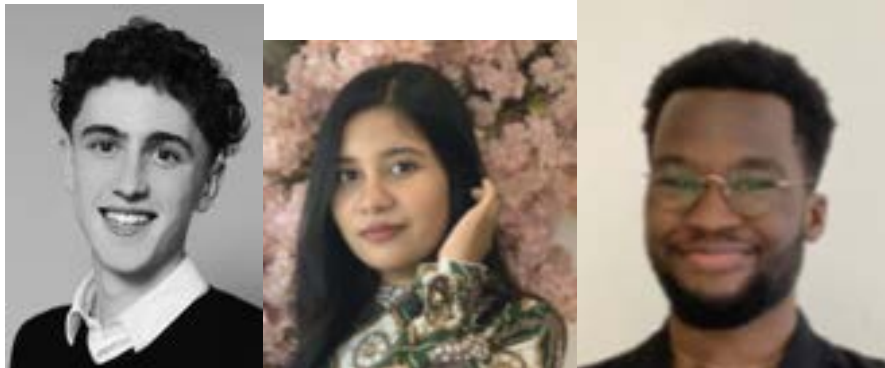


ALGORITHM SENSEIS

Game Developers

CART Project



Romain TREFAULT - Tasnia HOSSAIN - Carl KONE TAKUEFOU

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1. Introduction

1.1 The genesis of the project

The arrival of the COVID-19 virus has changed our daily lives, our plans, our studies, in short, our lives. It has challenged our precious freedoms, and our society. It is from this frustration that our game Doctor vs Covid-19 was born, where we will have the opportunity to play both sides of this epidemic. The first one is the doctor and the second one is the virus.

Which side would you choose? The destruction or the healing of our humanity?

1.2 Algorithm Senseis

The Obvious Corporation is a group born in December 2020 with the goal of bringing a touch of real challenge to the world of video games. We wanted to create a video game that allows players to embody characters that exist in real life. The idea of our game is to have a gameplay where players are under pressure because they must fulfill their mission to infect as many people as possible to save the virus in the case of the virus. On the other hand, to heal the most people to save humanity. Our game does not stop at this stressful side, but also allows the character to identify with the current situation that we all suffer. Thus, our game will generate tension between players while entertaining them and making them aware of this epidemic.

Between the second and last defense we tried to close this project. This report takes up various works accomplished during the previous defenses, describes the work done in order to finish this project, as well as various difficulties encountered.



Our team's logo

1.3 Logo design (Romain)

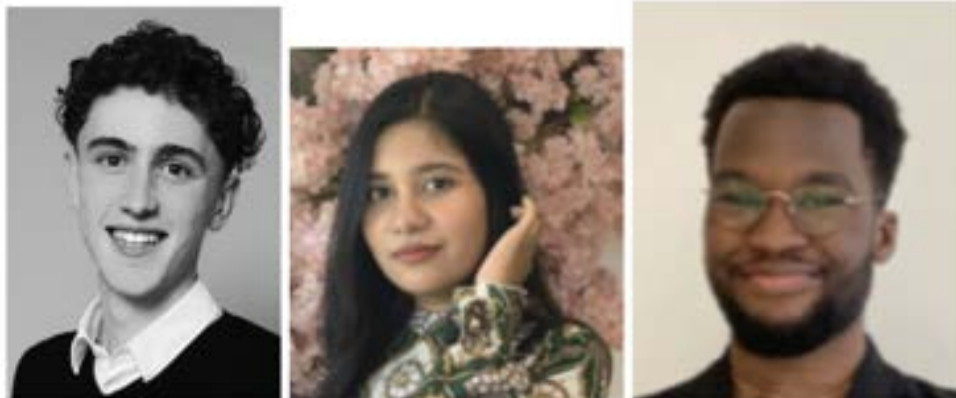
Our logo was designed through the website *Canva.com* which is a well-known site that helps graphics design logos and illustrations. Romain took 3 days to imagine and design the logo. A sentence below indicates “Game Developers” which we are. The logo represents a cobweb and illustrates our friendship and the fact that we are supporting ourselves during this project so that if there is a string that breaks, others are here to catch it up.

1.4 Team's members

I am Carl Kone Takuefou. I am a first-year student at Epita paris. Passionate about New technologies and UI/UX. Thrive to apply all that was studied in school to real world problems. That's why this game was an important project for me, and I hope to entertain as many people as possible with This game touching an actual concern of today's world (Covid-19).

My name is Romain Trefault, I am from France and I am 19 years old. I currently study at EPITA (School of Engineering and Computer Science). I partake in the design of characters, map, website and a part of the gameplay.

My name's Tasnia Hossain from Bangladesh. I am 19 years old. I am a first year Computer Science student at EPITA. I am passionate about my course. In the future, I want a career in a related field only. I also want to inspire more women to be interested in the field of Computer Science, giving it greater diversity.



The CART team

1.5 Tasks distribution

TASKS	TASNIA	ROMAIN	CARL
MENU			
Main Menu		Second	Principal
MULTIPLAYER			
Network		Second	Principal
Gameplay	Second	Principal	
Graphics			
Map design	Principal		Second
Characters design	Second	Principal	
ANIMATIONS			
Game play animations	Principal		Second
AI			
Commoners		Second	Principal
GAMEPLAY			
Physics	Second		Principal
WEBSITE	Second	Principal	
DESIGN			
Game's Rules	Tierce	Tierce	Tierce
Gameplay	Tierce	Tierce	Tierce
Task distribution	Tierce	Tierce	Tierce

Tasks' distribution board

2. Game's rules

2.1 Inspirations

2.1.1 Among Us

Among Us is the first game that we got inspired by. It is basically a multiplayer game where between four and 10 players are dropped onto an alien spaceship. Each player is designated a private role as a “crewmate” or “impostor.”. Players can be voted off the ship, so each game becomes one of survival: Successfully vote off the impostors or complete all your tasks to win. In fact, we wanted to reproduce a replica of this game at first. However, we eventually decided to take the direction of a simpler game and to mix it with another game to add a touch of realism.



Logo of Among us game

2.1.2 Plague Inc.

Plague Inc. is a unique mix of high strategy and terrifyingly realistic simulation with over 700 million games played!

Your pathogen has just infected 'Patient Zero'. Now you must bring about the end of human history by evolving a deadly, global Plague whilst adapting against everything humanity can do to defend itself. This is the official website description of the game Plague Inc.



Logo of Plague Inc. game

2.2 Rules

Reminder: The game is played by two players. Each player will incarnate either a virus, representing the COVID-19 virus or a doctor and will compete on a map. Other people, who will be controlled by the artificial intelligence, are called “commoners” and they are basically normal citizens like you and me are in life. There will be around 20 commoners scattered across the map.

There are two objectives depending on the character you represent, the first player who accomplish the objective is the winner:

- The objective for the virus is to contaminate a certain amount of the population to make sure the herd immunity (70 %) is not attained by doctor’s vaccines. To do this, he will need to go meet the commoners in order to contaminate them.
- The objective for the doctor will be to heal the commoners by vaccinating them. The principle of vaccinating commoners is the same as the virus’ contamination, the doctor will need to get the closest possible to the citizens and cure them. After a player reaches the needed percentage, the game is over, and the winner will be displayed on the screen.

3. Back to the specifications

3.1 Network (Carl)

We chose to use the asset (tool) "Photon Unity Network" (PUN) to manage the multiplayer part of the game which allows, with the free version, to have up to 20 players at the same time. However, only two people will be able to play against each other in our game.

