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CS 216
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Final Project - Perlin Noise in Terrain and Animation

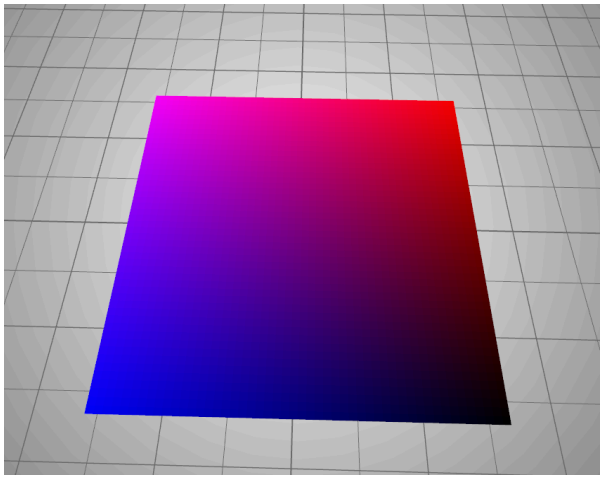
Problem Statement:

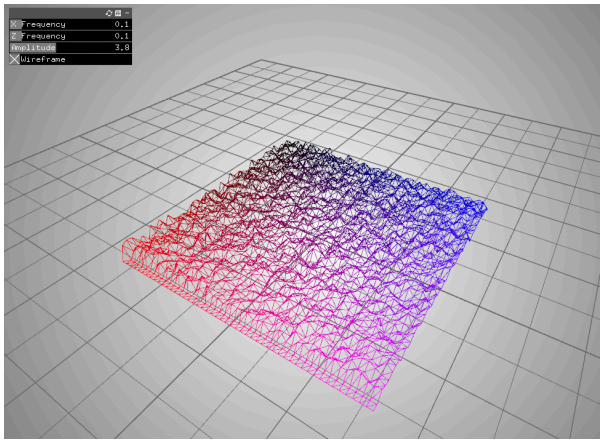
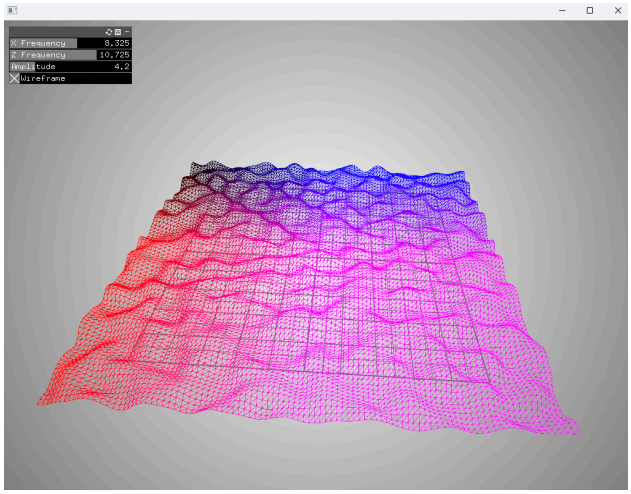
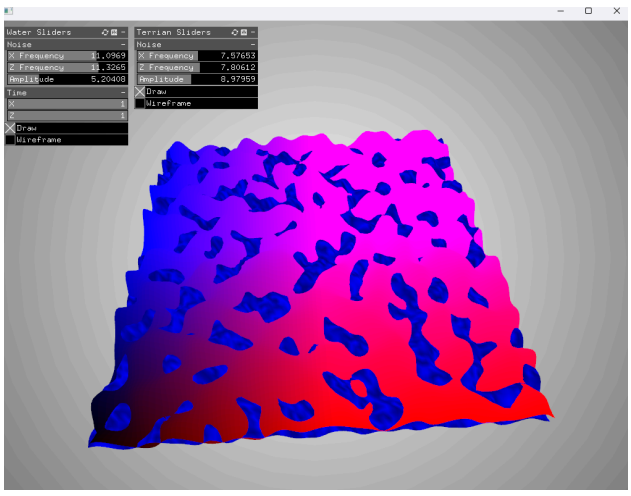
- Noise is often used to procedurally generate terrain. This terrain is often static and requires additional modification.
- My goal is to create procedurally generated terrain that has built in animation and live updates based on parameters passed to it.
    - Goal 1: Animate water using perlin noise.
    - Goal 2: Live color terrain and water based on parameters and noise output.

