Week 5: Simulation.

**Motivation:**  
Fire, Smoke, and mirrors! The VFX lesson.

**Learning Objective:**  
Methodology of: trig, derivatives, physics, standard BF simulation method, basic fluid dynamics   
Concepts of: solvers, iteration, port feedback, caching, varying source properties

**Schedule:**

Part 1:

* What is a solver? This is the biggest concept to be taught today. The concept of using the output of the last frame/iteration as the input to the next one. This enables pretty much all VFX systems in one way or another. This includes a lot of game engine systems, eg: Niagara
* Setting up a very simple solver (see video) points moving .. this is a manual particle system at it’s very simplest level – file attached: week5\_simple\_solver.ma
* How to add to that system once it is up and running
* Changing the solver parameters
* Bringing data out of the solver for use
* Derivatives and Physics!
* The simplest derivatives – position/Velocity/Acceleration
* Explanation of velocity vs speed, and how to use trigonometry to make circles inside a solver

**Break: 10m**

Part 2:

* From PPT, we will set up some Bifrost particles
  + Simulation basics in Bifrost, explain the layout of the “back\_” nodes and let the class know that it doesn’t change going forward.
  + In depth on basic particles
  + vary\_source\_property compound, your new best friend
  + per-particle-properties
  + colliders
  + influences
  + Setting properties based on the per-particle-properties
  + Using a field as a collider
  + Caching your work to .bob format, in depth on caching and why it’s so important

**Break: 10m**

Part 3:

* From the PPT, lets set some stuff on fire!!
  + Basic Aero graph – show the similarities!
  + What is smoke in the real world, how does it work – particulates, turbulence
  + How are we going to see our smoke? Explain standard volume materials (Arnold) for viewport display again
  + So how do we make fake smoke?
  + Smoke settings
  + Varying source properties
  + Using fields as influences
  + Caching to VDB this time – streamlining and cache sizes
  + Basic Combustion Graph
  + What is fire in the real world? Heat/fuel/oxygen
  + Aero fire and how it’s very much like the real thing
  + Aero settings – oxygen, buoyancy, expansion and soot
  + Radiative heating and cooling
  + Vary temperature with a field – using fields as inputs
* Talk about getting these VFX into a game engine next lesson, prepare the students for sprite work and rendering, encourage exploration and explosive explorations (strat them thinking about how they might build an explosion)