Theseus and the Minotaur: Virtual Reality for Historical Pedagogy

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ABSTRACT

Virtual reality is often presented to the public as a tool for video games, but there is a great deal of past and current research on its use in other domains, such as education. We present an application for the Oculus Go virtual reality headset that seeks to merge dynamic gameplay with education by re-creating the ancient Greek myth of Theseus and the Minotaur. By utilizing good design principles and focusing on maintaining user presence in the game, we hope to entertain players and encourage an interest in the study of history and the classics. We detail the implementation of our game and discuss feedback gathered from live demonstrations.

KEYWORDS

datasets, neural networks, gaze detection, text tagging

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Figure 1: The Oculus Go hardware, including the headset and the controller, which the player uses to swing the sword item.

INTRODUCTION

Motivation

The study of history and the classical world can be exciting and educational, but is often frustrating as well. Scholars and hobbyists alike can read all about the cultures of the ancient world; their daily lives, wartime struggles, and political events. But it is often difficult to feel a real connection with history because of the temporal distance involved. Reading words on a page simply doesn't do enough to bring history to life.

Virtual reality (VR) allows for the design and implementation of tools that immerse us in the past in a way we have never before experienced. If done well, we can know somewhat how it feels to stand in a crowded Roman marketplace or a summer villa in Greece. The ability to turn around in 360 degrees, tilt our heads up to gaze at architecture, and engage in face-to-face conversations allows for this kind of experience.

The reasons for building these applications (apps) are in line with the motivations behind the study of history in general. It is crucial to learn from the past; the trials and tribulations of past cultures informs modern day policies in economics, politics, military, education, and science. On the other hand, reading classical literature can inspire us in the realms of art, philosophy, and sociology.

Another benefit to this approach is that it enables travel-like experiences for the majority of us without the disposable income or time to travel around the world. VR allows us to stand in front of Michelangelo's David and understand the size and presence of the work in a way that can't otherwise be done without a flight to Italy.

Contribution

With all of this in mind, we decided to make a VR app with the goal of making the user feel as if they're the main character in a story from Ancient Greece, usually called Theseus and the Minotaur[14]. This is a myth relating the tale of a hero named Theseus, who - among other deeds - traveled to the Greek island of Crete to slay a monster who had been placed in the center of a massive labyrinth. The app was created for use on the Oculus Go[7] and was developed entirely in the Unity development engine.[12]

We chose this story in particular because it embodies our goals regarding virtual reality development. A good VR application makes the user feel immersed in the scene, which in general points to a first-person camera perspective and a feeling of agency or active gameplay. This myth is perfect for those design considerations because it mixes education with action; the player gets to feel how frustrating it can be to traverse a massive labyrinth by wandering around it in a real-time first person view. To emphasize this, we also implemented a custom interaction allowing the user to pick up and wield a sword by mapping it to the movement of the Oculus Go hand-held controller. By approaching the

Figure 2: Edward Burne-Jones's illustration of Theseus and the Minotaur in the Labyrinth, 1861[14]

minotaur and fighting it with their own movements, the player will be learning about the myth in a dynamic way that is likely to make a stronger impression than they would get just by reading about the myth.

PRIOR WORK

Many consumers think only of video games when they consider virtual reality applications. Indeed, gaming companies are some of the first and most vocal proponents of the technology, e.g. Valve with SteamVR and Sony with Playstation VR. "Domain-neutral" heavy hitters like Facebook's Oculus brand are also used mostly for games at this point. There is good reason for this; Tan et al. (2015) examined users' experiences with games on Oculus Rift and found that "participants experienced heightened experiences, a richer engagement with passive game elements, a higher degree of flow and a deeper immersion on the Rift than on a desktop setup." [11]

But although gaming is seen as the primary public-facing use case for VR, research is being done on its efficacy in other areas as well, for example in the medical domain with research like Strickland (1997) examining the use of VR for treatment of autism.[10] Individuals with autism display certain distinctive motor behaviors like avoidance of eye contact, and VR offers an interactive, low-risk space to work on such issues. This same benefit has informed work in education as well, such as Johnson and Rickel (1999), who were interested specifically in face-to-face interaction in the created of animated pedagogical agents. [4] Both of these papers show that emulating interaction between people in a virtual space can carry many of the same benefits as interaction in real life.

