FACULDADE DE ENGENHARIA DA UNIVERSIDADE DO PORTO

Emotion Regulation: Development of a serious game for adolescents

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Mestrado Integrado em Engenharia Informática e Computação

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Abstract

In the last few decades mental health, described by the World Health Organization as "a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community" has been emerging both as an ever so important study field and also as a general population conversation and discussion topic.

Emotion Regulation, the process by which us as individuals regulate and control our emotions, plays a vital role on mental health, since a good emotion regulation is associated with a good mental health and well being and on the other hand, evidence has suggested that poor regulatory skills constitute a vulnerability and maintenance factor among a wide range of mental disorders such as depression, anxiety, addiction and aggressiveness.

Also due to the many changes (social, hormonal, physical...) associated with it, adolescence is the prime age period to intervene and acquire good emotion regulation skills.

So in the context of GamEmotion, a serious game to enhance emotion regulation skills in adolescents and their parents, a project being developed in LIACC *(Laboratório de Inteligência Artificial e Ciência de Computadores)* this dissertation work was to develop a game that targets this objective, since the field of serious games is also on a rise and it has been proven than it is a good and effective teaching tool for users in this demographic.

The final product of this dissertation was GamEmotion, a 3D action-adventure digital game build with Unity designed to teach adolescents six basic emotions (happiness, sadness, fear, anger, surprise and disgust) and two emotion regulation strategies (cognitive reappraisal and emotion suppression), it was also produced a usability study and results regarding GamEmotion.

Keywords: Mental Health, Emotion Regulation, Adolescents, Serious Games, Videogames

Association for Computing Machinery Application Areas:

CCS -> Applied computing -> Law, social and behavioral sciences -> **Psychology**

CCS -> Applied computing -> Education -> **Interactive learning environments**

CCS -> Social and professional topics -> User characteristics -> Age -> **Adolescents**

Acknowledgements

This dissertation is dedicated to those special humans who hear
"I'm not okay"
and respond with
"That's ok, how can I help?"

I would first like to give a special thanks to my supervisors Eliana and Luís but also to every teachear, professor or educator from kindergarten to today for helping me develop a critical and objective mind, and whose world-views and philosophies I have integrated into my own.

Secondly I wanna thank my mom, my dad and my sister for the support and for always believing in me. And also I would like to thank and highlight Maria Dias for the support and for all the records and re-records of all the in-game voices, Sofia Reis for the support and marketing of my work and survey :p and again to my sister Carla Bibiana and my friend Sofia Alves for proofreading this document.

And last but certainly not least, my family. And I should mention that, my definition of family is not the traditional definition concerning an arbitrary defined amount of shared genetic material: but rather that which is given in Disney's *Lilo and Stitch:* "Ohana means family. Family means nobody gets left behind, or forgotten." It is to those people who who have never left my side –or my mind– that I owe the greatest, most heartfelt of thanks. I would name them all, but there is no need, for they instinctively know who they are. I thank you all for making me the person I am... I hope you've made yourselves proud.

Pedro França

"–on a mote of dust,
suspended in a sunbeam."

Carl Sagan

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Abbreviations

ER	Emotion Regulation
SG	Serious Games
VR	Virtual Reality
ECG	Electrocardiogram
EEG	Electroencephalography
CBT	Cognitive Behavioral Therapy
RCT	Randomized Controlled Trial
UI	User Interface
UX	User Experience
HCI	Human Computer Interaction
NPC	Non-Player Character
GEQ	Game Experience Questionnaire
HUD	Heads-Up Display

Chapter 1

Introduction

1.1 Context

This dissertation work is a part of a bigger project that will be developed in LIACC (*Laboratório de Inteligência Artificial e Ciência de Computadores*) called GamEmotion, a serious game to enhance Emotion Regulation(ER) skills in adolescents and their parents. The project was worked on by a multidisciplinary team of developers and psychologists with solid background in the study of emotions in adolescence and parenting. The final goal of the project was to develop and measure the usability of a Serious Game (SG) that promotes mental health and prevents psychopathologies through the teaching of ER strategies to adolescents, with some modules for their parents.

1.2 Motivation and Objectives

Mental health is very important and contributes for an individual overall well being, as we will see in the next chapter. Also, adolescence is a critical age for the development of a good ER due to the many physical, psychological and social changes that are intrinsic to that stage of development and that will be seen in more detail in the next chapter as well. These are the main forces that drove the development of this work.

The objectives for the project were to design and develop an evidence-based SG for mental health promotion and transdiagnostic prevention, by enhancing adolescents' ER skills. The Gross model claims that an adaptive ER involves using strategies under situation-specific regulation goals. Thus, the SG will provide psychoeducation about the nature and function of positive and negative emotions; increasing awareness of the emotions, and learning how to use them in a flexible way according to situation-specific goals. In order to achieve that goal, adolescents will learn and train the stages of the ER process outlined by Gross: identification, selection, and implementation. The SG will provide opportunities to learn and apply the Gross' families of ER strategies: situation selection, situation modification, attention deployment, cognitive change and

response modulation. The goal is to promote a broad repertoire of ER strategies among adolescents, in order to understand the conditions under which they are effective or not (e.g., controllability of stressors) and to train their use in different situations. The work developed in the present dissertation will not be focused in the above state modules for parents but only in the development of the SG for the adolescents.

1.3 Document Structure

Besides this first introductory chapter this document contains a second chapter regarding Emotion Regulation as a whole, the model proposed by Gross and also Emotion Regulation in the adolescence period in particular.

In the third chapter there is an introduction on the topic of Serious Games before going into detail in the ones applied in particular to Mental Health. This chapter also contains a review on the state-of-the-art regarding this field.

The fourth chapter is where the tools and resources used are described as well as how they were acquired during the making of GamEmotion.

The fifth chapter regards more in-depth information about GamEmotion itself. It has a structure similar to a Game Design Document, in this chapter is presented a game overview, the gameplay and mechanics, and finally a detailed description of the story of the game, describing each level.

Chapter six contains small sections of code and more in depth development details about parts of the development that were worth mentioning.

Chapter seven contains the testing conducted after the development with user input, in here the Game Experience Questionnaire and methodology are described. Finally it contains an interpretation of the results.

The eighth and last chapter is dedicated to conclusions and future work.

Lastly there are the appendix and references sections.

Chapter 2

Emotion Regulation

2.1 Introduction

In this chapter the concept of ER will be approached and how it ties to mental health and also overall health and well-being. It will also review the role ER plays in adolescence and why it is specially important in that phase of life.

Mental health as been described as "a state of well-being in which every individual realizes his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community" (World Health Organization, 2004).

Mental health is a very important aspect of an individual overall health and well-being. Although it has been disregarded for a long time, mental health importance and discussion has been growing in the last years. At the same time, anxiety, stress and other mental health related cases are rapidly raising which is a consequence of a poor ER.

2.2 Definition of Emotions and Emotion Regulation

Emotions have been described as biological states associated with the nervous system brought on by neurophysiological changes associated with thoughts, feelings, behavioural responses, and a degree of pleasure or displeasure [7]. ER has been defined as the intrinsic and extrinsic processes through which individuals monitor, evaluate, and modulate their positive and negative emotions to achieve goals [8]. This is how we try to take ownership or influence the emotions we have, how we express them, or repress them, internally or to others.

The concept that we can control our feelings and emotions instead of just living through them goes back centuries [9]. This has been studied with scientific works on psychological defenses [10] and, stress and coping [11]. In the 90's ER began emerging as an research field of its own [12].

ER is constantly used to achieve a certain objective, either hedonic or instrumental, making use of strategies that can be implemented before or after emotions occurrence. ER can be deployed both intrapersonally or interpersonally: individuals may attempt to control feelings in isolation, for example, by reappraising an event, however they can likewise search interpersonal help, for example, by seeking support from a close person or medical professional.

ER can be explicit or implicit, as well as controlled or automatic. On one hand, ER is explicit when significant goals are deliberately pursued, and it is implicit when regulatory mechanisms are automatically activated by unconscious goals.

An adaptive ER is associated with a good mental health and well being. It helps us better experience and control our feelings and emotions, be they positive or negative. On the other hand emotion dysregulation is associated with the development of psychopathology [13]. In the last years, emotion dysregulation has been shown to be a transdiagnostic factor [14]. Ample evidence has suggested that poor regulatory skills constitute a vulnerability and maintenance factor among a wide range of mental disorders [15] such as depression, anxiety, addiction and aggressiveness [2].

2.3 Gross's Process Model of Emotion Regulation

Although there are many theoretical models of ER, Gross's model is the one that presents the most empirical evidence and the one that is more largely studied, thus being the model chosen to support this work.

Gross has described a process model of ER using the definition [16]: 'Emotion regulation includes all of the conscious and nonconscious strategies we use to increase, maintain, or decrease one or more components of an emotional response'

The process model of ER [1] is an organizational scheme developed by Gross to help identify how different people engage in ER and what ER strategies to use. The author described emotion generation as a four-stage looping sequence (Figure 2.1).

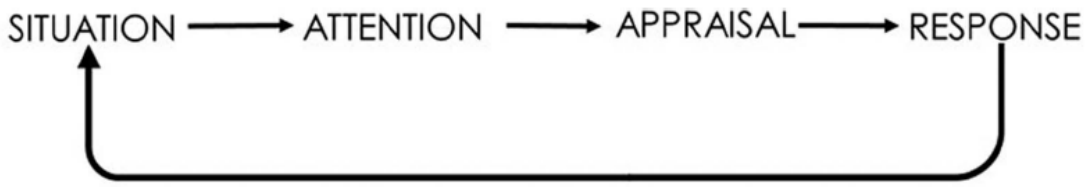


Figure 2.1: The four stages of emotion generation [1].

In this sequence first an individual encounters a situation where he/she might fell uneasy, after that he/she pays attention to key aspects of that situation, the next step is the appraising of the situation in relation to the desired outcomes, and the last step is to deliver some kind of response, that could be experiential, physiological, and/or behavioral. This response effect will create a emotional state that could be feeded back to the loop.

Gross also organized ER strategies to influence emotions into five families depending on where in the previous loop each strategy intervenes (Figure 2.2).

Situation selection concerns a pre evaluation by the individual of the situations that could generate pleasant or unpleasant emotions, allowing to choose one and avoid others. **Situation modification** consists of a change in the external, physical and environmental aspects of a situation allowing for an emotional impact that better suits the individuals goal state. **Attentional deployment** is about how individuals redirect their attention during a given situation in order to influence their emotions. **Cognitive change** concerns how an individual changes the evaluation of the situation, changing its "emotional weight", or changing its own capabilities of dealing with what the situations demand of him/her. One of the most studied strategies to deploy in this stage is reappraisal that is the act of changing the meaning of the situation in order to change its emotional impact. **Response modulation** occurs after the other responses have already been "initialized" and it's the process of influencing as directly as possible the physical or behavioural responses.

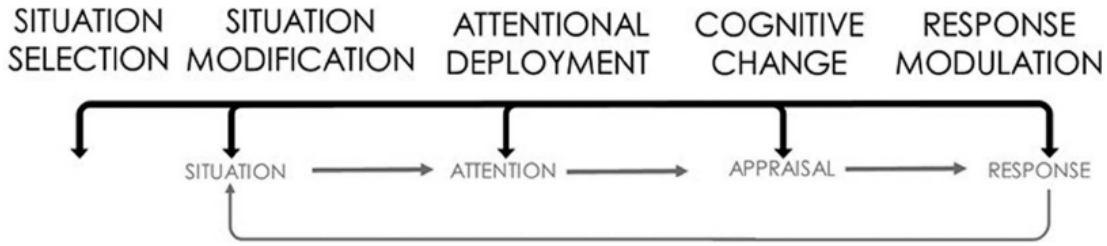


Figure 2.2: The five families of ER strategies described by Gross and the emotion generation stage where they intervene [1].

The need to use a regulation strategy arises when an individual finds himself/herself, or perceives himself/herself in an emotional state different that the one he desires to be in (goal state). So when this happens one **identifies** the situation, **selects** a regulation strategies from the ones seen above, **implements** said strategies making use of adequate tactics and reevaluates or **monitors** the whole cycle until the goal state is achieved [17].

The work developed during this dissertation was based on Gross's process model of ER, namely the two emotion regulation strategies used in GamEmotion were **cognitive reappraisal** and **emotional suppression** since they are considered to be two of the most important.

2.4 Emotion Regulation in Adolescence

Most of the work done in this field has been focused on earlier ages of life, like infancy or early childhood, and also adulthood. However it is recognized that late childhood and adolescence is a critical turning point in the acquisition of cognitive, social and emotional skills as well as in the development of independence [18] since the growth of cognitive capabilities allows adolescents to think about certain aspects of their own ER [19].

According to Gross and Munoz (1995) in late childhood and adolescence new ways of ER start to form, namely, the ability to attribute new meanings to things, empathy and the perspective

of others, and the adequate representation of time distant goals. There is also a considerable rise in opportunities to change contexts, in terms of social circles and high interest activities. Adaptive forms of ER can include culturally accepted activities like sports, music or other extracurricular activities. However there could be potential for bad adaptive ER like using psychoactive substances. It is also during this development stage that adolescents develop a sense of self that includes perceptions about emotional and interpersonal style, as well as the ER strategies that work the best for them [20]. Studies have been showing that adolescents experience emotions more frequently and strongly than infants or adults [21], the studies also suggest that adolescents may not be "more emotional" than other age groups but rather that they are likely to have more experiences that enhance emotional responses. Besides that, cognitive, hormonal and neural systems related to ER seem to mature during adolescence [22].

The dominance of psychopathologic disturbs also rises significantly during adolescence [23]. In this sense clinical trials with adolescents have recognized the importance of ER as a precursor of the development of psychopathologies [24] like depression [23] and externalization and internalization problems.[25].

It is also important to say that parents play an important role in how children develop ER, research indicates that parents emotional support, positive affect, emotion coaching, and use of joint strategies are all correlated with more effective ER in children. In contrast, parents psychological control, permissiveness, expressed anger, and criticism are correlated with struggles in ER in children. Furthermore, adolescents report positive affects when they are with their parents than when they are alone, and adolescents report that their parents help them regulate emotions, indicating that parents maintain their influence on ER during adolescence [26].

In sum, there is an agreement that the skills to regulate emotions aid adolescents to coordinate their conduct productively, and adjust to new conditions, individuals and objects, and to be better acknowledged by their companions [27].

