
Collision
Detection

Where we're at

- On our first class, we created **Primitives**, and rendered them.
- On our second class, we created **RigidBodies**, and "debug rendered"
- Today:
  - We'll fix the memory leaks.
  - We'll link RigidBodies and Primitives.
  - We'll have modules react to collisions.

A few changes

The handout is looking a little different to what it did before:

- X We're calculating the "**local Inertia**" upon creating PhysBody
- X Adding inertia, will allow bodies to turn and roll

```
btVector3 localInertia(0, 0, 0);
if(mass != 0.f)
	Shape->calculateLocalInertia(mass, localInertia);
```

A few changes

The handout is looking a little different to what it did before:

- **PhysBody3D** class has appeared!
  - Basic interface between Bullet3D and the rest of the code
  - btRigidBodies now hold a pointer to their "PhysBody3D"
  - Will help us manage memory, and void leaks

```
btRigidBody* body = new btRigidBody();
body->SetUserPointer(this) //this PhysBody3D
```

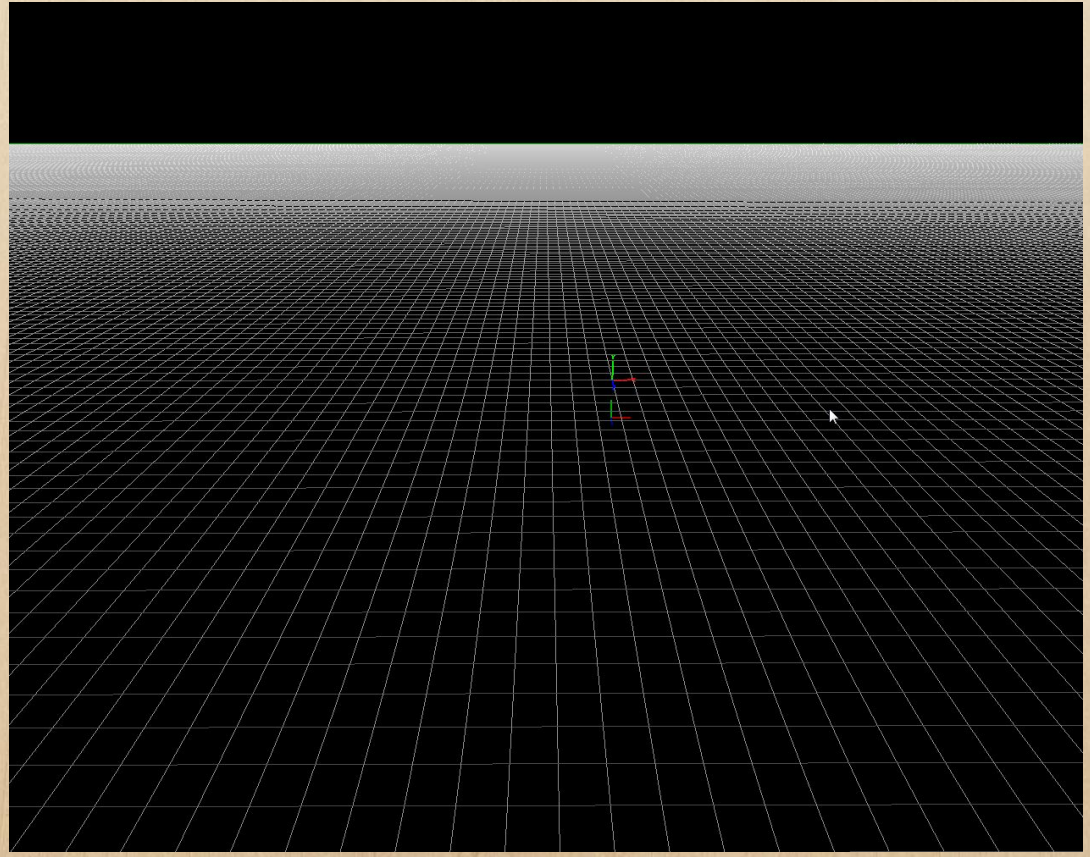
A few changes

The handout is looking a little different to what it did before:

