

# Door Explorer - Group 9

Lukas Jigberg, Daniel Persson and Joel Båtsman Hilmersson

January 14, 2024

## 1 Requirements

The following section is about how our project did implement the assignment requirements.

### Unity Assets

The game is filled with all manners of different Unity assets. All from self created mesh models, scripts, shaders and textures to found and downloaded assets.

### Player Interaction

A canvas has been placed over the phone screen enabling users to interact with the AR world by clicking and dragging with the finger. Moreover, the user can move around the phone in the AR world to view the world from different directions and in turn manipulate things through movement.

### Anchors

The game uses the floor the player is stood on as an anchor to fasten all game elements to the real world. It does this by creating a virtual invisible plane at the floor height in real life and places objects on it. The objects placed are then anchored to this virtual plane.

### Point Clouds

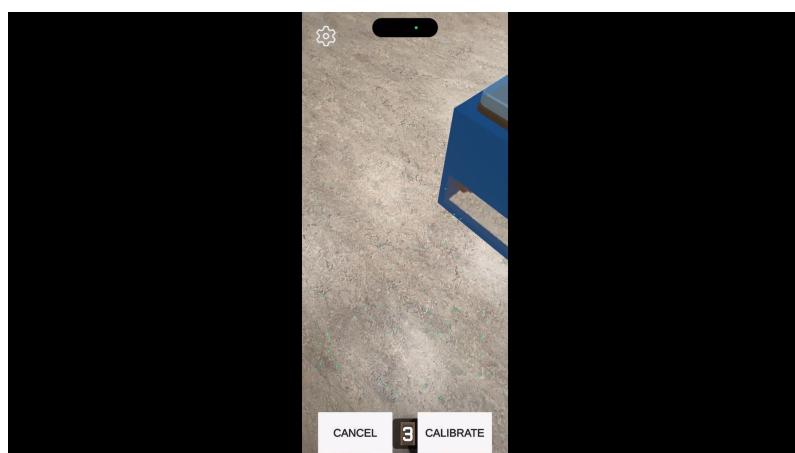


Figure 1: Image of the point cloud calibration menu in action

The game uses point clouds to allow the user to calibrate floor height if the virtual floor plane does not match floor height in real life. This is done through a menu where the player can select a point where after the virtual floor plane is set to that height. The menu is shown in figure 1.

### **Image Tracking**

The game does not include image tracking. The game design was geared more towards AR sandbox exploring.

### **Ray Casting**

Ray casting is used for many things in game. It enables placing portals, opening doors, interacting with items and picking them up. The camera is always shooting these rays to find interactions.

## **2 Additional Features**

The following section is a list of the additional features the game includes, from and not from the course module.

### **Teleportation Doors**

The unique asset from assignment two, the Doors<sup>TM</sup> are used to teleport the player in AR to unique rooms. The doors can be freely placed by the player in the real world which allows them to stay in one place while exploring a, in theory, infinite AR space.

### **Self-built and Probuilder Meshes**

Some meshes, including their materials, have been built by the group. These were either created by the use of the external modeling tool *BlockBench* or have been built using the extension / package *ProBuilder* in Unity. The custom meshes allowed for more interesting and unique meshes suited to the game and are shown in figure 2.

