

# Simona Donzelli\_Final Project 2021\_A

## Virtual experience of a physical impairment condition

Growing empathy through a VR experience

A virtual experience of a physical impairment condition (Game/VFX)

A "lived" experience of a one-armed person through an Avatar that interacts in a daily (VR) environment such as a kitchen aiming to let the user familiarise with the subject of diversity.

### Project purpose

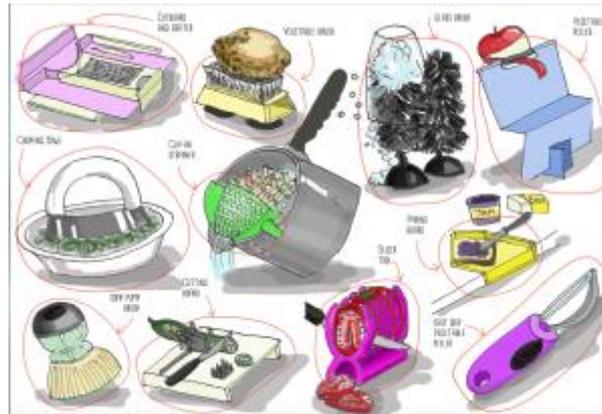
This is intended as an ethical design project that aims to help the inclusion of disabled people in society, growing empathy by living an involving experience such as the VR is. I intend to suggest this tool to professionals such as Designers, Architects, Engineers who design, think, make and shape the world in which we live. As a consequence of having this "personal experience" (so as experts describe it), in the role of a person with physical impairments, their subsequent products will be affected by that feeling; hence, the access to them would be offered to a more varied range of people. I'd propose this tool to institutions that aim to find new ways to solve the inclusion issue and companies that want to increase their users and customers typology.

### Design



1 - Floor plan of an inclusive kitchen made as an editable version on illustrator





5 - Sketch of the Kitchen tools based on the principles of the Universal Design, they'll be the objects my Avatar will interact with on the VR environment



6 - interactions

Thanks to the research I've done for the thesis, I realised how unwelcome can be an ordinary environment for a disabled person and how society is far from understanding their needs. I'm now aware that a new design of the space and the tools, could positively affect the integration of persons with physical and mental differences, as well as, the importance of able-bodied people's understanding of what means dealing with daily life "differently", as a disabled person does. So, I thought about a tool that can increase empathy and awareness about those difficulties they constantly experience, merely interacting with a surrounding filled with obstacles and barriers. As proven, a VR experience is so involving that can be perceived as a personal experience. I want to take advantage of such a "memory" (and the related feeling) to create consciousness when a professional is called to design and build daily-tools and public spaces. To think about making them accessible to all. There is a branch of the design industry that already operate in this way. That is the Universal Design (UD), which aims to make the world accessible and welcoming to anyone, universally, precisely. The experience to be a one-armed person can also be randomly applied to ordinary users to familiarise with the subject.

I didn't want to create a frustrating experience then, objects and tools the avatar interacts with are accessible to them, and the environment is barrier-free. Nevertheless I've included a few elements which are not compatible with such a disability, providing the very same tools (but UD version) as a suggestion, consequently, to take them as an example for an uniform production. Starting from the belief that disability (in doing things), is nothing but the result of an inadequate environment, the message is to show how anyone can be perfectly comfortable in the right surrounding.

## Construction

### Process:

1. Creating an inclusive design kitchen environment (**software used**)

- SketchUp (to make the draft)
- 3ds max (modelling, uv unwrapping)
- Substance painter (texturing)
- Import on Unity (final engine)
- Oculus quest 2 software (enabled for developer)
- Unity (to create Virtual environment and interaction)

2. Creating an interactive inclusive design kitchen tools (many of them accessible, others no, to compare the difference between an inclusive tool and the same not accessible)

- 3ds max
- Substance painter
- Import on Unity

3. Download a prosthetic to wear

- Programming it for interact on Unity

4. Environment and objects interaction:

- Different interacting with the objects (the objects not accessible can't be grabbed properly with the prosthetic)

