

Project in Lieu of Thesis

Presented to the College of Fine Arts of the University of Florida

In Partial Fulfillment of the Requirements for the

Degree of Master of Arts

The Art of the Museum

By

Michael Baksh

May 2013

Dr. Angelos Barmpoutis

Dr. Benjamin DeVane

Digital Worlds Institute

Digital Arts and Sciences

Abstract

Museums are popular forms of education and entertainment for people around the world. They are beginning to incorporate more technology to display information and grab an individual's attention. I believe that the next step in this evolution will be a completely virtual museum. Similar forms of media exist today but they are limited by the constraints of time and technology. I am developing a relatively quick and efficient way to create a 3 Dimensional (3D) museum and incorporate it into a videogame engine to make it user friendly and interactive. Users will be able to explore existing or fictional museums similar to the way they would navigate modern videogame environments.

Introduction

Even though museums are popular not everyone is able to access them for various reasons. Virtual museums give access to many people who would otherwise not be able to benefit from them. Arranging a virtual museum like a videogame would be beneficial because it would use the teaching abilities of games to make it fun and engaging for all users. Creating virtual versions of existing museums or making completely new ones will give the opportunity to showcase pieces of work in new and interesting ways. Museums will be able to create a database of their assets in virtual reality to preserve their pieces and to allow researchers the ability to study them without being present. Digital databases of research assets would allow people from around the world to study material that they might not have access to. Virtual museums would also be a good way for private artists to display their work in an unconventional manner. A virtual environment is especially good for people applying for jobs in the gaming or simulation industry. It would allow them to display a wide range of work and abilities in one demo package.

The primary function of this project is to capture and display 3D works in a virtual environment. This concept can be used for many different implementations; one such use is as an educational resource and digital database for the preservation of artistic and historic works. This process also has the ability to capture and display mechanical parts with astounding accuracy; this would be useful for the simulation and training industries. Virtual environments have a wide range of uses for museums in particular because of their ability to archive information and make it readily available for public use (Wachowiak & Karas 2009). Creating a virtual environment requires movement controls that allow the user the ability to navigate and explore the desired world. I decided to model my project after a computer videogame in terms of design and mechanics. According to the Department of Labor Statistics, children ages 15 to 19 spend more time participating in computer based leisure than in educational related matters (USDL, 2012). I believe that there can be a way to incorporate educational values into the extracurricular activities children tend to engage in the most. My intent is to create a virtual environment that will be engaging to a diverse audience. I want to allow people from around the world to enjoy a museum setting and learn something new in a unique and engaging manner. This program is also a good way to keep students and educators engaged in a fun learning process by disguising it as a game.

There are similar projects out there that are similar in design but different in execution. They succeed in certain aspects like aesthetics and fall short in others such as conception. Some people have created museums in *Second Life*, which is a perpetual virtual social environment where users can build things and share them with others as well as interact with each other. There are many limitations to what can be implemented by this program, which is a problem with all technology based media. *Second Life* brings in a social factor that is a good way to share

information and ideas between users. This program's major setback is its' inability to program interactions and also limits the amount of data that can be uploaded and displayed. There are other programs that are capable of much more complexity and detail. *Second Life* allows users the ability to import 3D models that they make, but due to bandwidth limitations these models have to be relatively simple. Because of this, *Second Life* design is limited and relies on basic shapes with images projected onto it; this is good for displaying paintings or pictures but not good for 3D pieces. *Google* has created a method for capturing physical museums in a similar fashion to their map program (Proctor, 2011). This process uses a movable robot affixed with multiple cameras all around it that records the visual data and constructs what appears to be a 3D environment. The users can explore certain historical museums and traverse the environment by clicking and being teleported to that location. This can give the appearance of a 3D environment and 3D objects but without actually having dimensionality and the ability to view the work from multiple angles. Using these robots to record the visual information is expensive and they have only recorded a small number of very popular museums. It is a very useful process but not very practical for everyone to use and lacks details of other scanning methods. Other online museums use a panoramic picture that revolves from a central position and captures the museum from a single point which limits the user's interactivity and immersion level. The most successful of these projects are the *Guggenheim Virtual Museum* and the *Museum of London* virtual exhibitions. These programs implement full 3D environments and display 2D and 3D virtual pieces. The 3D objects are reconstructions that are built using a different 3D modeling software package, the most common are *Autodesk Maya*, *3D Studio Max*, *Cinema 4D* and *Blender*. Creating assets with a modeling program makes for very good looking models but it relies on the skills of a 3D artist to recreate another artist's work. The 3D modeling process takes a lot of time

and dedication as well as resources to accomplish. 3D scanning follows a similar process but allows for quicker capture and creation with greater detailed accuracy. Using 3D scanners can take some time to learn and develop enough skills to capture objects well. As the technology becomes more available it is becoming easier to use and soon nearly anyone can learn and master this process with enough practice. The scanning process can be messy, but it is capable of capturing 3D objects with extreme accuracy. This is beneficial for researchers studying a particular piece and needing as much details as possible. I learned a lot from these projects and have incorporated some of their concepts into my project. The problem was to determine what aspects to include from other similar projects and what to omit. The benefit from studying other projects allows me to imitate their strengths and remove their weaknesses.

