

Exhibit Caution: Incorporating Alternate Reality Technology into Museums

An Honors Thesis (HONR 499)

by

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Abstract

Over the past few decades, public history institutions have faced many different challenges. Some of these challenges stem from the rise in technology. Previously, if someone wanted to learn more about a subject, a trip to a museum could provide valuable information through heavily researched exhibits. However, as the Internet became easily accessible, all this information was readily available with a simple search. Museums were no longer necessary to find answers to the burning questions of history. To combat this idea, many museums began to take steps to keep their visitor numbers up by incorporating emerging technology into their exhibits; technology that was not readily available to the general public. Historians needed to create narratives and exhibitions that could be boosted by modern technology. With this idea in mind, museums expanded into the fast-growing media of augmented reality (AR) and virtual reality (VR). This expansion has led to some great successes and strides in the field of exhibition design, but some roadblocks remain, especially for smaller institutions. To incorporate augmented and virtual reality, museums must consider cost, exhibit caution, and use the technology in a way that works well as an additional piece to an exhibition. Once all these factors have been taken into account, augmented and virtual reality can be an amazing tool for museums. With such a focus on the lengths that AR/VR technology can go, my research hopes to shine a light on some of its greatest accomplishments so far while also bringing to light some concerns and potential downfalls of its incorporation. In the appendix, I have included my capstone project for my Digital Media minor, in which I created a pamphlet on the positives and negatives of incorporating augmented and virtual reality into a museum.

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I would first like to thank Dr. Ron Morris for assisting me with this thesis. I have worked with him on multiple projects now, and he was very helpful and understanding during this entire process.

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Finally, and most importantly, I want to thank my family and friends. They have also helped shape who I am today, and their support of me has always been a blessing. I also want to thank my dogs for giving me a great reminder to take a break once in a while.

Process Analysis Statement:

Since changing my major to public history, I have really begun to look closely at museum exhibitions. Instead of actually reading the content, I often found myself paying attention to the design. I wanted to see how technology was being used and how the space was structured. I took a particular interest in the use of technology to create unique experiences. After adding a Digital Media minor, I decided that I wanted to write about the use of technology in museums. I wanted to cover all the ways technology was being implemented, and I wanted to find ways for smaller institutions to incorporate technology. After some consultation with my advisor, we decided it was best to narrow my scope. So, after some thought, I decided to look into augmented and virtual reality technology. This technology is relatively new, so I thought that my thesis could be a great way to educate others about the ways this technology is being implemented, and how it can be done for smaller institutions.

I started by researching articles on some of the amazing ways this technology was being used. I wanted to have an idea of just how far museums had gone. I wanted to cover the highs, but I also wanted to cover the lows. I spent time researching examples of AR/VR use by small museums, looking for articles of successful stories and some unsuccessful ones as well. I wanted my thesis to possibly help those looking to learn about this technology for their own small museum, so I made points like cost and success rate important. I also developed a capstone during my time writing that served as a more accessible guide dedicated to smaller museums, and this really helped me focus my ideas and form a clearer thesis.

My research was mostly done online, as access to a library or other research location was limited by the quarantine put in place during the COVID-19 pandemic. However, I made sure to search out sources from scientific and historical journals to balance the technology examples from news articles. As I reached the editing phase, I made sure to read through my writing multiple times, as well as taking my advisor's suggestions to heart to help make my thesis the best it can be.

A lot of my sources are from online sources. As technology is very fluid and changes fast, there are not a lot of journal articles for what I am trying to do. Still, all of my sources are solid and are used to discuss this topic in a somewhat current way. Many of these web articles are used to provide examples for how this technology is used through research and interviews with museum staff.

Introduction

History has a lot of stories. These stories formed the origins of humanity's history, and as time went on, those stories were passed down and transcribed. In recent times, museums are the medium for those stories. Museum exhibitions are created by curators to educate the public on history and the stories behind it. Because of this, museums have been a staple of field trips, first dates, and family vacations for a long time. And for a long time, museums included information that could only be found there. Of course, one could undertake deep and detailed research, but museums allowed a much easier and thought-out way of learning. But in the era of technology and the Internet, answers are much easier to find. So when information is just an online search away, why take the time to visit a museum? While this idea is a bit of an oversimplification, the thought can still scare curators. To combat this fear, many have begun to incorporate technology themselves to improve visitor experience.¹ They have decided that the best way to draw in visitors is to use technology that is not widely available. Virtual reality (VR) and augmented reality (AR) have been popular choices to create such unique experiences. However, a lot of information on how to successfully incorporate this technology is not known, especially for smaller institutions. Many places would love to incorporate these experiences or ones like them, but do not have any idea where to start. For museums, AR/VR technology has had a longer history than many might think, and today, those roots have created immersive experiences some could only dream of. To incorporate augmented and virtual reality, museums must consider cost, exhibit caution, and use the technology in a way that works well as an additional piece to an exhibition. Once all these factors have been taken into account, augmented and virtual reality can be an amazing tool for museums.

The Origins of AR/VR

Today, technology is expanding faster than ever before. It seems as if a new groundbreaking product is revealed every few months. One of the most intriguing areas of new technology right now is alternate reality. The leading areas of this field are virtual and augmented reality, better known as VR and AR. While VR has had a presence in society for a while now, AR is a new term for many people. To learn about augmented reality, it is first important to understand how it is different from virtual reality. With virtual reality, the user immerses in the digital reality, whether that immersion is with multiple senses or only visual. Subjects must wear either a VR headset or some sort of head-mounted display. By wearing that headset, the user can view a virtual world and even interact with it. There are multiple ways in which someone can experience virtual reality. Headsets are available for purchase from several companies, but a more accessible means is available through a smartphone. Cardboard headsets can be used to experience VR at a low price through a phone.

Augmented reality is a little different. As the name suggests, the subject's world is not entirely virtualized, but it is augmented or changed. Augmented reality enhances the real world with virtual information such as text or images, and can be accessed through a phone, tablet, or other device. The most common and referenced example of this is the Pokémon GO app, which gained massive popularity a few years ago and is still going strong with a passionate fanbase. When a Pokémon is found, the phone screen displays it overlaid onto the real world. The image will adjust based on the environment in front of it and the set distance from the user. In short, the real world remains, but a digital asset has been placed in it through a medium such as a phone.

