Digital Exhibition Platforms for Worcester Historical Museum

An Interactive Qualifying Project Report submitted to the Faculty of WORCESTER POLYTECHNIC INSTITUTE in partial fulfillment of the requirements for the Degree of Bachelor of Science

By:

Alexander Marry akmarry@wpi.edu

Jacob Watson jrwatson@wpi.edu

Jesse Earisman jkearisman@wpi.edu

Project Advisor:

Professor Joseph Cullon, Project Advisor

Project Sponsor:

William Wallace, Museum Director

The Worcester Historical Museum
# Table of Contents

Table of Contents .................................................................................................................................................. 1
Table of Figures ...................................................................................................................................................... 3
Table of Tables ....................................................................................................................................................... 4
Abstract ................................................................................................................................................................. 5
Acknowledgments ................................................................................................................................................... 6
Executive Summary ................................................................................................................................................. 7
Chapter 1: Introduction .......................................................................................................................................... 11
  Problem Outline .................................................................................................................................................. 11
  Mission ............................................................................................................................................................... 11
  Overview of Trends in Museum Digital Augmentation ....................................................................................... 12
  Methodology .................................................................................................................................................... 14
Chapter 2: Overview of Museum Software ........................................................................................................... 16
  Touchscreen Kiosks .......................................................................................................................................... 16
  Mobile Technologies ....................................................................................................................................... 17
  Website Enhanced Exhibitions .......................................................................................................................... 18
Chapter 3: Artifact Analysis .................................................................................................................................... 20
  3.1 Flying Shears of the Morgan Construction Company, c. 1893 ................................................................. 22
  3.2 Reed Organ of the Worcester Organ Company, late 1880s ...................................................................... 32
  3.3 Corset from the Royal Worcester Corset Company, circa 1900 ............................................................... 38
Chapter 4: Evaluative Criteria ............................................................................................................................... 44
Chapter 5: Open Exhibits Evaluation .................................................................................................................... 46
  Description of Software Platform ..................................................................................................................... 46
  Evaluation ......................................................................................................................................................... 47
Chapter 6: OnCell Evaluation ............................................................................................................................... 51
  Description of Software Platform ..................................................................................................................... 51
  Evaluation ......................................................................................................................................................... 51
Chapter 7: TAP Evaluation ..................................................................................................................................... 55
  Description of Software Platform ..................................................................................................................... 55
  Evaluation ......................................................................................................................................................... 56
Chapter 8: Findings and Recommendations ......................................................................................................... 59
Works Cited ..............................................................................................................................................62
Appendices ...............................................................................................................................................65
I - Preliminary Evaluation .......................................................................................................................65
Table of Figures

Figure 1: Artifact as Currently Displayed with Interpretative Text ........................................22
Figure 2: Portrait Photography of Inventory Victor E. Edwards .............................................23
Figure 3: Morgan Construction Company Agreement of Association .................................24
Figure 4: Original Technical Drawing Accompanying Patent 505,512 (September 26, 1893) ....25
Figure 5: The Rolling Mill Patent ..........................................................................................28
Figure 6: Screen Shot from a 1938 Promotional Film on Rolling Steel, “World of Steel”.28
Figure 7: Morgan in the World: A Geographic Display of Morgan-Built Mills ......................29
Figure 8: View of Jones and Laughlin from Oakland, Looking South ...............................30
Figure 9: Jones & Laughlin Steel Corporation, Pittsburgh Works, Morgan Billet Mill Engine .......................................................................................................................30
Figure 10: View of Worcester from Lincoln Square, c. 1910 ..............................................31
Figure 11: Modern View of Former Morgan Construction Company Complex at Lincoln Square, Worcester ........................................................................................................32
Figure 12: Reed Organ as Currently Displayed with Interpretative Text ...............................33
Figure 13: Screen Shot of YouTube Featuring Christopher Shayne Playing a Worcester Organ ................................................................................................................................33
Figure 14: Nineteenth Century Advertisements for Worcester-Made Organs .......................34
Figure 15: Worcester Organ Company Trading Card ..............................................................35
Figure 16: Loring and Blake Palace Organ Trading Card .........................................................36
Figure 17: A Taber Reed Organ, adapted to music roll by John McTammany, Worcester, 1880 ................................................................................................................................37
Figure 18: Corset as Currently Displayed with Interpretative Text ........................................38
Figure 19: Corset c. 1893 ........................................................................................................39
Figure 20: David Hale Fanning at his Worcester Office, c. 1911 ............................................40
Figure 21: Advertising the Modern Factory ............................................................................41
Figure 22: Advertisement for the Bon-Ton and Royal Worcester Corsets ...............................42
Figure 23: The Royal Blue Book of Correct Corset Styles, 1910 ............................................42
Figure 24: Graph of updates to the TAP software from 2011 to 2016 ..................................57
Figure 25: Warning from the TAP developers on the top of the installation guide ...............57
Figure 26: Example of the error messages we encountered when trying to use TAP ............58
Table of Tables

Table 1: Touchscreen Kiosk Evaluation .........................................................................................17
Table 2: Mobile Device Evaluation .................................................................................................18
Table 3: Web Evaluations ...............................................................................................................19
Table 4: Patents Taken Out by Victor E. Edwards on Devices Improving upon and Extending the Operation of Devices like the “Flying Shears” first patented in 1893. ........27
Abstract

The Worcester Historical Museum’s (WHM’s) Fuller Gallery of Industrial History is outdated, and the museum wants to redesign it in a way that makes it more engaging and immersive. Our group investigated different digital technologies that had the potential to achieve WHM’s vision. We chose three pieces of software for an in-depth investigation: OnCell, Open Exhibits, and TAP. We found OnCell to be easy to use and quick to deploy, while doing a good job of enhancing the exhibit. Open Exhibits has great potential, but needs more work to fully develop. Lastly, we found TAP to be outdated, unsupported, and buggy. We expect this work to be helpful to the WHM as they look toward the future of their gallery, and expect it to serve as a starting point for future research into digital options for the WHM.
Acknowledgments

We would like to thank Professor Joseph Cullon for being our advisor during this project. We would also like to thank William Wallace and Vanessa Bumpus at the WHM for sponsoring this project and the guidance they gave us.
Executive Summary

The Worcester Historical Museum (WHM) is seeking to update their Fuller Gallery of Industrial History by integrating digital technology. The current gallery feels cluttered and static, more like an art gallery than a historical museum. Our goal was to investigate how digital solutions could make the artifacts in the gallery feel more alive and be more engaging for visitors. We explored museum three genres of digital tools for museums - touchscreen kiosks, mobile applications and website systems. In January 2016, we performed a broad survey and preliminary evaluation of the whole universe of museum-oriented software (the full text of this preliminary evaluation is featured in Appendix I). In February 2016, we worked with William Wallace, Director of WHM and Vanessa Bumpus, Exhibits Curator, to identify three potential software options for in-depth evaluation as well as three museum artifacts for digitally augmented interpretation. After the meeting, our goal was to work with the artifacts and software and to evaluate how each platform could enrich the visitor experience and help the WHM achieve its vision for a more immersive and stimulating gallery.

The three museum artifacts we identified were:

1. A replica of Flying Shears patented by Victor E. Edwards for the Morgan Construction Company;
2. A reed organ manufactured by the Worcester Organ Company; and
3. A corset model featuring a piece from the collection of the Royal Worcester Corset Company.

All three were accompanied by a brief silkscreen description in the existing gallery. We expanded on these descriptions and developed interpretative materials to demonstrate the potential of the software systems. Specifically, we created enhanced interpretations that included greater historical detail, audio, visual images and video. We further gathered this information into packets available in the Appendix of this report.
The three software options we identified were:

1. Open Exhibits, a touchscreen system appropriate for touchscreen kiosks or panels
2. OnCell, a mobile application for use with tablets or smartphones
3. TAP, a mobile application for extending the museum experience beyond the gallery through walking and driving tours

Our in-depth evaluation involved working with these software packages to see how they might enrich the interpretation of particular museum artifacts. Our goal was to create prototypes exhibits in each using our artifact interpretations. At the end, we created two OnCell prototypes, but were unable to create prototypes in Open Exhibits or Tap because of the extensive programming that such an effort would require.

After working with the three software packages and attempting to develop prototypes for each three, we evaluated the systems using the following criteria:

1. Ease of use for museum staff for developing and maintaining interpretative materials with the system
2. Ability to integrate with other technologies so to create both in-gallery and extra-gallery experiences
3. Status of system with the larger field to see if its use is expanding or declining and if the system will be continuously maintained and updated to support users
4. Aptability of platform as interpretation through it can reach a range of audiences from grade school classroom visits to adult tours
5. Aesthetic appeal to match the museum’s distinctive style
6. Costs of subscribing, programing and maintaining the systems
7. Availability of technical support
There criteria were established and discussed with WHM staff, so to ensure that any recommendations would meet with the needs, requirements and resources of the museum and that potential implementation issues would be raised through the evaluative process.

The first piece of software we investigated was Open Exhibits. Open Exhibits is an open source framework for creating interactive touchscreen exhibits. It is best utilized on large touchscreen tablets that serve as a focal point of a gallery. Our experiments with Open Exhibits determined that developing even a prototype would require extensive programming, requiring more time more than our team was capable of dedicating. Additionally, we found contacting Open Exhibits users to be unexpectedly difficult, and were unable to get any user feedback. Despite these setbacks, we believe Open Exhibits to be an intriguing piece of software which holds a lot of potential, but would require much more time and effort before it would be ready for the WHM to deploy.

The second piece of software we investigated was OnCell. OnCell is a commercial product that helps museum owners develop interactive guides targeted towards mobile phones. It requires no programming, and can be downloaded directly onto visitor’s smartphones. There is a monthly fee of around $5,000 per year to use the software. It is also limited by a lack of customization options and lacks the potential to completely redesign the exhibit. OnCell offers the potential for a quick and easy digital augmentation that can achieve the WHM’s goals either as a permanent fixture or as an interim solution while they investigate other options.

