Project 3 Retrospective

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1   Introduction

For my individual project, I created Snowflakes, a winter-themed environment where users can create their own structures by manipulating snow blocks. Although I did not accomplish all of my initial goals, the project was extremely successful and I learned valuable lessons about user interaction via the controllers and handling physics-aware VR objects.

2   Goals

The following list describes my initial goals for Snowflakes. (Items marked with an * indicate that the goal was initially a stretch goal.)

- The environment will have "snow" on the ground.

- The environment will have static winter themed items.

- The environment will have snow falling.

- The user will be able to create new snow blocks by pointing both controllers at the ground and pulling both of the triggers. This action will create a snow block being held between the users hands.

- When the user releases the triggers, the snow block will fall.

- The user will be able to grab existing blocks by pointing at them with both controllers and pulling both triggers. This will teleport the block into their hands.

- The snow blocks will fall in a physically-accurate manner with collision detection.

- * The user will be able to create snowballs by pointing one controller at the ground and pulling the trigger.

- * The user will be able to throw the snowballs at the blocks to "break" the blocks.

- * Sounds such as Christmas music will be output to the VR headset's audio jack to enhance the experience.

3 Changes for the Actual Implementation

- I did not add snow to the ground. This proved to be problematic since we have not yet implemented shadows for `flight`. The actual snow blocks would have been too hard to see.

- I did not add snowflakes falling from the sky because `flight` does not yet have good support for rendering particle systems and I did not have time (or expertise) to implement that functionality myself.

4 Unexpected Roadblocks

I ran into many unexpected difficulties while implementing this project. Below are three that stood out as most difficult to solve.

- Integrating the `nphysics3d` library with existing items in the world proved to be difficult. I had to associate the physics world and the rendering world in a way that the rendering world would be updated when the physics world changed.

- Dealing with time step of the physics world was non-trivial. After much debugging, I realized that, if the world time-step was too large, collision handling started to behave oddly. From the time of the application start to the first frame can be close to 2 seconds which leads to problems to the physics library. To fix this, I maxed out the time step to a small number.

- Pointing at things in the world ended up being much more difficult than I initially expected. The largest difficulty was that with the libraries I used, static objects in the world (such as the floor) do not participate in certain collision detection functions. I ended up having to use some dot-product math to determine if the user was pointing to the floor or not when the pulled the triggers.

5 Conclusion

I was unable to implement all of my initial goals for Snowflakes, but I was able to implement the core functionality of creating snow blocks and having them interact in a physically-accurate manner. Overall, the project was a success and I look forward to improving it for the final deliverable.