

Designing a Virtual Tour and Virtual Exhibit Room for El Caño Archeological Museum and Park



By:

Cory Helmuth
Michael Reilly
Molly Sykes
Andrew Whitney



WPI



Designing a Virtual Tour and Virtual Exhibit Room for El Caño Archeological Museum and Park

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

By
Cory Helmuth
Michael Reilly
Molly Sykes
Andrew Whitney

Date:
August 2020

Report Submitted to:

Alexa Hancock
Fundación El Caño

Ricardo Montanari
Footprint Possibilities Inc.

Professors James Chiarelli and Robert Kinicki
Worcester Polytechnic Institute

Abstract

The El Caño Archeological Site in the Gran Coclé Archeological Culture complex displays discoveries that further pre-Columbian knowledge regarding burial rituals and chiefdoms of the indigenous tribes. The goal of our project is to increase the outreach of the El Caño Archeological Park and Museum by making the artifacts and park available to everyone through a virtual tour hosted on Fundación El Caño's website, with text available for Spanish, English and French speakers, so that a wider audience can grasp the historical significance of the site. Our team will accomplish this through conducting research, identifying applications to be used and their constraints, and collecting images and other multimedia.

Acknowledgments

We would like to acknowledge several sources who have provided support and resources which have contributed greatly to this project. We would like to express our gratitude to Alexa Hancock and Fundación El Caño for their continued assistance and cooperation throughout this portion of the project. Srta. Hancock's full support motivated our team, and the resources she provided influenced the development of the project. We are grateful for the organizational efforts of Srta. Hancock and other members of Fundación El Caño.

Furthermore, we would like to thank Ing. Ricardo Montanari of Footprint Possibilities Inc. for his continued dedication to guiding our project. Ing. Montanari's advice and contributions directed the development of our project. We are appreciative for the support and the opportunity which Ing. Montanari and his organization provide.

We would like to thank Prof. James Chiarelli of Worcester Polytechnic Institute for his aid in regards to our paper and presentation. His experience and instruction helped make our project possible. We would also like to extend our appreciation to Prof. Robert Kinicki of Worcester Polytechnic Institute for his efforts and guidance during the process of developing our paper and presentation. His constant willingness to provide direction for our team assisted the progress of our project.

Finally, we would like to offer our gratitude to Worcester Polytechnic Institute. Our team is fortunate to have the opportunity to collaborate with the aforementioned organizations which the institution made possible.

Authorship

Cory Helmuth, Michael Reilly, Molly Sykes, and Andrew Whitney all contributed to the research and writing of this report. The following is a breakdown of how the report was written for this project.

Cory Helmuth was the primary author of the Culture and Geographical Location section and the El Caño Archaeological Park section. Mr. Helmuth was the primary author for the Design Constraints section and a co-author for the Maintenance and Long-Term Sustainability and the Stakeholders section. Mr. Helmuth was the primary author of Appendix B.

Michael Reilly was the co-author of the Stakeholders section as well as the primary author for the Footprint Possibilities Inc. and Fundación El Caño sections of the Background. Mr. Reilly was also the primary author of the Gather Resources section of the Methodology.

Molly Sykes was the primary author of the Accessibility and Impact, Museum Virtual Tour Applications, and Criteria for Success sections of the Background, as well as the Application Review and Refinement section of the Methodology, and multiple sub sections of Methodology. Ms. Sykes was also the primary co-author on the Introduction as well as the Gather Resources and Conclusion in Methodology. Ms. Sykes is the primary author of Appendix A. Ms. Sykes is the primary editor for the entirety of the paper, compiled all sections into a cohesive document and revised every section.

Andrew Whitney was the primary author of the Virtual Tours section of the Background. Andrew Whitney was also a co-author on the Introduction. Mr. Whitney was a co-author on Virtual Tour Development, and was the co-author of Maintenance and Long Term Sustainability. Mr. Whitney also co-wrote Application Review and Refinement.

Table of Contents

Abstract	i
Acknowledgments	ii
Authorship	iii
Table of Contents	iv
List of Figures	v
List of Tables	vi
Chapter 1: Introduction	1
Chapter 2: Background and Literature Review	4
2.1 Culture and Geographical Location	4
2.2 El Caño Archaeological Park and Museum	5
2.2.1 Significance of El Caño Archaeological Park and Museum.....	7
2.3 Stakeholders	8
2.3.1 Footprint Possibilities Inc.	8
2.3.2 Fundación El Caño.....	9
2.4 Virtual Tours	9
2.4.1 Outreach and Impact	11
2.4.2 Virtual Tour Programs	12
2.5 Evaluation of Museum Virtual Tour Applications	13
2.6 Criteria for Success	17
Chapter 3: Methodology	18
3.1 Gather Resources	18
3.2 Virtual Tour Development.....	19
3.2.1 Application Design Constraints and Colleting Pictures.....	20
3.2.2 Development Collaboration	21
3.2.3 Development Timeline.....	22
3.3 Application Review and Refinement	23
3.4 Maintenance and Long-Term Sustainability.....	24
3.4.1 Documentation	24
3.5 Conclusion	25
References	26
Appendix A: Virtual Tour Application Research	30
Appendix B: Questionnaire Questions for General Users	31

List of Figures

Figure 1a: Gold pectoral with design of bipedal figures (left)	1
Figure 1b: Cast gold earring figurine (right).....	1
Figure 2: El Caño Archeological Park	4
Figure 3: Geological Map of El Caño and its Surroundings.....	5
Figure 4: El Caño Archeological Museum Facade	6
Figure 5: El Caño Archeological Museum Main Exhibit Room	7
Figure 6: Dollhouse view of the Salvador Dalí Theater-Museum Virtual Tour.....	13
Figure 7: 3D Space view of the Smithsonian National Museum of Natural History Virtual Tour	14
Figure 8: 3D Space view of the Salvador Dalí Theater-Museum Virtual Tour.....	14
Figure 9: 3D Space view of the Van Gogh Museum in Amsterdam	15
Figure 10: Launch page of the Smithsonian Nation Museum of Natural History Virtual Tour....	15
Figure 11: Launch page of the Van Gogh Museum in Amsterdam Virtual Tour.....	16

List of Tables

Table 1: Matrix of Virtual Tour Applications.....	12
Table 2: Gantt Chart for expected progress of application of the summer and A Term.....	23
Table A.1: Pros and Cons table of virtual tour application.....	30

Chapter 1: Introduction

Archeology is the study of past human behavior and culture through the recovery and analysis of artifacts. Excavation of artifacts and structures serve as a historical reference for undocumented civilizations, providing understanding of how and why the culture of a region has changed overtime (“Value of Archeology”, 2015). The documentation of the native cultures prior to Columbian Central America in the modern-day Coclé Provence of Panama is nonexistent. The Gran Coclé Culture Area, the civilization discovered through archeological digs in the Coclé Provence, is a collection of smaller archeological digs that archeologists connected through the pottery style. However, the archeological area lacks funding and therefore lacks investigation (“Pre-Columbian Coclé Pottery”, n.d.).