In another paper from that time period titled "VR for education?", Allison and Hodges (2000) try to "investigate the issues that arise when building virtual reality systems for knowledge acquisition and concept formation".[1] They use a system for teaching middle school students about gorillas at the zoo. This approach is important because it goes beyond face-to-face interaction. In this application, the students "become the gorilla" to get a different viewpoint on the subject in first person. Since then others have explored the power of virtual reality to make a user feel like they can inhabit other bodies, helping them to empathize and make new connections.[6][9]

Finally, we can turn to the domain of historical/classical education, the primary inspiration for our project. Allison (2007) surveys the field of history pedagogy through virtual reality, asserting that "History educators, elementary and secondary school teachers and professors, can all profit from the digital environment ... these technologies provide real-world immersion in the 'historical past' in a way that was previously not possible."[2] Roussos and Bizri (1998) created a system called Mitologies that attempts to weave together various labyrinth narratives into a project that "is an attempt to utilize this technology as a means of artistic expression and for the exploration of historical, political, musical, and visual narratives".[8]

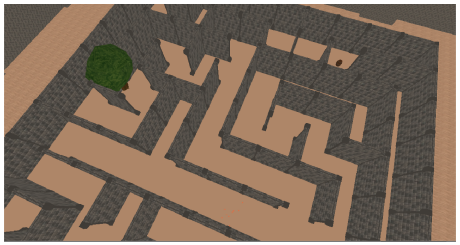

Figure 3: An overhead view of the labyrinth. The player must explore this area to find the three items.

When we think of history we often think of museums. One way of using new technology is to consider augmented or mixed reality instead of relying on a completely virtual world. Augmented reality has been researched for education before [3][5], but one particularly inventive use was in Wojciechowski et al. (2004), who used it to create visual models superimposed holographically, that guests in a museum could examine from any angle and pick up. All of these experiments show the value of new technology for history and classics pedagogy.

IMPLEMENTATION

Setting and Movement

Theseus and the Minotaur is a virtual reality game running on the Oculus Go headset and controller. It is a work in progress with a playable prototype currently available. The game takes place outdoors, in an area meant to represent the island of Crete. There are some theming elements around, e.g. a campfire and trees. Most importantly, the entrance to the labyrinth is directly in front of the player, as well as signboards detailing some of the myth as well as the controls. One of our primary considerations when designing our application was "presence". Witmer and Singer (1998) define presence as the "subjective experience of being in one place or environment, even when one is physically situated in another."[15] Their paper details a questionnaire with many metrics, including sense of player control, ability to localize sound, and sense of natural interaction with the world.

By including these theming elements, we attempted to help the player feel more presence in the created environment. Furthermore, we relied on physical signboards for the instructions and score counts rather than using floating semi-transparent pop-ups, with the assumption that reading off of an object placed directly in the game world would be conducive to presence and better fit the setting.

It was crucial to design the labyrinth in an intuitive and engaging way, as this is where the player spends most of their time. It is textured with natural stone walls that fit the setting, and the path was designed to be challenging but not overly frustrating. A good maze will have dead ends that force one to double back, but if there are too many they may lose interest. It is also important to have enough junctions where the user can proceed in multiple directions, increasing engagement through player choice. Last, the labyrinth is open-roofed. This allows the player to see the sky, trees, birds, and gameplay elements like a scoreboard posted on top of a tall pole.

Last is a note on player control or locomotion. There are various ways of controlling an avatar in virtual reality. One inspiration for our project was the VR game "Wonders of the World", which utilizes a point-and-click "teleportation" style of movement. This is good for a game that relies entirely on narrative, but we wanted to emphasize the exploration element of the source material, so instead we opted to allow the player to move directly. By sliding their thumb on the touchpad of the Oculus Go controller, the character will walk forward or backward. Horizontal rotation is accomplished by

Figure 4: The sword, shield, and key items, along with some thematic elements and a visual representation of the Oculus Go controller.

the user turning their head/body around, making it a 360 degree experience. They can also click the touchpad button down to sprint.