5. Testing/modelling/programming

#### **Equipment used:**

Oculus Quest 2

A powerful pc borrowed from college

My android phone

My Mac

#### **Methods (use of tutorials and courses)**

Tutorials on LinkedIn learn

Coursera online courses

YouTube video tutorials

3Ds Max modelling tutorials provided last year

Consulting lecturers

# Workflow/ Fabrication/Process



7 - WEEK 1 to 4 Design and Research

WEEK 3 to 16 Digital modelling and texturing

WEEK 7 to 16 Testing, modelling, research

## **WEEK 1 to 4 Design and Research**

are dedicated to research on the topic of VR and feasibility of my idea through courses, videos, tutorials and consulting my lecturers. Also I have to be aware of the design of a Universal designed Kitchen

### **Programming oculus controllers**

<https://docs.unity3d.com/Manual/Input.html>

interaction

<https://developer.oculus.com/blog/object-interaction-part-1-common-interaction-patterns/>

### **Unity**

Introduction to unity

[https://www.youtube.com/watch?v=gGYtahQjmWQ&ab\\_channel=Valem](https://www.youtube.com/watch?v=gGYtahQjmWQ&ab_channel=Valem)

Using Unity to Develop VR Experiences

<https://learn.unity.com/tutorial/unit-3-using-unity-to-develop-vr-experiences>

grabbing objects in unity

<https://www.youtube.com/watch?v=sxvKGVDmYfY>

interacting with objects unity

[https://www.youtube.com/watch?v=gGYtahQjmWQ&t=50s&ab\\_channel=Valem](https://www.youtube.com/watch?v=gGYtahQjmWQ&t=50s&ab_channel=Valem)

unity hand programming

<https://learn.unity.com/tutorial/unit-5-hand-presence-and-interaction>

<https://developer.magicleap.com/en-us/learn/guides/hand-tracking-key-points-unity>

VR Tool Kit (collection of useful scripts)

<https://vrtoolkit.readme.io/docs/summary>

### **courses and tutorials**

<https://www.coursera.org/lecture/3d-interaction-design-virtual-reality/object-interaction-within-reach-zA9BV>

updates of coursera

<https://medium.com/virtual-reality-virtual-people>

<https://learn.unity.com/tutorial/vr-best-practice>

links to unity tutorials relating the course

<https://www.coursera.org/learn/3d-interaction-design-virtual-reality/supplement/T7JZZ/getting-started-in-unity>

job simulator

[https://store.playstation.com/en-ie/product/EP0500-CUSA06311\\_00-JOBSIMULATOR0001](https://store.playstation.com/en-ie/product/EP0500-CUSA06311_00-JOBSIMULATOR0001)

## Universal design

[http://universaldesign.ie/Web-Content-/UD\\_Guidelines-Dementia\\_Friendly\\_Dwellings-2015-Section-3.pdf](http://universaldesign.ie/Web-Content-/UD_Guidelines-Dementia_Friendly_Dwellings-2015-Section-3.pdf)

<http://universaldesign.ie/What-is-Universal-Design/Case-Studies-and-Examples/Examples/>

<https://www.kbsa.org.uk/inspiration/kitchen/accessible-kitchens/>

<https://www.archdaily.com/920447/how-to-design-an-accessible-kitchen-adjustable-and-multifunctional-furniture>

<https://akw-ltd.co.uk/blog/accessible-kitchens-top-10-inclusive-considerations/>

## WEEK 3 to 7 Digital modelling

I started working on the sketch of the kitchen then:

