Week 4: Volumes.

**Motivation:**  
Happy little clouds, rough cliffsides

**Learning Objective:**  
Methodology of: mesh\_to\_volume, volume\_to\_mesh, marching cubes  
Concepts of: voxels, signed distance, density, advection, voxel fields, time

**Schedule:**

Part 1:

* What is a volume? How is it different from a mesh?
* What is a voxel?
  + What data can a voxel carry with it?
  + How do voxels work?
  + Fog Density
  + Level Set
  + Signed Distance
  + Voxel resolution – relative and absolute
* From PPT, let’s build some mushrooms!
  + Take the mushroom mesh, make it a volume
  + Back to fields, using voxel fields, mask fields and fractal noise fields
  + Combining fields for fun and profit
  + Making those new fields into volumes
  + Merging those volumes

**Break: 10m**

Part 2:

* From PPT, lets get into some level sets
  + Go through the material in the PPT on level sets, explain them in depth and talk about what a signed distance field is
  + We’re going to use scattering, displacement, and level sets to build some cliff geometry
  + Troubleshooting crashes due to excessive volumes
  + Resolution monitoring
  + Scattering another scatter (baked instances)
  + Volume Boolean operations: how to use merge volumes, cleanup

**Break: 10m**

Part 3:

* From the PPT, go through the volume advection and cloud creation
  + Go through the material in the PPT on cloud volumes (fog density)
  + Deep dive into voxel fields
  + Field advection
  + Using Arnold shaders to output our volumes to the viewport
  + Making a parameter and connecting it to multiple inputs
  + Resolution deep dive
  + Introducing the time node to evolve and translate our fields
  + How to write a VDB
* Provide a link to the Unreal VDB plugin as a **suggestion** for engine input (more on this later)