Chapter 3

Serious Games

Computer games are widely played by people from all ages worldwide, with over 40% of the US population playing them for 3 or more hours per week in 2015 [28]. These games can range from small, fast, simple games to more complex games with great stories, details and worlds, they can even go as far as to make use of augmented or virtual reality. Certain types of computer games have been proven to enhance concentration [29], improve retention of information [30], facilitate deep learning [31] and even behaviour change [32].

A serious game is a game designed for a primary purpose other than pure entertainment [33].

The development of SG started in the mid 90's with the objective of improving some aspects of the learning process [34]. Corti said that computer games capture the users attention and its emersiveness leads them towards a specific purpose [35]. SG go beyond mere entertainment, they are a form or learning with rules, challenges and specific objectives, and are usually developed to explore science, engineering, military training, healthcare, education and culture [36]. The first serious game being developed was *Army Battlezone*, in 1980, for military training [37](Figure 3.1). After that many games were designed and developed, especially in the health sector in the domains of psychological intervention, cognitive training and physical rehabilitation. SG has advantages to many areas and their growing proves it. Some of the advantages of SG use are:

- Information conveyed through images, video or sound is easier assimilated than thought exhaustive texts.
- The player becomes more engaged and motivated by the proposed challenges and by how they are set up.
- They may promote competition or collaboration which acts as a motivator for the player.
- They can predict results that would not be possible to test in real life because of the danger they could represent, the time they would take or the excessive amount of money needed [36].

- Ability to match player needs and skills to different environments, making the game more engaging.

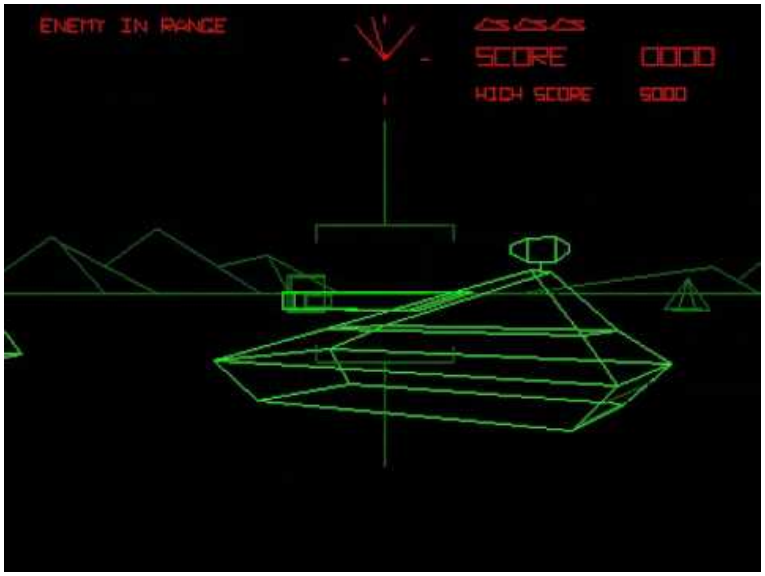


Figure 3.1: Army Battlezone. Considered the first SG developed. 1980.

In the business environment, companies are also using SG to recruit new employees, discover new talents or train their staff in communication skills inside their companies [34]. So it becomes clear how popular SG are becoming in multiple contexts [38].

A study has shown that 72% of adolescents play video games [39] from where we can also see that they are a good teaching tool to this demographic since it retains engagement. Health related games have also been raising since the 90's, with as many as 30 health related games publish in 2009 alone [40].

3.1 Serious Games applied to Mental Health

The number of health professionals using new cost-effective treatment approaches are raising. Because of this, technologies are being created and applied to support multiple medical treatments ranging from web based applications to video games [41]. Nowadays, these technologies have started to be used in multiple mental disorders, like obsessive-compulsive disorders [42], schizophrenia [43], eating disorders [44], addictive behaviours [45] and anxiety disorders [46]. There are many naturalistic studies showing that SG can be used for enhancing some positive attitudes [47], increasing problem solving strategies [48] and modifying some abnormal behaviours [49]. However although controlled studies on this field are rising there is still a lack in literature about video games being used as a tool to aid in specific mental disorders treatment [3]. Some initial studies suggested that SG could help in fields such schizophrenia [43], anxiety disorders [49] and attention deficit hyperactivity disorders (ADHD) [50]. Other study showed evidence that computerized cognitive behavioral therapy (CBT) works for treating anxiety and depressive

symptoms among adolescents [50]. It has also been studied the potential of using SG to enrich mental health professionals skills, and those who had used SG as a learning tool preformed better than those who had not, on a mental health nursing test [51]. It was also concluded that mental health professionals will likely start using SG in psychotherapy as they gradually become more familiarized with them [51].

SG may enrich the array of digital therapeutic tools due to their specific characteristics such as the ability to create of an alternative world in which learning and exploration is encouraged and may also make learning more meaningful, engaging, and challenging than traditional teaching by using the interactive, visual, and immersive characteristics available in video games [52].

Videogames may not gasp the complicity of human relations and emotions but they have many aspects that can be usefull for the promotion of ER. Using the psychological taxonomy of videogames unique aspects we can highlight three of them [53].

First, is the manipulation and control features, many features in a videogame that directly relate to the player's control over the game, like being able to save progress to correct wrong doings in the past, and the capacity to manage multiple resources. The controlled exposure to negative emotional stimuli may trigger and train reappraisal abilities, which is a key aspect to ER. Also positive effects can raise by negative emotions experienced while playing, like frustration due to gameplay difficulty or sadness and fear related to tragic or horror events. This is related to the interactivity of videogames, that has been called as the "art of failure" because it moves the player to overcome obstacles within the game instances. Due to their interactive nature, videogames allow the player to deal continuously and directly with what generates the emotional response and to recover from failure.

Second, the narrative and identity features that refer to the role of storytelling as a means of immersing the player in the videogame and to the ways the player can take on another identity in the game. As we've seen games can feature a wide range of emotional stimuli most of them integrated within complex and thought-provoking narratives. For example, in role-playing games gamers can select and change multiple character characteristics so that playing is associated with the ability to move among different opportunities for emotional experiences, reappraising them and learning new ways of dealing with negative emotions or disturbing events.

Third aspect is the feedback/reward features that are used so that players are reinforced for skillful play. Points or awards gained upon completion of game milestones, are designed to give players an understanding of their mastery over the game itself [52].

As we have seen there are many articles and reviews made on this field of SG directed to mental health, however these are not very robust, so there is a need for a contemporary advancement, in this rapidly evolving field [54].

It seems that the development and/or validation of serious games for mental health on this technical platform is lagging behind. As Fleming remarked, many mental health apps are already available. It is obvious that there are opportunities in this area. Accessibility and feasibility can be improved if this area is utilized [55].

3.2 Available Products

There are many examples of SG targeting mental health and ER already developed, in this section I will present the ones I found to be more relevant. All the games I selected are related to mental health but some target specific problems and diseases and not ER per say, however they are all somewhat related to emotions.

3.2.1 GameTeen

Gameteen (Figure 3.2) is not only a SG developed to train ER strategies on adolescents, but also a tool to assess how effective this new technologies are in the teaching of said strategies. It consists of mini games design to trigger emotions. The developers made two studies, one in a laboratory setting and one in a real world setting.

In the Laboratory study they compared two different game interface, a more traditional keyboard and mouse, and a gestural interface based on Time of Flight cameras. In this setting the subjects mood were monitored using questionnaires, physiological signal analysis (ECG, EEG and voice), face tracking and body gesture analysis.

In the real world experiment the mood induced games were played through the participants smartphone and the evaluation was made through an Ecological Momentary Assessment tool that was also developed by the team, which was in essence a questionnaire but the questions were asked by an animated avatar, and if the participants answered the questionnaires everyday they would be award points to be spent customizing their avatar.

Figure 3.2: The joy game and frustration game from GameTeen [2].

In the study they concluded that the use of SG drastically helps motivating, and that these type of games are more engaging to patients that are harder to motivate, such as adolescents. The authors also concluded that the use of VR can help to create realistic environments and induce emotions [2].

3.2.2 PlayMancer

The PlayMancer Project (Figure 3.3) is also a SG developed to be used as treatment in mental disorders, namely in impulse-related disorders, as well as to evaluate the effectiveness of SG as

therapy tools. It was used in the Department of Psychiatry (University Hospital of Bellvitge, Barcelona, Spain) in mental disorders and the objective of the game is not to win but for the patients to acquire better self-control skills.

The game scenario is composed of Islands and each island has a set of activities the player can perform. The game makes use of multiple biosensors (galvanic skin response, oxygen saturation, heart rate (HR) and HR variation, skin temperature, breathing frequency), and using this data it adjusts the activity difficulty in real time according to the player emotional response.

It has three main mini-games developed, one where the player has to avoid obstacles that are produced by emotions, a second one where the player is swimming underwater gathering collectables while also needing to control the oxygen levels, where the difficulty changes according to the player emotional response, and finally a third one that is a relaxation game where constellations are drawn in the sky according to the player calmness.

Figure 3.3: Example of a PlayMancer scenario [3].

They corraborated that patients are more willingly to engage in treatment using video games. They found that the characteristics of video games makes possible to apply techniques that would otherwise be harder to apply in patients, like controlled intensive exposure. In the study they also state that short after playing the game the patients started to show new coping styles with negative emotions in normal stress life situations, additional generalization patterns and more self-control strategies when confronted with them [3].

3.2.3 SPARX

SPARX (Figure 3.4) is a SG whose target audience are adolescents aged 12 to 19 years old and whose objective is to reduce anxiety related symptoms. SPARX has a Desktop version, and online browser based version and well as a mobile app version. It was developed by team of researchers and clinicians from The University of Auckland and as of the date of this writing is only available to New Zealand residents.

The game is based on CBT, which is a psycho-social intervention that aims to improve mental health, and the player has a costumizable character that he/she controls to restore tranquility to a fantasy world by problem-solving and taking down negative thoughts. There is also a character that guides the player and talks about the topics of depression and gives instruction to help the gameplay [56]. When a player completes a quest the guide tells him/her how to use new skills in order to feel better, solve problems and enjoy real life [57].

SPARX is made up of seven levels or modules that player has to complete, each one lasting about 30 to 40 minutes.

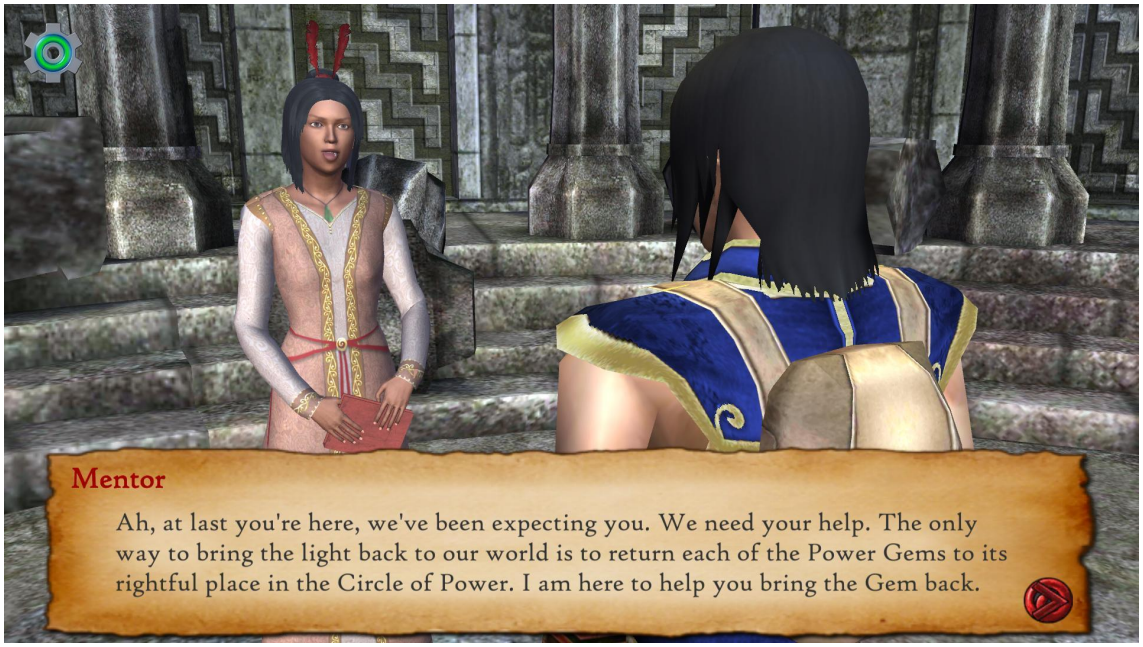


Figure 3.4: SPARX gameplay [4].

3.2.4 Nevermind

Nevermind (Figure 3.5) was developed by Flying Mollusk the media program for graduate studies at the University of Southern California.

It is a horror video game where multiple patients in a hospital revisit their past repressed mental traumas. It makes use of biofeedback devices that alter the game play difficulty according to the player emotions. The objective of the game is to collect ten photos inside each patient mind that relate to that patient repressed trauma so that the patient can revisit it and the trauma can be cured.

But the more stressed the player is the harder the game will become and opposingly if the player is calm the game becomes easier [58].

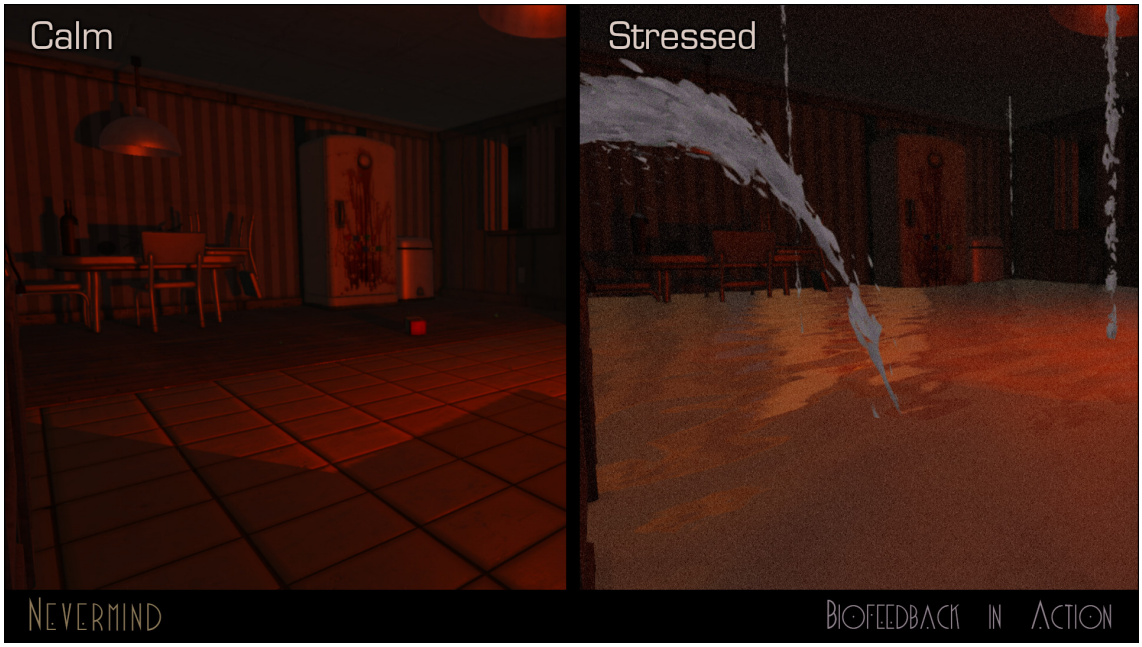


Figure 3.5: Nevermind ambient change according to biofeedback [5].

