

Name: Chih Hsuan Huang ID:

934554197

Email: huanchih@oregonstate.edu

Video Link: https://media.oregonstate.edu/media/t/1_9ioo2xvy

CS 450/550 -- Fall Quarter 2024 Final

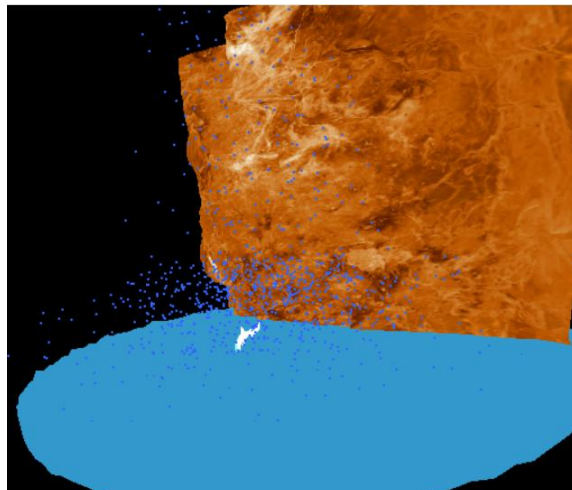
Final Project

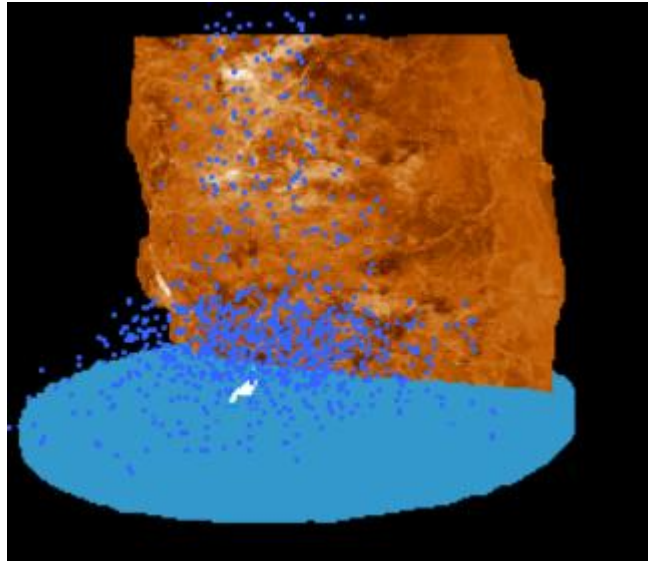
Description:

I will create a 3D natural landscape scene containing valley terrain, waterfalls and lakes, and use textures and light and shadow effects to create realistic valley and lake scenes. It mainly shows the basic rendering effects of water bodies and terrain.

Project goals:

Implement a particle system to simulate the waterfall's flow. Simultaneously, use texture mapping to define the valley terrain, placing a lake at the base. Enhance the lake's realism through transparency effects, preserving both its depth and clarity. Introduce swimming fish within the lake, using simple animations to simulate their natural movement paths. Finally, apply basic lighting effects to enhance the dimensionality of the waterfall and lake. By combining ambient and directional light, the scene will display realistic shadows and highlights, further enhancing the landscape's natural authenticity.





Video Link: https://media.oregonstate.edu/media/t/1_9ioo2xvy

1. Main functions(What did I actually do for my project?)

The purpose of this program is to simulate the effect of water wave particles on water. Simulate the dynamics of water waves by creating and updating particle systems. Each particle represents a water droplet on the water surface and will move and disappear based on the physical properties of gravity and rebound. The overall effect simulates the dynamic behavior of water waves. In addition, I textured the obj of the rock surface as the cliff of the waterfall, and added the irregular lake surface and swimming fish

First, I will initialize the life cycle of all particles to ensure that the initial state of all particles is consistent to facilitate the subsequent generation of new particles.

Ex.

```
for (int i = 0; i < maxParticles; ++i) {
    particles[i].life = 0.0f;
```

Then I will randomly set the initial position, speed, color, size and life cycle of the particles

Ex.

```
particles[particleWater].x = (rand() % 100 - 50) / 10.0f;
particles[particleWater].speedX = (rand() % 100 - 50) / 100.0f;
```

```
particles[particleWater].red = 0.2f;  
particles[particleWater].size = 2.0f;
```

Then detect the collision and simulate rebound and speed attenuation, reduce the life cycle and regenerate the particles. When the particles hit the water surface, they will rebound.

EX.

```
if (particles[i].y <= cylinderHeight) {  
    particles[i].y = cylinderHeight;  
    particles[i].speedY *= -0.3f;  
    particles[i].speedX *= 0.95f;  
    particles[i].speedZ *= 0.95f;  
}  
  
particles[i].life -= deltaTime * 0.05f;
```

As for the cliff, I used the obj file downloaded from Google and combined it with the textures we learned on project5 to build it.

