Don't Catch It: An Interactive Virtual-Reality Environment to Learn About COVID-19 Measures Using Gamification Elements

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Figure 1: Overview of our environments, from left to right: *Supermarket*, *Office*, and *Subway*. Each with one of our visualizations to help the user with social distancing: *circle*, *indicators*, and *shadows*.

ABSTRACT

The world is still under the influence of the COVID-19 pandemic. Even though vaccines are deployed as rapidly as possible, it is still necessary to use other measures to reduce the spread of the virus. Measures such as social distancing or wearing a mask receive a lot of criticism. Therefore, we want to demonstrate a serious game to help the players understand these measures better and show them why they are still necessary. The player of the game has to avoid other agents to keep their risk of a COVID-19 infection low. The game uses Virtual Reality through a Head-Mounted-Display to deliver an immersive and enjoyable experience. Gamification elements are used to engage the user with the game while they explore various environments. We also implemented visualizations that help the user with social distancing.

CCS CONCEPTS

• **Human-centered computing** → **Visualization design and evaluation methods**; **Virtual reality**; • **Applied computing** → **Interactive learning environments**.

KEYWORDS

virtual reality, COVID-19, gamification, social distancing

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1 INTRODUCTION

In 2020 the world was struck by a global pandemic that dominates well into 2021. The SARS-CoV-2 virus spread all around the world and, directly or indirectly, changed the lives of almost every person on earth. Governments and scientists developed countermeasures to minimize the infection rate and, therefore, control the virus and its impact on our lives. Examples of such measures are wearing medical masks in public spaces or keeping a safe distance from other people. Although the measures are largely accepted, the number of people who do not comply increases the longer they are in force [4, 17].

A study by Moore et al. [16] found several reasons for people not to keep social distance. Some of those are deliberate, like the belief that other precautions, such as washing hands, provide sufficient protection or that the measures are an overreaction. Other reasons not to social distance are work, concern about mental and physical health, or taking care of children. But they leave room for social distancing, at least to a degree. Even if there are reasons to partake in certain activities, with some support and better awareness of the benefits, more people might social distance. Furthermore, in our daily life, it might be difficult to keep the distance all the time. While looking for a specific item in the supermarket, we might not notice other people coming close, or we come too close to other people out of habit or stress.

Our goal is to deliver an immersive and fun experience while also teaching about COVID-19 and measures against it. For this, we developed a serious game in VR. This is achieved by enriching an environment with game elements that bring the topic closer to the user. In our game, the players have to avoid getting infected by people around them, or they have to infect as few people as possible while they are infected. They can test their abilities in three different scenarios and see how good they are at keeping the distance. If wanted, the player can activate visualizations of the distance to assist with keeping the distance to the agents.

2 RELATED WORK

On the 30th of January 2020, due to the outbreak of the novel coronavirus SARS CoV-2, a global health emergency was declared by the WHO Emergency Committee [22]. Medical personnel and researchers around the world warned about the impact this could have on health systems [14], economics [8, 11, 21], and the normal life of people [5, 20]. While the virus spread throughout the world, scientists developed measures against it, and they were deployed by governments. Examples of such measures are social distancing [13], testing [2, 23], or the wearing of medical masks [10].

Social distancing describes the practice of keeping at least 1.5 meters of distance from other people. This way, the risk of transmitting the virus is reduced. Similarly, face masks, from simple ones made of fabric to medical masks and even FFP2-certified ones, catch aerosols. Aerosols are particles that potentially carry viruses. They are so small and lightweight that they can float in the air. The evidence shows that these measures helped to minimize the impact of the virus [18]. Even though a lot of people are vaccinated now, some people are in denial about the virus, think that the measures are too much, or are just fed up with following all the restrictions.

Many technologies help us during a pandemic, but can VR also be one of them? This is answered by Singh et al. [19], who give an overview of medical usage for virtual reality during a pandemic. VR can play a vital role in handling the ongoing pandemic, is the main message they promote. But while they focus on the medical side of the pandemic, VR can also be used to prepare people for exceptional situations with many people, as Dickinson et al. [9] showed. Through a study, they found that the density of agents affects user experience and behavior. Thus VR, in combination with crowd simulations, can help with evacuation planning, designing buildings, event management, and training individuals.