The last piece of software we wanted to investigate was TAP. TAP promised to fulfil a similar role to OnCell, with more customization potential and no monthly fee. It required slightly more technological knowledge than OnCell, but no programming. Multiple members of our group attempted to set up TAP and create a prototype, however, each was met with a plethora of error messages and we ultimately failed to make the software function correctly. Further investigation reveals that there had been no significant updates to the software in the last few
years, and much of the information on the TAP website was outdated or wrong. With this in mind, we recommend that the WHM do not pursue TAP as a digital augmentation option.
Chapter 1: Introduction

Problem Outline

The Fuller gallery of Industrial History at the Worcester Historical Museum (WHM), contains elements that could be improved. The current exhibit is very crowded, with many artifacts in close proximity to each other. Furthermore, the artifacts within the gallery seem disconnected, leading to a layout that visitors might find overwhelming and disjointed. The exhibit feels very much like an art museum, with little motion or life from the machines and items on display. Furthermore, there is little indication of how the machines work or why they are significant. The informational media, such as the silk screen panels, the timeline on the wall, and the audio samples, are old and outdated. The layout is formulaic, and lacks a unique identity. The WHM recognizes the need to update the gallery, but modifications to the current interpretive apparatus are prohibitively expensive due to silk screening. As a result of this, it is infeasible to simply update the current model with new information. Digital technologies offer the opportunity to modify and expand the current exhibit while WHM develops a complete redesign of the gallery. Any redesign will also integrate digital technologies.

Mission

To address WHM’s desire to update the Fuller Industrial History Gallery with new technology, we have identified the following mission:

The integration of digital technologies to create a more immersive and engaging experience for visitors to the Fuller gallery of industrial history.

To address this need we researched many different software packages and evaluated them. We then performed a deeper evaluation of the three best products chosen by the WHM advisors to show them the potential of each package.
As we consider strategies to digitally augment the current exhibit, there are several constraints that must be acknowledged. Any new additions must appeal to and be accessible by multiple audiences ranging from elementary school students to adults. Any digital expansions must be easy for museum staff to maintain and operate. It must also be easy to modify or expand. The size of any redesign must be taken into account in order to make sure that the exhibit meets the size constraints of the Fuller Gallery.

Overview of Trends in Museum Digital Augmentation

The concept of technology being incorporated into museum exhibits has been documented by other institutions, with a universal result being that visitors both expect and enjoy technological integration in the museum experience. To begin, studies have shown that there is a desire among the public for technological integration into the museum experience. A study by Paul F. Marty in 2008\(^1\) polled users of museum websites about their expectations for museum websites. Out of the responses, 64.6% stated that they used museum websites on a regular basis, and 75.6% stated that they believe museums should use websites “to present unique experiences that cannot be duplicated in museums.” 63.1% of those who responded claimed that they would prefer to be able to access archives and research materials through a museum's website instead of in house\(^1\). On the topic of touchscreen integration, a study by Panagiotis Zaharias et. al. on the interactions of children with a newly installed museum touchscreen exhibit found that the children who used the touchscreen were more engaged and excited by the exhibit than a more traditional exhibit of the same material, and those who used the touchscreen exhibit were more likely to state that they wished to return to the museum in the

future2. Another study by Nuno Correia et. al. which watched museum visitors interactions with a touch screen kiosk in an art museum found that the kiosk acted as a supplement to the physical exhibits, as many visitors used the kiosk as a way to find more information and details on the exhibits they found most interesting3.

In addition, there are many examples of individual museums successfully integrating technology into their exhibits in a way that is congruent to our objectives. The New York Historical Society underwent renovations from 2009-2011, during which several touchscreen displays were added to multiple exhibits. These displays are designed to provide additional details and facts about the concepts and historical events in New York’s history depicted within the exhibits4. The Chicago Museum of Science and Industry has integrated its exhibits with interactive touchscreen kiosks containing games and activities designed to engage and inform both children and adults. Examples include the weather exhibit, where touchscreen based games allow the user to create and modify extreme weather events, such as tsunamis and tornados, and learn how researchers model and study these events5. The Cleveland Museum of Art has added several different layers of technology to aid visitors' experience. This includes a smartphone application called ArtLens, which allows visitors to examine exhibits with their smartphones to see additional information on the contents, locate nearby exhibits of interest, and see up to date event information for the museum. Several touchscreen kiosks located throughout the museum, called Lenses, allow visitors access to additional information about nearby artworks, but also feature interactive activities designed to allow visitors to interact with

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2 Learning through Multi-touch Interfaces in Museum Exhibits: An Empirical Investigation
Author(s): Panagiotis Zaharias, Despina Michael and Yiorgos Chrysanthou Source: Journal of Educational Technology & Society, Vol. 16, No. 3 (July 2013), pp. 374-384


5 http://www.msichicago.org/exhibit-sales/interactive-exhibits/weather/
pieces of art by rotating and zooming in on 3D models, something that would be impossible in a standard museum exhibition\(^6\).

Both the literature in Museum Studies as well as evolving priorities in curation and design underscore the centrality of digital technologies in gallery settings. Visitors now expect digital enhancements, and curators are embracing them. Whatever direction WHM takes in the thorough redesign of the Fuller Gallery, it should consider the integration of digital extensions through the institute website, gallery kiosks, and visitor smartphones. Digital technologies also offer the opportunity to aid interpretation of the current exhibit as the redesign is in progress.

Methodology

We conducted both a preliminary evaluation of a range of museum software packages, and an intensive evaluation of three packages identified by the museum. The goal of the preliminary evaluation was to educate WHM on the range of options available including both open source and commercial platforms. This preliminary survey examined software for the development of stationary kiosks, mobile application and websites. After presenting the primary evaluation to the WHM, the team focused their intensive evaluation on three packages: Open Exhibits, OnCell and TAPS.

The intensive evaluation involved the creation of a prototype using an artifact from the current exhibit as launching off point for digitally augmented interpretation. The prototypes created for each software platform were intended to display as many features of the technology as possible. The process of making a prototype also allowed an analysis of the technical skills and difficulties involved in exhibit development. Further, the three software packages were evaluated based on how many people are still using them, their documentation, and how they are being supported by their creators.

A summary of the preliminary evaluation can be found in the next chapter, while the full report is included here as Appendix I. The intensive evaluation of Open Exhibits, OnCell and TAPS follows in chapters six, seven, and eight.
Chapter 2: Overview of Museum Software

Since museums have been integrating computer technologies into their exhibits for the last two decades, several software packages have emerged to help institutions adopt new technologies without having to thoroughly reinvent the wheel. Generally, museums have experimented with three formats for digital augmentation: built-in kiosks with touchscreens, mobile applications for tablets or phones, and website extensions with exhibit content. This chapter provides an overview of the advantages and disadvantages of each format, along with summary tables of existing software platforms and their features. Further detail on the contents of the tables can be found in Appendix I, which features the full text of the preliminary evaluation.

Touchscreen Kiosks

Touchscreen kiosks are in-museum digital devices that are part of the exhibits themselves. There are two main ways of creating touchscreen kiosks. The first is to deploy software that is custom made for kiosks. The second is to use normal mobile app software on emplaced hardware. This section will only discuss the first option. The primary benefit to touchscreen kiosks is enhancing exhibits to allow more interaction and greater information density. They can display text, pictures, video, animations, as well as any custom features such as games all in the same place. It is possible to quickly and easily change displays with touchscreen kiosks as it is a matter of switching around features in software instead of having to manually move physical text. Some integration with web and mobile devices is also possible.

The main disadvantages of in museum touchscreens are that they more expensive than other technologies as they require the museum to buy hardware as well as software. They are also limited to in museum use, though integration with other technologies still allows some contribution to an out of museum experience. Of the technologies in this paper touchscreen
kiosks are the most dramatic and visual digital change to a museum but they are also the most expensive and difficult to implement.

**Table 1: Touchscreen Kiosk Evaluation**

<table>
<thead>
<tr>
<th>Touchscreen Kiosks</th>
<th>Open Exhibits</th>
<th>Lightbox 2</th>
<th>Intuiface</th>
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<tbody>
<tr>
<td>Fundraising/Membership</td>
<td>✔️</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3d models</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Gesture Analysis</td>
<td>✔️</td>
<td></td>
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</tr>
<tr>
<td>Social Media Integration</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>Mapping/Geolocation</td>
<td>✔️</td>
<td>✔️</td>
<td>✔️</td>
</tr>
<tr>
<td>QR Codes</td>
<td>✔️</td>
<td>✔️</td>
<td></td>
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</tbody>
</table>

Mobile Technologies

Mobile technologies includes all applications, hardware, and websites designed specifically to work with Smartphones and Tablets. The primary benefit of mobile technologies is the integration of visitors personal devices into the museum experience. Various mobile technologies have a wide array of features such as geolocation software for location aware tours, social media integration, interactive walking tours, and access to newsletters containing exhibit information. They allow for both in museum and out of museum experiences and are relatively easy to implement as they require no or very little changes to the museum.

If visitors do not bring a smartphone to the museum, they will miss out on the benefits provided by the museums mobile app. The museum can provide their own mobile devices for use by museum visitors, but these devices are often expensive to purchase and maintain, making this a costly solution. It may be necessary to create several different apps to support the
most popular mobile platforms. This is also a costly option when compared to creating a single app for a touchscreen terminal or a traditional web based platform. Mobile technologies are extremely flexible as they can be integrated into the museum or not, and have a wide variety of features.

**Table 2: Mobile Device Evaluation**

<table>
<thead>
<tr>
<th>Mobile Devices</th>
<th>Oncell Mobile Tour Apps</th>
<th>Omeka Mobile Plugins</th>
<th>TAP</th>
<th>Smartbeacon</th>
<th>Museum Anywhere</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundraising/Membership</td>
<td>✓</td>
<td></td>
<td>✓</td>
<td>✓</td>
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<td>3d models</td>
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<td>Gesture Analysis</td>
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<td>Social Media Integration</td>
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<tr>
<td>Mapping/ Geolocation</td>
<td>✓</td>
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<tr>
<td>QR Codes</td>
<td>✓</td>
<td>✓</td>
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</tbody>
</table>

**Website Enhanced Exhibitions**

Web technologies are websites focused on museums. The goal of web technologies is to give visitors the ability to access exhibits from their own computers or mobile devices, wherever they are. This allows the experience of the exhibit to go beyond the physical location and allows visitors to access museum content without physically being inside the museum.

