Design of a Contextual Digital Wayfinding Environment

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Abstract. The user experience presented here illustrates how a digital wayfinding experience was developed for a museum website, using both natural and historical context engagement. A general web site tour is supported for visitors to the museum website. In addition to this standard experience, a botanical and historical tour can be taken. For the botanical and historical layers depicted, the layered maps support differentiated experiences in a digital wayfinding environment, which is particularly important for users not able to be physically present at the site. The botanical layer of the website provides botanical information specific to the property. Using primary historical artifacts, a historical context is provided. Historical documents supporting the grounds layout, such as documents regarding the original plant orders, are presented alongside the landscape at that time. Both the physical and virtual experience of the site is enhanced, depending on the pathway selected by the user through the digital material presented. This digital wayfinding integrates user experience with historical fact, landscape architecture, and physical site information.

Contributions of this research include a methodology for digital wayfinding design at other physical locations and lessons learned regarding best practices in developing discrete information layers for traversal by differentiated user communities. Users reported increased interest in the differentiated general, botanical, and historical content when it was presented in context. Overall, interest in visiting the actual museum increased by fifteen percent after users completed the digital wayfinding experience.

Keywords: Digital wayfinding · Layered maps · Botanical · Historical · Museum

1 Introduction

Wayfinding is the way in which people orient themselves in physical space and navigate from place to place. People regularly use wayfinding tools, such as Google Maps or Waze, to help them navigate and reach destinations while driving. Wayfinding is not as popular when pedestrians navigate in an enclosed outside environment, such as an

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orchard. While it could be argued that wayfinding tools are not needed in an orchard or open space because everything to see is right in front of the visitor, this assumes that only the current physical layout is of interest. What if a person wanted to see what the space had looked like in the past?

Using layers to add onto maps, the research presented here created different experiences within one garden. Each layer represents a different way to interact with the garden's botanical environment or a different part of history. Each map holds unique information, making no two trips alike. Unlike other wayfinding systems, which have a user input a destination and a pre-set route is provided, this layered, intelligent wayfinding system is able to understand what the user wants to see and gives the user multiple paths he or she might find interesting. This places the user in control of the content and individual experience.

In this study, we created a wayfinding system for the grounds at Liberty Hall in Union, New Jersey, using layered maps that each convey a different user experience. These maps provide either general, botanical, or historical knowledge. Additionally, each map appeals to the different demographics that Liberty Hall Museum caters to, including senior citizens and K-12 students. Many senior citizens would like to know the historical information behind the herbs and trees planted in the garden or the overall history of the property. Science teachers may teach their students about the botany of the plants and trees in the orchard, while senior citizens and other students may only want a general knowledge of the property, not specific, and to observe nature. The layered mapping presented here provides a free, unrestricted experience.

Prior research that has been done about quick response (QR) codes, layered maps, and wayfinding systems in place was used in designing this experience. The hardships or challenges of promoting the visibility of an orchard [1, 2] were considered. We give insight into our methodology of each experience in the orchard and its layered maps. Finally, we discuss our conclusions, explain limitations, and suggest further research.

2 Prior Work

Global positioning systems (GPS) have been around for years as an alternative to physical maps as a wayfinding tool, yet they still lack the quality of physical maps. Physical maps for outdoor wayfinding have been found to increase the survey knowledge of users [3–6], thus helping the user become more spatially aware. In fact, spatial awareness is vital to a contextual understanding of an environment. However, in another study participants found that their smartphones provided them confidence with wayfinding tasks rather than hindering them, as some other literature suggests [7]. These two sides of the argument creates a level ground in which both can be improved upon.

Creating wayfinding systems in an outside environment, such as a garden or orchard, has proven to be difficult. The placement of trees and plants in an orchard are all carefully planned by the owner of the land or an arborist. The arborist wants visitors

to become aware of the nature surrounding them when visitors are physically in the orchard [6]. This is done by placing the trees in certain areas, expressing different landscapes, and creating pathways for a visitor to experience nature as it is intended to be experienced. Gardeners are constantly looking for ways to help maintain the longevity of their land and a way to do that is to pair areas of the garden with appropriate historical content. However, it is hard to find documents that provide historical information pertaining to tree and plant placement because of ambiguous document keeping from the past. Gardeners frequently have to sift through documents, leaving out the "interesting but not relevant" parts [4].

Combining parts of a garden and historical documents is a way for visitors to connect with the garden itself. To accomplish this, the garden would need an interface for visitors to use so that they could get the information. One study proposed using QR codes to enhance the experience of government websites, such as the U.S. National Park Service (NPS) [5]. The study was able to create a waypoint system for visitors of the park to use while also creating park incentives through the website. This study found a way to combine the experience of the actual park with the information available on the park's website. Using QR codes greatly improved the visitor's knowledge of park activities and general information.

