CS248 Lecture 10

SIMULATION (AND OTHER STUFF) IN UNITY

February 4th, 2016
Overview

- Physics
  - Rigid Body
  - Wheels
  - Cloth
  - Fracture (not covered in live demo)
- Particle Systems
- Navigation (not covered in live demo)
Rigid Body

Stereotypical Barrel Drop Physics Test (UE3)
Rigid Body

Cow Boosting (Just Cause 3)
Rigid Body

- Use Unity Rigid Bodies ([http://docs.unity3d.com/ScriptReference/Rigidbody.html](http://docs.unity3d.com/ScriptReference/Rigidbody.html))
  - Your GameObject should have some collider attached (box, capsule, mesh, sphere, etc.)
  - Give it a PhysicMaterial ([http://docs.unity3d.com/Manual/class-PhysicMaterial.html](http://docs.unity3d.com/Manual/class-PhysicMaterial.html)) to change how rigid bodies interact.

- How to move your rigid bodies? With forces! (Don’t forget: $F=ma$)
  - RigidBody also has ‘AddForce/Torque’ functions:

- Don’t use the C++ plugin rigid bodies (unless you really, really, really want to).
Rigid Body Constraints

- Use Unity joints (character joints, fixed joints, hinge joints, etc.).

Euphoria Engine Ragdoll
Wheels

- Use wheel collider: [http://docs.unity3d.com/Manual/class-WheelCollider.html](http://docs.unity3d.com/Manual/class-WheelCollider.html)
- You can now move your vehicle by applying forces (or braking) to your wheels

Need For Speed 2015 Racing
Cloth

- Use Unity’s provided cloth component: http://docs.unity3d.com/Manual/class-Cloth.html
- Your cloth won’t be perfect – it will intersect with things in the world and that’s okay.

Assassin’s Creed Unity Cloth
Fracture (Not Covered in Live Demo)

- Unity does not come with a built-in fracture system (UE4 does). Plugins exist (mainly non-free ones).
- But the concept is fairly simple (implementation not so much):
  - Start off with a static mesh (i.e. a pillar).
  - Upon hitting the mesh with a force (i.e. with a ball), split the entire mesh (or just part of the mesh) using an algorithm (pre-generated or on the spot).
  - Apply forces to the fractured mesh pieces as necessary (i.e. using the rigid body techniques from earlier)

Battlefield 4 Levolution
Particle Systems

WHAT GOOD ARE EXPLOSIONS IF THEY'RE NOT PRETTY
Particle Systems

Metal Gear Solid 5 Explosion
Particle Systems

Counter Strike Global Offensive Muzzle Flash
Particle Systems

- Particle systems transform according to rules that you give it:
  - Initial velocity, velocity over time, size over time, etc.
  - You also control number of particles to spawn, when they spawn, when they stop spawning, etc.
- Particle system is just a bunch of points moving in space.
- Rendered using textures (each particle gets the same texture).
  - Can use a texture atlas to give particle system the illusion of changing over time (i.e. going from fire to smoke).
- Free particle textures available on the asset store (you will probably find it hard to make your own)!
Navigation

U S U A L L Y E A S I E R
T H A N D R A W I N G
P A T H S
NavMesh

- Unity contains a NavMesh system: http://docs.unity3d.com/Manual/NRigation.html
- NavMesh concept
  - As a preprocess step, figure out where a character could potentially move to/can not move to (can have different “agents” that represent different character types).
  - At runtime, use an “agent” that queries the NavMesh to get the path to get from point A to point B.
  - You can use the path to do more than just moving a AI character.

Skyrim Clairvoyance Spell (Show Path to Objective)
Live Demo

CREATING
JUST CAUSE 248