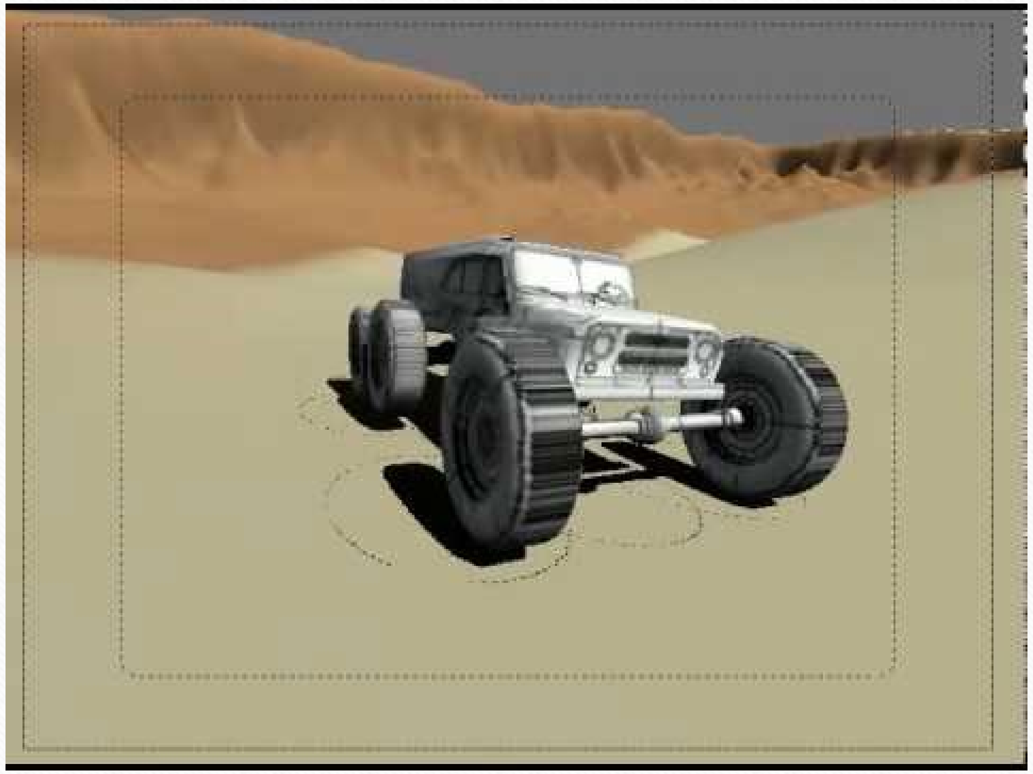
Physics II

CITM

Bullet Physics – Vehicle Creation

A vehicle

- With everything that we've learnt, how would you do a car?



A vehicle

- RigidBodies, Constraints with motors, Springs…
- That sounds like a lot of work.

btRayCastVehicle

Kester Maddock created a driving model system!

Meet the btRayCastVehicle

36.9 fps
8.6 km/h

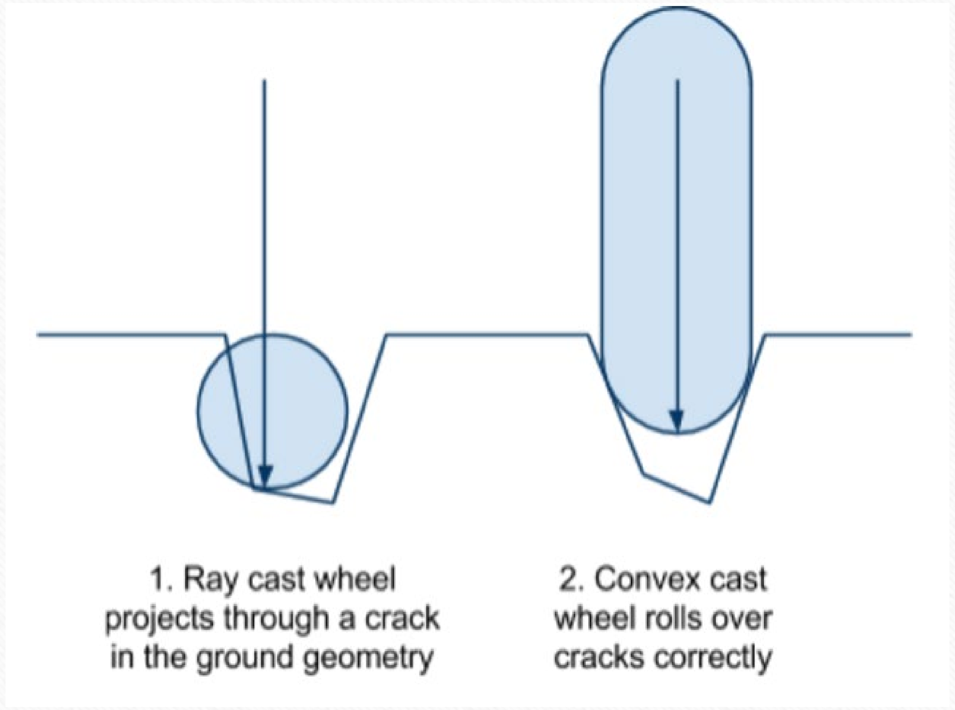
https://docs.google.com/document/d/18edpOwtGgCwNyvakS78jxMajCuezotCU_0iezcwiFQc/edit

btRayCastVehicle

"The entire vehicle is represented as a single rigidbody, the chassis.