3.2.5 Dojo

Dojo (Figure 3.6) is an emotion management game that helps adolescents to recognize and control their physiological and emotional arousal. Although very different from Nevermind or SPARX in graphic style and backstory it uses the same mechanics. It uses biofeedback that makes the game harder or easier according to the readings from the sensors the player is wearing, and also uses CBT techniques that are well-validated and commonly used in treatment programs (deep-breathing techniques, progressive muscle relaxation, positive thinking, and guided imagery) as relaxation tutorials.

There are three rooms in the game (fear, frustration, and anger), each one contains a relaxation tutorial and a challenging game designed to trigger the emotion in question and offers the opportunity to practice the acquired techniques.

After performing RCTs (randomized control trials), a type of scientific experiment that aims to reduce certain sources of bias when testing the effectiveness of new treatments, results indicate high user satisfaction, high self-reported compliance during trainings sessions, and a high potential of Dojo as an innovative intervention. It was concluded that Dojo can be a cost-effective way to engage high-risk adolescents in effective interventions [6].

Figure 3.6: "Frustration Dojo" level [6].

Chapter 4

Game Engine, Tool and Resources

This chapter will be focus on the tools used to develop the project and the type of resources used as well as how they were acquired.

4.1 Game Engine and Tools

4.1.1 Unity

Game Engine is a software which encompasses a bundle of libraries to simplify and abstract the development of digital games or other applications that require real time rendering. Game Engines usually include: a rendering engine for both 2D and 3D graphics, a physics engine, to simulate physics (gravity, mass, friction, forces) and collision detection, an audio engine, support for animations and networking, memory management, file management, execution management ("threading"), scene graphs and entities, and finally support some kind of scripting language.[59].

There are a lot of game engines in the market right now, some of the most used and well known are Unreal Engine, Unity3D, Gamemaker, Godot, Cryengine, LibGDX [60] each one having their own strengths and weakness. So before choosing a game engine there are several things one should consider like, do I have experience with any of the engines? what are my technical abilities? What are the key features I need in your engine? What is my time frame? How big is my team? What is my budget? What genre is my game? What platform am I releasing on? How good is the documentation, support, and community? And many more. [61]

After some time researching and considering the decision was to use the Unity3D game engine. Personally, I only had some small experience with two game engines before: GameMaker and Unity. The first one would not fit the projects needs since it is aimed at 2D games so it was quickly discarded. Although Unity3D is proprietary and thus not open source it has free student licences which allowed the use of its full potential for free. Besides that Unity is very effective rendering 3D scenes, it offers the opportunity for cross-platform development, when compared to the other engines it has a very good asset store, although sometimes the documentation lacks some features

or is outdated it has one of the biggest community which is very friendly and active. Besides all of this it fitted all other requirements for this project. The game engine is by far the most important tool for the project.

4.1.2 Pixlr Editor

Pixlr is an online browser-based image editing and manipulation software[62] similar to other well known image editing apps like Adobe's Photoshop or GIMP. While not having all the functionalities as the previously mentioned, it has all the functionalities needed and the ease of use made it the perfect choice for image editing. It was mainly used to create or modify all the asset regarding the UI elements, buttons, Heads-Up Display (HUD) icons, mouse, player's journal and tablet.

4.1.3 Blender

Blender is an open source software that is primarily used for 3D modeling although it is extremely capable and can also do UV unwrapping, texturing, raster graphics editing, rigging and skinning, fluid and smoke simulation, particle simulation, soft body simulation, sculpting, animating, match moving, rendering, motion graphics, video editing, and compositing.[63] In this project Blender was used for some minor adjustments and file conversion of some free assets found on the web and used in the game.

4.1.4 Audacity

Audacity is one of the most well know free, open source software for digital audio editing and recording.[64] Just like blender, Audacity was used for some minor editing and cutting of the audio files used in the game, as well as some of the recorded voices.

4.2 Resources

To make a digital game a lot of resources and assets are required, however, assets development were not included in the tasks and timeline of the present dissertation. Therefore, the assets used were free, available in multiple web platforms.

4.2.1 3D models

3D models are one of the most important assets in a digital 3D game, besides HUD elements, everything the player sees on the screen are 3D models, from the level itself to the player character model and also the various props that make the level design come to life.

3D models are resources that are usually highly priced, and rightly so, but this means that sometimes some ideas had to be adapted based on the models that were available for free use on the web.

Regarding 3D models, there were four sources that were mainly used, the first was a web application called Mixamo (Figure 4.1) from Adobe, this platform has free 3D character models as well as multiple animations for this characters.

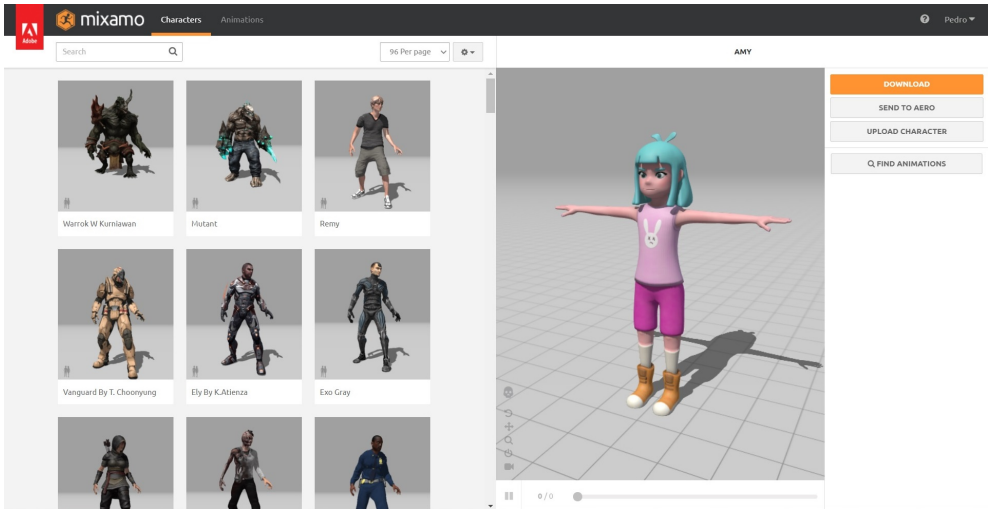


Figure 4.1: Mixamo app layout.

This is a great asset because not only is it free and easy to use but also has a vast collection of character models (Figure 4.2) with different characteristics which is good to make the player fell represented by the in-game model.

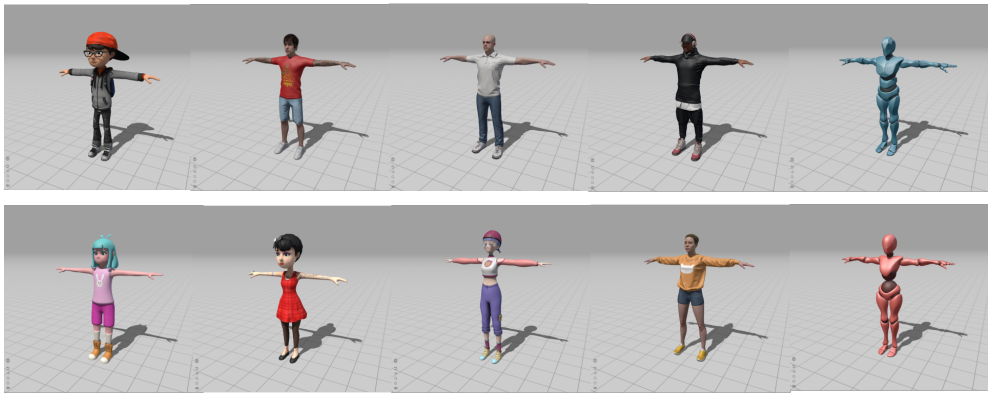


Figure 4.2: All character models used in the game from Mixamo.

The second source of 3D models used was the Unity Asset Store, which is a web app that is also available through the Unity game engine client. In there, 3D modelers, sound designers, and other professionals can sell, or offer, their work as assets that are unity compatible. The only paid asset in the entire project was bought in the Unity Asset Store, and was a dungeon pack (Figure 4.3), the models that come in this asset were used to build almost the entire levels of the castles. Other asset were also used from the Unity Asset Store, namely skyboxes, Non-Player Characters (NPC's) models, and other single object 3d models.

Figure 4.3: Dungeon asset pack from the Unity Asset Store. This pack contains almost all models used in the castle level design.

The other two web apps that were used to found 3d models were sketchfab.com and cgtrader.com, this two websites are very similar between them and both very similar with the Unity Asset Store, the difference being that they are not available through the Unity client. In these apps 3D modelers can upload and sell, or offer, their work.

4.2.2 Images

All 2D images and sprites (Figure 4.4) used in the development of this project were either made from scratch using Pixlr, or were found on the web but were free to use. 2D images and sprites are mainly used in the game as part of the UI elements.

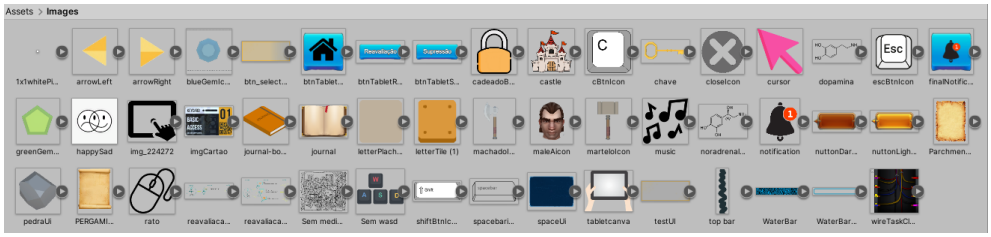


Figure 4.4: Image assets used in GamEmotion.

4.2.3 Audio

We can separate all the audio used in the game in two groups, the background music and ambient/interaction sounds, and the narrator audio clips. All background music and sound effects used in the game world interactions were found on the web. The narrator audio clips were recorded by a human using a previously written and revised text script according to the information that was being taught.

4.2.4 Fonts

There were two fonts used during the entire game. *Medieval Scribish* (Figure 4.5) a free font found on the web and used in the UI elements during the castle levels. Arial was used in every other occasion, including UI, Dialogue System, Floating Text and Menus.

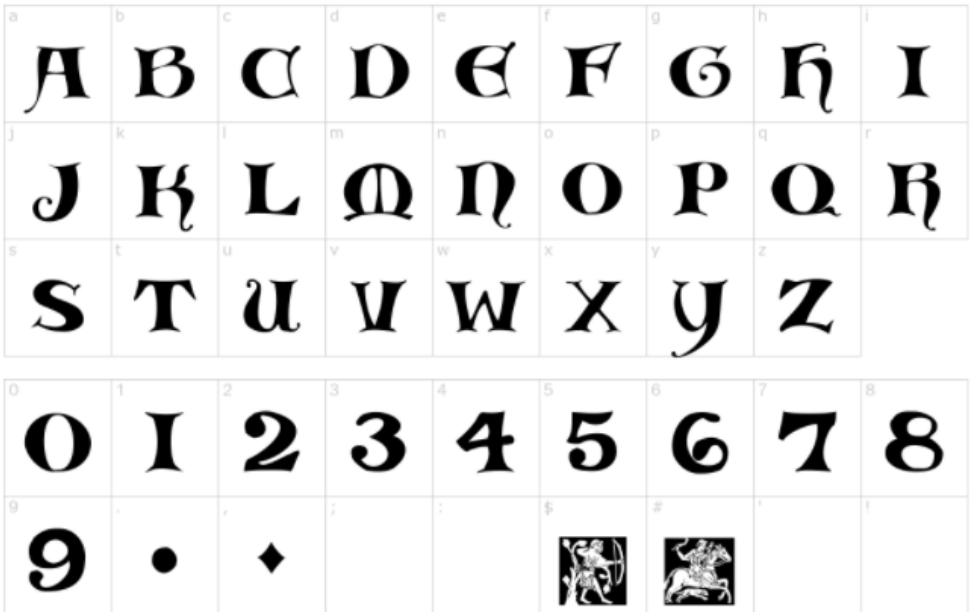


Figure 4.5: Scribish Font.

Chapter 5

GamEmotion

This chapter structure is based on a modified version of the Game Design Document for serious games[65] created by Diane Pozefsky[66], a computer scientist that teaches the Serious Games course at the University of North Carolina.

5.1 Game Overview

5.1.1 Game Concept

GamEmotion is a computer game designed to teach adolescents concepts about emotions and emotion regulation strategies.

5.1.2 Genre

Besides being a serious game, GamEmotion is also an action-adventure game since it combines elements from both action and adventure games because it features long-term obstacles that must be overcome using a tool or item as leverage (which is collected earlier), as well as many smaller obstacles almost constantly in the way, that require elements of action games to overcome. Action-adventure games tend to focus on exploration and usually involve item gathering, simple puzzle solving and combat.[67]

5.1.3 Target Audience

Defining a game target audience can be a challenging process from looking at market opportunities, using for example a SWOT analyses, to thinking about monetization strategies and distribution channels, and of course creating user personas and doing user testing. However as it was mentioned in the introduction of this document GamEmotion had already a defined audience, as the project was designed to develop a SG for adolescents aged twelve to eighteen.

5.1.4 Pedagogical Objective

The game aims to teach adolescents the six basic emotions defined by Ekman as well as how to recognise them. After that, two emotion regulation strategies are presented to player as well as how to use them in a real life context. These strategies are defined in Gross's model for emotion regulation and are named Cognitive Reappraisal and Emotion Suppression.