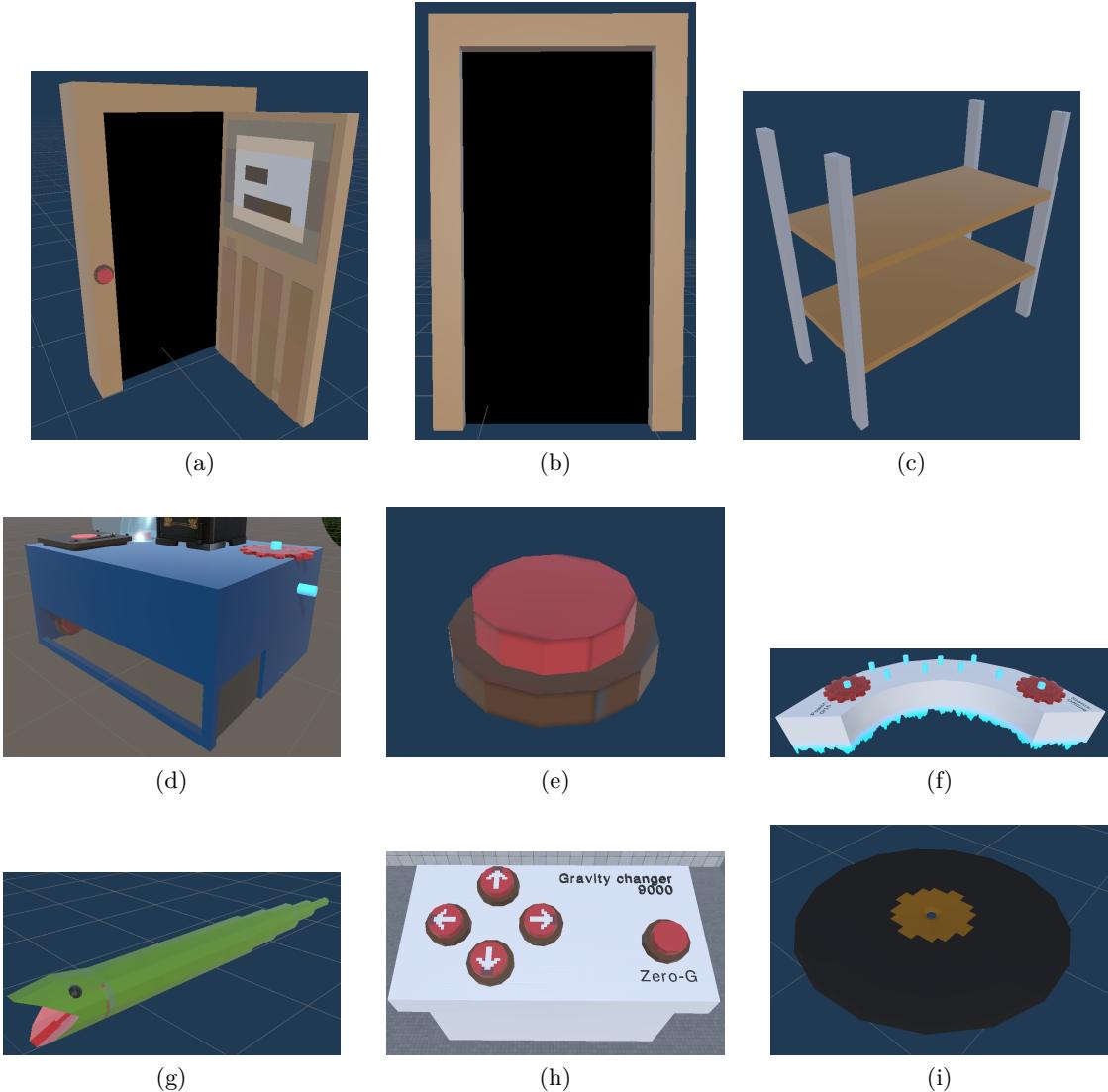


Figure 2: A collection of all main self-made meshes

### Self created Shaders

During the game creation, a few material shaders were created to better suit the visual looks for the game. These shaders were primarily made using Unity shadergraph and could do anything from just being static to creating movement in textures and slicing objects going through portals.

### Pickup Objects

All items can be made to be picked up by the player. An item can be picked up through portals and will be in front of the player until they drop it or in a matter of ways *break* their hold of it.

## Ray casting through portals

A ray-casting system to cast rays through portals has been created. This is used whenever the player ray casts something through the portal. It works by calculating the direction, length and hit location of the incoming ray in the portal and casting a corresponding new ray at the out portal,

## User Interactive 3D Mesh Rotation

If an item is picked up can a player rotate it freely by dragging a finger across the screen, allowing them to inspect every part of an object and to more easily utilize it.

## Local Skyboxes



(a) The local skybox of the sky island in game



(b) The local skybox for the painting room

Figure 3: The local skyboxes used in the game

Since a global skybox does not mix with the AR environment, a local one introduced. It encompasses a smaller part of the game, creating the illusion of an *outside* to an AR world. Examples of these local skyboxes can be seen in figure ??.

## Material and video remote

A modular script was created to allow intractable objects to change the video and material of a chosen object.