Web technologies do not enhance the on site museum experience as much as other technologies. The museum is required to host the website, or pay for hosting services. Many of the websites can also feel old fashioned. Web technologies are a good way to quickly and cheaply bring have some digital integration to the museum, though other technologies should probably be explored as well.
## Table 3: Web Evaluations

<table>
<thead>
<tr>
<th>Web</th>
<th>Omeka</th>
<th>PastPerfect</th>
<th>Pachyderm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fundraising/Membership</td>
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<td>3d models</td>
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<td>Gesture Analysis</td>
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<td>Social Media Integration</td>
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<td>Mapping/ Geolocation</td>
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<td></td>
</tr>
<tr>
<td>QR Codes</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter 3: Artifact Analysis

The evaluation of the three software platforms involved the analysis of artifacts presently on display in the Fuller Industrial Gallery. Specifically, the team developed interpretative analysis and apparatus to showcase the potential of digital augmentation to deepen visitors’ understanding of the artifact, its creators, its operation and its significance to Worcester and beyond. The team create three analyses corresponding to the the Morgan Construction Company flying shear (c. 1893), the Worcester Organ Company reed organ (c. 1880) and the Royal Worcester Corset Company corset model (c. 1900).

To develop consistency across the gallery, the team identified several content areas for analysis for each artifact, including:

1. Biographical information on the artifact’s creator or patent holder;
2. Corporate history of the manufacturer;
3. Operation detail of the device that might include video of its place in industrial processes, animation of its operation, historical photographs and textual descriptions;
4. Geographic information and photographs of where in Worcester it was made;
5. Sense of the product’s national or international reach and significance; and
6. Appreciation of the workers’ role in production and their lives within Worcester beyond the factory gate.

This is not an exhaustive list of interpretative elements and custom categories can be created to reflect the richness of WHM’s resources respecting each artifact. However, the team aimed for some element of interpretive consistency to guide the development of analysis of additional artifacts for digital augmentation.

One of the benefits of digital interpretation is that WHM can leverage the resources of other Institution to deepen the interpretation of particular artifacts. In developing its analyses of
the flying shears, reed organ and corset, the team relied heavily upon other archives, museums and digital repositories, which complement WHM’s holdings. For example, WPI’s Gordon Library holds the archives for the Morgan Construction Company and these records proved crucial to understanding the national and global impact of Morgan’s equipment on the steel industry.\(^7\) The Metropolitan Museum of Art of New York is home to a large corset collection donated by the Royal Worcester Corset Company, which can enrich the interpretation of the one corset currently on exhibit in the Fuller Industrial History Gallery.\(^8\) Further amateur collectors and enthusiasts share their passion for some of the artifacts, through blogs, YouTube videos or Pinterest pages. For example, harpist, pianist and reed organist, Christopher Shayne has posted beautiful photographs of his Worcester Organ Company reed organ along with videos of him playing the instrument.\(^9\)

The following subsections include the interpretative content that the team developed for use in digital augmentation of the flying shears, reed organ and corset. The material was developed with the plan that it be adaptable to several software platforms. Therefore, it was drafted and is arranged in a standard word processing format filled with text, tables, images, maps and video content. This interpretative content was successfully transferred into OnCell to evaluate its capabilities. However, the programming difficulties encountered with Open Exhibits

\(^7\) The Morgan Papers (M03) and Morgan Construction Collection, 1881–2008 (M066), Gordon Library, Department of Preservation, Curation and Archives, Worcester Polytechnic Institute, finding aid available at [http://www.wpi.edu/Images/CMS/Library/MS03_Morgan_Papers.pdf](http://www.wpi.edu/Images/CMS/Library/MS03_Morgan_Papers.pdf) and [http://digitalcommons.wpi.edu/cgi/viewcontent.cgi?article=1000&context=cpa-guides](http://digitalcommons.wpi.edu/cgi/viewcontent.cgi?article=1000&context=cpa-guides)

\(^8\) Onetime president of the Royal Worcester Corset Company, E. A. Meister donated a collection of 171 corset to the Brooklyn Museum in honor of Isidor Roth, his father-in-law and former president of the company, who assembled the collection possible for exhibit in the factory’s own in-house museum. The collection is now part of the Brooklyn Museum Costume Collection at The Metropolitan Museum of Art, Gift of the Brooklyn Museum, 2009; Gift of E. A. Meister, 1950. Thirty-one of the corsets in this large collection were manufactured by Royal Worcester Corset Company, for those corset see: [http://www.metmuseum.org/art/collection/search#!/search?artist=Royal%20Worcester%20Corset%20Company$Royal%20Worcester%20Corset%20Company](http://www.metmuseum.org/art/collection/search#!/search?artist=Royal%20Worcester%20Corset%20Company$Royal%20Worcester%20Corset%20Company)

\(^9\) For more on Christopher Shayne’s collection see [http://www.christophershayne.com/index.html](http://www.christophershayne.com/index.html) as well as his youtube channel at [https://www.youtube.com/user/musicman7nc](https://www.youtube.com/user/musicman7nc)
and TAP prevents its adaptation for those formats. However, the content would be transferable into new systems once background programming has been accomplished.

3.1 Flying Shears of the Morgan Construction Company, c. 1893

Presently, the Fuller Industrial History Gallery displays a scaled model of a flying shear. However, based on investigation into the history of the development of flying shears, WHM’s replica is of a later era than the original set patented by Victor E. Edwards in 1893. The interpretative analysis for this artifact then attempts to place the museum’s replica into the larger history of the flying shear concept and its evolution with other Morgan rolling mill technologies.

Figure 1: Flying Shears as Currently Displayed with Interpretative Text

The text corresponding with this artifact reads, “Replica of flying shears Invented in 1892 / Victor Edwards for Morgan Construction Company / Courtesy of Morgan Construction Company
Figure 2: Portrait Photography of Inventor Victor E. Edwards

*The Inventor.* After graduating from Worcester County Free Institute of Industrial Science (later Worcester Polytechnic Institute) in 1883, Victor W. Edwards held a series of positions in machine shops, wire works and a steel mill. Lured back to Worcester from a steel mill in Cleveland, he joined Charles H. Morgan and Paul B. Morgan in founding the Morgan Construction Company on September 23, 1891.

Edwards quickly took the lead in designing new machines to speed the work of continuous rolling mills and became best known as the inventor of the Edward’s Flying Shears for cutting hot billets while in motion. The patent for Flying Shears would be the first of many for Edwards, he went on to invent other key pieces for the Morgan Construction Company,

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10 Image from *The Iron Trade Review* (November 14, 1901), xxi.
including an apparatus for handling band iron, mechanical cooling beds and, with Morgan, the design for a patented rolling mill plant.¹¹

![Morgan Construction Company Agreement of Association](http://digitalcommons.wpi.edu/ms077morgan-docs/95)

**Figure 3: Morgan Construction Company Agreement of Association**¹²

**The Company.** Charles H. Morgan arrived in Worcester to work at Washburn and Moen Wire Works, but after several years as a highly creative engineer and inventor, Washburn and Morgan fell out over rights to Morgan’s reel patent. In 1891, the newly independent Charles H.


Morgan incorporated the Morgan Construction Company with the twenty-nine year old Victor E. Edwards and his son Paul B. Morgan (both graduates of WPI) with $10,000 in capital assets. The company sold custom machinery to steel mills and wire manufacturers. More significantly, they contracted to build entire mills, first for wire drawing and later for rolling steel. Although Morgan footprint in industrial Worcester would be comparatively small, its impact was felt throughout the steel-making regions of the United States and the world.\(^{13}\)

After the company patented a host of custom machines and an entire plan for a rolling mill, Charles H. Morgan was an enthusiastic booster for his technology, exclaiming (while president of the American Society of Mechanical Engineers), “the steamer going East and the railroad going West are built and burdened with the products of the mill. How much of the great West, and all the wealth which is in it, would have been ours without the help of the rolling mill?”\(^{14}\)

![Figure 4: Original Technical Drawing Accompanying Patent 505,512 (September 26, 1893)](image_url)

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The Machine. The unassuming scaled model displayed here cannot really capture the size or significance of Edward’s invention. The “flying shear” as it became known proved a crucial component in the Morgan and Edwards’s entire plan for continuous rolling mills.

The first shear invented for a Jones and Laughlin Steel Mill proved a challenge of engineering design. It had to be strong enough to cut a 1 ½” billet into lengths as fast as it emerged from the finishing process without causing the slightest slowdown in the 250 foot per minute delivery speed.15

Edwards created the shear with a hinged upper knife that allowed the billet to continue moving freely to the next step in the process without pause or delay. He adapted a steam actuated hydraulic intensified to furnish the pressure for a powerful cutting stroke.

Upon the initial test of the device, Edwards would modestly telegraphed the Worcester office from the Pittsburgh mill that “under full steam and everything went satisfactorily …. We are not a little gratified with the result.” Once patented, the Flying Shear was an engineering triumph for speeding the steeling making process and provided Morgan Construction Company with unmatched capabilities.16

The Patents. The company would jealously protect with patent for “flying shears,” as Edwards took out 14 separate patents for various configurations of and improvements to his “metal-cutting shears” until 1932. After Edwards’s death, the Morgan Construction Company would continually improve upon the design so the most recent patent dates 2004.

15 A full contemporary account of the Jones and Laughlin mill appeared as “The Morgan Continuous Billet Mill,” The Iron Age (May 24, 1894), 996-997.

Table 3.1: Patents Taken Out by Victor E. Edwards on Devices Improving upon and Extending the Operation of Devices like the “Flying Shears” first patented in 1893.

Table 4: Patents Taken Out by Victor E. Edwards on Devices Improving upon and Extending the Operation of Devices like the “Flying Shears” 1893-1932.  

