

# My Portfolio World

## Introdução à Computação Gráfica

Trabalho realizado por:

Miguel Figueiredo - 108287

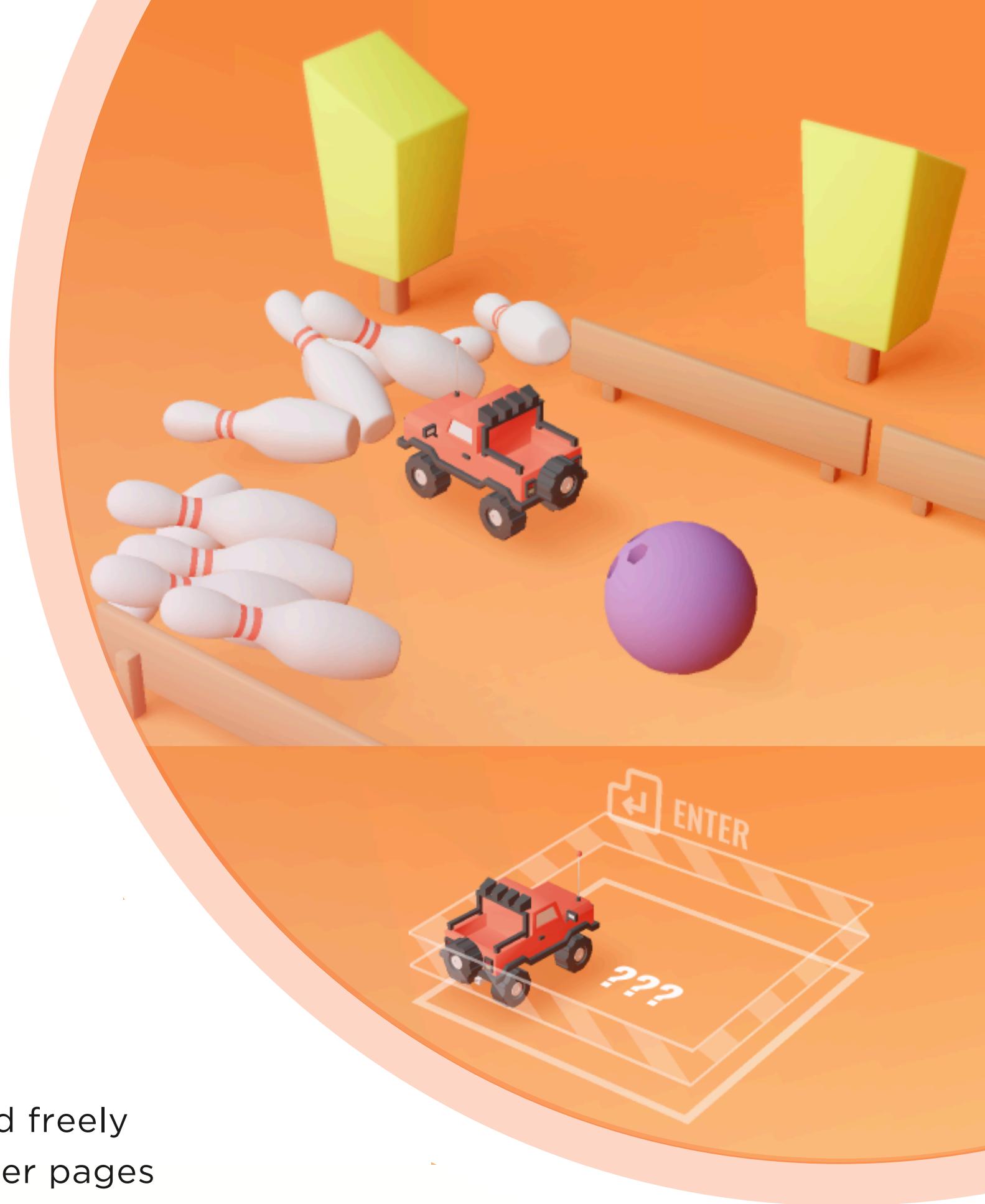
## Disclaimer

This presentation/report contains  
animated videos. I advise you to go  
over the report [here](#)

# Context and Objectives

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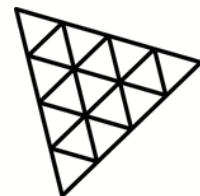
- Concept and visuals inspired by [Bruno Simon's portfolio](#)
- Website that illustrates my **academic journey** and the **story of my life** and that should connect the user to my **social media platforms**
- **Models:**
  - Car that travels around the scenario
  - Collideable Objects
- **Interactions:**
  - **Keyboard:**
    - move the car
    - open links to other pages
  - **Mouse:**
    - explore the world freely
    - open links to other pages



# Models

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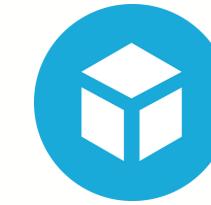
## Visual Models



### Threejs

Javascript 3D Library

- Built my own Models
- Import already existing .glb models from [sketchfab](#)



## Editing existing .glb models

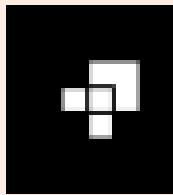


### Blender

Open Source 3D Creation Suite

- Separate parts of the model (e.g. wheels and chassis of the car)
- Remove elements of the model not supported by threejs so that he can render it

## Visual Models connected to a physics representation through a Physics Engine

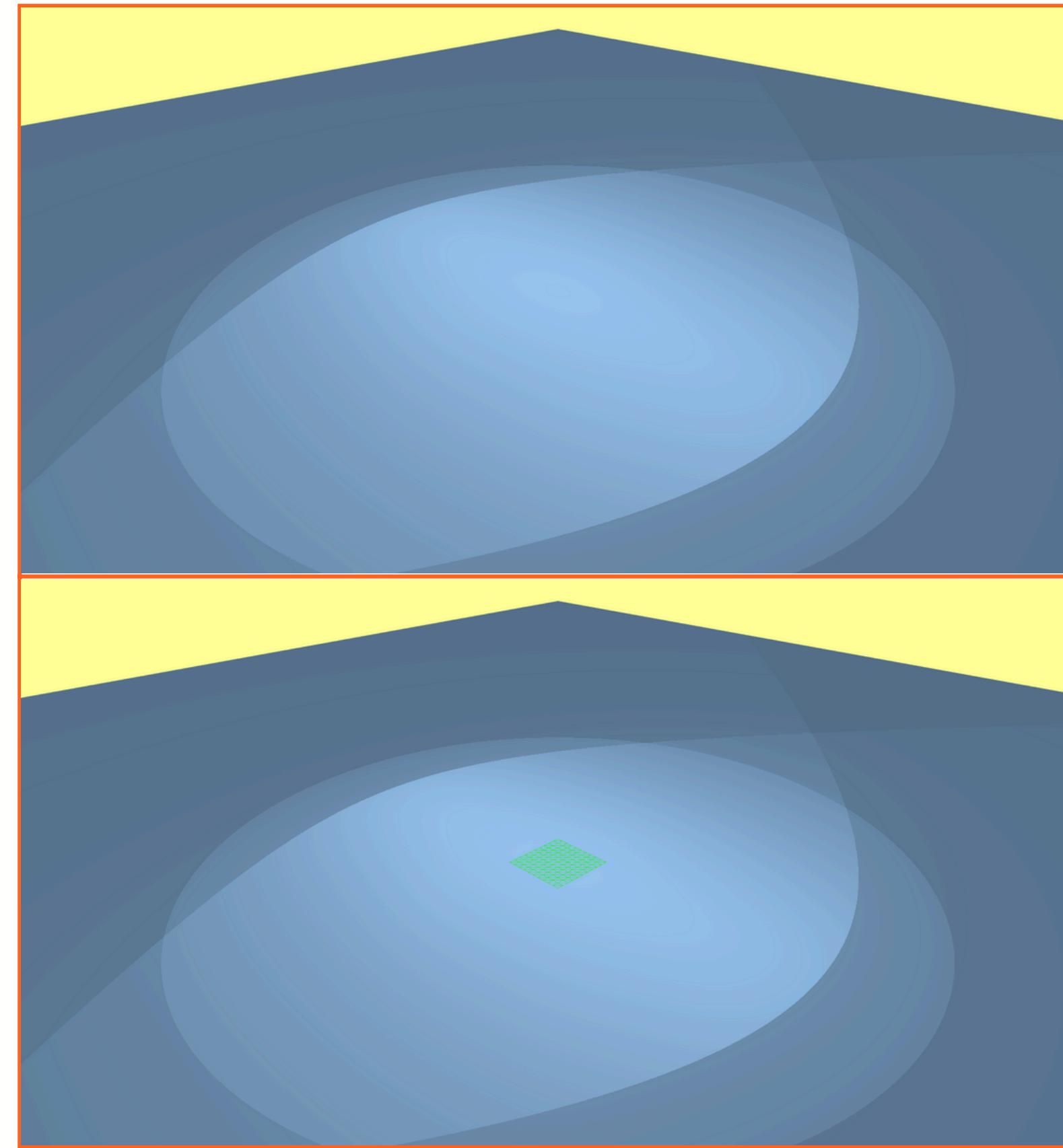


### Cannon-es

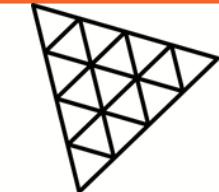
Maintained fork of cannon.js

# Models - Ground

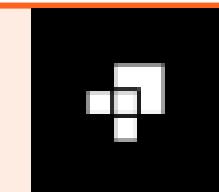
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- **Plane Geometry**
- **MeshPhongMaterial**
- It's not infinite
  - **But it appears to be by using MapControls**



- **Infinite PlaneBody**
- Body of type **STATIC**
- Has **specific interactions** with:
  - Ball
  - Bricks
  - 3D Letters