3.2 Flow of the game

Here is the flow of the game as imagined in the specifications:

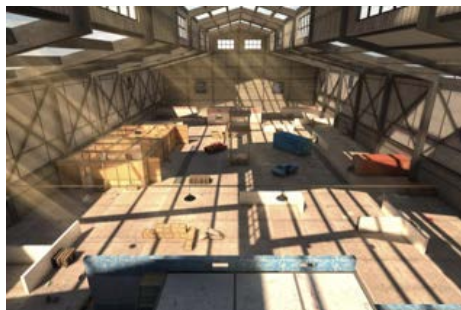
- Visual of our map in the background
- Choice of characters
- Players start their game in multiplayer
- Players go through the map while infecting or vaccinating citizens controlled by an AI, a percentage is displayed on the top right and left expressing the number of people infected and vaccinated.
- As soon as the first player has reached the desired percentage, the game ends with the winner.

3.3 Objects (Tasnia)

We downloaded assets and objects from the internet in order to decorate our map and illustrate our apocalyptic-real theme.

3.4 Map (Tasnia)

We did not have any idea of any map, so we took a look on the internet and fell on some ideas of map:



3.5 Graphic style

As we said in part 2.1, we have as inspiration: Among us and Plague Inc. These two games bring us inspiration in terms of gameplay but also graphic inspirations.

We wanted to have a graphic mix between these two games, not too "horror" as in Plague Inc. and not too "cartoon" as in Among us. So, we had to find a balance between the two. That's how we came up with our current map.

3.6 Tools used

- **Programming:**

At first, to develop our game, we needed computers equipped with certain development software, whether algorithmic or artistic (IDE C#, Unity, Blender, ...)

- **Graphics:**

In order to perfect the design of our graphics we will also use drawing materials (Drawing paper, ...)

- **Organization:**

To ensure a good communication of tasks and requests between members we have set up various means of transmission of information (Discord, Google drive, Mails Epita, ...)

3.7 Game's communication

The communication of the game is one of the important phases of development since it is what will make the potential player want to play it. The idea is to catch the curiosity of the future player. Let's start with the first thing a person will see: the name of the game. "Doctor VS COVID-19", whether the individual is French or English speaking, any nationality will understand it. Moreover, the title contains the word COVID-19 which is the health and life issue at the moment.

Our website will describe all the issues of this game and will make the player want to play as one of the main characters of this epidemic. It is up to him to adopt the good or bad side.

3.8 Task planning table

TASKS	First Presentation Completion
MENU	
Main Menu	10 %
MULTIPLAYER	
Network	50 %
Gameplay	10 %
Graphics	
Map design	10 %
Characters design	10 %
ANIMATIONS	
Game play animations	11 %
AI	
Commoners	50 %
GAMEPLAY	
Physics	20 %
WEBSITE	50 %

Task planning table according to the first defense

4. Reminder first presentation

4.1 Graphism (Romain)

For the graphics, we downloaded some 3D models online because we lacked the skills and time to do them ourselves. But this was not the case for this first cycle. The first 3D objects that seemed the most obvious to model were obviously the virus, the doctor, and the commoner because these were the main elements of our game. The case was not won in advance because complications appeared when implementing some characters in Unity. In particular, the animations of the doctor and the commoner. This problem was unfortunately solved by taking 2 new characters from the Mixamo platform and leaving the two characters that Romain took a long time to create.

Then, we had to imagine the environment in which the players would evolve. That's how Tasnia started to work on the first sketches that would surround our characters. First, we had to do research work, because indeed, the

objects and the map which must surround our characters must agree on the theme of our game, which is a mix between the apocalypse and the real.



Illustration of the characters (made by Romain, not the ones from Mixamo at this point) and the assets in the second presentation

4.2 Menu (Carl)



Picture of the main menu

4.3 Game's mechanisms (Carl)

The game had the following mechanics at the first defense:

- Movement of the skeleton of the virus and the doctor
- Movement of the camera
- Movement of the commoners controlled by the artificial intelligence
- The home menu

4.4 Artificial Intelligence (Carl)

The AI at this stage was just a cylinder capable of moving around.

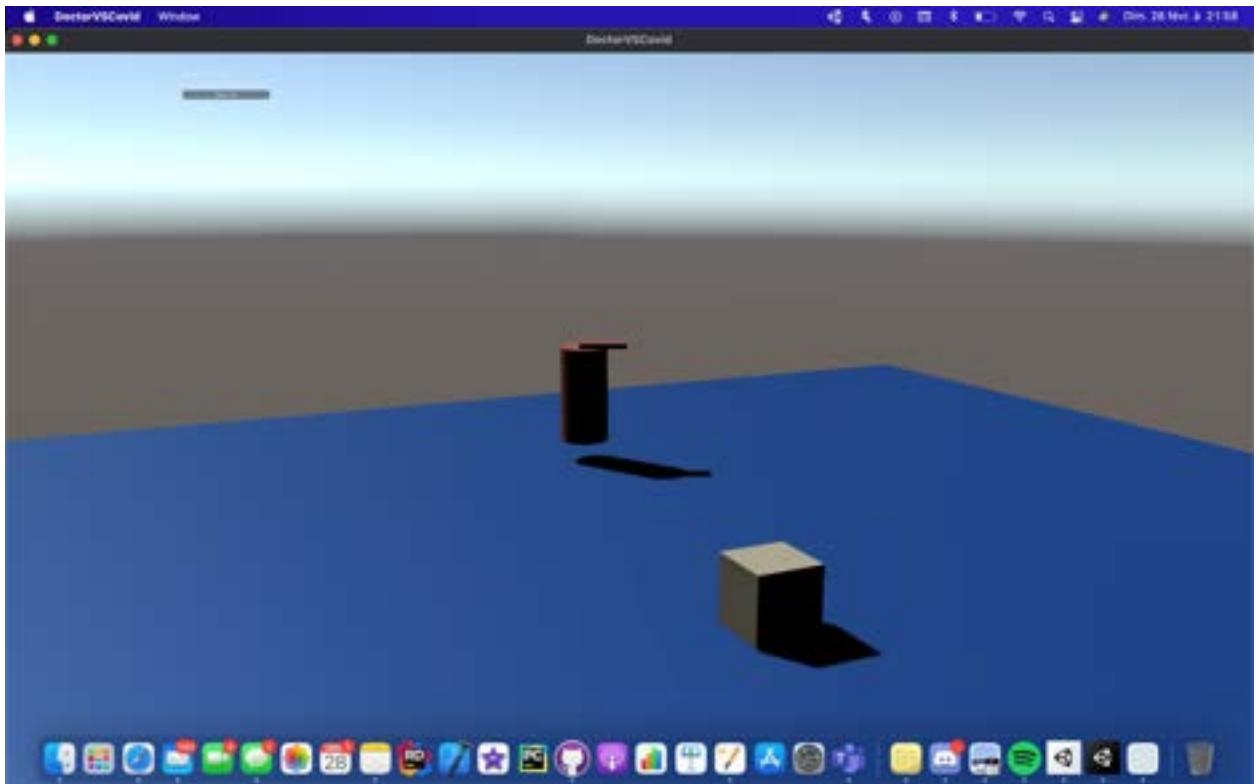
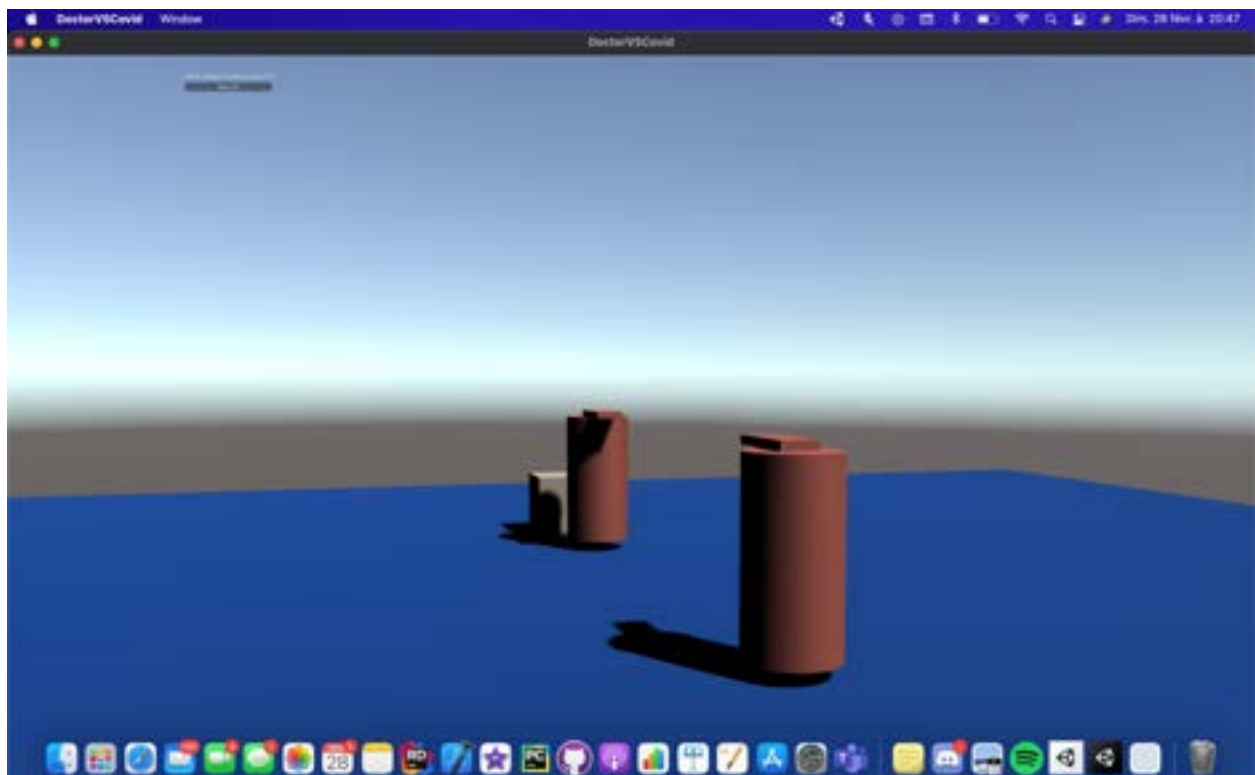