<table>
<thead>
<tr>
<th>Patent Number</th>
<th>Patent Name</th>
<th>Year Patented</th>
</tr>
</thead>
<tbody>
<tr>
<td>505,512</td>
<td>Rods in Motion</td>
<td>09/26/1893</td>
</tr>
<tr>
<td>587,362</td>
<td>Bars in Motion</td>
<td>8/3/1897</td>
</tr>
<tr>
<td>587,363</td>
<td>Apparatus for ...</td>
<td>8/3/1897</td>
</tr>
<tr>
<td>616,608</td>
<td>metal cutting shears</td>
<td>12/27/1898</td>
</tr>
<tr>
<td>653,506</td>
<td>apparatus for cutting...</td>
<td>7/1/1900</td>
</tr>
<tr>
<td>757,604</td>
<td>apparatus for cutting metal bars</td>
<td>4/19/1904</td>
</tr>
<tr>
<td>1,031,056</td>
<td>metal-cutting shears</td>
<td>7/2/1912</td>
</tr>
<tr>
<td>1,047,185</td>
<td>metal-cutting shears</td>
<td>12/17/1912</td>
</tr>
<tr>
<td>1,228,543</td>
<td>feeding mechanism for metal-cutting shears</td>
<td>6/5/1917</td>
</tr>
<tr>
<td>1,259,968</td>
<td>apparatus for controlling the operation of shears</td>
<td>3/19/1918</td>
</tr>
<tr>
<td>1,304,034</td>
<td>shearing mechanism</td>
<td>5/20/1919</td>
</tr>
<tr>
<td>1,521,514</td>
<td>The art of shearing metal bars while in motion</td>
<td>12/30/1924</td>
</tr>
<tr>
<td>1,599,880</td>
<td>The art of shearing metal bars while in motion</td>
<td>9/14/1926</td>
</tr>
<tr>
<td>1,878,121</td>
<td>Shearing Machines</td>
<td>9/20/1932</td>
</tr>
</tbody>
</table>

17 Table developed using the “Patent Files” in Morgan Construction Collection, 1881-2008 (M066), Gordon Library, Department of Preservation, Curation and Archives, Worcester Polytechnic Institute.
Figure 5: The Rolling Mill Patent

Place of Flying Shears in Morgan Rolling Mills. In 1898, Charles H. Morgan and Victor E. Edwards went on to successfully patent the entire process for rolling steel with their custom machinery. In the patent illustration above, no. 10 marks the central place of the flying shear in the entire operation.

Figure 6: Screen Shot from a 1938 Promotional Film on Rolling Steel, “World of Steel”
Machine at Work. The Morgan Construction Company Archives includes several 16mm promotional films about their equipment and completed steel plants. This short clip serves as a placeholder until further work can be done in the corporate archives to identify appropriate Morgan produced footage. However, the above clip demonstrates the working of a Morgan rolling mill and the operation of flying shears in the process.

Impact of Morgan. Between 1888 and 1919, Morgan Construction Company designed, built and installed equipment for 101 rolling mills in the United States, Canada, Europe and Australia, in the following breakdown:

- 80 in the United States
- 5 in Canada
- 5 in England
- 3 in France
- 1 in Belgium
- 1 in Australia
- 1 in Austria
- 4 in Germany
A geographic video could display the unfolding of Morgan Construction Company’s impact as pins are added over a chronological time lapse.\textsuperscript{18}

![Image 8](image1.png)

**Figure 8:** View of Jones and Laughlin from Oakland, Looking South

![Image 9](image2.png)

**Figure 9:** Jones & Laughlin Steel Corporation, Pittsburgh Works, Morgan Billet Mill Engine

Scale. To appreciate the enormous scale upon which Morgan Construction Company operated, the Library of Congress houses a series of photographs of the billet mill originally constructed by Morgan in 1893 and then continuously expanded and improved. The photo

\textsuperscript{18} “List of 101 Complete Rolling Mill Plants, May 1919” in Morgan Construction Collection, 1881-2008 (M066), Gordon Library, Department of Preservation, Curation and Archives, Worcester Polytechnic Institute.
series, of which Images 3.9 and 3.10 are only two examples, were taken after 1968 reveals the
decisive impact that Morgan had upon the steel making heartland of Pennsylvania and the
upper Midwest.\(^\text{19}\)

![Image: Worcester, MA, Lincoln Square, c. 1910](image)

**Figure 10: View of Worcester from Lincoln Square, c. 1910**

Morgan Construction Company primary office and factory is the marked by the smoke stack in
center of image.

\(^{19}\) “Jones & Laughlin Steel Corporation, Pittsburgh Works, Morgan Billet Mill” in Historic American
Figure 11: Modern View of Former Morgan Construction Company Complex at Lincoln Square, Worcester

Where in the Worcester. These images capture historic and modern views of the Morgan Construction Company complex at Lincoln Square. Today, the 3.5 acre property is comprised of two interconnected buildings, totaling approximately 90,000 square feet. Recently acquired by the Massachusetts College of Pharmacy and Health Sciences, the complex is being redeveloped to provide rental apartments for its graduate students, faculty, and staff.

3.2 Reed Organ of the Worcester Organ Company, late 1880s
Figure 12: Reed Organ as Currently Displayed with Interpretative Text

The text corresponding with this artifact reads, “Organ / Late 1880s / Worcester Organ Company / Worcester Organs made by this and other companies, were marketed worldwide”

Figure 13: Screen Shot of YouTube Featuring Christopher Shayne Playing a Worcester Organ

https://www.youtube.com/watch?v=r_UYev_9Hcs

Making Music. Musician Christopher Shayne’s had posted many videos of him playing a organ manufactured by the Worcester Organ Company. His videos demonstrate the unique sound of reed organs and provide samples of the pious nature of organ music.
Figure 14: Nineteenth Century Advertisements for Worcester-Made Organs

Many Styles. Established in 1875, The Worcester Organ Company, and its later incarnation as the Taber Organ Company after 1890, established a national reputation for the musical quality and ornate cabinetry of their instruments. With dealers throughout the country, the Worcester factory designed organs that match the lavish Victorian style of the late nineteenth century.

Worcester and Taber were not the only options from Worcester. The Taylor & Farley Company as well as the Loring and Blake Organ Company could be purchased through dealers
across the country and potential consumer could choose among a host of designs featured in free company catalogues.²⁰

![Figure 15: Worcester Organ Company Trading Card](image)

Compliments of L.H. Wheelden, Bangor Maine

**Piety in the Parlor.** Organs provided more than a form of entertainment in middle-class Protestant homes. The organs, from their design to the music played upon them, connected the home with church. Often resembling elaborate church furnishings, home organs evoked a spot for pietistic practice. Much of the music written for organs expanded the hymns often performed in church. In 1897 author and music critic Henry Finck, published an essay in which he too equated musical taste and morality, insisting that "one of the most important moral functions of

music [is] that of weaning the people from low and demoralizing pleasures.” He believed music, as well as upbringing in any household with an “infectious musical atmosphere” would suppress vicious habits and promote even temperaments. The presence of music, then, was much more than a social diversion; it was a measure of a household’s moral well-being.21

Figure 16: Loring and Blake Palace Organ Trading Card
Compliments of L.H. Wheelden, Bangor Maine

Organ for Every Budget. The nationwide popularity of Worcester-manufactured organs rested upon comparatively low cost compared with pianos. Despite elaborate, imposing and church-like parlor organs, like those made in Worcester, were less expensive than pianos

because they were easier to manufacture. In 1897 a household could treat itself to a fairly elaborate parlor organ for $56 by order from Sears, Roebuck, compared with $125 for a piano.22

![Figure 17: A Taber Reed Organ, adapted to music roll by John McTammany, Worcester, 1880](image)

**Machine in the Organ.** John McTammany, an itinerant musical instrument maker and inventor, migrated to Worcester because of its established reputation as an organ-making center in the 1780s. He had already created a self-playing organette in Cambridgeport, Massachusetts, but wanted to adapt the concept to the then popular parlor organ. John McTammany, applied his invention for a roll-playing mechanism to a Taber organ. The roll

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mechanism was clearly simple and a small handle (on the right of the keyboard) turned the roll in a similar fashion to an organette.

3.3 Corset from the Royal Worcester Corset Company, circa 1900

![Corset from the Royal Worcester Corset Company, circa 1900](image)

**Figure 18: Corset as Currently Displayed with Interpretative Text**

The text corresponding with this artifact reads, “Corset / c. 1900 / Royal Worcester Corset Company”
Industrial Fashion. In the early nineteenth-century, corsets were often custom-made to accompany gowns and dresses. However, by the second half of the century, new inventions allowed corsets to be mass-produced. Soon corsets were available through mail order companies and local dry goods stores. Royal Worcester Corset Company specialized in just this kind of non-custom corset.

Constructed of cotton, metal and bone with lace accents at the top and bottom, this corset was designed for use during the hotter summer months. Corsets like this were displayed at the Columbian Exposition in 1893, where the Company received the Highest Award and Gold Medal.

Figure 20: David Hale Fanning at his Worcester Office, c. 1911

Shaping the Female Form. David Hale Fanning adapted industrial techniques to the shifting styles of the nineteenth century. First establishing The Worcester Skirt Company, Fanning specialized in making hoopskirts to support the full skirts that were in vogue. Over the 1870s, Fanning shifted the focus of his factory, as the focus of the woman's silhouette changed from hoop skirts to shaped torsos and hips, and it was renamed the Worcester Corset Co and in 1901 renamed the Royal Worcester Corset Co. From waist cinchers to full-length corsets, the company under Fanning’s leadership produced numerous silhouettes as fashion shifting.
The Royal Worcester Corset Factory gained national acclaim during these years and touted itself as the "factory of America" for its modern amenities and progressive treatment of workers. Indeed, the company’s own advertising emphasized the modern nature of its factory and labor relations. In its publicity, the Royal Worcester Corset Factory claimed to be the largest corset manufacturer in the world. It was also able to boast of being the largest employer of female workers in the country. Women counted for about 90% of their workforce.
Figure 22: Advertisement for the Bon-Ton and Royal Worcester Corsets

Figure 23: The Royal Blue Book of Correct Corset Styles, 1910

24 From the New York Public Library’s Digital Collection at http://digitalcollections.nypl.org/items/510d47e0-fcb6-a3d9-e040-e00a18064a99
For Every Shape and Size. The Royal Worcester Corset Company offered a variety of styles and sizes in an effort to match the right corset with the right physique. As one advertisement lamented, “It is not to be wondered at that many women today can trace present ill health to the wearing of corsets that were not in any way adapted to their forms or constitutions.” The company produced three brand names: “Royal Worcester,” “Bon Ton,” and “Adjusto” (for ‘fleshy’ women). Prices ranged from $1-3 for the Royal Worcester corset and $3-5 for Adjusto to $3-15 for the Bon Ton corsets. In 2009, those prices would roughly equal $24.41 to $366.16.
Chapter 4: Evaluative Criteria

As the team worked within the three software platforms and copied interpretative materials into them, it analysis numerous features of the platforms. The following criteria were developed in consultation with WHM to evaluate the museum software. In the chapters that follow, these criteria will be applied to Open Exhibits, OnCell and TAP.