The final goal for my project is that it not be limited to just displaying models for people to interact with, but also to be used as an interactive educational tool. Most virtual environments are designed for displaying 3D historic pieces and are predominately created to show off the architecture and the pieces on display. They are not created with the intent to be a resource for researchers or to be used as an educational tool useful for a variety of users. The navigation method I chose to use is similar to a computer videogame and would be familiar and fun for younger users to interact with. A database function would give people the possibility to navigate directly to the desired work and view the object and its information in a window interface. This would be a supplemental feature that would be useful for people trying to study a particular object and are not interested in superfluous information. Not all users will have the same levels of competency in every area of usage. People interested in research would more likely use the database function and not rely on the ability to navigate through the spaces. Student users would tend to treat the experience more like a videogame and play it as such. This particular process of

game design can be used to teach a subject such as history or art in an engaging and dynamic manner. Using 3D capture technology allows for a quick and precise method of digitizing objects. As the scanning technology becomes more readily available people will be able to capture their personal works or other objects that they might want to display. Detailed models of mechanical creations can be captured by this process allowing for different communities to be added to the list of potential users. All of these processes work towards the goal of the preservation of art, history and technology. Allowing users the chance to actively participate in the development and maintenance of their communities facilitates its growth and worth. It also encourages collaboration and maturation for the subject through the sharing and facilitation of information. Creating a dynamic experience for users to enjoy separates most of the existing programs from what I am trying to accomplish. While some designs are very well executed they lack user interactivity and interaction with the environment and objects. Those that do incorporate this feature have limitations in their execution and have the least amount of detail and capabilities. My project attempts to balance the aesthetics and usability to create an environment where a user can explore, learn, and interact with the subject matter and other users.

Digitally created environments have been used very frequently this century thanks to the pioneers of the 80's and 90's who started the 3D revolution. Now 3D assets are used in a number of different applications and disciplines. Because 3D technology is used so widely it would be very useful to have a library of objects available for research. Museums are indispensable for the preservations and presentation of historic and artistic artifacts. In this digital age many museums are incorporating digital displays and other interactive works that can grab and hold the attention of the attendants. With the constant incorporation of technological assets the next logical step would be an entirely digital environment. In these 3D spaces where people can gather and

interact with each other as well as the objects around them, users will be able to upload their own works for others to view and comment on. According to “Moore’s Law” technology doubles every two years and tends to get cheaper and more available to the general public. With current technology it is possible to create an interactive virtual world with a small budget. It will continue to be more efficient as the technology becomes readily available and cheaper for the regular people to obtain. People can use a variety of free programs and applications to capture and display 2D and 3D assets in an online environment. Such processes give people the opportunity to digitize and display their own work for any number of needs. Museums are valuable cultural assets of our modern society and I do not believe that they can be replaced by anything virtual, but they can be enhanced and supplemented by such applications.

Access to online databases is easily accomplished and are accessed regularly all around the world. People share information and ideas on various topics and subjects with the use of file sharing programs and social sites. The interaction shared in these online spaces creates communities of individuals with similar interest. Collaborative groups are formed around communities with similar interests and goals who work together to achieve a greater purpose (Black & Reich, 2012). Social spaces are not generally designed to be used by students for learning purposes or for professional purposes. The concept of creating a virtual museum is to bring the attraction to people who would not be able to access them in another way. The attendance of online museum patrons has steadily increased over the past few years and they are valuable at preserving cultural artifacts of their community. With the availability of online resources for everyone to access whenever they want to, some museums would be better off with a digital presence to improve their accessibility. The concept of a perpetual environment has been around for many years and was pioneered by Massive Multiplayer Online Games (MMO)

like *World of Warcraft* and social spaces like *Second Life*. These virtual worlds give people constant access to a space created to display a particular set of information and allows for interaction with other peers. The concept of a digital museum is to bring together people with common interests to share an experience. My idea is to make online museums more sociable and allow people to share the experience together and learn from each other. These concepts can be applied to educational or research purposes. Researchers would benefit from instantaneous communications with peers and gives them more information on demand. Discerning knowledge and information can be done through many different processes but for people studying a common artifact the ability to view the piece and discuss it is extremely valuable. Giving access to rare or uncommon artifacts allows for people with limited or no access to that material a chance to view it in the best possible way without having to be physically present. Social interaction is also a valuable educational tool that is capable of teaching many lessons. Students can engage each other in discussions about the material presented to them and while they are just idly chatting they are facilitating the learning process without being forced to do so. The voluntary action of playing in a virtual environment and engaging in social actions related to the experience makes play time an educational experience.