Figure 1a: Gold pectoral with design of bipedal figures (left)
Figure 1b: Cast gold earring figurine (right)
Image Source: Fundación El Caño Artifact Repository, 2020

One of the most monumental archeological digs in the Gran Coclé Culture Area is the excavation of El Caño’s seven tombs that revealed over three dozen skeletal remains of varying statuses, ages, and sexes (Mayo et al, 2016). Some skeletons were accompanied by valuable

objects made of gold such as ear ornaments, pendants, belts, bracelets and breast plates and other objects such as perishable good and ceramics (see Figure 1) (Kaal et al, 2019).

The archeological discoveries at El Caño are especially significant for the Gran Coclé Cultural Area because they provide knowledge regarding burial rituals and suggest that the civilizations were chiefdoms (Williams, 2013). Fundación El Caño, the organization that manages the excavation site of El Caño, established a park and opened a museum on its grounds in April 2019 to display a portion of the artifacts from the excavation of the seven tombs. Fundación El Caño is a non-profit organization committed to the conservation and investigation of the archeological heritage of Panama (“Fundación El Caño”, 2020). To further the outreach of the El Caño museum and park, Fundación El Caño is interested in developing a virtual tour of the museum and park. A virtual tour will allow the global public to experience the museum and park while learning about Panamanian culture. In addition, the creation and documentation of a virtual tour for a small foundation like Fundación El Caño will serve as an example of a multi-media tool that other small museums, parks and historic sites in Panama might mimic to share Panamanian culture with a greater audience.

Fundación El Caño currently has a mobile application that enables users to go on a self-guided tour of the archaeological park (Baez, Kandaras, Louis & White, 2019). It utilizes a map of the site, along with pictures and captions, to provide information on various features of the park for visitors in English and French. The self-guided tour application allows a greater audience to experience the park while in El Caño, Panama. A virtual tour expands accessibility to the global public to experience the museum without traveling to the El Caño Archaeological Park in Panama. The virtual tour would simulate the experience of visiting El Caño and walking through the park and museum. A virtual tour also provides the opportunity for “virtual exhibit

rooms”, imaginary rooms or floors added to the existing museum, to enable the park to display additional exhibits without being confined to the exhibition space available.

The goal of this project is to develop a virtual view of the El Caño Archaeological Park that is more accessible to people around the globe. By creating a framework for this virtual tour, the intent is for this project to set the groundwork for other archaeological parks in Panama. Through researching preexisting museum virtual tour applications, collecting pictures and graphics, designing the virtual tour application, conducting user surveys, refining the virtual tour application and creating a cohesive guide, a virtual tour application will come to fruition for the El Caño Archeological Park and Museum.

The creation of a virtual tour application of El Caño Archaeological Park provides a unique opportunity to display the cultural significance of the El Caño Archaeological Park and Museum, and the importance of the artifacts for Panamanian history with a global audience. The main stakeholders of the project that will benefit from the virtual access to the museum and park are students, academics, the museum staff and the members of the general public who are not able to visit the site. The anticipated features of the virtual tour are a walking tour with 3D imagery of the park and museum, photos and detailed information about the artifacts in the main exhibit room, and a “virtual exhibit room” to display additional artifacts.

Chapter 2: Background and Literature Review



Figure 2: El Caño Archeological Park
Image Source: Hancock, 2020

The creation of a virtual tour application for the El Caño Archeological Park (see Figure 2) and Museum connects the globe with Panamanian culture discovered through the excavations at El Caño. The background chapter presents research conducted on the history of the park and museum at El Caño and pre-existing museum virtual tour applications. In addition, the background explores the impact of a virtual tour application. Research conducted on published literature provides a wealth of information regarding the topics states above.

2.1 Culture and Geographical Location

The city of El Caño, located in the Coclé Province in Panama, consists of approximately 265,000 people (“Instituto Nacional de Estadística y Censo”, 2019). The province is primarily an agricultural area, supported by its tropical rainforest biome. The Tabasará mountain range begins near the Coclé province, runs through the middle of the province, and splits the province into two distinct areas. The majority of the population and development in this province is in the lower

half. The mountain range continues to grow in size as it runs west through the rest of Panama, with El Caño situated at the base of the mountain range (see Figure 3).

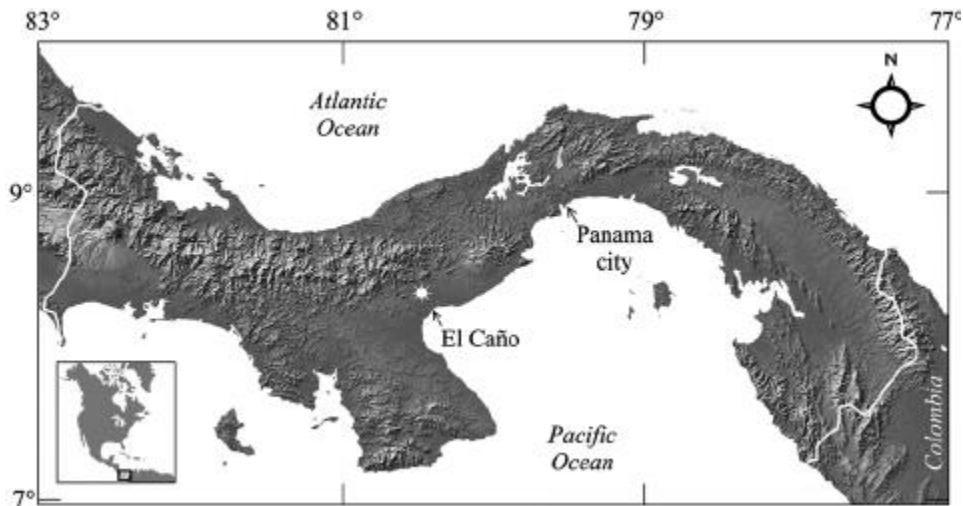


Figure 3: Geological Map of El Caño and its Surroundings

Image Source: Tabbagh, 2014

Due to the violent nature in which the control of Panama shifted from indigenous tribes to the Spanish invaders, archaeologists have sparse knowledge of Panama’s pre-Columbian history. Archaeologists identified the tribes in the area around El Caño as the Cueva and Coclé tribes (“History of Panama (to 1821)”, 2020). The Spanish brought disease, infection and fighting to the Cueva and Coclé tribes decimating the population and causing the migration of indigenous Panamanians. The only documentation remaining from this period are testimonials from European explorers who described basic observations of the indigenous tribes.

Archaeological finds supply much of the evidence to determine the majority of pre-Columbian history, such as the archeological site of El Caño providing a history for the Coclé tribes and pre-Columbiana Panama as a whole.