## Gravity Changer 9000

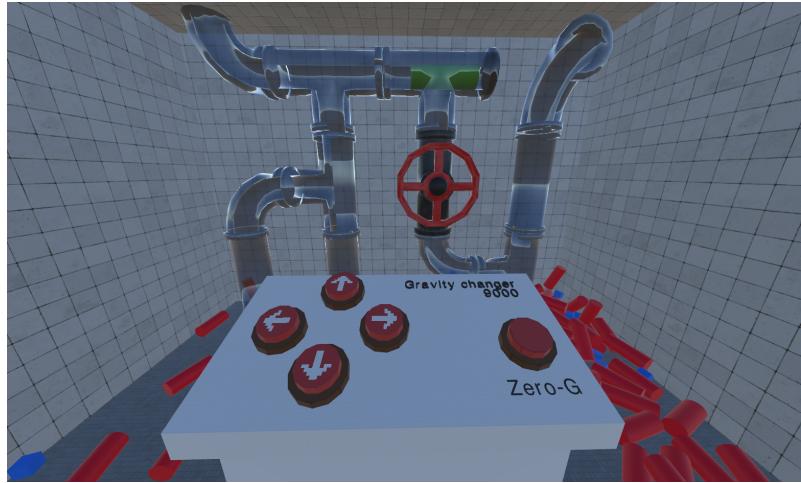


Figure 4: Image of the gravity changer 9000 that the player uses to select gravity

Inside the gravity room, a system was created to allow items have different gravities based on user selection. This system works with all items that enter the room and can make them have gravity pointed up, down, left, right and zero-g. The player gravity selector can be seen in figure 5.

## Gear rotation and meshing system

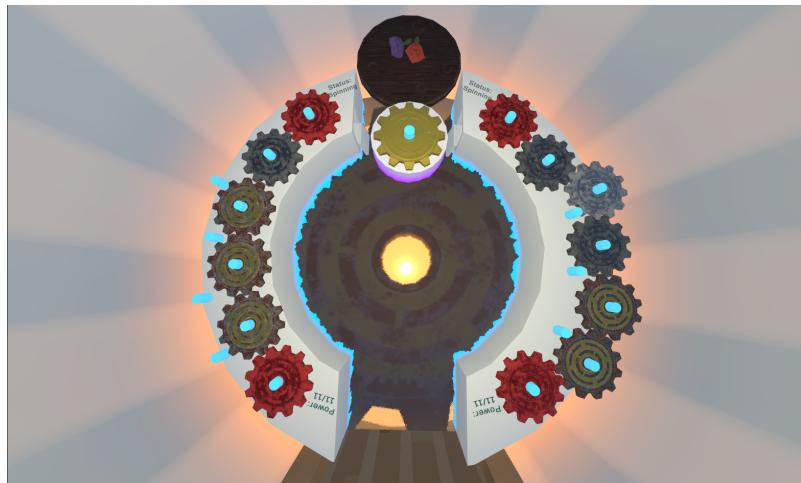


Figure 5: Image of the gear meshing system working

For the gear puzzle, inside the gear room, a rotation and meshing system was created to make sure the gears placed by the user would mesh visually together. Also, depending on the resistances of the gears attached and powered by the starting gear, the speed of the gears turning will decrease as resistance gets higher. It will then stop if the resistance of the gears becomes too high. In figure 5, the gear meshing system is seen working as intended with all gears meshing together without clipping.