Method

Creating assets in 3D is a costly and time consuming process. Currently the 3D capturing technologies are also relatively expensive and difficult to operate. Handheld scanners can range from a few hundred to a few thousand dollars and, stationary laser scanners cost even more. There are some companies such as 3DScanCo and Laser Design Inc. that perform scanning services for a large sum and restrict the size of the object scanned. Laser scanning is a more accurate form of scanning technology but requires the use of specialized attachments to scan

large objects. Laser scanning is not a practical method for those on a low budget, but it does have its' benefits and uses. Recently there have been some breakthroughs in the scanning process which makes personal scanning easier and very inexpensive. The *Autodesk* software company has developed an application for mobile devices that use the camera function to record a physical sculpture 360 degrees around and processes the images together to create a 3D object. The program *Autodesk 123D* is free to own and only costs a few dollars for someone to export a captured model to an editable format. Other similar processes take a lot of 2D images and merge them together to form 3D representation of the captured images. As the technology becomes more available the cost will go down and more people will be able to perform these operations. Soon we will be able to use a digital camera or similar device to perform the same action. Similar functions can be achieved with the use of web cameras and even the *Microsoft Kinect*, both of which are not nearly as expensive as buying your own scanner or renting one. The quality is not on par with the expensive devices currently, but they are very close and are capable of capturing an accurate account of the scanned object. For a fraction of the time and cost a regular person can have access to virtual scanning technology. The other technologies required to refine and display objects online are also available for free or at a low cost. The generosity of companies like *Autodesk* to distribute free programs allows for a larger number of people to have access to valuable technology that is necessary to the digital process.



(Me scanning one of my sculptures using the *Artec* scanning device)

Creating any type of digital environment is a difficult endeavor that requires a lot of time and dedication. For a project like this one, a number of 3D assets would be scanned or created then imported into the game engine *Unity*. After assets are brought into the game engine then some basic programming is done to establish movement controls and collision detection. The process of creating objects in 3D is a tedious task that requires lots of time and patience. To accomplish this I will use the program *Maya* created by *Autodesk*. *Maya* and its counterpart *3D Studio Max* is generally very expensive and available to professionals only. *Autodesk* has allowed students to obtain a three year license for educational purposes which gave me access to a familiar program for free. There are free versions of a similar software, namely *Blender* which is not industry standard but it is very popular in the private sector. 3D modeling software is used by the videogame and film industries to create computer generated objects and animations. I have used 3D modeling programs for many years and am proficient in traditional box modeling and 3D sculpting using *Autodesk Mudbox*. I use different modeling techniques to make assets

that are later exported to function in a game engine. Most preliminary modeling is handled in *Maya* is then exported to *Mudbox* to be sculpted and refined to the highest quality. A lot of detail can be created using a 3D sculpting program such as *Mudbox* or *ZBrush*, but it requires a lot of time and attention to create; a 3D scan can do a more precise job in a fraction of the time. The ability to use a sculpting program is very beneficial for game and film industries but it also makes the use of the *Artec* program much easier and more intuitive since they share similar tool sets.

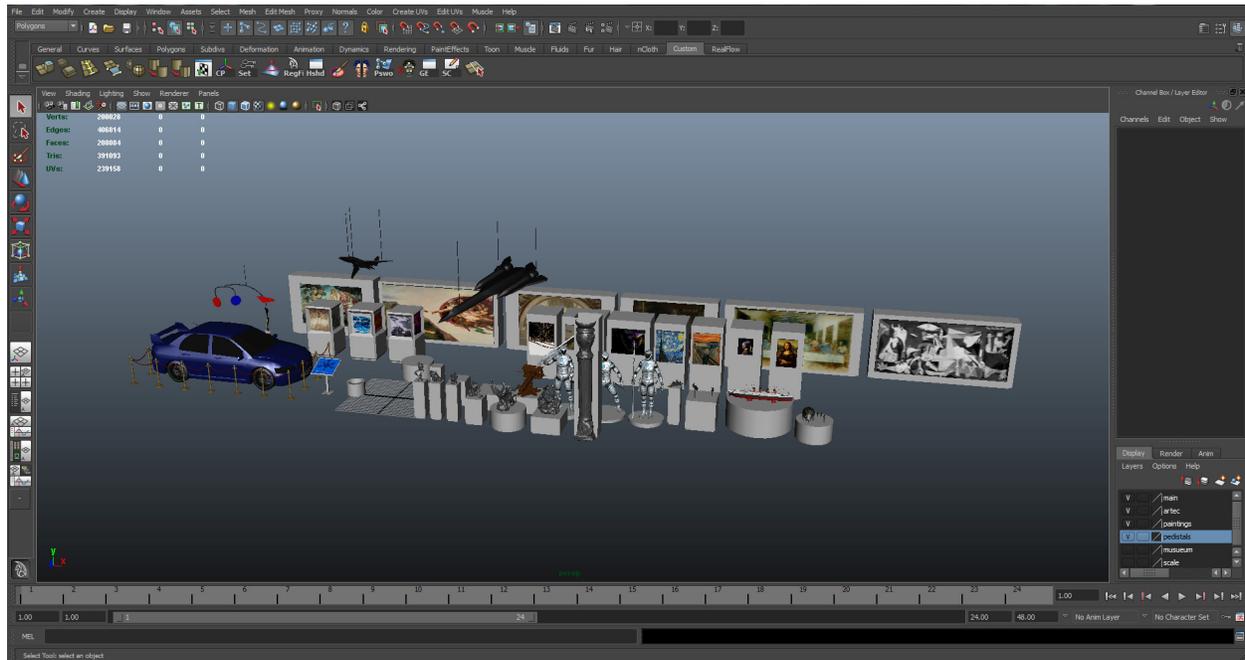
The works that I created have been modeled for other projects and will be used as exhibits in my virtual museum. There are some custom pieces that I created specifically for this project to show a variety of my abilities. My models were mostly created from a single cube that was molded and sculpted into the desired object; this process takes a lot of time and attention to detail. 3D scanning is a valuable part of this project and relies on the use of an *Artec* 3D scanner which is an expensive piece of equipment that can scan and recreate an object in 3D requiring a lot less time and effort than traditional modeling. The *Artec* scanner projects an infrared grid onto an object and uses a depth camera to determine the high and low points of the object while taking a number of photographs that are used as the texture. After an object is scanned it must be processed by running the scan through a series of algorithms that turns the initial scan from a point cloud model to a mesh based object. Once it is a mesh orientated object I can perform a series of clean up procedures including smoothing and erasing incorrect topography and rebuilding distorted parts of the mesh. Similar to traditional modeling techniques a texture is applied after the model has been created. The *Artec* program uses the images captured to form a seamless texture that is photorealistic. Texturing an object in this way has greater accuracy than other methods but it is difficult to export that texture into a game engine. I avoided this problem