# MapControls

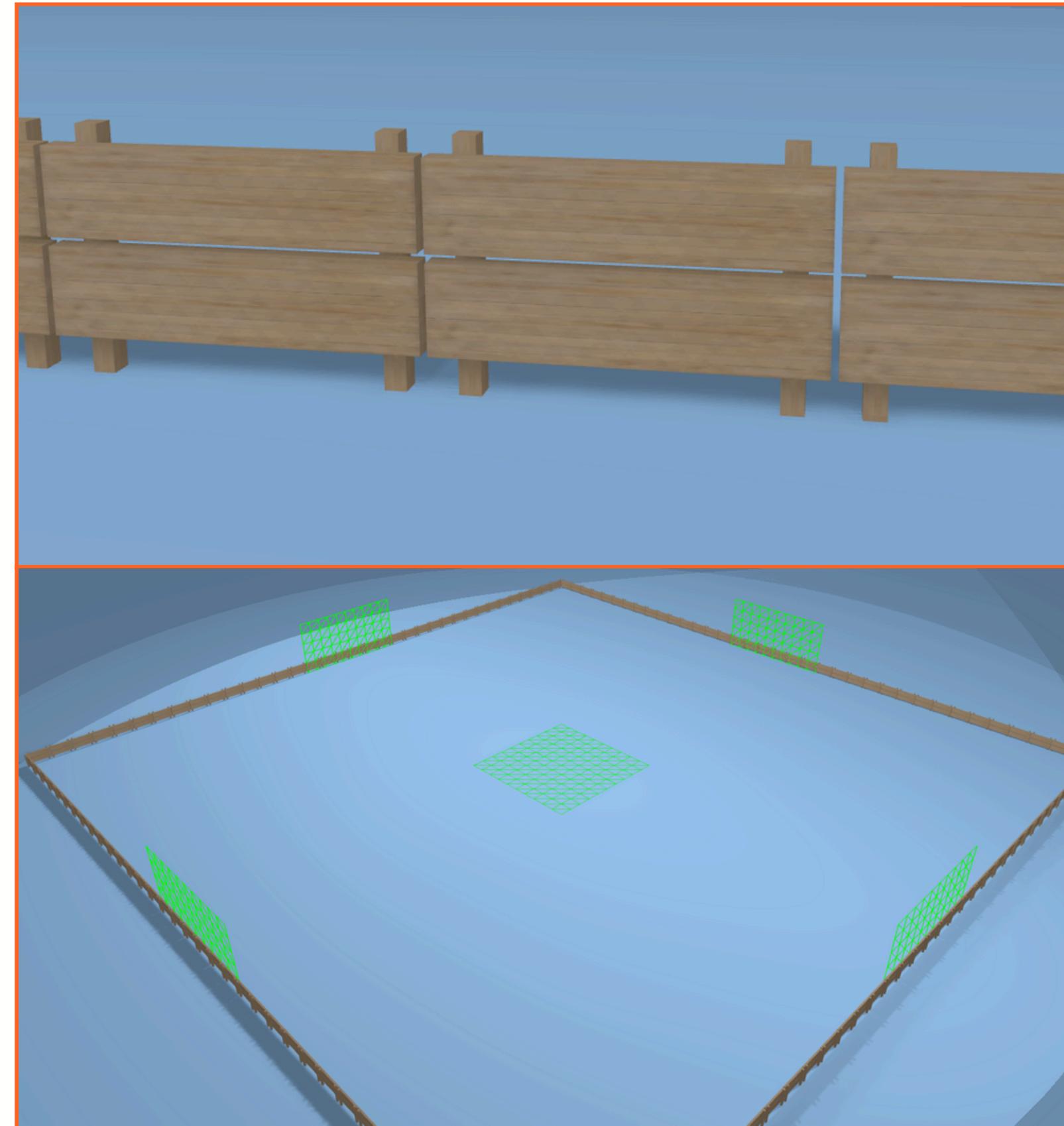
- To **travel freely around the scene**
- **Limited zoom** - minDistance & maxDistance
- **Disable Rotation**
- **Limited Radius** - maxTargetRadius - **now the user can only see the blue plane**



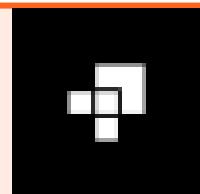
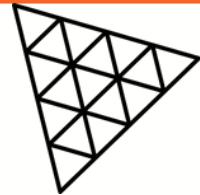
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# Models - Fence

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- **4 Fence Groups** with visual and physical representation that have 35 Fences each
- **Each Fence Item is a Group** constituted by:
  - **4 BoxGeometry's** with Textures:
    - **Map**
    - **NormalMap**
- **Each of the 4 Fence Groups also has:**
  - Invisible Wall - **PlaneBody rotated**
  - **Body of type STATIC**

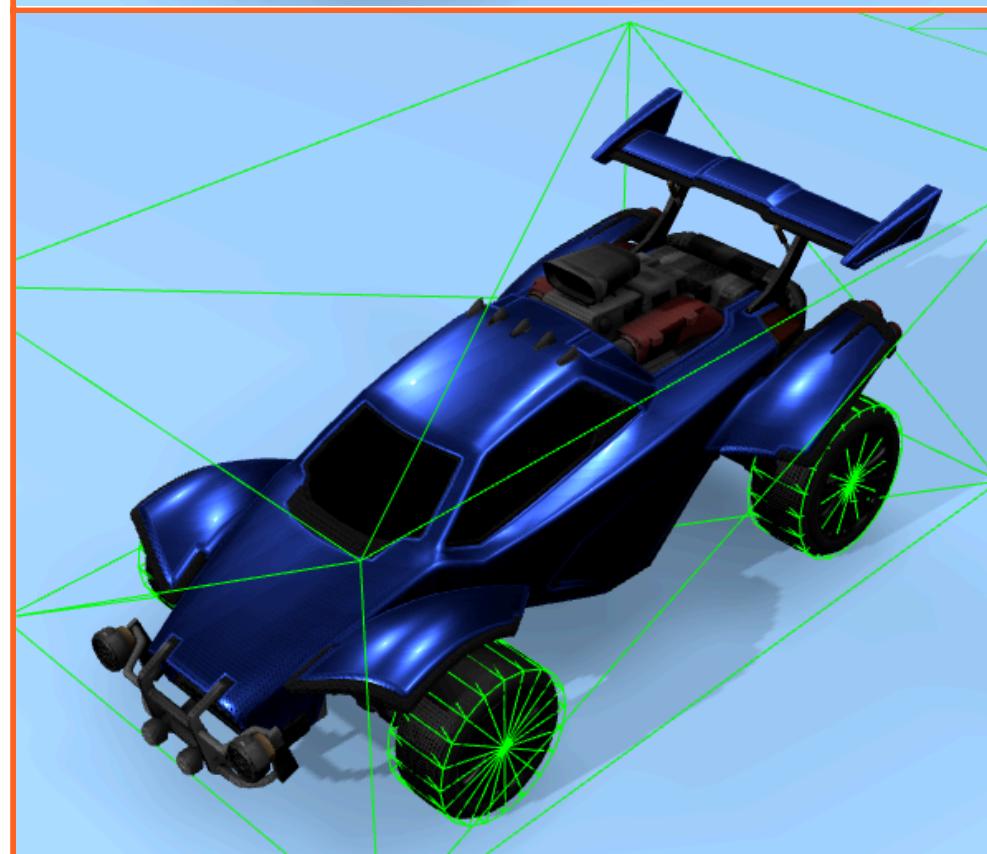


# Models - Car

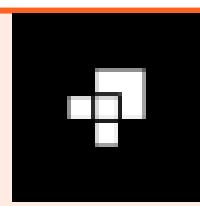
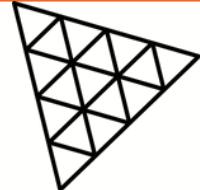
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- **Wheels must spin independently from the chassis**
- **Group** constituted by:
  - Chassis .glb
  - Front Left Wheel .glb
  - Back Left Wheel .glb
  - Front Right Wheel - Front Left Wheel .glb Flipped
  - Back Right Wheel - Back Left Wheel .glb Flipped



- **Raycast Vehicle** constituted by:
  - **ChassisBody**
  - **4 Cylinder Bodies** corresponding to the wheels
  - Each wheels have options like radius and suspension stiffness
- Define interactions between wheels and ground by **creating a contact material** between the wheel material and ground material

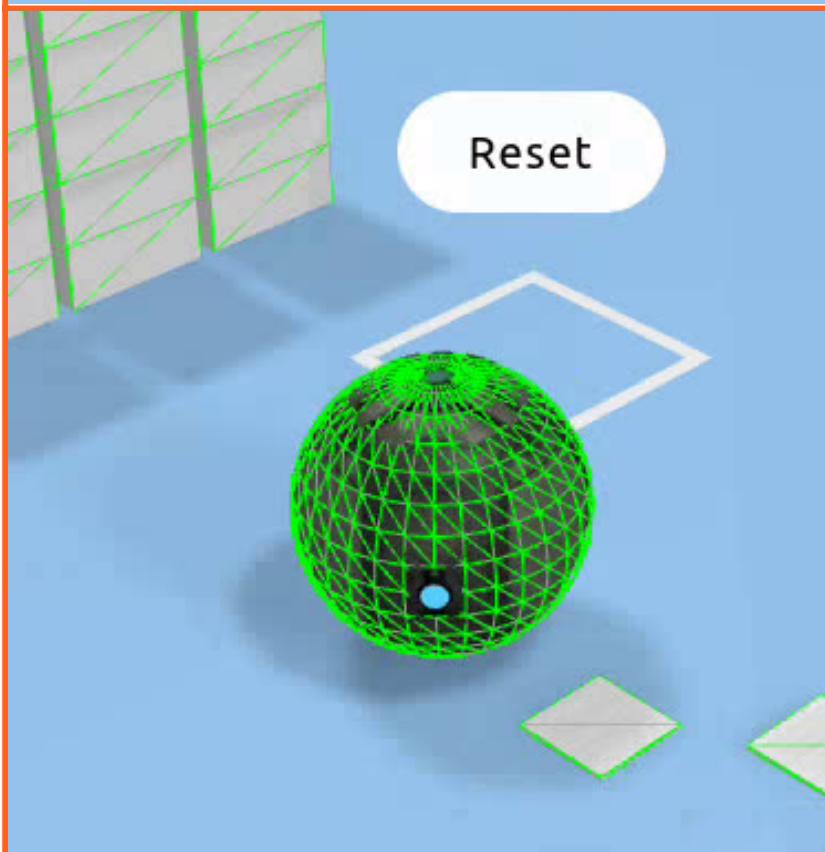


# Models - Ball

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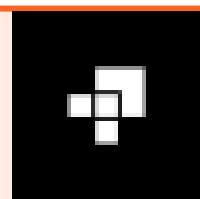
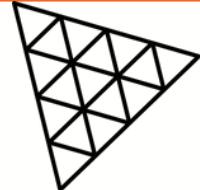