There is also a form of altered reality that is a step above augmented, and that is mixed reality. Mixed reality takes pieces from both virtual and augmented reality. Like AR, the real world is the base, and digital assets are included. But with mixed reality, those digital assets can be interacted with and respond to feedback as if they were real. However, this paper will focus mainly on VR and AR. To sum up the difference between these two: VR is fully immersive into a replicated or brand new virtual world, while AR is the real world with some augmentation, or enhanced reality.²

The idea of expanding or defying reality has long been a dream for many people. Although the technology, and the amazing feats that have been accomplished using it, seem new, virtual and augmented reality have been around longer than one might expect. Technically, you can trace virtual reality all the way back to the early nineteenth century with the invention of the stereoscope. With the stereoscope, objects could be viewed from two different angles, as opposed to the usual single point-of-view of a photograph or drawing. In his 1856 book on the stereoscope and its future uses, Sir David Brewster mentions just how revolutionary the stereoscope is by writing “the most skillful artist would have been incapable of delineating two equal representations of a figure or a landscape as seen by two eyes... but the binocular camera, when rightly constructed, enables us to produce... the pictures which we require, with all the perfection of that interesting art.”³ While not much more than what a child’s View-Master toy is today, it was a first step down the path to virtual reality. The next steps would come in the late twentieth century, as scientists found more ways to show a world beyond just a still image. For example, Morton Heilig’s Sensorama Simulator, created in 1956, utilized multisensory stimulation. While using stereoscope technology, he added simulations of other senses, using

sound, vibrations, and smells to create a simulated experience. In Heilig's patent application, submitted in 1961, he mentions that his apparatus could be used for dangerous workplace training, education of complex subject matter, or just for personal inspiration.⁴ However, this technology was about the size of an arcade cabinet. While virtual reality would branch off in a somewhat different direction, this multisensory style is still used today in 4D theaters and theme park rides.

As the century continued, so did the expansion of this technology. In 1985, VPL Research was founded by Jaron Lanier and Thomas Zimmerman. Lanier would go on to popularize the use of the term "virtual reality" in 1987.⁵ Once the 1990s hit, virtual reality exploded into the public sphere. Its greatest impact was on the world of gaming. VR arcade games began surfacing, and game developer Nintendo released its Nintendo Virtual Boy console in 1995.⁶ However, the technology was still somewhat lacking. This is shown in the massive failure of that Virtual Boy console, as it was discontinued after less than a year on shelves. Possible reasons for this failure range from problems with implementing the technology to Nintendo giving up on the console too early.⁷ The hype around virtual reality would recede soon after, but has risen again in recent years as technology has allowed for more achievements to be had.

The history of augmented reality is the same as virtual up until the late twentieth century. The term was first coined in the early 1990s by Thomas Caudell and David Mizell,⁸ and since then it has slowly made its way into the same level of success as virtual reality in recent years. Arguably the greatest impact augmented reality had during this period was in sports. After a failed attempt to incorporate technology into hockey, focus shifted to American football. In

football, the team with the ball must travel ten yards in four attempts to obtain a first down, which is repeated until the team scores or fails to convert in four attempts. On the field, the spot ten yards from the starting point is marked by chains and bright orange posts on the sideline. As football became more popular, more and more people were watching from their homes. With the limited range of the camera, it was often difficult to know if a player had made a first down. This dilemma was combated in 1998 by a company called Sportvision, who debuted the yellow yard marker on an ESPN broadcast. The line marked the spot the team needed to reach for a new set of downs. The graphic remained on the screen through many different camera angles and always appeared below players, and it immediately became a hit amongst the sports world. Sportvision would later incorporate their technology into other sports, including the batter box graphic seen in baseball broadcasts. The yellow yard marker technology is still used today, and even more lines and graphics have since been added to the broadcast.⁹

This technology has exploded in the last decade. To try and capture this explosion, a tech battle began featuring most of the major players in the technology world. Amazon, Apple, Facebook, Google, Microsoft, Sony, and Samsung all created VR and AR divisions to try and gain a hold on the market for this technology. Each of these companies manufacture a medium of some sort, with varied degrees of success. Oculus, a technology company founded in 2012, has been more successful critically than all these powerhouses; at least until Facebook purchased the company in 2014 for \$3 billion.¹⁰ Sony has a strong yet expensive model with its Playstation VR headset, while Google suffered a misstep with its AR device Google Glass. With this arms race for AR/VR superiority, several organizations and industries have received amazing technology to help teach and learn. One major outlet for this technology is the military. With the amount of

danger military personnel operate in, VR simulation is a great tool to assist them in learning techniques and training without putting lives in danger. VR has also become a great tool for veterans suffering from post-traumatic stress disorder (PTSD) through virtual reality exposure therapy.¹¹ But virtual and augmented reality is for more than video games or the military. This technology has found a place within the public history sphere, and many sites are looking to go beyond their physical exhibition into the world of altered reality.

Roots of Immersive Exhibitions

While the implementation of this technology into museums is relatively new, the path to this moment has been long ongoing. Curators constantly work to make an immersive world from exhibitions' subject matter. This is best seen in natural history museums. How can an exhibit designer best describe the scope of the age of the dinosaurs or the Ice Age? In the time of cavemen, cave drawings could depict the scale of humans or Neanderthals related to mammoths or other creatures. Today, there is nowhere to go but up.

The idea of immersion begins with storytelling. In storytelling, the author or narrator wants the reader or listener to feel as if they can see the story play out in their own head. Adjectives and adverbs serve the grammatical purpose of expanding upon nouns and verbs. They are meant to give a better idea of what is happening in the story. For example, if a story mentions a box, any sort of image could be conjured in someone's head. But by including adjectives that describe color, size, shape, or material, the mental image for the listener is much more vivid, and they feel more invested in the story.

However, words are not always the most exciting. People are always looking for the next innovation or product that will draw them in. In Saul Carliner's article *Modeling Information for Three-dimensional Space: Lessons Learned from Museum Exhibit Design*, he writes that museums must, "use techniques such as immersion and layering to avoid presenting information in book-like form."¹² In moving away from that dry, book-like form, exhibitions work to incorporate narrative stories to pull in visitors. They also pull visitors in through visual aids. A notable example of this is with dinosaurs. Drawings of dinosaurs in textbooks or online can never do them justice, especially for children. When standing next to a dinosaur skeleton, children can truly see the difference in size for themselves. However, while these reconstructed skeletons fulfill the visual sense, the other senses are left empty.

The next step toward AR/VR immersive exhibitions is with interactive exhibitions. Reaching those other senses would give a better idea of immersion, providing how that world would feel, smell, and sound. In short, immersion via a large-scale Sensorama, but without the giant apparatus. Probably the most popular sense to incorporate is touch. Following the dinosaur theme, molds of footprints can be made next to a certain dinosaur, and they can be measured against a visitor's hand. At Old Faithful, the visitor center museum has the fur of animals from the area. The fur is attached to the information panels for visitors to feel with their own hands, without having to touch expensive models. While this sort of installation could attract consequences such as the spread of germs or disease, with scheduled cleaning that issue should be minimized.

