PEDIATRIAPP 2D GAMIFICATION OF PEDIATRIC HEALTH PROCEDURES

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VJ1241 - Final Degree Work

Bachelor's Degree in

Video Game Design and Development

Universitat Jaume I

17/05/2021

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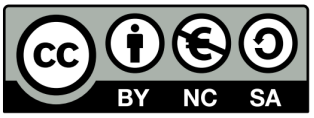

To my family, because despite not understanding anything I do,
they support me unconditionally.

ABSTRACT

This document represents the Final Degree Work report of Fernando Soria Mascarós in Video Game Design and Development.
This work consists of the development of an application aimed at minors that will explain, through mini-games and text, the paediatric procedures that are carried out when trying to diagnose diseases or solve health problems that minors may have when they go to a health centre or hospital. All these procedures will be adapted to the sensitivity of the child audience and will be explained from a real approach but in a moderate way and according to the perception of a child. The main objective of this application is to allow children to be informed about what will be done to them in health centers in such situations and to lose their fear of the unknown. It is a 2-dimensional application developed in Unity for computer.

KEYWORDS

- Pediatrics
- Application
- Health
- Infancy
- Gamification

CONTENTS

INTRODUCTION

This chapter explains the purpose of the work, the motivations that resulted in the project, the initial objectives and the starting stage of the development of the idea. There is also the result of the investigation on child psychology.

1.1. Work motivation

The main purpose of this work is to help the child population to overcome a fear that can be generated by the lack of knowledge of the pediatric procedure. And also to try to educate in this health field through some tools that are increasingly used by children: the new technologies. To this end, the application in which my work will consist of will focus on gamifying different procedures such as auscultation, taking temperature, performing an X-ray, placing a splint and making a suture. In these mini-games I will also provide informative text messages that explain to the user why the procedures are done and how they make the process easier. The motivation of this work is to create a useful tool in the education of children and in clearing fears and doubts in the present times, where health is the most important thing.

I took inspiration from games like Professor Layton (See Figure 1.1) for its ability to simplify complex concepts and adapt them to all audiences, in addition to its cartoon style that is so nice to look at. I also took ideas from Reanimation Inc (See Figure 1.2 and Figure 1.3), which is an app about medical procedures but much more serious and focused on the adult world, I would even say professional.

Figure 1.1: Sample of the video game Professor Layton and the Diabolical Box

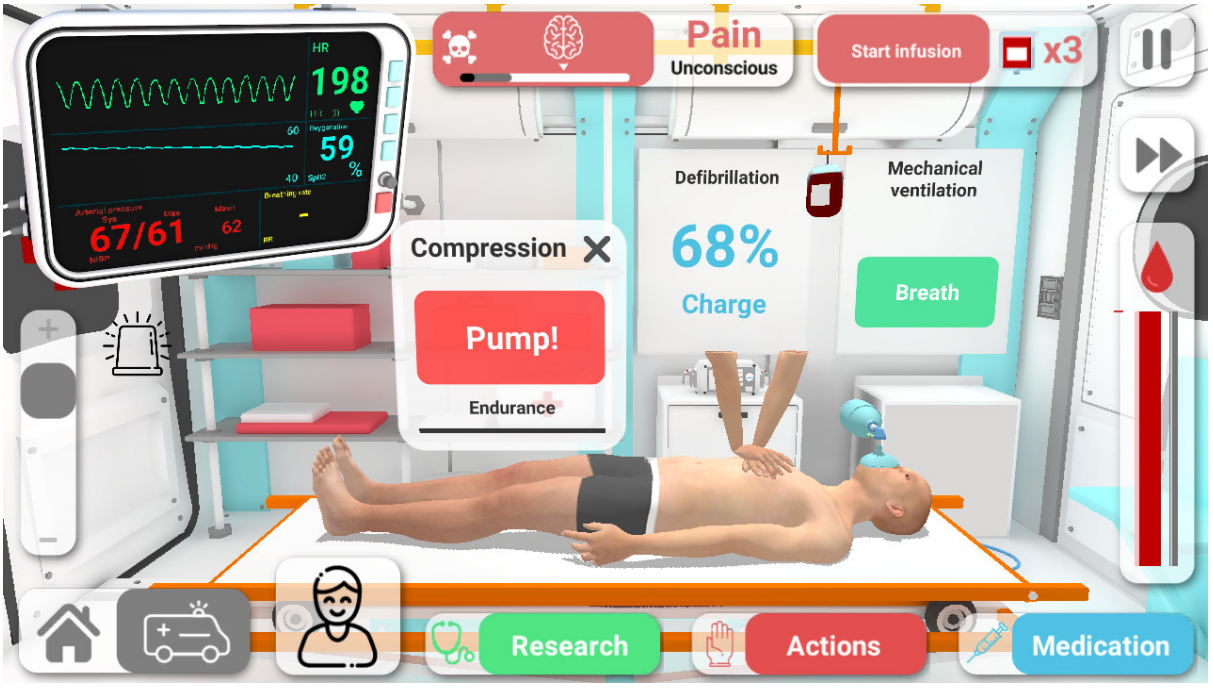

Figure 1.2: Sample of the video game Reanimation Inc

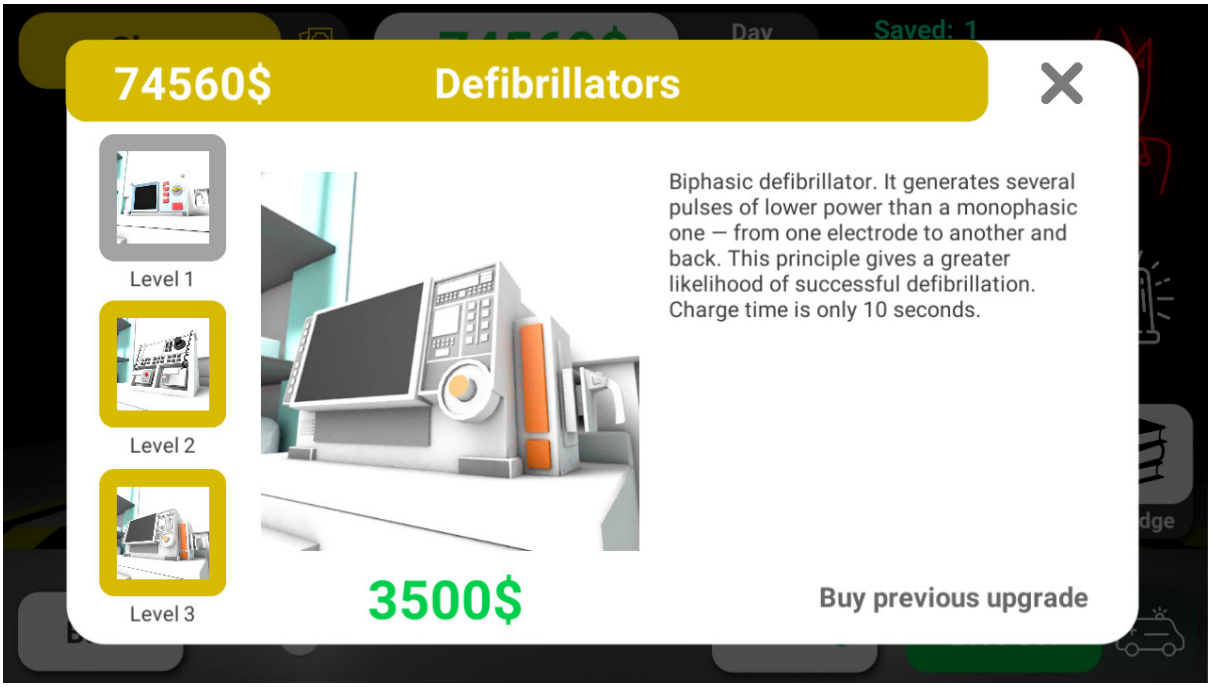

Figure 1.3: Sample of the video game Reanimation Inc

1.2. Objectives

- Implementing 2D drawings and gamification techniques to favour the relation between minors and the procedures they are subjected to in health centers.
- Create an app that adds variety to the gaming experience through the different mini-games it includes, thus avoiding inattention or boredom.
- To ensure that children using the application can visit the health center without fear of the unknown.
- Develop an original application that can be used in a pedagogical way or in addition to the education of a child.
- Implement a user-centered model to improve the project and try to perfect it.
- Develop an application that is easy to use and understand and that can be expanded even further in the future to cover more pediatric areas.

1.3. Environment and Initial State

The idea for the application was born from a nurse with great enthusiasm and conviction, as she made me realize the need for it.

Hospitalizations or visits can seriously affect the natural development of children and can cause disorders such as anxiety or stress. As a solution to this problem, different therapeutic methods are used, such as game therapies, which use ludic resources such as video games to improve the stay of children who are hospitalized. Apps or video games are a recreational and therapeutic resource aimed primarily at hospitalized children.

The main objective is that the application serves to alleviate their stay, as well as for the dissemination of basic health concepts and the pediatric context of the hospital.

From the creator's point of view it was also very interesting, but above all what attracted my attention was the challenge of making a fun health education app.

Once the topic was chosen, I had to think about how it would be developed. On the one hand it was clear to me that the app would have a direct access to the complete information, on the other hand I wanted the players to not be able to avoid it completely if they only played the mini-games. So the idea of splitting the mini-games into information camouflaged in the tutorial and the game itself came automatically.

The project would be done with the Unity 2D game engine for convenience and because of the extensive information about it that can be accessed. The programming, the visual aspect and the sounds would be created by the author of the work using references and his own creativity, with his own style.

1.4. Study on child psychology

The length of hospital stay disrupts the natural growth process of hospitalized children, as it negatively affects their behavior and emotional development and leads to illnesses such as anxiety or stress [1]. Therefore, hospitals use different treatment methods to alleviate this part of the patients' burden during hospitalization, such as play therapy, which can reduce the negative emotions and anxiety levels of hospitalized children [2]. In this way, the app is seen as a treatment tool that can help these children to stay in the hospital, because this branch of science is very popular among children and young audiences.

Society's attraction to new technologies has allowed the development of their informative potential, with the development of numerous recreational resources closely related to education and even tourism.

Considering the potential of the application as a tool for use in play therapy, the present work aims to take advantage of this tool for both informative and therapeutic purposes. To this end, we propose the development of an application which contains basic information on the branch of science that constitutes pediatrics and on the different types of procedures, as well as their pediatric context. This application will be nourished by basic elements characteristic of video games, as well as 2D models of the different utensils, iconography, and instruments of the hospital, and will be designed from a playful and informative point of view, since the application is aimed at hospitalized children in order to alleviate their stay in the hospital and to offer an alternative resource for the teaching of biological sciences.

Playing is an activity capable of stimulating humanity in children, which allows them to learn how to socialize and become familiar with various ethical concepts specific to their culture. There are different points of view when it comes to understanding the act of playing, as pointed out by Hernández-Arenas [3]. According to the relaxation theory, the game opens a space in which it is possible to relax the body and mind, it can become an exercise of reflection that reviews the history of the human being. On the other hand, the theory of practice affirms that the main function of play is to exercise in a playful way the necessary skills to overcome the obstacles of adult life. Other meanings simply define it as any spontaneous activity in which a child actively participates, and which also finds pleasurable [4].

It has often been considered that playing is a vital part of children’s natural development [5] [6]. In fact, several studies define it as a child's way of expressing themselves, in other words, it constitutes their language [7]. By playing, children learn about the world around them, how to express themselves, make decisions, explore unfamiliar or stressful topics safely, practice their skills and develop competencies.

In this sense, the role of this activity in the hospital context should be explored. The function of hospital institutions is to care for patients who cannot lead a normal life because they are affected by some type of illness, with children making up a high percentage of this group. Children have this in mind and these feelings can also be exteriorized on the most common visits. The stay in the hospital itself can affect the development of this sector, since hospitalization can be a stressful and threatening experience for them [1]. The hospital environment, as well as medical procedures, are part of a context with which the child is not

familiar, which can result in psychological disorders such as anger, anxiety, uncertainty and even feelings of helplessness [8] [9].

In these cases, decreasing anxiety is a priority so that the child can approach their treatment in a comfortable and controlled manner [10]. In fact, children with lower anxiety levels demonstrate greater cooperation during medical treatments [11], suffer from less post-treatment fear [12], require less sedation [13], and show a faster recovery [14]. Therefore, the inclusion of games in therapeutic procedures can be useful when dealing with these negative issues, as it possesses several therapeutic qualities (for example, the emotional expression or active participation) and promotes physical, cognitive, and social-emotional development [15]. Playing has been shown to alleviate the stress experienced by pediatric patients and their families during the hospitalization period [16], there are even studies that show that children find it easier to express their feelings regarding the hospital after "playing" with clinical instruments [17].

"The game transforms, creates very different 'realities' in those who play; it prevents distinguishing between fiction and reality, both included in the same game. (...) That is why it can be said that it heals to the extent that it transforms reality to make it something different, possible, feasible through mechanisms of identification, understanding and elevation." [3]

For these reasons, playing is usually integrated into the child's treatment in the form of preparation, care and normalization activities, for the patient to adapt to and become familiar with the medical procedures that concern them according to their disease.

In this context, child life specialists use several types of games to deal with the negative effects of hospitalization in children. These are:

- *Normative play* [18], understood as a spontaneous activity that a child finds pleasurable and in which they actively participate. It constitutes the set of activities that children typically engage in outside the hospital environment, a daily experience that promotes their growth and development as well as competence, so naturally hospital staff provide them with the opportunity for this type of play during hospitalization. It is really useful since it provides the child with something familiar and fun in the hospital environment, as well as allowing them to continue their development during extended stays [19] and to interact with other patients and the professional staff of the facility. Normative play is carried out both in toy libraries and in the hospital bed, even in waiting rooms, and includes activities such as board games, puzzles, drawings, and even video games. All in all, it is a very widespread

form of entertainment nowadays, as the result of technological innovation, which is interesting both for its recreational component and for its usefulness in facilitating the treatment of patients, reducing their perception of pain [20].