- **Ball .glb**



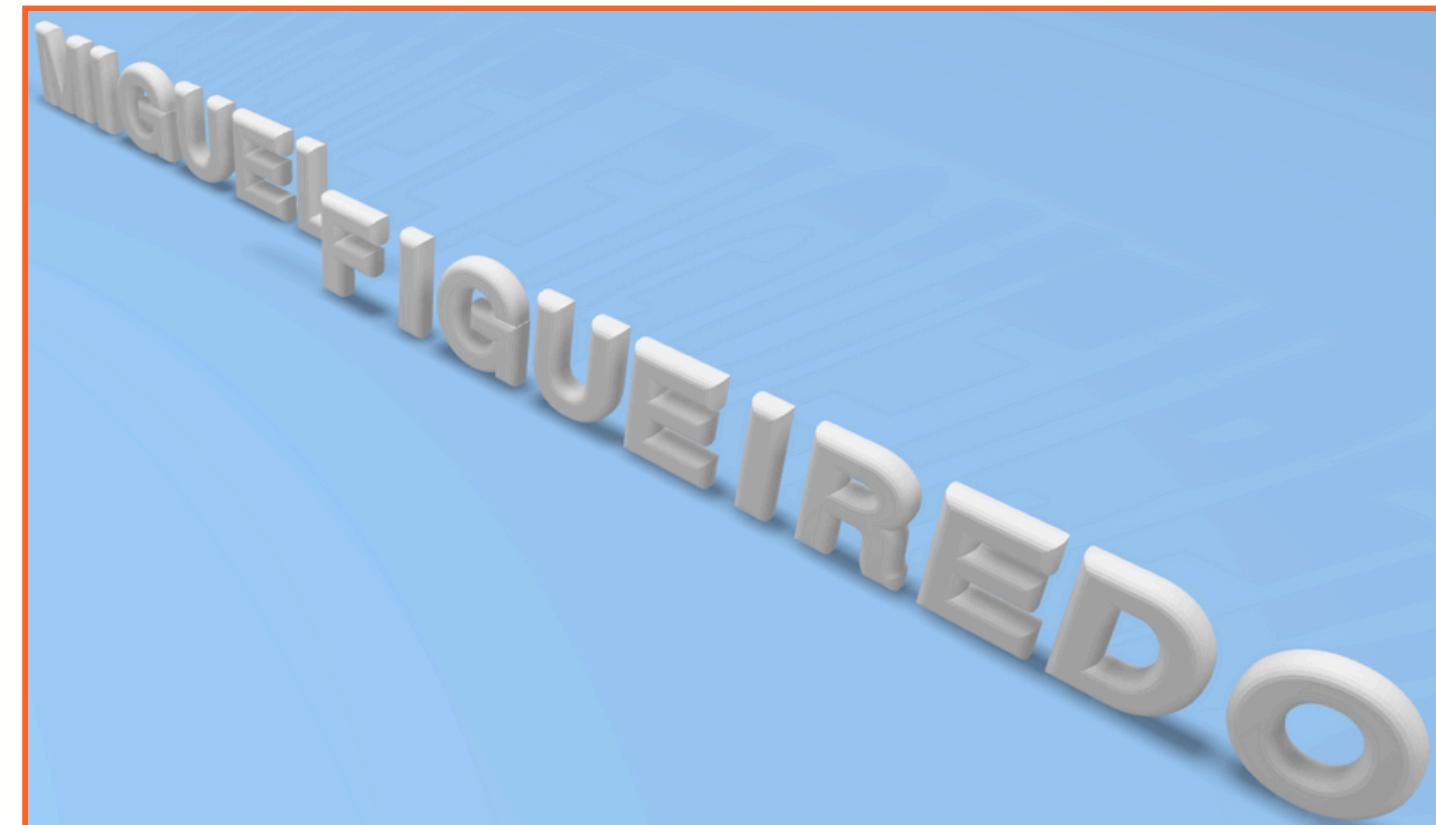
- **SphereBody**

- Defined **Contact Material** between Ball material and Ground Material for the ball to **bounce**

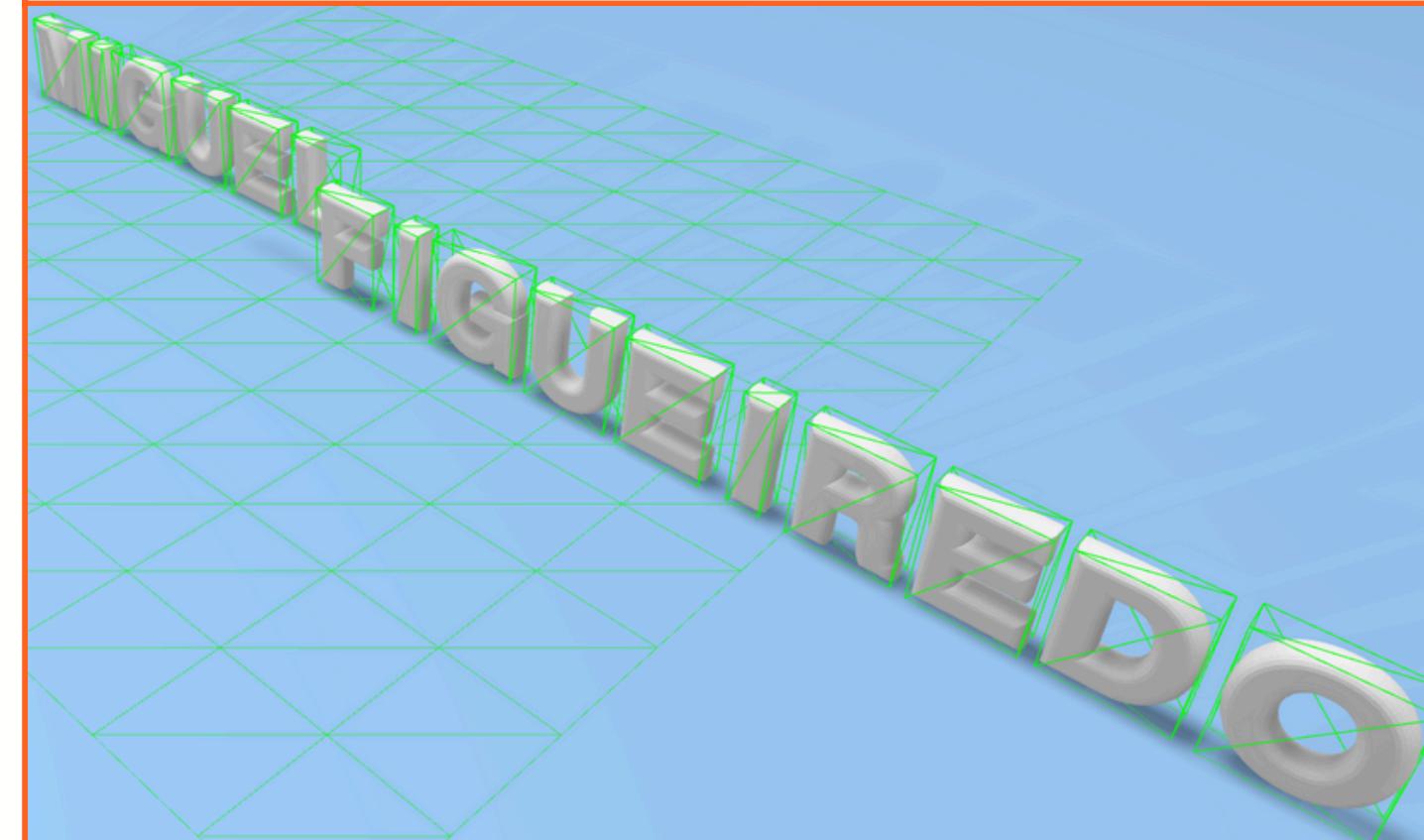


# Models - 3D Letters

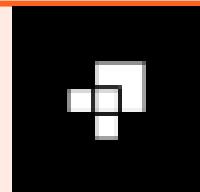
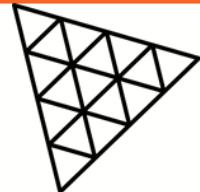
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- **TextGeometry**
- Each letter must be independent so that it can collide and move independently