Manson et al. [15] investigated if VR could be used as a simulation for pandemic situations and how visualizations could help there. They came up with two visualizations, one being a notification over other agents if they get too close to the player. And the other is an outline that changes its color if an agent does not keep the distance of 1.5 meters towards other individuals. They discuss that their visualizations can help to detect bottlenecks on pathways or help an individual while social distancing.

This was the inspiration for us to build *Don't Catch It!*. Our goal is to help people that do not understand the measures or do not believe in their effectiveness. The game shows how important it is to social distance and how different measures can mitigate the spread of the virus. To deliver an immersive and memorable learning experience, we use gamification elements. Gamification is, as Blohm et al. [3] describe it, *"enriching products, services and information systems with game-design elements in order to positively influence motivation, productivity, and behavior of users."*

3 DON'T CATCH IT!

This section describes the implementation of *Don't Catch It!*, a VR game where the player has to complete various everyday tasks while keeping their risk of infection with SARS-CoV-2 as low as possible. It also covers the scenarios, tasks, objectives, gamification elements, and supporting visualizations. Everything was created using Unity version 2019.4.21f1 with XR support.

3.1 Scenarios

We used three scenarios for our game, a supermarket [7], an office [6], and a subway station [12], see Figure 1 and Figure 2. We chose those environments as they represent typical scenarios one might have to engage in during a pandemic. To populate the environments, we used the modular humans from 255 pixel studios [1]. We decided on a simple graphic design as it allowed us to focus more on the game implementation while also avoiding the uncanny valley. Also, we hope that the graphic design is pleasing for the players and aids to deliver a fun game experience.

3.1.1 Supermarket. A supermarket has narrow aisles customers have to navigate through to gather the items they want from different spots in the market. Finally, they have to stand in line to pay for their goods. All this has to be done while avoiding the other shopping people, and the employees of the market. Our supermarket has multiple aisles with various typical items and five checkouts.

3.1.2 Office. Employees in open-plan offices have to keep an appropriate distance towards their colleagues. This might be difficult