2.2 El Caño Archaeological Park and Museum

Hyatt Verrill discovered the El Caño Archaeological site in 1925 and excavated three skeletons. Archaeologists in the United States largely ignored Verrill’s findings forgotten by the

archaeological community (Araúz, 1982). In the 1970s the archeological site regained global interest and excavation restarted, but the combination of political unrest as well as insignificant findings caused scientists to abandon the site. Archaeologist Julia Mayo, equipped with more advanced surveying equipment, determined El Caño site warranted another excavation in the early 2000s (Owen, 2011). The site began its most significant excavation in 2008 and continued with major excavation past 2011, resulting in the discovery of seven tombs.



Figure 4: El Caño Archeological Museum Façade
Image Source: Hancock, 2020

Fundación El Caño converted the excavation sites at El Caño into the El Caño Archeological Park in 1979 following its rediscovery shown in Figure 2. The organization constructed a building on the premises of the newly formed park mirroring the architecture style of local homes during the founding of the park as seen above in Figure 4. Fundación El Caño converted the building into the El Caño Archeological Museum in 2019 to display the golden artifacts discovered in the tombs of El Caño (“Fundación El Caño”, 2020). The size of the original building restricts the museum space, limiting the exhibit area to one room. The El Caño Archeological Museum and Park provides an abundance of information regarding El Caño’s historical and cultural background through the display of artifacts and excavations sites.

2.2.1 Significance of El Caño Archaeological Park and Museum

Excavations of the El Caño site revealed seven tombs with over three dozen skeletal remains (Mayo et al, 2016). Archeological crews discovered male skeletal remains with gold artifacts that symbolize high status in two of the excavated graves. The golden artifacts are objects such as pectorals, ear ornaments, pendants, belts and bracelets (Kall et al, 2019). All tombs at El Caño contain multiple simultaneous burials, but vary in the number of skeletal remains in the tombs. The practice of multiple burials suggests a hierarchical burial system in which graves of high-status individuals contained the bodies of lower ranking citizens (“Fundación El Caño”, 2020). Excavations at the El Caño Archeological Park are very important to Panamanian culture as the discoveries further pre-Columbian knowledge regarding burial rituals and chiefdoms.

The discoveries at the El Caño Archaeological Park not only serve as significant historical developments for pre-Columbian Panamanian culture but are also captivating. The golden artifacts from the pre-Columbian indigenous tribes are awe inspiring due to the intricacy of the patterns and details inscribed in them (see Figure 1). The opulence of the gold artifacts of El Caño draws attention to the discoveries made at the site. Exhibition of these golden artifacts promotes the continued study and excavation of an archeological site critical to the understanding of pre-Columbian Panamanian history (see Figure 5).



Figure 5: El Caño Archeological Museum Main Exhibit Room
Image Source: Hancock, 2020

2.3 Stakeholders

The creation of a virtual tour application for the El Caño Archaeological Park provides the ability to display and share the cultural significance of the artifacts and landscape found at the park. While the team is working for the El Caño Archeological Park, the people that would benefit from the application are more than just the visitors and the park staff. Academics and people who are not able to visit the site also benefit from this application. That being said, the major stakeholders for the creation of a virtual tour application are Footprint Possibilities and Fundación El Caño. Footprint Possibilities is a United States-based group that acts as an intermediate between student organizations from the United States and foreign organizations who are seeking to collaborate (“Footprint Possibilities Inc.”, 2020). Fundación El Caño is the primary organization responsible for the excavations, research, and display of the artifacts located at the El Caño Archaeological site (“Fundación El Caño”, 2020). With this application, Fundación El Caño will be able to share the site and the artifacts with students and the general public.

2.3.1 Footprint Possibilities Inc.

Footprint Possibilities Inc. is a private charity based in Florida that seeks to organize and fund projects benefitting international communities. Footprint Possibilities Inc. states in their mission that they wish to serve as a point of contact for local agents of US-based student organizations wishing to work in Panama (“Footprint Possibilities Inc.”, 2020). They focus on programs which enhance the connection between a community and an aspect of that group, such as the environment around them or their culture. Footprint Possibilities Inc. served as a liaison for projects with Worcester Polytechnic Institute IQP projects in the past such as a project in San Lorenzo del Chagres which focused on the distribution of clean drinking water to the area as well

as Fundación El Caño to create a mobile application that featured a guided tour of the archaeological site (Baez, Kandaras, Louis & White, 2019).

2.3.2 Fundación El Caño

Fundación El Caño funds and leads the majority of the archaeological work at the El Caño archeological site. Their mission includes working to increase the connection between Panama and its cultural heritage (“Fundación El Caño”, 2020). Fundación El Caño runs and maintains both the El Caño Archeological Park and the El Caño Archeological Museum. The park encompasses all of the seven excavated tombs as well as the uncovered monoliths at the El Caño site. The museum displays a small portion of the hundreds of artifacts excavated from the tombs. Built in 1972, the museum reflects the building architecture of the time period and limits the available exhibition space to one small room. The artifacts provide information about the burial practices and hierarchical system of the indigenous tribe of El Caño. Fundación El Caño desires to increase the global impact of the discoveries at the El Caño Archeological Park and Museum through a virtual tour application through a partnership with Footprint Possibilities Inc. and Worcester Polytechnic Institute IQP students.

2.4 Virtual Tours

In 2019, an estimated 4 billion people were using the internet (“International Telecommunication Union”, 2019). As over 50% of the world population uses the internet, digital media has increased potential for the spread of knowledge. The World Wide Web provides access to many sources which are easily accessible to the general public, and these sources utilize a variety of means to convey their information.

A virtual tour simulates the experience of being in a location through the use of modern technology. Virtual tours have been growing in importance due to the impact it has on Search

Engine Optimization (SEO), the process of making your site better for search engines. This is due to the fact that search engines search for content that is aimed for users, and is refreshing (Google Search Quality Team, 2020). Google states that knowing how to utilize SEO is important, “if you own, manage, monetize, or promote online content via Google Search” (Google Search Quality Team, 2020). Creating the Virtual Tour with SEO in mind is important on drawing more users to the site, and increasing the potential audience. The interaction with the proposed Virtual Tour will lead to users staying on the website longer than usual while making the website more effective at drawing an audience to the organization or location (Sherman, 2019).

Virtual tours are gaining popularity in 2020, especially since the outbreak of COVID-19. Searches such as “Virtual tour”, “San Diego zoo virtual tour”, or “Google arts and culture virtual tour” skyrocketed in popularity in March 2020. Google labels virtual tours as a Breakout Trend. “Virtual Tour” has gone from a peak interest of 17% in the past 12 months to 100% interest in March and maintaining an interest over 50% (Google Trends, 2020). This newfound interest, while seemingly the result of COVID-19, is drawing awareness to a larger audience on the large availability of virtual tours, which will have a lasting effect even after the side effects of COVID-19 have passed.

Implementing a virtual tour is a process of blending images, videos, and other multimedia to attempt to replicate the experience of being in a certain location. Good virtual tour designs achieve this through overlaying images with captions and interactive features, as well as providing videos of interesting experiences. The website hosts the tour so users can access it and go on the tour from anywhere they have an internet connection.