**Ease of Use.** The museum staff is not highly trained, and should not be expected to maintain highly complex software. Thus, one of our evaluation criteria must be how easy the software is to maintain. This includes maintaining day-to-day functionality and fixing any problems that should occur.

**Ease of Integration with other technologies.** If the WHM decides to implement two or more different technologies, it is desirable for the different technologies to be able to integrate with each other to create a consistent feel across different platforms. Part of our evaluation will include how easily each piece of software integrates with others.

**Ease of Expanding.** One of the goals for the exhibit is for it to be able to evolve and expand with time. Given this, one of our evaluation criteria should be how easy it is to add and remove content from the different software.

**General Accessibility.** The Museum’s guests include all different kinds of visitors, from first graders to history enthusiasts. It is important for the software to be usable by all of these people, and have content that appeals to them.

**Aesthetics.** Better looking software enhances visitor experience within the museum. One of our criteria is how good the software looks and how natural it is to use and explore. This is one area that commercial software may perform better than open source alternatives.

**Cost.** Open source software, including Omeka, and Open Exhibits, is available free of charge. Commercial software may have a free version, but usually requires some kind of payment, either a one time activation fee or a monthly payment. Even if all of the software is
within the museum’s budget, they may want to prioritize less expensive alternatives where available.

Support. Generally, commercial software comes with support, where it is possible to get a representative from the company to help with setup and troubleshooting. This support is usually lacking with open source software. Because the museum employees are not extensively trained, the availability of support may be an important factor to consider.
Chapter 5: Open Exhibits Evaluation

Description of Software Platform

Open Exhibits is a set of open source software components based in Adobe Flash designed to aid in the construction of touch-enabled applications for use within a museum setting. Open Exhibits runs on any Windows or Mac OS X capable computer, but requires a touchscreen to be installed to function properly. While any computer meeting those requirements could be used with Open Exhibits, it is primarily aimed towards use with specialized touchscreen kiosks that have been designed with public display in mind. Open Exhibits in its simplest form relies on two programming languages, Gesture Markup Language (GML) and Creative Markup Language (CML) to create content. Both GML and CML are extremely similar to the XML language, and are fairly straightforward to use for designing and modifying content. Using CML, one can create instances of Open Exhibits objects, such as a movie player or a slideshow of pictures, and edit their contents and properties. With GML, one can design customized responses to touch gestures, such as making a picture rotate or move when one touches it on a touch screen. Using CML, GML gestures can be applied to Open Exhibits objects to customize how they can be interacted with through touch in an exhibit.

Once the virtual exhibit has been created and filled with content, installation and setup of that exhibit on the touchscreen kiosk is simple. Open Exhibit’s exhibit files can either be saved as CML files, or as a standalone application. When using the CML files, installation is completed by simply downloading and installing the Open Exhibits Player application from the Open Exhibits website. When the player is installed, clicking on a CML file will cause the player to automatically load up and run the exhibit, similar to how one would open a document in Microsoft Word. If the virtual exhibit is in the form of a standalone application, the only setup required is to move the application onto the kiosk. Once that is done, the exhibit can be started.
simply by running the application.

**Evaluation**

One of the most notable benefits of this system is how simple it makes it to update exhibit content. As previously mentioned, Open Exhibits content can be saved as CML files, which for all practical purposes are simple text files. By changing the text in this file, it is possible to switch out the content of the exhibit without any major modifications to the existing system. For example, one could simply copy and paste text into the proper location in the CML file using a text editor, save it, and relaunch the Open Exhibit application, and the text within the exhibit would change. This example works for not only text but with videos, pictures, audio clips, and other multimedia. Using CML, an Open Exhibits setup can have basic content modifications completed within only a few minutes. For example, below is the CML code for a box containing a picture of the Wright Brothers:

```xml
<TouchContainer x="50" y="50">
  <Graphic id="title-bg" x="10" y="10" shape="rectangle" width="420" height="80" alpha="1" color="0x223444">
    <Text id="title" x="20" y="18" fontSize="30" color="0xFFFFFF" width="500" height="50" str="Wright Brothers Collection" />
  </Graphic>
  <Image id="wb-1" src="library/assets/wb0.jpg" x="10" y="108" scale=".6"/>
</TouchContainer>
```

If the designer wished to add another photo, they would simply copy and paste the highlighted line above, and change the photo’s name (id in the highlighted line above), the location of the new photo on screen (the x and y coordinates), and tell Open Exhibits where to find the photo on the computer (the src section of the line above, which takes the file path of a photo on the computer's hard drive). The result would look like this:

```xml
<TouchContainer x="50" y="50">
  <Graphic id="title-bg" x="10" y="10" shape="rectangle" width="420" height="80" alpha="1" color="0x223444">
```

47
This new CML code would add the photo “wb1.jpg” under the name “wb-2” into the exhibit. To make these photos move, the designer would simply add a few more lines to the box’s code telling the software what gestures the photo box should react to. For example, if the designer wanted the visitors to be able to drag, scale, and rotate the photo box, they would add:

```xml
<TouchContainer x="50" y="50">
  <Graphic id="title-bg" x="10" y="10" shape="rectangle" width="420" height="80" alpha="1" color="0x223444">
    <Text id="title" x="20" y="18" fontSize="30" color="0xFFFFFF" width="500" height="50" str="Wright Brothers Collection" />
  </Graphic>
  <Image id="wb-1" src="library/assets/wb0.jpg" x="10" y="108" scale=".6"/>
  <Image id="wb-2" src="library/assets/wb1.jpg" x="575" y="108" scale=".6"/>
  <Gesture ref="n-drag"/>
  <Gesture ref="n-scale"/>
  <Gesture ref="n-rotate"/>
</TouchContainer>
```

Through only the addition of the three lines above, the photos will now move around when touched on screen. If the developer changes their mind and wants the photos to stay still on the screen, all they would have to do is go back into the CML file above and delete those three lines.

After some time experimenting with the Open Exhibits Software, we have reached several conclusions regarding the possibility and effectiveness of implementing Open Exhibits within the Worcester Historical Museum’s Fuller gallery. While the simplicity of Open Exhibits use of CML does make it seem like a very desirable system, it is not without its limitations. Despite the option being available to use Open Exhibits as a standalone and complete system
for designing touch screen exhibits, it is in reality very limited in what can be created within it without custom built extensions. Open exhibit allows the developer to use its pre-made components to display multimedia and make it interactive, but any functionality that does not fall under the abilities of these components is expected to be coded by the exhibit designer in a programming language called ActionScript. For example, adding a button that would cause another screen to open in the application is a functionality that is not supported by the base components included in Open Exhibits, and would have to be coded into the application separately. This leaves two options to design an application in Open Exhibits; make a fairly simple exhibit without any “bells or whistles” using only the limited premade components, or create a more advanced exhibit capable of more advanced content and interaction through a combination of the premade components and custom coded components.

The addition of custom coded components does come with major benefits in the areas of accessibility and aesthetics, however. As the developer has full reign over how content is displayed within these custom components, practically any interface or visual style that WHM desires can be built within the software. For example, the exhibit could have different custom components which each cover the same topic, but each is tailor made for a different age group. This could be done through having a section for small children which contains games, simplified navigation controls, and a colorful design, and another section for adults with more detailed information, a more serious design, and advanced navigation controls. As the exhibit’s design and functionality is all under the control of the developer, the aesthetics and accessibility of an Open Exhibits kiosk is completely customizable and open to the desires of the museum.

Open Exhibits on its own is designed not to interact with other systems, such as a smartphone app or a content management system like Omeka. All content is built into the CML files or standalone application as detailed above, and that is the content that the exhibit can display. However, through the use of custom components, developers can add the ability for the exhibit to integrate with other technologies can be added to Open Exhibits. However, as the
success of integrating another set of software into Open Exhibits depends on the limitations of the other software as well, it is unlikely that every combination of software will be possible.

Another major issue with Open Exhibits is the lack of documentation and support for non-programmers. While the Open Exhibits website does provide an online forum and a few simple guides for setting up and using Open Exhibits, detailed documentation and assistance is scarce. In addition, any modifications or updates to the exhibit would require knowledge of the CML language, making exhibit maintenance and troubleshooting a difficult job for someone without a computer science background. A museum using Open Exhibits would be practically on their own in regards to technical support and questions regarding the system, and the staff may not have the technical expertise or time to develop and maintain the software, suggesting that an in house or out of house consultant would be necessary for technical support.

Open Exhibits is an Open Source software platform, meaning that the software can be downloaded and used for an unlimited amount of time for free. This means that the cost of an Open Exhibit setup is really a combination of two things: (1) the hardware used in the exhibit and (2) any fees paid to consultants for development and maintenance of the exhibit software. The former may be a one time fee, but it is likely that the services of the consultant will be needed on multiple occasions to update or fix the exhibit, making that a recurring cost.