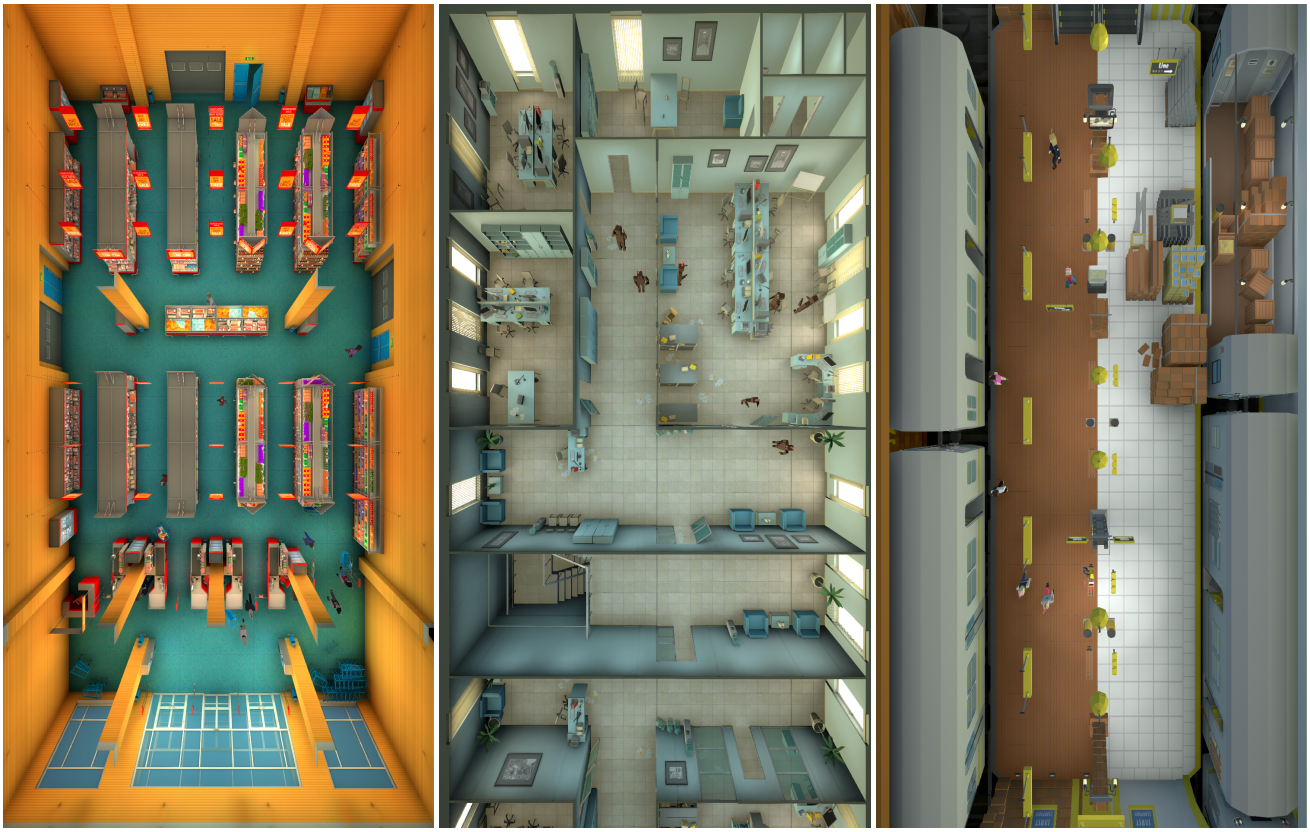

Figure 2: Bird's-eye view screenshots of our three environments, from left to right: supermarket, office, and subway.

while attending a meeting, grabbing a coffee, or going to the bathroom, especially on a busy day when there is a lot of motion inside and between the individual rooms. The environment we chose for our office has all those elements, open office spaces, hallways, bathrooms, and typical office equipment.

3.1.3 Subway. To get from one place to another efficiently, especially in cities, many people choose the subway. To do this, they have to enter enclosed subterranean stations. They have to walk through corridors and down stairways to get to the platforms. Once they are there, they need to purchase a ticket and then wait for the right train to come. Keeping a safe distance from all the other passengers that walk around the stations can be very difficult. The underground station we chose for our game has one platform for two railways with the typical seating possibilities and ticket vending machines.

3.2 Tasks

As described above, there are a lot of things to do in these scenarios, which make it hard to comply with social distancing during a pandemic. We broke such tasks down to three main types, which we can represent in our game. In the first, *Move*, the player has to go to a specific point highlighted in their vision, like the next aisle in a supermarket. The second, *Interact*, has the player go to a highlighted object and interact with it, like getting a ticket for a train. *Wait* is the third task, where the player simply has to wait some time in a specific area, such as in front of the bathroom.

3.3 Objectives

We have decided on two objectives: *stay-healthy* and *contain-it*. If the player is healthy, their goal is to stay healthy and not get infected. And if the player is infected, the goal is to infect nobody else. For both objectives, the player has to avoid coming too close to other individuals.

3.4 Gamification Elements

We implemented various gamification elements to create a game about teaching the players how different measures impact their risk of getting infected. The player and the agents have an *infect-o-meter* which represents how likely it is that they are infected with the virus. If the objective is to *stay-healthy*, the player has to keep their own *infect-o-meter* low by avoiding being too close to other agents which are presumed to be infected. *Contain-it* starts the player with a full *infect-o-meter* which in turn increases the *infect-o-meter* of agents in their vicinity. Infected agents breathe out aerosols, which affect the *infect-o-meter*, so the player has to avoid stepping in the aerosol clouds. As all our environments are well ventilated, the aerosols dissolve after a short time. Furthermore, we added face masks into the game. If the player or an agent wears a mask, the radius in which they infect other people is reduced, and they emit

fewer aerosols into the air while breathing. We also implemented a disinfection system where the player gets a temporary infection resistance after applying disinfectant.

3.5 Visualizations

Furthermore, we implemented multiple visualizations to help the player keeping the distance of at least 1.5 meters towards other individuals. Those are an indicator over the head of the agents, an outline around the agents, or a shadow beneath the agents that indicate with color if the agent is too close. The last visualization is a circle on the floor that displays the minimum distance the player needs to be apart from other people to reduce their risk of infection. For all visualizations, we also implemented a colorblind-friendly option.

4 CONCLUSION

With this, we presented our game *Don't Catch It!*. While the pandemic is still the dominant topic all over the world, there is a growing number of people that are tired of the restriction and measures to mitigate the spread of the virus. Our game is there to remind these people that it is still necessary to follow the restrictions and apply the measures against the virus, all while being interactive, immersive, and fun.

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