Illustration of the artificial intelligence

4.5 Network (Carl)

The network is 35% terminated right now. The implementation is local to the machine for now. For instance, a server and a client can both have access simultaneously to the game and independently interact with each other. The networking is done using a unity package called **Multiplayer HLAPI**. The networking can be done only between two computers and not more.

Below is an image of a server machine and a client machine facing each other. The players look alike but they are two distinct entities. This can be proven with the box placed behind one of the players.



4.6 Advances and delays

If we compare the board below with the planning table in 3.8, we observe that we accumulate some lateness in some parts but were in advanced in others.

The main menu, the artificial intelligence, and the website were the two parts where we were the most advanced.

However, we were delayed regarding the network, and the graphics, animations parts. Thus, we adjusted our work according to the first presentation's remarks.

TASKS	First Presentation Completion
MENU	
Main Menu	90 %
MULTIPLAYER	
Network	15 %
Gameplay	10 %
Graphics	
Map design	10 %
Characters design	10 %
ANIMATIONS	
Game play animations	11 %
AI	
Commoners	80 %
GAMEPLAY	
Physics	20 %
WEBSITE	70 %

Table of Advances and Delays First presentation

4.7 Conclusion first round

The beginning of the project allowed us to learn a lot of things from the global management of our project to the specific skills developed by each one. The cohesion within the group being good, we were able to advance our game. This first part allowed us to lay the foundations of our game.

5. Reminder second presentation

5.1 Graphism

In terms of graphism, we implemented a button at the bottom right of the screen in order to make the player able to click it when he is close enough to the commoner, it will give the ability to either vaccinate or contaminate.



Button to infect the commoner

Button to vaccinate the commoner

Moreover, we decided to add a circle either red or green to implicitly mention that the commoner has been contaminated by the virus (red) or vaccinated by the doctor (green).



Contaminated commoner



Vaccinated commoner

5.2 Website (Romain)

For this defense, it was necessary to make a website of the project. Romain decided to create the website. The website was created using Wix.com.

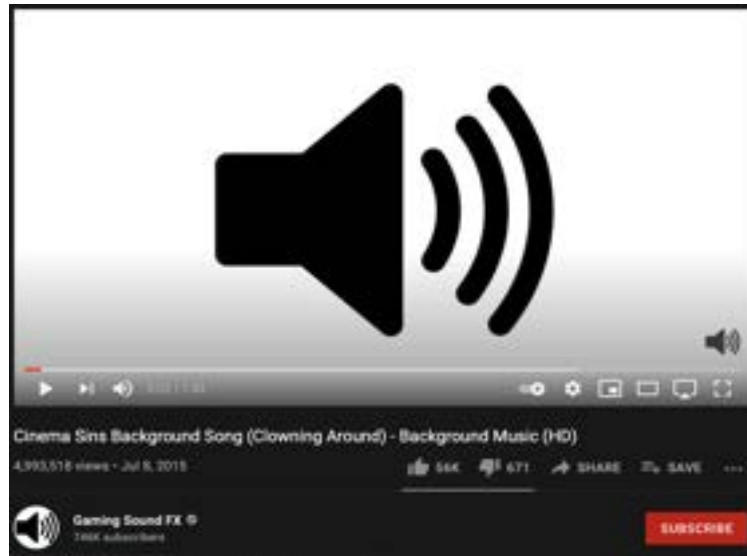
Romain did a previous work on the research of themes and templates that could correspond the most to the spirit of our game. In addition, we chose red and green as the main colors of our game. Romain then separated the site into 4 parts: What, How, Who, Roadmap. Most of the organization of the site and the design (with the templates) was done, now we just had to fill in these sections.



Representation of the logo and the four parts in the upper part of the website

5.3 Music (Romain)

Concerning the music, we had the problem of the copyright and the free use of it. We had to find music which fit well to our theme, but which was also free to use. After a few days of research by Romain on Youtube at the channel "Gaming Sound FX", the music that was chosen is called "Cinema Sins Background Song (Clowning Around) - Background Music (HD)". This music is used a lot in Youtube videos to accompany and make it less boring.



Youtube page of where we found our background theme music

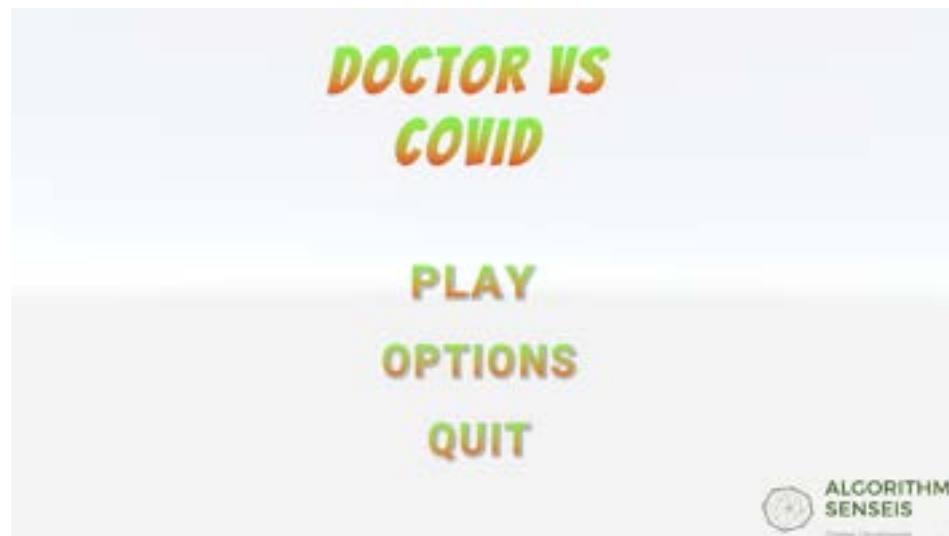
Also, we decided to add a sound when the virus was infecting the commoners and then when the doctor was vaccinating the commoners. At first, we chose the same sound as another game when the player heals an ally, it represented and pleased us to illustrate the action of vaccinating the commoners. In a second time, Romain had the idea to use the sound that is found in Minecraft when the character gets damaged by zombies in the single player mode. This sound illustrates perfectly the action of contamination to the commoners.

