COMP 371 - Computer Graphics

TEAM #4 - GUACAMOLE

INTERACTIVE MUSEUM

MEMBERS:

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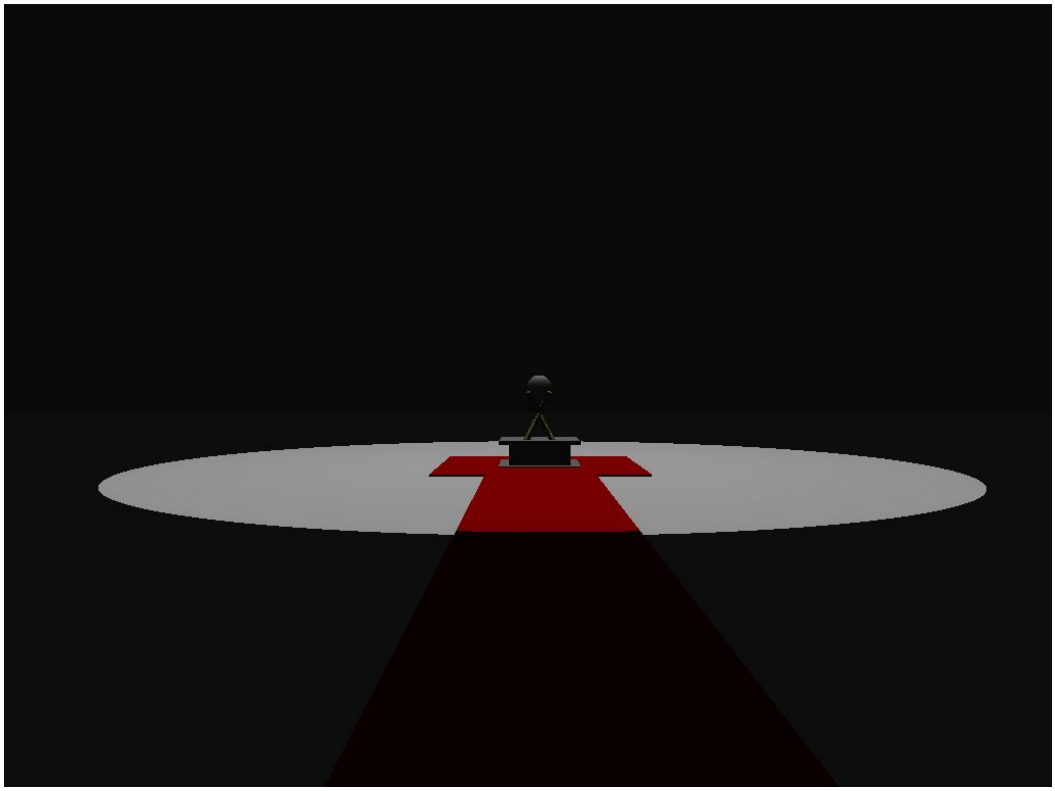
Introduction

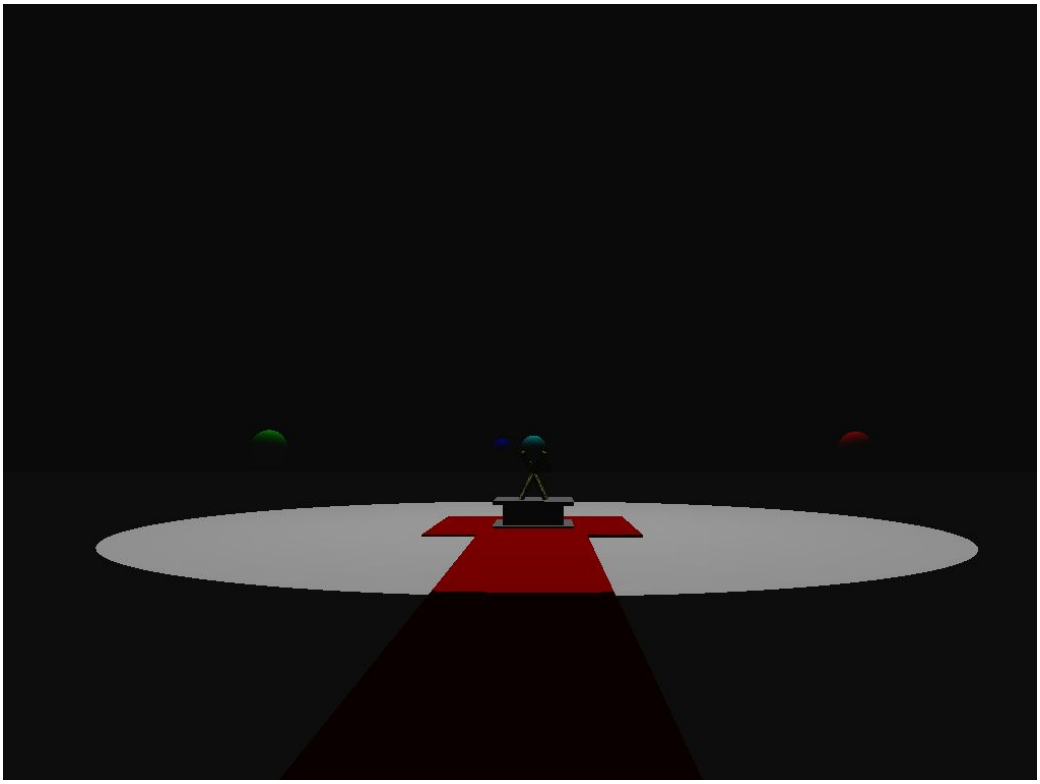
This report aims to outline what our team has achieved while working on the computer graphics final project. The project theme we chose is the Interactive Museum. We wrote a proposal of what we aimed to accomplish by the end of the project and how we would be managing our time, however we made key changes to our project while we were working on it. In this report we will detail the final outcomes of each of the rooms of our Interactive Museum, and further we will make comments on how we stayed on schedule and managed the workload, what we learned and what resources we used to complete the project.