by applying a metallic grey material to the scanned objects which shows the user the detail and polygon topography of the object. Normally objects would be smooth and textured to show off all of the components of the object. The final step in the process is to bring all these assets into a game engine and program them to have interaction capabilities. I chose *Unity*, a game engine developed by *Unity Technologies*, for the ease of use and the purpose of cross-platform game development. The *Unity* program has a free version that has many limitations on its capabilities and a professional version that is relatively cheap and effective. For my purposes the free version is sufficient but it forces me to constrain my project to the limitations presented to me. Learning *Unity* was easy because its interface is similar to other programs I have used. Game Engines also allow for the use of a variety of scripting languages including *Python*, *Java script*, *C#* and many others. Coding allows for the creation of interaction and usability. I was able to create a first person controller that simulates a person walking and made it controllable by mouse and keyboard combination. The user controls this unit to move around the museum I built and view the assets that were imported and placed in the scene. I was then able to export my work as a standalone executable program that can be run on many different computers. I have had to use other programs such as *Adobe Photoshop* and *Crazy Bump* as needed to create textures and maps. These programs are used regularly in different industries to manipulate and create images that are used to project an image onto a 3D object. 3D artists have to be able to use a variety of programs and have more than a basic understanding of them to properly use them together. Some of these programs can speak to each other, this streamlines the production process but it is still a tedious process.

I have experience with creating 3D models and have been doing so for more than eight years. I have modeled a variety of objects, including a human character, a car and a few

historical recreations. My modeling style relies on the use of reference images and precise measurements to recreate objects such as the *HMS Lusitania*, and the *SR-71 Blackbird*, which are some of the models in my museum. I know how to work within the constraints of the program to create the best possible pieces that I possibly can. Though I have worked with the *Artec Scanner* for only two years I have learned a lot of tips, tricks and shortcuts to operate the scanner and its accompanying software effectively. They are easy to operate, but they are difficult to master; a goal I am striving towards. I am learning new techniques and new methods that will make the process more efficient and streamlined. My experiences gave me the knowledge and ability to create virtual environments and objects to populate the space effectively. I have created numerous models and environments of various types for different projects and assignments which gives me a broad range of design knowledge for these assets. Mostly, I enjoy creating historic works or modern mechanical objects which is clearly visible in the type of assets in my virtual museum. I have a library of ready objects to choose from to incorporate into the *Unity* game engine. To keep this project simple I did not include all of the models I created, but attempted to display a variety of works, mostly my own. Use of the *Unity* engine is the final step in the creation process and though I'm not an expert at this, but I have the ability to use the engine to complete my projects. I made animated shorts and I relied on the use of *Adobe After Effects* for video editing and special effects program. The post process for animation and videogames is completely different and requires a diverse frame of mind. The two processes share similar advantages and disadvantages so I tend to treat the similar. In creating both I have incorporated an audio element that creates a calming atmosphere that the player would enjoy to be in. When using a game engine programming allows for the creation of intractability and real-time physics. Interaction is the major advantage that videogames have over other forms of media.