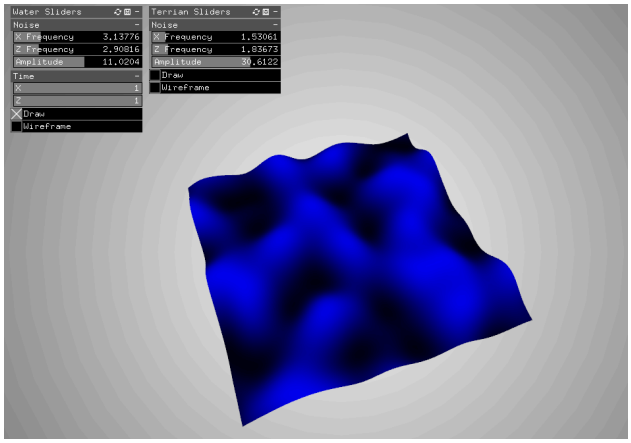
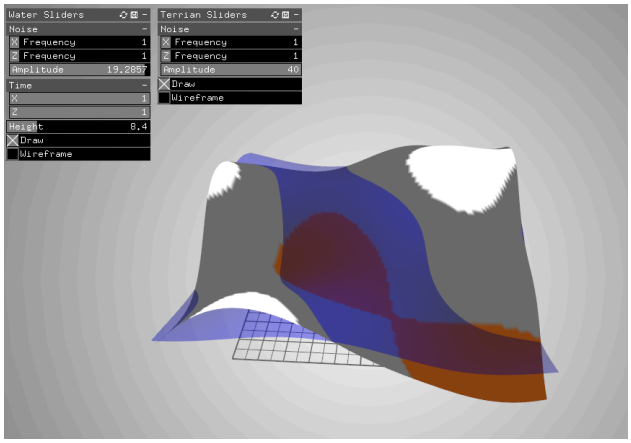
Prototype:

- Videos and open frameworks code of the prototype have been attached but I will also go over some development images I took during the process of making this project.

Development Process:

Step	Image
1) First implement a mesh that will eventually serve as our height field. I colored it based on vertice index to be able to tell which way is X and Z.	

Step	Image
2) Then implemented a wireframe grid view as well as basic random noise along the mesh.	
3) From there I implemented actual perlin noise and hooked up the parameters.	
4) From there I worked on getting a separate mesh for water and terrain set up. The water texture was initially randomly generated before I got terrain coloring working.	

Step	Image
5) From here I got terrain coloring working based on noise output on the water mesh. This is where initial animation testing was implemented. For an animation demo, see demo videos attached alongside the project.	
6) Finally once terrain coloring was fully implemented, both meshes were fine tuned. Alpha coloring of the water mesh was lowered to make it slightly see through.	

References

- K. Perlin, “An image synthesizer,” *ACM SIGGRAPH Computer Graphics*, vol. 19, no. 3, pp. 287–296, Jul. 1985. doi:10.1145/325165.325247
- K. Perlin, “Improving Noise,” *New York University*, Jul. 2002. https://rmarcus.info/blog/assets/perlin/improved_perlin.pdf
- Open Frameworks Documentation
    - Color: https://openframeworks.cc/documentation/types/ofColor/
    - Depth Test: https://openframeworks.cc/documentation/graphics/ofGraphics/#show_ofEnableDepthTest
    - Grid Plane: https://openframeworks.cc/documentation/3d/of3dUtils/#show_ofDrawGridPlane
    - GUI: https://openframeworks.cc/documentation/ofxGui/
    - Map Function: https://openframeworks.cc/documentation/math/ofMath/#show_ofMap
    - Mesh: https://openframeworks.cc/documentation/3d/ofMesh/#show_ofMesh
    - Noise Function: https://openframeworks.cc/documentation/math/ofMath/#show_ofNoise
- Smith, Kevin. “Lecture 8 - Ray Marching – SDF’s and Noise Functions” Geometric Modeling, 9 April 2024, San Jose State University. Lecture.

Acknowledgements:

Here are some resources that inspired this project:

- Blog: Using Perlin Noise to Generate 2D Terrain and Water, https://gpfault.net/posts/perlin-noise.txt.html
- Blog: Toon Water Shader: Perlin Noise, Animation & Foam, https://danielpokladek.wordpress.com/2020/03/24/toon-water-shader-perlin-noise-animation-foam/
- Video: Roblox Projects - Water Simulation with Perlin noise, https://www.youtube.com/watch?v=N_Mpo0u4h9M