The collision detection of the wheels is approximated by ray casts,

and the tire friction is a basic anisotropic friction model."


1. Ray cast wheel projects through a crack in the ground geometry
2. Convex cast wheel rolls over cracks correctly

Vehicle info struct

```
struct VehicleInfo
{
    ~VehicleInfo();

    vec3 chassis_size;
    vec3 chassis_offset;

    float mass;
    float suspensionStiffness; // default to 5.88 / 10.0 offroad / 50.0 sports car / 200.0 F1 car
    float suspensionCompression; // default to 0.83
    float suspensionDamping; // default to 0.88 / 0..1 0 bounces / 1 rigid / recommended 0.1...0.3
    float maxSuspensionTravelCm; // default to 500 cm suspension can be compressed
    float frictionSlip; // defaults to 10.5 / friction with the ground. 0.8 should be good but high values 
feels better (kart 1000.0)
    float maxSuspensionForce; // defaults to 6000 / max force to the chassis

    Wheel* wheels;
    int num_wheels;
};
```

Wheel struct

```
struct Wheel
{
    vec3 connection; // origin of the ray. Must come from within the chassis
    vec3 direction;
    vec3 axis;
    float suspensionRestLength; // max length for suspension in meters
    float radius;
    float width;
    bool front; // is front wheel ?
    bool drive; // does this wheel received engine power ?
    bool brake; // does breakes affect this wheel ?
    bool steering; // does this wheel turns ?
};
```

PhysVehicle struct

```
struct PhysVehicle3D : public PhysBody3D
{
public:
    PhysVehicle3D(btRigidBody* body, btRaycastVehicle* vehicle, const VehicleInfo& info);
    ~PhysVehicle3D();

    void Render();
    void ApplyEngineForce(float force);
    void Brake(float force);
    void Turn(float degrees);
    float GetKmh() const;
public:

    VehicleInfo info;
    btRaycastVehicle* vehicle;
};
```

Vehicle Creation

- To create a vehicle, we need to fill in and tweak the different parameters in the VehicleInfo struct.

- Then, we just call `App->physics->AddVehicle(const &VehicleInfo car);`

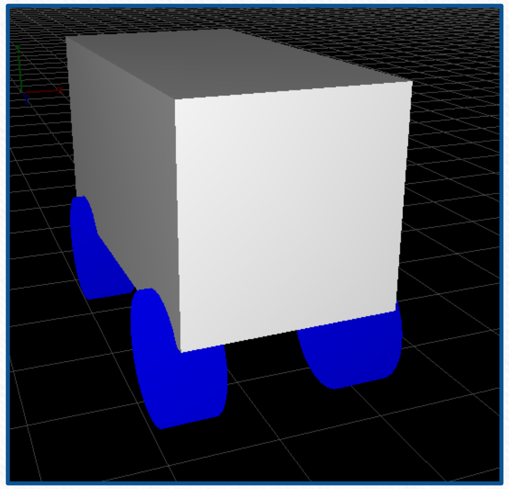
- We can control the car in an Update loop! (Create PlayerModule?)

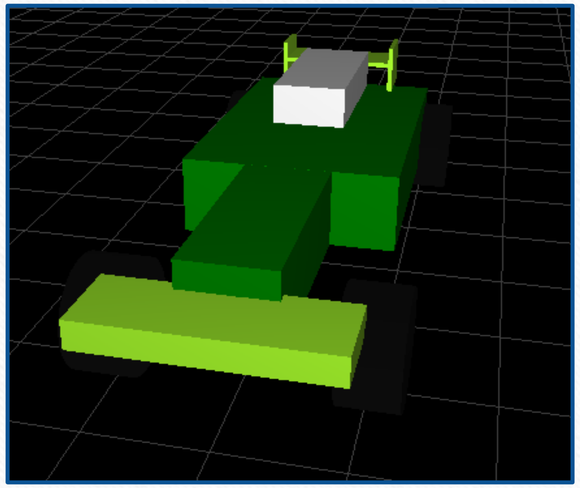
Vehicle Creation

Once you understand the code, try to go crazy:

- Change the chassis of your car:

A Formula 1, a jeep, an articulated bus, a van, a forklift?





Vehicle Creation

Once you understand the code, try to go crazy:

- Tweak the values: it depends on the type of vehicle that you want:

Vehicle Creation

Once you understand the code, try to go crazy:

- How many wheels do you need?

The camera

- The camera can make or break your game. Give it some love.
- It's going to be harder than it looks. We're in 3D now.
- How will it behave in your game? A static/dynamic panoramic view, a chasing camera…? Controller with the mouse, keyboard?
- The **LookAt** method on camera will be very useful for this assignment.

Homework

- We now have everything we need to make our game (or almost).

- Create the **circuit**, try and find a place to use constraints.
- Create the **camera** for your game.

- Remember we’re **making a game**! Which is the objective? How do we win? How do we lose?

Homework

- Brainstorm! Try different things.
- How is the car?
- How many laps?
- Obstacles? What can we do with constraints?
- Landmines?
- Drifting?
- More than a single car?

Homework

- Next class, try to have a “playable” version of the game.
- Having other people try it can be a BIG help!
- Aim to have an “almost finished” game. Polishing it to make it fun takes longer than you’d think.