Visual information retains younger audiences due to the constant feedback. Young audiences have short attention spans and respond better to this mode of information. Using visuals provides information quickly, so users stay longer as opposed to moving on (Audet & Wilson, 2009).

2.4.1 Outreach and Impact

Small museums, such as El Caño Archaeological Park and Museum, lack the same outreach as large, world renowned institutions. The addition of a virtual tour website component for museums can increase website traffic and retain website visitors. Visitors to a website that features a virtual tour stay generally three times longer on the website (Priolo et al, 2017). In addition to increasing website views, a virtual tour can provide access to the benefits and education of a museum to a greater population. Virtual exhibitions enable additional audiences, including people with disabilities and students of all ages, to experience and interact with the vast collection of objects in a museum (Cellary, Walczak & White, 2006).

In addition to outreach, virtual tours benefit museums by providing additional virtual exhibition space. Museums, including the El Caño Archeological Museum, must limit the number of physical exhibits due to the size of the museum buildings causing artifacts to remain in storage. Virtual tours provide the best solution of museums and cultural heritage sites to display the otherwise stored artifacts (Cellary, Walczak & White, 2006). As a result of the additional display of artifacts through virtual tours, museums produce a more informative, immersive and engaging experience (Priolo et al 2017). A virtual tour fabricates a space to give users a more detailed and closer experience with each artifact and creates a place for museums to display more artifacts without having to expand or rotate their exhibits.

2.4.2 Virtual Tour Programs

The project team considered the sponsor’s desires, the cost and ease of development, the suggestions from Alexa Hancock of pre-existing museum virtual tour applications, and the program knowledge from coding experience when assessing the virtual tour research.

The team researched potential programs to create the virtual tour. The four main methods are Google Virtual Tour, Matterport, Unity, and “Do It Yourself” using JavaScript. The team fabricated a table to show the show the pros and cons between the various methods, along with a matrix chart to provide a two-dimensional examination of the tools.

Table A.1 (located in Appendix A) provides the tabulated research regarding potential virtual tour applications. The table lists the pros and cons for each application with regards to the following categories: cost, ease of development, and sponsor desires (3D environment, addition of virtual exhibit rooms).

The matrix chart compares the different applications in the same categories as Table A.1 in a concise format. Table 1 provides a matrix of four critical categories for design of the virtual tour application. An “x” denotes the existence of the listed feature. The application chosen to use for development of the virtual tour is Unity due to the platform's adaptability, the relative ease of development compared to the other options, and the low cost. As evidenced by the matrix, Unity is apparent as the clear forerunner amongst its competitors.

Table 1: Matrix of Virtual Tour Applications

Application	Free to Use	3D Environment	User Support	“Virtual Exhibit Room”
Matterport		x	x	
Google Tours	x	x	x	
Unity	x	x	x	x
JavaScript	x			x

2.5 Evaluation of Museum Virtual Tour Applications

The success of a virtual tour application is based on the target audience and the desired experience. A virtual tour is an ideal solution for those not able to visit a museum or those who only want to examine specific elements or exhibits of a museum. These users desire a seamless navigational experience. Our evaluation of three different museum virtual tours based on virtual reality experience, perception of presence, navigation, and learning aspects (Kabassi, Amelio, Komianos & Oikonomou, 2019) provide a basis for development of a virtual tour application for the El Caño Archeological Park and Museum. The three museum virtual tours are, the Salvador Dalí Theater-Museum (“Salvador Dalí Theater-Museum Virtual Tour”, 2019), the Van Gogh Museum in Amsterdam (“Van Gogh Museum”, 2020), and the Smithsonian National Museum of Natural History (“Smithsonian National Museum of Natural History Virtual Tour”, 2020).

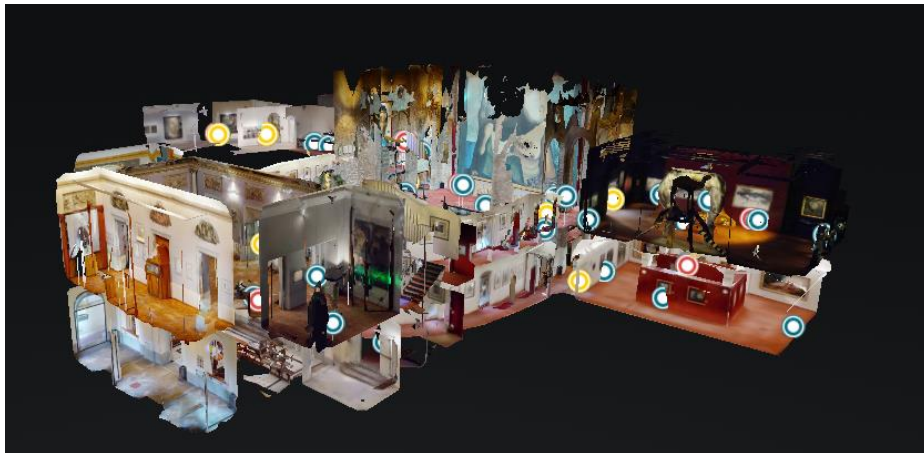


Figure 6: Dollhouse view of the Salvador Dalí Theater-Museum Virtual Tour

Image Source: “Salvador Dalí Theater-Museum Virtual Tour”, 2020

Virtual reality experience, perception of presence, and navigability of the museum virtual tour cater a positive user experience. The evaluation of three virtual tours defined the key characteristics for these topics. All three museum virtual tours use a panning feature too “look” around the 360-degree environment. This tool simulates the experience of standing in a museum.

The Salvador Dalí Theater-Museum and the Smithsonian National Museum of Natural History offer overviews of the museums’ virtual tours to assist with navigation. The Salvador Dalí Theater-Museum utilizes a dollhouse view of the museum (see Figure 6) while the Smithsonian

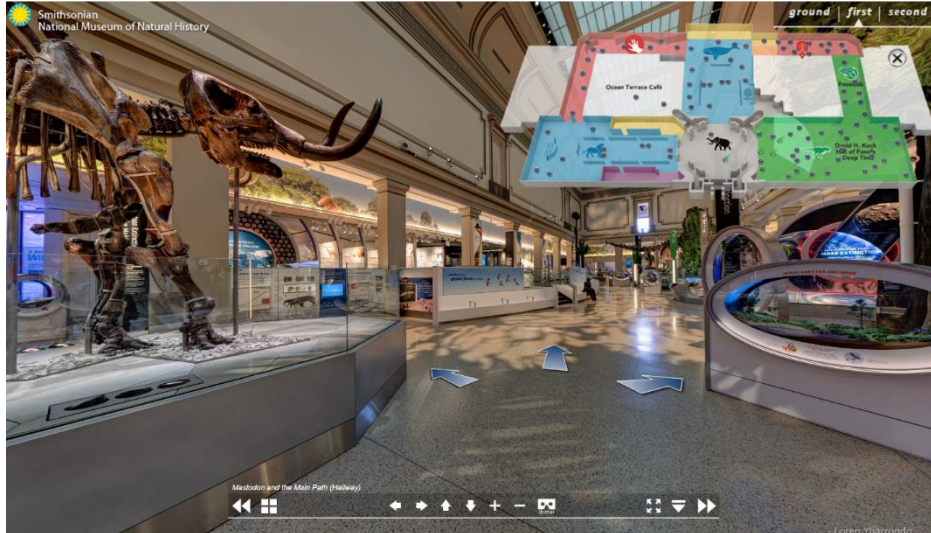


Figure 7: 3D Space view of the Smithsonian National Museum of Natural History Virtual Tour
 Image Source: “Smithsonian National Museum of Natural History Virtual Tour”, 2020