Sound also plays a major role in immersion. The sights or displays could be stunning, but all of that could be lessened by the sounds of the surrounding crowd. Like the feeling of a baby

crying in a movie theater: you might absolutely love the movie, but with a baby crying intermittently throughout, that love could be lessened. For museums, the noise of other visitors is hard to escape. Say a clip of John F. Kennedy's famous inaugural address is playing in a Cold War exhibit. If the sound plays only through the screen's speaker, it will be nearly impossible to hear with people constantly moving past. For most museums, the obvious solution to this issue is closed captions. While this helps get the point of the video across, Kennedy's speech might not be as iconic without his voice giving the words life. So, museums must be creative. At the Flight 93 National Memorial in Pennsylvania, telephones are used to play the phone calls of passengers who were calling their family for the last time. At London's Foundling Museum, a 2011 exhibition on children who grew up in hospital care used directional speakers and pressure pads to trigger audio to be played.¹³ At the Children's Museum of Indianapolis, sound is used to create an immersive state for an entire area. As visitors walk around the dinosaur exhibit, the sound of rain and thunder flow in from speakers, creating the rainforest atmosphere that these prehistoric beasts would have experienced. Of course, sound can also be immersive in much simpler ways, such as audio tours, which are often available at large historic sites like Gettysburg.

Possibly the least utilized of the five senses, besides taste, is smell. An easy place to incorporate smell is a historic recreation site like Conner Prairie. When the staff of the site spend the entire day running these farms and shops with real animals and tools around them, the smell comes along with the sight. In fact, Conner Prairie can even incorporate taste, whether it be baking bread for visitors or making treats for Halloween. Between the smells of sawdust and farm animals, Conner Prairie really sets the bar for immersion without modern technology. When it comes to spaces that cannot bring in animals, that is where technology can come in

handy. One company that specializes in this technology is SensoryCo. This company creates immersive experiences for museums as well as 4D theaters, theme parks, and concerts. SensoryCo worked on an exhibition on the baby boomer generation at the Newseum in Washington, D. C. With the displays filled with paraphernalia, scents were released in the exhibition that relate to the practices of the artifacts' time. The smell of fresh-cut grass is used to symbolize the social movement into the suburbs, and incense is used to symbolize the images of freedom and nonconformity.¹⁴

The roots of AR/VR also trace back to general technology integration. Altered reality is not the only technology being experimented with in museums. From television screens to tablets, digital technology has exploded into the public history sphere. This technology does not focus on immersion; it focuses on creativity in providing information. There are many positives to incorporating technology into museums. First, just the mention of new technology will draw in new visitors and encourage old ones to return. Second, it provides so much more space for information. With a tablet, multiple tabs are made available for visitors, and they can search for whatever topic interests them. With just a display board, the cost may be less, but the impact and room for information are also less. Larger tablets can even create an exhibit subsection on their own. Recently, the Indiana State Museum opened *FIX: Heartbreak and Hope Inside Our Opioid Crisis*, a temporary exhibit focusing on the state's troubles with opioid addiction and how it can be combated. This new space is filled to the brim with creativity: a recreated desk of a teenager with an addiction, a tent made from blankets used by patients, and a set of large screens displaying opioid statistics. These statistics include opioid-related deaths per county over the last few years. With ninety-two counties in the state, there is a lot of information to communicate.

Using these large tablets, visitors can select the statistics they want to know and not have to squint or zoom to find their answers. There are two of these screens in this section, so two visitors can use the same program at once, which helps avoid a line and keeps traffic moving. A step beyond these large tablets are wall-mounted touch screen displays such as the ArtLens Wall at the Cleveland Museum of Art. This wall is forty feet long and multi-touch, meaning multiple people can select items on the screen at the same time. The ArtLens Wall displays every piece of art on display at the museum, which amounts to more than four thousand. Each image is on the screen, paired by thematic groupings to make searching easier. There is even a companion app for this wall, which visitors can use to see the artifact-sharing activities of other visitors. If someone locates an artifact they enjoy and wants to see it in person, all they need to do is dock their phone to the wall and the app will direct them to that artifact.¹⁵ The ArtLens Wall is truly one of the most awe-inspiring pieces of museum technology in the world. However, technological innovation goes beyond touch screens. With AR/VR technology, the entire world is ripe for new expansions of museum technology into the altered-reality world.

Reasons for Incorporation

With all the advancements in technology, why focus on augmented and virtual reality? Most museums have a very limited budget; one that does not allow for the level of development required to create new content for their exhibitions. Despite this major hurdle, if the money is available, working with this technology can lead to inspiring creations.

One notable positive of incorporating AR/VR technology is the potential to draw in new audiences. Now, most places draw in audiences with any new exhibition. People want to see new

artifacts and new pieces in place; this is what allows museums to continue. However, incorporating new technology can draw even more people to a museum, especially in this digital age. According to a 2017 article from CNBC, “museum attendance has skyrocketed more than ever since computers and iPads entered the art [museum] realm.”¹⁶ This technology allows museums to create new digital experiences for its visitors, including utilizing augmented and virtual reality. Experiences like these are likely not available at home, so a museum is a great place to interact with this technology. The wonder of the experience is coupled with the educational aspect of the museum exhibition, creating a great attraction for visitors young and old. It allows a lesson to be learned in an interactive and immersive digital environment.

Another great use for this technology is in digitization. The digitization movement has been tremendous for both museum staff and visitors. As the Internet and the capabilities of technology expand, as does the ability to make artifacts more accessible. When digitizing a letter or newspaper, only one or two scans are needed per artifact. With 3D artifacts such as trophies or pottery, a 360-degree view may be needed. Utilizing a 360 camera, the image of an object can be taken from all angles, and a full view can be seen online. Taking digitization a step farther can create detailed 3D models from the images. Through efforts like the MUS.INT. Project, valuable artifacts are being laser-scanned and recreated digitally. This project can create high resolution digital recreations for archives as well as lower resolution scans for virtual exhibitions. This way, researchers looking into archives can find recreations as close to the real artifact as possible, and curators creating a virtual museum can have lower resolution objects with much quicker load times with little noticeable dropoff to the average visitor.¹⁷ While digitization on this level can sometimes be expensive, it gives a better reference to archivists on objects as well as giving

researchers an opportunity to see artifacts in VR as if they were in the room. If the funds are not available, capturing the important parts of the artifacts with still images can still get the job done.

The third reason to incorporate augmented and virtual reality is innovation. With such an emerging branch of technology, there is a lot of room for discovery. However, innovation can be dangerous, especially for a museum looking to step into untested waters. While the world-renowned museums may have the safety net to invest in an AR/VR production company, many museums are not capable of funding this level of innovation. While innovation could lead to enhanced popularity and attendance, it could also lead the museum to debt and lead to employees losing their jobs. According to the 2015 Museum Edition of the New Media Consortium Horizon Report, “it is vital for museums to develop evaluation benchmarks before deploying new technologies so they are not trying to retrofit a solution to standards created post-implementation.”¹⁸ The use of this technology needs to be planned out entirely before implementation, but that can be difficult to do for curators looking to innovate without a reference. Innovation has helped our society grow, but in the museum realm, perhaps it is best to wait and see with this technology, only considering it when an idea has already shown success in similar locations.

