Assisting the *Inhabiting Byzantine Athens* Project: A Case Study of Educational Virtual Reality

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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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ABSTRACT
As the utility and usability of Virtual Reality (VR) expands, the technology offers an increasingly salient opportunity for use among academics and educators. To those developing VR software for these purposes, it is important that they have a conceptual foundation based on others' prior work with which to build from. In my work as a research assistant at the University of Virginia, I used 3D models of Byzantine buildings to construct a virtual world through which the supervising professor's findings could be more vividly communicated. I produced this environment in the Godot game engine currently with support for Meta Quest. At the current pace and quality, I fully expect my deliverable to fulfill my original task at or beyond expectation. Development on this project is ongoing and will likely continue into the Summer of 2024 as I implement the remaining missing features and improve compatibility with other VR devices.

1. INTRODUCTION

Professor Fotini Kondyli began the *Inhabiting Byzantine Athens* project in 2018 while teaching Byzantine Art History and Archaeology at the University of Virginia. Until this year (2024), the team's output had mostly centered around designing 3D models of a select number of Athenian buildings in the architectural application, SketchUp, based on notes from mid-20th century excavations of the Athenian Agora. This work is broadly divided between two groups: those interpreting excavation logs and those translating the former's findings into models.

When I joined the team in November 2023, though I was expected to ultimately handle VR implementation, I began and continued to work on the latter task, helping create some of the final models in the course of the project. In February 2024, I started work on bringing the project into VR. During my time working for Professor Kondyli, I also assisted with side projects relating to her research, such as animating figures from pieces of Byzantine pottery.

2. RELATED WORKS

Much of the literature on Educational Virtual Reality details projects tailored toward students in a classroom setting. For instance, Hutson and Olsen (2022) note that to a great degree this pertains to VR's ability to motivate students, rather than its particular affordances that set it apart from other learning mediums. They also say that the lack of research on this subject is due in large part to the, until now, prohibitive cost of VR headsets. The above body of work however differs from this project in that our intended audience is academics, as well as those among the general public who look into our work out of their own interest.

Research such as that by François, et. al. (2021) is more in line with this latter variety. They highlight the fact that these types of endeavors often face difficulties from needing to cater to both the scholarly and casual user, which is a critical consideration for this project.

3. PROJECT DESIGN

The three main components of my project design were my game engine, Godot; the Godot XR Tools library which I used heavily for this application; and the in-game environment itself.

3.1 Game Engine

For this project I ultimately chose to use the open-source Godot 4 game engine (currently Godot 4.2.1). This choice was primarily due to the fact that I had recent experience with the platform and found it to be relatively easy to pick up and begin prototyping with. Comparatively, I had tinkered with Godot's main competitor, Unity, a few years prior and found it to be obtuse. However, this may have been from my lack of programming knowledge at the time, rather than an inherent flaw within Unity.

I also shied away from Unity in part because of recent controversies surrounding their now-reversed attempts to modify their service's fee structure (Parrish, 2023). While these changes would not have impacted a fee-exempt non-profit project, it nevertheless left a poor impression.

In retrospect, it would have been beneficial to have weighed my options more carefully before locking myself into one system or another. From some follow-up research, it appears that, while Godot is fully capable as a game development platform, its VR capabilities are not as mature as Unity's. While this is unfortunate, it has not yet stood in the way of any features being implemented, although it has made some solutions more time-consuming to create than they might have been otherwise.

3.2 Libraries

The main Godot add-on I have been using to complete this project is Godot XR Tools (Olij & Nixon n.d.). As Godot lacks deep native support for Virtual, Augmented, and Mixed Reality, the XR Tools libraries are broadly the de facto standard library for XR developers using Godot. With these tools I was able to quickly set up basic movement, as well as headset and hand-tracking for my environment.

That is not to say using the add-on was entirely without difficulties, however. As the XR Tools add-on is more tangential to the primary community efforts on Godot itself, its documentation is not as thorough, leading to issues when I tried to implement interactable objects such as doors into the project. In future, I would likely reach out for more help through Godot's community platforms on Discord and on their dedicated forum instead of resolving issues through lengthy trial and error.

3.3 World

The VR experience I created for this project is a local, single-player environment. Besides the menu where the player can modify game options, including accessibility, and view credits, users spends the majority of their time in the one connected world made up of the buildings modeled as a part of *Inhabiting Byzantine Athens*.

An important part of Professor Kondyli's research concerns changes over time in these structures. As such there are two phases of interest which the user can toggle between, using a remappable input on their controller. To assist with navigation, players can rotate their arm, as if checking a watch, to view an overhead map of their surroundings. On this

mini map, they can view nearby buildings with associated labels as well as an indicator of their current location. The action can be simplified to a button press with an accessibility option for those unable to complete the motion.

4 ANTICIPATED RESULTS

Due to time constraints, the fact that this was my first project of such a size, my lack of experience developing for VR, and the VR implementation being a solo project, I will certainly find some areas of the final output unsatisfactory.

Overall, however, I expect that my contribution to this project will meet and likely exceed the expectations set forth initially. The resulting quality of my work will no doubt be helped by the weekly meetings I have with Professor Kondyli, which will allow me to effectively iterate upon my design according to her specifications.

5 CONCLUSION

Besides the particular value of having a more tangible experience of the past for my professor's work, it is also important for those who wish to create similar applications to have some basis to build from which I hope to provide in some small part. I found this project also to be incredibly valuable for my own development. Through my work, I gained a large degree of experience in game design and especially in developing for someone else rather than just for myself or as part of an assignment.

6 FUTURE WORK

I will likely continue work on this project for a few months following my graduation in May 2024. During this time I expect to work more closely with Professor Kondyli to pinpoint additional features she would like to see in the end product. If I can complete these final changes with time to spare, then I will close out my time on this project by deploying the game to as many VR platforms as possible, though this may be limited by the lack of different headsets available to me for compatibility testing.

7 ACKNOWLEDGMENTS

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