National Museum of Natural History utilizes a map displayed in the upper right part of the screen (see Figure 7). The final navigational feature of all three virtual museums tours is the navigational tool used to “walk” through the museum. The Smithsonian National Museum of Natural History (see Figure 7) uses arrows placed on the floor to “jump” ahead to different



Figure 8: 3D Space view of the Salvador Dalí Theater-Museum Virtual Tour
 Image Source: “Salvador Dalí Theater-Museum Virtual Tour”, 2020

exhibits and sections of the museum. The Salvador Dalí Theater-Museum (see Figure 8) and the Van Gogh Museum (see Figure 9) use a ‘click and travel’ method to navigate the museum, similar to that of Google Maps. The ‘click and travel’ method produces the effect of “walking” from place to place rather than the “jump” that is achieved with the arrows.

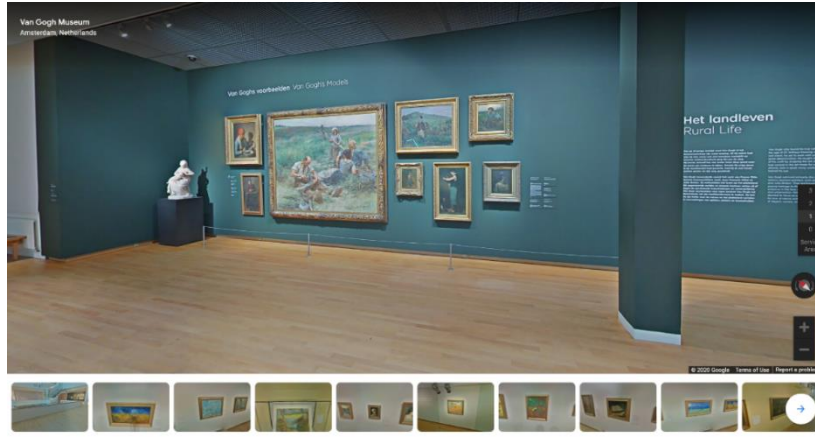


Figure 9: 3D Space view of the Van Gogh Museum
Image Source: “Van Gogh Museum”, 2020

The learning aspects of a museum virtual tour are necessary to achieve an immersive experience. Learning aspects references the virtual tour features regarding ease of access to information as well as the individual exhibit interest points. The Van Gogh Museum does not have textual information on the exhibits within the virtual tour, but uses an external mosaic of pictures to present information (see Figure 10). Similarly, the Smithsonian National Museum of



Figure 10: Launch page of the Smithsonian National Museum of Natural History Virtual Tour
Image Source: “Smithsonian National Museum of Natural History Virtual Tour”, 2020

Natural History does not have textual information about the exhibits included within the virtual tour, but uses the camera zoom option to explore exhibit descriptions. The Salvador Dalí Theater-Museum delivers an immersive learning experience through the use interactive dialog boxes (see Figure 8.) Each dialog box adds specific information regarding the artifact within the exhibit.

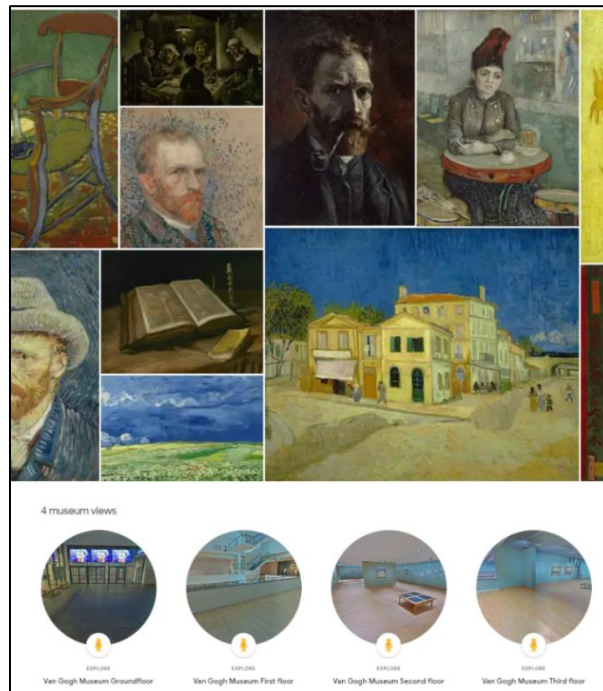


Figure 11: Launch page of the Van Gogh Museum in Amsterdam Virtual Tour
Image Source: “Van Gogh Museum”, 2020

Additional noteworthy features of the three reviewed museum virtual tours are a navigation bar at the bottom of the screen to “jump” to different exhibit rooms, displayed at the bottom of Figure 9. The Van Gogh Museum and the Smithsonian National Museum of Natural History utilize this feature. Supporting this feature in both museum virtual tours for increased navigation is a launch page (see Figures 10 and 11). The Van Gogh Museum allows users to jump to different floors of the museum from the launch page while the Smithsonian National Museum of Natural History allows the user to have the option to jump to different exhibits.

2.6 Criteria for Success

Our team's review of three museum virtual tours assisted in creating criteria for the El Caño Archeological Museum and Park virtual tour application. The team informed the sponsors, Fundación El Caño and Footprint Possibilities Inc. of the attainability of different aspects of these museum virtual tours through discussion of the potential applications. The reviews of the museum virtual tour application in combination with research regarding the impact of virtual tour applications and cultural significance of the El Caño Archeological Museum and Park contribute to the preliminary background necessary to develop a successful and maintainable virtual tour application for the El Caño Archeological Park and Museum.

Chapter 3: Methodology

The goal of the project is to develop a virtual view of the El Caño Archaeological Park that is more accessible to people around the globe. The virtual tour, hosted on Fundación El Caño's website, will display artifacts from the museum and the archeological sites in the park, with informational text available in Spanish, English and French. To accomplish this goal, the team developed the following methods:

1. Gather Resources
2. Develop Virtual Tour
3. Review and Refine the Application
4. Determine Maintenance and Long-Term Sustainability

The methodology chapter discusses the proposed methods to develop the virtual tour through these methods listed above.

3.1 Gather Resources

To learn about the best practices and things to avoid when developing a virtual tour in Spanish, English and French for Fundación El Caño and Footprint Possibilities Inc., the team assessed the current requirements for the deliverable and conducted research accordingly. The main deliverable will be a virtual tour of the El Caño Archeological Park and Museum hosted on Fundación El Caño's website. There are two distinct steps of the research process, collect sponsor resources and virtual tour application research.