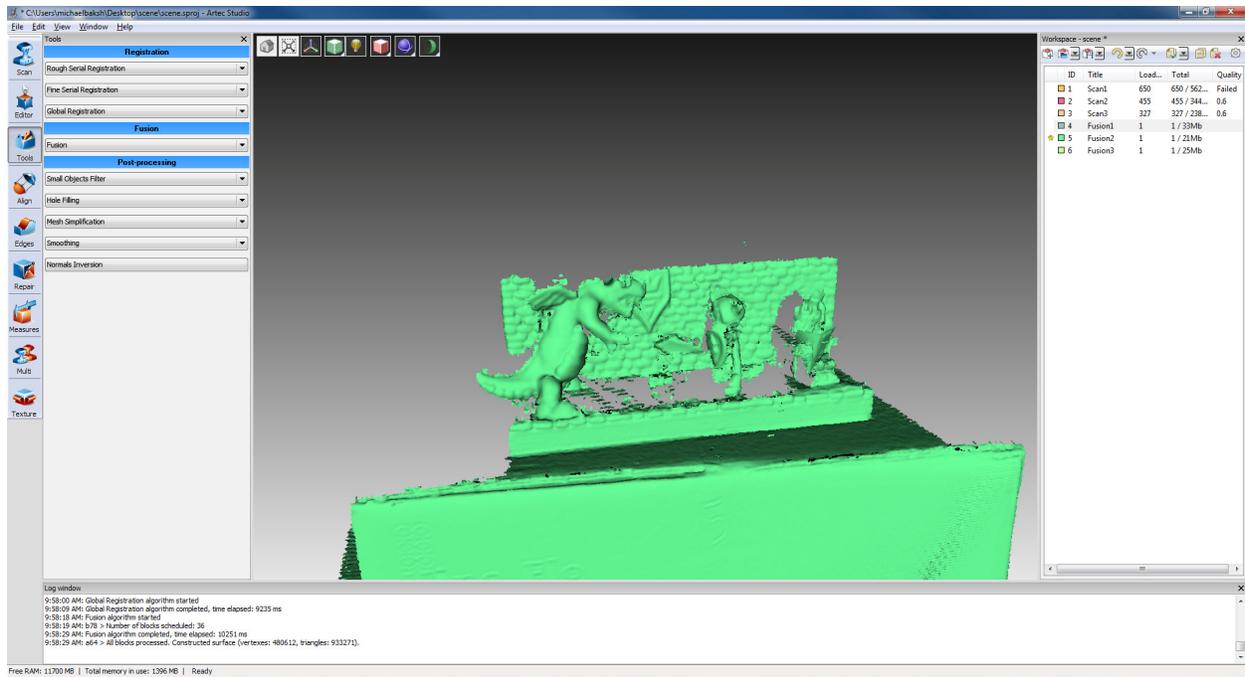
Learning how to use the program is easy because of the extensive online community and plethora of training material available for free. It takes a lot of time and dedication to learn and apply these skills in any scenario.



(Autodesk Maya and the models that I have included into my project)

I have experience with a number of various programs for pre-production, production and post-production work. I digitally created many historical works, including a Roman style Ballista and a conceptualization of the Hagia Sophia Mosque in Istanbul. Some of my other works include the reconstruction of modern airplanes and other mechanical devices. Along with some paintings and 3D scans I want to show as many different styles as the *Unity* editor can handle and display without crashing. My objects have their own places on display within various rooms of the digital museum. This gives me a way to show my work to potential clients or employers in a distinctive fashion. On display will also be some scans of various objects, some are my sculptures and some of the 3D scans were created by the *Artec* group and is available on their website. Complicated sculptured or mechanical objects are notoriously difficult to create

and require a lot of time and effort to produce accurately. Using 3D capture software the process of recording and refining objects requires only a fraction of the time and creates a very detailed model. The *Artec* scanner is capable of scanning an object using multiple passes to capture it from many different angles. If an object is very large it will require multiple scans from different angles. Those scans are refined using a few complicated algorithms and then aligned by setting anchor points and destination coordinates. The scans are then merged together to form a 3D mesh and finally has a texture applied to it. Similar processes can replicate an ornate object with astounding accuracy, which is very important when imaging detailed historic artifacts. Scanned models are not perfect and require some refining and polishing to be able to import into a game engine. Models scanned are never as refined and smooth as something created through traditional modeling but because of time restrictions, scanned meshes can capture minute details quickly and easily. Displaying these artifacts with the correct accuracy requires a program capable of handling multiple computing factors. Such factors include the calculation of “normal maps” which takes into account of the angle and direction of light and bends it according to the contours of the displayed object. Depiction of complex assets in games and movies rely on this process that reduces the amount of rendering time it takes to calculate and display every object in a scene. Light effects are necessary to create a realistic illusion; unfortunately the free version of *Unity* does not allow me to cast shadows since that render process is only available in the pro version. Game engines are designed to work with polygon models and are capable of creating real-time dynamics, physics and interaction.



