Creating Game Scenes in Virtual Reality

Exploring the Possibility of Using Virtual Reality During the Video Game Creation Process

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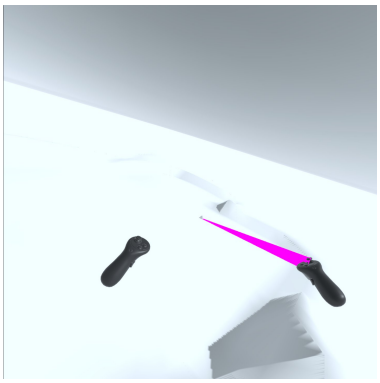

Games are easier to make today than they ever were in the past. Popular game engines such as Unity and Unreal are opening the doors of game development to many people. However, when designing levels for these games, the editing tools can be clunky and difficult to learn. If we can take the level editing process of game development and transport it into Virtual Reality(VR) space, there are many benefits: Terrain can be sculpted like clay, landscapes become more intuitive and creative since the user is both experiencing and creating, and the depth of the game world can be comprehended with ease compared to typical editors. While VR is traditionally used for playing games or experiencing virtual 3D worlds, in this project we have taken VR out of the game play world and utilized it for game creation itself. Utilizing Unity's height terrain map feature, we have made a VR level editor that has begun to explore this possibility in an intuitive and fun way.

1 INTRODUCTION

The motivation behind this project was to help game developers who are making VR games be able to have more control over their landscapes while in the process of making the game. It is difficult to sculpt land in an editor, then put on a VR headset to test it and get an idea of what needs to change, and then go back to somewhat blindly editing. Our VR editor allows developers to put on a VR headset and stay immersed in the environment they are creating as they sculpt it. This will hopefully save time and headaches, and allow for more passionate and creative landscape creations.

To accomplish this we utilize Unity's Height Terrain Map, and build off of the ideas of many game developers before us who have sculpted a multitidue of different landscapes. This means we are using similar calculations and algorithms to determine what terrain to alter, and in what way, but our novel idea is to bring this into the world of VR. Building off of these key skills, we simply enabled a user to be able to sculpt land while in the VR environment, essentially building the terrain around them, so they can see what it would look like to a user in real time. The challenges this brings on top of implementing known (non-VR) techniques include creating an intuitive and useful user interface, as well as implementing the functionality for users to interact with the terrain using VR controllers instead of the standard mouse and keyboard.

While our implementation of real-time terrain sculpting is functional and enables users to efficiently and intuitively sculpt the terrain around them in VR, we also recognize there are many different ways our terrain sculptor could be improved. This includes adding texturing capabilities and different types of brushes, both of which are readily available when not sculpting in real-time using VR. Another feature we would like to explore in the future is being able to easily export the user's sculpted environment and importing it into other projects.

1.1 Contributions

- Todd: Implement main terrain sculpting functionality.
- Todd: Implement user ray interaction with VR controller for better user experience.
- Todd: Provide VR headset and controllers.
- Alaina: Creating a unique user interface from scratch and setting up demo that includes a tutorial for users to interact with.
- Alaina: Creating functionality for user to change brush sizes in multiple ways and creating new brush styles.

2 RELATED WORK

Currently, most real-time sculpting in VR is popular for creative and artistic renditions of clay sculpting. This can serve as a place of inspiration for terrain sculpting, as the current intricate tools for brushes could most likely be transferred to terrain sculpting.
There are also current implementations that use VR, but more as a "God"-like point of view of sculpting a canvas in front of you, not one you are immersed in. This is similar to the clay sculpting approach to real-time sculpting, and has the potential to add useful and complex tools to future projects like ours.

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3 METHOD

Many games have levels that are designed around massive planes that are composed of thousands of evenly-spaced vertices that can be moved up and down to create an environment, or terrain. As discussed above, the main backbone to our terrain editor is utilizing Unity's built in terrain object. Essentially, a height terrain map is a plane of triangles where the designer can vary the height of the vertices to create elevation and make a convincing landscape. Typically in a game editor you would use a combination of brushes to mold and texture this environment, but these tools have their limits. The problem is the difficulty of moving things around in a 3 dimensional environment with a mouse and keyboard, while looking at a 2 dimensional screen with little depth cues.