5.4 Menus and Interfaces (Carl)

To make the game more consistent with its universe, we changed the main menu to make it more beautiful, cleaner and more attractive for new players. This is also due to the game's logo which immediately gave the look of the game before even playing it.



Menu before implementing the logo of our team



Menu after implementing the logo of our team

5.5 Game's mechanisms (Carl & Romain)

3.3.2. GAMEPLAY

1) Player

The players will be represented by humanoid-like avatars.

In Multiplayer mode, players will connect to the server, and choose who will incarnate the virus and the doctor.

Game's scenario:

- 1 doctor and 1 virus + some commoners
- The goal of the doctor is to find as many commoners as possible and to vaccinate them. The commoners will have been scattered randomly within the map by the computer. The doctor will have a health bar that will decrease a little each time he encounters a contaminated person.
- Doctor wins if at least 70% of the commoner are vaccinated (herd immunity) before the virus.
- The map will look like an abandoned industry or hangar.
- The virus will have another feature which will be that its speed is somewhat slightly better than the doctor.
- A gauge will appear on the screen which indicates the percentage of vaccinated/contaminated people.
- Initially, there will be around 20 commoners who will be controlled by the Artificial Intelligence.

3) How does the game end ?

Either the virus or the doctor wins: The game is won by the doctor when:

- At least 70 % of the population is vaccinated.

The game is won by the virus when there are more commoners that are infected than commoners vaccinated and the 70 % of the doctors are not reached.

5.6 Artificial Intelligence (Carl)

The AI of our game regards the commoners. They are the entities of the game who can be either vaccinated by the doctor or contaminated by the virus. They cannot be controlled by the Player and therefore need to move on their own.

We implemented their movements which are the same scheme of movement as for the player. i.e. it can move up, down, left, and right. We make it move away from the virus when he sees it and move a little bit closer to the doctor when he sees him approaching. The commoner can move alone, it reacts in function of the doctor and virus' movements. You can see the script of the implemented Artificial Intelligence below.



Commoner following the doctor and going away from the virus

5.7 Camera (Carl)

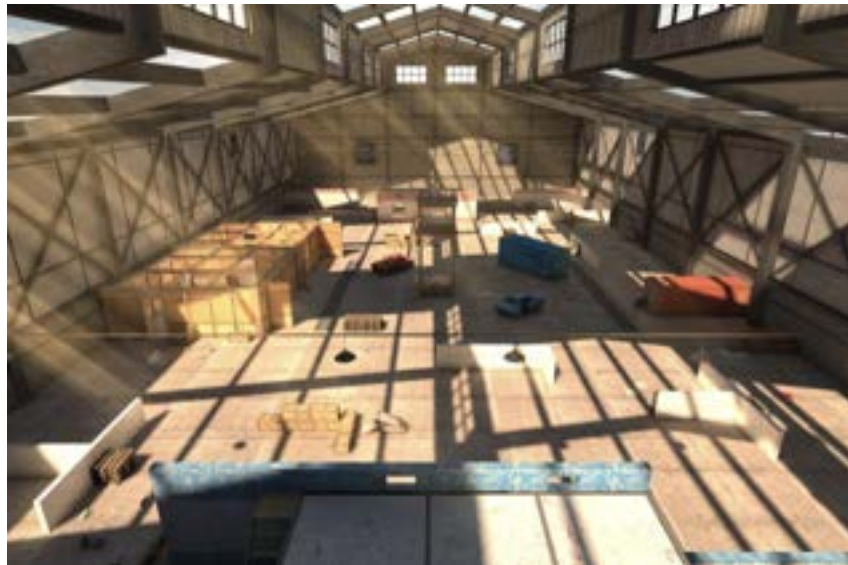
The camera is fixed when the arrows of the keyboard are used. If the player wants to get another point of view, the latter needs to use the mouse in order to move the camera. When the mouse button for rotating the camera is released, the camera stays at the position it was told to (according to the player). The stability has been greatly improved to limit the inconvenience of fast or chaotic movements.

5.8 Network (Carl)

The network at this stage Was more about transitioning from the multiplayer HLAPI to setting up the PUN account. The first choice was a bad one as it was a deprecated API.

5.9 Game map (Tasnia)

Finally, we chose the map representing a hangar, it was not too big, and not too small to scatter the commoners in a balanced way.



Overview of the map

5.10 Advances and delays

The gameplay was our last big part to do, we had the written gameplay and we just needed to implement it in code.

The characters' animations were delayed due to the problem we had with the characters that Romain created.

The menu and website were almost finished and it was just a couple of little things to finish.

TASKS	First Presentation Completion
MENU	
Main Menu	70 %
MULTIPLAYER	
Network	80 %
Gameplay	10 %
Graphics	
Map design	100 %
Characters design	100 %
ANIMATIONS	
Gameplay animations	33 %
AI	
Commoners	100 %
GAMEPLAY	
Physics	45 %
WEBSITE	75 %

Table of advances and delays of the second cycle

5.11 Conclusion second round

Even if some difficulties were encountered, during this second session, we have made a great leap forward. Indeed, whether it is on the level of the playability or simply on the visual aspect.

6. Last presentation

6.0 Installation software and the game

When a player wants to play our game, his first reaction is to download the game. So, we need as few obstacles in his way as possible if we don't want to leave him before he even plays the game. To do this, the player must first download it from our website. Once the installation software is downloaded, the game is installed on the player's computer. All the player has to do is double-click on the downloaded icon on the desktop of his computer to start the game. All he must do is find another player to play with and have fun.

6.1 Website (Romain)

The website was an important part for the group as it was a sort of “window” that showcases our game to new people. It needed to be perfectly representative of our game’s universe. The website required effort, and dedication to make it functional and pleasant to visit.

One of the first challenges I encountered was the implementation and organization of the website: how was I going to introduce it? What will be the different parts that compose it? What will be the illustrations and themes? All of that were questions that I asked myself.

“Wix” has been used in order to help me with templates that best correspond to our game environment.

The 2 main colors of our website are red and green. I separated the website into 4 parts:



- The « **what** » which represents the goal, history, and main characteristics of our game. The goal of the history and the explanation of the main characteristics - *Survival Strategy, Real-World Gameplay, Incarnate the heroes and demons of our generation* - of our game is to make the player want to play our game as it will remind him what is life in our society with the virus. The first page also contains the citation of each one regarding the best moments of the game's conception. Also, it illustrates all the software we used during the making of the game (Photon (PUN), Youtube (tutorials), Rider (coding), Unity, ...)



- The « **how** » part indicates the problems we encountered and their solutions during the process of creating the game.

Example of a Problem-Solution relation

Problems	Solutions
<p>Animations of the characters (Rigging)</p> <p>The problem I encountered regarded the doctor and commoner characters. Indeed, I did not succeed to rig them correctly like the virus one.</p>	<p>Mixamo</p> <p>The solution I found was to take characters which look the most like the characters we wanted and animate them in Mixamo.</p>

- The « **who** » part shows the team who made the game accompanied by a little description of each of us.

Example of Carl's presentation

OUR TEAM	
<p>Carl Kane-Takoufou</p> <p>First year student at Epita paris. Passionate about New technologies and UI/UX. Thrive to apply all that was studied in school to real world problems. That's why this game was an important project for me and i hope to entertain as many people as possible with This game touching an actual concern of today's world</p>	

- The « **Roadmap** » part is a planning of our conception strategy and each checkpoint of the making of the game. It will also provide links to our report, project.



This is the link to our website: <https://romaintrefault.wixsite.com/doctor-vs-covid-19>

6.2 Characters (Romain)

Reminder: At the beginning, Romain decided to create our own characters, however when implementing the animations, a problem was encountered, and after some days of research we decided to use Mixamo as the time was playing against us.