(Artec Studio displaying a 3D scan of my narrative sculpture)

Using 3D modeling programs I can create any design wanted as a medium to display assets. Since this is my first attempt of creating an intractable virtual environment, I decided that it would be best to stick to the basics and have a working product. The layout of my museum is simple by any standards but is easy to navigate and an efficient design to showcase all of the models that I would like. My design is a wheel and spoke layout with exhibits on the end of each branch. This simple layout is mainly to determine if it can work and for convenience. I included a diagram of the layout for users to follow but it is not necessary since it is designed to be as easy and straight forward as possible. Keeping the design of the museum simple allows me to have some very complex models in the scene without creating long loading times. Some interesting settings for a virtual museum would be an outdoor environment populated with computer generated foliage which could be an artistic instillation in itself. Since virtual environments do not need to abide by the laws of physics any design or imagined creation can be built, even a surrealistic setting that could not exist in real-life. Another possibility is to reconstruct an

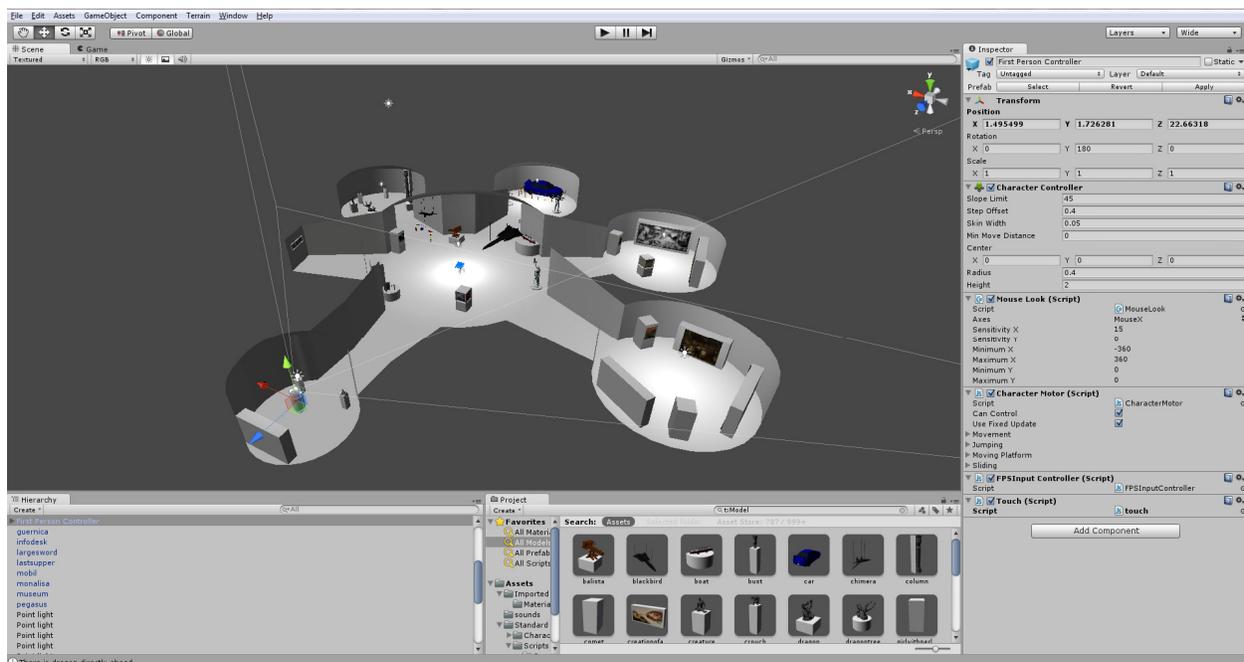
archeological site and have it populated with artifacts found at the site. A site such as the tomb chambers of the Pharos could be easily laid out and populated with scans or reconstructions of the objects found at that location. Recording techniques like this would be very useful for researchers trying to keep their work organized and orderly while maintaining the maximum amount of accuracy. A deep level of emersion would give users the ability to step into the shoes of the people actually there or even the people that created it. Interaction and sociability are popular ways to get students interested in learning. It is also a popular method of data organization and retrieval. Social communities designed around period themes would be useful tools for studying, especially if populated with artifacts of the time. For professional users no scene view would be necessary just an index of assets and a way to view them 360 degrees and be able to zoom in/out. Many programs or scripting languages could accomplish this but game engines are designed to run complex models with lights and textures. Using these features as well as a first-person navigation tool for movement controls allows for an interactive and immersive environment. The main focus of my project is to display the assets in an interesting manner that can be used and enjoyed by a variety of people. I drew inspiration from many sources for the look and feel of my environment but mainly from my favorite works and museums. The *Guggenheim* and *Museum of London* were my greatest inspirations for the color pallet and layout design. I used a simple color schemes with black, white and grey tones extensively. I believe a simple color scheme takes focus away from the environment and draws attention to the colorful and design intensive objects. Even some of the 3D models have simple textures applied to them to but they are so detailed that the user focuses on the model instead of the color. I have included some paintings and drawings done by famous artists to illustrate the ability to reproduce historical pieces and display them effectively. Game engines are so useful

because they can apply a “bump map” to the painting based on a grayscale version of the image; this simulates positive and negative space on a surface and can give the illusion of brush strokes on the canvas. Details like these are necessary to create a realistic illusion that aids in the understanding and evaluating the complex details and nuances of any artifact.