Items and Interaction

Aside from the layout of the maze, the contents within make up the core experience. The player enters in one corner and we placed three items in the other corners: a sword, shield, and key. The objective of the game is to gather all three items and then exit the maze to fight the minotaur. In the original myth, Theseus encounters the minotaur in the center of the maze, but we decided to have the "boss fight" take place outside.

Aside from ease of implementation, this results in a better flow of gameplay. When starting the game, the player can see a large wall with the logo of a key on it. The boss fight with the minotaur takes place behind this wall. When considering the best practices of game design, it is better to let players discover the game naturally through exploration rather than through textual exposition, whenever possible. By setting up the boss fight behind this key wall near the starting point, the player knows that they need to explore the maze, find items, then return back to where they started.

The shield is the second item hidden in the maze, though it represents a feature not yet implemented. We intended to add a health system to the player, so that they can be killed if they do not fight the minotaur well enough. This sense of danger helps with maintaining presence, because it is realistic in the setting. If the player is invincible, they will feel less involved and may rush through the game too quickly.

The shield item would be used to protect the player from a few hits before dying. However, we recognize that this interaction is not crucial for the educational component of the game. Within the given time constraints of the project, focusing too much effort on implementing the health system would prioritize the action too much over the educational component. In order to keep balance between these two goals, we leave the implementation for future work.

The last item is the sword, which is required in order to kill the minotaur. For this project we were required to implement a "custom interaction" that uses the hardware in a unique way. The sword represents this interaction, as it is mapped directly to the movement of the Oculus Go hand-held controller. We think this is an immersive interaction because it allows for action to be informed by natural hand motions. We track the velocity of the sword; if the player moves it fast enough to cross a certain threshold, the game counts it as a swing, which deals damage.

This conforms to best practices in multiple ways. First and most importantly, the player is free to play the way they want. The sword can be swung in any direction as long as the velocity is fast enough. In fact, it even counts as a hit when you use the sprint button to run forward while holding the sword out in front of you. We think this is a fun way to interact with the game and will keep users engaged.

Figure 5: The player holding the sword item, standing in front of the minotaur. Note the health bar above the head.

In addition there are visual effects that give immediate feedback. The sword changes color when a swing is registered so that the player knows how fast they need to swing and can experiment. There is also a low-poly blood particle effect that plays when the minotaur is successfully hit with the sword.

Boss Fight and Effects

As stated, the goal of the labyrinth exploration phase of the game is to gather the items. The player is required to obtain all three before they can proceed to the boss fight phase, where they use the items to encounter and fight the minotaur serving as the central opponent to Theseus in the original Greek myth. For the minotaur's model and animations we used a free asset by author VSIFY downloaded from Unity's asset store [13].

The boss fight consists of swinging the sword close to the minotaur, hitting it five times before it dies. In addition to the visual blood effect, there is also a health bar floating above that depletes when it is hit, showing progress. Once they have succeeded, the game is over. The player can walk around and read a score board that displays how long it took for them to win. The idea is to introduce some replayability by encouraging them to try again for a lower time.

We also implemented animation and music. At first, the minotaur is set to an "idle" animation where it breathes and shifts its body slightly. Upon entering the boss area, it begins an "attack" animation, punching repeatedly in the direction of the player. At the same time, appropriate music starts playing to set the mood for the fight. When the minotaur dies, it switches to its death animation, falling over slowly. The music also changes to a victory song so that the player knows they've won and the game is over.

FEEDBACK

Fortunately we have had the opportunity to play-test our game, both with our classmates and with members of the public who have little to no experience with virtual reality. Receiving their written feedback helped in seeing which parts of the game worked well and which need more work. Even more helpful than written feedback was watching people play the game in person, seeing how they interact with the game, where they understood the controls and objectives, and where they needed more instruction.

One issue of concern was that players had a tendency to not read the instruction boards, because they were more interested in playing the game immediately. It is important to allow player freedom and not to try too hard to control their experience, but on the other hand we noticed many occasions where players would get frustrated because they did not know what to do. An example of this difficulty is the marking system. One aspect of the game is that a player can squeeze the trigger on the controller to leave a mark on the ground. This ties in to the myth, where Theseus unwinds a spool of string behind him so that he doesn't get lost. We included this functionality so that the player would be

able to keep track of their location. However, players who did not read the instruction board did not know about this and as a result would get lost more easily. Therefore, a consideration for future work is to find a way to allow players to keep a sense of agency while making sure they are aware of how to play the game.