6.2.1.1 Characters' interactions

Reminder: This task is one of the bases of the game: interaction. Indeed, at the end of the last defense, we had not set up the characters and the interactions between them, neither the doctor was able to heal the commoners, nor the virus was able to contaminate them.

Romain then made sure to implement the interactions regarding the vaccination and the contamination between the commoners and the virus/doctor after the second presentation.



Action of contamination from the virus



Action of vaccination from the doctor

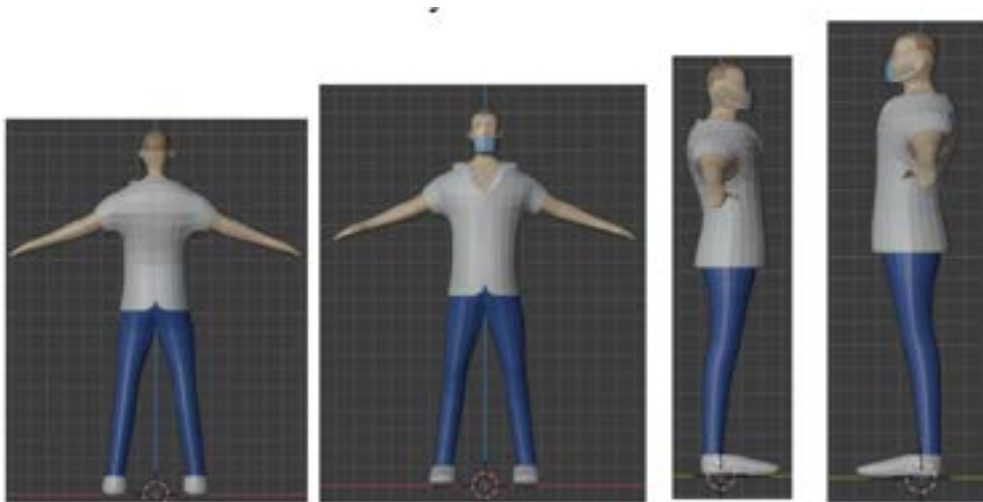
6.2.2 The Doctor

- The doctor wears a surgeon doctor's shirt, a pair of anti-virus blue pants and a mask to protect him from virus molecules. He also wears a sort of beanie in order to be fully protected from the COVID-19 virus. The character illustrates a man who is around 30 years old.

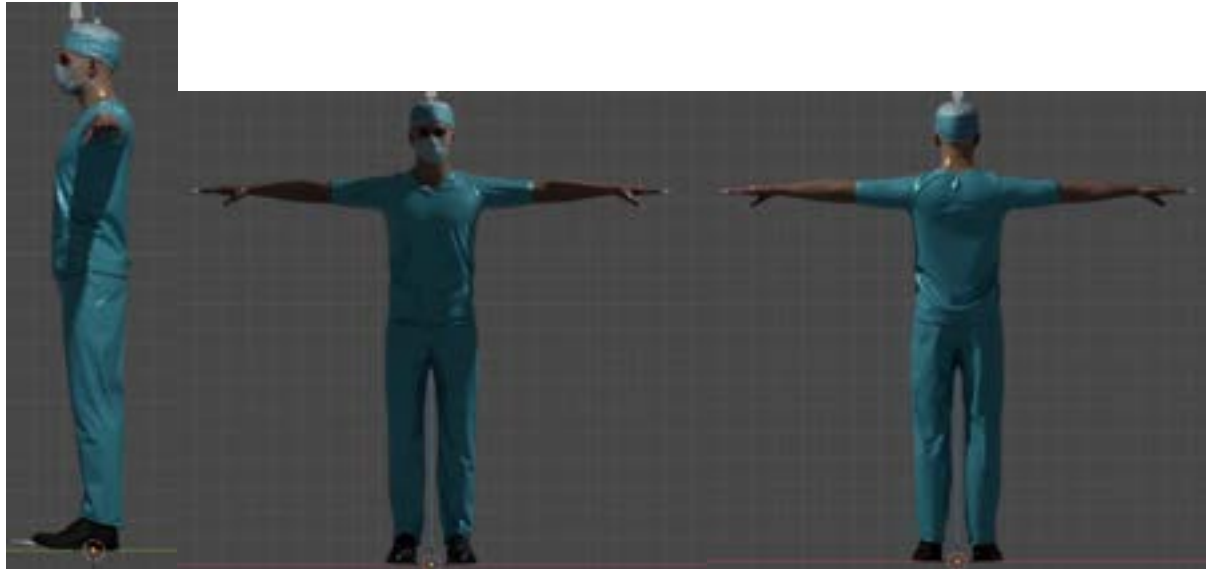
I encountered a problem with the implementation of the animations regarding each of the characters I previously designed using Blender. I could not manage to implement the animations because the characters were not enough rigged as humanoid. This is something I believed was easy to solve... add a humanoid skeleton for the doctor, virus and commoner and rig the characters.

Nevertheless, for weird reasons that I cannot explain, it only worked for the virus. After hours of trying to know why it did not work for the other characters, I did not manage to do it. Fortunately, I figured out that I could find a doctor and a commoner character on Mixamo and directly implement the animations there. Thus, it is what I did for the doctor and the commoner characters.

Design of the first version of the doctor

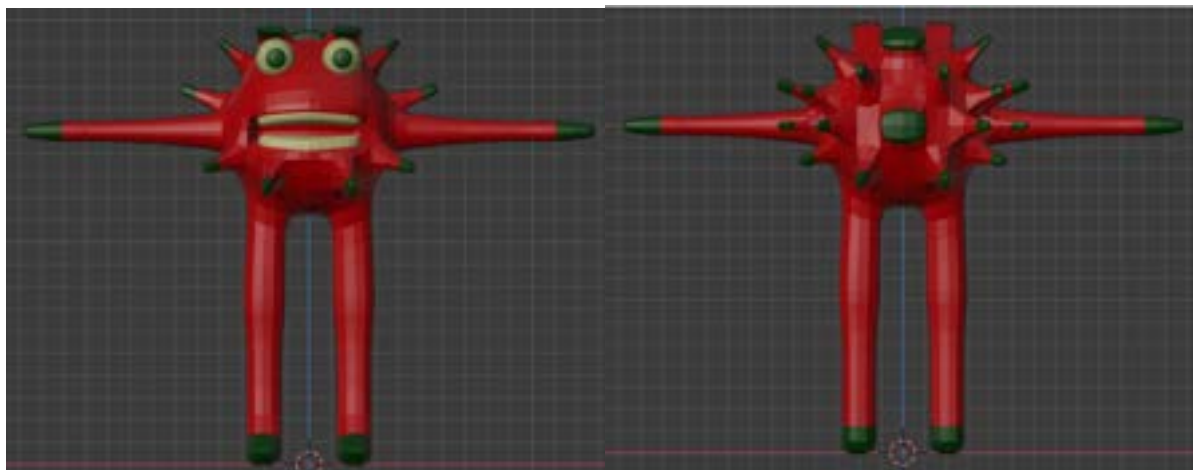


Final design of the doctor (now)



6.2.3 The Virus

- The **virus** is red and green (the main colors of our game), has big eyes, no nose, and a sizable mouth. Its legs and arms are also substantial. The goal of this design is to make this character the least humanoid and proportional as possible. It contains peaks on the center of its body to perfectly illustrate the design of a real virus.





6.2.4 The Commoners

- The **commoners**, they basically incarnate as « normal citizens ». At first, as I did with the doctor, I designed them by myself, however I encountered the same problem so I needed to find a character that would fit well as the commoner. I finally came with a character that was the simplest possible, young, in order to make the players feel they are in real life because the commoner will be the perfect representation of what he or she is.

The first version of commoners was simple, it represented a young man who wore an overall to make him look like the workers in the industries.