Virtual museums are best published online to make them readily available for people to use. Access and availability of online resources makes it a perfect platform for research and education purposes. The ability to access my digital museum would be great for online use but I made it so that it can be downloaded and ran without an internet connection. The ultimate goal of my project is to make it available online for people to use and interact with by participating in social communities based on the content of the environments. I believe *Second Life* is good at giving users a space for them to interact with each other and build objects and environments as they like. *Second Life* has declined in popularity but is still used by a variety of people and can be used as an educational tool if utilized properly. (Wauters, 2009). It seems that the existing material out there is well done but each of them could use elements from other programs to make them better tools. My prototype incorporates some of the elements necessary for it to be a useful educational device. The major function that it lacks is the ability to share and update information which would be a valuable addition to any research and education program.

The navigation controls for my application is a basic setup that would be familiar to anyone who plays computer videogames. Users can move with the “W”, “S”, “A”, and “D” keys or the arrows on the keyboard. The mouse controls the ability to look around and the left mouse button interacts with objects. These controls are understood by younger audiences and fun for them to use. For other people who might not have as much experience with this form of navigation other forms of data visualization would be useful. Many videogames have a log of

terminology and assets that is viewable in the game as a way to gain a deeper insight into those creations. For example many of the modern Final Fantasy games have a “Bestiary”, that is a list of all the monsters you have engaged, and allows you to read about their stats and information. A feature such as this would be an easy way to view and learn about any 3D object, making it easy to use for anyone. Displaying assets that way is very efficient but quite boring and not very engaging. A database mode would be more useful for researchers when they need to access information quickly and effectively, but for other users the act of engaging the environment is part of the experience. *Google* has digitized some famous museums and they use a click and move control that warps the user to the location that they click on. Controls like this are very interesting but lacks the same amount of interaction traditional controls implement.



(Unity Game Engine with all my assets in the museum setting and a camera controller)

For my final publication I have released a standalone application that can be run on nearly any modern computer. Included is a set of various art works and historic pieces depicting a range of styles and techniques. Some of the models include famous paintings from throughout

history such as the *Mona Lisa* and *The Last Supper* both by Leonardo da Vinci. Most of the 3D models were created by me in a 3D package or a scan of my personal sculptures. I have included some models scanned by the *Artec Company* to display some of the capabilities of 3D scanning technology. The artwork that is not my own is not copyrighted and the *Artec Company* grants permission to display the sample work they have available free online on their website. All of these assets represent a few types of work that can be displayed in a 3D environment. Many of the 3D scans are very complex and require a lot of processing power to calculate, but the game engine *Unity* handles them easily. Having all these assets on display at once is not a problem for a standalone application but for use on the internet, models would have to be simplified to save on loading times. In my web version all assets are loaded upon startup and can take a few seconds to load with a decent internet connection. More assets can be loaded into a scene if they are separated into multiple rooms that only appear when the player enters the area. This can be supplemented with a function that can load a high quality render of the object upon request. This feature is very valuable but not necessarily needed when creating a virtual environment for 3D assets; it is more valuable as an organizational device. Also a downloadable version would allow a higher quality version and it would allow people to access certain information even if offline. This is what the standalone executable version of my project demonstrates. For users studying various artifacts the accessibility and quality of the detail is necessary to determine a number of different factors in any given piece of work.



(Virtual Museum as seen from the game window)

Results

Users are able to explore my virtual museum and view a variety of different works in a few small exhibits. Two of these exhibits display some of the most famous paintings in history as well as a few of my own works. I have included a gallery comprised of scans by the *Artec* Company as well as a few sculptures that I have created and digitized. The rest of the museum is comprised of a few works that I have created specifically for this museum or have created for past projects. There is also a closed wing of the museum because it seems every time I visit a museum the exhibit that I really want to see is always closed. Limitations due to time prevented me from implementing some of the optional features that I would have liked to incorporate to

determine if they worked and were viable functions. Unfortunately the free version of *Unity* is limited to what I could have implemented. I have determined through my experience that it is always better to have a simple working product than a complex program that does not work properly. Because of this, I have limited the amount of interaction in this piece but the methodology has proven to be viable. It is possible to create a template for other museums to be created in a virtual environment. The use of scanners has greatly sped up the process of capturing and creating complex works digitally. Assets that could be digitized and uploaded to a database would not be limited to only historic and artistic pieces but other mechanical parts such as transmissions and carburetors. A database of mechanical objects would be useful for a number of applications including displaying the products for potential buyers or students learning about the products. The training and simulation industries could greatly benefit from an educational database of assets that can accessed at anytime. Increasing the amount of objects in a digital library will increase the number of different users who could benefit from these applications.