Virtual Reality

Many places have already taken advantage of virtual reality technology. They have made innovations that truly inspire both visitors and other museums. Three of the most prominent uses of virtual reality currently are virtual and online museums, virtual tours, and expanding on non-physical exhibitions.

The idea of an entirely virtual museum can be hard to grasp. For some, the entire appeal of a museum is to take a visit to see the artifacts or see the artwork with their own eyes. This stance does have some merit; pictures just cannot do justice to some art pieces and objects. Plus, with museums pushing for interactive experiences, creating programming divulging from that seems counterproductive. However, incorporating a virtual museum component can be beneficial to both the physical museum and the entire organization. According to Werner Schweibenz, a professor at the University of Saarland in Germany, there are three types of virtual museum. These are brochure museums, content museums, and learning museums.¹⁹ A brochure museum is just a website with basic museum information such as collection types and hours, with the goal of informing potential visitors about the museum. A content museum presents the museum's collections and invites visitors to explore those collections online. The goal of this type of museum is providing a detailed portrayal of the museum's collection online. A learning museum is constructed in a context-oriented fashion to motivate the visitor to form a connection with the website and the museum and eventually visit the physical museum to see these researched objects in person.

With emerging technology, more upgrades can be made to these virtual museums. A step above a learning museum is a true virtual museum: a website linking to digital collections for anyone to see. Of course, there is an obvious concern in detracting from physical visitors. However, as Schweibenz mentions,

“The virtual museum is no competitor or danger for the “brick and mortar” museum because, by its digital nature, it cannot offer real objects to its visitors, as the traditional museum does. But it can extend the ideas and concepts of collections into the digital space and in this way reveal the essential nature of the museum. At the same time the virtual museum will reach out to virtual visitors who might never be able to visit a certain museum in person.”²⁰

A virtual museum is meant to expand upon the museum and draw in new visitors. By including virtual reality aspects into that virtual museum, more of those new visitors will be attracted to the brick-and-mortar site. Virtual exhibitions can be viewed online in 3D galleries of the artifacts in the collection or in a picture-by-picture view like Google Maps Street View. For larger museums, entire programs can be created out of VR technology, allowing for an experience not available in the physical museum. Extra content such as this can push someone to learn more at the physical museum or learn more once they have left.

Virtual reality also allows for virtual visits for those who could never experience a museum in person. For example, while natural wonders like the Grand Canyon and the fjords in Norway would be a greater experience in person, many people just do not have the money to travel across the world to see them. While the images from these places can be stunning, they still pale in comparison to being there. To combat this, historic sites can create a halfway point with virtual reality tours. For example, Yosemite has an online interactive VR tour of the most popular parts of the park and the surrounding area. At this point, the program is not offered through the typical VR headset setup, but this is due to the current low quality of VR imagery. The website notes that if the technology were to improve, they would consider creating an alternate version for headsets.²¹ Instead of a headset-supported version, the program runs through a typical web browser. Each available vantage point is photographed in a 360-degree panorama in high resolution, allowing for viewing in literally any direction. Also adding to the immersion are the sounds of that location, whether they be a busy crowd or the calming chirping of birds. Within the panorama are red targets marking other points in the park to visit on the virtual tour. Informational captions on each location and gyrosphere functionality on mobile devices bring the

entire product together. Scott Highton, the photographer behind the project, has captured more than two hundred locations in the park. Each interactive panorama offers a breathtaking view for those who have never visited, as well as a new perspective for those who might want a new view or a reminder of the park.

Another major market for these virtual tours are art museums. These are faced with a similar dilemma to the sites of natural wonders in that the full experience cannot be captured without seeing the artwork in the real world. While this may be true, another truth is that the world has changed how it communicates. Artwork is posted all over the Internet on social media sites and the personal websites of artists. The digital world is a great opportunity for new art to be shared across the world. This is the basis of what Kosta Popov envisioned with his Cappacity for Art initiative. It was with this idea that he partnered with the New York Academy of Art. In an article from *The Irish Times*, Popov states that “the partnership ... began with a shared conviction that fast and qualitative production of virtual museums, galleries, and exhibitions is possible.”²² The partnership’s goal is to showcase sculptures created by faculty and students, as well as other artists’ work. With a VR setup, these artworks are readily available for anyone looking to be inspired by artwork. The hope is for this program to extend into other major exhibitions and galleries within the Academy of Art. This program has also allowed for students to create a digital portfolio for their artwork. With this technology, potential clients can view artwork from any angle, and experience their work in a method second only to physically being there. This virtual reality technology has allowed so many avenues for art to reach the public, and with plans to digitize physical exhibitions as well, the innovation of this technology into virtual experiences may be just beginning.

In the incorporation of virtual technology, innovation also goes on inside the museum. Virtual reality can serve as an extension of the physical experience of an exhibit. With the addition of some headsets, visitors can be taken to an immersive experience of history within exhibitions. In Aarhus, Denmark, a couple different institutions have incorporated virtual reality for very different purposes. At the Moesgaard Museum of Natural History, visitors can throw on a headset to envision themselves within a Stone Age settlement or tomb. At the Woman's Museum, visitors of the exhibition on eroticism can view pornography in virtual reality.²³ While these institutions are utilizing the technology very differently, each allows for an expansion of the story that would not be possible without the technology. For the Moesgaard, the physical exhibition space is still decorated with artifacts, and provides information on those artifacts. The whole exhibition is not built around the VR capability; it is an optional addition for visitors. That way, if the technology were to go out of style, failure to attract visitors to the technology would not tank the entire exhibition.

This technology being an optional addition can also pose problems. For example, the Moesgaard has less than ten operational headsets at any given time. On a day with multiple field trips or a day with abnormally large attendance, that section of the exhibit may become crowded. If that is the case, not everyone will be able to experience this technology. When a Mona Lisa VR experience was being planned for the Louvre, this problem was a primary focus. When discussing the Louvre's original reluctance to incorporate the technology into art, director of the AR/VR startup Acute Art stated, "It's simply not so easy to show [VR] to huge audiences. A successful [art] show has 250,000 people—how would you do that?"²⁴ It is supply versus demand; will the museum be able to fund enough headsets to supply their number of visitors? Is

the experience short enough that a long wait is not necessary? Does the room provide enough physical space for each headset to be properly used? All these questions are important when considering implementing a VR addition.