5.1.5 Game Flow

The following figure (Figure 5.1) represents the flow of GamEmotion, showing all the paths and directions in which the player can navigate in the game.

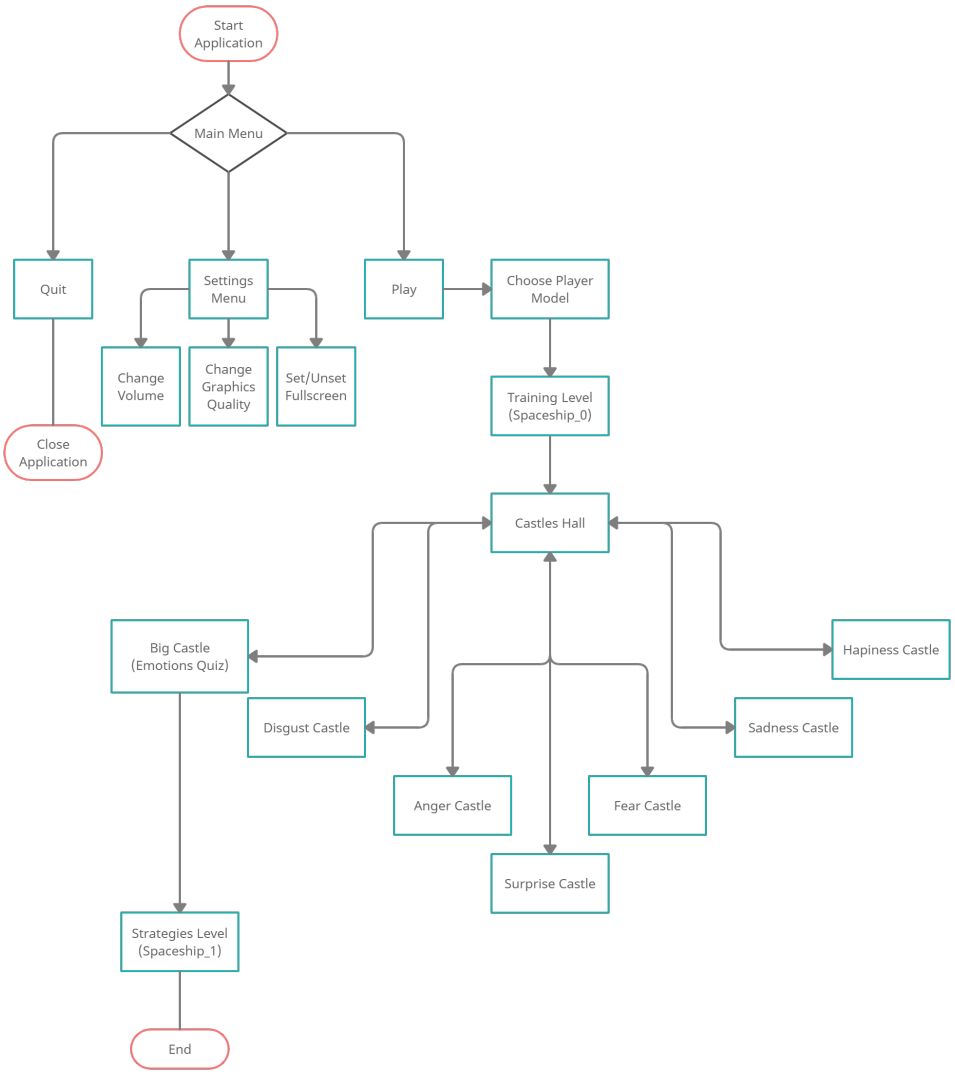


Figure 5.1: Game Flow Chart.

5.1.6 Look and Feel

GamEmotion can be described as 3D action-adventure game or even as a 3D platformer in the style of Super Mario 64. Regarding looks, it presents a vibrant low poly style environment.

5.2 Gameplay and Mechanics

5.2.1 Gameplay

In GamEmotion the player controls a 3D character model through an experience that intends to taught him/her six basic emotions and their respective characteristics as well as two regulatory strategies.

After a training level that takes place at a technology advanced spaceship where the player is taught the game mechanics, he/she enters a virtual reality experience where six castles, each one corresponding to each emotion, have to be completed. In these castles the player must find all the clues corresponding to said emotion and then complete a word puzzle to discover what is the emotion that corresponds to the clues gathered.

After completing all six castles, a seventh castle becomes accessible where the player steps on a trap making the water level raise. To escape the player must complete a quiz like puzzle concerning all the knowledge that was previously acquired during the six castles. Upon succeeding this quiz the player is able to escape the raising water and finish the virtual reality experience being brought back to the spaceship. Once back at the spaceship the player is able to learn two emotion regulation strategies.

5.2.2 Mechanics

The player can move in the game using the WASD or arrow keys and the mouse. The WASD keys control the movement of the character models forward, backwards and sideways and the mouse controls the game camera, which influences what direction is forward. Player movement and camera setup details will be explained more in detail in the next chapter.

The player can also use the SPACE key to jump and LEFTSHIFT to run.

Most interactions with the game world objects are made using the E key with exception of talking with NPC's which is accomplished thought the F key.

The game autosaves every time the player enters a new level, and if the game is closed the player can continue where he left of by clicking "Continuar" in the main menu.

5.2.3 Game Options

If the player access the settings menu using the ESC key he/she can control the audio volume, the graphics quality and Set/Unset fullscreen mode.

The player can also, during gameplay, change between the first and third person cameras using the C key on the keyboard.

5.3 Story, Setting and Character

5.3.1 Story and Narrative

The player begins its journey in a spaceship futuristic environment where a voice (the narrator) informs him/her about what is happening and guides him/her to the main laboratory in the spaceship where the player can found an advanced virtual reality system.

Upon interacting with this system the player is transported to a fantasy world where he/she can see seven castles, six equal size smaller ones and a final big one. The player can choose any of the six smaller castles to enter.

Once a castle is entered the player has to find clues and interact with NPC's to discover what is the dominant emotion in that castle before he/she can exit.

After completing all six castles a seventh castle becomes accessible where the player steps on a trap making the water level raise. To escape the player must complete a quiz like puzzle concerning all the knowledge that was previously acquired during the six castle. Upon succeeding this quiz the player is able to escape the raising water and finish the virtual reality experience being brought back to the spaceship.

Once back at the spaceship the narrator greets the player and gives him/her a tablet and introduces him/her to a new technology design to teach emotion regulation strategies. After this, the player can choose to enter one of two rooms each one corresponding to a strategy. In each one, the player can experience some type of augmented reality experience where he/she takes part.

After finishing each room the player tablet unlocks new tabs giving the player more information about that strategy.

5.3.2 Game World

The game world has two main styles (Figure 5.2). One more futuristic that happens inside a spaceship and one more medieval with *dungeony* vibes that the player experiences while exploring the six castles.

Figure 5.2: Comparison of both dominant environments.

5.3.3 Characters

In GamEmotion the existence of three separate character types can be considered. The narrator (Spaceship Voice) that interacts and guides the player in the levels that happen on the spaceship. The player itself, that allows the person playing to explore and advance throught the game. And finally the NPC character that exist in the castles that the player can talk with.

Regarding the player there is a set of ten player models that the player can choose from when starting a new game.

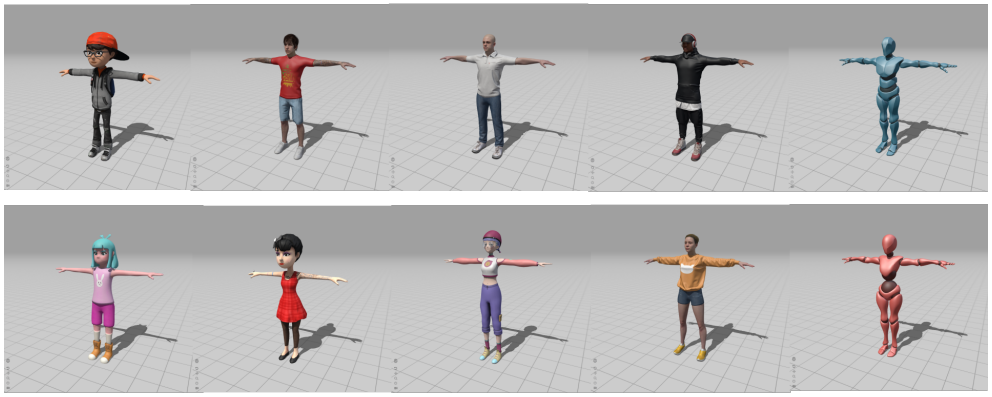


Figure 5.3: All character player models available in GamEmotion.

5.4 Levels

GamEmotion can be decomposed in ten different levels or scenes and this chapter will dive into detail about each one of them.

It is worth mentioning that the six castle levels corresponding to the six emotions share the same basic layout with a few differences and some areas being closed of or opened up in some of them. In all six castles the player also has a journal where he/she can see the clues already collected in that castle as well as how many clues are left in that castle. Finally all six castles have a different ambience music that also tries to match the mood of that castles emotion.

The clues found in each castle will be written in this document as they are in-game, this means that they will be not translated and will be written in Portuguese.

5.4.1 Training Level

When the player starts a new game he/she is informed by the narrator, that he/she is partaking in an experience designed to teach him/her about emotions and emotion regulation strategies. The player is also informed that there has been some kind of error with the teleport to the spaceship and that the player is trapped in the spaceship storage room (Figure 5.4). While this happens UI elements show up on the screen informing the player about the movement keys.

After exploring for a brief moment the narrator tells the player that at that time there is no one available to go get him/her from the storage area and that the access card reader will need to be "hacked to proceed". When the player interacts with the card reader a mini game pops up where the player needs to connect some electric wires based on their color to be able to proceed.

Upon completion, the player has now access to the next room where he/she is informed by the narrator that although he/she did a good job hacking the card reader that can be dangerous and so he/she should be able to find an access card in the room he/she is now in. This is meant to teach the player about interactable object in the game world as well as inventory items as UI elements.

When the player finds the card he/she can use it in the next card reader and thus gaining access to the last room where the narrator informs him/her that he/she is about to embark on a virtual reality journey using the latest virtual reality technology. Before interacting with the virtual reality equipment the player can read a digital "tablet like" sign that displays information about the pedagogical intentions of the game.

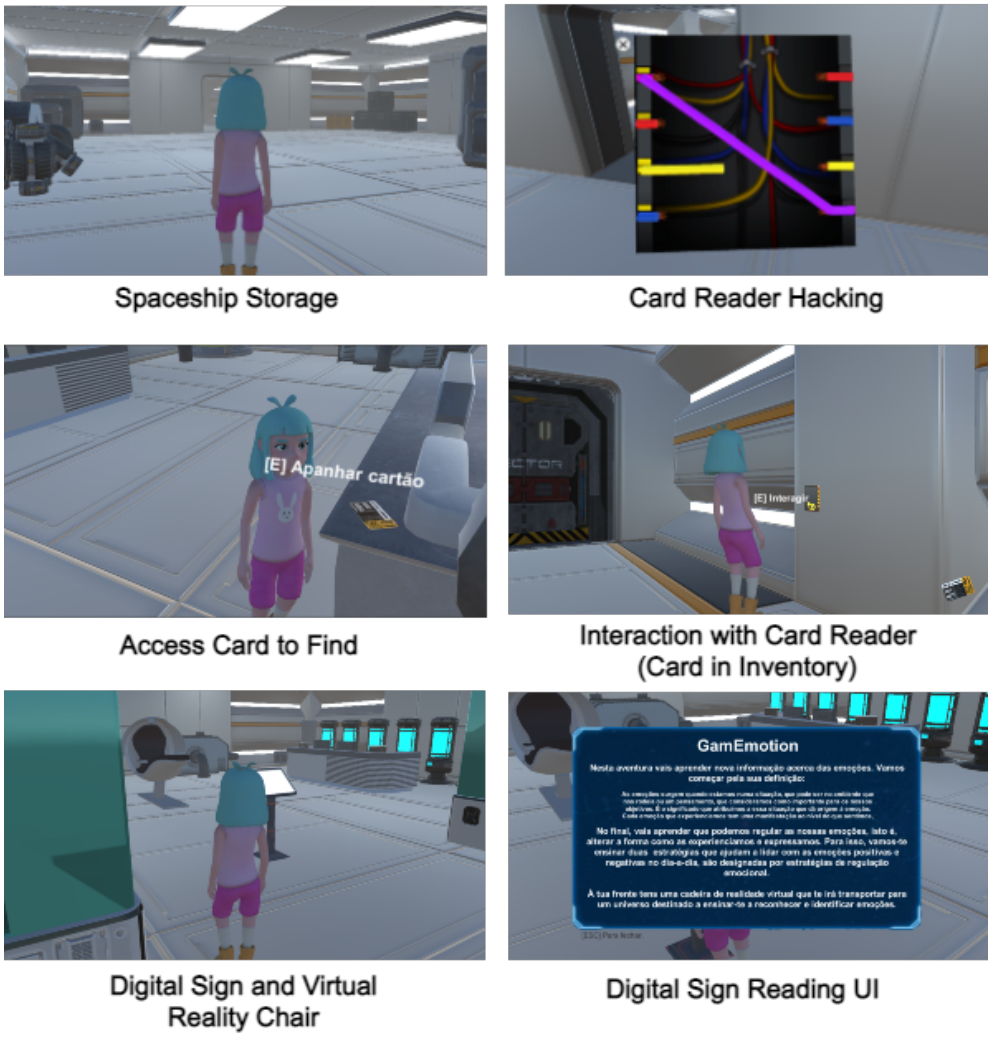


Figure 5.4: Training Level screenshots.

5.4.2 Hall

After the training level the player enter a floating "hall" (Figure 5.5) where six equal sized smaller castles and one bigger castle can be seen.

When the level starts a UI element appears informing the player that he/she can open/close their journal (Figure 5.6) by clicking the TAB key. The journal contains a page describing how the castles level work and also the six emotions that start empty but will be filled as the player finishes each castle.

The seventh, bigger castle is locked and will be unlocked when the player finishes all other six castles. The player can complete the six castles in any order he/she wants. After completing a given castle the player can no longer enter that castle.

This is also the level that the player will return to every time he/she exits a previously entered castle.

Although it should be hard for the player to fall off the map since invisible walls were added, if this is to happen there is a collider bellow the level that if the player is to touch it he/she will be respawned at the level as normal.