Making the model by 3ds Max

Texturing the elements by Substance painter

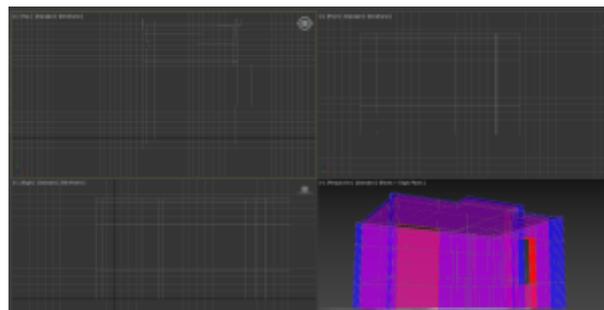
Uploading them on Unity

this was the main process, I wanted to make animated elements within my kitchen (such as the sliding door, the doors of the press units, the adjustable sink unit, oven with liftmatic door, etc..)

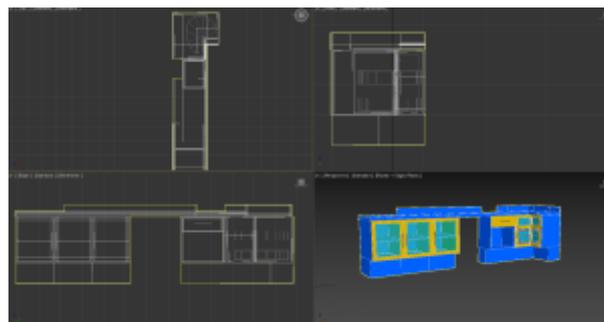
beside the environment of the kitchen, I modelled the required furniture of a normal kitchen based on the principle of the universal design interactive objects

I dealt with 3Ds Max, Substance Painter, Unity and Oculus software mainly.

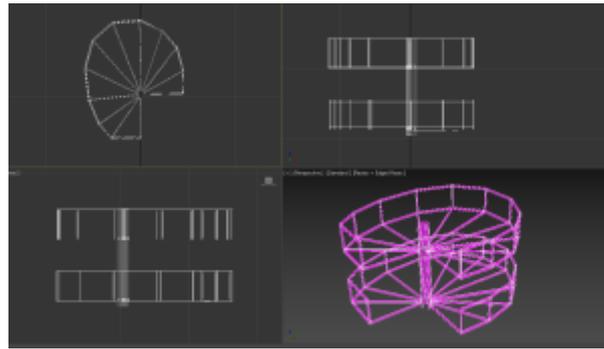
a few examples of the models I have created until week 7



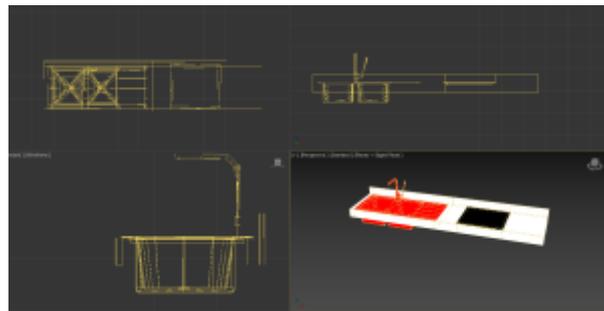
8 - walls



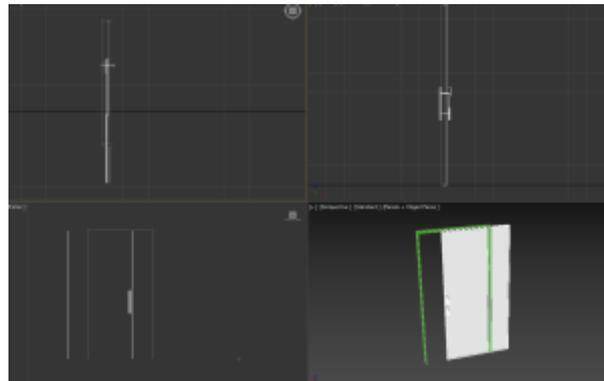
9 - units (some of them animated)