Of course, not every museum has the luxury of making a VR investment only an additional piece of their institution. Still, for those who have that ability, it can make for a great addition. The British Museum in London installed an experience like the Moesgaard with a Bronze Age experience. According to Lizzie Edwards, head of the Samsung Digital Learning Program at the British Museum, the experience was successful in a few ways. For one, it provided another level of education for visitors, as many were surprised that houses could be found in the Bronze Age, as it is a time period that visitors find difficult to visualize. Secondly, it followed through on the promise of an influx of teenagers and younger visitors.²⁵

Virtual reality can also create a permanent home in an institution. At the National Museum of Natural History in Paris, a room was permanently renovated to house five VR stations. This room, titled The Cabinet of Virtual Reality, allows for a calming and danger-free shift into virtual reality. In its original form, the Cabinet served as an extension of the permanent *Journey into the Heart of Evolution* exhibition. This extension featured a branching orb of 460 species, tracing back to the last universal common ancestor.²⁶ In the future, more programs will be added to put the room to a good use and keep visitors returning.

With the continuous expansion of VR technology likely allowing for similar experiences to be had at home, some museums are also recognizing the writing on the wall. At the American Museum of Natural History, a VR experience was created for its T-rex exhibit. This experience allowed visitors to work together to put a T-rex back together bone by bone. Once the dinosaur

skeleton is completely reconstructed, it is transformed into a digital recreation, as is the surrounding area. The final project was launched in March 2019, and is scheduled to last until August 2020.²⁷ Through a subscription to Vive Studios' streaming service Viveport Infinity or a five-dollar purchase, the program can also be played at home with a VR headset. Yes, even virtual reality has a subscription service. By allowing their experience to have a home release, it can give those without museum access a chance to view the hard work put into the project. Plus, potential visitors could be persuaded to make a trip to see what else the museum has in store.

Augmented Reality

Virtual reality is not the only artificial reality technology to make its mark on the field of public history. While virtual reality can create completely virtual worlds, augmented reality can take the real world and build upon it. With augmented reality, the physical world can be enhanced in several ways.

Like virtual reality, AR can expand upon existing exhibitions and create more than what the physical world can provide. For museums, this can include revamping old exhibits with a new virtual installation. This revamping can even extend to iconic museums such as the Smithsonian or the Kennedy Space Center. In the Smithsonian's Bone Hall, some of the bones have been on display since 1881. In 2017, the museum introduced an app to breathe new life into these old artifacts. The app, called Skin and Bone, superimposes the images of the animals on top of the bones. When viewing the bones through the app, the bones are overlaid with skin and some movement is added. The app even works for other areas of the exhibition, showing a bat flying away or a sea cow skeleton being covered with skin. A bird called an anhinga also

attempts to catch artificial fish.²⁸ At the Kennedy Center, the AR experience takes a different approach. Inside the Heroes and Legends exhibition is a display of the Gemini 9 space capsule used by astronaut Gene Cernan. He performed the second spacewalk in history in June of 1966, but he almost did not survive it. His spacesuit overheated, and he was sent spinning, blinded by his fogged visor. With the help of AR, a recreation of his harrowing experience is shown to the audience. By looking through an installed screen, visitors can witness a hologram of Cernan attempting to return safely to his capsule and save his life. The hologram is even accompanied by voiceovers from Cernan and his commander.²⁹ Just by looking through a screen, old artifacts can be brought to life to show why they are worth displaying in the first place. If a child sees a collection of bones or an old space capsule from the 1960s, they may not give a second thought. But if those bones suddenly become real or the space capsule has a man hurriedly trying to get inside it, they see why these old dusty artifacts matter. History comes alive before their very eyes; maybe not truly alive, but as close to it as possible.

Another area in which AR can add to exhibitions is accessibility. As time goes on, the world becomes more connected than ever. Cultures continuously overlap, and it shows at museums and historic sites. At these locations, curators and exhibit designers work hard to create engaging and informative content for their visitors. However, with the barrier of language, pieces of the exhibit can be lost on international or non-native-language speakers. Some museums have taken steps to add multiple languages to their exhibit information, but a lot of places do not have the space or the budget to incorporate widespread accommodations. For those smaller museums with large multilingual traffic, a translation brochure is a cheap and safer option. For larger institutions with massive international traffic, augmented reality could provide a great

opportunity to incorporate translations. In fact, apps have already been developed for this purpose. The app Layar is one such app. This app already exists in stores, so all museums must do is purchase it and incorporate it into their programs. Koven Smith, the director of digital adaptation at the Blanton Museum of Art, found this technology perfect for a 2015 exhibition. The museum had recently acquired plates of the Crusader Bible, which has been owned by several people throughout its history. As such, three different languages were written on those plates, being Persian, Judo-Persian, and Latin. After downloading the Layar app onto some dedicated iPads, visitors could see the text translated in real time. For the app to work, tests were run on copies of the plates for about a month for the testing to work on the real artifacts.³⁰ When interviewed about the project, Smith stated that roughly twenty percent of their visitors took advantage of the Layar app iPads, and that the feedback was generally positive, though some visitors were wary to try the technology. Smith added that while he is “genuinely skeptical that having tech in an exhibition is in some way a draw to visitors on its own, there was a clear PR value.”³¹ AR translator apps are also available to the general public, and can be used anywhere to translate languages. Apps such as Word Lens were first on the market almost a decade ago, and now apps such as Google Lens dominate the market. Museums could recommend this type of app to visitors to help translate for those non-native-speaking audiences.

One genre of museum that augmented reality has really touched is the art museum. Art has always been a medium for experimentation, so the inclusion of augmented reality is no surprise. Many museums have turned to companies like Artivive to help implement augmented reality into their artwork. Artivive, which began as a startup in Austria in 2017, has grown into one of the best options for artists and museums looking to use AR in their work. By May of

2018, the program had already been downloaded 60,000 times, with over 2,000 artists in sixty-five countries using it, and many Austrian museums already running it.³² As programs like Adobe Aero and Unity have also gained popularity, more and more artists are looking to its benefits. In an interview with Michael Steeber of *9 to 5 Mac*, artist Heather Cathleen Dunaway Smith said of AR:

“AR is especially good at allowing people to try on different perspectives and realities. The illusion of proximity makes the work really impactful. Experiences that seem to happen in your immediate physical space automatically feel personal and emotionally potent. If the piece is truly responding to the audience, it will give them a sense of agency and ownership over the work. The line between art and audience is blurred, leading to a deeper emotional connection.”³³

Just as Smith says, AR allows for a sense of immersion with artwork that does not require an entirely virtual environment and a VR headset. Whether the art pops off the canvas or moves before the viewer’s eyes, augmented reality adds another level to artwork.