By transporting this terrain level editing into VR we have given the designer a better sense of depth. To do this, we can target specific parts of the terrain map with a VR controller, and implementing height changes to that part of terrain based on what type or size of brush we are using. Additionally, since the VR controller can be controlled in 3 dimensional space and allows for more natural manipulating of the environment. In order to do this we needed to create a ray-like interactor that shoots out of the users right hand that is used to pinpoint what part of the terrain they would like to manipulate. Utilizing the Unity collider system we are able to use our VR controllers to manipulate the terrain around us in real-time. This creates a more immersive experience, like how molding clay with your hands can be an easier skill to pick up than making models in Blender. This can lead to saving time and creating more creative and intuitive VR environments.

4 IMPLEMENTATION DETAILS

Our development environment used for this project was Unity, and our VR headset was a Meta Quest 2. We utilized Unity's built in Terrain Maps to modify the terrain object in our scene. Specifically, we use hit colliders for our terrain and our VR controllers ray to determine what part of the terrain to modify. We then get the terrain data from the terrain collider, and get a 2D mapping ("box") of the x and z values we wish to modify the height (y coord) of based on our radius (brush size). Using this 2D array we then use a nested for loop to go through each coordinate and set it's height to our desired value. The desired value is based on the current brush we are using. To implement different brush styles, we simply modify the height at which we will set the current coordinate of our box is depending on where we are in our nested for loop. We had three main styles, a plain style that raised the height of the terrain the same for all points in our box, a Gaussian effect that raised the height the most in the center and faded as you reached the sides of the box, and a "spikey" custom brush effect that created a large spike. For our plain brush we just raise every coordinate of the box to the y value of the user's controller that is sculpting the terrain. For the Gaussian effect, we apply the Gaussian formula to create a "blurring" effect near the edges of the box, creating a more "natural" looking terrain. For the spikey brush we simply multiply the height by a scalar that causes the height to be most extreme on the corner, and steeply drop off for the rest of the coordinates in the box.

5 EVALUATION OF RESULTS

We have successfully created a development environment in VR for sculpting terrain in real-time. Users are able to interact with our menu interface to choose between different sizes and styles of "brushes," and are then able to use VR controllers to interact with the terrain accordingly. While this is a feat of its own, there are places our development environment falls short. It is done entirely in Unity currently, so any potential user would have to open up this project in Unity instead of just downloading a build and being able to export the terrain they create to use in other projects. This would be a large "quality of life" improvement that would make the concept of our project more practical for use in actual game development. We also do not currently have texturing implemented due to timing constraints. This would be an area of great improvement if users were not only able to sculpt their terrain in real time, but also apply textures. Currently, the limitations discussed have made our implementation's positive aspect of having the novel experience of sculpting in real-time not quite outweigh the trouble of going between a Unity editor and a VR headset to sculpt as developers currently do.

Overall we believe our project has made successful strides towards real time terrain sculpting in VR, but is missing a few useful features that would make this usable for actual game building.

6 FUTURE WORK

There is a lot of room for improvement for real-time terrain sculpting. Now that clay sculpting simulators are becoming more popular in VR, these techniques can be transferred over to real-time terrain sculpting to aid with game development. The menus and UI in the final build need work as the content is all there, but colliders are broken. This was due to never ending Unity XR package errors that we were not able to overcome. Cleaning up the code and packages could solve this and get the on-hand menus functioning fully quite easily.

7 CONCLUSION

We believe our work during this project has shown there is great potential in using virtual reality for not just playing video games, but also creating them. This is an intuitive next step in creating virtual reality games, and will lead to new avenues of creative game play. Real-time terrain sculpting will offer a novel, efficient, and immersive way to create entire new worlds in virtual reality.

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