Another issue was with pacing. Players seemed to enjoy the boss fight, but some appeared to get bored before they got to that point, because they had difficulty making their way through the maze and lost interest. Fixing the aforementioned problem with instructions will help alleviate this, but it is also clear that players want more interaction within the maze itself. We are planning to fix this by adding monsters within the maze. This source of danger for the player should help maintain interest. In addition, it serves a design purpose by allowing them to practice using the sword to kill the monsters before they need to use it for the boss fight. This change should therefore improve pacing and presence.

CONCLUSION

Theseus and the Minotaur is an attempt to balance action and education in a way that leaves players excited to explore VR in general and more specifically to learn about history and the classics. It builds upon general best practices of game design and is informed by research into the use of virtual reality for education, both for historical pedagogy and in other domains.

We received feedback from multiple sources and plan to use that knowledge to inform our future improvements. Building this application taught us many things about game design and the potential of virtual reality to deliver novel experiences that were not available previously.

We were surprised to learn that questions about the future of virtual reality often come from decades in the past. Even so, recent advances in technology are re-opening these questions and attracting new people to the field. We are glad to contribute to this work by bringing a part of the ancient world back to life and by receiving support and feedback from our peers.

REFERENCES

[1] Don Allison and Larry F. Hodges. 2000. Virtual reality for education?. In *VRST*.
[2] John Allison. 2008. History educators and the challenge of immersive pasts: a critical review of virtual reality âĂŸtoolsâĂŹ and history pedagogy. *Learning, Media and Technology* 33, 4 (2008), 343–352.
[3] Zhi geng Pan, Adrian David Cheok, Hongwei Yang, Jiejie Zhu, and Jiaoying Shi. 2006. Virtual reality and mixed reality for virtual learning environments. *Computers Graphics* 30 (2006), 20–28.
[4] W. Lewis Johnson and Jeff Rickel. 1999. Animated Pedagogical Agents : Face-to-Face Interaction in Interactive Learning Environments.
[5] Katherine K. Lee. 2012. Augmented Reality in Education and Training.
[6] Emily Matchar. 2016. Using Virtual Reality To Walk in the Shoes of Someone With AlzheimerâĂŹs. https://www.smithsonianmag.com/innovation/using-virtual-reality-walk-shoes-someone-with-alzheimers-180959329/.

[7] Oculus. 2019. Oculus Go. https://www.oculus.com/go/?locale=en_US. [Online; accessed 5-May-2019].
[8] Maria Roussos and Hisham Bizri. 1998. Mitologies: Medieval Labyrinth Narratives in Virtual Reality. In *Virtual Worlds*.
[9] Mel Slater, Bernhard Spanlang, Maria V. Sanchez-Vives, and Olaf Blanke. 2010. First Person Experience of Body Transfer in Virtual Reality. In *PloS one*.
[10] Dorothy Strickland. 1997. Virtual reality for the treatment of autism. *Studies in health technology and informatics* 44 (1997), 81–6.
[11] Chek Tien Tan, Tuck Wah Leong, Songjia Shen, Christopher Dubravs, and Chen Si. 2015. Exploring Gameplay Experiences on the Oculus Rift. In *CHI PLAY*.
[12] Unity Technologies. 2019. Unity Engine. https://unity.com/. [Online; accessed 5-May-2019].
[13] VSIFY. 2019. Minotaur. https://assetstore.unity.com/packages/3d/characters/humanoids/minotaur-62219. [Online; accessed 5-May-2019].
[14] Wikipedia contributors. 2019. Minotaur — Wikipedia, The Free Encyclopedia. https://en.wikipedia.org/w/index.php?title=Minotaur&oldid=895270048. [Online; accessed 5-May-2019].
[15] Bob G. Witmer and Michael J. Singer. 1998. Measuring Presence in Virtual Environments: A Presence Questionnaire. *Presence* 7 (1998), 225–240.