Alexa Hancock of Fundación El Caño and Ricardo Montanari of Footprint Possibilities Inc. conveyed to the team information about the El Caño Archaeological Park and Museum and the expected final deliverables. The sponsors and the project team discussed these topics through

Zoom meetings and through documents created by Alexa Hancock and shared in Dropbox. These initial documents give further clarification on features of the virtual tour application discussed during the team's informal meetings.

In addition, Alexa Hancock provided the English translation of the information to be featured in the virtual tour through the Dropbox as well as multiple pictures from different locations at the park. This information is converted to the text that is displayed in the museum to be shown on the tour. The documents shared include the text that is featured in the museum on the walls and by artifacts. By sharing museum pictures, Alexa gave the team the ability to visualize the site before physically visiting it.

During trips to the El Caño Archaeological Park during the time the team spends in Panama, the team will collect 360° images of the locations of the park which will be featured in the virtual tour. These images will include the parts of the museum as well as different locations in the park, such as the excavation sites and other areas of interest featured in the park. The team will collect the images using a specialized 360° camera with the ability to take simultaneous pictures of different view angles from the same location. The team will then upload the images to be utilized on the virtual tour. If the team is unable to procure a 360° camera, the team will employ the panoramic picture feature of the camera of modern smartphones as a substitute.

3.2 Virtual Tour Development

The design and development of the virtual tour involves research on preexisting virtual tour applications, see section 2.4.3 Virtual Tour Programs and 2.5 Evaluation of Museum Virtual Tour Applications. The team selected Unity based on the research tabulated in Figure 1. The

following subsections further elaborate on the process of identifying constraints, selecting a development environment, and developing a timeline for development.

3.2.1 Application Design Constraints and Collecting Pictures

In the beginning stages of the design process, mockups are important for setting expectations on design and the complexity of the application. Creating mockups before any actual development of the application begins is important for keeping track of progress. As project goals adjust, the team will design new mockups to reflect the goals.

The team identified the constraints before the development of the virtual tour, to set up and design before the actual virtual tour development and executions. Constraints improve development and sustainability. This project has a strict budget constraint. This limits our options as most professional grade equipment is expensive. The second constraint the team must contend with is experience. With only two team members majoring in Computer Science, making an application from scratch would be a taxing task. To make an application from scratch would limit the complexity of the application. Options that do not require a lot of programming are best. The final main constraint is time. Time will limit the team's options as building larger applications require a lot of time, so looking for templates and other online tools will help save time.

The first developmental step is designing a clear, concise, informative menu. A menu is crucial for separating options for the visitors and the system administration and allows the user to quickly navigate the virtual tour. In addition, a menu provides full access and quick navigation options for the virtual tour application and is essential in the debugging process.

The second developmental step is determining and designing an edit feature for the actual virtual tour application. Without an edit feature, making changes to the exhibits and layouts for the application becomes unsustainable as someone with programming experience may not be able to help make modifications. The addition of an edit feature strives to support the interest of museum virtual tour stakeholders, allowing the information of the tour to stay up to date and informative.

The team needs to collect images and other multimedia for the virtual tour to reference and use to make the experience more immersive. The project needs basic panoramic images for the application to “construct” the rooms. The application requires more in-depth images of the artifacts to allow for a more immersive experience of each exhibit. Other multimedia, such as white noise, will add to the impressiveness of the tour, but is not required. The team will collect images using either phones or more advanced 360-degree capable cameras upon arriving on site.

3.2.2 Development Collaboration

The most important part of working in a team is effectively collaborating on a project. To maintain constant, clear, streamlined communication with the entire team and sponsors, the project is using a Dropbox for remote sharing and collaboration on documents. The Dropbox includes a Task Tracker sheet where the status of various tasks is updated. Members can assign tasks that will be assigned different completion dates, assignees to complete the task and informative notes. The Computer Science majors, Cory Helmuth and Andrew Whitney, will lead the technical development of the application, while Michael Reilly and Molly Sykes will lead the design process and information gathering. Breaking the team into two distinct groups more effectively utilizes the skills of each team member while maintaining team wide involvement in the deliverable development. All team members will contribute in all portions of the project,

focusing individual efforts to areas that complement the individual's strengths. The team created a repository in Microsoft Teams that facilitates working on PowerPoints and Word documents simultaneously across multiple devices, improving workflow, and increasing productivity. Additionally, using a Google Drive folder facility to keep track of data collected, forms, meeting minutes and agendas, questionnaires and other information, separates these development components from the Microsoft Teams repository which contains the deliverables.

Throughout the summer and the project, the team will meet biweekly with sponsors Ricardo Montanari and Alexa Hancock for progress updates. During these meetings the team will update the sponsor on the application, receive feedback and adjust as needed to deliverables. The Task Tracker is essential to keep all groups updated in between meetings. The sponsors and the team update the Task Tracker by assigning tasks during meetings. In addition to biweekly meetings, additional meetings may be scheduled to ensure good communication.

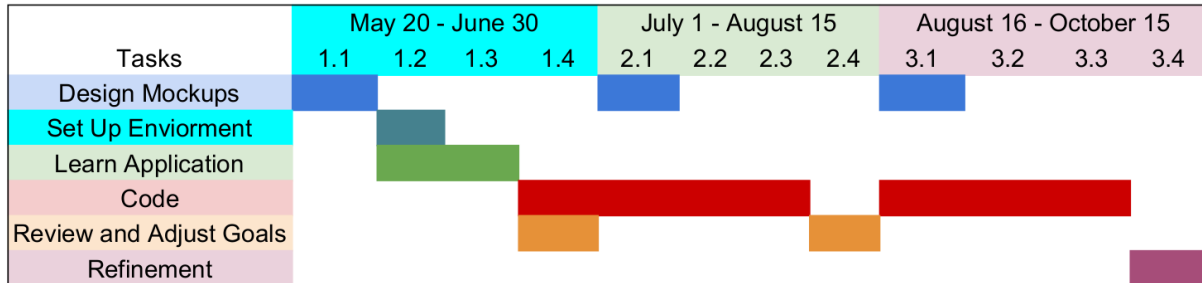
The team selected GitHub as the organizational tool for the coding portion of our deliverable. GitHub is a website that utilizes the technology Git to manage code for large products and allows the team members to work on the same project at the same time. When a team member is done editing, they will commit their work to the online repository. This allows each member of the team to easily navigate different versions of the repository, without losing information. GitHub is essential in industry for effectively creating software.

3.2.3 Development Timeline

The team will strive to complete the application development stages in a timely manner to keep the project on track. Creating a structured timeline allows the team to stay on track with biweekly reflection to readjust goals. A structured timeline allows the team to produce a

complete product that will satisfy the sponsor’s requirements. Separating the code development of a project into different sections, usually know as iterations, creates smaller obtainable goals so the product development remains streamlined and progress easy to track. Table 2 tracks the expected project progress over the summer and A term, August 27th to October 15th.