- *Medical play* [21], understood as an activity that seeks to explore medical topics, usually involving the use of medical instruments. It aims to help the child adapt to common medical procedures such as doctor's visits, different treatments and hospitalization itself. It consists of 4 components: first, a medical subject or equipment is always used. Second, medical play can be initiated by the adult, but it is the child who takes the initiative, participating continuously in the activity. Third, it is presented as a fun activity. Fourth, it is intended to help children gain mastery and control, express emotions and explore their fears towards medical instruments and equipment. The benefits of this type of play include addressing misconceptions, distinguishing between reality and fantasy, expressing fears, worries, and anxieties, as well as increasing children's knowledge of medical experiences [22].
- *Therapeutic play* [23], activities designed and implemented to help children think and express their feelings in relation to difficult events. It is a structured play that promotes emotional expression in order to enhance the child's normal development, as well as their psychological well-being and adaptive ability. Through this type of play, specialists can gain a better understanding of children's feelings, as they are usually expressed in such games [24] [25] [26].

Thus, the game has important relevance in the care of hospitalized children, since it allows them to comply with their treatment, in addition to turning the hospital into a playing scenario in which the child understands that their stay in it includes, playfully, "their mental codes and transforms their state of illness through positive social relationships with other children and with the medical and nursing staff" [3]. This context includes video games, a type of game that is very widespread today and deserves to be considered in this area.

The relationship between the video game and hospitalization is given by its ludic and educational character, as it is a type of game integrated into the Normative play. *"The video game is a multimedia software that runs on a wide variety of hardware, for example: computers and consoles. It is created primarily for the purpose of entertainment, to be another form of leisure, but it is also possible to obtain learning through its didactic use, that is, based on educational objectives we can take the video game as a mediating tool for the achievement of the same."* [27]

The video game industry has shown a great development throughout the last years, becoming one of the most popular forms of entertainment in the world, giving rise to increasingly complex and interactive products [28] that are even considered as part of contemporary theoretical thinking in which several research fields such as psychology, computer science or education converge [29]. Several studies have analyzed the relationship between video games and education, affirming that video games intervene in the construction of the child's social identity while shaping their learning modalities [30], as well as being an effective tool in the classroom to form both critical individuals and for the teaching of writing [31] [32]. However, the video game as an educational resource in hospitals is a topic that is still under development. For example, a pedagogical performance methodology has been developed based on the use of video games in hospital classrooms in Extremadura, with the premise of creating a positive environment that facilitates the learning process through the game [33].

On the other hand, the use of video games as a therapeutic tool has been largely explored. This is evidenced by studies such as those conducted in patients with burn injuries, which suggest that the use of video games of varying levels of complexity provides therapeutic benefits in pain management and tolerance to curative treatments [34] [35]. This is due to the effectiveness of this activity as a tool for pain distraction and relaxation, particularly in younger patients [36]. In several clinical trials it was expressed that "one innovative application of video games in health care is their use in pain management. The degree of attention needed to play such a game can distract the player from the sensation of pain" [36] This context includes Virtual Reality (VR), an immersive digital environment of which there is evidence of its successful use in different therapies.

Treatments such as those in [35] achieved a significant reduction in patient pain during treatments using VR, with the study conducted on 12 patients in the burn unit (undergoing 3 minutes of regular therapy and another 3 minutes of VR). It being the most renowned, since these patients reduced their pain-related thoughts during treatment, demonstrating the importance of keeping the nervous system engaged in other actions of interest and its impact on pain perception. From this, VR was applied as a therapeutic tool for the treatment of several pathologies [37] [38]. To a lesser extent, there are also cases that implement video games based on Augmented Reality (AR) in the hospital context. This technology allows users to interact with virtual objects introduced in the real environment, increasing their experiences in that environment [39], and that have shown positive results both in rehabilitations [40], and in the treatment of patients with an autism spectrum disorder [41] [42] [43].

To conclude, we can state that the game, and therefore the video game, has a series of features and qualities that provide it with great potential in three senses: didactic and informative, and therapeutic. Therefore, it is a resource that can be used both for children to learn and have fun and to help them during their stay in the health center, reducing their anxiety levels and alleviating their treatment, and in turn promoting normal development both physically and psychologically. In this context, pediatrics becomes important as it is an attractive discipline for the young population. For this reason, the app can be used as an informative resource. In the same way, the video game that integrates Augmented Reality and Virtual Reality provides a resource of great potential in the educational and didactic fields [44] [45], this represents a perfect opportunity to disseminate and enhance the value of the content in the health center through the use of the game, specifically the video game, while constituting a therapeutic and educational resource that can serve to alleviate the hospital stay of juvenile patients, while learning about the science around them.

The app is especially aimed at children, as it is also intended to serve as an aid to alleviate their stay in the health center with the aim of trying to reduce their stress during their stay and promote positive emotions through play and pediatrics, as well as making it an alternative educational resource to support the daily teaching given to long-term patients at the hospital school.

PLANNING AND RESOURCES EVALUATION

This chapter details the planning I followed while developing the app and the resources and methodology that I used to complete the job.

2.1. Planning

This section shows the planning for the work, including all its tasks and details. Some of these tasks have been altered and some I thought they were going to take less time and it took longer in the end. I tried to do all of them in order and completing one before making another, but I had to alternate between to figure some things out. The Gantt chart that explains all the scheduling visually is also included (See Figure 2.1 or follow the link [46]).

- **Research of information on pediatric procedures (20 hours):** To look for references for mini-games, learn about pediatric procedures and think about how to adapt them to gameplay, and interview a pediatric nurse.
- **Investigation on child psychology (50 hours):** Conduct an exhaustive research and documentation in order to adapt an adult and scientifically complex field to the world of children.
- **Application design (40 hours):** The design of the main menu, the style and gameplay, the HUD and user experience, as well as the test player surveys and the relevant changes as a result of these surveys.
- **Creation of assets (40 hours):** Find references to form the appropriate artistic style, organize a complete list of all the assets I would use, draw and color them.
- **Programming (100 hours):** Construction and programming of each scene with its respective objects, behaviors and mechanics. Each mini-game has its own details and peculiarities that have been polished.
- **Documentation (50 hours):** Drafting the necessary documents including the Final Degree Work report and the presentation set-up.

To briefly explain the Gantt chart of the tasks, there are two periods of time when the project was paused. The first one was in December, and it lasted until the last days of January

because I had to make a technical proposal for the project. After finishing it, I had to study for final exams, so the project was postponed for a while. Later, in February I did the GDD. After that, I continued with my final degree work.

In the Gantt chart you can see that first the main menu was done, then the character creator and finally the mini-games, which were done one after the other. For each minigame, I first programmed everything and then created the assets for it, finally I adjusted everything to the detail. The final step was to test it on the target users and collect their feedback and adjust it again.

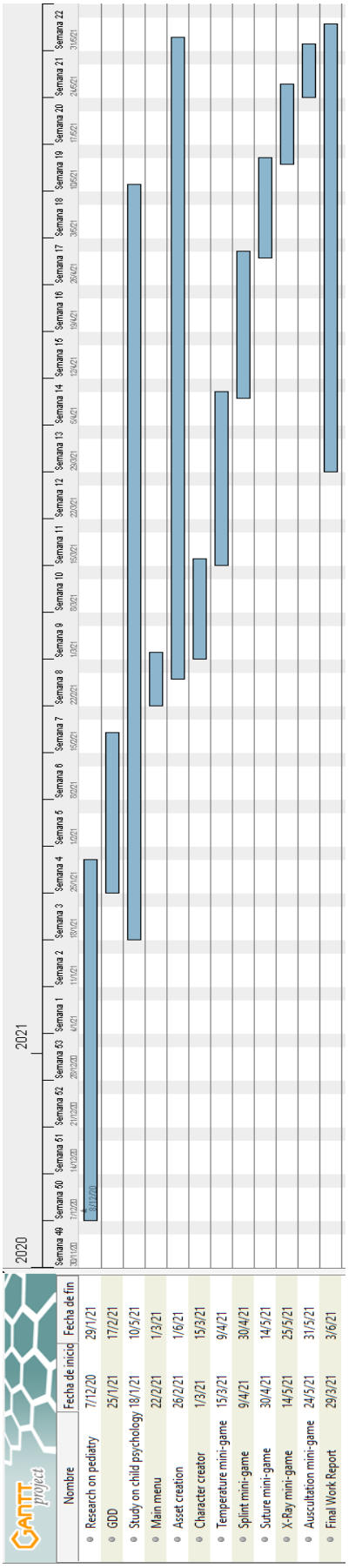

Figure 2.1: Gantt chart of the tasks (made with Gantt Project)

2.2. User Centered Model

It was decided to carry out this project using a working methodology with a user-centered model. This model promotes, incentivizes and shows the potential of the app from the player's point of view. The main focus of this model is the definition of a user profile that takes into account different aspects such as their tastes, their way of playing, their opinion regarding how they feel some features of the game, their appearance's perception, and these opinions are used to adapt the content of the game.

Analyzing in detail the responses of users after testing the app in different states, we find common general characteristics. Having the user as the center of attention when creating the app, allows to go beyond horizons or schemes that simply take into account the needs of a functional app leaving aside the information needs and what the user is looking for when testing the game. Considering these characteristics and each of the dimensions that model/represent the user, was what led to propose a profile of common proposals that were repeated. Taking into account this profile aims to make each user feel that the app is designed to take them into account.

In order to take into account all dimensions of the user's needs and preferences, the profile has been divided into several components:

- Result preference: This represents the way and the order in which the user wants to see the information. The user preferred the information presented to him at the beginning to be clearly visible and simple, therefore the headings are simplified. In addition, the user can define in which order he wants the information, e.g. he can decide to play before getting information or create his character.
- Artistic preference: Tastes are defined in the long term, being a pleasure or delight that is experienced for some reason or received from anything. Each user will have a taste when it comes to the visual aspect, but all agreed that it was nice to see a simple and childish drawing when playing and navigating the menu.
- Gameplay preference: In the gameplay is where most discrepancies were found among users, but most of them agreed that the fact that there was no defeat condition was very beneficial when it came to give that relaxed atmosphere that was sought.

2.3. Resource Evaluation

The resources used for this project are:

- **Hardware:**
    - **Laptop computer HP Envy** with i7, 12GB of RAM, and 1TB of hard disk.
    - **Wacom basic graphic tablet:** To draw all the assets.
- **Software:**
    - **Unity Hub 2.4.2:** To keep the unity projects and versions organized
    - **Unity Version 2020.1.8f1 (Student license):** The main software to create the project and work on it.
    - **Visual Studio 2019 (Student license):** The programming software attached to Unity.
    - **GitHub Desktop (Student license):** An online cloud-based repository where I uploaded the project weekly to have a safe place besides the computer.
    - **Trello (browser version):** An online tool to organize all the tasks and keep track of the progress.
    - **Google Drive spreadsheet:** An online tool I used to organize and visualize all the deadlines.
    - **Adobe Photoshop CS6 (portable, basic license):** The main program to draw all the assets of the project.

SYSTEM ANALYSIS AND DESIGN

This chapter shows the requirements analysis, the system design and the system architecture, ending with the design of its interface.

3.1. Requirement Analysis

Before performing the requirements analysis, the operation of the game should be reviewed in order to get a clearer picture.

The designing goal of this project was to make the app the simplest way possible for the users. With that in mind we tried to reduce and simplify all aspects of it, starting with the main menu, which gives a choice of 5 buttons (See Figure 3.1.1).

The first one *Play* leads to a selection of 5 mini-games (See Figure 3.1.2). The second button is *Character*, and leads to character creation. The third button is *Library*, and takes the player to a selection of information. The fourth button, *Exit*, closes the game. The last button is *Settings,* which allows the player to change the volume, choose whether the player wants to play in full screen or not, choose the resolution, and return to the menu (See Figure 3.1.3).

Each mini-game is divided into 2 parts, the first part will always be the same, an introduction from a pediatric approach to the procedure, and an explanation as a tutorial (See Figure 3.1.4). The second part of each mini-game will consist of:

- Temperature mini-game: In this game the player will have to defend the center of the screen, where the player's avatar is taking the temperature. The player will control the bar around the center, being able to move it closer or further away and rotate it around the center with the arrow keys, and will collide against the cold and hot particles that will try to restart the temperature taking. These enemies will appear out of the screen all around. Each time a particle hits, the progress of the thermometer will drop a little. The player must hold off the surges until the thermometer bar is full (See Figure 3.1.5).
- Plastering mini-game: Inspired by the popular game Doodle Jump. The player will control a wet roll of plaster bandages, and will jump from left to right between separate platforms until reaching the player's avatar. The character will automatically jump by bouncing on the platforms, so the player will only have to move the character

with the lateral arrows.The player must avoid falling between the gaps to avoid losing time (See Figure 3.1.6).

- Auscultation mini-game: Inspired by the popular game Pang. Players will be able to move from left to right avoiding the sound balls by bouncing around with the side arrows, they will also be able to shoot a wire from their stethoscope to eliminate them and thus end the noise (See Figure 3.1.7).
- Suture mini-game: Inspired by the popular game Frogger. Players will be able to move in any direction by jumping with the arrow keys, and will have to reach from the bottom of the screen to the target at the top. They will have to dodge the bacteria that will appear crossing the screen from one side to the other horizontally, because if they touch the player they will have to start from the beginning (See Figure 3.1.8).
- X-Ray mini-game: Inspired by the popular game Angry Birds. In this physics-based mini-game, players must drag the X-rays with the mouse and throw them with some force to the body part that is visibly broken on the other side of the screen (See Figure 3.1.9).

All the mini-games do not have a condition of total defeat, so that users of the wide age range should not be worried or nervous, it should be remembered that the aim of these mini-games is to create a didactic and non-pressured environment, not competitive.