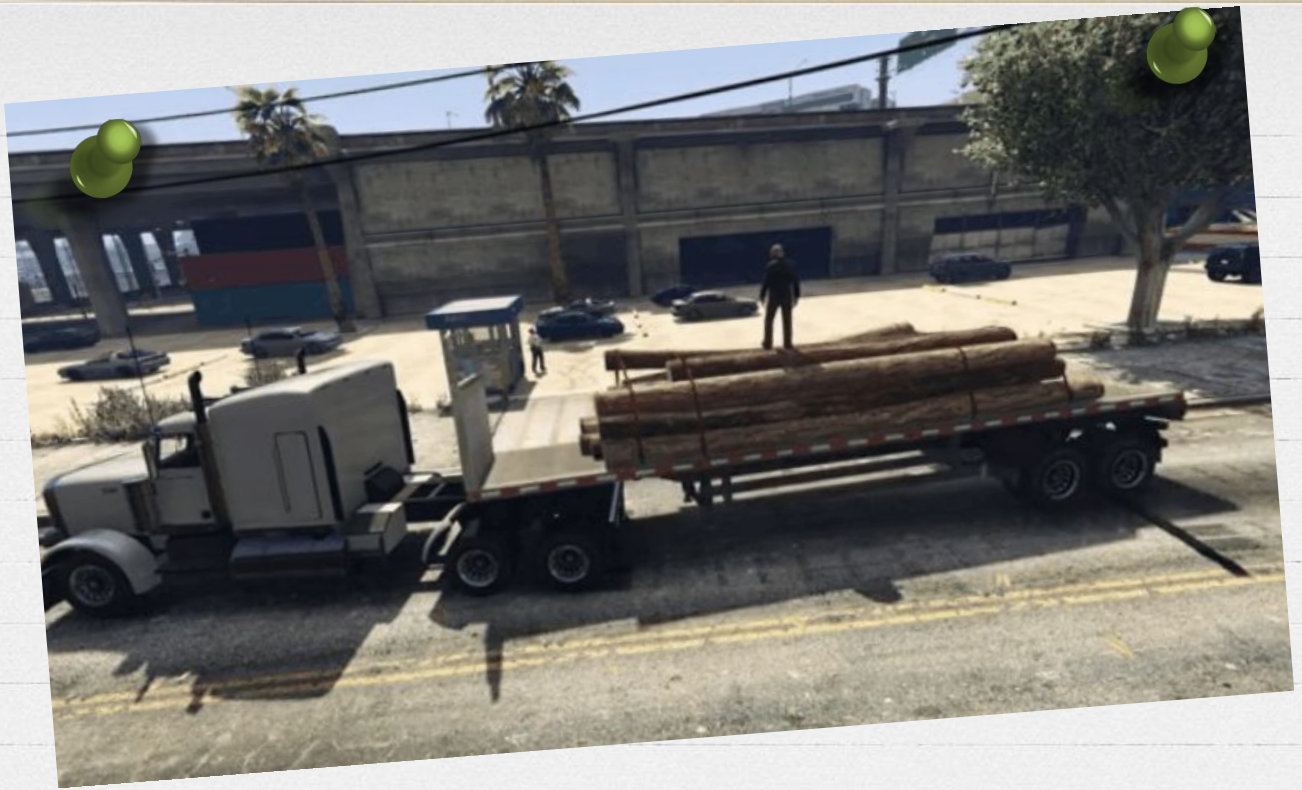
- **PhysBody3D** class has appeared!
  - The "RigidBody" creation, has been moved into PhysBody3D
  - Instead of sending "radius" as a value, we pass a "Sphere" it's going to fit into

```
void CreateBody(float radius, float mass);
```

```
void CreateBody(float radius, float mass);
```



Our goal



YOUR TURN !

TODO No 1

```
//TODO 1: Store all "new" created values
```

Memory leaks! Every **new** needs a matching **delete**.

Let's store all the "new" created variables, so we can destroy them later!

Not for the faint of heart... but a good thinking exercice: Collision shapes could be re-used between equal bodies. How could that be done?

TODO No 2

```
//TODO 2: And delete them!
//Make sure there's actually something to delete, check before deleting
```

Now, let's **delete** all the values we've stored!

Make sure there's something to delete! If no "new" was called, calling "delete" will yield an exception.

How do we differentiate between a pointer with or without content?

TODO No 3

```
//TODO 3: Create a "new" sphere, and add it to the "primitives" DynArray
```

Before, when we pressed "1" we used to create a "PhysBody" that we could only render in "debug".

Now, let's instead create a **Sphere primitive** which should be always visible.

We'll later link primitives and PhysBodies.

Add the sphere to the "Primitives" array to store them.

TODO No 4

```
//TODO 4: Add a PhysBody to the primitive
```

We want to make sure every primitive has its own physics body linked to it.

```
//TODO 4: Initialize the PhysBody to be a Sphere
```

When we create the Sphere, call "**InitBody(...)**" in order to actually create the Physics body.

TODO No 5

```
//TODO 5: On the primitive update, make it match the Physics body, so the render moves around!
```

Right now, every time we create a Primitive, we're also creating a Physics body. However, the body will fall and leave the Primitive behind!