The original map for Liberty Hall (Fig. 1) did not provide sufficient detail on the general, botanical or historical aspects of the site. The presentation was basic, with shapes and color being the primary visual indicators. No informative or descriptive text was provided, only the identification of a street name which borders the property.

Fig. 1. Original map for Liberty Hall, Union, NJ.

3 Methodology

In the early phase of this project, a decision had to be made regarding how to develop the website for Liberty Hall Grounds (www.libertyhallgrounds.org). Given the length and intent of the project, it was not possible to hardcode the entire website. Additionally, the Liberty Hall staff are not familiar with programming, therefore making the idea unsustainable in the long-term. The Liberty Hall staff communicated that they needed to be able to easily update the museum website in the future. With this in mind, the Webflow platform was selected.

Webflow is a web-based drag-and-drop tool for building responsive websites. With Webflow, a user with no programming experience can create their own website, and if a user knows how to code, then the user can create a more sophisticated website. Webflow is useful for people with no programming skills both to create websites, and to update websites in the future as coding is not required to update content. This was a solution to a significant hurdle and the main reason Webflow was selected to create the website. Webflow gives the Liberty Hall museum staff the control to change the website at will without having to worry about not knowing how to program.

At the conclusion of the project, a decision was made regarding the site's hosting. Multiple hosting services were considered, however they all required us to export code from Webflow. This would defeat the purpose of using the platform in the first place because by exporting code, if Liberty Hall wanted to make changes, then the staff would have to know how to program. Ultimately, Webflow was selected to host the website, as Liberty Hall could keep their easy access.

4 General Map

The first experience to convey to visitors was a general experience. This experience caters to individuals who are not interested in the botany of the trees and plants and who do not care about historical significance. The resulting map (Fig. 2) contains points of interest, such as the trees, the formal garden, and Serpentine Path without focusing on the context of each object. The objective was to make sure that visitors did not feel pressured when looking at this map, that they felt free to do what they wanted and see what they pleased. The idea that visitors were free made a huge impact on the experience we wanted to convey.

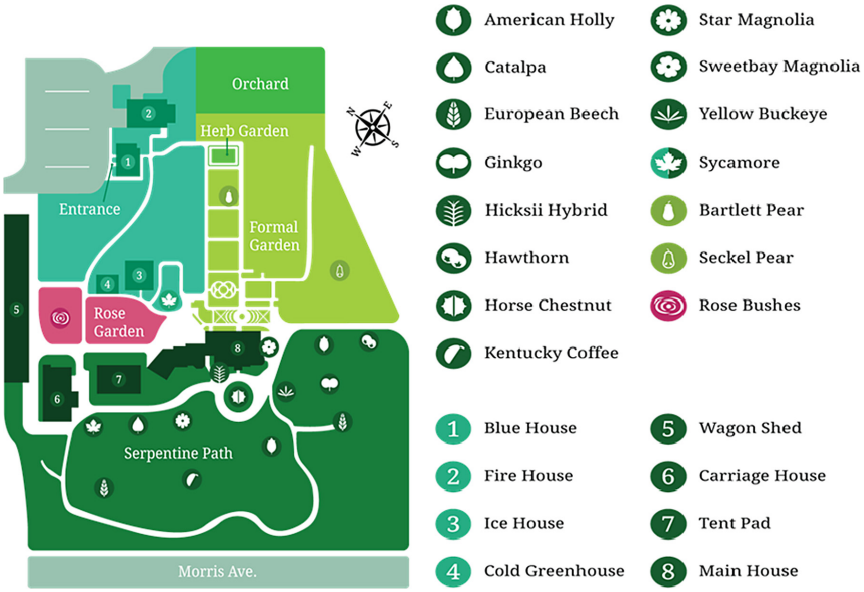

Fig. 2. New general map and guide for Liberty Hall, Kean University, Union, NJ., with botanical and site building detail.

5 Botanical

The second experience tackled was the botanical experience (Fig. 3). Before this project started, the orchard had no place for visitors to lookup botanical information on its champion trees. A website was created that contained each tree's picture, scientific

Fig. 3. Botanical map for Liberty Hall, Kean University, Union, NJ

and common name, background, and a link for more information about the tree. The website has fourteen trees, yet the orchard contains sixty-four trees, this is because these select few were picked by the orchard's arborist as the orchard's champion trees. Of these champion trees, certain tree sections on the website contain statistics from the New Jersey Department of Environmental Protection regarding records that the tree at Liberty Hall holds.