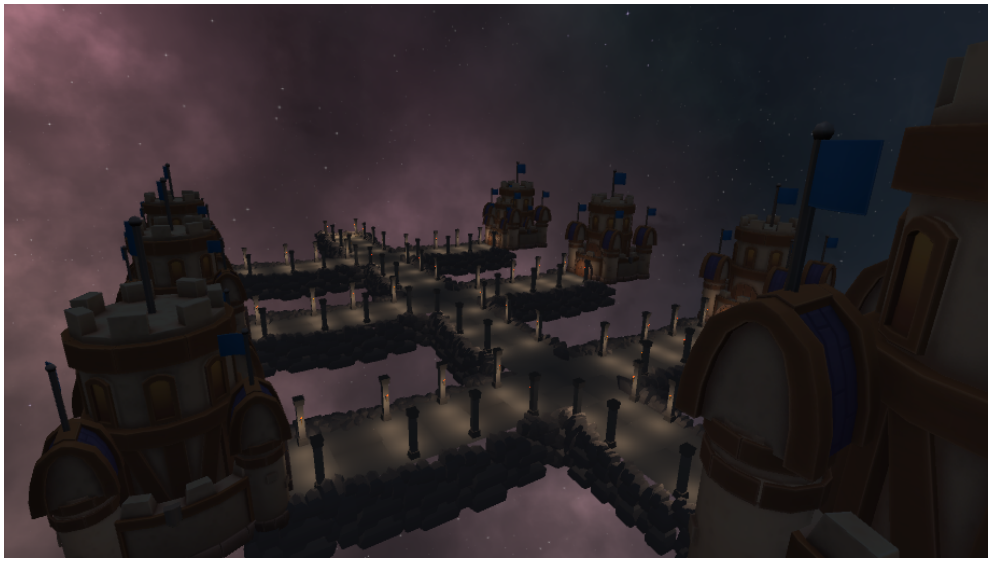


Figure 5.5: Floating hall scene.

Figure 5.6: Player journal in hall.

5.4.3 Happiness Castle

As previously stated all castle levels have the same basic layout with some small differences. In the next subsections, concerning castle levels, I will only refer the specifics of each castle and the clues that the player have to discover in that castle.

There are three main ways the player can find clues on each castle, by talking with NPC's, by observation (usually with camera cutscenes), and by reading from books found on the level.

The happiness castle will probably be one of the first castles that the player will enter, because of this and also due to the emotion associated with it, this can be considered an "easy" castle where the can player can explore the castle layout without any hustle.

The following table (Table 5.1) shows all the clues the player has to collect to exit the castle as well as how they are presented to the player.

Table 5.1: Clues Happiness Castle.

Clue	Unlocked by	Description
Ativada por acontecimentos favoráveis	Dialogue	"Olá! Acabei de receber muito boas notícias!!!! Vou arrumar as minhas coisas e juntar-me aos outros no salão para lhes contar."
Associada a bem estar físico e psicológico	Dialogue	[Two friends talking] "Olá, bem vinda! Eu e a Ana estávamos a comentar como temos sentido um maior bem estar e energia"
Favorece maior abertura às experiências que nos rodeiam	Dialogue	[Threeway conversation] "Estamos a combinar ir numa aventura pelo mundo! Vai ser incrível."
Favorece a aproximação entre indivíduos	Observation	[Camera shows a group of friends talking and goofing at the table]
Facilita a resolução de problemas	Dialogue	"Estou tão feliz que que até vou conseguir resolver este problema que tenho há semanas"
Dopamina e Noradrenalina	Book	
Gratidão	Book	
Otimismo	Book	
Sorriso na cara	Dialogue	"Olá! Entra! Podes explorar, fica à vontade :) Está toda a gente a divertir-se, junta-te a nós. Quando tiveres todas as pistas volta a esta porta inicial para conseguires sair! Até já"
Associada a maior Auto-Estima	Observation	[Camera shows couple dancing in the main dinning room]
Realização	Dialogue	[Couple talking] "Hey! És nova por aqui? Eu e o carlos começamos a namorar há pouco tempo, sinto-me mesmo realizada"
Bom Humor	Book	

5.4.4 Sadness Castle

In the sadness castle the whole ambience is perceived as sad by the background music as well as the NPC's animations. In this castle there is a lever the player must find to open a door (Figure 5.7), after this a new path is opened where there is an intentionally hard skill jump (Figure 5.8), that can make the player feel frustrated. After this jump there is a door that must opened with a key previously picked up by the player. If by chance the player has not found the key before getting to the door he/she will have to repeat the hard jump.

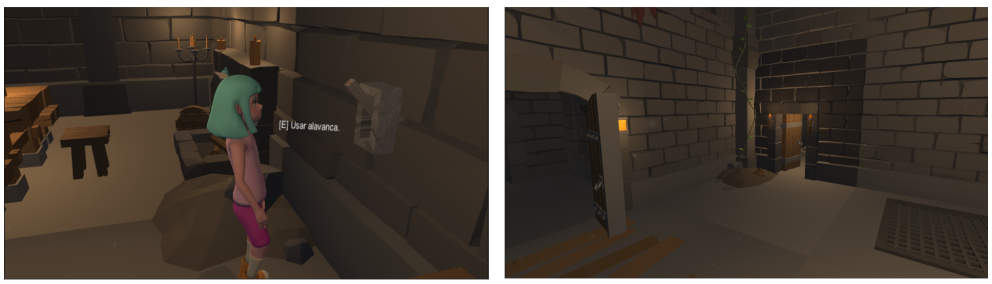


Figure 5.7: Sadness castle lever door mechanism.

Figure 5.8: Sadness castle jump.

The following table (Table 5.2) shows all the clues the player has to collect to exit the castle as well as how they are presented to the player.

Table 5.2: Clues Sadness Castle.

Clue	Unlocked by	Description
Associada a pessimismo	Dialogue	"Olá, não há nada de interessante neste castelo nem nas suas gentes. No entanto volta a esta porta quando tiveres recolhido todas as pistas, mas duvido que consigas"
Diminuição dos níveis de serotonina	Dialogue	[With inmate] "Sinto-me bastante deprimido. Por vezes os guardas até me dão um pouco daquela garrafa azul que está em cima do barril"
Perda de Motivação	Dialogue	[Lying in bed] "Não me apetece fazer nada, sinto-me completamente desmotivado."
Diminuição do interesse na participação em atividades sociais	Dialogue	[King] "Estou muito triste. Ninguém no reino quer vir conviver e comer para o salão. Até fechamos as portas principais" + "Não tenho interesse em conviver. Por favor deixa-me estar sozinha"
Diminuição de energia	Dialogue	[Deitado na cama] "Só quero dormir, ou pelo menos descansar, não tenho energia para nada"
Associada a situação de perda (de amigos, de admiração pelo outro , de saúde, de parte do corpo ou função, de objeto precioso)	Dialogue	[Blacksmith] "Fechei a minha oficina de ferreiro, ninguém quer comprar as minhas espadas, perdi a confiança e admiração dos meus conterrâneos pois umas das minhas espadas partiu durante uma batalha."
Foco da atenção no negativo	Dialogue	[Couple praying] "Tudo nos tem corrido mal, não conseguimos pensar noutra coisa"

5.4.5 Fear Castle

The fear castle castle is different from all others since all the lights in the castle are turned off, and the player is given a flashlight to navigate through the castle (Figure 5.9). There is a light switch in the bedroom that can be used to turn the lights back on, but this is not mandatory to complete this level.

The dark environment and creepy music contribute to the *feary* feeling of this castle. There are also other scenic elements that contribute to this, like a prison cell door opened, suggesting that an inmate might have escaped.

There is also a NPC that has lost her dog and cannot get to it because of the gap in the bridge, the player can also use a lever to get the bridge back up.

Fear castle lightning Player mounted flashlight

Figure 5.9: Fear castle lightning and Flashlight.

The following table (Table 5.3) shows all the clues the player has to collect to exit the castle as well as how they are presented to the player.

Table 5.3: Clues Fear Castle.

Clue	Unlocked by	Description
Associada ao perigo	Book	
Função de proteger os indivíduos de determinados riscos (Físicos e Psicológicos)	Book	
Ativada por algum tipo de ameaça	Dialogue	"Está um cão à solta! Tenho fobia a cães! Além disso, não consigo ver nada."
Propicia ação de fuga / Necessidade de se proteger	Dialogue	"Nao consigo ver nada, vim para o meu quarto porque me sinto mais seguro"
Foco da atenção no estímulo ameaçador	Dialogue	[Woman who lost her dog and can't cross the bridge] "O meu cão atravessou para o outro lado, mas com o escuro, tenho receio de atravessar, só consigo focar-me no abismo e no burraco na ponte"
Perigo	Book	
Pavor	Book	
Ansiedade	Book	
Preocupação	Dialogue	"Estava a ler mas agora estou um bocado preocupada com a falha da luz, espero que alguém trate disto rapidamente :("
Nervosismo	Dialogue	"Ficamos sem luz no castelo, estou um bocado nervoso. Bem, volta aqui quando encontrares todas as pistas, mas não demores muito por favor""
Apreensão	Book	

5.4.6 Anger Castle

In the anger castle besides the vivid background music and the NPC's displaying violent and angry looking behaviours there is a new type of logic puzzle. The player must find two gems and put them in their respective placeholders in order to unlock a door on the level. One of the gems is placed on a desk and is easily visible, the second one however is hidden inside a wooden vase, for it to be picked up the player must first find a hammer and break the vase with it and after that he/she is able to pick it up. Once the player has both gems he/she can place them in their respective placeholders, marked by a ribbon on the wall with each gem corresponding color (Figure 5.10).

Besides this, there is also a new way for the player to find clues. There are four treasure like chests that the player can open and inside them lies a rolled sheet of parchment paper. The player can interact with this and read the clue written on the parchment paper (Figure 5.11).

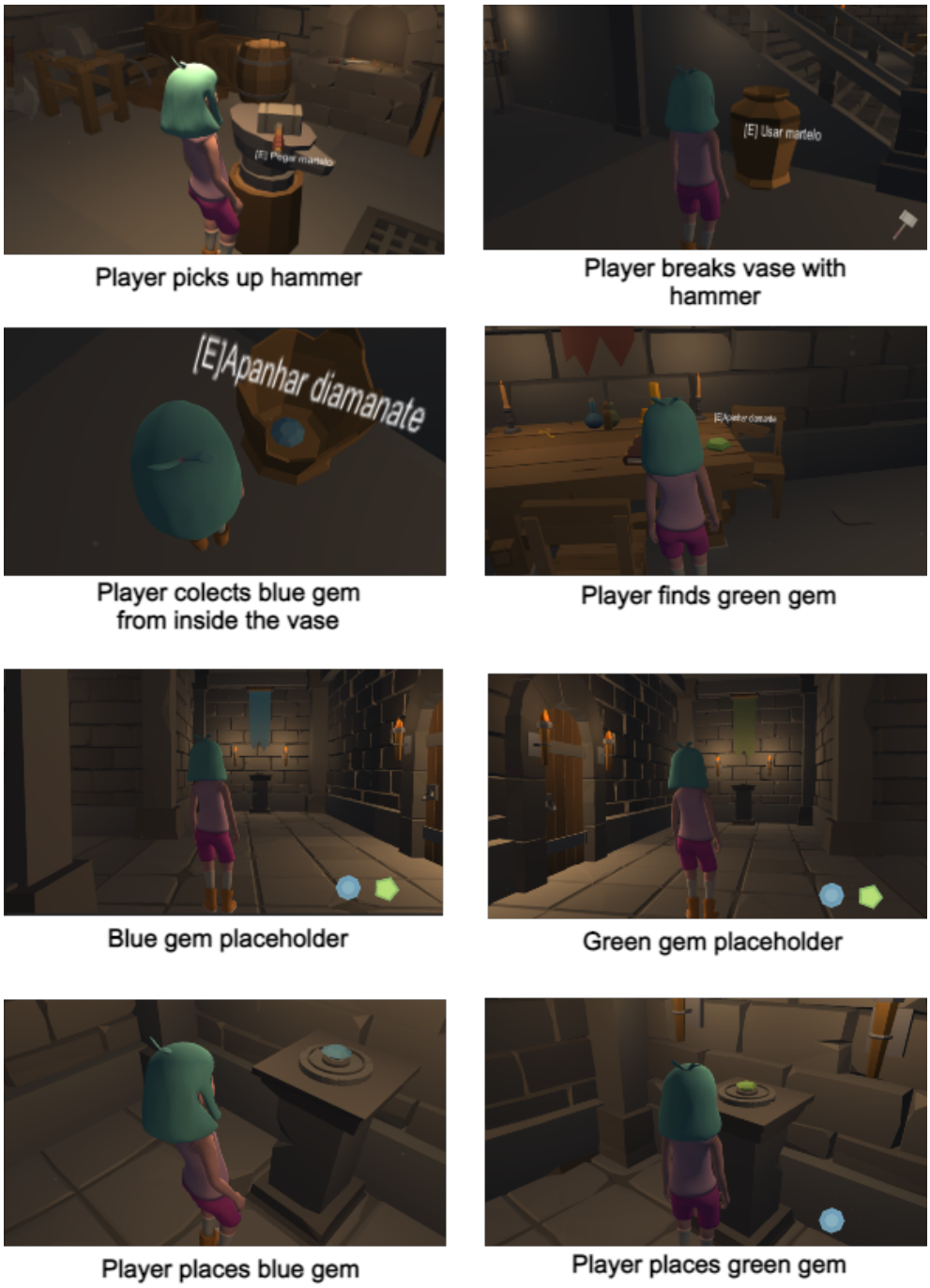
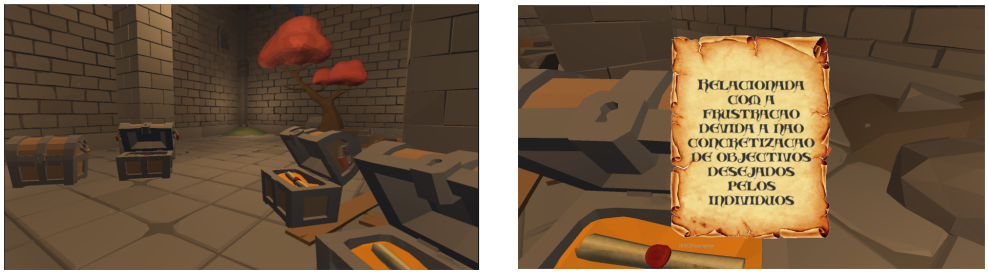


Figure 5.10: Anger castle gems puzzle.



