages was not useful in the end. This recalls the same problem that started us down this path, this time with respect to signal at all instead of resolution of aGPS data, though the former may lead to the latter problem even if other obstacles were removed.

Another change that came late in the design process was uploading our audio to SoundCloud rather than hosting our own MP3 files. Using SoundCloud provided users with a contextual grouping of all tour audio and allowed them to let

one play into the next in a playlist if they desire. That approach seemed like added value over

separate links to our server, so we made the change. As SoundCloud is a social site and fairly popular, we offer a warning to be prepared to weed out aggressive and potentially inappropriate spam accounts from follower lists. It is also worth noting that creating an account for the project or organization is also recommended.

Considerations, Lessons Learned, and Future Directions

It is fair to note the effort involved and expertise required in compiling the resources and working with the technology. To underscore the rate of change in AR technologies, the Layar API is

Work	Artist	Resources and Links
Serengeti	William Halsey	SoundCloud embed of re-recorded audio by Mike Dodd Recreated Lowcountry Digital Library Slideshow using Layar "Clickable Slideshow" widget Geo Layer prompt
Blue Depths	William Halsey	SoundCloud embed of re-recorded audio by Mike Dodd Interview with Halsey Institute Director Mark Sloan YouTube Geo Layer prompt
African Patchwork with Violet	William Halsey	SoundCloud embed of re-recorded audio by Mike Dodd Link to Lowcountry Digital Library Oral History Geo Layer prompt
Stones in Time VII	William Halsey	SoundCloud embed of re-recorded audio by Mike Dodd Link to Gibbes Museum Spotlight on Halsey Link to Gibbes K-12 Educator Guide PDF Geo Layer prompt
Arabesque	Corrie McCallum	SoundCloud embed of re-recorded audio by Mike Dodd Link to artists' Travel Sketchbook (Library Catalog) Link to Gibbes Museum Spotlight on McCallum Geo Layer prompt
Panorama of the City of Charleston and Harbor	Corrie McCallum	SoundCloud embed of re-recorded audio by Mike Dodd Link to Smithsonian Oral History Interview with McCallum and Halsey Geo Layer prompt

Table 2. Final Painting and Resource Pairings

currently on version 7.2 (Layar, n.d.b). They have put out 11 dot releases of the API since their founding in 2009. Time put into designing, developing and using AR experiences must be weighed against time maintaining and potentially redeveloping due to technology changes that make earlier work obsolete or nonfunctional.

Further attention will be required as installations change in our local museums and galleries. The South Carolina Historical Society is moving to the College Library space in the coming year, so its POI data will certainly need an update. In fact, it may need to be removed as a separate POI and instead become a candidate for more Creator pages. In a similar case, our initial Creator Pages included a link to a slideshow on the Lowcountry Digital Library site. The Lowcountry Digital Library's recent change from ContentDM to a Drupal site using Fedora Commons and Blacklight (Gilbert & Mobley, 2013) lacked that particular slideshow, so we built a new one in Layar Creator. Maintenance with regard to data's continuing validity and its best structure is always an issue. We see this as an opportunity because it keeps content fresh.

Further work will also be needed on the ground to make the most of the AR experience. Print materials and signage need to be made to instruct patrons on how to download the Layar app and scan the paintings, for instance, if further outreach programs make use of this project. Layar provides excellent resources to get started, including a Layar-Call-to-Action Pack that includes the Layar logo and recently released all new Call-to-Action Guidelines to help users market their campaigns.

We realize that these products are ephemeral and that the image scanning technology used is not always perfect since it depends heavily on image quality and complexity as well as lighting. We are also aware that we have just scratched the surface in terms of Layar's features and have yet to experiment with other platforms in depth as well. Each institution should consider its own cost-benefit analysis with regards to organizational and patron needs and opportunities. In the end, we felt both the experience of working with Layar and the specific AR deliverables we created were worthwhile. Adoption by libraries of Layar's interactive print feature should be seriously considered by libraries for marking services and resources and as a means to promote increased social engagement with users.

We look forward to the next round of opportunities and further exploration of Layar and AR technologies in a library and instructional setting.

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