The character creation screen will allow the player to change the appearance of their avatar and save it for the mini-games. They can choose from body type to hair, skin, eyes, nose, and mouth. There is also a random button that you can press (See Figure 3.1.10).

The library screen will allow the player to navigate between different screens with text that will allow the player to learn more about the mini-game procedures and more advanced pediatric procedures (See Figure 3.1.11).

To return to the menu the user can press the back button or hit the escape key at any time during the mini-games, where the action will stop and a menu will open with the options of resuming the mini-game or returning to the main menu (See Figure 3.1.12).

Functional Requirements

With this previous explanation, the functions of the system that are going to be developed are easy to identify:

1. The player can select the mini-games.
2. The player can change the volume.

3. The player can mute or unmute the game.
4. The player can choose the window or full-screen size of the game.
5. The player can choose the resolution of the game.
6. The player can modify the character.
7. The player can visit the library.
8. The player can quit the game.
9. The player can pause the game.
10. The player can press a button.
11. The player can return to the main menu.
12. The player can navigate through the library.

Non-functional Requirements

These requirements impose conditions on the design or implementation. In this case, there are:

1. The game will have a cartoonish art style.
2. The game will be playable on PC.
3. The game's HUD will be simple.
4. The library will be filled with curiosities.
5. The mini-games will be dynamic and attention-grabbing.
6. The elements of the game will be related with pediatrics and health center tools.
7. The mechanics will be easy to learn and the gameplay will be fluid.

Figure 3.1.1: Main menu.

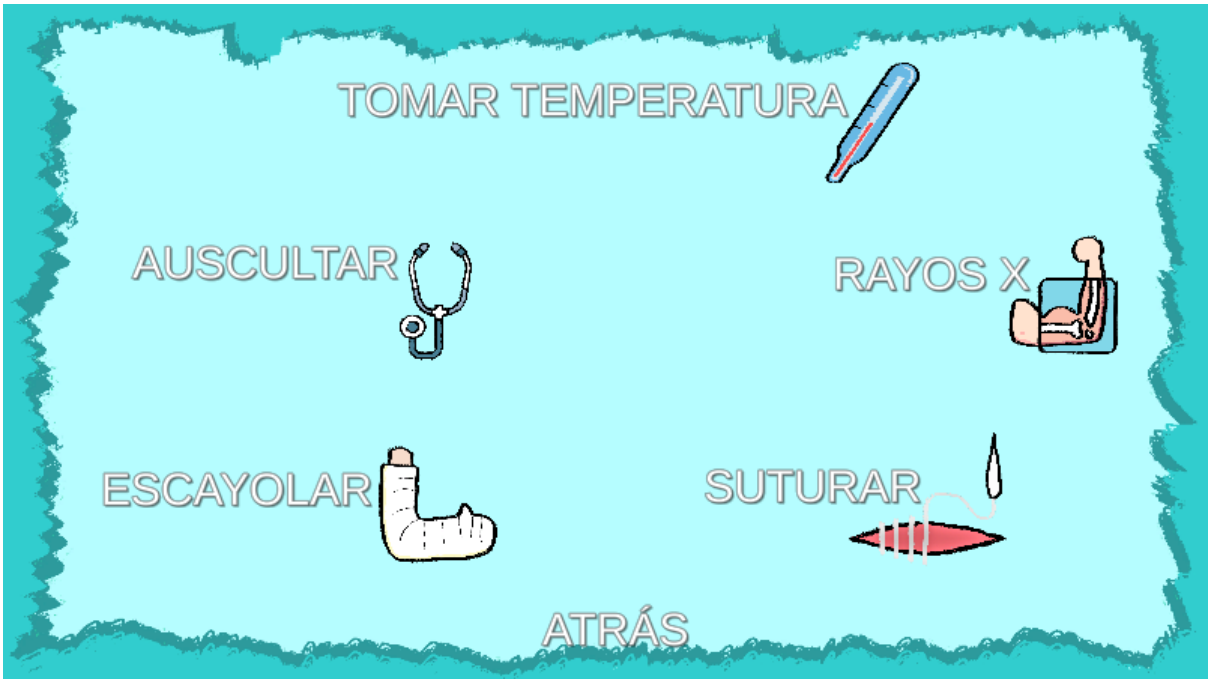

Figure 3.1.2: Mini-game selection.

Figure 3.1.3: Settings.

Figure 3.1.4: Tutorial.

Figure 3.1.5: Temperature mini-game.

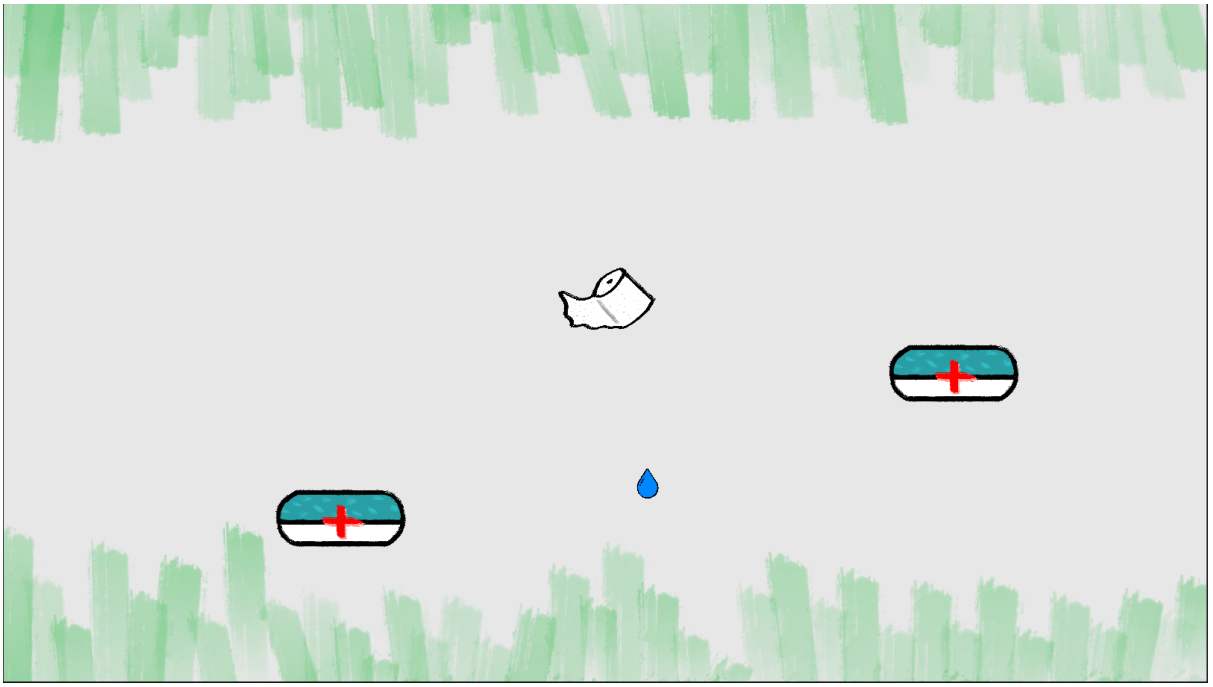

Figure 3.1.6: Plastering mini-game.

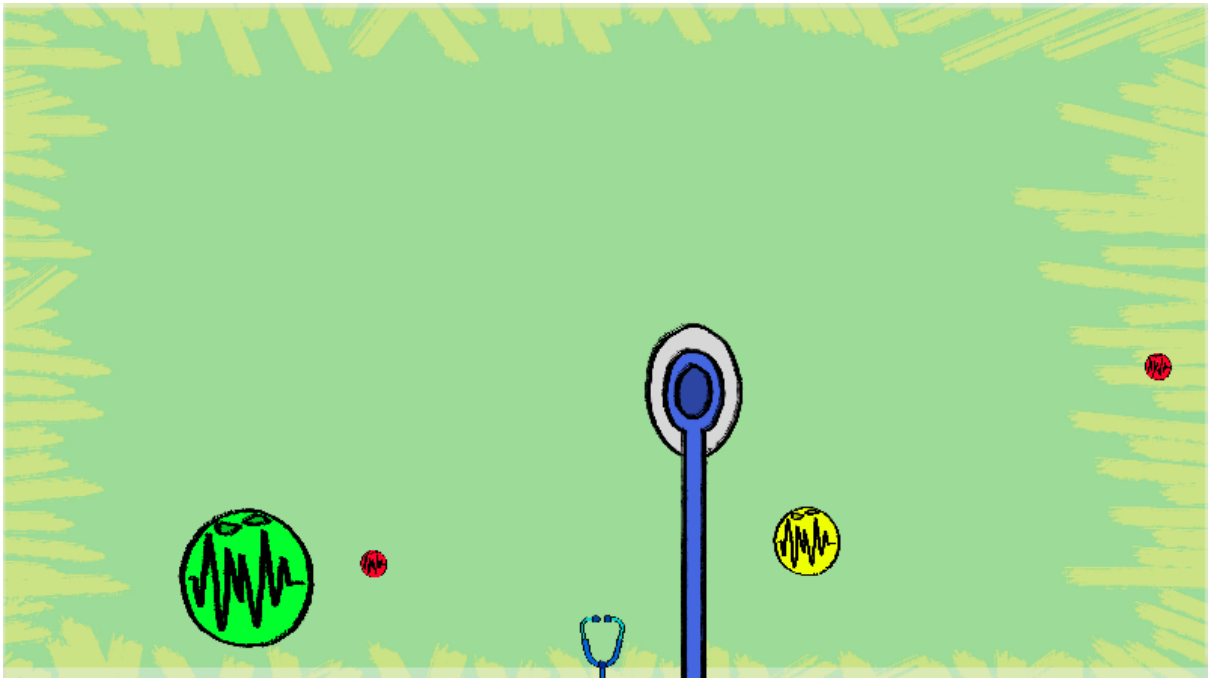

Figure 3.1.7: Auscultation mini-game.

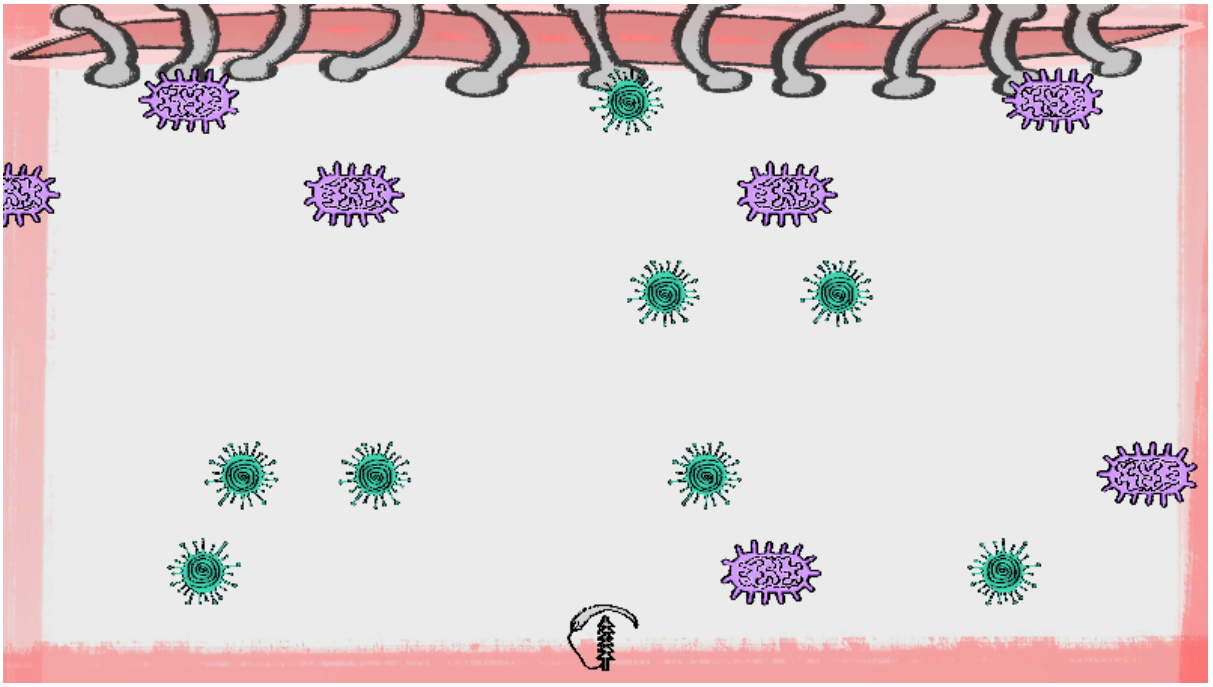

Figure 3.1.8: Suture mini-game.