While Open Exhibits has flaws, it still remains a strong system for creating powerful and interactive touch screen applications. Practically any sort of application or activity could be built within the system, as long as one has knowledge of ActionScript and computer programing, suggesting that the services of a consultant or developer is necessary to truly maximize Open Exhibits effectiveness. As such, we believe that Open Exhibits could be a useful tool for the Worcester Historical Museum, assuming that an outside consultant/developer is involved with the project.
Chapter 6: OnCell Evaluation

Description of Software Platform

OnCell is a commercial software suite designed to allow museum curators to create guides that run on mobile devices. OnCell tours feature several different pages of information. Pages can include text, images, videos, as well as embedded google maps. Users can navigate between pages easily by clicking on links within a page. OnCell tours can run natively on iOS and Android devices, or within a user’s web browser. The target device is a smartphone, however, the software also runs well on tablets.

Evaluation

We have experimented thoroughly with the trial software and have created a prototype exhibit that we believe showcases the power of the software. During the process of creating this prototype, we have learned several things about the software.

Developing an OnCell guide is a very simple and easy process. All guides are created using a simple intuitive graphic user interface (gui). There is no programming involved, and we believe it is something that could be done in-house, without the WHM needing to hire a developer. It is also easy to add, remove, or change parts of the guide, allowing extensions or modifications to the exhibit to be easily reflected in OnCell.

With the simplicity of the technology comes a tradeoff. Creating a guide requires no code, but because of that it is impossible to add arbitrary functionality to a guide. In this way, the software is inherently limited in a way that suites like Open Exhibits are not. Something we talked about when considering exhibit design was a game that involved altering an image to reflect the effect of a corset on the human body. This would be impossible in an OnCell guide. Despite this, we believe that the functionality available should be more than adequate for creating an immersive guide using audio, video, animation and visual materials.
One feature that OnCell offers is the way it can potentially extend the museum experience outside the gallery. OnCell integrates with google maps to offer interactive maps, and also provides “geoalerts” that can notify users when they are close to an interesting location. All of this means that an OnCell tour has the potential to offer up interesting content outside of the physical museum. Due to limitations of the free trial, we were not able to experiment with this aspect of OnCell as much as we would have liked. We urge the WHM to get more information from a representative.

OnCell is a commercial product. This means there are two things to consider when the WHM is reviewing the software. The first is that it is not free. OnCell requires a monthly subscription fee. This fee is not advertised on their website, but we have received a quote of $4788.00 per year for the WHM to use the technology. One thing to note is that there are many levels available, each priced separately and offering different services. Should the WHM decide to pursue incorporating OnCell technology into their exhibit, we believe they should fully discuss the options with a OnCell representative to determine the level they wish to use. The final price may be different from the one offered here.

The second factor to consider about commercial software is the support. OnCell offers tech support as part of the package. They also offer other services, like making the mobile app available on google play and the apple app store for visitors to download. Some users, however, may be unwilling or unable to download an app onto their personal mobile devices. One possibility is for the WHM to provide tablets or phones with the app preinstalled for their visitors. The specifics of this proposal is a topic for another group to investigate.

We found the aesthetics of OnCell to be inoffensive and perfectly acceptable. The app is designed to emphasize content over presentation, so the color scheme and design are very plain but functional. The limitations of the software prevent the WHM from customizing the look of the application, however, we believe that the theme of the software is good enough that it should not influence the WHM’s decision.
Visitors to the WHM are a diverse group. This group includes history enthusiasts, people looking for family ties on the story of Worcester’s industry, and children as young as the first grade. With this in mind, any digital augmentation that the WHM pursues should be capable of catering to this diverse group. The presentation of information should be layered so that visitors are not inundated with more information than they want. Digital technologies, inherently handle this problem well, due to the nature in which the information is structured. Specific strategies for dealing with this in OnCell could include separate exhibit pages designed for children and adults, or structuring pages where deeper information is hidden behind “Learn More” links. One thing we were unable to determine is the feasibility of having multiple tours rather than different pages within one tour.

If the WHM is looking to adopt more than one digital technology, they want the different technologies to integrate. While it is also possible for links in OnCell to go to web pages, OnCell is designed as a standalone application. It is not designed to interface with other technologies. However, any content or interpretations developed for OnCell can always be migrated to other software platforms.

Deploying an OnCell guide will require very little modification to the existing gallery. It should be thought of as an augmentation to the existing exhibit rather than a redesign. Should the WHM want to investigate the potential of more complex software, like Open Exhibits, but also want something in the short term, OnCell works very well as an interim technology. It provides a short term solution that also allows the WHM to examine visitors reactions to digital augmentation. Later, the WHM can decide to keep OnCell, or transition to something that offers more potential for redesigning the gallery.

Ultimately, OnCell provides a quick and easy way to create an engaging digital enhancement. Creating and expanding guides is simple, and should the WHM encounter any problems, OnCell staff will help them. The guides are accessible and available on multiple platforms. However, the guides are limited in theme and do not offer the potential to completely
revamp the gallery. Overall, we believe that OnCell offers a very mature software platform for the WHM to explore digital augmentation with a minimum of hassle. OnCell offers a free trial for potential users to experiment with the guide builder. We recommend that the WHM sign up, start creating some guides, and experience the software for themselves.
Chapter 7: TAP Evaluation

Description of Software Platform

The TAP system is an open-source development tool for touchscreen mobile applications designed to create apps centered around walking tours. TAP allows a user to design a tour that consists of multiple stops, where each stop can contain detailed information about a certain artifact or landmark as well as multimedia files such as images, video, and audio files. These tours can be exported into the TAP mobile application and then run on mobile devices. The TAP mobile app runs on Apple iOS devices, such as the iPad, iPhone, and iPod touch, but it is also possible to run the TAP mobile app as a web app, allowing it to run on Android and Windows phone devices.

On the content development side, TAP is based around the Drupal website content management system, which has been repurposed from website design to the creation of TourML files, which is a programming language similar in design and function to CML in Open Exhibit. These TourML files are then exported from the Drupal System, and placed within a prebuilt mobile application, the TAP iOS/Web app. This application is then ready to be loaded onto mobile devices for use by visitors.

Due to the Drupal system TAP runs on, content creation is simply a matter of logging onto the museum’s private TAP website, and filling out a number of web based forms with the information and multimedia that the app will contain. Using these forms, a user can simply select what kind of content they would like to display on the app, like a photo, video, or audio tour, upload it to TAP and add some text. Once the user finishes the form with desired content, the page is complete. Taps natively supports media in the form of video, audio tours, photos, and maps. Because of the simplicity of this system, content creation and updates are tasks that we believe could be handled by WHM without any assistance. However, the act of actually
setting up and maintaining the systems used in this process, as well as the tasks of maintaining and loading the created content onto the TAP mobile app, are actions that require a more technical background, and would likely be best handled by a consultant.

**Evaluation**

In its current state, TAP by itself does not have any built in ability to integrate with other technologies. The web app is viewable on desktop computers, but it is not designed to function in such a way, and therefore does not perform ideally within that setup. In addition, TAP by itself does not have many features in the way of customization. TAP apps have a simplistic layout with rather plain aesthetics. The applications do not really stand out or have a unique design. The layout used is functional, but extremely basic and barebones, meaning that some visitors such as small children, the elderly, or those unfamiliar with mobile devices may struggle with using the app. In order to customize or add new features to a TAP application, it would be necessary to hire a developer to program the additional functionality into the TAP application. Through this developer, it would be possible to develop any desired integration with other systems, modify the aesthetics, and create new interfaces and content layouts better suited towards the varying groups of visitors. In summary, it is possible to have a high level of customizability with TAP, but at the high cost of having to hire a developer and the long wait for them to modify the app before it can be used.

TAP is open source, so the software is completely free to use, but if you wish to use the Apple iOS app, you do have to pay for an Apple developers licence, which is a minimum of $99 a year. However, this does come with the added benefit of allowing you to put your version of the TAP app with the tour built in onto the Apple Appstore, allowing visitors to download and use your app on their personal devices.

During our evaluation, we have run into several issues with the TAP system which make us question its value to WHM. As previously mentioned, TAP is Open Source. While this does
provide the benefit of the software being free, it also means that there is no real dedicated technical support base behind TAP to answer questions or provide assistance. In addition, developer support for TAP seems to be declining. Developer updates and bug fixes to the TAP software have practically stopped since 2013:

![Graph of updates to the TAP software from 2011 to 2016.](image)

Figure 24: Graph of updates to the TAP software from 2011 to 2016.

The documentation and guides on the website are extremely undetailed and incomplete, and in some cases, are completely broken. For example, in the guide to install the TAP development software, the primary installation methods listed within the guide have been declared “out of date” by the TAP developers, with only an incomplete stopgap installation method listed as a replacement.

![Warning from the TAP developers on the top of the installation guide.](image)

Figure 25: Warning from the TAP developers on the top of the installation guide.

Multiple attempts were made by our team to use the TAP software, but we were unable to get the development software to install correctly, and without any proper documentation or guides to help us address these errors, we were unable to proceed further and create tours and content with this software.
Figure 26: Example of the error messages we encountered when trying to use TAP.

For these reasons, we cannot recommend TAP to WHM. However, if WHM wishes to use the TAP software, we believe that it would be absolutely necessary to hire a consultant to setup and manage the TAP software, due to both its less than stable nature, and to handle the computer-oriented tasks of migrating tour content onto the TAP mobile app and then managing the mobile app.
Chapter 8: Findings and Recommendations

Our investigation confirmed what WHM had already intuited. Namely, digital enhancements to the Fuller Industrial Gallery have the power to:

1. Virtually expand the space so additional interpretative apparatus can be added digitally without further crowding the already limited space available;

2. Create an immersive experience of particular tools by adding audio, video and animation to enhance visitors’ appreciation of how a device works and its significance in Worcester and beyond;

3. Customize interpretative materials so to encompass text and material appropriate to diverse audiences ranging from elementary school groups to adult visitors;

4. Expand the museum experience outside the walls of the gallery by integrating walking tours and geolocation experiences; and

5. Enhance the overall understanding of Worcester’s industrial legacy and imprint on the city, the nation, and the world.

These benefits of digital enhancements to the current and anticipated redesigned gallery can be achieved through variety of software packages created to aid museums. Our preliminary survey of the broad universe of exhibition software platforms led us to intensively investigate three options - Open Exhibits, OnCell and TAP. Our experiences with these different software and hardware platforms experimented with during this project have led us to a number of findings and recommendations for WHM.