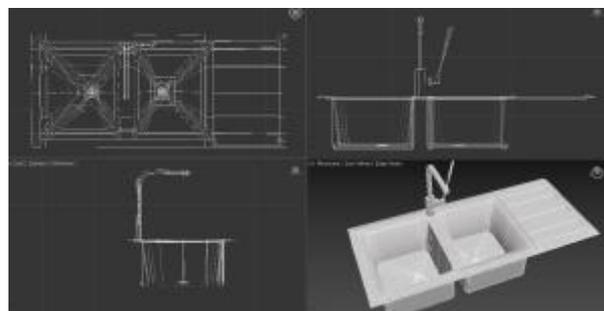
10 - carousel within the angular unit

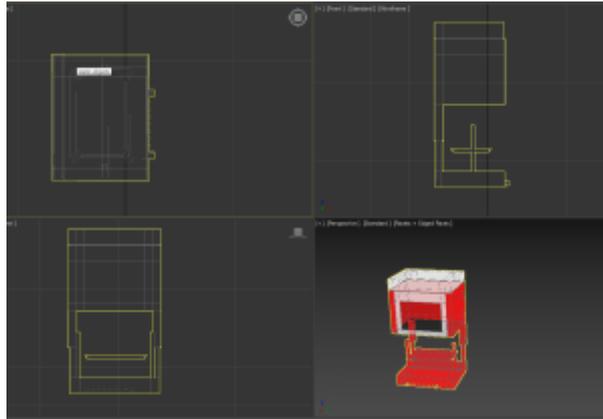


11 - adjustable sink/hob unit

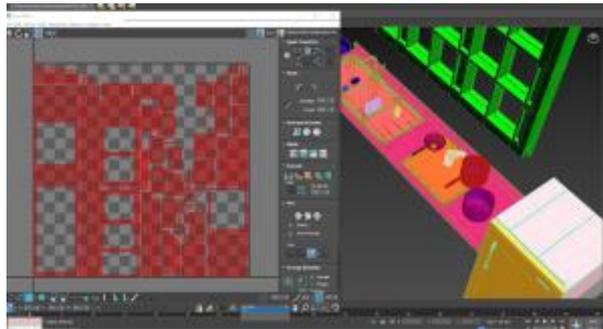


12 - sliding door





13 - a random unwrap UV of a part of the kitchen



14 - a general idea through the rendering of a part of the kitchen



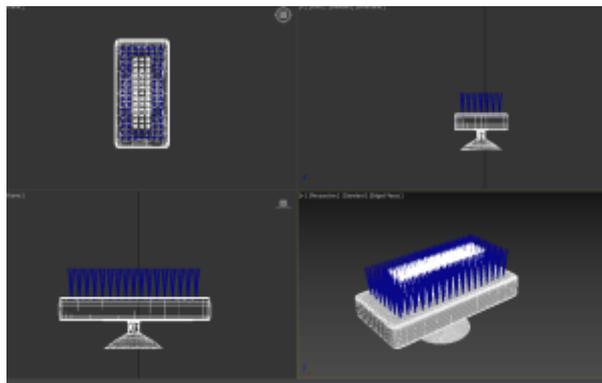
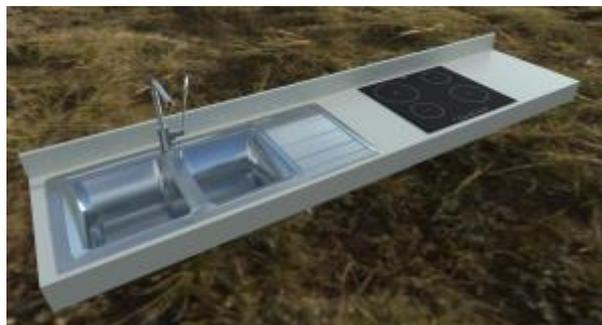
## WEEK 7 to 16 Testing (plus modelling, coding, texturing etc..)