- Each letter has it's own **BoxBody**

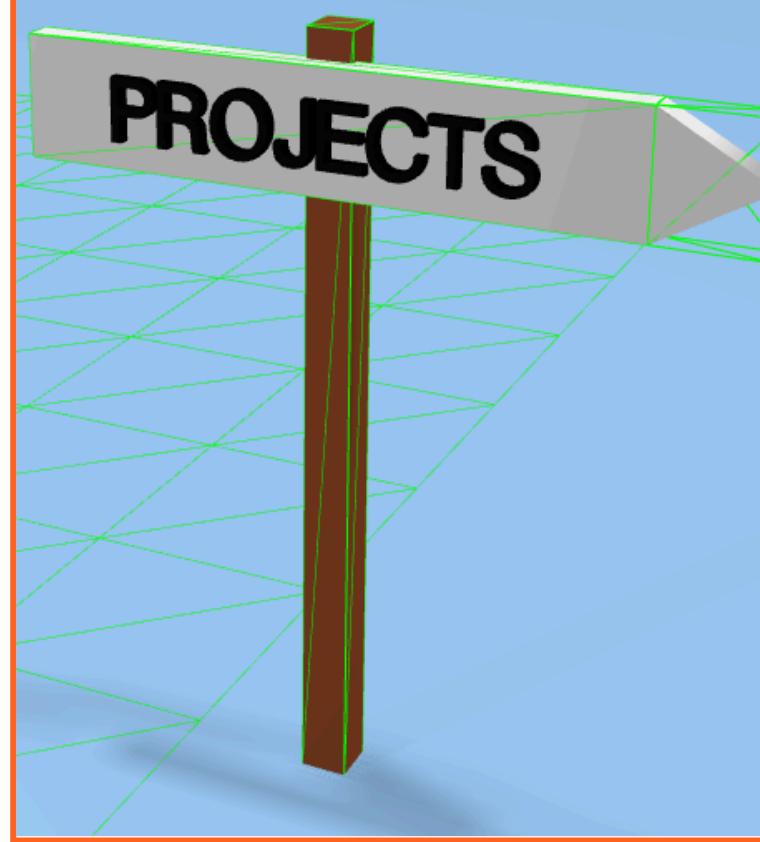


# Models - Road Sign

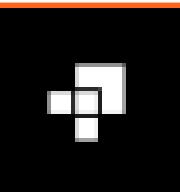
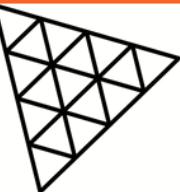
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- **Group** constituted by:
  - **TextGeometry**
  - **2 BoxGeometry**
  - **CylinderGeometry with radial segment 3**



- **Body constituted by 3 BoxShape**
- **Body of type STATIC**
- **CylinderShape wasn't used because of Cannon-es collision limitations**
  - Collision Algorithm between cylinder and sphere isn't implemented

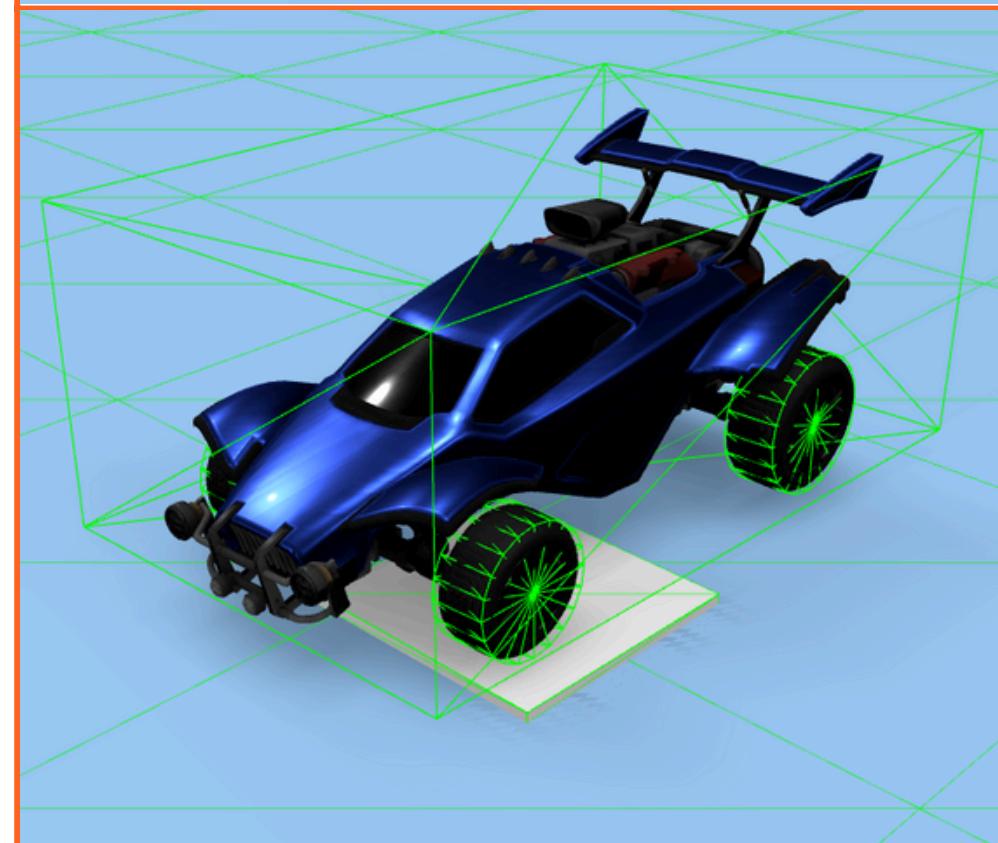
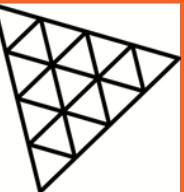


# Models - Tile

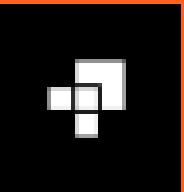
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- **BoxGeometry**



- **BoxBody**
- **Wheel of the car should adapt and pass over the tile**



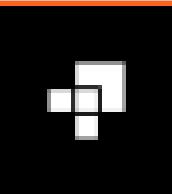
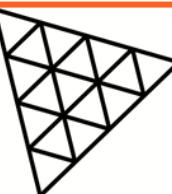
# Models - Painting

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- **Group constituted by:**
  - Frame .glb
  - **Transparent PlaneGeometry with the image as its texture**

- **BoxBody**
- **Body of type STATIC**

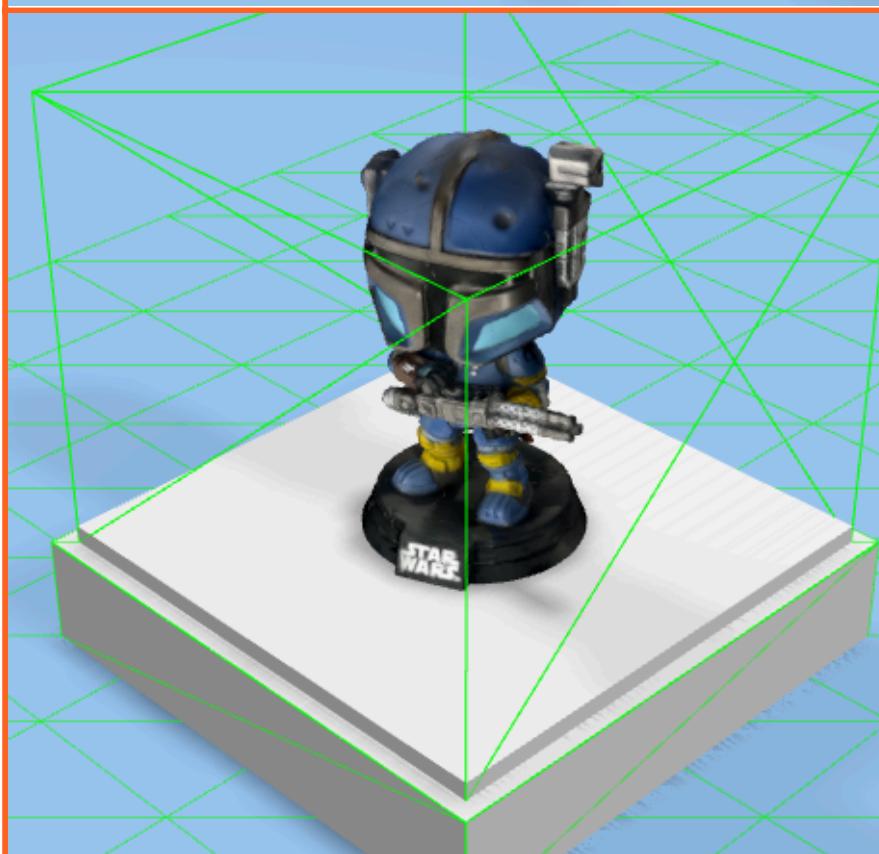


# Models - Statues

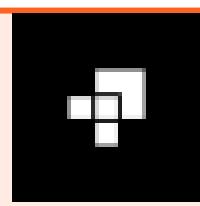
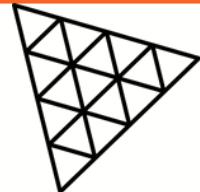
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- **Group constituted by:**
  - Statue .glb
  - Base BoxGeometry
  - Top BoxGeometry
- Used **Bounding Box** to center the statue