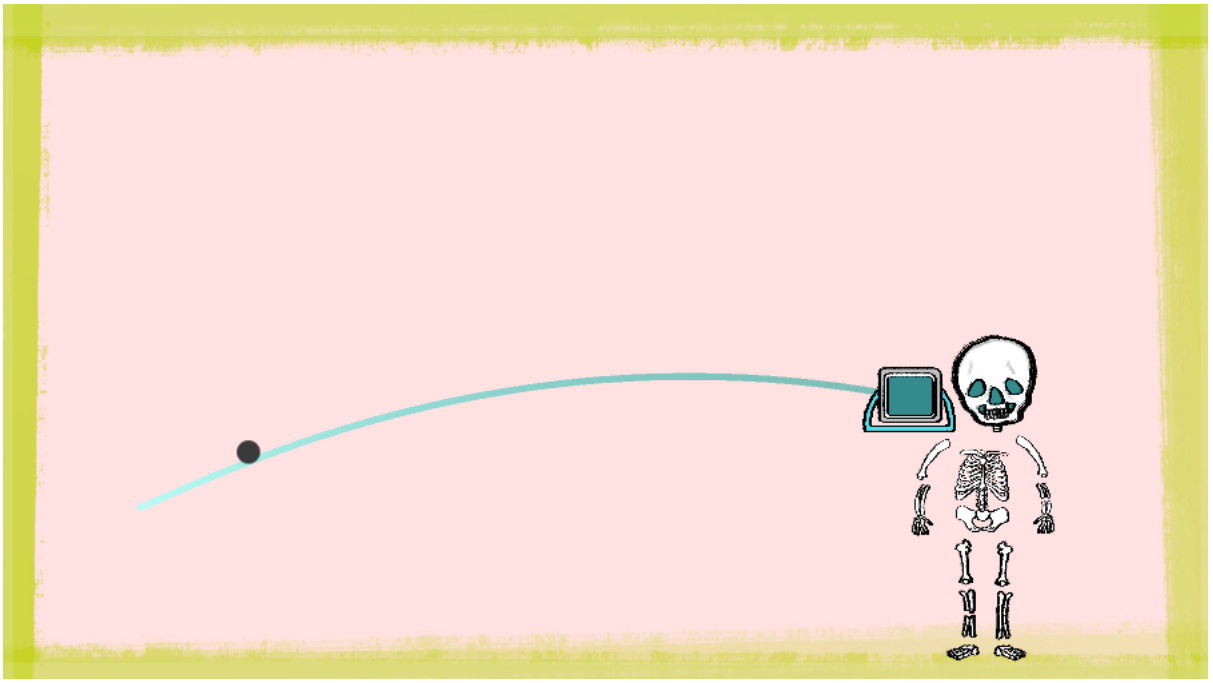

Figure 3.1.9: X-Ray mini-game.

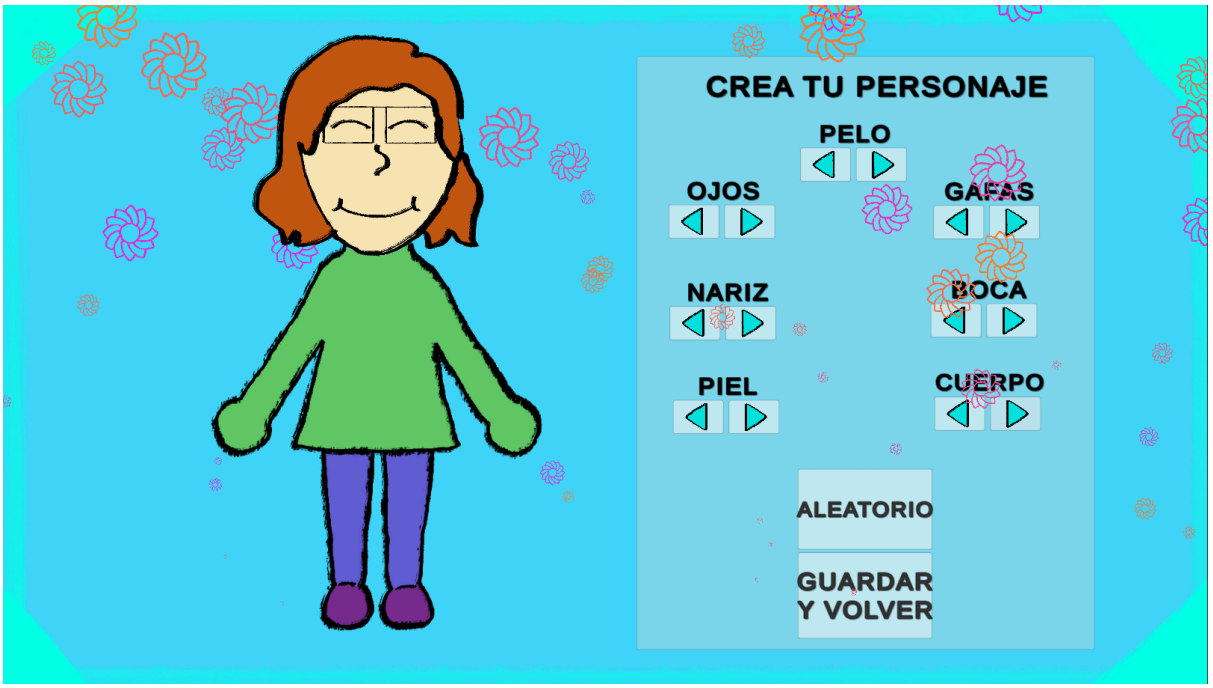

Figure 3.1.10: Character creator.

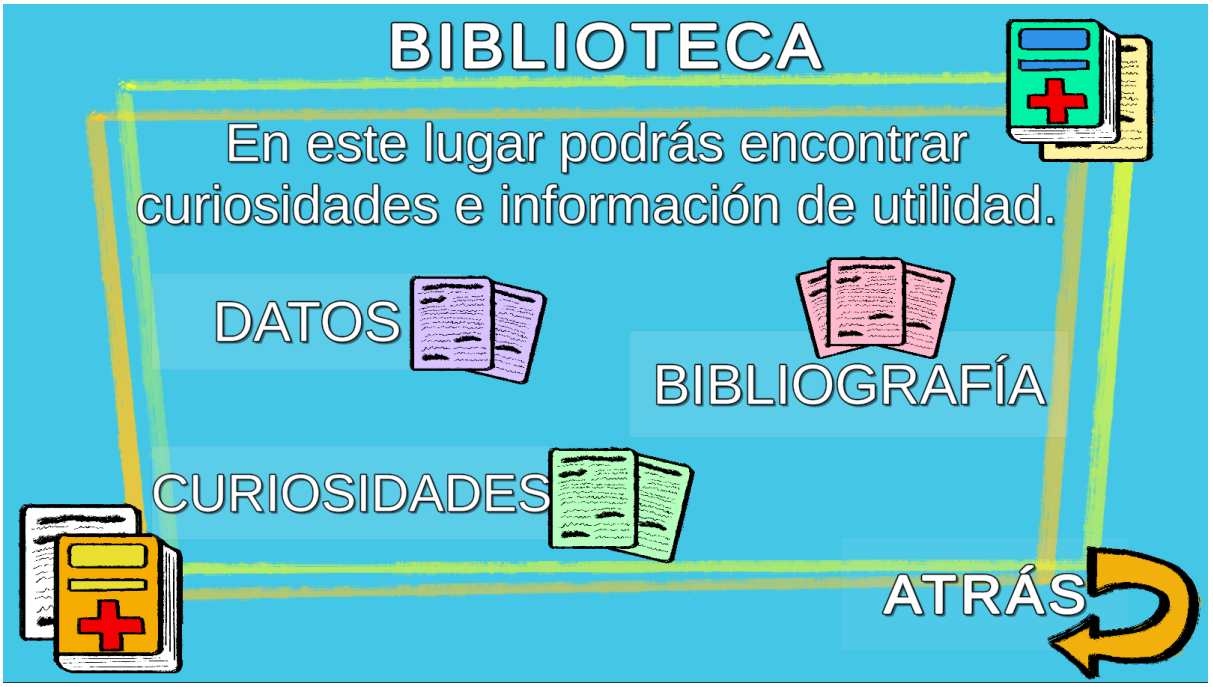

Figure 3.1.11: Library.

Figure 3.1.12: Pause menu.

3.2. System Design

This section shows the logical design of the system. A use case diagram is included to visually capture the functional requirements previously discussed and subsequently defined as use cases (See Figure 3.2.1).

Requirement: The player can select the mini-games.
Actor: Player
Description: The player gets into the mini-game selector by pressing the button Play.
Preconditions:

1. The player must be in the main menu.

Normal sequence:

1. The player presses the button Play.
2. The system loads the mini-game selector screen.

Alternative sequence: None

Table 3.1: Case of use «Play»

Requirement: The player can change the volume.
Actor: Player
Description: The player gets into the settings menu by pressing the button Settings.
Preconditions:

1. The player must be in the main menu.

Normal sequence:

1. The player presses the button Settings.
2. The system shows the settings menu.

Alternative sequence: None

Table 3.2: Case of use «Control sound»

Requirement:.The player can mute or unmute the game.
Actor: Player
Description: The player gets into the settings menu by pressing the button Settings.
Preconditions:

1. The player must be in the main menu.

Normal sequence:

1. The player presses the button Settings.
2. The system shows the settings menu.

Alternative sequence: None

Table 3.3: Case of use «Mute sound»

Requirement: The player can choose the window or full-screen size of the game.

Actor: Player

Description: The player gets into the settings menu by pressing the button Settings.

Preconditions:

1. The player must be in the main menu.

Normal sequence:

1. The player presses the button Settings.
2. The system shows the settings menu.

Alternative sequence: None

Table 3.4: Case of use «Screen mode»

Requirement: The player can choose the resolution of the game.

Actor: Player

Description: The player gets into the settings menu by pressing the button Settings.

Preconditions:

1. The player must be in the main menu.

Normal sequence:

1. The player presses the button Settings.
2. The system shows the settings menu.

Alternative sequence: None

Table 3.5: Case of use «Resolution»

Requirement: The player can modify the character.

Actor: Player

Description: The player gets into the character creation screen by pressing the button Character.

Preconditions:

1. The player must be in the main menu.

Normal sequence:

1. The player presses the button Character.
2. The system loads the character creation screen.

Alternative sequence: None

Table 3.6: Case of use «Character creation»

Requirement:.The player can visit the library.

Actor: Player

Description: The player gets into the library screen by pressing the button Library.

Preconditions:

1. The player must be in the main menu.

Normal sequence:

1. The player presses the button Library.
2. The system loads the library screen.

Alternative sequence: None

Table 3.7: Case of use «Library»

Requirement: The player can quit the game.

Actor: Player

Description: The player quits the game by pressing the button Exit.

Preconditions:

1. The player must be in the main menu.

Normal sequence:

1. The player presses the button Exit.
2. The system shuts down the program.

Alternative sequence: None

Table 3.8: Case of use «Quit game»

Requirement: The player can pause the game.

Actor: Player

Description: The player stops all in-game action by pressing the button escape on the keyboard.

Preconditions:

1. The player must be in any mini-game.

Normal sequence:

1. The player presses the button escape.
2. The system stops the in-game time and shows the pause menu.

Alternative sequence: The player is not in a mini-game, but presses the button, nothing happens.

Table 3.9: Case of use «Pause»

Requirement: The player can press a button.

Actor: Player

Description: The player moves the character by pressing the arrow keys.

Preconditions:

1. The player must be in a mini-game.

Normal sequence:

1. The player presses the arrow keys.
2. The system moves the character on the screen.

Alternative sequence: None

Table 3.10: Case of use «Movement»

Requirement:.The player can return to the main menu.

Actor: Player

Description: The player gets into the main menu by pressing the button Main Menu.

Preconditions:

1. The player must be in the paused game screen.

Normal sequence:

1. The player presses the button Main Menu.
2. The system loads the Main Menu screen.

Alternative sequence: None

Table 3.11: Case of use «Main Menu»

Requirement: The player can navigate through the library.

Actor: Player

Description: The player gets into the library's archives by pressing the selection of buttons.

Preconditions:

1. The player must be in the library.

Normal sequence:

1. The player presses the buttons.
2. The system shows information in text.

Alternative sequence: None

Table 3.12: Case of use «Investigate»

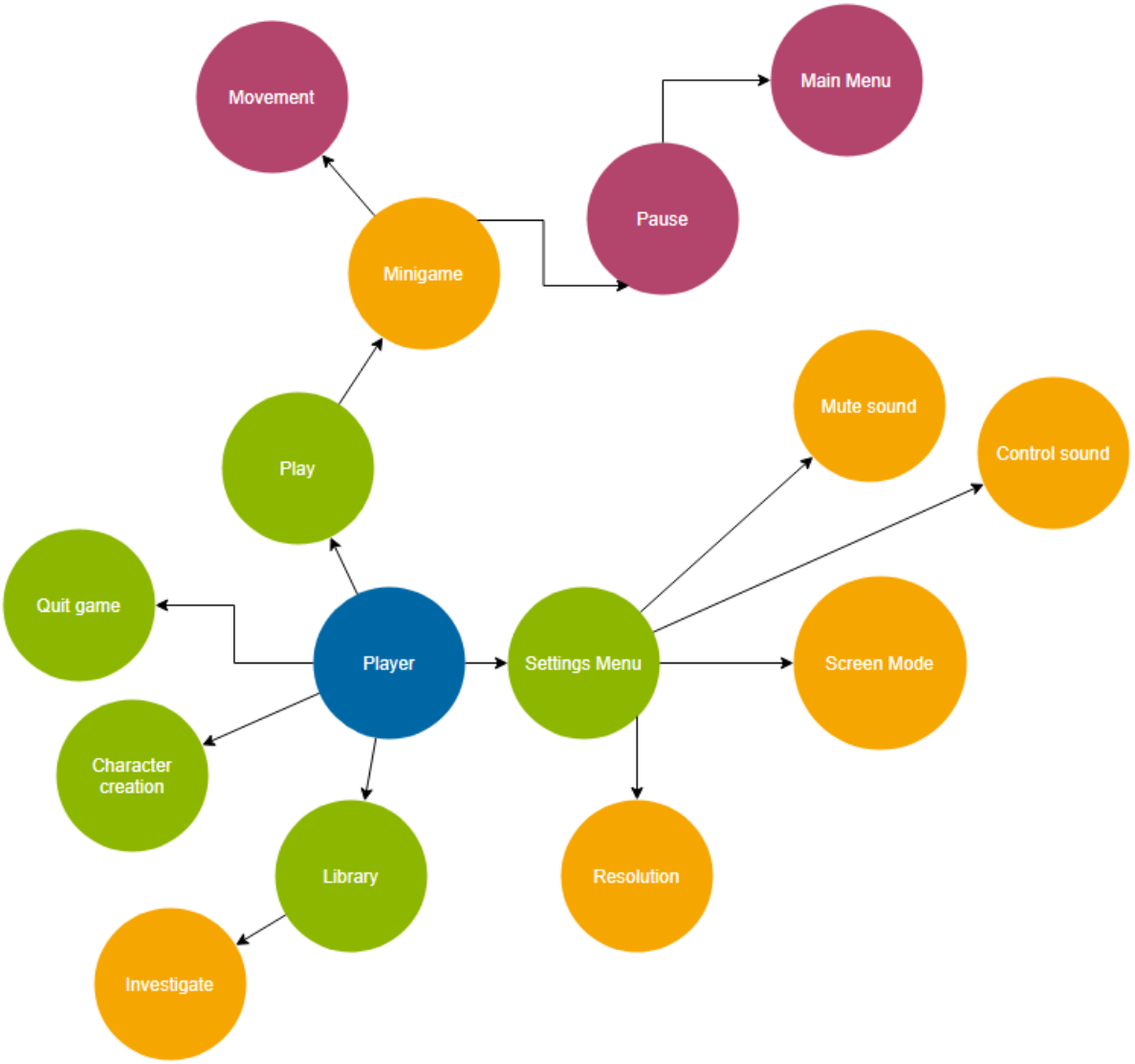

Figure 3.2.1 Case Use Chart (made with Online Visual Paradigm)

3.3. System Architecture

This section should describe the minimum specifications of the system that will run the app.
On PC:

- The operating system Windows 7, at least.
- A CPU with x86 or x64 architecture.
- At least a graphic card (GPU) with DX10.
- RAM: 4GB.
- A keyboard and a mouse or a touch panel.