Room #1 - Artifact Room

In this room of the interactive museum, there is an artifact placed in the center of the room on a pedestal. This room is meant to be a puzzle room, where the player must activate all of the artifacts in order to “activate” the middle artifact, whose crystal ball is grey at first. The room doesn’t actively tell the player what to do, instead, using visual queues, the player must logically figure out what to do. We achieve this by using spotlights to signal to the player which artifacts to activate.



This room was inspired by exploration puzzle games which use environmental queues and don’t hold the player’s hand through the game. Granted, this is a simpler version of these puzzle games which can be very intricate. The room is built using only primitive geometry and using the property of transparency and blending to allow the player to see through the crystal balls. Once all three artifacts are activated, red, green, then blue, the center artifact starts to change colours, and the 3 coloured artifact crystal balls hover and rotate around the center artifact giving the impression that they are channeling their colours into the center artifact.

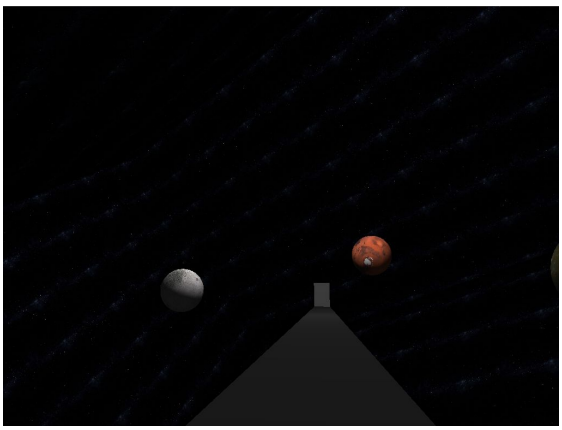


Room #2 - Black Hole Room

This room tries to simulate the experience of space distortion. You'll be able to walk through a stable bridge in the middle of the imagined black hole, inspired by a similar room that I experienced in an actual museum.

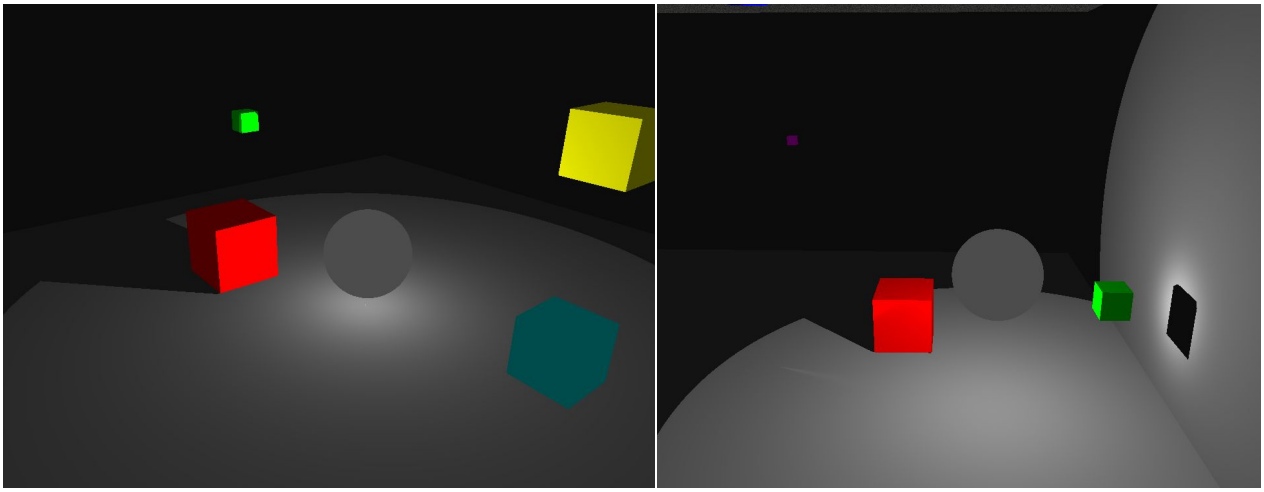
The room itself is pretty simple; made up of six rotating walls with a specific texture to simulate the black hole experience. Upon pressing "V", the texture will change and planets will be created, these will rotate around giving the impression of being on a space walk. You can toggle planets on and off using the "O" and "P" keys, respectively. You can further play with the background textures to experience different environments using the "C", "V", "B", "N" and "M" keys!