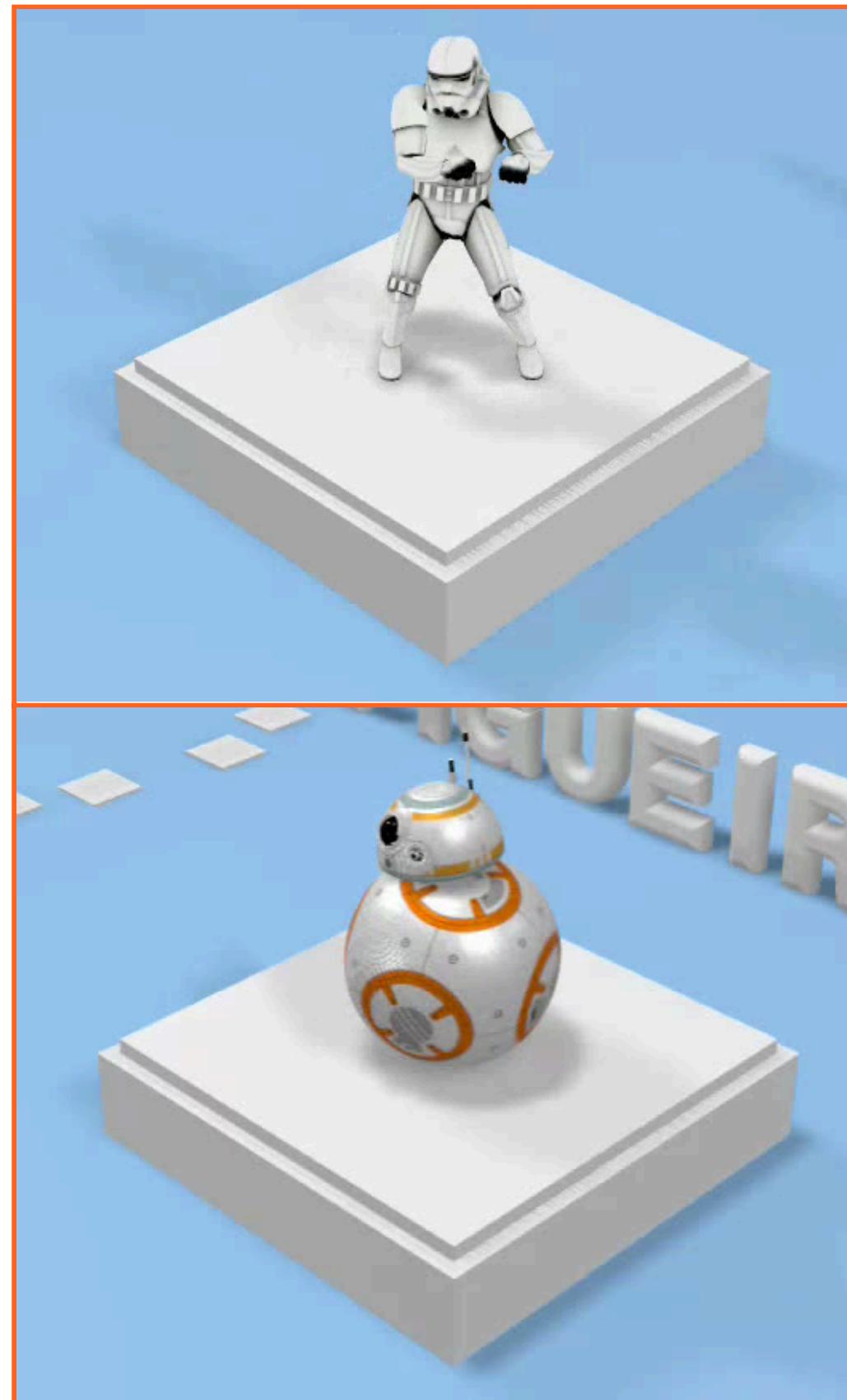


- **Body** constituted by:
  - Bottom BoxShape with the same size as threejs model
  - Top BoxShape with:
    - the same side as threejs model
    - with the same height as the .glb statue
- **Body of type STATIC**



# Models - AnimatedStatuses (included)

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## Animation included in .glb

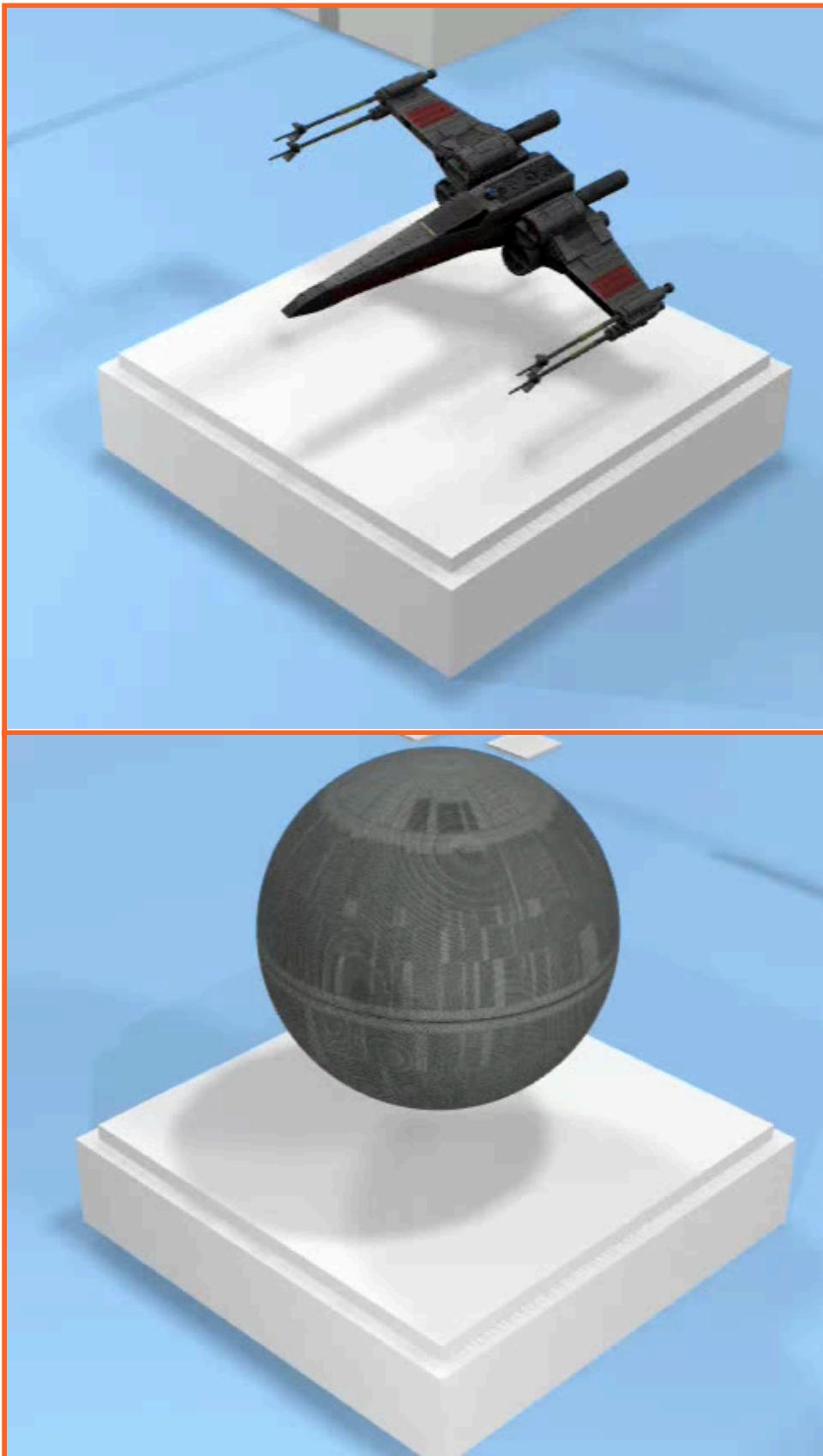
- To play the animation it was necessary using:
  - **AnimationMixer**
  - **Clock**
  - **AnimationClip**

## Animation included in .glb

- To play the animation it was necessary using:
  - **AnimationMixer**
  - **Clock**
  - **AnimationClip**

# Models - AnimatedStatues (custom)

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## Animation included in .glb

- To play the animation it was necessary using:
  - **AnimationMixer**
  - **Clock**
  - **AnimationClip**