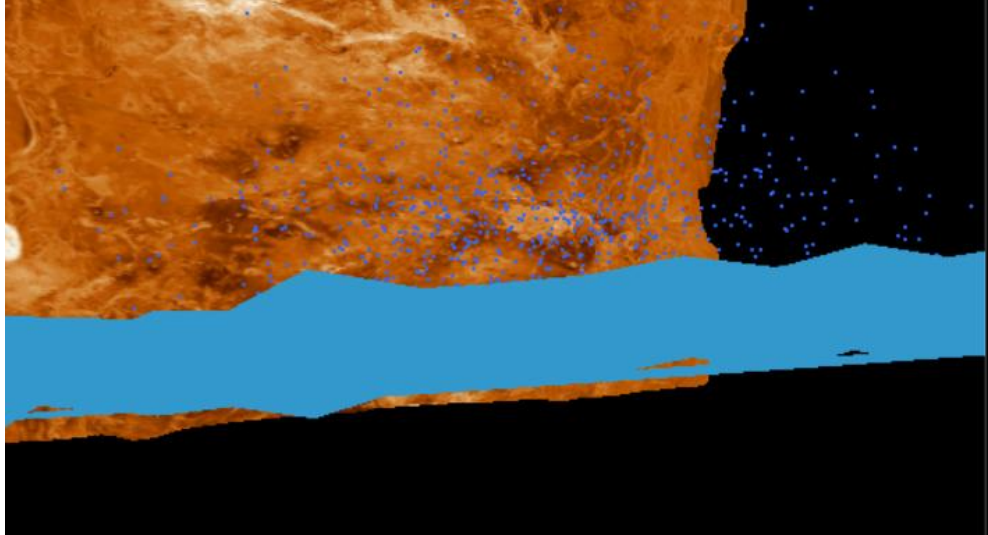
EX.

```
RockDL = glGenLists(1);  
glNewList(RockDL, GL_COMPILE);  
glPushMatrix();  
glScalef(12.0f, 12.0f, 12.0f);  
glRotatef(-135, 0, 1, 0);  
glTranslatef(0.0f, -0.2f, 0.5f);  
glCallList(CliffDL); // a dl can call another dl that has been  
// previously created  
glPopMatrix();  
glEndList();
```

The water body attempts to simulate waves

EX.

```
glVertex3f(x, cylinderHeight - 2 * wave, z);
```



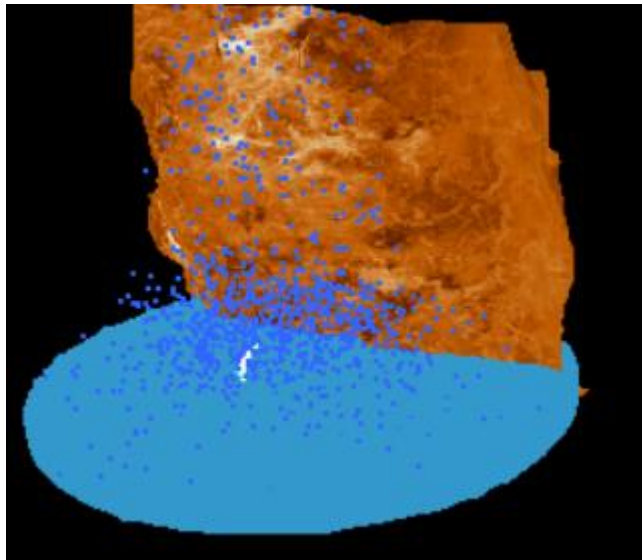
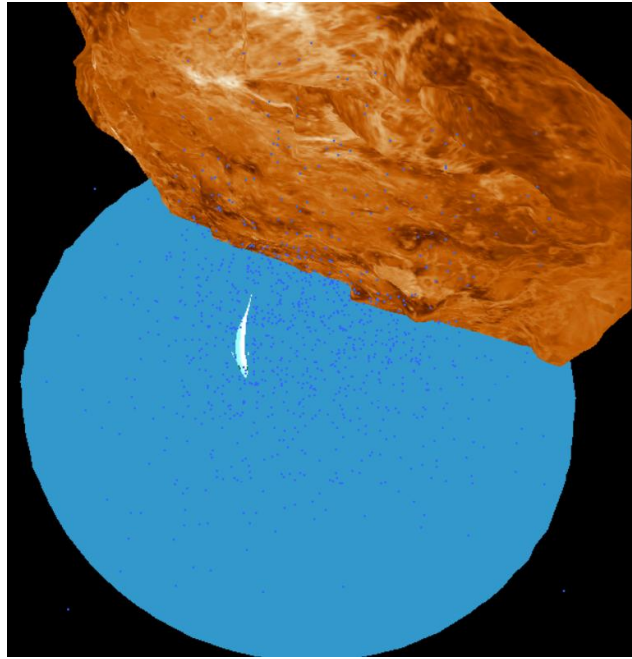
2. Different (How my project differs from what you proposed, and why)

Initially, I aimed to create a more refined lake that would appear transparent and exhibit a sense of flow. However, during the implementation process, I encountered several challenges. Through my research, I discovered that achieving the lake's transparency and flow effects required additional development and exploration of many underlying functionalities. I also attempted to install and use GLAD, but due to technical limitations, I was unable to complete the flowing water effect.

3. What learned from doing this project

For this project, I made some basic physical simulations, including gravity, collision detection, and speed attenuation. Compared with the previous animations that only showed through translation, these allowed me to simulate waterfall splashes and bouncing water drops more realistically, and added random particles to mimic the uncertainty of water

4. Some images that are especially representative of what I did



Video Link: https://media.oregonstate.edu/media/t/1_9ioo2xvy