Let's make the primitive match the Physics body.

```
//TODO 5: Complete PhysBody3D functions!
```

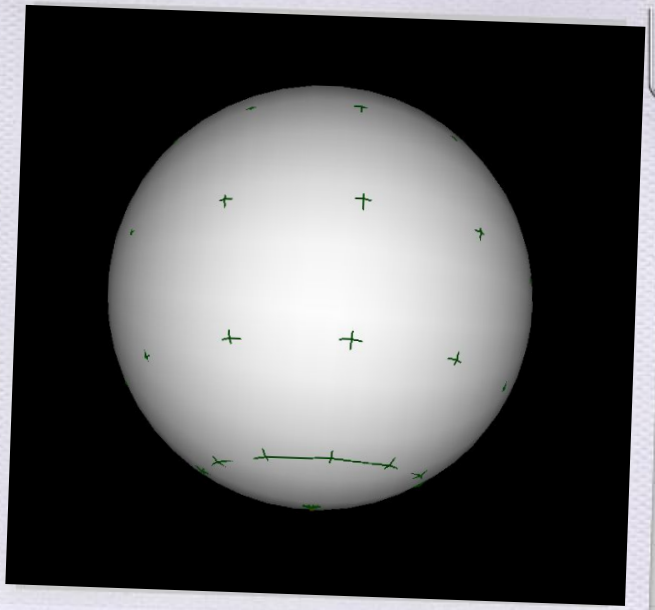
In order to do so, we'll need to finish the PhysBody3D functions!

Look what functions "btRigidBody" gives you.

At the end, add "body->activate();"...

TODO No 5

Now, both entities are synchronized!



TODO No 6

```
//TODO 6: When we move the primitive, we want to move the Physics body too!
```

If we didn't update the Physics body position, as soon as we called "Primitive::Update()" the primitive would return to its original position.

Let's make sure that doesn't happen, and position changes in both the "render" world and the "physics" world.

TODO No 7

```
//TODO 7: Create virtual method "On Collision", that recieves the two colliding
PhysBodies
```

Here's an easy one:

Create a virtual void function, that receives two **PhysBody3D***

This way, any module can implement its own method to handle collisions.

TODO No 8

```
// TODO 8: Detect collisions:
      // - Get world dispatcher
      // - Iterate all manifolds
      // - Check we have more than 0 contacts
      // - If we have contacts, get both PhysBody3D from userpointers
      // - Make sure both PhysBodies exist!
      // - Call "OnCollision" function on all listeners from both bodies
```

Here's a trickier one!

If a PhysBody3D has any modules added to "CollisionListeners", we want to call that module collision handling function, sending the colliding bodies.

TODO No 9

```
//TODO 9: Create an "OnCollision"
method specific for the Scene
```

Create a specific "OnCollision" method for **ModuleSceneIntro**, so it overwrites the base Module function..

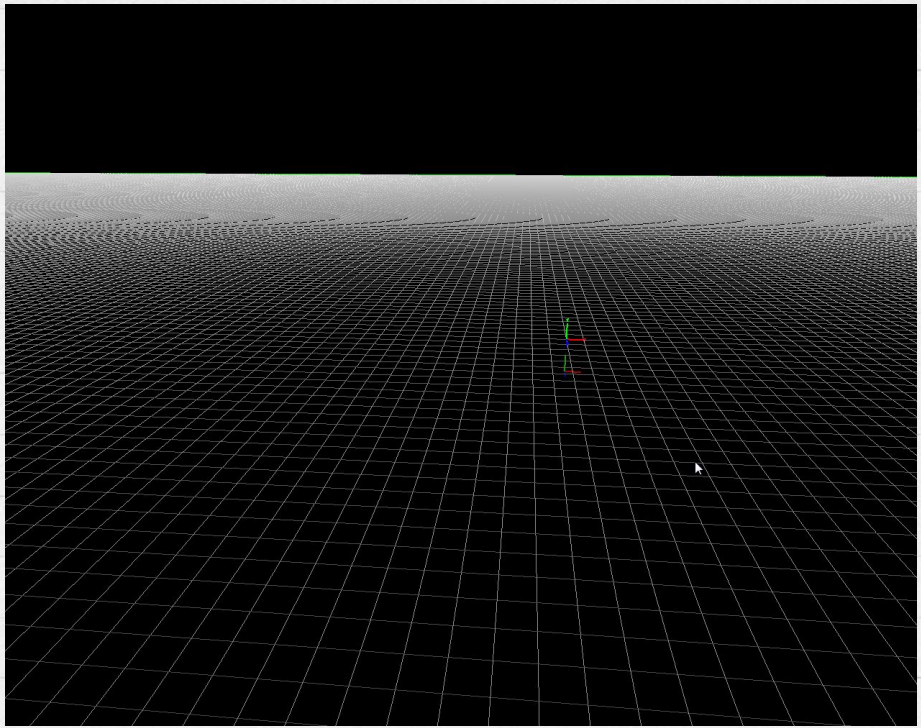
```
//TODO 9: And change the color of
the colliding bodies, so we can
visualize it working!
```

Do something when two bodies collide, so we can check if the code is working. The easy route: change the primitive color whenever it collides.

Homework

We can create spheres. Now create boxes and cylinders with their corresponding physics bodies.

Extra: When pressing '1', throw spheres in the direction that camera is looking at.



Next Week . . .

Bullet Constraints