The requirements have been taken from Unity documentation.

3.4. Interface Design

For the game I decided to make a 2D interface as simple and simplified as possible. As it can be seen in figure 3.4.1 and figure 3.4.2, these icons represent a simple idea and are easily distinguishable. In trying to make an educational as well as entertaining game, I wanted to make the interface as simple as possible for two main reasons. First, I wanted to keep the style thematically appropriate, and second, I did not want to detract or distract attention from the interface, as I wanted the user's main focus to be on the teaching. In the 2D library scenario, the player can read information about selected pediatric procedures and trivia (See Figure 3.1.11).

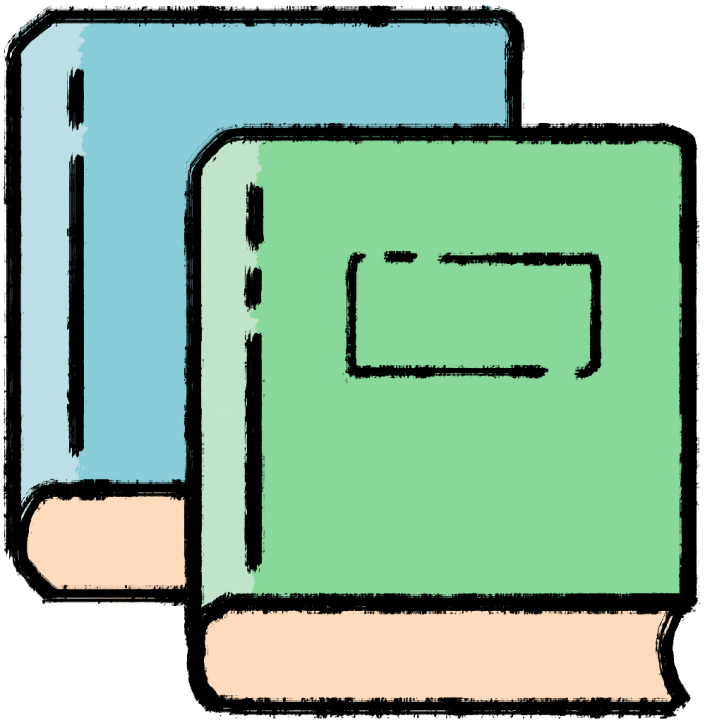

Figure 3.4.1: Library icon.

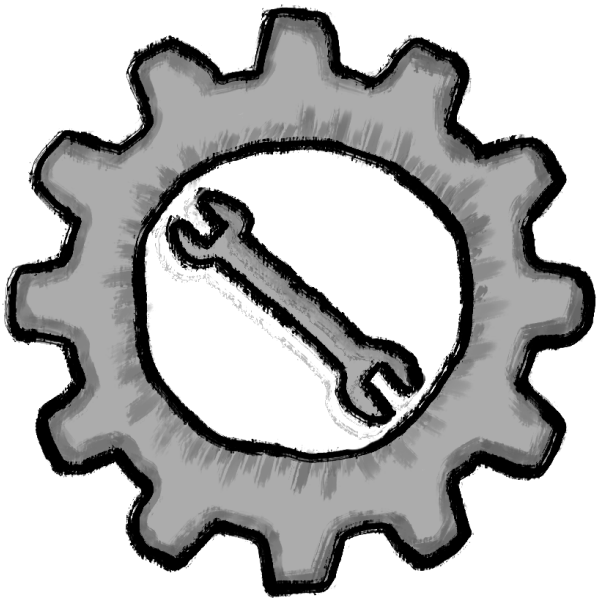

Figure 3.4.2: Settings icon.

At the start of each mini-game, an information panel and a short tutorial appear and provide the player with some context about the procedure and hints as to what the objective is (See Figure 3.4.3). The buttons in the tutorial are also integrated into the drawing because I wanted to focus the player's attention on them (See Figure 3.4.4).

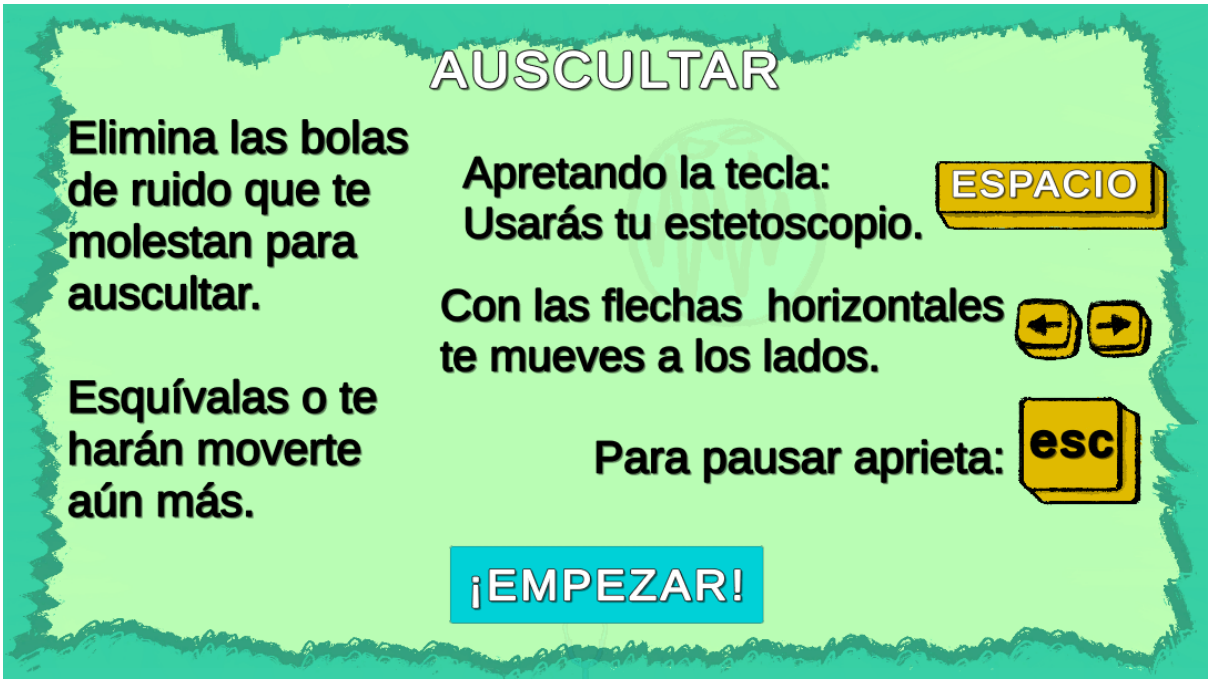

Figure 3.4.3: Auscultation mini-game tutorial.

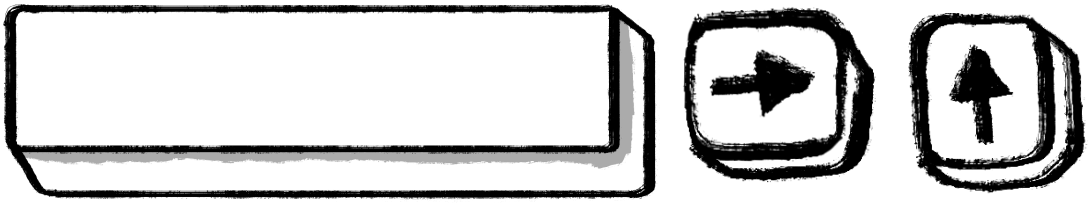

Figure 3.4.4: Buttons.

All the drawings have the same style that replicates the drawing style of a minor, with fat strokes and bright colors. The inspiration came mainly from the video game Yoshi's Island (See Figure 3.4.5) and the inspiration for the character creation came from Nintendo's Mii menu customization (See Figure 3.4.6 and Figure 3.4.7). Another example of such inspiration is the colorful victory screen (See Figure 3.4.8).

Figure 3.4.5: Yoshi's Island.

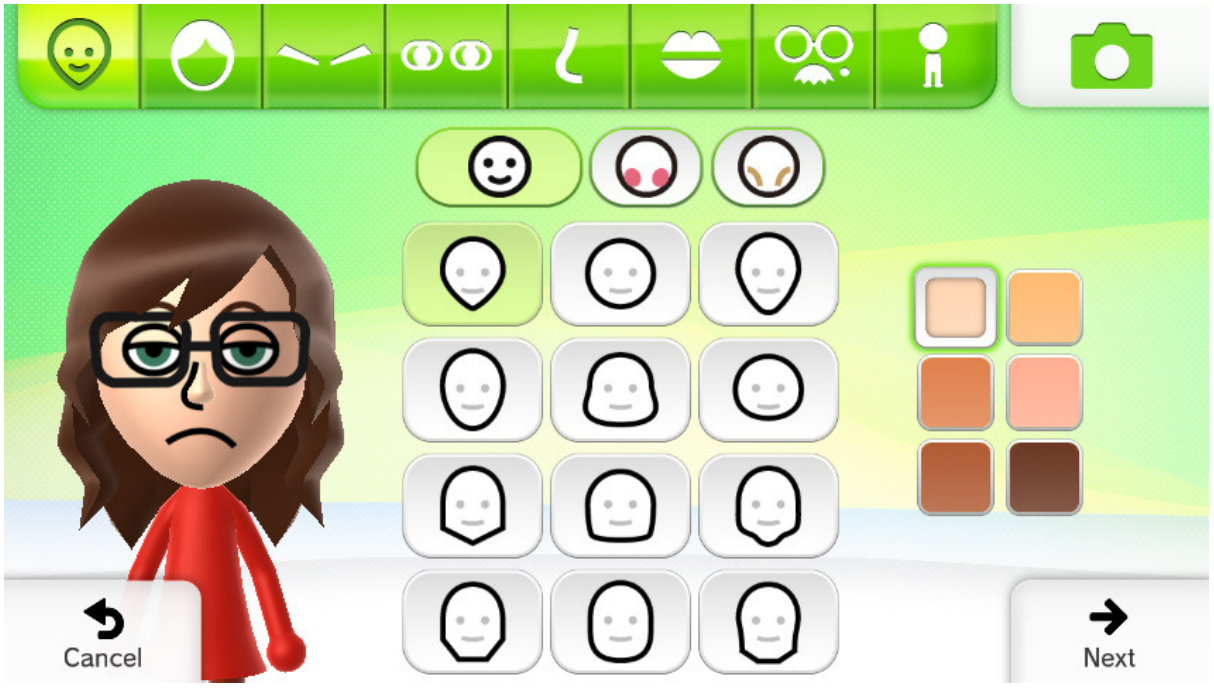

Figure 3.4.6: Mii Editor from Nintendo.

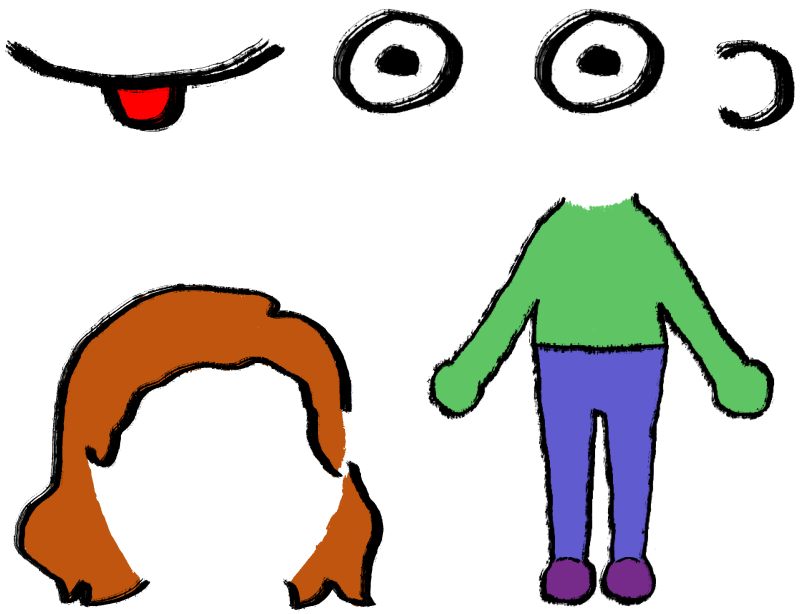

Figure 3.4.7: Parts of the body.