This period of time there was a mixing of modelling, improving the texturing, programming and testing simultaneously to ensure my project worked seamless as a VR experience. I'm not a programmer, so it was very tough finding the right compromise to make things acting as I needed. I used codes and I blended information caught from online tutorials, I consulted experts and studied a lot!

I made from scratch most of the models of the scene, I only downloaded (but modified to meet my needs, though):

fridge, microwave, toaster, kettle, dish washer.

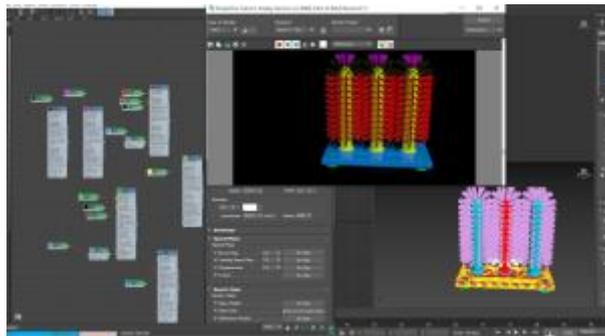
All the other elements are made up or rebuilt from models (such as the sketchup ones) which weren't compatible with Unity.



15 - sample of modelling



16 - sample of texturing



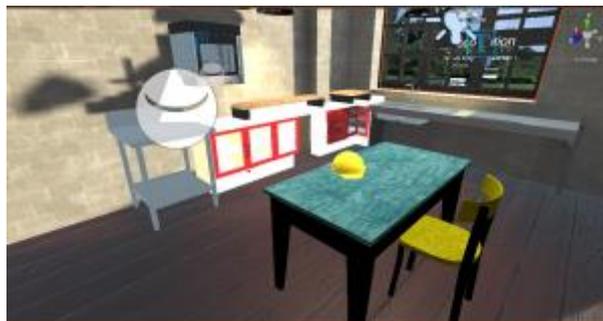
17 - sample of modelling



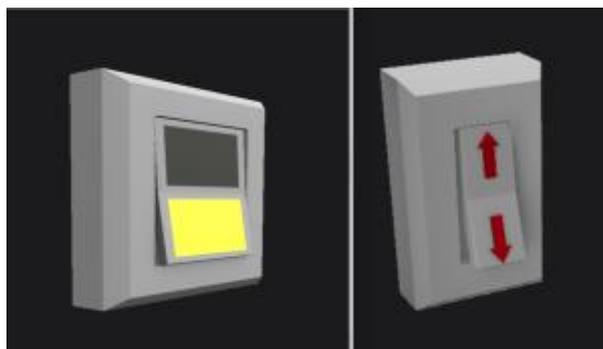
18 - sample of texturing



19 - the first time I entered into my kitchen



20 - improving VR environment...



21 - Hybrid models (downloaded but adapted to my needs) those have joints and will be in the scene to trigger events...



22 - managing to have a first version of a hand on the VR scene



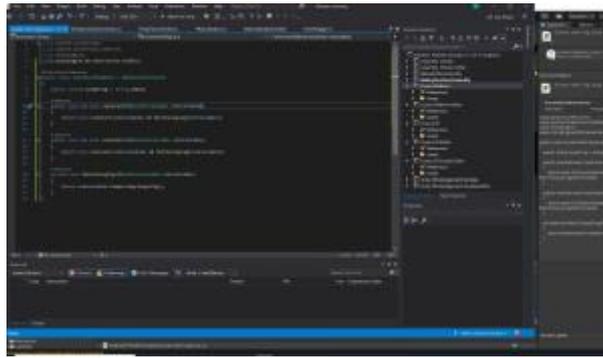
23 - both hands (biological and artificial), not yet animated