**The TAP system had become dated and should be avoided.** First of all, we recommend that the TAP system be completely avoided. While it may have once been a viable system, at this point interest and developer support for the system seem to have completely stopped, leaving the system in a confusing and unstable state. TAP was developed with a grant, and as that grant has now expired, it is unlikely that interest for the project will return. For these
reasons, if WHS installed a TAP system, it would be practically obsolete before it could be even turned on.

**OnCell offers the best opportunity to quickly enhance the current gallery as it undergoes a redesign and a reliable if simple platform beyond a transitional period.** OnCell is a stable and quick to deploy system that, while not a perfect solution for the desired fundamental redesign of the exhibit, would make a great “stopgap” augmentation to the existing exhibit while other, more customized software solutions are being developed. OnCell’s standardized layout allows any content created within it to be easily recreated and reused in other systems. In addition, as OnCell apps can be loaded onto or viewed on visitors devices, no hardware would need to be purchased to use OnCell during the transition period. We recommend that WHM uses OnCell’s online demo system to experiment with creating and viewing content in OnCell to better understand how it could be used. We also suggest that WHM experiment more with how OnCell might enhance the extra-museum experience through google maps integration and geo-alerts, two features available in OnCell subscriptions.

**Open Exhibit offers great potential as part of a thorough redesign of the gallery but requires additional evaluation and testing.** Open Exhibits, due to its extremely customizable and programming heavy nature, is a system that we believe should be further researched before WHM makes a decision regarding its use. Open Exhibits offers the potential to fundamentally redesign the entire exhibit experience around visitor interaction with technology, but doing so could be a extremely large venture that WHM may not be willing to take. For this reason, we believe that more research should be done by a future IQP team on what is possible within Open Exhibits, the difficulty and costs that this system entails, and what possible hardware setups could be used in the exhibit before any decision is made.

**Commercial software packages offer many positive attributes despite their costs.** One general rule that we have found from our research is that in general, commercial software
is generally easier to use and maintain for a museum than its open source counterparts. While systems like Open Exhibits lead to a wide range of possibilities, it also requires a large amount of behind the scenes work to operate, such as hiring developers to build the software, a consultant to maintain and update the system and its content, and much more. As such, open source software like Open Exhibits can become a significant drain of resources for a museum. A commercial system like OnCell is a completely different story. As much of the work is done by the company behind the software, exhibit design, setup, and maintenance become more like automated tasks, leaving the museum staff free to focus on other issues. This often comes with the downsides of more limited customization and higher fees, however, so it is up to WHM in the end to decide which category of systems provides the more valuable benefits to the museum.

**New applications for extra-museum interpretation should be further investigated and prototyped.** One issue that remains is researching systems that provide a quality extra-gallery experience. While both TAP and OnCell contain sets of features that could provide the framework to create an extra-gallery experience, such as google maps integration and geo-alerts, they may not be ideal solutions for such a task. Our focus for this project was primarily on how these systems could be used within the museum, and as such their extra-gallery features were not heavily evaluated. In addition, the OnCell online demo does not allow testing of extra-gallery features, which prevented us from exploring those options fully. Further research into this area should be done before WHM makes a final choice on a software system for walking or driving tours across the city.
Works Cited


Link Is Dead


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183-204

Integration of Digital Technologies into an Industrial History Gallery

Software Evaluation Catalog

Submitted by:

Alexander Marry akmarry@wpi.edu
Jacob Watson jrwatson@wpi.edu
Jesse Earisman jkearisman@wpi.edu

Submitted to:

Prof. Joseph Cullon, Project Advisor
Executive Summary

As the WHM seeks to augment their industrial history gallery with digital technology, they have sought out the help of our team in determining which software is most capable of realizing their vision. In pursuit of this, we have created this catalog outlining several options. It is our hope that the WHM staff are able to use this document to narrow down the list of options enough for our team to perform a more in depth analysis.

The catalog is divided into six sections. The first section consists of a glossary of potential features available within the software examined in this catalog. Section two is a comparison of features within the various software packages. Section three details the criteria we plan to consider in our evaluation of the software. The next three sections each detail a category of technology the WHM may want to use. The fourth section is about touchscreen kiosks, the fifth details the software available for mobile apps, and the last discusses web technologies. Each section is preceded by a header outlining the advantages and disadvantages of the platform.

Inside of each section is a selection of software options that run on that platform. Each piece of software has a brief description, followed by a list of features. Links are provided so the WHM staff can explore further. Lastly, as advisors, we gave our initial impressions with the software.
# Table of Contents

Executive Summary 2  
Table of contents 3  
Feature glossary 4  
Software Comparison 5  
Evaluative Criteria 6  
Touchscreen kiosks 7  
  Open Exhibits 8  
  Lightbox 2 9  
  Intuiface 10  
Mobile Technologies 11  
  OnCell Mobile Tour Apps 12  
  Museum Anywhere 13  
  Omeka Plugins for mobile 14  
  TAP 15  
  SmartBeacon 16  
Web Technologies 17  
  Omeka 18  
  Pachyderm 19  
  PastPerfect 20
Feature Glossary

Different software options have different features. The purpose of this section is to list and define the numerous options so the WHM staff can choose which features they believe can best achieve their goals for the exhibit.

- **fundraising/membership features:**
  Fundraising or membership features can be implemented within an application and add the ability for the program to handle financial transactions between the user and the museum. For example, the application could have a button taking the user to a page where they could enter their credit card or Paypal information, and then donate an amount of their choosing to the museum, or sign up for museum membership.

- **3d models**
  3d models allow an entire artifact to be scanned into the software, rather than a two dimensional image. Typically, users can rotate and examine the model, giving them a more realistic idea about the shape of the artifact.

- **gesture analysis**
  Gesture analysis means that the software is capable of interpreting movements of the user’s body, and can react to these movements. A simple example is a piece of software that advances to the next screen when the user waves their arm to the right. Gesture analysis can also be used to create activities or games that more fully engage visitors.

- **social media integration:**
  Social media integration is the idea of adding features from popular social media services (Facebook, Twitter, etc.) into the application, allowing the users to interact with these services within the application. Examples of this includes allowing users to post information or activity results from the application to their social media account, allowing users to subscribe to the museum’s social media account, update their social media status to show that they visited the museum, and much more.

- **mapping/geolocation functions:**
  Geolocation is the ability to determine the geographic location of an electronic device through the device’s internet connection or cellular connection. An application can use this information to determine where the device’s user is located, and therefore what points of interest are in proximity to the user. This can be used within a museum to allow an application to detect what displays or exhibits the user is close to, or guide a user along a walking tour of Worcester to historically important locations.

- **QR codes:**
  A QR code, or Quick Response code, is a type of barcode that can be read by the camera in a device (such as a tablet or smartphone) and direct that device to a webpage or application. QR codes can be placed near points of interest to direct visitors to digital museum materials like apps and webpages.
# Software Comparison

## Touchscreen Kiosks

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<th>Feature</th>
<th>Open Exhibits</th>
<th>Lightbox 2</th>
<th>Intuiface</th>
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## Mobile Devices

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<th>Oncell Mobile Tour Apps</th>
<th>Omeka Mobile Plugins</th>
<th>TAP</th>
<th>Smartbeacon</th>
<th>Museum Anywhere</th>
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<th>PastPerfect</th>
<th>Pachyderm</th>
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Evaluative Criteria

Below is a listing of the evaluative criteria we plan to use during our later in-depth analysis of WHM's preferred software packages. These criteria will provide the guidelines to our review and testing of the software packages.

Ease of Use:
The museum staff is not highly trained, and should not be expected to maintain highly complex software. Thus, one of our evaluation criteria must be how easy the software is to maintain. This includes maintaining day-to-day functionality and fixing any problems that should occur.

Ease of Integration with other technologies:
If the WHM decides to implement two or more different technologies, it is desirable for the different technologies to be able to integrate with each other to create a consistent feel across different platforms. Part of our evaluation will include how easily each piece of software integrates with others.

Ease of Expanding:
One of the goals for the exhibit is for it to be able to evolve and expand with time. Given this, one of our evaluation criteria should be how easy it is to add and remove content from the different software.

General Accessibility:
The Museum's guests include all different kinds of visitors, from first graders to history enthusiasts. It is important for the software to be usable by all of these people, and have content that appeals to them.

Aesthetics:
Better looking software enhances visitor experience within the museum. One of our criteria is how good the software looks and how natural it is to use and explore. This is one area that commercial software may perform better than open source alternatives.

**Cost:**
Open source software, including Omeka, and Open Exhibits, is available free of charge. Commercial software may have a free version, but usually requires some kind of payment, either a one time activation fee or a monthly payment. Even if all of the software is within the museum’s budget, they may want to prioritize less expensive alternatives where available.

**Support:**
Generally, commercial software comes with support, where it is possible to get a representative from the company to help with setup and troubleshooting. This support is usually lacking with open source software. Because the museum employees are not extensively trained, the availability of support may be an important factor to consider.
Touchscreen Kiosks

Touchscreen kiosks are in-museum digital devices that are part of the exhibits themselves. The primary benefit to touchscreen kiosks is enhancing exhibits to allow more interaction and greater information density. There are two main ways of creating touchscreen kiosks. The first is to deploy software that is custom made for kiosks. The second is to use normal mobile app software on emplaced hardware. This section will only discuss the first option.

**Advantages:**
More interactive exhibits
Display text, pictures, and video in the same space
Quickly and easily change displays
Some integration with web and mobile devices

**Disadvantages:**
Limited to in museum use
Requires the museum to buy hardware
Open Exhibits

**Features:** Open Exhibits is a tool to make interactive digital exhibits. By default it includes templates, components, and utilities that can be assembled to make exhibits in a way similar to web development, though it does include a software development kit (SDK) to program more customized features. The software includes support for touchscreen displays and MP3. Notably it has a gesture library which can be used in conjunction with motion sensors such as the Microsoft Kinect to provide a gesture based interface. It also supports Arduino, an open source circuit board, which would allow for integration with custom hardware. Omeka Everywhere should tie Open Exhibits into Omeka.