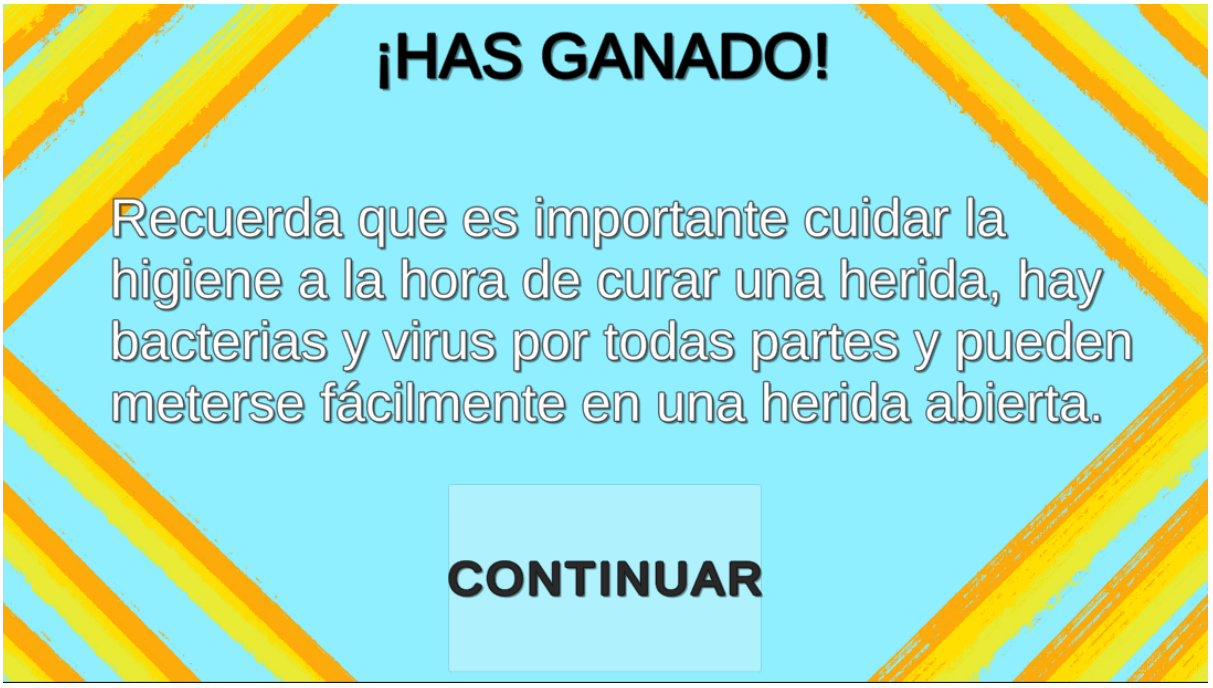

Figure 3.4.8: Victory screen.

The GUI is implemented and camouflaged in the mini-game, such as the thermometer, which indicates the progress of the temperature mini-game and is an object within the mini-game (See Figure 3.4.9), as well as the camera shake that occurs when in the mini-games two elements collide and produce a negative effect. The mouse icon is also drawn and integrated

into the game to increase immersion in the game (See Figure 3.4.10). Even the particles that can be seen when there are explosions or crashes are drawn (See Figure 3.4.11).

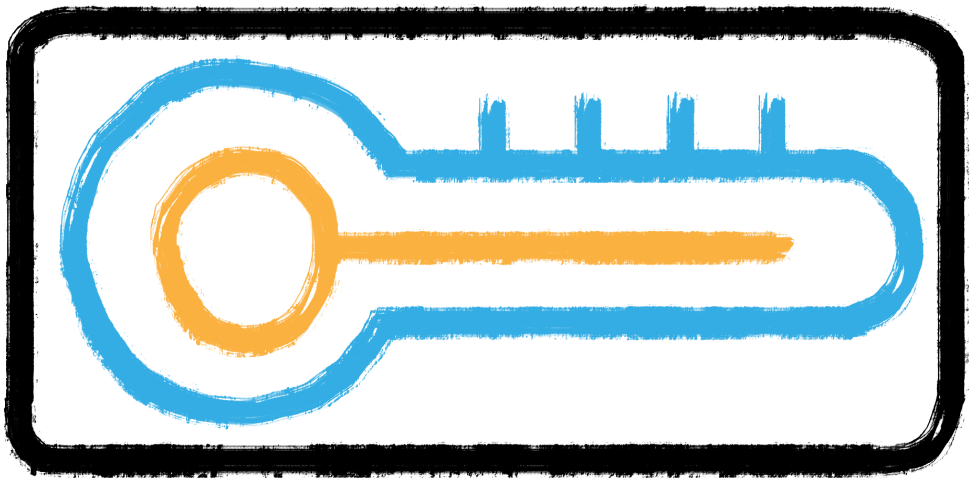

Figure 3.4.9: Termometer.

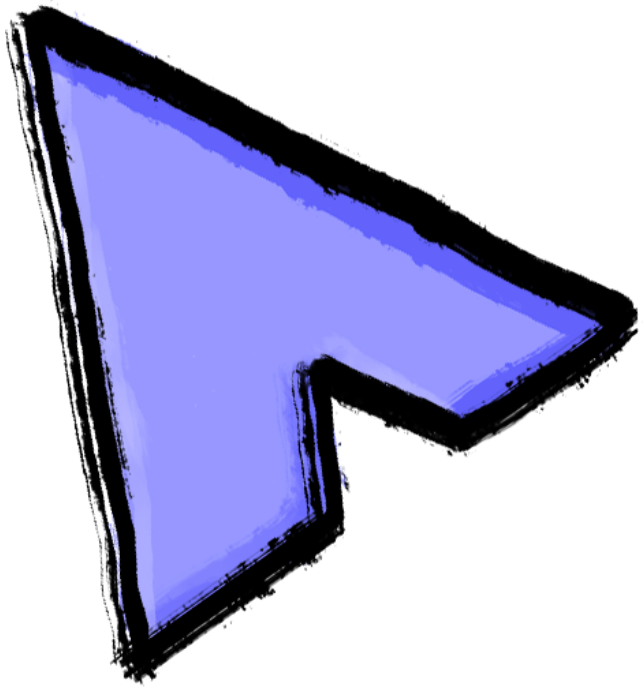

Figure 3.4.10: Mouse.

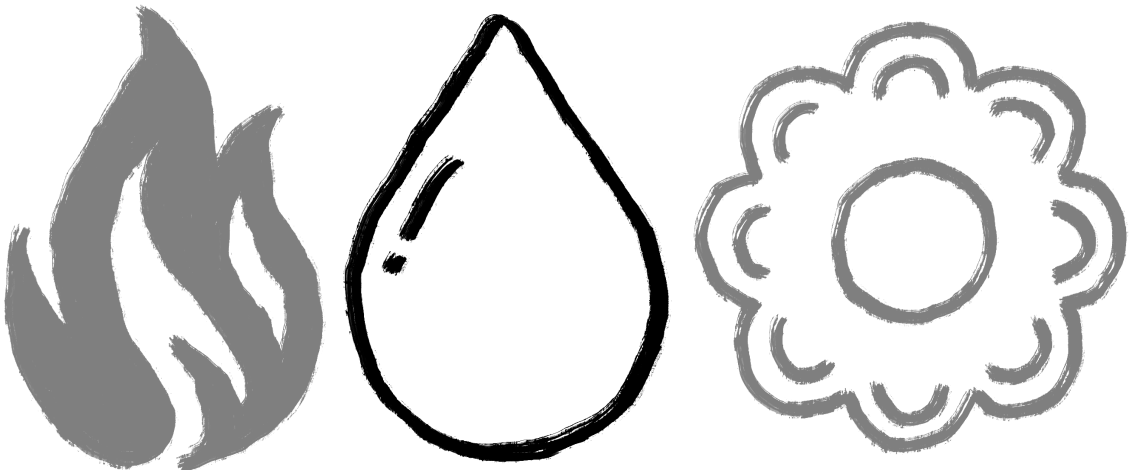

Figure 3.4.11: Particles.

WORK DEVELOPMENT AND RESULTS

This chapter shows the development of the project from its inception to its completion. It also includes an evaluation of the results and of changes and transformations of ideas, recommendations of the supervisor and opinions of the users who have been testing the prototypes.

4.1 Work Development

The work development will be explained in chronological order so that the project's progress is followed well. The whole project was created in order, from the main menu to the last mini-game.

Let’s start with the main menu. Everything was created from scratch. The assets were put later after the completion of the main menu design. The buttons and the scenes to which they would direct were added early on to test the functionality of the program. The last thing that was added to the code was the scene transition animations.

After this I created a sub-screen inside the main menu that would allow the player to change the volume of the music with a slider, since thanks to the slider the volume would be a floating variable and with the decimals it would allow more precision.

After fixing the volume and adding the music I created the full screen option and the resolution option, which allows to choose all the available resolutions of the computer where it is running.

Next I got to work on the temperature mini-game. The first thing I did was to program the player's movement to rotate around an object that I placed in the center. My idea was that this mini-game would be reminiscent of a satellite defending the earth from meteors, and I easily adapted it to the sanitary with the art, although I left the background of stars to evoke that feeling in the player. The player can move with the keyboard arrows clockwise and counterclockwise and can zoom in and out to a certain point from the center. After polishing the movement I created the enemies and added a script that made them rotate towards the target from any direction and move towards the target, which I placed in the center. And finally, I added a script to the GameManager that made the enemies spawn around the screen.

To finish the minigame I had to add a victory condition, so I created a variable that increased with time and made it visible in a slider inside the thermometer drawing, I also put in a condition that if the enemies crashed against the thermometer it would take away a part of the progress. This first minigame was the one that cost me more to make since I added many details and conditions besides being the first one that I made, from this one the rest were coming to me in a faster and more natural way.

After that, I made an enemy and its movement towards the target, I made it destroyable by touching both the player and the target and from that object I made a prefab that I could modify and duplicate for a second enemy and a spawner. Finally I added all the assets and made the victory condition, that while the thermometer is attacked it shows the progress bar that is modified when it is hit by the enemy.

The second mini-game to be made was the plaster, which I used to start testing the physics of the engine, and I also wanted to use a random scenery generator. So combining both concepts I made a side-scrolling jumping game that generated in each game a list of platforms in different positions and heights randomly. After making the movement of the character with the lateral arrows of the keyboard and the generation of platforms, I added to both minigames a basic tutorial menu that at the end of all the minigames would adorn. I also added a victory screen that I would reuse like the tutorial in the rest of the minigames. Continuing with the second mini-game, I added a victory condition and particles, as well as adding the camera shake effect. This mini-game was inspired by the popular mobile game Doodle Jump (See Figure 4.1.1).

For the third mini-game of auscultation I was also able to use the physics engine to create a ball that bounced between the four walls I had set up. I also created a character that could move sideways with the arrow keys and put an object that would follow its position so that when the player pressed space the object would move upwards. Later I added collision conditions to each object so that the ball could be destroyed and added a script that allowed the ball to split into two smaller ones. After that I replicated the menus and the tutorial. This mini-game was inspired by the popular game Pang (See Figure 4.1.2).

With the fourth mini-game, the Suture mini-game, the first thing I did was the enemies and the enemy generator, where in this case I created several spawn points. The spawn points were very useful for the random generation of enemies and after that I created the movement of the character, which with the arrow keys can move in all directions in jumps. To finish it I added the defeat and victory conditions, the defeat condition caused the character to return to the initial position without having to load the scene again. The victory condition is generated

when the character reaches the top of the screen, where there is a collider that detects it. Of course after finishing these last 2 mini-games I went back to add particles and effects and the final assets. This mini-game was inspired by the popular game Frogger (See Figure 4.1.3).
The last minigame I had left to do was based entirely on physics, recalling the popular Angry Birds game (See Figure 4.1.4), but adapting it to the theme of an X-ray. First I created the character that you can drag with the mouse and throw. But then I added a fixed point where he could not get out until the left mouse click was released. Then I added some obstacles with physics to test if everything worked correctly. And finally I created some objects different from the obstacles that would allow me to destroy them and thus create a victory condition. After checking that everything worked I added the menus and the tutorial, then the particles and effects, and finally the final assets, and so I had finished my project of the five mini-games. The last two mini-games took me the least amount of time, while the first and third ones slowed me down quite a bit. All the minigames were first created with white pixel squares that I recolored to know which was the enemy and the player, and that was enough to do the tests (See Figure 4.1.5). The particle system was a great help to me as it was intuitive and the changes could be seen in real time (See Figure 4.1.6).

At the end of the development I realized that the character editor was using the UnityEditor, which is a tool that does not allow to create an executable program. So I had to change it and remove the simple use of PrefabUtility.SaveAsPrefabAsset.
As finishing touches I added the hospital that welcomes you in the main menu and gave it a distorted but animated voice, as I thought the main menu was missing something with charisma.
The library was the last thing I did, which being a simple system of menus and information through buttons I made it quickly and easily, along with its art and graphic aspect. And finally I added the music I had sampled from themes I knew and the sounds created from several programs called SFXR, JSFXR, BeepBox and Fractal Sound Explorer.

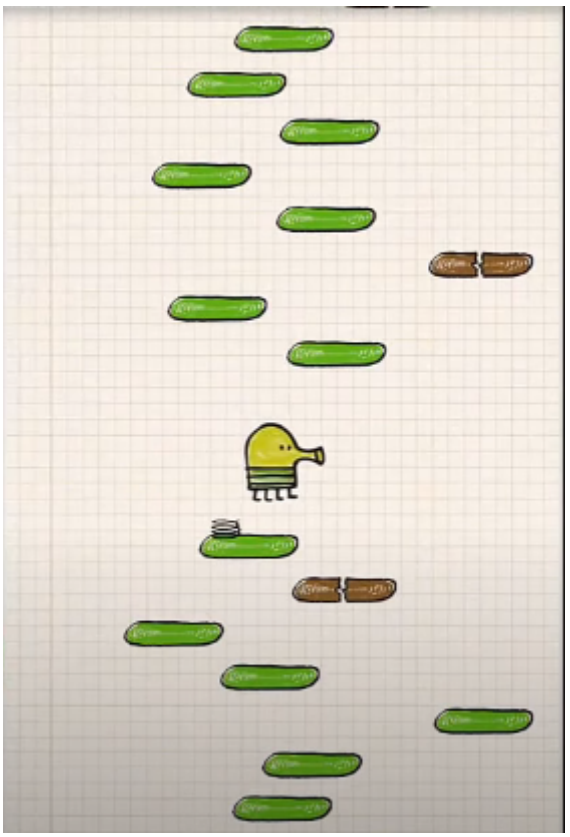

Figure 4.1.1: Doodle Jump.