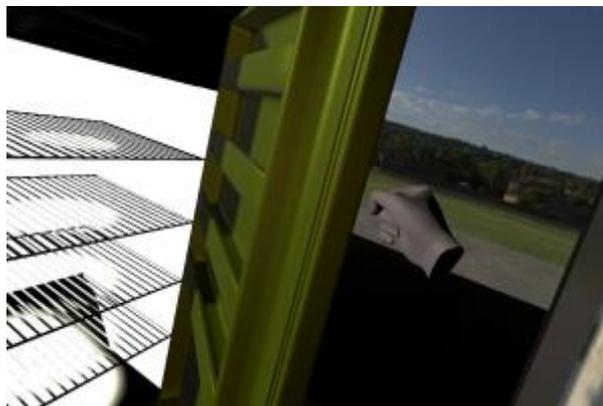
24 - after several attempts to animate it, here the first succeed. I will need more time to rig the prosthetic though

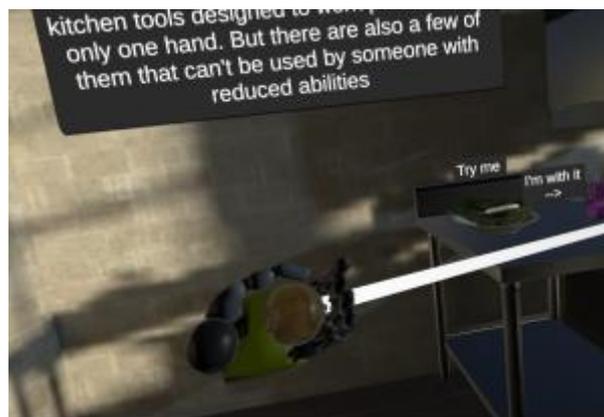
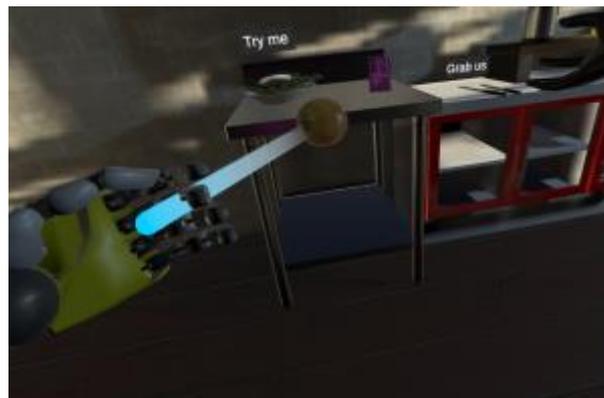
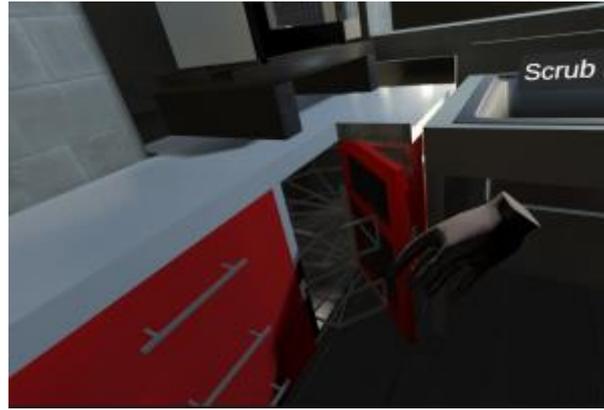


25 - the very last look of my kitchen, where the elements are animated and interactable



26 - example of coding for trigger the event through one of the switch





## Credits:

I've downloaded the followed models:

All of them have been UV unwrapped through 3Ds Max and applied customised textures by Substance painter. Some of them have been optimised for the VR scene.