At places like the Albertina Museum in Austria, companies work with the museum to create altered content. However, in some cases, these augmented reality creations are not authorized. This was the case for the Museum of Modern Art and the takeover of its collection of Jackson Pollock paintings. Eight artists collaborated to create “MoMAR,” a virtual reality program that allows visitors to see their works on top of the paintings. The Pollock paintings were chosen because the room had been unchanged for so long, and the erratic style of Pollock allowed for easy AR markers upon which to activate the augmented reality. Some of the creations added to Pollock’s work, while some took a different approach. One artist turned the frame of a painting into an iPhone, which has the capability to “like” the painting or play certain audio. Another piece, aligning with Pollock’s idea of artist’s block, portrays a difficult video game level. One artist, who viewed Pollock’s work as very masculine, created a piece on fertility

and women as creators.³⁴ While some see this as an attack on art and museums by the younger generation, others view the creations as an interesting additional level to the pieces. Either way, AR and the MoMAR app has given artists a stage upon which to display their work.

One of the most exciting ways in which AR is being used is in conjunction with artificial intelligence, or AI. As the world continues to populate with AI products like Google Home and Amazon's Echo, museums are finding their own ways to incorporate it. To do so, museums combine AI with a technique popular in science fiction: holograms. In 2017, the Illinois Holocaust Museum and Education Center debuted its Take a Stand exhibit. As the number of Holocaust survivors alive today continues to fall, the museum wanted to find a way to preserve their stories before they were gone. So, with the help of USC Shoah Foundation's New Dimensions in Testimony program, they were able to create a 3D hologram which can respond to questions posed by visitors. The program is housed in a holographic theater, and the recordings are paired with a voice recognition software to reply with the corresponding voice and body recording. To create this, the thirteen survivors each spent several days in a studio in Los Angeles. The subjects each answered over 2,000 questions about their experience during the Holocaust, all while being filmed by more than fifty cameras.³⁵ With this technology, the stories of these survivors can be told long after they are gone. By adding a visual and artificially intelligent component to the audio, it creates an oral history that proves more immersive than a simple oral history interview.

Another example of AI hologram technology comes from the Pro Football Hall of Fame. In 2019, the museum, working with the tech start-up StatMuse, developed an AI augmented reality program around the bust of John Madden. The company captured high-resolution 3D

scans of Madden's bust for animators, and a digital replica of Madden's bust was created. After obtaining about two hours of audio from Madden, the project was complete. With a smartphone or tablet, Madden's bust will appear alive, and will answer a variety of different questions on his career.³⁶ This is different from the Illinois Holocaust Museum holograms because instead of being totally holographic, this program is marked to the bust. While this does create the disadvantage of having to be viewed through a smart device, the program is created from a physical object that the visitor can see, not just a 3D recreation of the interviewee. The museum hopes to expand this capability to other busts in the future, to a point where many NFL legends have the ability to reach audiences with their stories.

A downfall of augmented reality is its somewhat limited applications at a reasonable price tag. Niantic, the designer of Pokemon GO, is still working to improve upon its AR system by acquiring startups to help develop their experience.³⁷ While the AR takeovers at the Museum of Modern Art are not developed by a major company, the cost of development is not cheap either. If augmented reality is able to move into the mainstream world like virtual reality did, perhaps it will follow a similar trend in creating more affordable technology and allow museums to consider the possibilities of augmented reality instead of immediately casting it aside.

Augmented and virtual reality are not the only forms of altered reality. By working with both technologies at once, even more possibilities are unlocked. Mixed reality, or MR, takes aspects of virtual and augmented reality by allowing for both digital and real-world interactions. According to Mafkereseb K. Bekele, "MR is not just an alternative to augmented or virtual reality. Rather, it is a unique perspective that enriches humans' perceptions of both real and virtual environments."³⁸ All three of these are under the umbrella of extended reality, or XR.

While the XR term is still emerging in mainstream usage, it encompasses VR, AR, MR, and any other future forms on the spectrum of entirely real to entirely virtual.

Potential Challenges

The incorporation of this technology could really help a museum. However, there are a lot of obstacles to consider before making such a large investment. According to Many Ding's study on augmented reality in museums, some important factors to consider are the museum's ability, the visitor's needs, and special requirements necessary for the exhibit. For those who have already implemented the technology, Ding recommends an effective evaluation process and creating awareness among patrons.³⁹ There are so many factors to consider, both before, during, and after the technology is incorporated. Between installation, development, maintenance costs, and trends in popularity, there are many potential challenges to consider before considering this new technology.

The first major roadblock is cost. If one is developing an AR experience, they may need to develop an app, which would probably require a new hire that knows how to develop an app, which is even more money out of the museum's funds. The museum could reach out to a company to help them design the experience, but the exhibit designers might be unsure about whether these non-historians can catch the vision of the exhibition. With a lot of money on the line, every expense counts, and the budget should be clear and concise before making final decisions. Another expense is obviously the hardware. Whether it be VR headsets or 3D hologram projectors, it is another addition to the cost. Thinking beyond that, a physical space would need to be developed for the experience, even if it were just a small area. Someone in

virtual reality gear will need to move around, and augmented reality may require reprinted artifact labels or new installations. Even with the falling cost of some technology, there is an accompanying cost that needs to be accounted for.

The next challenge is finding a purpose. What will this new technology be used for? An exhibit should not be designed around the technology; it will function better as an additional piece. For example, a designer's thought process should be that AR/VR technology would be a great addition in an exhibition on dinosaurs, not that a dinosaur exhibition could be made from AR/VR technology. This thought process, of course, is in a perfect scenario. What if the museum board demands to have the technology in their museum as soon as possible? Even if the funding is secured, if there is not a great idea, the experience could fall flat. A second layer of this is installation and position within an exhibit space. The design needs to flow around the rest of the exhibition. A museum should avoid using the technology as a gimmick or to appear more modern. Only when the technology can be implemented thoughtfully alongside an exhibition should it be considered.⁴⁰

A third challenge is perhaps the largest flaw of any technology: it can break. A set of VR headsets could be a great fit for an exhibition, but what happens when it stops working? The out of order sign should not stay up forever. Adequate funds need to be set aside for this inevitable moment. No matter how much the area is padded or the wires are checked, at some point in time the object will break, or the technology might experience an error. If the technology just remains broken for months, money is being wasted. Visitors want to get the full experience, and if the museum gives up on a certain aspect of an exhibit, especially an expensive one, it could spread a

negative message to visitors when they try to use the technology and it does not work. Issues will arise with any technology, and museum staff should be prepared to handle them when they arise.

One final problem to consider does not deal with the technology or the museum but with the visitors themselves. While an AR/VR experience may be exciting and attractive now, a new wave of technology could make that experience boring and uninteresting. For this scenario, the options need to be weighed and acknowledged. The technology will go out of style at some point, so the developers must decide if the original boost is worth the monetary cost. A larger museum may be able to constantly alter their AR/VR content for a new experience, but smaller museums and historic sites may not be as financially flexible. Another factor to consider is the capability for innovation. If the technology is being bought for a year-long exhibition, could the museum staff create new uses for it in later exhibitions? Do they have a contact in the tech world who is willing to create these programs? The initial boost of the technology will wear off, so the staff needs to be ready to either reuse the technology for another exhibit or create new experiences for that same installation.