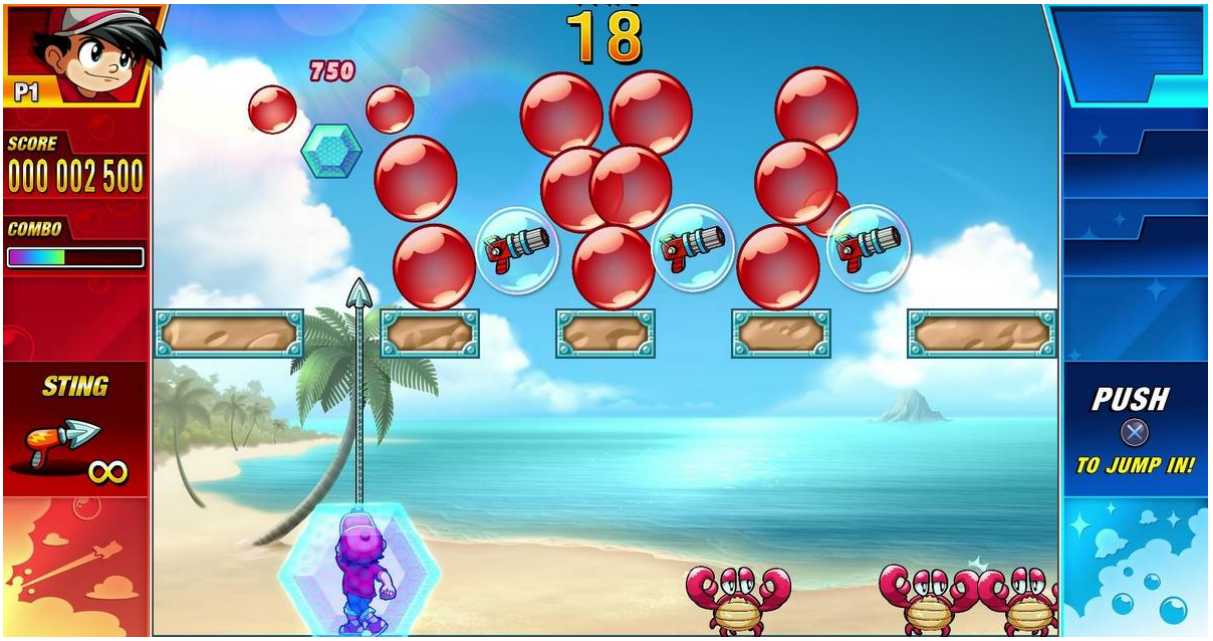

Figure 4.1.2: Pang.

Figure 4.1.3: Frogger.

Figure 4.1.4: Angry Birds.

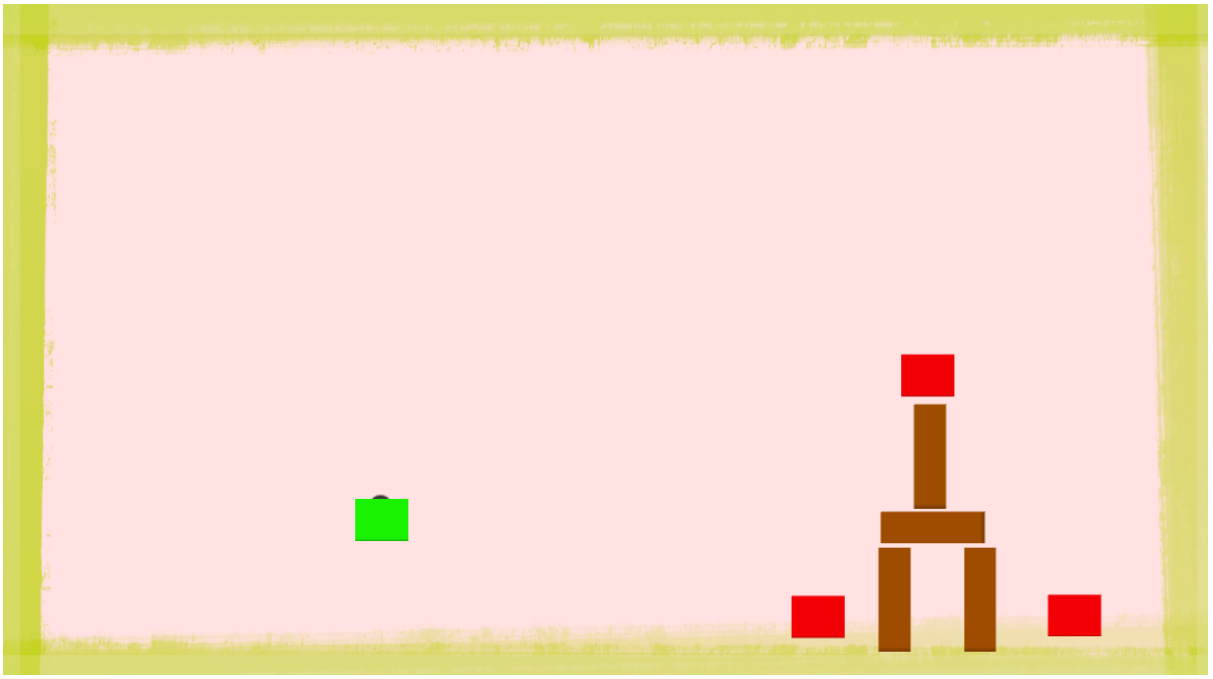

Figure 4.1.5: Test from the X-Ray mini-game.

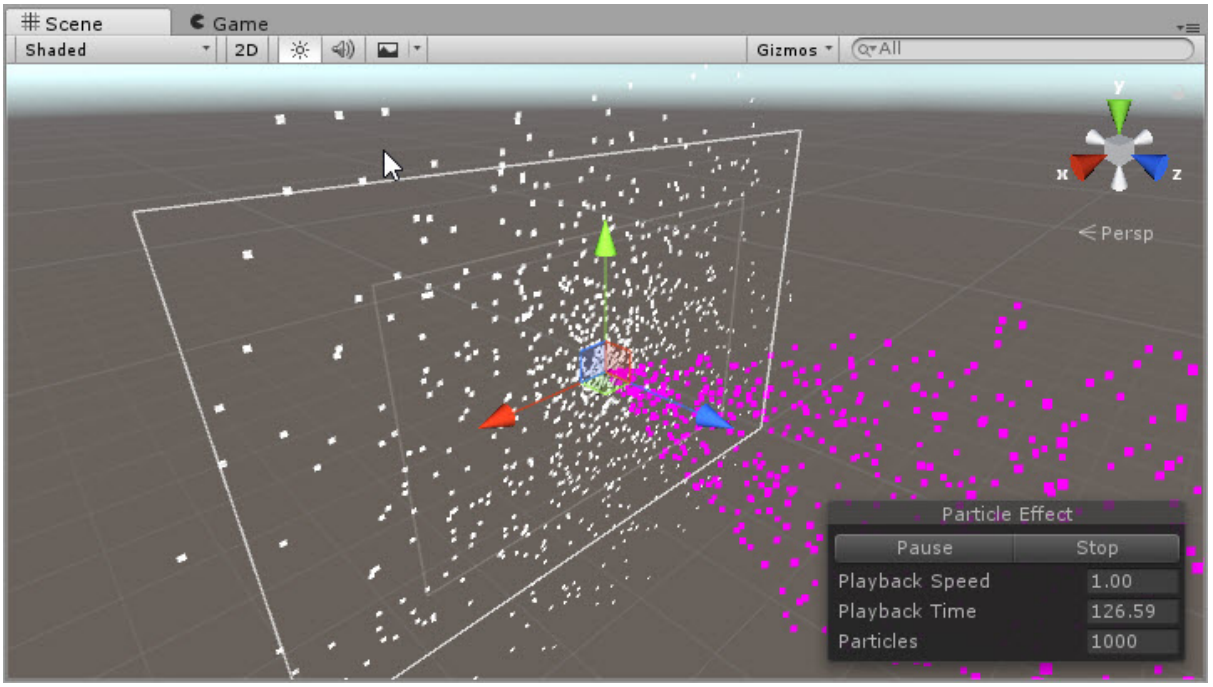

Figure 4.1.6: Unity Particle System.

4.2 Results

The initial objectives from the beginning were twofold. Firstly, the main objective was to design and develop an app, with mini-games and a character creator. On the other hand, to make an educational and entertaining project at the same time, dealing with an interesting and serious topic.

Although the main idea was to make a much more direct and serious version, about hospitalized children and their pathologies, the tone was eased after a meeting with the supervisor, who advised to look for simpler and more innocent procedures.
In addition to this, the mini-games were intended to be as realistic as possible, but after a prototyping and testing phase, they turned out to be more boring than desired, so the idea of realistic mini-games was discarded and the initiative of taking classic arcade games and transforming them was embraced. Another aspect to highlight is that the mechanics of each mini-game are different from the rest, so it has been possible to give variety to the player's experience. In addition, 5 mini-games have been created, as it was conceived in the conceptual design of the game. I would have also wanted to transfer the app to mobile devices but due to lack of time it was not possible.

On the other hand, another objective was to bring the science of pediatrics closer to the younger public. In the mini-games, elements are included that allow the player to get informed and research on the subject, besides getting a taboo for their psychology to be explored and confronted.

The repository of the project is accessible with this link:

GitHub.

There are also builds of this project for Windows and Mac in this link:

Drive.

CONCLUSIONS AND FUTURE WORK

This chapter discusses the conclusion of the work along with the outlook for the future.

5.1. Conclusions

While developing this project I have used resources that I have been learning during my years of university career, from video game art to programming, through design and organization, and while it is true that some of them separately interested me more than others, I have realized that by putting them together and using them all at once, I have managed to get another perspective on the realization of a project. I have learned that with perseverance you can achieve absolutely anything and that you have to learn to say enough when it comes to perfecting and finishing a job you have done. On the other hand, I have learned to use Unity much more fluently and to organize tasks in a project several months in advance.

This project has also affected me personally, since being a person who suffers from trypanophobia (fear of needles), I have always suffered a lot as a child when visiting a pediatrician. I have learned a lot with the research, and by collaborating with doctors I have appreciated their work much more. By collaborating with minors, I have learned significantly about child psychology and I have gained substantial perspective regarding the difficulty in game design, the user experience and also the graphical aspect of a project.

I hope that this project can transmit the passion and care with which I have been doing it, and above all, if I can get a player to go to a visit with a pediatrician with a little less fear, or more relaxed, it will have been worth it for me.

5.2 Future work

This project has an immense capacity and potential for growth, as new mini-games related to pediatric methodologies can be added, the library can be expanded with even more data from it, categories can be included to differentiate the different types of pediatric procedures, from the most harmless and common ones that have been treated in this application, to the strongest and most serious ones.

The application can be in constant growth thanks to the simplified design and the fact that the part on which the project is based, which is pediatrics, is widely researched and studied, so there is plenty of information from which to draw inspiration when adding content.

By facilitating access through a tool that most people own, it is a social cross-class tool, and a support for access to public knowledge and social education.

It has even been considered in the future to focus the application on adding an online social component, so that players can compare scores or even participate together in mini-games. All with the aim in mind that patients should stop being afraid of going to a healthcare center and see that the procedures are simple procedures that, with enough information, can be faced without nervousness.

BIBLIOGRAPHY

[1] Francischinelli AGB, Almeida FA, Fernandes DMSO (2012) Routine use of therapeutic play in the care of hospitalized children: nurses' perceptions. Acta Paulista de Enfermagem 25:18-23.

[2] Li HCW, Chung JOK, Ho KY, Kwok BMC (2016) Play interventions to reduce anxiety and negative emotions in hospitalized children. BMC Pediatrics 16:36.

[3] Hernández-Arenas MG (2014) La función del juego en el ambiente hospitalario. Acta Pediátrica de México 35:93-95.

[4] Axline V (1969) Play therapy. Ballantine, New York.

[5] Erikson E (1963) Childhood and society. 2nd ed. W W Norton & Company, New York.

[6] Piaget J (1963) The origins of intelligence in children. Norton, New York.

[7] Capelani PL, Castanheira NL, Silva PI, Souza GT, Mendoça LF (2006) Recreaçao para crianças em sala de espera de um ambulatório infantil. Revista Brasileira de Enfermagem 59:233-235.

[8] Fernandes SC, Arriaga P (2010) The effects of clown intervention on worries and emotional responses in children undergoing surgery. Journal of Health Psychology 15:405-415.

[9] Li HCW (2007) The effect of pre-operative therapeutic play on post-operative outcomes of Hong Kong Chinese children and their parents having surgery in a day surgery unit. Dissertation Abstracts International: Section B. Sciences and Engineering 67:6309.

[10] Barkey ME, Stephens B (2000) Comfort measures during invasive procedures: The role of the child life specialists. Child Life Focus 2:1-4.

[11] Favara-Scacco C, Smirne G, Schiliro G, Di Cataldo A (2001) Art therapy as support for children with leukemia during painful procedures. Medical and Pediatric Oncology 36:474-480.

[12] Yun-ping L, Zhen-hua H, Finley GA, Yun-xia Z (2012) Effects of the combination of mask preconditioning with idazolam pre treatment on anxiety and mask acceptance during pediatric inhalational induction and postoperative. Chinese Medical Journal 125:1908-1914.

[13] Mahanjan L, Wylie R, Steffen R et al (1998) The effects of a psychological preparation program on anxiety in children and adolescents undergoing gastrointestinal endoscopy. Journal of Pediatric Gastroenterology and Nutrition 27:161-165.