The only exceptions are the **potato**, the **bread** and the **onion** for which I used their own texture (I Unwrapped them on 3Ds Max and applied the attached texture on Substance though)



27 - Potato on the scene

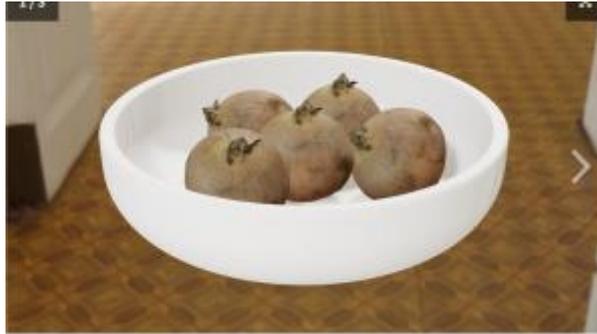


28 - Downloaded Potato

<https://www.turbosquid.com/3d-models/3d-robot-potato-stilts-model-1470962>



29 - Onion on the scene



30 - downloaded onion

<https://www.cgtrader.com/free-3d-models/food/vegetable/onion-dfc7a480-fcd2-4a7a-b4d3-7cb5a8906f47>



31 - Kettle on the scene

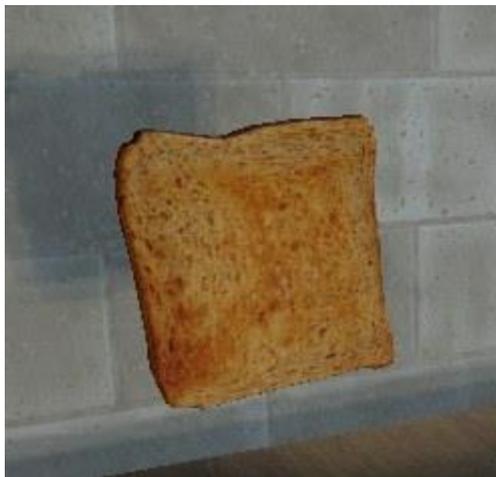


32 - downloaded kettle

<https://www.turbosquid.com/3d-models/teapot-kettle-max-free/983355>



33 - toaster on the scene



34 - bread toasted on the scene



35 - downloaded toaster

<https://www.turbosquid.com/3d-models/free-bread-3d-model/656227>

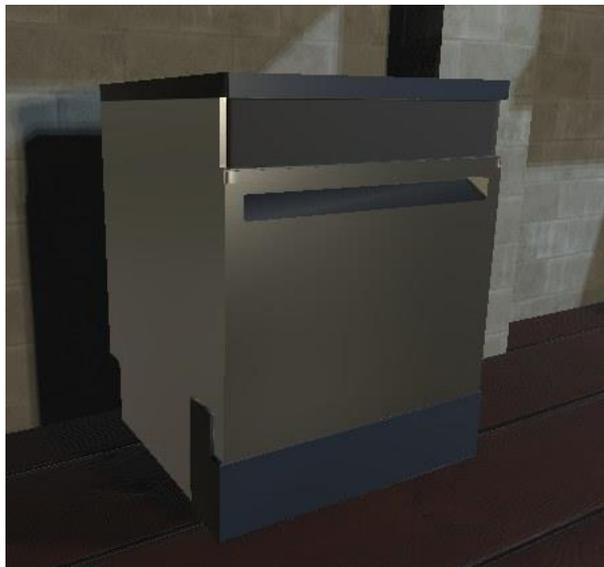


36 - microwave on the scene



37 - Downloaded microwave