Having the information on the website was a good start, visitors to the grounds needed to have a connection to the website for botanical information. The user's experience on the grounds needed to be integrated with the experience of the website.

A user friendly and non-age restrictive way to combine the physical experience on the grounds and the botanical information on the website was needed. The use of QR codes allowed users easy linkage to the website with each QR code. A code was created for each tree for the visitors' convenience. Figures 4 and 5 show how the QR codes are integrated into the display, supporting the digital wayfinding experience and directing users back to the website.

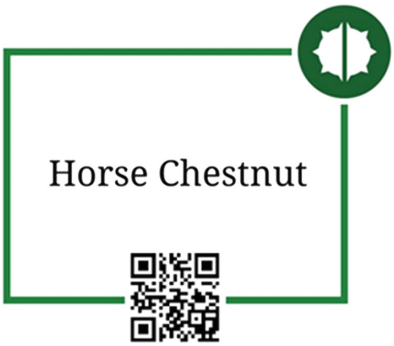

Fig. 4. QR code and sign for the Horse Chestnut tree.

Fig. 5. QR code and sign for the Seckel Pear.

6 Historical

The final experience addressed was the historical experience. The grounds at Liberty Hall are rich with historical context, from the first Governor of New Jersey, William Livingston, owning this land to the structure of the garden itself, modeled after 18th century Europe. Using a layered map ideology, several maps were created from the main map. The first layer (Fig. 6) contained the original front of the house, which is the formal garden. This formal garden is modeled after French gardens in the 1700s. In a letter from Louis-Guillaume Otto, French consul in New York, to Charles-Claude de La Billarderie, who was in charge of France's royal gardens, wrote that, "gardening in America was in its infancy. Most Americans, in his opinion, were either indifferent to the amelioration of the garden arts, or too engaged in producing 'mauvais fruits et des légumes' for mere subsistence" [2]. William Livingston was one of the few in America who wanted to create a beautiful garden, because maintaining a garden meant that he was a gentleman. In our layered map, we wanted to convey how Livingston created his orchard from nothing to an elaborate, thought-out sanctuary. Detail from historical documents which include his orders for fruit trees (Figs. 10 and 11) are provided as well.

Fig. 6. Layered, historical map for Liberty Hall showing Early Liberty Hall, pre-1770.

The second layer (Fig. 7) to the historical map takes place a few years after, when Livingston added to his orchard by working on the back of his house. There, he added the Serpentine Path, which took visitors around a new path and through his new trees. This layout was modeled after the English, which took on a more "free flowing" path. This second map combined the map of the front of the house and the new additions to the back of the house. With this, visitors could see how, when times changed, so did the

Fig. 7. Layered historical map 2, showing Liberty Hall's evolution from 1770–1788.

Fig. 8. Layered historical map 3, showing Liberty Hall's evolution from 1798–present.

garden. When the English garden style became prevalent, Livingston added it onto his property. Visitors are able to take a trip to the past and move forward, seeing the orchard's change.

The final layer (Fig. 8) to the historical maps included the same idea as the second layer. The difference being that, after the Serpentine Path was added, the orchard

Fig. 9. Map presented, with the three experiences – general, botanical, and historical – visitors can select. www.libertyhallgrounds.org

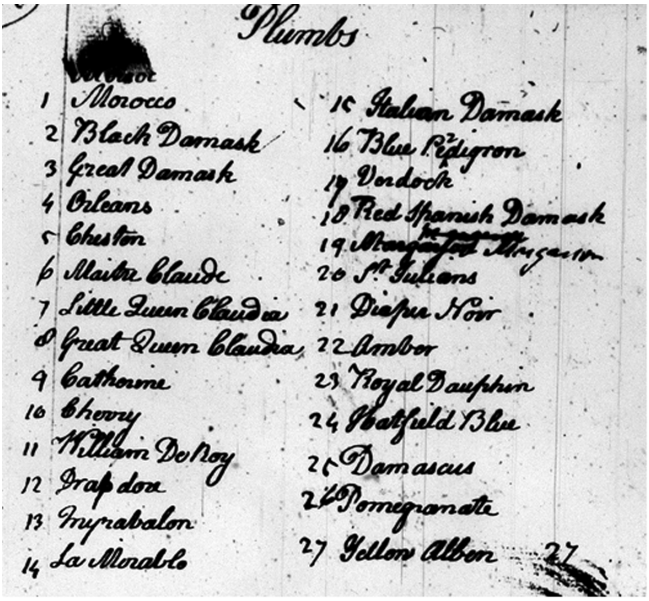

Fig. 10. William Livingston's plum order in 1766.