AR/VR Options for Smaller Institutions

A lot of historic sites, historical societies, and small museums will face these problems at some point in time. These lower-level and low-budget institutions do not have the ability to create massive immersive AR and VR environments or partner with organizations who can. So, when attempting to implement this technology, any way to save money while still providing an experience is welcome.

One of those changes is a double-edged sword, that being the recent drop in price for VR headsets. The price of a HTC Vive Pro headset was cut in early 2020, dropping from \$799 to \$599.⁴¹ Mobile headsets, while only containing the operating power of a smartphone, are widely available for low prices. So, smaller institutions now have the capability to purchase this technology and possibly create an exciting experience. But with the lowered price, consumers also have easier access to this technology. With virtual reality losing a bit of its rarity, people are not as likely to visit a museum just to try out VR. With the supply heightened, the demand drops. So, a smaller museum really needs to consider if going into immersive technology for their exhibitions is worth it, or if funds should be allocated elsewhere, or even to a different form of technology.

If incorporating virtual or augmented reality into exhibitions is not in the cards, perhaps the technology can be used behind the scenes. Another way to utilize virtual reality is with 360-degree photography. This can be useful for both the public and the museum staff. With a 360 photo of an object and the right technology to pair, the object can be recreated in 3D. For museum staff, especially those in the archival department, this could save a lot of trouble if an artifact is requested. For example, if an outside researcher wished to see a trophy in a museum's archives, they would normally have to fly in to see it themselves, or have pictures sent to them. With 3D artifact scans, the researcher does not have to visit the museum at all, and the archival staff does not have to dig up the trophy to photograph a certain angle or look for a certain marking the researcher asked about. These 3D scans can also boost the online presence for a museum. For any online exhibits or online content that a museum wishes to make available, interactive 3D models are much more appealing and interactive than scrolling through images.

A 360 camera can also create a sneak peek into a museum. While these cameras may not create the sleek and super-clear VR tours mentioned earlier, it can be a frugal alternative. Like Google Maps' Street View feature, a single 360 image is taken in a certain location, which website visitors can view online, whether it be on their device or with a pair of VR goggles. The images could be from several locations: different exhibitions, the gift shop, popular artifacts, or a new exciting temporary exhibition. Historic sites can provide images of its most popular locations, whether it be the peaks of mountains or the inside of a log cabin. Publicizing these images should not hurt visitor numbers at all. Images of these locations have almost certainly been made public by former visitors or other professional photographers, so what is the concern with publicizing it under the historic site's brand? Again, anyone using these photos in VR may not be treated to a deeply immersive experience like the one at Yosemite, but any information is better than none. So, even on a tight budget, augmented and virtual reality can have a place in a museum or historic site.

Alternatives Outside AR/VR

The implementation of experimental technology like augmented and virtual reality can be risky and frightening, especially for those institutions with little room to fail. If this is the case, there are other avenues in which funds can be used. While this may not be as experimental or state-of-the-art as an AR/VR installation, these alternatives are solid and safer ways to create an immersive environment with technology.

One of the best forms of technology for a smaller budget are apps. The app might not be able to run AR technology, but it can still be a great resource. An app can include a map of the

museum, event times, exhibition summaries, detailed information on artifacts, and more. The app could also make use of quick response, or QR, codes. QR codes are a great option. These codes can be placed throughout a museum to bring up more information on an area, which saves space in the physical exhibit. If the budget is available, a museum can allow tablets to be rented with the app pre-downloaded for those who do not have a compatible device or need a bigger screen. Plus, if there is still a desire to sneak in some AR, markers could be included in an area of the museum, allowing for pictures with digital assets. These pictures could be purchased at a gift shop later, or a link could be sent if the subject lists their email address.

Sometimes just a developed website can be a great addition to a museum. Without a website, prospective visitors can be turned off immediately. There is absolutely no negative in adding a website, even if it may not be top-notch material. There are plenty of services that can help with website creation, so with some good pictures and helpful information, popularity could boost. A website is crucial to reach potential visitors, and AR/VR alternatives such as 360 photos would need to be on a museum website. Websites or apps can also provide additional information not found in the museum. A section of the site can provide links to further reading or related exhibitions, helping boost other museums with the same topics. The bottom line is that in today's digital age, websites have been around for a long time, and not having one is unacceptable and harmful to the institution.

Another way to add technology is with tablets, or just more screens. Tablets are great devices for giving access to a large amount of information. Within one tablet could be tens or even hundreds of screens of additional information. A tablet such as this gives its own immersive feeling, even if it does not involve an altered reality. Tablets or tabletop screens can be a great

place for activities like short educational games or interactive maps. Visitors can choose what they want to know more about, giving them a smaller form of interactivity wherein they choose what they experience.

Television screens may seem simple, but they are still a helpful form of technology for an exhibit. These screens are easy ways to play videos that are necessary for an exhibition. Screens can be used throughout a museum, whether they be showing ticket prices or a famous telecast. They are typically cheap and easy to install, so they are worth consideration if looking to incorporate technology in a small way.

When this mainstream technology just is not within reach, analog interactive exhibits are a tried and true formula, and have been accomplishing similar feats for decades. Whether it be speakers in a rainforest exhibit, molds of the footprints of prehistoric creatures, or a recreated Native American teepee, these installations can create an immersive atmosphere without the cost of immersive reality technology. The development price can come out much cheaper, with less need to replace expensive technology and a larger focus on the interior design of the exhibition.

Conclusion

For museums and historic sites, augmented and virtual reality can be a great addition. It provides an immersive and interactive environment for visitors to experience art or history. It allows for stories to be told in imaginative ways. However, it needs to be done carefully and with months or even years of consideration. Even with the technology becoming more accessible, the cost of developing experiences can be very high. If a museum wants to utilize this technology, it needs to be prepared and be smart. For one, the technology should not be the focus: it works

better as an additional piece of an exhibition. This way, if development goes wrong and the project must be canceled, the entire exhibit is not scrapped. Museums should continue to design exhibitions around physical artifacts and displays. Also, while the idea of innovation can be attractive, many smaller museums do not have the budget to experiment on their own, so waiting to observe what works with similar institutions could save money and jobs. To incorporate augmented and virtual reality, museums must consider cost, exhibit caution, and use the technology in a way that works well as an additional piece to an exhibition. Once all these factors have been taken into account, augmented and virtual reality can be an amazing tool for museums.