Treasures chests containing clues Clues in parchment paper

Figure 5.11: Anger castle clues inside chests.

The following table (Table 5.4) shows all the clues the player has to collect to exit the castle as well as how they are presented to the player.

Table 5.4: Clues Anger Castle.

Clue	Unlocked by	Description
Relacionada com a frustração devido à não concretização de objectivos desejados pelos indivíduos	Book	[Parchment paper inside chest]
Aumento da pressão arterial,	Book	[Parchment paper inside chest]
Aumento da frequência cardíaca	Book	[Parchment paper inside chest]
Aumento de hormonas que impulsionam ações vigorosas	Book	[Parchment paper inside chest]
Violência verbal (gritos, insultos, ameaças)	Dialogue	"O QUE É QUE QUERES? JÁ SABES O QUE FAZER, NAO JA? DESAPARECE DAQUI E DEIXA-ME EM PAZ"
Violência física (agressões, lutas, empurrões)	Observation	[Camera shows two NPC's fighting]
Dificuldade de autocontrolo	Observation	[Camera shows multiple NPC's displaying violent behaviour and trying to fight even through jail cells]

5.4.7 Surprise Castle

There are two main differences in the surprise castle, these differences are meant to make the player itself fell surprised.

First, when the player enters the level it starts not in the same place as every other castle played before but rather inside a dungeon cell guarded by and NPC guard. Not only the different start surprises the player but this is also a logic puzzle the player must complete.

In order to exit the cell the player must find a rock in the ground of the cell and throw it at the guard in the exact moment he passes near the cell door while doing his route. If the player is able to hit the guard the cell door key will follow to the ground near the cell door where the player is able to grab it and thus open the door and escape the dungeon cell. It is also worth mentioning that when the player exits the cell if he/she is caught inside the guard vision collider the guard will capture the player and put him/her back inside the dungeon cell (Figure 5.12).

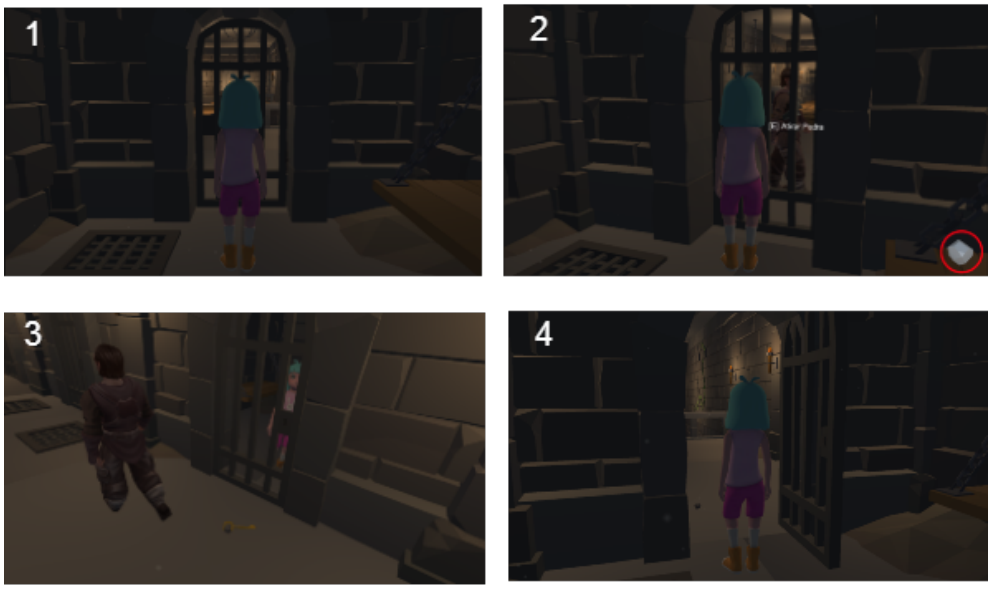


Figure 5.12: Dungeon cell puzzle sequence.

Second, when the player gets out of the cell he/she can go to the castle main hall which is familiar to him/her but to add to the surprise factor the castle layout was changed and when the player opens any door the room inside will not be the room that the player expects to be there from the previous castles layout.

And finally there is yet one more logic puzzle for the player to do before completing the level. In order to access a room that is boarded up, the player must collect an axe that is in the main dinning room and use that axe to cut down the wooden boards and thus be able to collect the clues inside that room (Figure 5.13).

Figure 5.13: Axe/Wood boards puzzle sequence.

The following table (Table 5.5) shows all the clues the player has to collect to exit the castle as well as how they are presented to the player.

Table 5.5: Clues Surprise Castle.

Clue	Unlocked by	Description
Relativa a um acontecimento inesperado (Reação causada por algo imprevisto, inédito ou estranho)	Dialogue	"Alguém mudou toda a disposição do salão, nem queria acreditar"
Pode ser positivo ou negativo dependendo do fator que lhe deu origem	Book	
Diminuição da frequência cardíaca	Book	
Aumento do tônus muscular	Book	
Vocalizações espontâneas	Book	
Ativa os processos de atenção, exploração e curiosidade	Dialogue	"Alguém mudou toda a disposição do castelo :0 Ando a explorar tudo..."

5.4.8 Disgust Castle

In the disgust castle there are multiple visual elements intended to help the player realize the emotion. All the water in the fountains on this level has neon green hazardous look. There are two NPC's vomiting in the castle. Rotten vegetables can be seen on the dinning hall tables. And finally there is a locked room that the player can peek into that resembles a murder scene, this is intended to generate a feeling of visual disgust as well as a feeling of disgust towards the actions that happened in that room (Figure 5.14).

Figure 5.14: Disgust castle visual clues.

The following (Table 5.6) table shows all the clues the player has to collect to exit the castle as well as how they are presented to the player.

Table 5.6: Clues Disgust Castle.

Clue	Unlocked by	Description
Gera repulsa ou necessidade de expulsar algo	Dialogue/ Observation	"Ele bebeu água daquela fonte agora está assim..." [A NPC can be seen vomiting near a foutain with hazardous looking water]
Cria sensação de desagrado nítido	Book	
Especialmente percebido através de expressões faciais	Book	
Associado a coisas que são percebidas como sujas, incomestíveis ou infecciosas	Dialogue/ Observation	"Acho que não devia ter comido aqueles legumes que estão em cima da mesa..." [A NPC can be seen vomiting near a table with rotten vegetables clearly visible]
Pode ser físico (associado a impureza física) ou moral (associado a tomada de decisões)	Dialogue/ Observation	"Se quiseres podes espreitar, mas não te aconselho a entrar neste quarto... Houve um indivíduo que se descontrolou ali dentro. Nao so nao sei lidar com os atos que ele cometeu, mas também o cenário em si dá-me náuseas" [A camera cutscene can be seen showing a room where a murder has happened]
Objetivo principal é rejeitar estímulos que podem provocar intoxicação mas com o tempo ganhou contexto social de rejeitar estímulos sociais tóxicos	Observation	[Player can hear two NPC's gossiping about their friend behind the friends back]

5.4.9 Final Castle

The seventh and final castle becomes unlocked and available for the player to enter after all previous six castles are completed. When the player enters this castle he/she must cross a bridge that has water underneath it. After crossing this bridge the player finds all the six journals from the previous castles containing all the clues and associated emotion. The player can read these books and refresh his/her knowledge before going up the stairs next to them. When the player reaches the top of the stairs he/she can see a stone pedestal with some candles and a parchment paper roll on top of it. When the player tries to interact with this object he/she realizes that he/she is standing on top of a rock that is in fact a pressure trap thus making the water level on the castle start to rise. The player is then presented with a quiz like mini game where he/she must connect clues to the associated emotion, with a timer represented by the water level raising. If the player fails to complete the challenge before the water reaches him/her the level will be restarted, however if the player succeeds the water level will stop raising and the door in front of the player will open. This door gives access to a floating platform. At the end of this platform the player can see the virtual reality chair, where he/she begun his/her journey at. If the player interacts with this chair the virtual reality experience will end, and he/she will found himself/herself back at the spaceship (Figure 5.15).

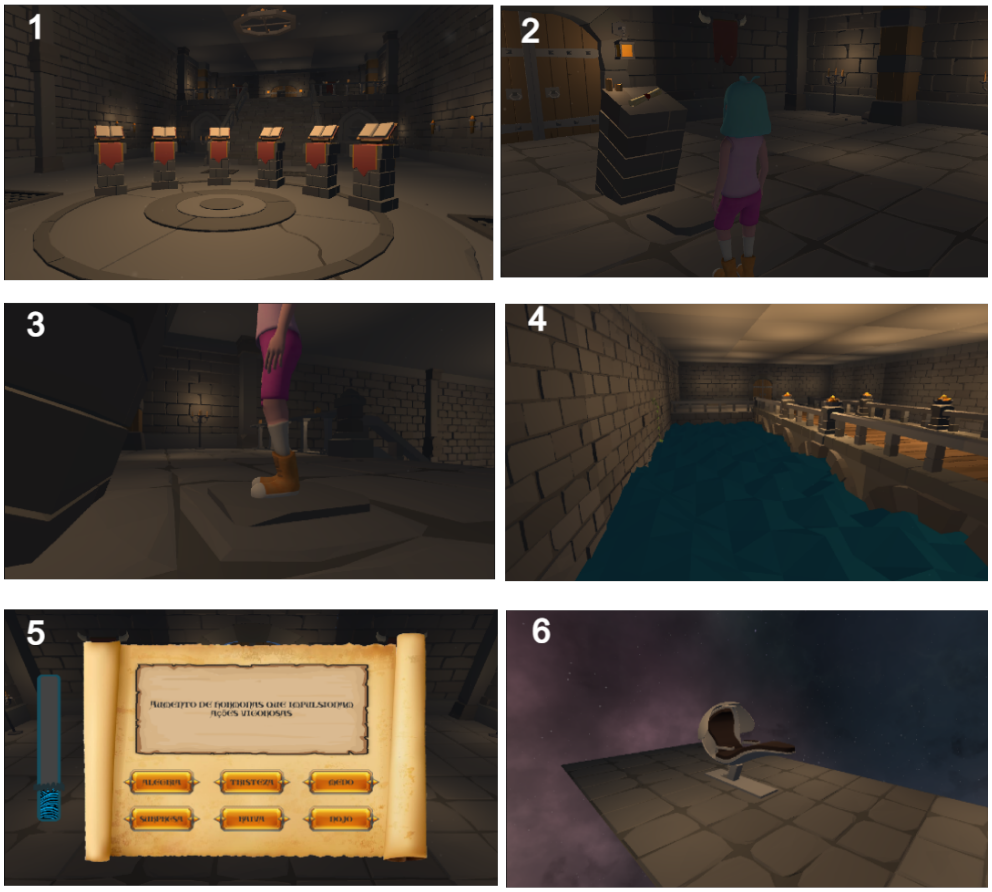


Figure 5.15: Final castle sequence.

5.4.10 Emotion Regulation Strategies Level

When the player gets back to the spaceship he/she is greeted by the narrator and informed that the spaceship underwent some layout changes, upon advancing the player finds a tablet that he/she can pick up and finds also a set of two closed doors (Figure 5.16). He/She is informed by the narrator that these two rooms where design to teach him/her emotion regulation strategies and that he/she can proceed to enter any one that he/she likes. At this point in time the tablet that the player picked up only has one of three sections unlocked (Figure 5.17), the other sections will become unlocked after the player goes throw the room corresponding to a given strategy.

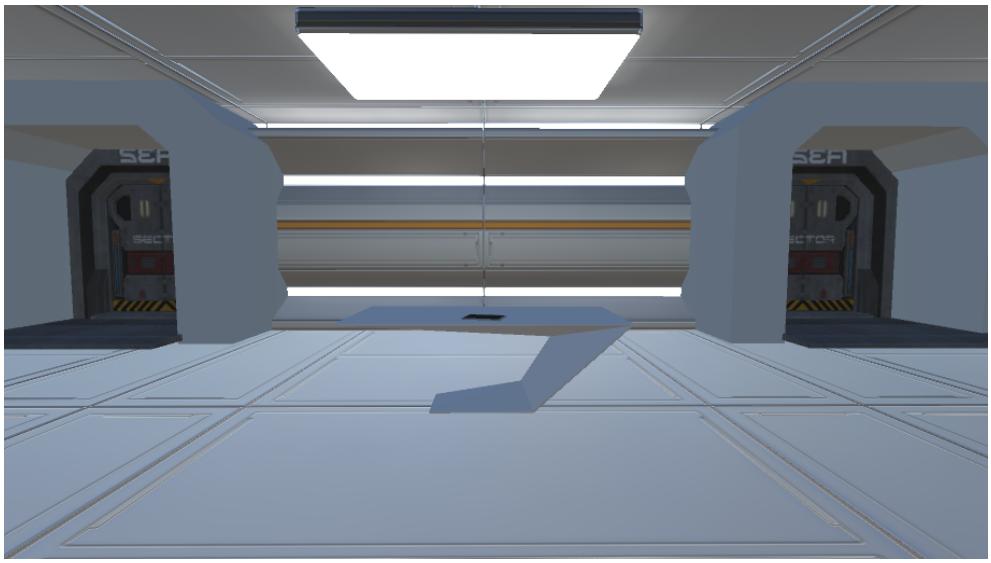


Figure 5.16: Tablet to pick up and both doors.

Figure 5.17: Tablet only available section upon pick up.

After playing both rooms/experiences a tablet notification appears and a new section is also unlocked, informing the player that he/she has now new tools to deal with emotions, and that is the end of the game.

5.4.10.1 Cognitive Reappraisal

When the player enters the door on the left the Cognitive Reappraisal experience (Figure 5.18) starts. This experience is presented as a kind of augmented reality experience where an old scary classroom fades in around the player, while the narrator tells the player that it is understandable to feel frightened in some situations and that is why the classroom can be perceived as scary.

However, the narrator explains how that situation can be reappraised and that by doing this the player can make the environment be perceived as not scary. As the narrator explains this, the old scary classroom starts to fade out as a new, well lit and vibrant classroom, fades in. After this the narrator even allows the player to walk through the walls of the new room, and allowing him/her to look through the 3d model of the classroom from outside, "breaking the fourth wall", as a metaphor for "taking a different look" or "looking from another angle" at the reality that surrounds us.

After this the narrator has yet another example and takes the player to a plane in the sky, as if the player was skydiving, and also explains how that can be a frightening experience and how it can be reappraised. After this the player can jump of the plane to the room he/she was previously in.