Table 2: Gantt Chart for expected progress of application of the summer and A Term



3.3 Application Review and Refinement

A successful virtual tour application has multiple iterations during development that improve upon themselves to strive for a seamless user experience. Feedback from virtual visitors is important in the development and sustainability of the tour application (Priolo et al, 2017). A questionnaire to determine ease of use, product content, and areas for improvement will be given to the stakeholders following the last iteration of the product before it is finished. The project team will utilize the questionnaire to provide feedback for improvements and adjustments prior to the first product release (see Appendix B). Furthermore, the questionnaire responses will serve as a cultural checkpoint to keep the application sensitive to Panamanian history and culture. Following our last iteration, the questionnaire will allow the team to track improvements in the application from the first release to the last release. The team will review the results and make modifications to the program based on the information the survey yields.

3.4 Maintenance and Long-Term Sustainability

The main factor in the maintenance of the application is keeping the website up and running. The application requires space on a server provided by the sponsor. A key factor in creating a sustainable project is thorough documentation. Proper documentation allows others to view the code, make edits and adapt the tour as the exhibits change. Commenting code, along with providing documentation in a manual is essential to keeping the product sustainable and facilitates the task of changing the product.

The team will strive to maintain a proper file directory that makes code easy to navigate and allows users to update images, captions, and other important information. Good organization of the code, along with quality documentation leads to quicker and more effective maintenance, with fewer mistakes.

3.4.1 Documentation

The team will develop a manual to deal with any potential issues, upkeep, and in order to facilitate the addition of pictures and artifacts to the virtual tour application in an easy and quick manner. The manual also details the proper steps to load and disable the application should issues arise, along with how to modify the application to fit new needs as presented.

The team will produce an additional guide explaining the steps taken to develop and maintain the virtual tour application for the other museums in Panama. The goal of this additional guide is to allow other small museums in Panama to create Virtual Tours similar to the deliverable for Fundación El Caño and the El Caño Archeological Park and Museum. Museums will use the developmental guide to promote the history of Panamanian society and contribute to Panama by increasing the online availability of their history.

3.5 Conclusion

Through following the steps defined in this section, the team will successfully create a web-based virtual tour application. Successful research is important in creating mockups and collecting images. Mockups are essential to keeping the team on track throughout the project and reduce time spent creating the actual application. Conducting user surveys allows for project refinement and provides a better user experience. Proper and thorough documentations allow for Fundación El Caño to maintain the virtual tour application and allows for other museums in Panama to replicate the project and promote Panamanian history worldwide.

References

- Araúz, R. T. (1982). The Site Museum of the El Caño Archaeological Park. *Museum International*, 34(2), 117-119, DOI [10.1111/j.1468-0033.1982.tb00A375.x](https://doi.org/10.1111/j.1468-0033.1982.tb00A375.x)
- Audet, M. and Wilson, M. (2009 April). Virtual Tours: Reaching Consumers with Effective Internet Advertising. *Wav Group*. Retrieved May 6, 2020 from <http://wavgroup.com/wp-content/uploads/2011/05/virtualtour.pdf>
- Baez, K., Kandaras, M., Louis, M., White, J. (2019). Development of a Self-Guided Tour for El Caño Archaeological Park. *Worcester Polytechnic Institute*. Retrieved from https://web.wpi.edu/Pubs/E-project/Available/E-project-101019-135449/unrestricted/El_Cano_Guided_Tour_Paper_A19.pdf
- Bedard, C., DuBois, J., Lehtinen, S., Loveland, B.. (2006) Creating a Virtual Tour Design Guide for Museums with the Centre for Accessible Environments. *Worcester Polytechnic Institute*. Retrieved from <https://digitalcommons.wpi.edu/cgi/viewcontent.cgi?article=3845&context=iqp-all>
- Briggs, S. (2015). *Surveys 101: A Simple Guide to Asking Effective Questions*. Zapier. Retrieved May 6, 2020 from <https://zapier.com/learn/forms-surveys/writing-effective-survey/>
- Case Study: The 3 Reasons Why Virtual Tours Are Important for Local Businesses*. (2008). Montreal 360. Retrieved May 2, 2020 from <https://www.montreal360virtualtour.com/3-reasons-virtual-tours-are-important/>
- Cellary, W., Walczak, K., White, M.. (2006). Virtual Museum Exhibitions. *Computer*, 39(3), 93-95.
- El Caño, Panama (archaeological site). (2020, May 2). In *Wikipedia* [https://en.wikipedia.org/wiki/El_Ca%C3%B1o,_Panama_\(archaeological_site\)](https://en.wikipedia.org/wiki/El_Ca%C3%B1o,_Panama_(archaeological_site))
- Footprint Possibilities Inc.*.(2020). Retrieved May 2, 2020 from <https://footprintpossibilities.org/>
- Footprint Possibilities Inc. Facebook*. (2020). Retrieved May 2, 2020 from <https://www.facebook.com/FootprintPossibilitiesInc/>

Fundación El Caño. (2020). Retrieved May 2, 2020 from <https://www.fundacionelcano.org/>

Fundación El Caño Facebook. (2020). Retrieved May 2, 2020 from <https://www.facebook.com/fundacionelcano/>

Fundación El Caño Artifact Repository [Online image]. (2020). Fundación El Caño Repository. Retrieved May 13, 202 from http://www.oda-fec.org/nata/view/paginas/view_paginas.php?id=1

Google Search Quality Team. (2020). Search Engine Optimization (SEO) Starter Guide. Retrieved May 4, 2020 from <https://support.google.com/webmasters/answer/7451184?hl=en>

Google Trends. (2020 April 15). Virtual Tour Trend. Retrieved May 4, 2020 from <https://trends.google.com/trends/explore?q=virtual%20tour>

Google Tour Creator. (2020). Google Tour Creator. Retrieved May 4, 2020 from <https://arvr.google.com/tourcreator/>

Google Virtual. (2020). Dulwich Picture Gallery. Retrieved May 5, 2020 from <https://artsandculture.google.com/partner/dulwich-picture-gallery>

Hancock, Alexa. *Drone Picture of El Caño.* Fundación El Caño, 3 May 2020.

Hancock, Alexa. *Picture of El Caño Museum.* Fundación El Caño, 3 May 2020.

History of Panama (to 1821). (2020, May 2). In *Wikipedia*. [https://en.wikipedia.org/wiki/History_of_Panama_\(to_1821\)](https://en.wikipedia.org/wiki/History_of_Panama_(to_1821))

Instituto Nacional de Estadística y Censo. (2019). Retrieved from <https://www.inec.gob.pa/>

Instituto de Recursos Minerales (2014). *Geological map of El Caño and its surroundings.* Retrieved from https://www.researchgate.net/figure/Geological-map-of-El-Cano-and-its-surroundings-source-Mapa-Geologico-de-la-Republica-de_fig2_266634737

International Telecommunication Union. (2019). PDF. Geneva.