First version of commoners



Final version of commoners



6.2.5 Capacities

Each of the characters has different capacities. The virus has an ability that makes him walk faster than other characters due to its height. The doctor does not have special abilities, however, because he only needs to vaccinate 70 % of the population, this can be considered as an advantage compared to the virus. Commoners are not controlled by the players, it's an AI that makes sure they move correctly according to the virus and doctor's movements.

6.2.6 Camera (Carl)

We created two cameras in the game. Both can be found in the "Demo" Scene. The first one is the "spawn camera". It just displays a floor background and two buttons: the "doctor" button and the "Virus" button. This camera only helps both players to select the player they want to use and only disappears when both players have selected their avatar. Of course, both players cannot select the same avatar.



Matchmaking screen

The second camera used is for the player. Actually, two duplicates of the “main ” camera exist during the gameplay. One that follows the player using the doctor and the other that follows the player using the virus. The main camera was the hardest to code and coordinate with the different scripts, especially the scripts handling the movements.

Here are some brief points about the main camera.

- The camera follows the “Transform” of the player.
- The camera also follows the rotation of the player.
- The camera has a collision property with the walls and objects of the map so that depending on the movement of the player, it will never enter or go behind a wall.
- The camera can be rotated using the mouse. To provide a 360 rotative movement to the player.
- There are many more things the camera can do.

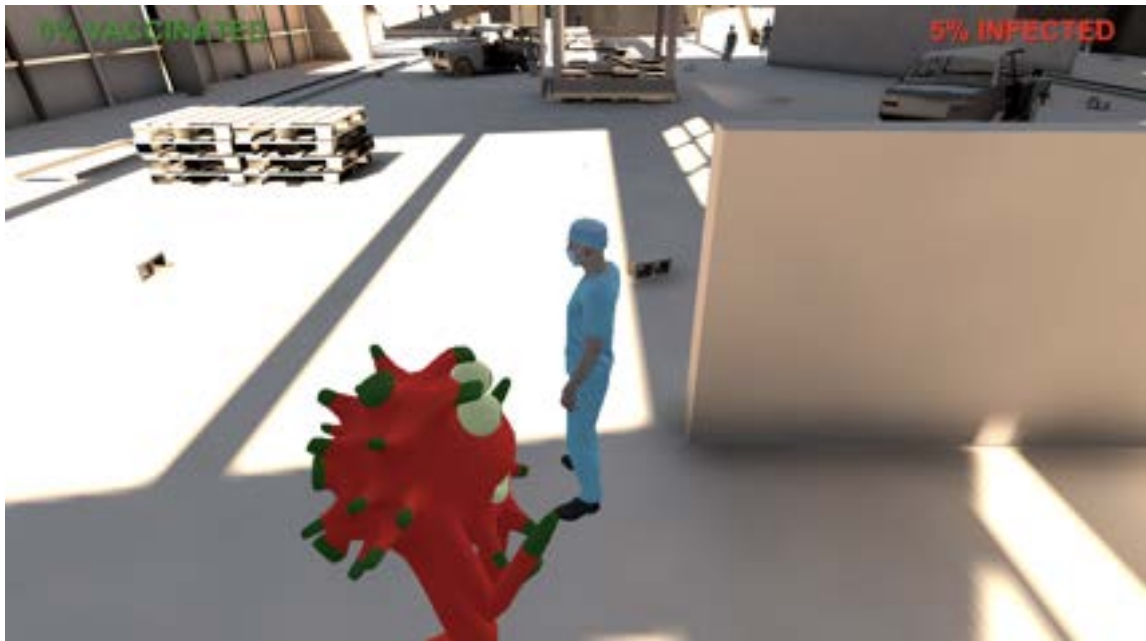


Illustration of all the characteristics of our game

6.3 Moving (Carl)

The movement is mainly separated into two main movements. There is the rotational movement and the directional movement. We finally settled on the use of the directional arrows on the keyboard in order to control the directional movements of the characters. The rotational movement consists of a 360-rotation made with the mouse. It is activated only when the player clicks and maintains his finger on either the left clicks, or the right click. We thought it was better doing so in order to increase game reactivity. Below are the three scripts that handle movement of the virus, the doctor and the citizens.

```
1 using System.Collections;
2 using System.Collections.Generic;
3 using UnityEngine;
4
5 #if UNITY_EDITOR
6 #endif
7
8 public class VirusController : PlayableCharacter
9 {
10     // Dr. 3 images
11     public override void Action()
12     {
13         base.Action();
14
15         // check is citizen can be infected and look at him
16         foreach (CitizenController citizen in GameManager.citizenPool)
17         {
18             if (Vector3.Distance(transform.position, citizen.transform.position) < actionRange && citizen.state !=
19             {
20                 Vector3 targetDir = (citizen.transform.position - transform.position).normalized;
21                 targetDir.y = transform.position.y;
22                 transform.rotation = Quaternion.LookRotation(targetDir);
23                 citizen.SetState(CitizenState.Infected);
24                 GameManager.Instance.PlaySound(1, transform.position);
25             }
26         }
27     }
28 }
```

Virus Controller script

```
1 using UnityEngine;
2
3 // asset manager
4
5 public class DoctorController : PlayableCharacter
6 {
7     // 0-1 images
8     public override void Action()
9     {
10         base.Action();
11
12         // check if a citizen can be vaccinated and look at his
13         foreach (CitizenController citizen in GameManager.citizenPool)
14         {
15             if (Vector3.Distance(transform.position, citizen.transform.position) < actionRange)
16             {
17                 Vector3 targetDir = (citizen.transform.position - transform.position).normalized;
18                 targetDir.y = transform.position.y;
19                 transform.rotation = Quaternion.LookRotation(targetDir);
20                 citizen.SetState(CitizenState.Vaccinated);
21                 GameManager.instance.PlaySound(0, transform.position);
22             }
23         }
24     }
25 }
26
```

Doctor controller script


```

1 // 14 steps 2 // 14 steps
2 public enum CitizenState
3 {
4     None,
5     Infected,
6     Vaccinated
7 }
8
9 // 14 steps 2 // 14 steps
10 public class CitizenController : MonoBehaviour
11 {
12     public CitizenState state = CitizenState.None; // current citizen state 4 unchanged
13     public float minWanderingDelay = 3f; // minimum wandering delay 4 unchanged
14     public float maxWanderingDelay = 6f; // maximum wandering delay 4 unchanged
15     public float wanderingRadius = 5f; // maximum wandering radius 4 unchanged
16     public float fleeRadius = 3f; // radius in which the citizen will start to flee 4 unchanged
17     public float fleeSpeed = 2f; // flee speed 4 1.1
18     public Image infectedCircle; // infected circle ui 4 Image (MonoBehaviour)
19
20     NavMeshAgent agent; // ai navmesh agent
21     Animator anim; // animator controller
22     VirusController virus; // virus controller in scene
23
24     // temp values
25     float wanderTimer;
26     bool fleeing = false;
27     Vector3 fleeDir;
28
29     // Start function
30     void Start()
31     {
32         agent = GetComponent<NavMeshAgent>();
33         anim = GetComponent<Animator>();
34
35         wanderTimer = Random.Range(minWanderingDelay, maxWanderingDelay); // initialize wandering timer
36     }
37 }
38
39 CitizenController

```

Citizens Controller script

```

1 // 14 steps 2 // 14 steps
2 void Update()
3 {
4     // If we're not the master client then do nothing
5     if (!PhotonView.IsMine)
6         return;
7
8     virus = FindObjectOfType<VirusController>();
9
10    anim.SetBool("fleeing", agent.velocity.magnitude > 0); fleeing = true;
11
12    if (virus != null)
13    {
14        // check if the virus is nearby
15        if (Vector3.Distance(virus.transform.position, transform.position) < fleeRadius)
16        {
17            fleeing = true;
18
19            // stop wandering if not stopped
20            if (!agent.isStopped)
21            {
22                agent.isStopped = true;
23                agent.ResetPath();
24                wanderTimer = Random.Range(minWanderingDelay, maxWanderingDelay);
25            }
26
27            // flee direction and movement
28            Vector3 fleeDir = (transform.position - virus.transform.position).normalized;
29            fleeDir.y = transform.position.y;
30            Quaternion targetRotation = Quaternion.LookRotation(fleeDir);
31            transform.rotation = Quaternion.Slerp(transform.rotation, targetRotation, Time.deltaTime * 180);
32            agent.Move(fleeDir * fleeSpeed * Time.deltaTime);
33        }
34        else
35            fleeing = false;
36    }
37
38    // update wandering timer
39 }
40
41 CitizenController

```

Citizens controller scripts

6.4 Animations (Romain)

Reminder: I used Mixamo to import animations on Unity. I took two of its models to “rigged” them on Mixamo and associated them with animations. I implemented three movements:

- The virus’ walk which is a sort of “scary” walk, the virus is slumped. This walk is to show that the virus is mean and seems dangerous
- The doctor’s walk is a “classic” walk, except that it is faster than normal to rush him to vaccinate the greatest number of commoners.
- The commoner’s walk is more of a “panic” walk, because we had to represent the fear in the “population” regarding the Covid virus.