After this, the experience is over and the player receives a new notification on the tablet, which unlock the Cognitive Reappraisal section of the tablet.

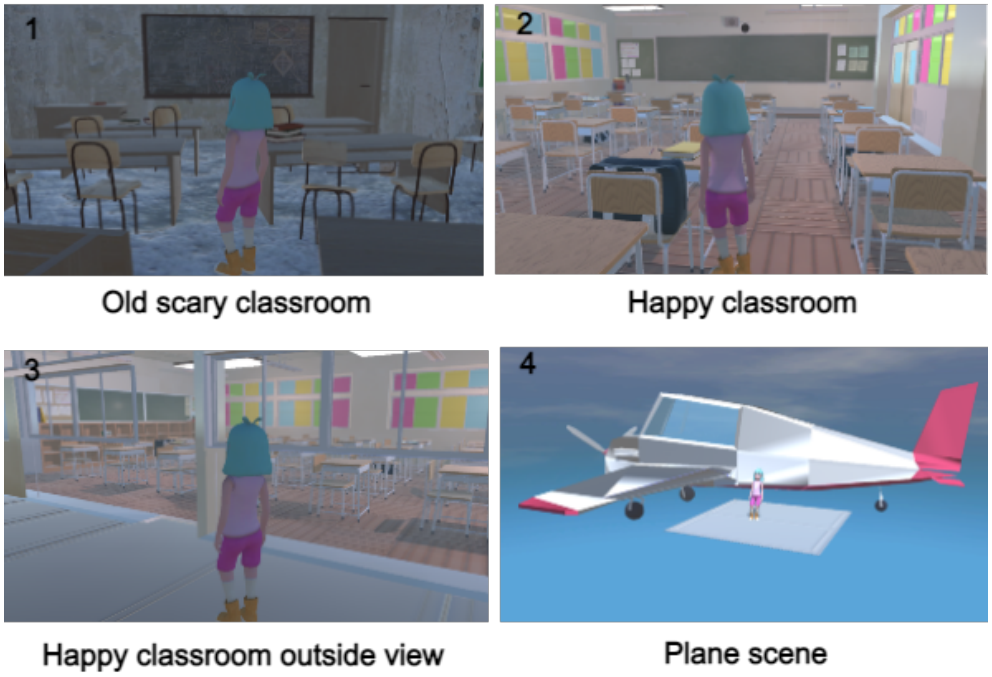


Figure 5.18: Cognitive Reappraisal scenes sequence.

The complete narrator script for this room will be presented here exactly as it is in game, and that means, as the castle clues, that it will be in Portuguese.

```
[Entra na Sala da nave vazia]

-"Espera! Imagina que estás numa sala de Aula... Sabes que tens um
  trabalho para apresentar e o professor te vai fazer perguntas"

[Fade In de um cenário de sala de aula com mau aspeto e escura]

-  "Será que os teus colegas se vão rir de ti?"

-  "Visto assim a sala de aula pode parecer um sítio escuro e
    assustador não é?"
```

```
-  "Mas espera... Pára!"

-  "E se pensares que já apresentaste outros trabalhos e nada de
    mal aconteceu?"

-  "Estás confiante com o teu trabalho! e, afinal de contas, estás
    aqui para aprender"

-  "Ninguém se riu de ti da última vez, e até tiveste boa nota!"

[Sala de aula com mau aspeto e escura começa a desvanecer]

-  "E assim..., do nada..., se fechares os olhos..... e
    voltares a abrir, é como se a sala se transformasse num lugar
    agradável e não assustador!"

[Aparece sala de aula luminosa e bonita]

-  "Normalmente não fazemos este tipo de experiências, esta
    tecnologia é nova e pode ser perigoso,  maaaaaaas, experimenta
    sair da sala, e olhar de fora"

[As colisões entre o player model e a sala de aula são desligadas,
podendo o jogador atravessar as paredes da sala e ter uma perspetiva
da sala de um lado exterior, sendo usado como metáfora para olhar as
situações do dia a dia de uma "outra perspectiva"]

- "Também no dia-a-dia podes fazer algo semelhante, experimenta olhar
   de  outra perspetiva, para as situações que poderão ser
   desconfortáveis, e refletir um pouco sobre elas "

[Após isto a voz volta a falar]

- "Já sei, tive uma ideia! Segura-te!"

[Jogador é transportado para um cenário em que está no ar, num avião,
pronto para saltar]

- "Algumas experiências podem despertar medo em nós. Por vezes o medo
   é um aliado, mas noutras pode privar-nos de novas experiências e
   conhecimento que seriam agradáveis. Saltar de paraquedas pode ser
   uma experiência assustadora, mas se reavaliares a situação, isto é,
   se alterares o seu significado e pensares que estás com profissionais
   experientes e a cumprir todas as medidas de segurança, irás alterar o
   impacto emocional que tem em ti. Assim, podes diminuir o medo desta
   experiência e sentir mais segurança. Por isso, quando estiveres
   preparada... Salta!"

[Após isto o jogador deve saltar e irá aterrar de volta na sala da nave]

-"O que acabaste de aprender e aplicar é uma estratégia de regulação
emocional chamada reavaliação cognitiva, descobre mais sobre ela no
teu tablet"
```

5.4.10.2 Emotional Suppression

When the player enters the door on the right the Emotional Suppression experience (Figure 5.19) starts, it is presented as a kind of augmented reality experience that the player can watch but not interact with. It starts with a garden appearing in the room and in this garden two persons appear, one teenage girl and the player model character itself, as if it was a clone. These characters are animated and a scene starts playing out where the teenage girl starts bullying the player "clone" without any valid reason. At some point the teenage girls pushes the player "clone" and the scene freezes, after this, the narrator asks the player what course of action would he/she take if that was really himself/herself in that situation, in real life. As the narrator says this, two big buttons appear on scene that the player can interact with, a big red button that should be pressed if the

player would respond to the aggression with aggression and a big green button that should be pressed if the player would choose to suppress his/her anger impulses. When the player presses these buttons a UI element appears explaining to the player why he/she should choose or not choose that course of action.

After reading this UI elements the garden that was on scene disappears and the narrator gives to the player other examples where Emotional Suppression could be helpful, and while the narrator explains this, some 3d models are spawned on the room to illustrate each example.

Figure 5.19: Emotional Suppression scenes sequence.

After these three examples, the simulation ends and the player receives a new notification on the tablet, which unlock the Emotional Suppression section of the tablet.

The complete narrator script for this room will be presented here exactly as it is in game, and that means, as the castle clues, that it will be in Portuguese.

```
[Entra na Sala da nave vazia]

- "Hmmm, acho melhor colocar aqui esta barreira, seria perigoso entrares
na simulação"

[Aparece na sala uma "barreira" que impede o jogador de entrar na área
de simulação]

- "Ok, (entaaaaao)hmmmm Precisamos deeeeeeee, um jardim! "

[Aparece na área de simulação um jardim]

- "Será que alguém me consegue arranjar uma luz maiiiis... solar?"

[Liga-se luz mais alaranjada]

-  "Perfeito! Obrigado!"

[Inicia-se uma simulação em que podemos ver o jogador e outra rapariga em
movimento onde se desenrola uma discussão e por fim um empurrão]

- "Olha! :0 És tu, e uma menina"

- "Ela está a ser agressiva e a incomodar-te sem motivo"

.........

- "eeeeeeeee, cena!"

[A simulação pára/congela no exato momento em que a menina é empurrada]

"A menina empurrou-te sem motivo, provavelmente neste momento estás a
sentir alguma raiva. Nesta situação podes escolher expressar a tua raiva
e reagir agressivamente de volta ou então,  não a expressar, e ir embora.
Qual vais escolher?"

[Aparecem na sala dois botões, um verde e um vermelho, correspondentes
as opções: "Suprimir Raiva" e "Reagir com Raiva". Quando clicados
aparece a seguinte mensagem para o jogador]

[Botão Vermelho - "Nesta situação, respondendo com raiva podes despoletar
diversos problemas como por exemplo começar uma luta, onde quer tu quer
a outra menina se podem magoar com gravidade. Podes arranjar problemas
com os teus pais, com a escola, ou mesmo com a polícia. Será responder
com raiva a melhor resposta?"]

[Botão Verde - Nesta situação, em que podes simplesmente ir embora e não
escalar o conflito, pode ser vantajoso não demonstrares as tuas emoções,
neste caso a raiva, e assim evitar problemas maiores. Boa escolha!]

[Após isto a voz volta a falar]

- "Boa escolha! Vamos ver outro exemplo"

[Jardim desaparece e aparece mesa com cartas
~
 e cromos colecionáveis. ex:pokemon,yugioh,etc...]

- "Imagina que queres trocar cartas com um amigo e tu queres muito uma
carta que ele tem. Se o teu amigo perceber que estás  muito feliz e que
queres muito aquela carta, isso pode fazer com que ele perceba que ela
para ti tem muito valor. Desta forma, ele poderá pedir um maior número
de cartas para troca,  por exemplo trocar a carta que queres por 3
cartas tuas. Nesta situação pode também ser favorável tentar suprimir
a manifestação das tuas emoções, como por exemplo a tua expressão
facial, para que a emoção não seja entendida pelos outros."

"O mesmo conceito pode ser aplicado por exemplo numa negociação
```

durante um jogo de monopólio ”

[aparece em cena mesa com tabuleiro de monopólio]

“Uma outra situação em que poderá ser utilizada esta estratégia é, um dia mais tarde, quando quiseres, por exemplo, comprar uma casa. Nesta situação, poderás usar esta estratégia para não demonstrares o teu entusiasmo com a casa ao vendedor e desta forma não existir a possibilidade dele aumentar o preço da mesma. ”

[aparece em cena uma casa para venda]

- "Nestes exemplos, foi usada a supressão emocional em situações em que experienciamos emoções negativas e positivas. Em ambas as situações, a supressão emocional poderia ser uma boa opção. No entanto, ao longo do tempo, um uso frequente desta estratégia está associado a um menor suporte social e emocional. Como não demonstras as emoções que estás a sentir, poderás não receber o apoio que necessitas em muitas situações. Além disso, podes começar a sentir-te desconfortável por não demonstrares o que realmente estás a sentir aos outros. ! Descobre um pouco mais sobre ela no teu tablet!"

[simulação desaparece e a experiência termina]

5.5 Interface

5.5.1 HUD

GamEmotion does not have HUD that is always on, displaying for example a health bar or some kind of in-game collectables as is usual in some games, but these concepts do not apply to GamEmotion.

However there are three situations where a HUD is used (Figure 5.20). The first is whenever the player has a short term item in is his/her inventory, this is displayed in the bottom right corner of the screen. Second when the player acquires a new clue during the castles levels, which is displayed in the bottom left corner. Finally when the player has a new section available on the tablet during the last spaceship level, a tablet notification icon appears in the upper left corner of the screen, this notification icon will only disappear when the player acknowledges it by opening the tablet.

When the player clicks TAB to open his/her journal or tablet, depending on the level the player is currently in, this gimmick (journal/tablet) could also be considered a HUD.

Figure 5.20: HUD examples.

5.5.2 Main Menu

When the player first boots up the game he/she will be presented with GamEmotion main menu, if it is the first time playing the game there will be three options: Starting a new game, go into the settings menu, and quit the game. If, however, the player has previously played the game a fourth option will appear allowing the player to continue the game using the previous save file. When the player chooses to start a new game he/she will need to choose a character model before starting the actual game. If the player chooses to go into the settings menu, he/she will be able to change the available settings, this menu will be seen in detail in the next chapter.

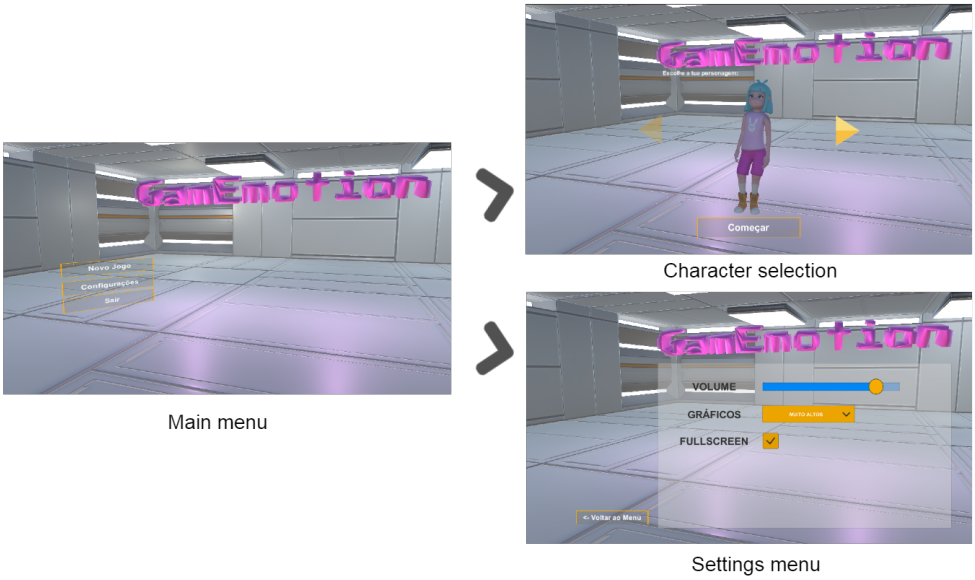


Figure 5.21: Main Menu flow.

Chapter 6

Implementation Details

In this chapter some technical details of the game implementation will be discussed as well as some other details regarding some parts of the code will be mentioned.

6.1 Player Movement And Cameras

Player Movement is one of the most important aspects of a digital game since it is through it that the player can discover and interact with the game world. The camera setup is intrinsically connected with the player movement since camera movement is controlled through mouse input and directly influences movement.

At anytime during gameplay the player can change the camera setup by clicking the 'C' key on the keyboard and switching between third person or first person camera, which in turn will have some effect on how movement works.

In both cases the player uses WASD or arrow keys to move, SPACE to jump, LEFT SHIFT to run, and moves the camera with the mouse. Also in both cases there is small invisible sphere near the player model feet that acts as a ground check, to check if the player is grounded and based on that allow the player to jump, walk or run.