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Appendix

A. “AR/VR Technology in Your Museum: How to Best Incorporate Emerging Technology”

During my first semester of working on this thesis, I was also working on my capstone project for my minor in Digital Media. I wanted to create a capstone that related to a certain area of my thesis. So, I created an informative brochure for small-budget museums on augmented and virtual reality. I felt this could become a great companion piece to my thesis, as an eight-page brochure such as this is more digestible than a large thesis. The brochure touches on a lot of the basics of what this technology is and what is possible with it, but it also puts a focus on helping educate the staff of small museums. This can inform them on the steps they should take if they are looking to incorporate this technology, as well as some alternatives if AR/VR is not quite in their best interest right now. The sheets of the brochure are included below.

AR/VR Technology in Your Museum



HOW TO BEST INCORPORATE EMERGING TECHNOLOGY

by Noah Nobbe

What is AR/VR?

Virtual Reality

Virtual reality is an **artificial environment** that is experienced through a computer or other technology in which one's real-world actions determine what happens within the artificial world.

Augmented Reality

Augmented reality is an **enhanced version of reality** created by using technology to overlay information over a real-life image or object when viewed through a device (smartphone, tablet, etc.)

Reasons to Incorporate

More Visitors

For any museum nowadays, attracting visitors has become a difficult task. Basically any idea to bring in more guests is worth trying. With the incorporation of new and exciting technology, visitors both old and new will be tempted to check out the museum and all it has to offer.

Innovating the Museum World

Just like any profession, innovation is good for the sake of expanding attainability. Innovation with this emerging technology can lead to new ideas and new mechanics that couldn't be imagined just decades ago.

Potential Challenges

Of course, this technology, and others like it, aren't always easy to install or maintain. There are a number of possible challenges.

Cost

This entire process isn't cheap. The AR/VR tech itself isn't cheap, and the process of developing content for that new tech takes time. You shouldn't throw a lot of money into a new piece of tech without having a solid and firmly laid-out plan to incorporate it into your museum space.

Broken/Malfunctioning Technology

Another challenge of technology is that it doesn't always work. You've almost certainly seen "Out of Order" signs over a piece of tech at an exhibit before, maybe even your own. Hopefully most of these issues can be fixed with some slight repairs (which can also add up in cost), but if an accident occurs or the tech stops working altogether, a lot of money goes down the drain.

Going Out of Style

Tech can go out of style just like fashion. AR may be intriguing now, but a decade or two down the line it may be old news. You just have to weigh the options of whether the boost now will be worth it, as well as if you will be able to continue innovating with this technology in your exhibits for years to come, especially for museums with less funds.

Examples

Virtual/Online Museums



Virtual museums can be an additional piece of a museum, or recreate a site entirely. This is more common for historic sites, in cases where many people cannot experience it because of its location. Online museums can also build interest in drawing more visitors who wish to see it with their own eyes.

AR Exhibit Additions & Translations



Using AR through a medium, more information can be shown about an artifact by placing images overtop the artifact. This can include showing the body of a dinosaur over its bones or having pop-up videos about the object. This can also translate text in exhibitions to other languages.

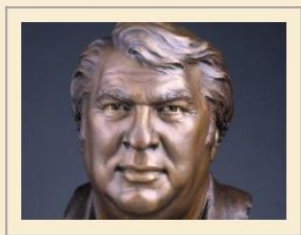
VR Guided Tours



The evolution of audio tours, VR tours can incorporate information that would only be found on a guided tour, allowing for additional information to be available to any visitor. The environment can also be altered to include immersive environment to expand exhibits beyond the physical.

Examples (cont.)

Intelligent & Responsive AI in AR



The company StatMuse has developed a program that animates the Hall of Fame bust of John Madden. When viewed through a device, the bust will move and answer visitors' questions. Madden's voice and facial expressions all go into this, and hours of storytelling are available.

VR Expanding on Non-Physical Exhibitions



When an exhibit cannot fully immerse a visitor in its world, VR can accomplish what it cannot. The Moesgaard Museum in Denmark uses VR headsets to show what the world looked like in the early years of human existence within their own physical exhibit.

Art Museum AR Takeovers



At art museums such as MOMA, renegade artists created an AR app that uses artwork as markers to display these artists' content, adding another layer to the works. There are arguments both for and against this, but it does draw more interest for the museum, even if it isn't for its own exhibits per se.

Alternatives for Smaller Museums

Obviously, not every museum or historic site is able to fund the development of such astounding technology.

However, there are other avenues in which technology can be used to draw in visitors and create an immersive and educational environment.

Tablets/Apps



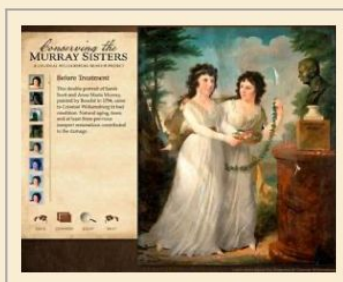
One of the cheapest forms of technology for a smaller budget is apps and tablets. Your app might not be able to run AR technology, but it can still be a great resource. An app can include a map of the museum, event times, exhibition summaries, detailed information on artifacts, and more. If the budget is available, you can even allow tablets or smartphones to be rented out with the app pre-downloaded for those who don't have a smartphone or need a bigger screen. QR codes can also be placed throughout your museum to bring up more information on an area if a visitor desires to learn more, which also saves space in the physical exhibit.

Analog Interactive



When technology just isn't within reach, analog interactive exhibits have been accomplishing similar feats for decades. Whether it be the sounds in a rainforest exhibit, molds of prehistoric animal feet, or life-size replicas of living spaces, analog exhibitions can still immerse visitors in an exhibit, with a much cheaper development price.

Online Extension



Sometimes just a developed website can be a great addition to a museum. Besides offering a place to find locations, times, and exhibit dates, it can offer 360 degree images of artifacts as well as exhibits themselves. While this may seem antithetical to drawing visitors to your museum, having these resources tends to draw more visitors wishing to see exhibits for themselves. Websites or apps can also provide additional information not found in the museum, leading to more curiosity and more visits.

Taking Your Next Step

In short, AR/VR technology is astounding. Innovations are constantly being made in the medium, so there's a chance a lot of this technology will be old news a decade from now. However, right now, taking steps with this technology while it's fresh and finding extraordinary new uses for it is one of the best ways to attract new visitors and keep the old ones coming back for more.

Without the means for such innovation, smaller museums can still use similar technology to draw in visitors. This can be accomplished through many different avenues, and any innovation, even without AR/VR, will bring a good chance of increased interest in your museum.

For More Information

For more information, there are a number of sites through which you can find out more about both AR/VR within public history and the places listed within this pamphlet.

National Council on Public History

- ncph.org

StatMuse Inc.

- statmuse.com

Moesgaard Museum

- moesgaardmuseum.dk/en

Pro Football Hall of Fame

- profootballhof.com