I looked for movements that could represent well the emotions we wanted to communicate according to the characters. I finally fell onto three interesting ones in Mixamo. Then, I imported into Unity and configured them with each corresponding character.

Additionally, I needed to find still movement to make sure that when the player does not touch any arrows of the keyboard, the character does not move. So, I imported, this time, the three same movements into Unity.

6.5 User Interaction (UI) (Carl & Romain)

Reminder: Romain took charge of the implementation of the buttons and the designs that represent each type of buttons. Carl did the Main menu before starting the game.

6.5.1 Skill Icons (Romain)

The UI is finalized. Each character has its own unique UI with icons for their abilities or artworks for their market cards. The icons of the abilities come from the iconfinder website. It offers many icons; we took only free ones. The difficulty was then to find icons that represent well the associated ability:

For the "Vaccinate" ability of the doctor I chose to represent it by a syringe.

The movement abilities don't need to be represented by arrows since it will be the "arrows" of the player's keyboard that will make the characters move.

The "Contaminate" ability of the virus is represented by a virus icon which marks the dangerous side of the act.

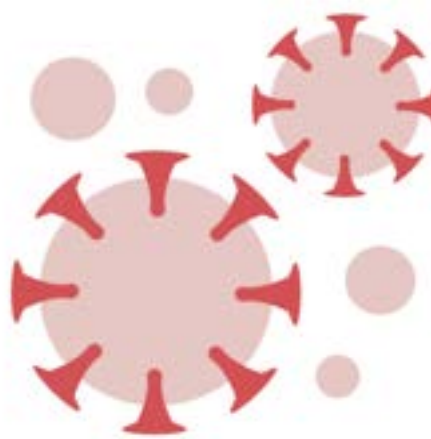
The ability to "climb stairs" is simply represented by a staircase.

All these icons are of low resolution but that is enough for our use, they are of size 128 x 128 px. I have grouped the icons into categories according to what they do: heal, contaminate. With experience, players won't even have to read the text related to the card to understand its effect. Movements are not represented by buttons, as it will be the arrows on the keyboard that determine the movements. These icons are therefore designed primarily to be clear.

IconFinder icons used to represent capabilities:



Vaccinate icon



Contaminate icon

6.5.3 In-Game Menu (Carl)

The in-game menu just consists of a button to quit the game when necessary.

6.6 3D Models (Tasnia)

6.6.1 Presentation

The characters were created on Blender by Romain, however, the objects composing the map of the video game were found on the internet in order to facilitate our work and optimize our time since our experience on Blender is null.

6.6.2 Objects/Assets (Tasnia)

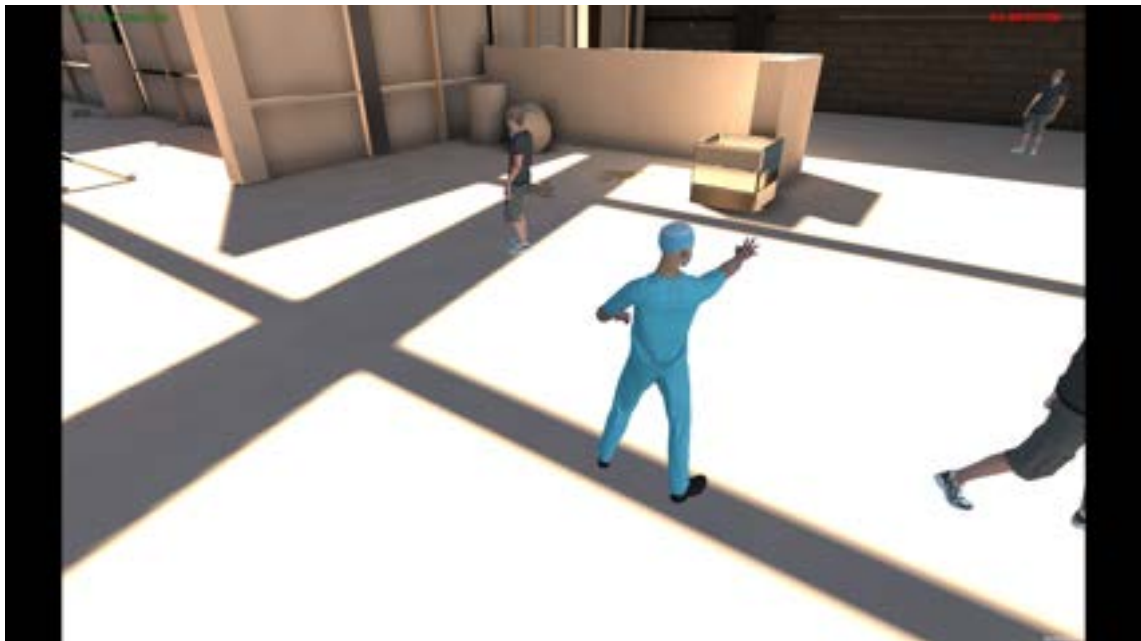
We found the assets and objects on the internet.

6.7 Artificial Intelligence (Carl)

The AI in our game consists of the commoners (citizens) who can be either contaminated by the virus or vaccinated by the doctor. The ultimate goal was to implement in such a way that the citizens had to move away from the virus when it approaches and move towards the doctor when it approaches too but the lack of time did not permit us to terminate.

We did implement the AI in such a way that the commoners move in a random manner once every 5 seconds. Randomly choosing between moving North, East, West or south. The movement also lasts for about 5 seconds. The speed of the movement was initialized to 4 km/h. A steady speed considering the speeds of the virus and the doctor.