[14] Rozanski A, Kubzansky L (2005) Psychological functioning and physical health: A paradigm of flexibility. Psychosomatic Medicine 67(S1):47-53.

[15] Jun-Tai N (2008) Play in hospital. Paediatrics and Child Health 18:233-237.

[16] LeVieux-Anglin L, Sawyer EH (1993) Incorporating play interventions into nursing care. Pediatric Nursing 19:459-463.

[17] Erickson F (1958) Reactions of children to hospital experience. Nursing Outlook 6:501-504.

[18] Vessey J, Mahon M (1990) Therapeutic play and the hospitalized child. Journal of Pediatric Nursing 5:328-331.

[19] Haiait H, Bar-Mor G, Schobat M (2003) The world of the child: A world of play even in the hospital. Journal of Pediatric Nursing 18:209-214.

[20] Griffiths M (2005) Video games and health. Videogaming is safe for most players and can be useful in health care. British Medical Journal 331:122-123.

[21] McCue K (1988) Medical play: An expanded perspective. Children's Health Care 16:75-85.

[22] Webb J (1995) Play therapy with hospitalized children. International Journal of Play 4:51- 59.

[23] Koller D (2008) Child Life Council evidence-based practice statement: Therapeutic play in pediatric health care: The essence of child life practice. Child Life Bulletin Focus 26:1-4.

[24] Li HCW, Lopez V, Lee TLI (2007) Effects of preoperative therapeutic play on outcomes of school-age children undergoing day surgery. Research in Nursing & Health 30:320-332.

[25] Schwartz B, Albino J (1983) Effects of psychological preparation on children hospitalized or dental operations. Journal of Pediatrics 102:634-638.

[26] Zahr L (1998) Therapeutic play for hospitalized preschoolers in Lebanon. Pediatric Nursing 24:449-454.

[27] Revuelta-Domínguez FI (2012) Socialización virtual a través de los videojuegos Etnografía virtual sobre el uso de juegos on-line y videojuegos. Editorial Académica Española, Berlín.

[28] Egenfeldt-Nielsen S, Smith J, Tosca SP (2008) Understanding Video Games: The Essential Introduction. Routledge, New York.

[29] Wolf M, Perron B (2005) Introducción a la teoría del videojuego. Formats Revista de comunicació audiovisual 4.

[30] Esnaola GA (2004) La construcción de la identidad social a través de los videojuegos: Un estudio del aprendizaje en el contexto institucional de la escuela. Tesis doctoral. Universitat de València, Valencia.

[31] Cortés S (2010) Mundos imaginarios y realidad virtual. Videojuegos en las aulas. Tesis doctoral. Universidad de Alcalá, Alcalá de Henares.

[32] Martínez R (2006) El papel de los videojuegos en el desarrollo del pensamiento narrativo: una experiencia extraescolar. Tesis doctoral. Universidad de Alcalá, Alcalá de Henares.

[33] Guerra-Antequera J, Revuelta-Domínguez FI (2015) Videojuegos precursores de emociones positivas: propuesta metodológica con Minecraft en el aula hospitalaria. IJERI: International Journal of Educational Research and Innovation 3:105-120.

[34] Das DA, Grimmer KA, Sparnon AL, McRae SE, Thomas B (2005) The efficacy of playing a virtual reality game in modulating pain for children with acute burn injuries: A randomized controlled trial. BMC Pediatrics 5:1.

[35] Hoffman HG, Patterson DR, Carrougher GJ (2000) Use of virtual reality for adjunctive treatment of adult burn pain during physical therapy: A controlled study. The Clinical Journal of Pain 16:244-250.

[36] Griffiths M (2005) Video games and health. Videogaming is safe for most players and can be useful in health care. British Medical Journal 331:122-123.

[37] Morris LD, Grimmer-Somers KA, Spottiswoode B, Louw QA (2011) Virtual reality exposure therapy as treatment for pain catastrophizing in fibromyalgia patients: proof-of-concept study (Study Protocol). BMC Musculoskeletal Disorders 12:85.

[38] Pietrzak E, Pullman S, McGuire A (2014) Using Virtual Reality and Videogames for Traumatic Brain Injury Rehabilitation: A Structured Literature Review. Games for Health Journal 3:202-214.

[39] Dunleavy M, Dede C, Mitchell R (2009) Affordances and Limitations of Immersive Participatory Augmented Reality Simulations for Teaching and Learning. Journal of Science Education and Technology 18:7-22.

[40] Chau T, Eaton C, Lamont A, Schwellnus H, Tam C (2006) Augmented environments for pediatric rehabilitation. Technology and Disability 18:167-171.

[41] Daniels J, Schwartz J, Haber N et al (2017) 5.13 Design and efficacy of a wearable device for social affective learning in children with autism. Journal of the American Academy of Child and Adolescent Psychiatry 56:S257.

[42] Voss C, Washington P, Haber N et al (2016) Superpower glass: delivering unobtrusive real-time social cues in wearable systems. Proceedings of the 2016 ACM international joint conference on pervasive and ubiquitous computing: Adjunct:1218-1226.

[43] Washington P, Voss C, Kline A et al (2017) Superpowerglass: a wearable aid for the athome therapy of children with autism. Proceedings of the ACM on interactive, mobile, wearable and ubiquitous technologies 1:112.

[44] Fernández M (2017) Augmented-Virtual Reality: How to Improve Education Systems. Higher Learning Research Communications 7:1.

[45] Kesim M, Ozarslan Y (2012) Augmented Reality in Education: Current Technologies and the Potential for Education. Procedia - Social and Behavioral Sciences 47:297- 302.

[46] Gantt's Diagram image:
https://drive.google.com/file/d/1cQhE-9Jo94nzdEJQk_BWqcBCzTK-61Wd/view?usp=sharing

6.1. Other considerations

In this appendix I reproduce the interview I made to Carme Pardo on the 12th of February of 2021.

Interview to pediatric nurse

On Friday, February 12th, 2021 I interviewed Carme Pardo Camps, the results are presented here:

Fernando Soria: *Please introduce yourself.*

Carme Pardo: My name is Carme Pardo Camps, I am a 23 year old resident nurse specializing in Pediatric Nursing at the General University Hospital of Alicante.

Fernando Soria: *Why did you choose to become a nurse?*

Carme Pardo: I have always liked health sciences and I have been interested in working in something related to health care. Within that world, I found that the role of the nurse is the one that best suits what I was looking for. Caring and accompanying patients at times when they are most vulnerable, when they are sick or at the end of their lives, trying to make everything more bearable and giving them the tools to cope in the best possible way. I am also interested in health education, providing knowledge to empower the population so that they are able to make the best decisions for their health and prevent diseases.

Fernando Soria: *Where did you study?*

Carme Pardo: I studied at La Fe Hospital in Valencia.

Fernando Soria: *Why did you choose pediatrics?*

Carme Pardo: Childhood is a very special age, with a characteristic view of life from which we can all learn a lot. I am fascinated by children's minds and their ability to cope with whatever is put in front of them. At the same time, they are a vulnerable population that

requires specific care and treatment, hence the need for specialist nurses. A healthy child, with a happy childhood and healthy lifestyle habits, is much more likely to be a happy and healthy adult, both physically and mentally.

Fernando Soria: *What gave you the idea for a pediatric app?*

Carme Pardo: I believe that technology is a fundamental tool for the health and empowerment of the population that can make our work much easier if used properly. Together with gamification, it is a good strategy to get a message across in a simple, dynamic and entertaining way.

Fernando Soria: *Why do you think this app can help children?*

Carme Pardo: Many adults think that the less children know, the better, which makes them go to the health center or hospital without knowing what to expect, with a lot of uncertainty and fear. It is not a matter of hiding information from them, but of adapting the message to their level of understanding so that they can understand what is going to happen and prepare for it. We are all afraid of the unknown and knowing what we are facing helps us cope better.

Fernando Soria: *Would you have liked to have had this app when you were a child? Or do you know someone who would have been helped by it?*

Carme Pardo: Personally, I've never had a problem going to health centers, as I've always been interested in the subject and was curious about it. But it is something I see in my day-to-day life. Children who come to the office knowing what is going to be done to them, whether it hurts or not, what the tools we use are for, etc. tend to cope much better.

Fernando Soria: *Do you think parents can also use the application?*

Carme Pardo: Yes, I think it can be a useful tool for the whole family, since the tools section that refers to resources such as the website of the Spanish Association of Pediatrics provides a lot of information so that they can make informed decisions about their children's health.

Fernando Soria: *Thank you for participating, I hope you like the results of my work in a few months.*

Carme Pardo: Thank you too for the interest taken and for making a great idea possible.

6.2. Source code

Buttons Script for the Main Menu.

```
public class StartMenuButtons : MonoBehaviour
{
    public Animator transitionAnim;

    public GameObject panel;

    public void ProcedureScreen(){
        StartCoroutine(LoadScene1());
    }

    public void CharacterScreen(){
        StartCoroutine(LoadScene2());
    }

    public void LibraryScreen(){
        StartCoroutine(LoadScene3());
    }

    public void ExitApp(){
        Application.Quit();
    }

    IEnumerator LoadScene1(){
        panel.SetActive(true);
        transitionAnim.SetTrigger("outro");
        yield return new WaitForSeconds(1.05f);
        panel.SetActive(false);
        SceneManager.LoadScene("ProcedureSelector");
    }

    IEnumerator LoadScene2(){
        panel.SetActive(true);
        transitionAnim.SetTrigger("outro");
        yield return new WaitForSeconds(1.05f);
        panel.SetActive(false);
        SceneManager.LoadScene("CharacterCreation");
    }

    IEnumerator LoadScene3(){
```

```
        panel.SetActive(true);
        transitionAnim.SetTrigger("outro");
        yield return new WaitForSeconds(1.05f);
        panel.SetActive(false);
        SceneManager.LoadScene("Library");
    }
}
```

The script loads every scene with its own animation.

Game Manager Script for the plastering mini-game.

```
public class GameManager : MonoBehaviour
{
    public GameObject platformPrefab;

    public int platformCount;

    void Start()
    {
        Vector3 spawnPosition = new Vector3();

        for (int i = 0; i < platformCount; i++){
            spawnPosition.x += Random.Range(3f, 10f);
            spawnPosition.y = Random.Range(-5f, .01f);
            spawnPosition.z = 9;
                            Instantiate(platformPrefab,  spawnPosition,
Quaternion.identity);
        }

    }
}
```

The script manages to create platforms from left to right in a certain range and distance randomly at every start of the level.

Spawner script for the Temperature mini-game.

```
public class EnemySpawn : MonoBehaviour
{
    [SerializeField]
    private float spawnRadius = 20;
    private float time = 1.5f;

    public GameObject[] enemies;
```

...

```
    void Start(){
        //Spawn
        StartCoroutine(SpawnAnEnemy());
```

...

```
    //Enemy Spawner around the object
    IEnumerator SpawnAnEnemy(){
                                            Vector2      spawnPos      =
GameObject.FindGameObjectWithTag("Objective").transform.position;
        spawnPos += Random.insideUnitCircle.normalized * spawnRadius;
         Instantiate(enemies[Random.Range(0, enemies.Length)], spawnPos,
Quaternion.identity);
        yield return new WaitForSeconds(time);
        StartCoroutine(SpawnAnEnemy());
    }
```

This script manages to spawn from a certain radius all the enemies on a list every specified time.

Player Movement Script for the Temperature mini-game.

```
public class PlayerMoveTemp : MonoBehaviour
{
    public GameObject target;
    private Vector3 moveDirection;
    private float moveY = 0;
    public float moveSpeed;
    public float safeCloseDistance;
    public float safeFarDistance;

    public GameObject explosionParticle;
```

```
    void Start(){
        explosionParticle.SetActive(false);
    }

    void Update(){
        ProcessInputs();
    }

    private void FixedUpdate() {
        Move();
    }

    void ProcessInputs(){
        float moveX = Input.GetAxisRaw("Horizontal");
        moveY = Input.GetAxis("Vertical");
        moveDirection = new Vector3(0f, 0f, moveX).normalized;
    }

    void Move(){
                        transform.RotateAround(target.transform.position,
moveDirection, moveSpeed * Time.deltaTime);
               if  (moveY  >  0  &&  Vector2.Distance(transform.position,
target.transform.position) < safeFarDistance){
                                                    transform.position    =
Vector2.MoveTowards(transform.position,   target.transform.position,   -
moveSpeed/10 * Time.deltaTime);
        }
            else if(moveY  <  0  &&  Vector2.Distance(transform.position,
target.transform.position) > safeCloseDistance){
                                                    transform.position    =
Vector2.MoveTowards(transform.position,       target.transform.position,
moveSpeed/10 * Time.deltaTime);
        }
    }
```

This script manages to move the player around the center of the screen (taking the position of an object within) and makes the player move away or close to the center too.

Enemy Movement Script on the Temperature mini-game.

```
public class EnemyMovementTemp : MonoBehaviour
{
    public float speed;
    public float destroyingDistance;
    private Transform target;

    void Start(){
        target =
GameObject.FindGameObjectWithTag("Objective").GetComponent<Transform>()
;
    }

    void Update(){
        if(Vector2.Distance(transform.position, target.position) >
destroyingDistance){
            Vector3 difference = target.position - transform.position;
            difference.Normalize();
            float rotationZ = Mathf.Atan2(difference.y, difference.x) *
Mathf.Rad2Deg;
            transform.rotation = Quaternion.Euler(0f, 0f, rotationZ);
            transform.position =
Vector2.MoveTowards(transform.position, target.position, speed *
Time.deltaTime);
        }
    }

    void OnTriggerEnter2D(Collider2D col) {
        switch (col.gameObject.tag){
            case "Player":
                Destroy (gameObject);
                break;

            case "Objective":
                Destroy (gameObject);
                break;
        }
    }
}
```

This script manages to move the enemies to the objective pointing at it at the same time.