JavaScript. (2020). Retrieved May 4, 2020 from <https://www.javascript.com/>

Kaal, J., Seijo, M., Oliveria, C., Wagner-Wysiecka, E., McCoy, V., Kraemer, M., Kerner, A., Wenig, P., Mayo, C., Mayo, J. (2019). Golden artefacts, resin figurines, body adhesives and tomb sediments from the pre-Columbian burial site El Caño (Gran Coclé, Panama): Tracing organic contents using molecular archaeometry. *Journal of Archaeological Science*, 113.

Kabassi, K., Amelio, A., Komianos, V., Oikonomou, K.. (2019). Evaluating Museum Virtua Tours: The Case Study of Italy. *Information*, 10(11), 351-362

Matterport. (2020). Retrieved May 4, 2020 from <https://www.matterport.com/>

Mayo, J., Mayo, C., Guinea, M., Herrera, M., López, J. (2016). La Tumba T7 de la Necrópolis de “El Caño”, Tradición Arqueológica Gran Coclé, Istmo de Panamá. *Arqueología Iberoamericana*, 30-43.

National Museum of Natural History - Virtual Tours. (2020). Retrieved May 10, 2020 from <https://naturalhistory2.si.edu/vt3/NMNH/>

Owen, J.. (2011). “Golden Chief” Tomb Treasure Yields Clues to Unnamed Civilization. *National Geographic*. Retrieved from <https://www.nationalgeographic.com/news/2011/12/111221-gold-panama-cano-chiefs-tombs-science/>

Pre-Columbian Coclé Pottery. (n.d.). Retrieved May 1, 2020 from <http://www.bepreprimitive.com/stories-descriptions/pre-columbian-cocle-pottery>

Priolo, F., Mediavillo, R., Austria, A., Delos Angeles, A., Fernando, M., Cheng, R.. (2017). Virtual Heritage Tour: A 3D Interactive Virtual Tour Musealization Application. *ICCIP*, 109-195.

Salvador Dalí Theater-Museum Virtual Tour. (2019) Retrieved May 10, 2020 from <https://www.salvador-dali.org/es/museos/teatro-museo-dali-de-figueres/visita-virtual/>

Sherman. (2019 August 27). The Benefits an Interactive Website Design Offers Your Business. Retrieved from <https://www.lyfemarketing.com/blog/interactive-website-design/>

Smithsonian National Museum of Natural History Virtual Tour. (2020). Retrieved May 10, 2020 from <https://naturalhistory.si.edu/visit/virtual-tour>

Survey Monkey (2020). *Writing good survey questions*. Retrieved May 3, 2020 from <https://www.surveymonkey.com/mp/writing-survey-questions/>

Tabbagh, A. (2014). Geological map of El Caño and its Surroundings [Online image from article]. Investigating Pre-Columbian Ceremonial Feature at El Caño Archaeological Site, Panama, through Geophysical Surveys. DOI [10.3997/2214-4609.20141971](https://doi.org/10.3997/2214-4609.20141971)

Unity. (2020). Retrieved from <https://unity.com/>

Value of Archaeology (2015, September 10). Retrieved April 29, 2020 from <http://www.phmc.state.pa.us/portal/communities/archaeology/resources/value-archaeology.html>

Van Gogh Museum. (2020). Google Arts and Culture. Retrieved May 10, 2020 from <https://artsandculture.google.com/partner/van-gogh-museum?hl=en>

Williams, A.R.. (2013, June 20). *Pre-Hispanic Chiefs in Panama Were Born to Rule*. Retrieved May 1, 2020 from <https://www.nationalgeographic.com/news/2013/6/130619-panama-chiefs-el-cano-gold-burial-discovery-inherited-power-archaeology-science/#close>

Appendix A

Virtual Tour Application Research

Table A.1 provides the tabulated research regarding potential virtual tour applications. The table lists the pros and cons for each application with regards to the following categories: cost, ease of development, and sponsor desires (3D environment, addition of virtual exhibit rooms).

Table A.1: Pros and Cons table of virtual tour applications

Application	Pros	Cons
Matterport	<ul style="list-style-type: none"> - Fully built virtual tour application - Access to a help service - Use service to publish virtual tour - Maintained by Matterport 	<ul style="list-style-type: none"> - Requires specific camera types - Requires a subscription (\$9.99/month) - Unable to create “virtual exhibit” rooms
Google Tours	<ul style="list-style-type: none"> - Free to use - Accessible on multiple devices through the Google Tour platform - Use service to publish virtual tour 	<ul style="list-style-type: none"> - Unable to create “virtual exhibit” rooms
Unity	<ul style="list-style-type: none"> - Free to use - 3D immersive environment - Ability to create “virtual exhibit” room - Access to platform support 	<ul style="list-style-type: none"> - Less refined/not as clean and professional looking - Significantly more work - Requires maintenance by the park
JavaScript	<ul style="list-style-type: none"> - Lightweight structure - Free and easy to code - Ability to create “virtual exhibit” room 	<ul style="list-style-type: none"> - Limited virtual and 3D components - Less immersive of an experience - Requires maintenance by the park

Appendix B

Questionnaire Questions for General Users

The following questionnaire questions are used to review the application to determine the strengths and weaknesses while developing and refining the virtual tour deliverable. The questionnaire serves as anonymous feedback to improve the final deliverable to the El Caño Archeological Museum and Park. The team distributes the questionnaire via Google Forms, which is an online survey. The questions are written in English.

Product Development of the El Caño Archeological Park Virtual Tour. The following survey questions collect data on the application you have just used. It will focus on features to be added and what needs to be improved. The following data to be collected will be anonymized, you can stop at any time. You must be over the age of 18 to take this survey. No question is required. By clicking next, you are certifying you are over the age of 18.

The following questions will appear on the questionnaire:

Who do you think would benefit the most from the distribution of this tour?

[Students / Academics / Scientists / Hobbyists]

How experienced do you consider yourself with technology?

[I regularly have trouble / I can work with them fine / I am able to make the computer do what I want]

How much did you enjoy using the application?

[Scale of one (extremely dissatisfied) to ten (extremely satisfied)]

How easy was the tour easy to use and interact with?

[Scale of one (impossible) to ten (natural)]

Please give a brief explanation of your answer:

[Short answer]

The visuals were appealing

[Scale of one (not appealing) to 5 (appealing)]

How well does the tour promote Museo El Caño?

[Scale of one (not well) to 5 (very well)]

By your definition, how fast is your internet connection speed?

[Short answer]

Did the tour load in an acceptable amount of time?

[Yes or No]

Is there anything you would change about the appearance of the application?

[Short answer]

Is there anything you would change about the virtual tour to make it easier to use?

[Short answer]

Were you satisfied with the amount of information the virtual tour conveyed?

[Short answer]

How would you rate the quality of images and graphics?

[Rate on Scale of 1 (poor) to 5 (excellent)]

What can we do to improve the delivery of information?

[Short answer]

Would you like there to be more images and graphics in the Virtual Tour?

[Yes or no]

Is there anything else that you would change?

[Short answer]