<https://www.turbosquid.com/3d-models/free-microwave-blender-3d-model/669210>



38 - Dishwasher on the scene



39 - Downloaded dishwasher

<https://sketchfab.com/3d-models/dishwasher-f52b015abe1c473e8fddb704b7f031b8>

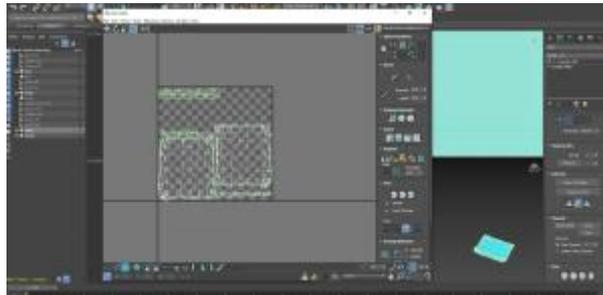


40 - Refrigerator on the scene



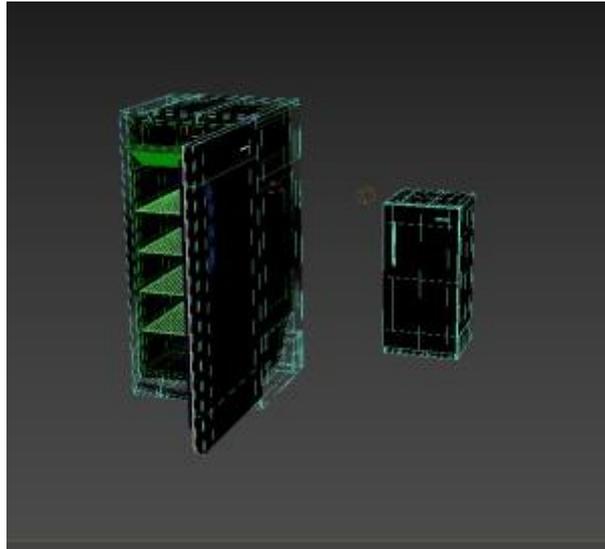
41 - Downloaded refrigerator

<https://www.turbosquid.com/3d-models/russian-refrigerator-biryusa-max-free/862779>

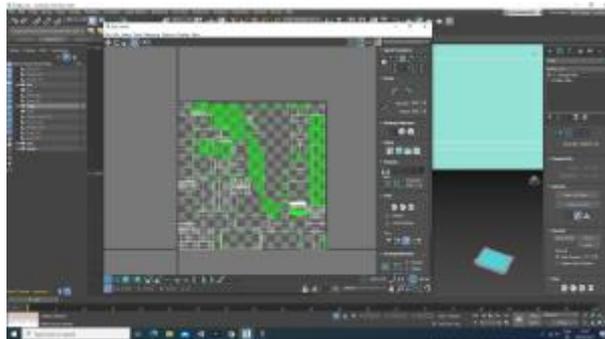


42 - 2 examples of UV Unwrapping through 3Ds Max

(toasted bread)



43 - The two models of the fridges (the original on the left, mine on the right). Here I made a few changes to adapt the model to the scene



44 - Refrigerator

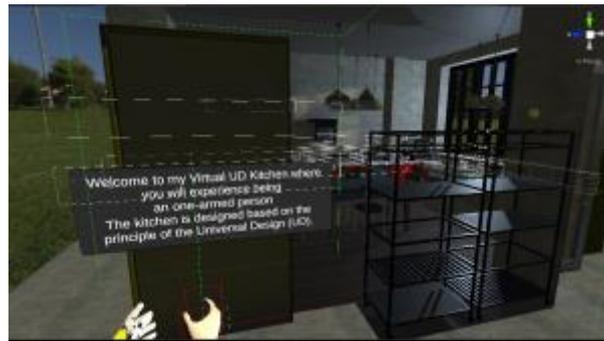


45 - 2 examples of texturing through Substance painter



46 - Toaster (+bread)

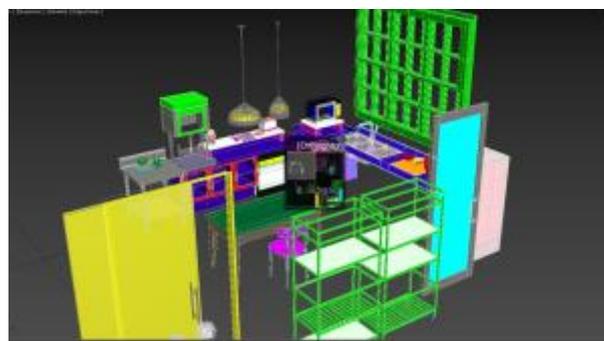
## Deliverables



47 - Kitchen Oculus



48 - kitchen Unity



49 - kitchen 3ds max

The End

Thank you!