Make sure to not have a lot of background lighting since some textures are pretty dark.



Room #3 - Pong Room

In this room of the interactive museum we observe shadows and collision. Initially there is an immobile sphere at the center of the room. This sphere (our “Pong Ball”) also serves as a light source with a limited range. At the outset the floor beneath the ball and nearby objects are illuminated by the ball and even cast shadows.

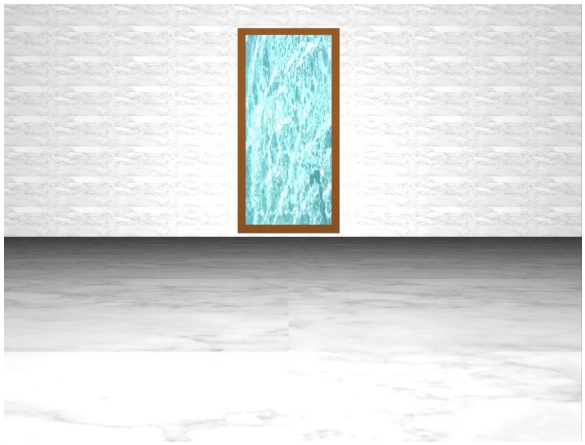


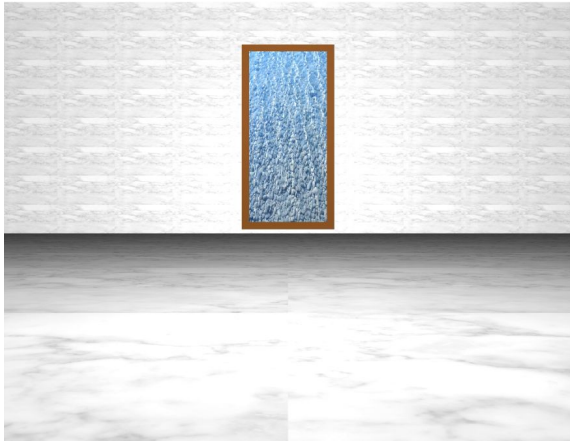
Using the left mouse button, the ball can be given a velocity vector matching that of the camera. Several cubes have been placed about the room to serve as obstacles. Should the sphere strike the face of any cube or any of the room’s walls it will rebound off. As the sphere moves about the room and reflects off surfaces the user can observe as the illuminated area follows along and the shadows cast by the cubes distort.

The shadows are generated omnidirectionally using a cube map to create a depth map based on the distance between the light source and objects in the room

Room #4 - Sound Room

In this room of the museum, the viewer can spend some time reflecting on visual representation and sounds. This interactive sound room showcases a frame in which an image is presented. This image is accompanied by sound. There are 4 different “scenes” available to view: ocean, rain, rocks and classical music. These scenes can be switched pressing the [T|R|Y|M] keyboard keys. This room is built using primitive geometry, textures and the irrKlang sound library to create a sound engine. Each sound, .wav files, are imported using this library to be used with OpenGL.





Team Organization

In order to stay organized, our team used git to collaborate on source code. Furthermore, our team used Discord to conduct voice meetings and to text-chat about problems we had. Our team tried to stick to the same schedule that was proposed in the project proposal, however due to the current circumstances we were unable to meet those goals. Also, we decided to work on the different rooms of the project in parallel, each team member in charge of a different room, which is not what we stated in the project proposal. We think that working on the rooms in parallel was a better idea anyways. Since we opted to make a graphics engine, working in parallel also had the benefit of being able to figure out what that graphics engine needed for the different rooms much quicker.

What We Learned

The most valuable thing we've learned in this project is how to collaborate with one another in graphics projects. One of our biggest challenges was integrating everyone's work together, which meant we had to organize ourselves to develop the application using the same programming pattern. Our solution to this problem was to create custom scene classes for each room in our project which all use the same underlying graphics engine. Whenever one room required more functionalities in the game engine, that developer would add it to the game engine and everyone would synchronise with those changes in git. Doing this saved us a lot of time when putting everyone's work together. Through making a game engine in parallel, we've learned more about how we can compartmentalize OpenGL into different levels of abstraction and this also allowed us to better understand the pattern of OpenGL calls.

Resources Used

Besides the concepts we've learned in class and in the labs, a resource that we used, that was very helpful, was the website "www.learnopengl.com". It was a very helpful reference when writing shaders for lighting and shadows as well as implementing the first person camera. Another useful resource was "www.songho.ca", on this website there is a tutorial for generating spheres which has graphics which explain how to calculate the positions of each vertex in the sphere. This is something we took influence from when generating primitive geometry in our project's graphics engine. Finally, for the sound room, the "https://www.ambiera.com/irrklang/" website was used for downloading the library and following the implementation steps. All sources for the audio and images used for the Sound Room can be found in the "credits.txt" file.