## Custom Animation

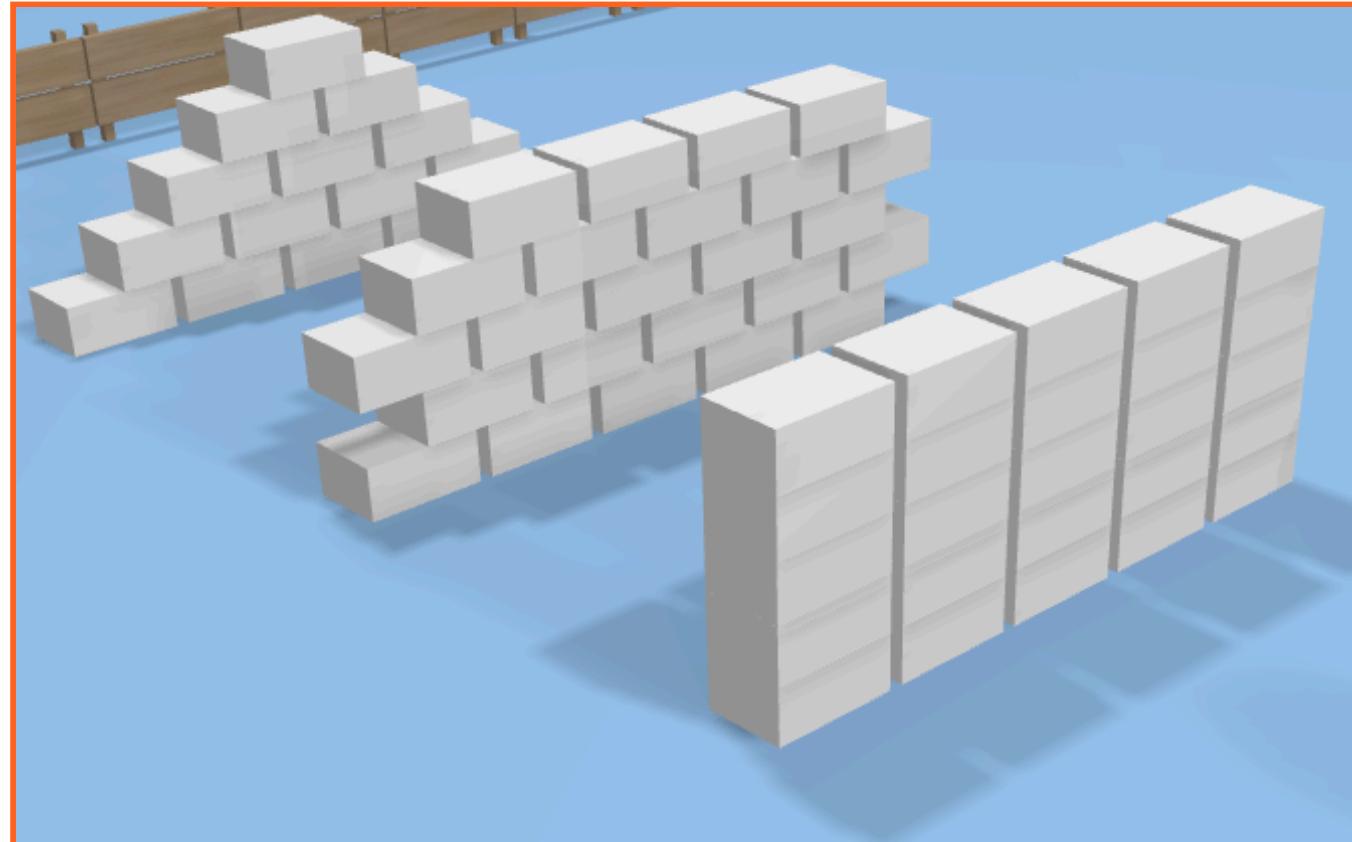
- Rotation around the z-axis

## Custom Animation

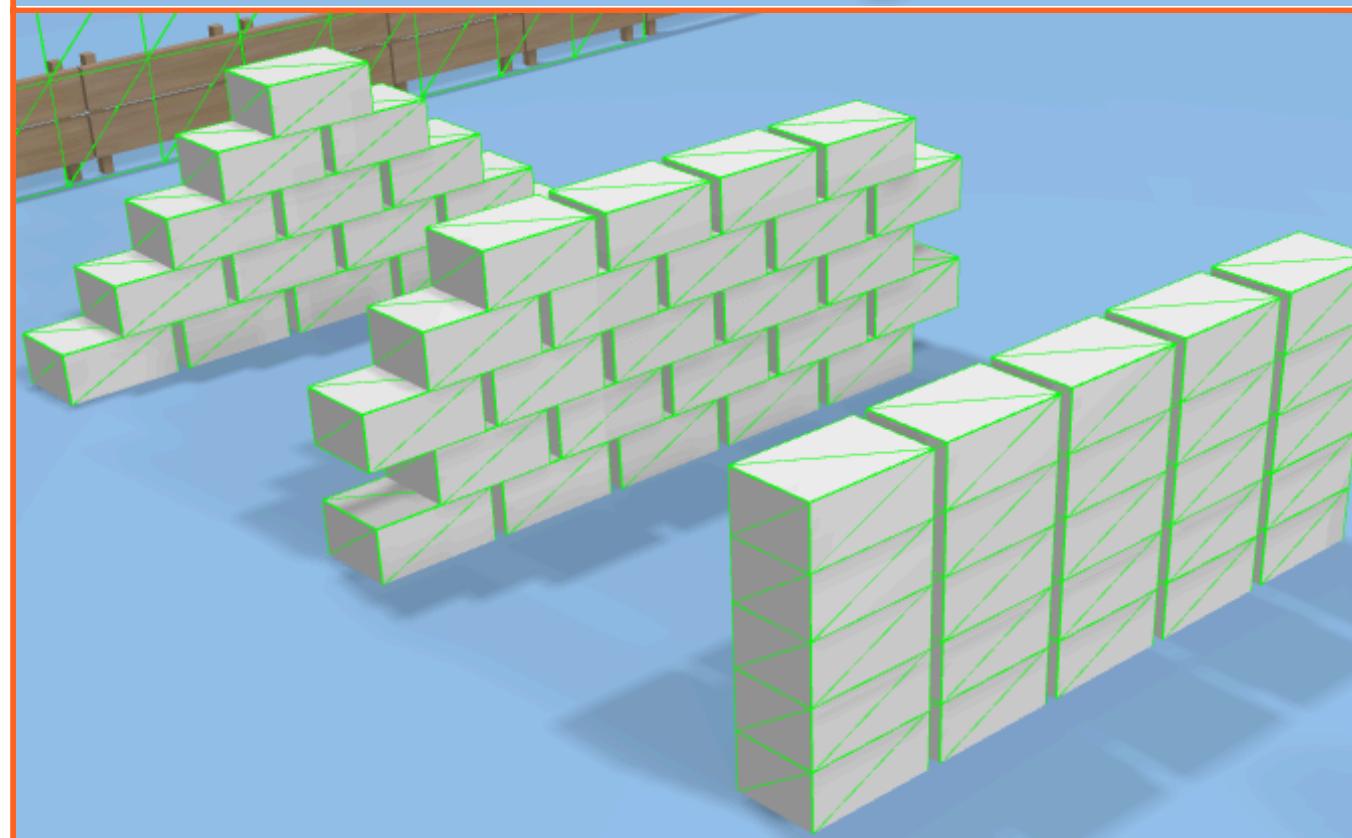
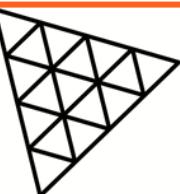
- Rotation around the y-axis

# Models - Brick Piles

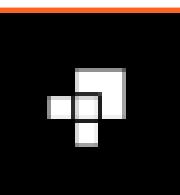
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- **BoxGeometry:**
- Each brick must be independent so that it can collide and move independently



- Each brick has its own **BoxBody**
- Required sleeping the brick's body if it's bellow a certain velocity
  - Otherwise the pile of bricks would wobble until it falls

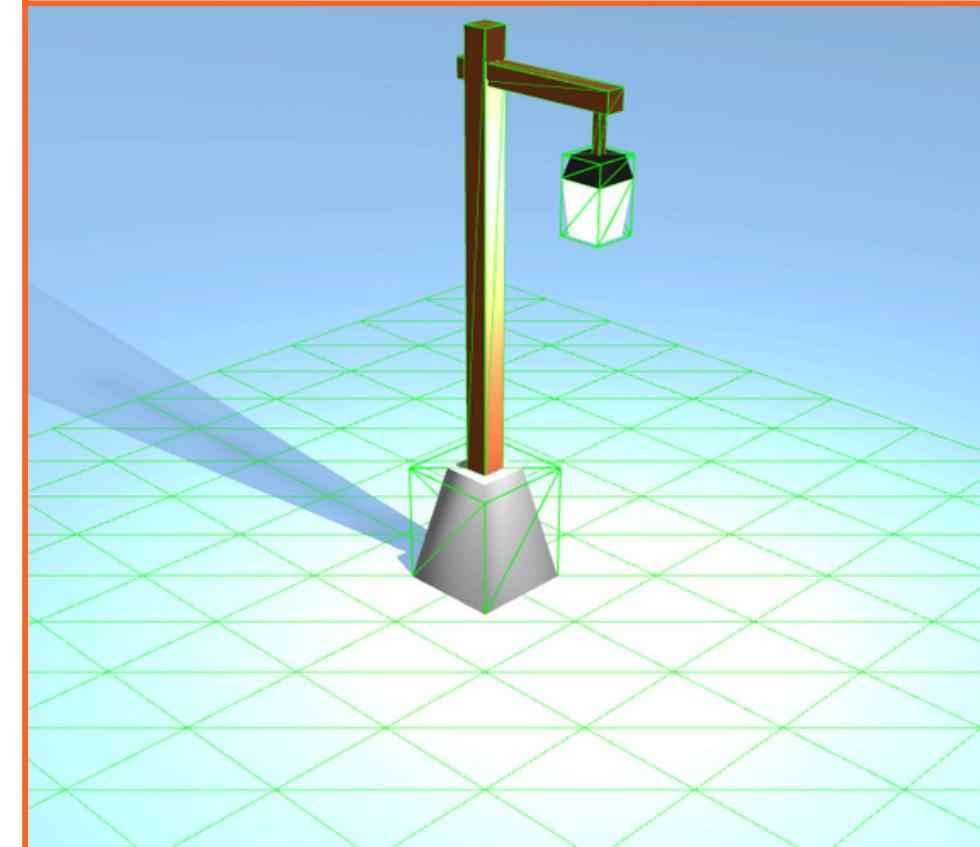


# Models - LightPole

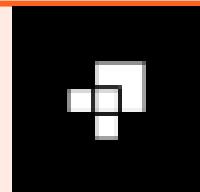
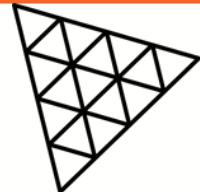
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- **Group** constituted by:
  - **2 BoxGeometry**
  - **4 CylinderGeometry with radial segment 4**
  - **PointLight** in one of those cylinders
- **Each brick must be independent so that it can collide and move independently**



- **Body constituted by 6 BoxShapes**
- **Body of type STATIC**
- **CylinderShape wasn't used because of Cannon-es collision limitations**
  - Collision Algorithm between cylinder and sphere isn't implemented