## Free-fly AR simulation camera

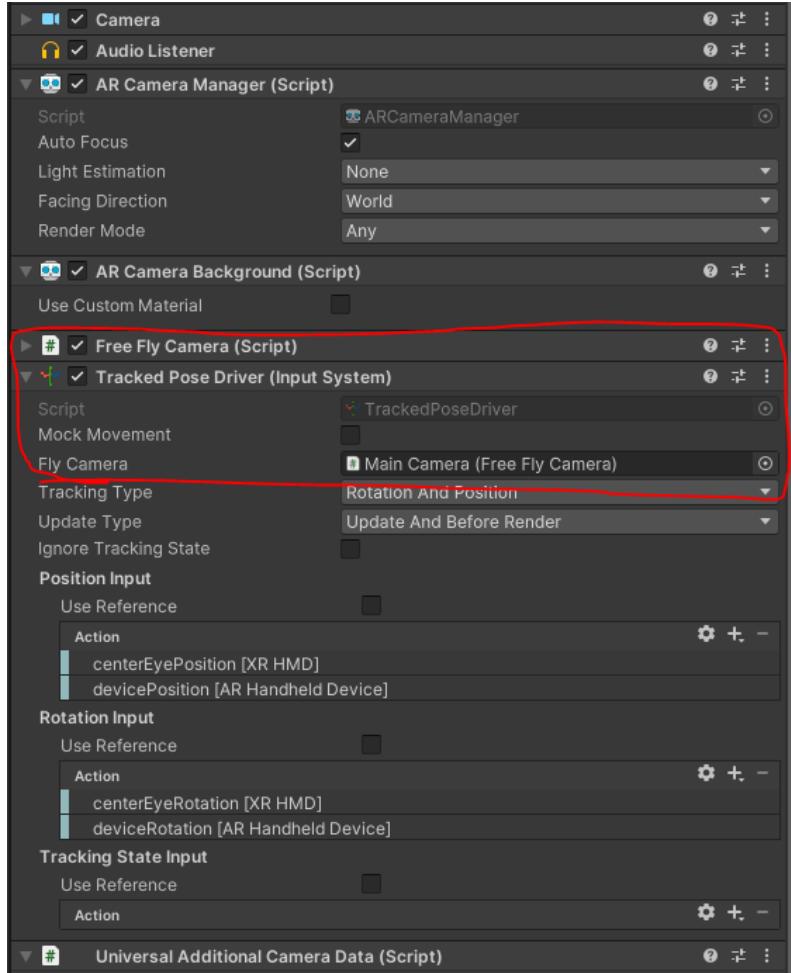


Figure 6: Image showing the addition of components to enable movement of AR camera inside the unity editor

To help develop the game easier, a modification was made to the "TrackedPoseDriver" which allowed us to insert pretend AR movement values inside the unity editor. By using a free-fly camera script to generate these pretend values, we could send them to the driver which took them as input from the outside ARCore/ARKit.

This allowed us to simulate the actual AR camera movement inside the unity editor as if it were built to and tested on device. Since the build step often could be removed, this saved us a lot of time and helped in debugging. Figure 6 displays the components used and placed on the camera to make this work.

## 3 Game Design

This section will briefly describe the aim and different parts of the game. It will also include a walkthrough on how to play it.

## Aim

The game is meant to allow the player to explore an Augmented Reality world inside using their phone. It is meant to be played in a semi-large room with space to walk around in. When the player starts the game they are given ample instructions on how to play it but are thereafter meant to explore to reveal the more unique parts of the game. The game has a goal but is not meant to be played as a mission type game with clear instructions and objectives for the next part. It is instead more similar to an escape room, where the player has to search and think logically to advance and lock up more parts.

The game does include parts that do not advance the story and instead is just meant to be interesting or funny. Both for the hopeful enjoyment of the player but also to demonstrate ideas for features for AR development.

When the player has completed or feels done with the game is our aspiration that they will have had both an enjoyable but also an interesting time trying something different.

## Game Features

A list of all substantial game features created for the playability of the game.

### Final Puzzle

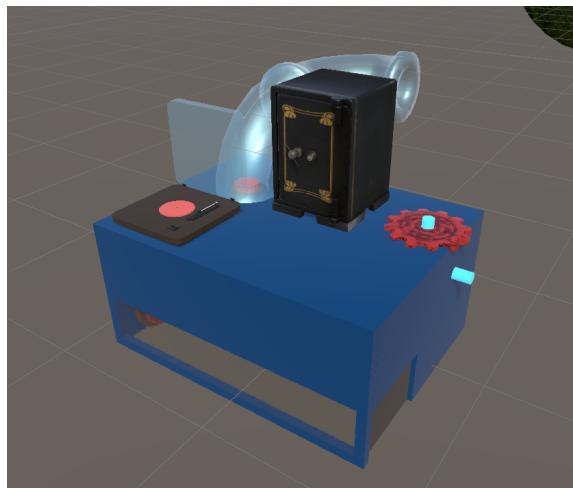


Figure 7: Image of the final puzzle

The goal of the game is to solve a puzzle that is seen right in front of the player when opening the game. This is solved by gathering objects from the five rooms and placing them in the correct position in the puzzle.

## Teleportation Doors



Figure 8: Image of the teleportation door leading to the sky island

There are a total of four doors, each leading to a unique room. A door can be placed using the UI on the phone screen. Each door consists of a frame, movable door and a self-destruct button. Pressing the button will not reset or items in it, but will instead only allow the player to replace the door somewhere else. More than one door can be placed at a time. One of these doors can be seen in figure 8.