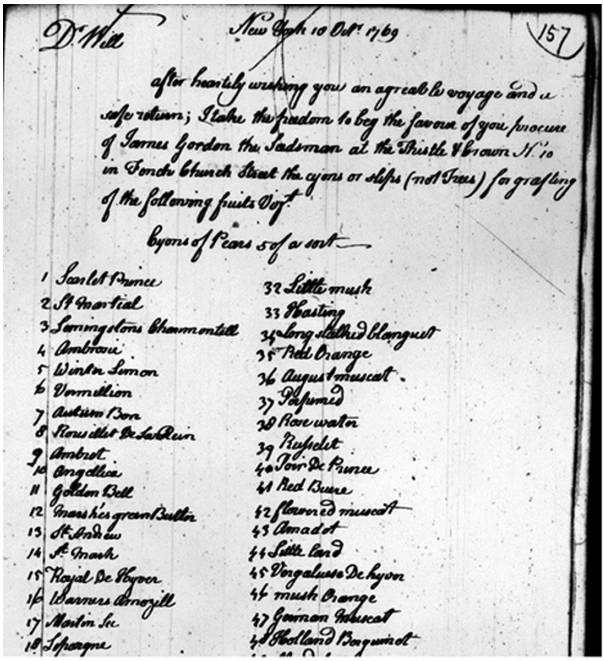

Fig. 11. William Livingston's order of pears in 1766.

expanded its tree collection, added a rose garden, and built a wagon shed around 1900. Visitors would be able to see how in the 1900, the wagon shed was built to store farm machinery because farming was very important during its time. The orchard also sees the addition of a rose garden, because roses started to become more prevalent in society.

Lastly, the final layer added tree icons to show visitors what trees were planted at what time periods. Considering Livingston died in 1790, visitors can then see what types of trees the new owners, such as the Kean family, planted. This content is very important to Liberty Hall because, by showing when trees were planted, it helps convey the importance of the champion trees and the records they break by being on the grounds. The purpose of these layered maps is to help each visitor experience the past as it were. By physically show the expansion in segments, users are able to fully understand the whole picture as it evolves.

The layered, historical maps (Fig. 9) can each be seen on the history's Land page of the website created (www.libertyhallgrounds.org). While walking throughout the orchard, visitors can follow along on the website to see how the maps progress. Meanwhile, information that may be confusing to comprehend by looking at the map is written below the maps. This is for users who are more verbal learners than visual.

7 Results

To test the user experience, a survey was conducted. To evaluate if the new botanical map was visually appealing, a five-point Likert Scale was used, which has the participant choose from five options varying from extremely appealing to extremely unappealing. Of the responses received (n = 41), all responded with either an extremely appealing or appealing answer. This is a significant difference compared to when participants were asked if the old map was visually appealing, in which all participants responded with either unappealing or extremely unappealing.

Users reported increased interest in the differentiated general, botanical, and historical content when it was presented in context. User perception of the features of the botanical, and historical maps was high (70–80%). Overall, interest in visiting the actual museum increased by 15% after users completed the virtual digital wayfinding experience. Integration of the physical wayfinding experience with the digital wayfinding environment has great potential to enhance the physical experience, while opening the environment to a larger community of users and visitors.

From these results of the survey, we can conclude that the general map needs more of a distinction that it is a general, all-purpose map. Even though participants saw that the general map had buildings numbered, as well as tree icons, almost half of the participants did not understand. A future map should prioritize user understanding. There should be additional testing done to identify how users can be encouraged to distinguish between different maps, such as a general map or a botanical map in this case.

Furthermore, the results showed that the new maps created were much more visually appealing than the older map. The new map provides color and appropriate icons that are easily distinguishable with the help of the map's legend. The old map did not contain a legend, so the ability for users to now know what they are looking at on the map is very beneficial.

8 Conclusion and Future Work

In conclusion, three new maps were created to show visitors different paths through the Liberty Hall Museum grounds which visitors can experience. First, there is the general map, which shows all of the points of interest, including buildings and trees. Next, there is the botanical map, which only shows users information about the champion trees on the grounds of Liberty Hall. Finally, there is the layered, historical maps which show how the Liberty Hall grounds have changed over time, from Governor William Livingston in 1770 to present time. These maps are accessible through the website specifically created for the grounds at Liberty Hall. This website can be reached by either typing out the website (www.libertyhallgrounds.org) in the browser manually or by using one of the multiple QR codes that are placed around Liberty Hall's grounds. Future work will continue to bring this historical environment to both visitors to the physical site and visitors to the virtual site on the web, extending the reach of the physical property while increasing access and understanding of the general, botanical, and historical information available through the digital wayfinding experience.

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