# Lighting

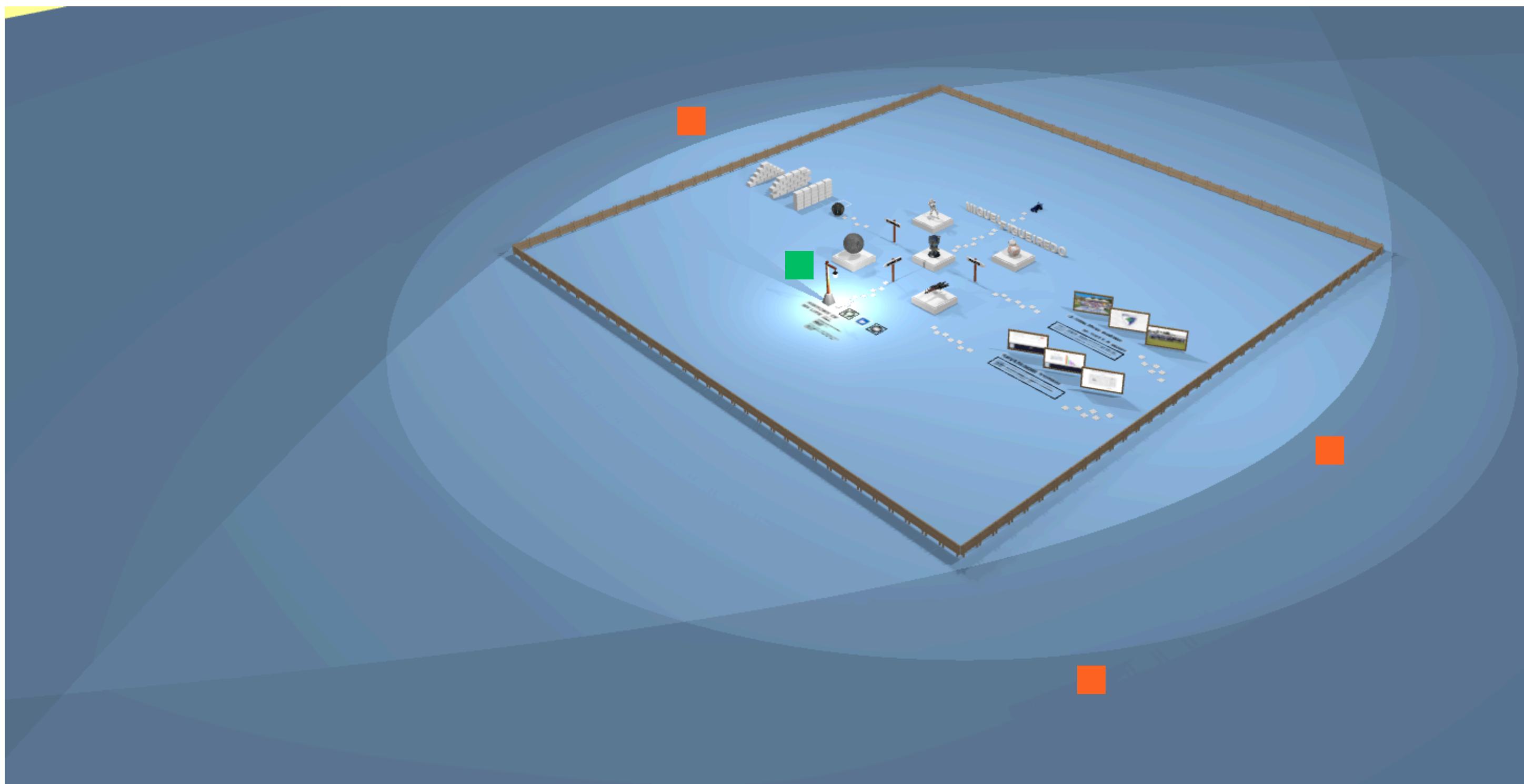
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■ AmbientLight

■ 3 SpotLights

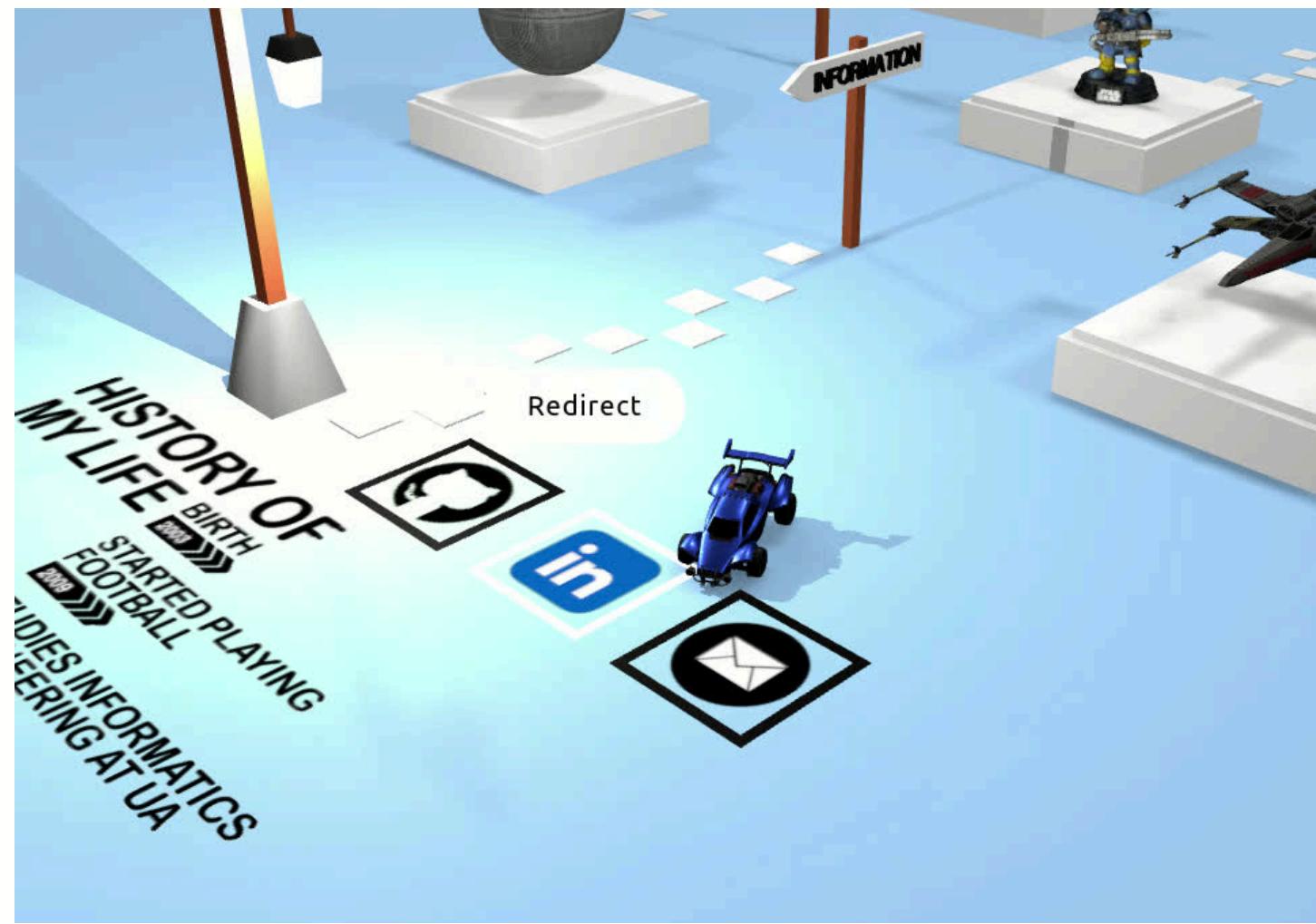
■ PointLight - previous slide

All models receive and cast shadow!



# Interactions

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- Car Movement by using **W, A, S, D** or **←, ↑, ↓, →**
- Move freely around the space by dragging the mouse
- Zoom in using mouse wheel
- Interact with buttons in 2 different ways:
  - **Press Enter when car is on top of the button**
  - **Clicking the button with the mouse left click**



- Button constituted by:
  - Visible Empty Rectangle - **ShapeGeometry**
  - Invisible plane - **PlaneGeometry**
- **CSS2DRenderer & CSS2DObject** to add to a scene (and model) the css tooltip
- **loadButton** function receives function callback to **customize button actions**
- **raycaster.intersectObject(button)** alongside **raycaster.setFromCamera()** or **raycaster.set()** to intersect with pointer or car, respectively



# Collisions

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**2 different things can happen when the car bumps into another body:**

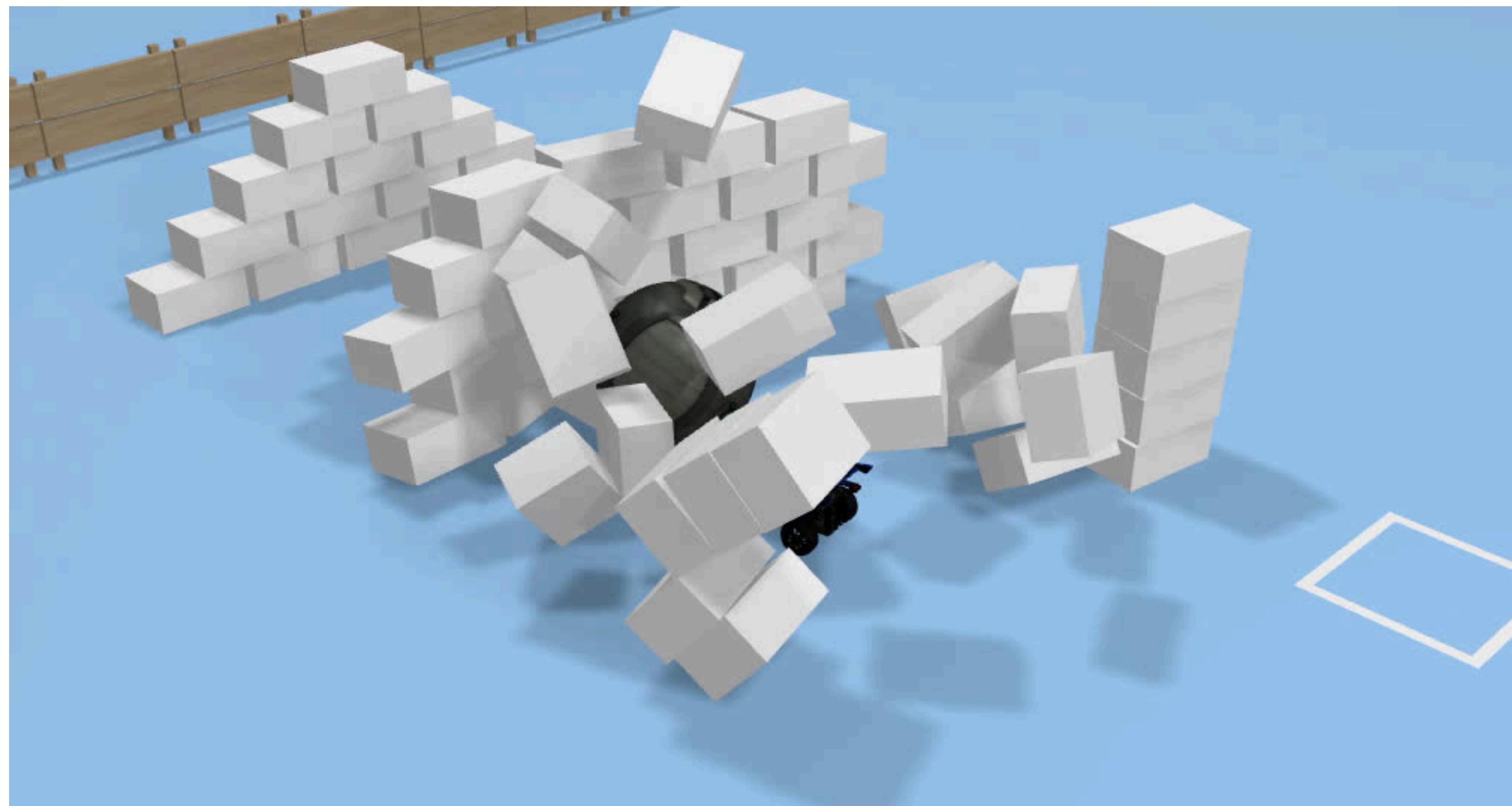
- If that body is of **type STATIC**, then the car isn't able to move it
- If that body **has mass** (as well as the car), **then the car is able to move it**