## Shed Room



Figure 9: Image of the shed

The shed room is the same as in assignment 2. It is a low polygon room filled with different items for the user to interact with. The main object being the record player. On this record player, a user can place different records to play different songs. Currently, the two songs are "The Imperial March" and "Carmen". One of these records are also needed to complete the final puzzle. The shed room is shown in figure 9.

## **Painting Room**



Figure 10: Image of the painting room

The second room looks like an old mysterious shed that is filled with random items and furniture. It is the only room with a window that leads *outside*, showing a skybox of a forest. The player can alter the skybox using a remote placed at the window board. The room also features a painting of the Mona Lisa. Interacting with it will change it to play an assortment of different videoclips. The painting room is shown in figure 10.

## **Gravity Room**

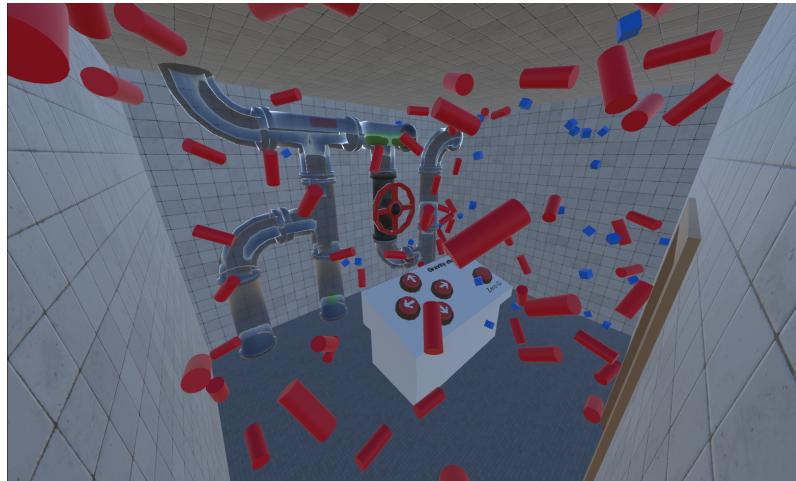


Figure 11: Image of the gravity room with gravity set to 0

The third room has a control panel that alters the gravity of all objects in the room, except the player. The panel has five buttons, four buttons for directions and one for zero gravity. Behind the control panel you can find a puzzle. This puzzle is solved by using the gravity buttons and interacting with the valve. You also need to first move a green cylinder blocking an entrance in the pipe. This is also done by altering gravity direction. The room is also filled with small items that will whirl around as the player shifts the gravity. The gravity room is seen in figure 11.

## Gear Room

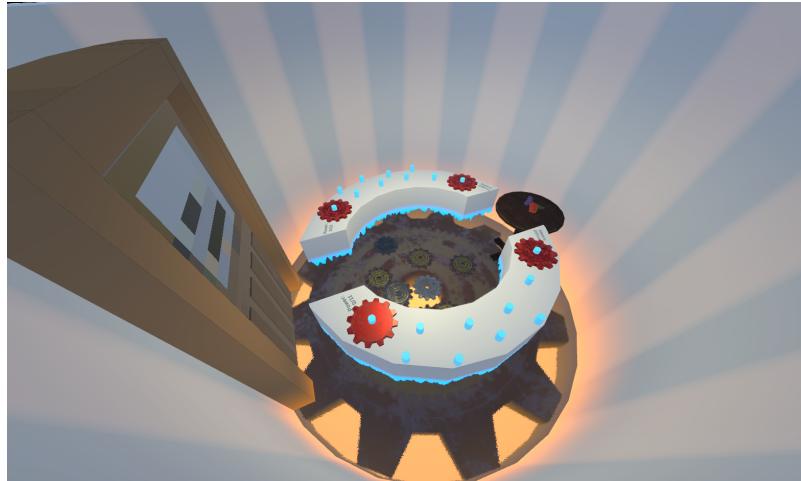


Figure 12: Image of the gear room

The gear room is primarily filled with a gear puzzle divided up in two parts on either side. The task is to place gears from one starter gear towards an end gear so that it meshes together into a chain to move. The three different gear types found in the room has different turning resistances which needs to be taken into consideration since the power level each starter gear produces is limited. If the power threshold is surpassed the gears will stop. The gear room is shown in figure 12.