My goal for this project is to create a virtual museum displaying a variety of different assets while utilizing a scanning device and a game engine. I managed to scan and upload a number of objects using the *Artec* 3D scanner. I have also created a lot of material in 3D using *Autodesk Maya* and have implemented these assets into the *Unity* Game Engine. I created a standalone application and web version that can be used on any modern computer and is intended for a variety of users. Primarily it is designed as a method to display 2D and 3D assets in a virtual environment that could be used as an educational tool. The movement controls and mechanics are derived from computer based videogames and are well suited for a younger audience. Scanning and processing assets has proven to be a quick and efficient method to digitize physical objects into a virtual space. With new advancements in scanning, the

technology is becoming cheaper and more readily available to everyone. Museums and other institutions would be able to digitize and upload assets to a virtual environment for preservation purposes and allows anyone to access them anytime. My intent is to have a space where people can study and learn about historic, artistic and mechanical objects and ideas in a fun and engaging manner. The potential uses for this type of system can be extended to many different uses including the simulation and training industries as well as research and documentation purposes. Digitizing various assets is technology's way to preserve and display assets, allowing for a wide audience access to materials that are not otherwise accessible. Virtual environments are great tools for social interaction but could be used more as an educational tool. Combining the social and educational components in an environment that is familiar to users is a good method to merge the concepts into a single program. Virtual museums are becoming a popular form of media and as technology progresses it is becoming easier to create them. I believe that my method of using a combination of 3D scanners, hard surface modeling and game engines is a very efficient and practical method of creating virtual environments populated with a variety of digital assets. Virtual museums will be a helpful tool for many people especially for documentation, research and educational purposes.

References

3DScanCo (2012). 3D Laser Scanning Services. Retrieved from

<http://www.3dscanco.com/services/3d-scanning.cfm?gclid=CKjvi-CLsbUCFQ3nnAodEEwABQ>

Artec Group (2013). Artec 3D Scanners. Retrieved from

<http://www.artec3d.com/>

Autodesk (2013). Imagine. Design. Create. 3D Design, Engineering and Entertainment Software and Services. Retrieved from

<http://www.autodesk.com/>

Black, R., & Reich, S. (2012). Culture and Community in a Virtual World for Young Children.

Games, Learning, and Society Learning and Meaning in the Digital Age, 14, 210-229.

Linden Research, Inc. (1999). Second Life Your World. Your Imagination. Retrieved from

<http://secondlife.com/>

Microsoft Corporation (1975). Kinect for Windows. Retrieved from

<http://www.microsoft.com/en-us/kinectforwindows/>

Museum of London (est. 1976). Virtual Tours. Retrieved from

<http://www.museumoflondon.org.uk/London-Wall/>

OpenBuildings (2011). Guggenheim Virtual Museum. Retrieved from

<http://openbuildings.com/buildings/guggenheim-virtual-museum-profile-2437>

Proctor, N. (2011). The Google Art Project. Curator The Museum Journal. Retrieved from

<http://www.curatorjournal.org/archives/635>

Unity Technologies (2013). Unity Game Engine and help community. Retrieved from

<http://unity3d.com/>

U.S. Bureau of Labor Statistics (2012). American Time Use Survey Summary 2011 Results.

Retrieved from <http://www.bls.gov/news.release/atus.nr0.htm>

Wachowiak, M. & Karas, B. (2009). 3D Scanning and Replication for Museum and Cultural

Heritage Applications. *Journal of the American Institute for Conservation*, 141-158.

Wauters, R. (2009). Does Anybody Still Use Second Life? And If So, How Much Is It Worth

Today? Retrieved from

<http://techcrunch.com/2009/07/02/does-anybody-still-use-second-life-and-if-so-how-much-is-it-worth-today/>

WFMU Radio (2013). Free Music Archive (Beta). Retrieved from

<http://freemusicarchive.org/>

Biographical Sketch

The Designs of Michael Baksh are reflections of his passion for history and ancient cultures as well as futurism and high technology. His art contrast minimalism with obsessive attention to detail. Combining simplicity and complexity, he creates worlds of unity designed to be enjoyed by a diverse audience.

Michael Baksh is a dedicated 3D modeler and animator who has been working with 3D programs for over a decade. He is also known for creating dynamic sculptures and drawings that are influenced by his background as an animator. He is able to create entire worlds with a limited amount of sound, movement and story, but they can be understood and enjoyed by a diverse audience.

He was born in Queens, New York but lived most of his life in Orlando, Florida. Being influenced by both a southern and northern culture has greatly affected his designs. His parents were from a small country in South America called Guyana and coincidentally his art reflects the morals and values of the former British colony. Michael constantly integrates other cultures and beliefs into his own personality, thus broadening his horizons and knowledge.

His interest in animation started at a young age watching animated TV shows. Michael was introduced to 3D modeling during high school but honed his skills during his undergraduate and graduate college career. Implementing architectural and mechanical designs into his body of work has created a variety of designs that reflect his personality and style. Michael strives to transcend the boundaries of traditional art and strives to incorporate multiple styles and techniques.