# Reset models after collision feature

**When first loading the object it is saved in a map an entry that:**

- Contains the elements, its original quaternion and its original position
- Is passed to the button a function that resets the velocity to zero, original quaternion and original position of all elements in the collection.



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# Textures

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**Each Fence Item is a Group** constituted by:

- **4 BoxGeometry's** with Textures:
  - **Map**
  - **NormalMap**



Images on the paintings and 2D text on the floor are all transparent planes with the image as its texture!

Had to use renderOrder to prevent z-fighting between planes

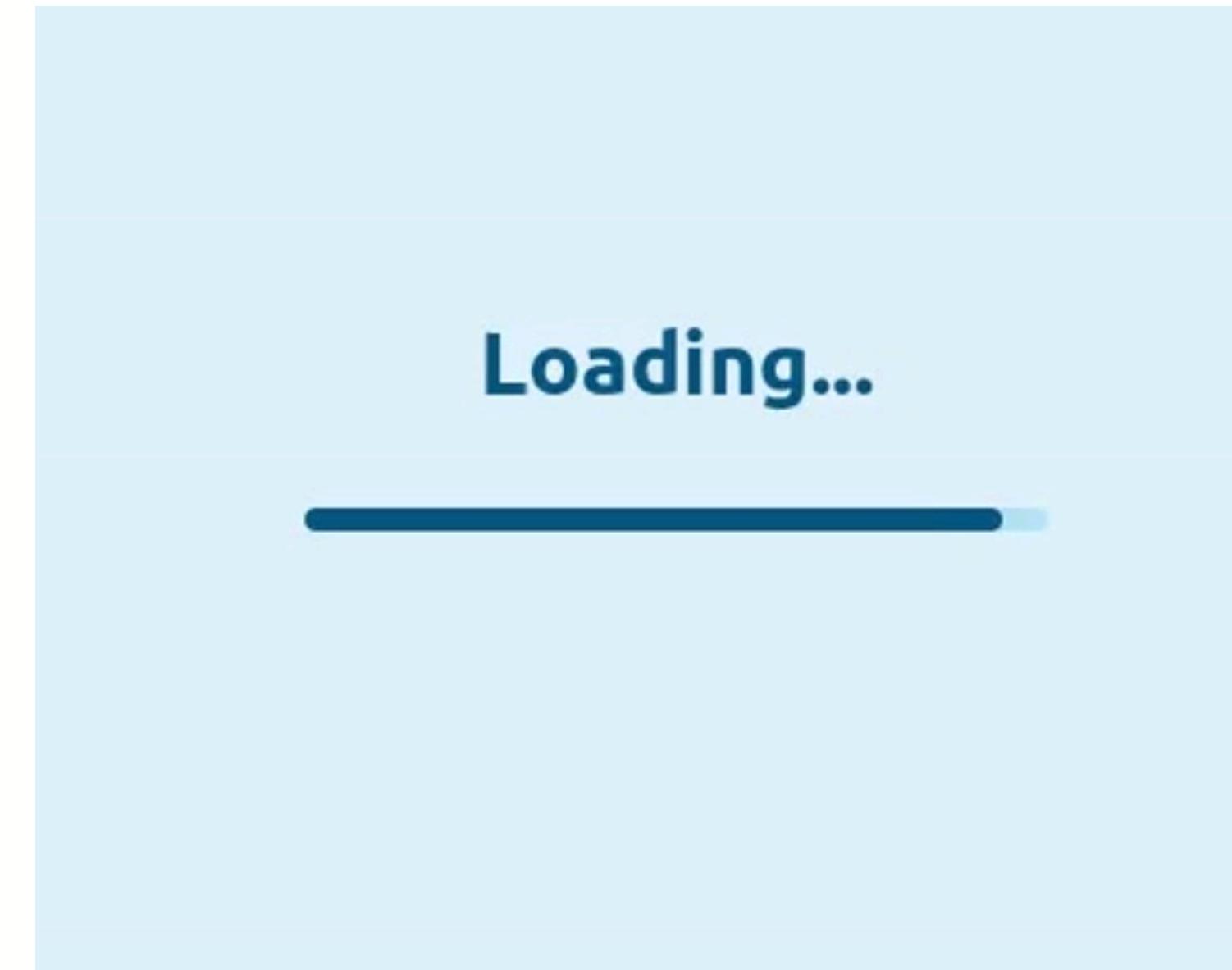
Text Images were **built by me** using Photoshop!



# Loading Screen

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- **LoadingManager**
  - Gets passed to all loaders and **handles and keeps track of loaded and pending data**
  - Has **onProgress function** where you can get the **progress percentage**
  - Has **onLoad function** that runs once all there is is loaded
- **Loading Animation using css:**
  - Percentage updates using onProgress function
  - Button appearance using onLoad function



# Audio - Positional Audio

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- Audio attached to a mesh
- As you change the camera closer to the target the audio gets louder and louder
- As you approximate the mesh with the car (and consequently the camera) the same behaviour happens
- You can also distinguish audio coming from left or right
- Models with attached audio:
  - **Bricks and 3D Letters** when they fall on the ground above a certain speed
  - **Dancing Stormtrooper** - where the positional audio is most noticeable because the model is always in the same position



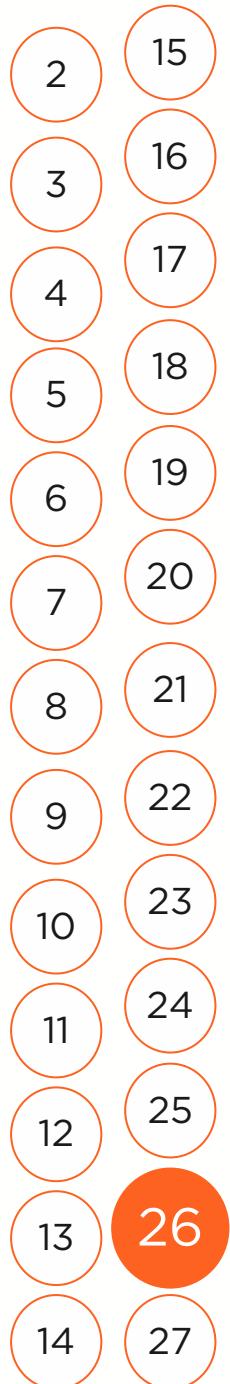
Used **no-copyright audios** and edited them on **Audacity** to obtain short-duration audios for collision

**LIVE DEMO**

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# Thank you!

- **Github Repo:** <https://github.com/Migas77/migas77.github.io>
- **Video:** In the sent zip or in the above github repo. Made 2 videos: with and without commentary
- **Deployed solution:** <https://migas77.github.io/>



# Resources used in the solution and the due credit

## Audios

- <https://pixabay.com/sound-effects/brick-dropped-on-other-bricks-14722/>
- [https://pixabay.com/sound-effects/bricksfalling\\_owi-38352/](https://pixabay.com/sound-effects/bricksfalling_owi-38352/)
- [https://pixabay.com/sound-effects/trung\\_gach-a-96162/](https://pixabay.com/sound-effects/trung_gach-a-96162/)
- <https://pixabay.com/sound-effects/bricks-41542/>
- <https://pixabay.com/sound-effects/mouse-click-153941/>

## .Glb Models

- <https://sketchfab.com/3d-models/bb8-animated-star-wars-c34d6dd797134a228863ac4eea7925f8>
- <https://sketchfab.com/3d-models/death-star-star-wars-423fb92f677f4448aef407112a1fc032>
- <https://sketchfab.com/3d-models/low-poly-framed-painting-f9e52d4738204d0baff9462d614c2435>
- <https://sketchfab.com/3d-models/heavy-infantry-mandalorian-funko-pop-87c004229df54350a96da22b>
- <https://sketchfab.com/3d-models/octane-rocket-league-car-9910f0a5d158425bbc7deb60c7a81f69>
- <https://sketchfab.com/3d-models/ball-rocket-league-2c8911aa1dcd4c53bad842f2d354dfe2>
- <https://sketchfab.com/3d-models/repost-of-dancing-stormtrooper-32478eda16df43048835b323885f9a0>
- <https://sketchfab.com/3d-models/star-wars-x-wing-a93f607a94d747568371b8910a81fb12>

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