**Price:** Open Source

**Used by:** National Museum of Dance, Commonwealth Air Training Plan Museum, Grandfather Mountain Stewardship Foundation, and others.

**Hardware:** Requires: Windows 7/8 devices

Supports: Arduino (customizable open source circuit board), Kinect and Leap Motion Controller (motion sensor devices), TUIO (Multi Touch interface technology)

**Link:** Website [http://openexhibits.org/](http://openexhibits.org/)


**First Impressions:** Open Exhibit is an flexible and powerful tool for creating digital exhibits. It does require technical expertise to do anything with it.
**Lightbox 2**

**Features:** Lightbox 2 is a commercial platform for multi-touch interface. The design and interface are already developed. It displays text, pictures, video, and a web browser. It has an easy to use backend for content management and front end for viewing.

**Price:** 1,000$-2,000$

**Used by:** National Coal Mining Museum (England), Inglis Memorial Hall Library

**Hardware:** Windows computer and touchscreen displays

**Link:** Website [http://www.blackboxav.co.uk/lightbox-2-museum-media-browsing-software](http://www.blackboxav.co.uk/lightbox-2-museum-media-browsing-software)

**First Impressions:** Lightbox 2 is easy to use and maintain and it does the basics of digital information display. The customization is extremely limited and it can’t do anything but basic information display.
Intuiface

Features: Intuiface displays text, pictures and video, it also includes “assets” for interactive programs, 3d models, animations, maps etc. and includes a web browser. The design editor seems relatively easy to use (no coding) and allows for flexible design. It is possible to track user data with it. The manufacturer provides training and continuous customer support. It consists of a “composer” for development and a “player” for display.

Price: 86$/month composer
2-26$/month for each display device

Used by: RKD studios, Hawaiian Legacy Hardwoods, and others

Hardware: Apple, Windows, and Android devices. On windows it can use kinect and RFID readers as input.

Link: Website http://www.intuilab.com/

First Impressions: Intuiface does most of what Open Exhibit does though it is not open source so it is less customizable and it more expensive. It also is not specifically designed for museums.
Mobile Technologies

Mobile technologies includes all applications, hardware, and websites designed specifically to work with Smartphones and Tablets. The primary benefit of mobile technologies is the integration of visitors personal devices into the museum experience.

Advantages:
Geolocation software or proximity beacons can be used by smartphones to create location aware applications and tours
Social media integration
Interactive walking tours
Access to newsletters or exhibit information through the mobile application regardless of the user's location

Disadvantages:
If visitors do not bring a smartphone to the museum, they will miss out on the benefits provided by the museums mobile app
The museum can provide their own mobile devices for use by museum visitors, but these devices are often expensive to purchase and maintain, making this a costly solution
It may be necessary to create several different apps to support the most popular mobile platforms. This is also a costly option when compared to creating a single app for a touchscreen terminal or a traditional web based platform
OnCell Mobile Tour Apps

**Features:** Oncell provides custom smartphone applications centered around guiding visitors. Features include interactive maps, location aware beacons, and real time content updates. Several different levels of service are available: Audio tour, which contains basic audio and text, the Lite tour, which adds support for images, and the Pro tour, which adds video, interactive images, and additional interactive features. They offer both web based applications, or full smartphone applications, which OnCell will submit to the Android/iOS app stores. Their basic plan gives access to their app building software so users can create the application themselves, but they also offer a custom application design service if desired.

**Price:** Subscription based, dependant on services required

**Used by:** Metropolitan Museum of Art, Texas Historical Commission, Newport Historical Society

**Hardware:** Smartphones (iOS, Android, Blackberry, Web)

**Link:**
- Website: [http://www.oncell.com/](http://www.oncell.com/)

**First Impressions:** OnCell has the widest range of features out of all the mobile systems, and it appears just about any desired feature for a mobile app could be implemented through their programs. However, doing so is likely to be expensive, and similar (but not quite as flashy) applications could be created with cheaper or open source software.
Museum Anywhere

Features: Museum Anywhere makes two museum apps. The Customized Museum App displays multimedia content to users. It works in conjunction with iBeacon, a product made by the same company, to coordinate the content with exhibits. The app has integration with facebook and twitter. It has fundraising and membership features as well as digital maps and brochures. The Visitor View App is a museum directory, if a museum signs up they are placed in it and people who download the app can view it.

Price: Customized Museum-App:
“Regular Museum”: $14,995 purchase, $4,000 setup, $2,995/year Maintenance
“Smaller Museum”: $9,995 purchase, $3,000 setup, $1,995/year Maintenance
Maintenance isn’t for new version of the app.

Visitor View App:
“must-see” $1,000
“marketing” $3,000

Used by: Anchorage Museum, and others
Hardware: iOS and Android phone and tablets
Link: http://museumanywhere.com/

First Impressions: Museum Anywhere provides a wide range of features within their base applications and also offers the creation of custom add-ons if the base app isn't enough. Its geolocation services and social integration aspects appear very strong, and the application interfaces have a clean and professional look. However, many of these services may be overly complex to implement and maintain, and therefore are not particularly aligned with WHMs needs. In addition, many of these features could be implemented, while perhaps not in a way that is as visually appealing, using open source software or cheaper software tools with a little work.

Omeka Plugins for Mobiles
**Features:** These open-source plugins add mobile device oriented features to the Omeka web publishing platform. Omeka itself is able to create mobile accessible websites, but these plugins add features optimized for visitors to the museum using mobile devices to access the website. These features QR codes, Geolocation features such as location based search and interactive museum maps, the ability for visitors to submit comments on exhibits or mobile content, social network interaction, among other features. An Omeka system is required to use these plugins.

**Price:** Open-source

**Used by:**

**Hardware:** All smartphones, Omeka


**First Impressions:** These features are all individual plugins for the Omeka system, and as such using them requires Omeka. How they appear within the website itself is dependant on the limitations and features of Omeka.
TAP

Features: TAP is a collection of open-source software tools used to create mobile museum tours. It can be used to create native iOS applications or web based mobile applications. TAP requires a basic knowledge of web design and coding to create applications. Content is created and modified using the included authoring tools, then is ported to front-end mobile applications for use. A open-source iOS application and web application that have been designed to function with content from the TAPS authoring tools are included.

Price: Open Source

Used by: Art Institute of Chicago, National Air and Space Museum, Museum of Fine Arts Boston

Hardware: iOS and web capable tablets/smartphones

Link: Website: http://www.tapintomuseums.org/

First Impressions: TAP is mainly focused on creating walking tours, and its ability to display other formats and media is very barebones compared with its competitors. It also requires a basic understanding of web design and familiarity with a computer, which may

![TAP app screenshots](image-url)
SmartBeacon

Features: Smart Beacon provides custom mobile proximity beacons, which are small devices that send out geolocation signals to nearby smartphones/computers, that can interact with an application on a smartphone to activate content within the app when the phone comes within a certain proximity of the beacon. SmartBeacon offers custom designed proximity beacons, software to setup and control the beacons, and a custom mobile application designed to interact with the beacons. The beacons can be used to trigger the display of text, audio files, photos, or videos within the app when a visitor walks up to an exhibit with their phone. The app also contains geolocation content, a newsletter feature, support for passbook coupons, social media integration, and user profiling software.

Price: Dependant on software and beacons purchased

Used by: Venaria Reale

Hardware: iOS capable devices

Link: http://smartbeacon.it/


First Impressions: SmartBeacon’s services are very heavily focused on geolocation, with the rest of the app falling into place around it. If geolocation is a desired feature for WHM’s app, then SmartBeacon is a good choice. If geolocation is a secondary concern or not desired, it might be best to look elsewhere.
Web Technologies

The goal of Web technologies is to give visitors the ability to access exhibits from their own computers or mobile devices. This allows the experience of the exhibit to go beyond the physical location.

People that came in and want to know more can explore more resources after the leave the museum.

Potential Visitors can browse the collections before going to see them in person.

Advantages:
Accessible anywhere the user has access to a PC or mobile web browser
Allows visitors to access museum content without physically being in museum

Disadvantages:
Does not enhance on site museum experience as much as other technologies
Requires the museum to host the website, or pay for hosting services
Can feel old fashioned
Omeka

Overview: Omeka is an open source project designed to make online publishing easy and free. It is useful for libraries, museums, and scholarly collections. It is designed for academics and institution staff rather than technical experts and IT staff. It is designed to create good looking, easy to customize websites viewable from any computer or mobile device.

Features:

- Can store multiple different file formats, including audio, video, images, etc.
- Storage size is only limited by hardware
- Multiple different easy to install themes
- Different plugins available, including geolocation, timeline, and mobile plugins
- Conforms to “Dublin Core” standard

Price: Free and open source

Hardware: Requires a linux server, can also be hosted on Omeka.net

Used by: http://omeka.org/codex/Sites_Using_Omeka

Link: http://omeka.org/
Pachyderm

Overview: Pachyderm is a multimedia design tool for building flash-based online presentations. It looks like it would work best as an embedded addon to enhance immersion in an existing website.

Features:
- Interactive creations can include text, audio, images, and video
- Pachyderm pieces are standalone creations, can be customized for each artifact

Price: Free and open source

Used by:
Link: http://pachyderm.nmc.org/
Examples: http://pachyderm.nmc.org/category/showcase/

First Impressions: It looks like it could be very powerful, but the old fashioned look and loading times are very distracting. It is not a total solution, but pachyderm creations could provide more depth to an existing website.
Past Perfect

Overview: One of the most popular collection management suites, used by many museums. It seems to primarily be for managing rather than displaying, but there is a web addon that can be purchased alongside the main software that allows you to put all content in an easy to navigate web page.

Features:
- Very good support system
- Large capacity
- Mapping feature to map artifacts to locations

Price: One time price. Base system is $870, Multimedia upgrade is $375 extra, online setup is $285 extra

Used by: Over 9,500 museums, many examples at http://pastperfect-online.com/

Hardware: A baseline windows computer to edit collections. PastPerfect online is hosted externally

Link: http://www.museumsoftware.com/index.html

First Impressions: Seems to do a very good job of collections management. In terms of an outward facing website, it looks like other software would do a better job.