

**3D Modeling in Unity: Utilizing Algorithms and Digital Models to Reinvent Sports
Analysis**

**Digital Artifacts: A Museum's Best Underutilized Resource and How Museums May Best
Take Advantage of Them**

A Thesis Prospectus
In STS 4500
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By
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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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Introduction: Background for Digital Artifacts and their Existence in Museums

Museums are a central part of modern society and academia because they are places where people gather to learn, study the past, and entertain themselves. The central focus of the museum is to study and preserve artifacts, and the processes to do this have been refined throughout history. Now, in the 21st century, many museums are starting to use 3D modeling techniques to create databases of digital artifacts. Digital artifacts are virtual copies, such as scans, photographs, and 3D models, of the physical pieces of history being preserved in museums. This is beneficial because these models will not erode, tear, smudge, or fade from use. Furthermore, digital artifacts provide additional resources for the public, and the databases storing these digital artifacts have much more space than the physical showrooms of museums. Despite the many benefits to using 3D modeling, some methods are less effective than others because they lead to biases in the modeling; such improper mesh tracking: a common issue in 3D facial modeling where the meshes used to map a person's face do not properly align with their actual facial properties (Fidaleo, 2005, Pg 6). An example of improper mesh tracking can be seen in figure 1, where four different people have their faces mapped with a mesh to varying degrees of success. The schema used in 3D modeling is created by the software developer and this human generation of code leads to these inherent biases in the ways in which the data is recorded.

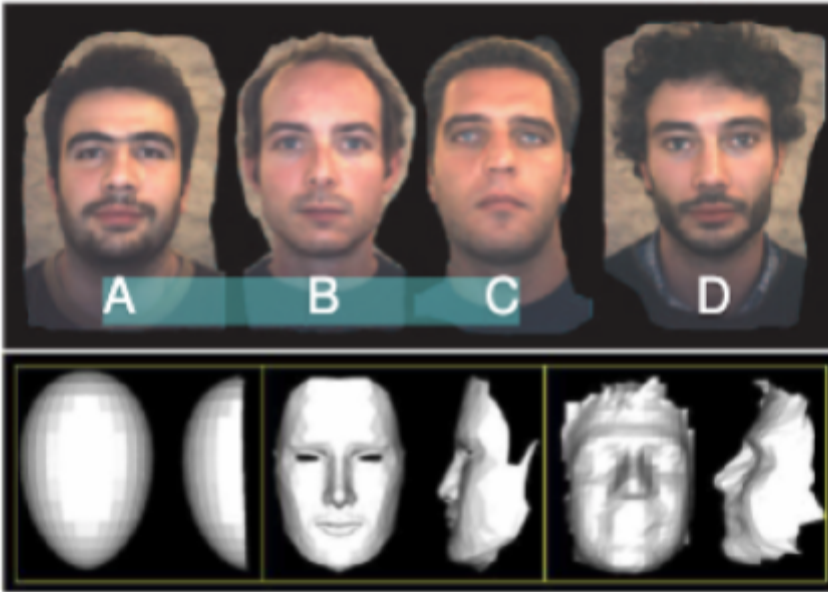


Figure 1: A bias in mesh generation leads to inaccuracies in the model generation of each man's face. (Fidaleo, 2005, Pg 6)

This technical research will analyze some of the many different methods of 3D modeling and come to a conclusion as to the best practice for 3D modeling, storing the data, and making the models available to the public. Specifically, I am looking into certain techniques such as volumetric integration, consensus surface, 3D surveying, and luminous spectroscopy (Santos, 2012) (Giuffrida, 2019). I also will be researching cybersecurity and how to keep databases safe and secure. Furthermore, for my STS topic, I am researching the ways in which the public interact with digital artifacts as opposed to their interactions with physical artifacts. Digital artifacts are a new idea and they exist alongside their physical artifacts. It is necessary to understand the benefits of digital artifacts so that they may be built and displayed according to their strengths. Furthermore, an understanding of digital artifact use will allow museums to engage with

a larger audience, allowing history, art, science, and learning to be brought to the forefront of society.

Technical Topic: Create a 3D modeling technique that minimizes bias and find the optimum methods for museum preservation.

There are many different modeling systems that have been used by museums to create 3D models of their artifacts. Some of these models are less effective for creating a database of unbiased digital artifacts for public use. According to Barry Molloy, it is a researcher's job to find artifacts and use "subjectivity and manipulation" to analyze and utilize the artifacts as they see fit (Molloy, 2018, Pg 111). Modeling techniques that already "subjectively manipulate" the artifact take a level of autonomy away from the researcher. They provide the researcher with manipulated artifacts, saying that they are the original thing. This leads to a faulty basis of information for that person's arguments because the researcher's assumptions are based on the assumptions of the modeler, not the actual artifact. This could lead to inaccuracies and problems for the researcher. In order to prevent the biased manipulation of artifacts, when they are being modeled, I intend to research different 3D modeling techniques and determine a best practice that can be followed. The ultimate goal would be to determine a way to universally model artifacts without bias or with as close to zero bias as possible.