## Sky Island



Figure 13: Image of the sky island

The sky island consists of one empty island surrounded by a heaven skybox. On the island is a single tree, a few flowers and an iron lock. The iron lock unlocks a small car when unlocked. The island can be seen in figure 13.

## Walkthrough

To unlock the safe faced with when starting the game the player will need to gather a few things.

1. Place door 4 and enter the gear room to start retrieving a unique gear.

Once the puzzle is finished bring the gear back to the safe in the middle and place it on the empty peg. A garage door will open on the side of the machine.

2. Place door 2 and enter the painting room. Underneath the sofa will there be a key. Bring that key outside the room and place door 5. Enter with the key and use it on the tree lock. Grab the car that spawns and bring it back to the machine. Place the car so that it drive into the new compartment. The record players lid will have opened.

3. Place door 1 and enter the shed room. Grab the record on the barrel to the right and bring it back to the machine outside. Place it on the record player. Music will start to play.

4. Place door 3 and enter the gravity room to start retrieving a unique green ball. Use the panel to change the gravity to lead the ball out of the tubing on the back wall.

Put the ball into the pipe on the safe machine. This together with the previous steps should have opened the safe. On the inside should a price be, congratulating you on job well done.

## Unity version

We did not use the recommended version suggested by this course as it had bugs when building to *IOS*. Therefore we chose Unity version *2022.3.12f1*.

## Github

The project can be found on github through this link: <https://github.com/Danilll01/DAT380-DoorExplorer>

## 4 Credits

The following is the credit for all downloaded assets.

### Gravity Room

- White Tiles  
<https://sketchfab.com/3d-models/freebie-game-art-white-tiles-3c9fe794746847d8bf634eb61870e4e7>
- Metal Pipes  
<https://sketchfab.com/3d-models/little-pipes-free-pipes-kit-8bd897449b454e1f88e3a3f0535cb9b8>

## Gear Room

- Gears  
<https://sketchfab.com/3d-models/steampunk-gear-816749e8e343492f9dab0cd94cd94507>

## Sky Island

- Flying Sky Island  
<https://sketchfab.com/3d-models/low-poly-early-autumn-tree-794a118d71a545139eeeb100b28cb6fd>

## Painting Room

- Sofa  
<https://sketchfab.com/3d-models/couch-51afb7573410472ca3d1c181f31add07>
- Best Boy Rat  
[https://polyhaven.com/a/street\\_rat](https://polyhaven.com/a/street_rat)
- Big Painting  
<https://sketchfab.com/3d-models/picture-frame-af199ff482b24def9e8216d318c39a79>
- TV  
<https://sketchfab.com/3d-models/tv-ee802eec0b5742f2b036ea986b89ad88>
- Tombstone  
<https://sketchfab.com/3d-models/tombstone-6ff9cc405b3748f18d4c55803d242c15>
- Stool  
<https://sketchfab.com/3d-models/stool-69c8a117d535403dbbc72ece3a1cf0ec>
- Floor material  
[https://polyhaven.com/a/tiled\\_floor\\_001](https://polyhaven.com/a/tiled_floor_001)
- Wall material  
[https://polyhaven.com/a/weathered\\_planks](https://polyhaven.com/a/weathered_planks)
- Lock and Key  
<https://sketchfab.com/3d-models/old-lock-and-key-4db4428ca1944142a5185b0223474631>
- Remote  
<https://sketchfab.com/3d-models/remote-777238e7561a4ac1b2d1ccefd1de5865>
- Window  
<https://sketchfab.com/3d-models/wooden-double-hung-window-572f866f92664f6cb9ba8ebffa4ca803>
- Skyboxes

- Meadow 2  
[https://polyhaven.com/a/meadow\\_2](https://polyhaven.com/a/meadow_2)
- Winter Forest  
<https://sketchfab.com/3d-models/sky-pano-winter-forest-b42c27358ab04e8885ffb2ecf69c352c>
- In the Cloud  
<https://sketchfab.com/3d-models/free-skybox-in-the-cloud-b270497defe24f9cb497b9a075eeb28f>

## Final puzzle

- Safe  
<https://sketchfab.com/3d-models/antique-iron-safe-196cf0d3d5094b50874dbf51064a7d3e>
- Trophy  
<https://sketchfab.com/3d-models/trophy-low-poly-game-ready-23ff15bc69d44c21be3fb5a4c3731527#download>