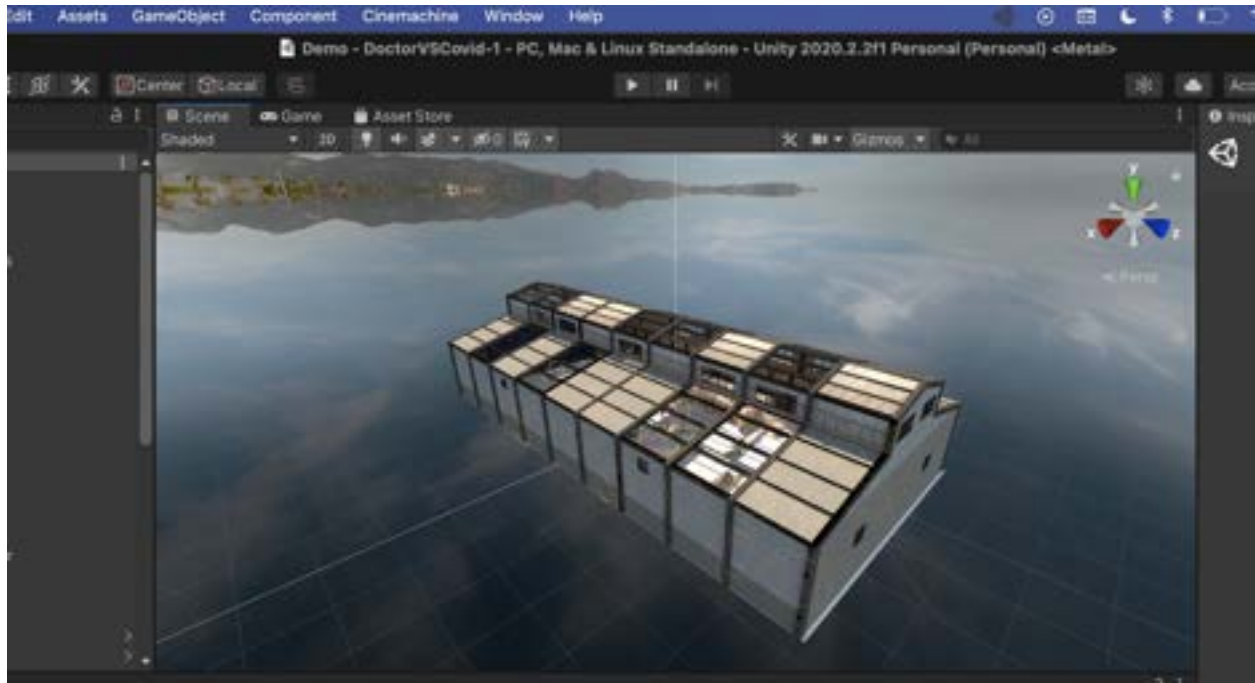
Overall, the AI movement was not too complicated to produce although we wanted more advanced capabilities.



Moving citizens

6.8 Game's map (Tasnia)

Here is what the final map looks like:



Map on unity

6.9 PHOTON UNITY NETWORKING (PUN) (Carl)

6.9.1 Why PUN ?

We chose to use PUN because it had a lot of tutorials online. It was free. And was reputed to be simple to learn.

6.9.3 Spawn Point

There are two spawn points on the map. One for the doctor and one for the virus. One is on one end of the map while the other is on the opposite end directly facing the first spawn point.



Match Making

6.9.4 Game's access

6.9.4.1 GameMaster

To access the game, both spawn points should be occupied.

6.9.4.3 End of the game

The game ends when either the virus has won, or the doctor has won or if there is a draw. As a reminder, the virus wins if it contaminates 100% of the citizens while the doctor wins if he contaminates. There can also be a draw which results in nobody winning.

6.10 Sound effects (Romain)

6.10.2 In-game

6.10.2.1 Infection sound

Regarding the sound that the commoner makes when he is contaminated by the virus, Romain chose the sound that we can find in *Minecraft* when the character is damaged by a zombie: https://www.youtube.com/watch?v=0T_NR2KY8ul.

6.10.2.2 Vaccination sound

Regarding the sound that the commoner makes when he is vaccinated by the doctor, Romain chose the sound that we can find in *The Elder Scrolls: Skyrim*, when the character is having his skill of healing other characters:

https://youtu.be/IIAqW7_kpuU?t=8.

6.11 Animations (Romain)

6.11.1 Walk

Each character will be able to walk. We decided not to make them able to run, because otherwise, it would become too easy to reach the biggest number of commoners. Thus, we implemented a walk for each type of character, however, this walk differs from the character concerned.

6.11.1.1 Virus' walk

I wanted to make the walk of the virus kind of ugly, a sort of walk that is scary, that is why I chose a slouched walk. This type of walk is faster than the doctor, because the virus is smaller than the doctor but also because the stride of the virus is bigger than the doctor's due to the choice of this walk.

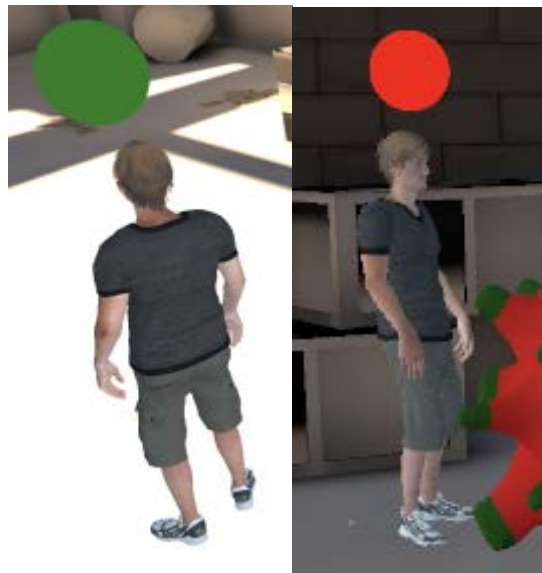
6.11.1.2 Doctor's walk

The walk of the doctor is more classic than the virus' walk, it illustrates a less confident type of walk as the doctor still fears the virus. The doctor is slower than the virus, however, his range of vaccination is larger than the scope

of the virus' contamination. Those differences make sure that the virus and the doctor start on the same level, and no one is superior and more efficient than the other.

6.11.2 Contamination & Vaccination

The contamination and the vaccination from the doctor or virus have the same gesture. Indeed, the gesture of the virus when he contaminates or the doctor when he vaccinates are the same, when doing the action, they raise their arm in the direction of the commoner. Accompanied by the specific sound (vaccination or contamination), the gesture takes up to 2 seconds, after that, the commoner is now vaccinated or contaminated. Thus, to detect if the commoner is vaccinated or contaminated, a point will be located above each of the commoners. The red point will represent a contaminated commoner, and the blue point will illustrate a commoner that has been vaccinated.



Indication of infected or vaccinated commoner

6.12 Conclusion

6.12.1 Accomplished Tasks

Now is the end of a long and enjoyable adventure, all tasks have been finished :).

6.12.2 Feelings

6.12.2.1 Romain

It is my opinion that the free project of S2 has been something very beneficial, indeed, it allows the application of programming and algorithms courses when designing the programs that are the basis of the game. I think that the request to carry out a project in the first years is a very good thing because it gives us a first contact between studies and the real world of work. This project has allowed me to gain experience. I know, for example, that time management is a determining factor.

In addition to the skills of group work and project management, the realization of this game allowed me to improve my knowledge in programming. But it's not over yet, there are still a lot of things to learn in the creation of video games and I see this project as the beginning of a great adventure in artistic creation via computer science.

6.12.2.2 Tasnia

I really enjoyed this project and working with a team.

6.12.2.3 Carl

So, this is the first “big” project I’ve ever done in my life, furthermore the first project in which teamwork was so important. It taught me a lot. From handling a team, to the importance of collaborating, passing by how indispensable it is to know how to search for information and to learn. I gained a lot of skills during the journey. I never thought it would be so fulfilling to be able to make a project reach its end.

Furthermore, although I think I will not want to do a game project again in my life. I feel like I've learned a lot especially in the domain of physics. And it is fun to play a game you made yourself, although it is not necessarily at the same level as the game I used to play. Not at all!

6.13 Final review

Doctor vs. Covid-19 is a project that carries the hopes and efforts of our group. It is the thing that made us come together, work and debate. Doctor vs Covid-19 is the result of half a year's work by four people whose will, and perseverance overcome the obstacles.

Six months ago, our project was just an idea, now it represents our determination to succeed and all our work. Our pride cannot be hidden.

Our project is complete, all our primary objectives are met, the final globality of doctor vs Covid-19 satisfies our group and we are proud of our first project done at EPITA.

6.13.2 Acknowledgements

We are Algorithm Senseis and we would like to make a list of people we would like to thank for the realization of this project:

- Our parents, who despite their lack of understanding in what we were doing, knew how to motivate and encourage us.
- EPITA who gave us the opportunity to embody our vision and state of mind.
- Supreme leader of algorithms, prophet of the ancient axioms, preacher of recursion, bishop of complexity, defender of optimization, protector of the sacred garden of binary trees, alpha and omega of the prep school, Krisboul.