There are thousands of museums in the world, and just as many 3D modeling techniques. Computer modeling is a new field and a "best" method has not been found yet. In order to find the best way to create an unbiased 3D modeling system, the first step is to see what is currently being performed. Most of my research deals with

different ways in which 3D modeling can be done and the pros/cons of each. From this analysis of current modeling techniques, I hope to create a new way of modeling that reduces bias and will allow artifacts to be preserved in their natural state.

In addition to 3D modeling techniques, there is also a need for security and management of digital resources. Museums hold millions of artifacts and creating a database full of image and model information is extremely beneficial; however, it is difficult to maintain. There are circumstances where an individual may alter an image or change the low-level data for a 3D model. In such a large database, these attacks may happen often and be extremely difficult to detect. In addition to the difficulty of detecting the actual attack, once it has been made, it is almost impossible for the average user to see that the file has been altered. Furthermore, this type of attack is much easier and available to perform than altering physical artifacts. Yes, it may be difficult to upload the file, and there may be some digital security measures in place, but it is still a threat to artifact integrity. This quote, by Theresa Beamsley, shows the danger of unsecured museum databases and how misinformation may be spread: “failure to detect corruption of digital information means that invalid, partial, or inappropriate information will be spread under the guise of authentic reliable information.” (Beamsley, 1999, Pg 1) This research is looking to create secure databases so that museums will be able to share their artifacts with the public safely, so that they may be used, but their integrity will not be compromised. This new level of security, together with an unbiased 3D modeling technique, will allow museum artifacts to be created and displayed more easily, efficiently, and will become more accessible than ever before.

STS Topic: Analysis of Digital Artifact Usage and How People May Utilize them Differently

Museums have had a very niche and specific role in the community for the past several centuries. They house artifacts, preserve them for the future, and provoke the thoughts of its visitors. People use museums and the artifacts stored there to study the past in its original form. This desire, to see the past in its original form, is what leads people to see museum artifacts in a certain way and may cause conflict when digital artifacts are used instead. People use different artifacts in different ways and the introduction of digital artifacts has changed the way in which many people interact with the past. I hope to conduct research to see, specifically, how people have used digital artifacts, such as 3D models, videos, and images, to analyze the past; and I hope to also discover how this may be different from the traditional usage of physical artifacts, such as books, paintings, sculptures, and physical objects.

In order to see how people may use digital artifacts differently, I also need to analyze why people go to museums and their actual place in twenty-first century society. According to Fiona Cameron, museums' position in society is constantly changing: "The museum community is diverse, but as institutions, their mission, civic, social responsibilities and modes of engagement have always been in a constant process of transformation in response to social, discursive and economic imperatives. (Cameron, 2005, Pg 3)" This shows how museums are extremely adaptable to peoples' needs and that they become very different institutions based on the time period and who is currently interacting with them. This analysis is relevant because the reason why people attend museums will change the way in which they interact with the artifacts

there. A person who attends a museum because they find art beautiful and want to find inspiration for their own art will use the artifacts differently than a person who has political motives and wants to find evidence for their opinions. I need to see what the motivations people may have for using digital artifacts to show the approaches users are coming from.

Furthermore, there is a need to analyze how digital artifacts are being used so that their creation and future management can be justified. Creating and maintaining vast databases of digital artifacts takes a lot of time and money and the people providing those resources need to know that the digital artifacts being created are actually used. David Hopes explains the current dilemma of how institutions are creating artifacts, but have no idea how they may be used: "...pressure to make digital content more accessible and more usable but with no clear idea of how end-users actually engage with it and how economic value can be returned to the institution.(Hopes, 2013, Pg 4)" Creating digital artifacts is certainly more accessible than having to search warehouses full of physical artifacts, but there is a need to know who is using these artifacts, why they choose to use them, and what conclusions can be drawn from them so that digital artifacts are justified and their databases can be presented to users in more meaningful ways.

Conclusion: The Deliverables of This Thesis Project

As I have shown, bias in the creation and foundation of digital artifacts leads to false conclusions and a loss of trust in said artifacts. I see these artifacts as being the future of analysis and research, but it is necessary to create them in the image of their physical counterpart, without alteration. This provides users with a wealth of new, easy

to access digital artifacts for research, study, and personal growth. While I have asserted that it is necessary to have unbiased digital artifacts, it is also important to analyze why we need digital artifacts. By analyzing the methods in which museums and institutions display digital artifacts, it is possible to understand how museums view their own collections. Furthermore, it is of utmost importance to monitor how and why users would choose to engage with digital artifacts over the real, physical artifacts nearby. Is it simply that digital artifacts are more accessible or could there be a level of analysis that can only be gained from digital artifacts? Through this thesis project, I will have gained an understanding of why digital artifacts exist and their importance to society, as well as have developed an unbiased procedure in their creation.

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