6.1.1 Third Person Movement

This is the default camera mode that the game starts at (Figure 6.1). The camera object for third person movement uses the cinemachine package which is unity's solution for creating interactive camera movement. This package has multiple different types of cameras, the one used in this case has the *Free Look Camera* since it fitted all the project requirements. The camera was set up so that it follows the player game object and also it always looks at the player game object. After this three rigs are define as seen on Figure 6.1 the top rig, middle rig, and bottom rig. Each rig has its own radius and these 3 rigs are the space where the camera can move. The middle rig has the biggest radius and the top and bottom rigs have smaller radius this means that if the

player moves the camera too much up or down the camera will also approach the player model to match the corresponding rig. The player model animations are played based on the speed the player is moving. These animations were also matched to the footstep sound so that the footstep sounds precisely match the player feet touching the ground. In third person, when the player uses WASD or the arrow keys, the player model body rotates based on this. The camera movement in this mode will not make the player model rotate, except for the fact the where the camera is pointing will be considered *forward*, so after rotating the camera if the player presses the W key the player model will rotate and start move in that direction. Also while using the third person camera there is always a possibility that a wall or level prop will be in between the player model and the camera, when this occurs what happens is, the camera object is pulled forward until there is nothing between the player and the camera using the cinemachine collider script.

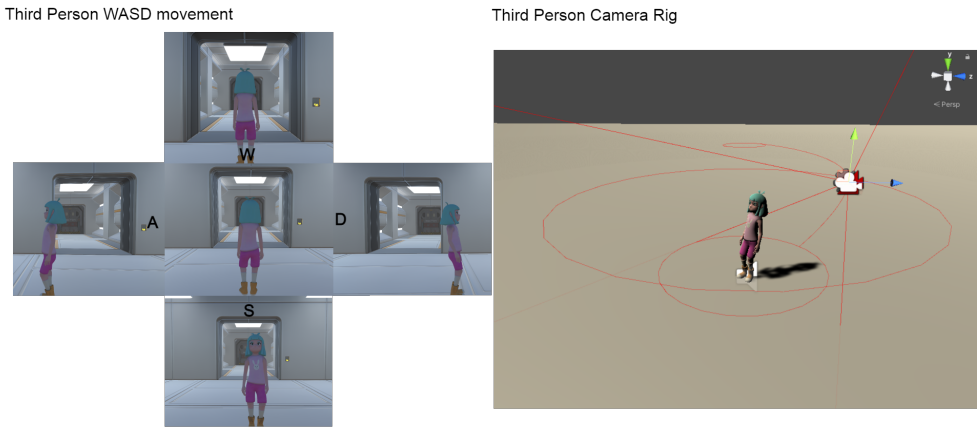


Figure 6.1: Player Movement and Camera rigs in Third Person

6.1.2 First Person Movement

If the player is using the first person camera setup (Figure 6.2) the camera will be at the player models head and the player will not be able to see the player model unless he/she looks down at his/her feet. In this mode WASD or arrow keys will *translate* the player model position forward, backward or sideways based on the direction the player its looking at and **without** rotating the player model. The mouse input its what rotates the camera on a fixed axis and in turn it is what rotates the player model left and right defining its forward direction.

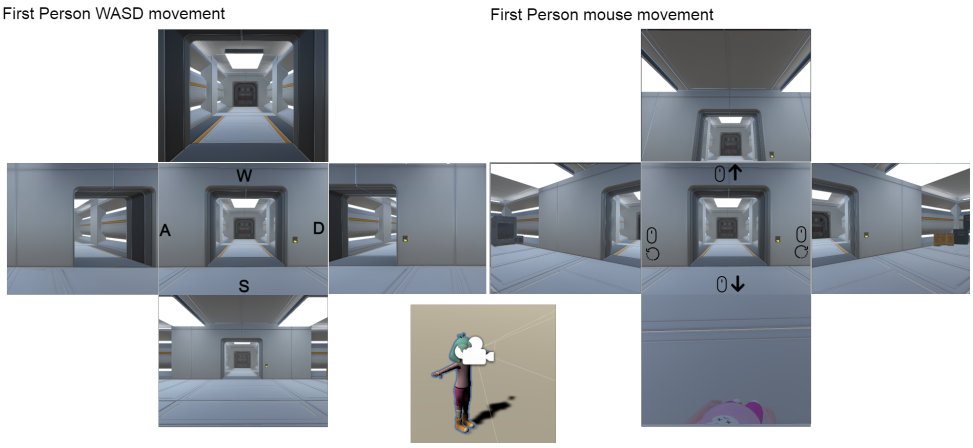


Figure 6.2: Player Movement and Camera rigs in First Person

6.2 Load/Save

Whenever it comes to storing data in Unity there are a few different ways to go about it, the quickest and easiest way is to use the built-in *PlayerPrefs*, with *PlayerPrefs* we can easily store single variables one by one however is not a great solution to store player progress since it's really only meant to handle small amounts of data and it's not at all secure. Another way is to use a simple file format like JSON and XML to store the data, the advantage of these formats is that they are super simple and easy to modify, however this strength is also their weakness, they are so easy to modify that they are not at all secure and so not ideal to save player progress. The third option and the one chosen was the creation of a custom binary file, which is more secure due to being much harder to read and modify. A not so good part of creating a custom binary file is that Data Types specific to Unity like Vector3 or Color are not serializable, but they can usually be decomposed in primitive Data-Types, bur this did not apply to this case.

So a class to model the elements that were needed to be store was created containing only its constructor.

```
1  [System.Serializable]
2  public class GameData
3  {
4
5      public string sceneName;
6      public char modelSkin;
7      public bool castleOneCompleted;
8      public bool castleTwoCompleted;
9      public bool castleThreeCompleted;
10     public bool castleFourCompleted;
11     public bool castleFiveCompleted;
12     public bool castleSixCompleted;
13     public bool thirdPerson;
14
15     public GameData()
16     {...}
```

After that actually save and load the data a *static* class was created that takes a GameData object and transforms it in binary data using a Binary Formatter and creates/updates a binary file

in the system. To make it system independent a built-in function called *persistentDataPath()* was used that takes care of where to save the file in the system.

```
using UnityEngine;
using System.IO;
using System.Runtime.Serialization.Formatters.Binary;

public static class SaveSystem
{
   static string path = Application.persistentDataPath + "/data.gamemotion";

   public static void SaveGame()
    {
        BinaryFormatter formatter = new BinaryFormatter();
        FileStream stream = new FileStream(path, FileMode.Create);

        GameData data = new GameData();

        formatter.Serialize(stream, data);
        stream.Close();

    }

    public static GameData LoadGame()
    {
        if (File.Exists(path))
        {
            BinaryFormatter formatter = new BinaryFormatter();
            FileStream stream = new FileStream(path, FileMode.Open);

            GameData data = formatter.Deserialize(stream) as GameData;
            stream.Close();

            return data;
        }
        else
        {
            Debug.LogError("SaveFile not found in " + path);
            return null;
        }
    }
}
```

Finally these functions are called in the script attached to the player GameObject

```
public class PlayerMovement : MonoBehaviour
{
    {...}

    public void SaveGame()
    {
        SaveSystem.SaveGame();
    }

    public void LoadGame()
    {
        GameData data = SaveSystem.LoadGame();
        model = data.modelSkin;
        castleOneCompleted = data.castleOneCompleted;
        castleTwoCompleted = data.castleTwoCompleted;
        castleThreeCompleted = data.castleThreeCompleted;
        castleFourCompleted = data.castleFourCompleted;
        castleFiveCompleted = data.castleFiveCompleted;
        castleSixCompleted = data.castleSixCompleted;
        thirdPerson = data.thirdPerson;

    }

    {...}
}
```

The games auto saves every time the player enter a new level/scene, and if a savefile is found

in the system when the player boots up the game a option to continue the game appears in the main menu.

6.3 Floating Text

All throughout the game when the player approaches an interactable object, or NPC, a floating 3D text appears (Figure 6.3) indicating what key the player should press to interact with that object or NPC, this text rotates to always face the camera the player is using so that it is always readable from every angle it is looked at. The GameObject containing the 3D text appear/disappears when the player enters/exits a trigger collider, the rotation facing the camera is done using a built-in function called LookAt(Vector3 target) which rotates the transform so the forward vector points at target's current position.

```
1  public GameObject overText;
2  {...}
3  void Update()
4  {
5      if (isInside)
6      {
7          if (mainCam.enabled || fpCam.GetComponent<Camera>().enabled)
8          {
9              overText.SetActive(true);
10             overText.transform.LookAt(Camera.main.transform.position);
11             overText.transform.Rotate(0, 180, 0);
12         }
13         {...}
14     }
15     {...}
16 }
17 {...}
```

Figure 6.3: Floating Text Example.

6.4 Padlock Word Puzzle

When the player is learning the basic emotions he/she has to go through 6 different castles, each one corresponding to a different emotion. When the player enters a castle he/she cannot leave that castle until he/she finds all the clues spread around that castle. When the player finds all the clues he/she returns to the main door of the castle which was previously locked with a padlock, and now he/she can enter a "mini-game" to get out (Figure 6.4).

Figure 6.4: Padlock Word Puzzle.

This mini-game is a word puzzle where the player sees the emotion corresponding to that castle with the letters all scramble up and has to put the word in the correct order by dragging the letter to the correct place. If a player starts dragging a letter and drops it anywhere on the screen that does not correspond to the correct place that letter will snap back to its initial position. Also when a letter is clicked on and it is being dragged its alpha value is reduced so that it looks faded and its perceptible that is is being interacted with.

The whole puzzle is made up of UI elements and the drag and drop system uses the UnityEngine.EventSystems library, more specifically the follwing interfaces: *IPointerDownHandler, IBeginDragHandler, IEndDragHandler, IDragHandler* for dragging the letters and *IDropHandler* on the spot where the letters are dropped.

When a letter is being dragged its position moves proportionality to the delta of the mouse movement event. To make the letter drag corresponds exactly to where the mouse pointer is on the screen this delta is divided by the canvas scale factor so that it is screen size independent and always work as intended.

```
1 public class DragDrop : MonoBehaviour, IPointerDownHandler, IBeginDragHandler, IEndDragHandler, IDragHandler
2 {
3   {...}
4     public void OnBeginDrag(PointerEventData eventData)
5     {
6         canvasGroup.alpha = .6f;
```

```
7         canvasGroup.blocksRaycasts = false;
8         droppedOnSlot = false;
9     }
10
11    public void OnDrag(PointerEventData eventData)
12    {
13        rectTransform.anchoredPosition += eventData.delta / canvas.scaleFactor;
14    }
15
16    public void OnEndDrag(PointerEventData eventData)
17    {
18        canvasGroup.alpha = 1f;
19        canvasGroup.blocksRaycasts = true;
20        StartCoroutine(CheckIfOnSpot());
21    }
22
23   IEnumerator CheckIfOnSpot()
24    {
25        yield return new WaitForEndOfFrame();
26
27        if (!droppedOnSlot)
28        {
29            GetComponent<RectTransform>().localPosition = defaultPos;
30        }
31    }
32
33}
```

```
1  public class LetterSlot : MonoBehaviour, IDropHandler
2  {
3      public string letter;
4      public void OnDrop(PointerEventData eventData)
5      {
6
7          if(eventData.pointerDrag != null)
8          {
9              if (eventData.pointerDrag.GetComponentInChildren<UnityEngine.UI.Text>().text == letter) {
10                 eventData.pointerDrag.GetComponent<RectTransform>().anchoredPosition = GetComponent<RectTransform>().
                       anchoredPosition;
11                 eventData.pointerDrag.GetComponent<DragDrop>().droppedOnSlot = true;
12             }
13
14         }
15     }
16 }
```

6.5 Emotions Quiz

After finishing all six castles corresponding to each emotion the player can now enter a seventh larger castle where he/she stand on a trap a the water level start rising, the player is then presented with a quiz like game (Figure 6.5) that he/she has to pass before the water level reaches him.

There is a clue corresponding to all the clues the player have collected before and six buttons each one corresponding to each of the basic emotions he/she learned.

Figure 6.5: Emotions Quiz.

This game is also made using UI elements. There is a **Questions** object that has a clue and the answer (emotion), the answer can only be of type **emotion**, which is an ENUM containing only the six type of emotions.

```
[System.Serializable]
public class Questions
{
    public enum emotions
    {
        ALEGRIA, TRISTEZA, MEDO, SURPRESA, RAIVA, NOJO
    }

    public string pista;
    public emotions resposta;
}
```

The quiz script has an array of **Questions** and presents to the player a random question from that array. When the player answer the button become non interactable during one second and a new random question is loaded on the screen and so on until the player answers all the questions or the times runs out, in which case the level would restart. The questions that was just answered is removed from the array of unanswered questions. If the player responded correctly a triumph sound will play and if the player answers wrongly not only a hornet sound will play indicating that the answer was wrong but it will also make the speed at which the water raises go up a bit.

```
public class PuzzleFinalCastle7Script : MonoBehaviour
{
    public Questions[] questions;
    private static List<Questions> unansweredQuestions;

    private Questions currentQuestion;

    [SerializeField]
    private Text questionText;

    [SerializeField]
    private float timeBetweenQuestions = 1f;

    {...}
```

```
15
16      void SetCurrentQuestion()
17      {
18          int randomQuestionIndex = Random.Range(0, unansweredQuestions.Count);
19          currentQuestion = unansweredQuestions[randomQuestionIndex];
20
21          questionText.text = currentQuestion.pista;
22      }
23
24      IEnumerator TransitionToNextQuestion(Text emotionText)
25      {
26
27          foreach (GameObject button in buttons)
28          {
29              button.GetComponent<Button>().interactable = false;
30          }
31
32          unansweredQuestions.Remove(currentQuestion);
33
34          yield return new WaitForSeconds(timeBetweenQuestions);
35
36          SetCurrentQuestion();
37          foreach (GameObject button in buttons)
38          {
39              button.GetComponent<Button>().interactable = true;
40          }
41
42
43      }
44
45      public void UserAnswer(Text emotionText)
46      {
47          if(currentQuestion.resposta.ToString() == emotionText.text)
48          {
49              audioSource.PlayOneShot(acertouClip);
50          }
51          else
52          {
53              waterBar.GetComponent<WaterBar>().waterRaiseAmount += 0.1f;
54              audioSource.PlayOneShot(errouClip);
55          }
56
57          StartCoroutine(TransitionToNextQuestion(emotionText));
58      }
59
60      private void Update()
61      {
62          if(unansweredQuestions.Count <= 0)
63          {
64              StartCoroutine(WinGame());
65          }
66          if(waterBar.GetComponent<WaterBar>().waterPercent >= 1)
67          {
68              StartCoroutine(LoseGame());
69          }
70      }
71
72      {...}
73  }
```

6.6 Settings Menu

Either through the main menu or by clicking ESC anytime during game play the player has access to the settings menu (Figure 6.6), besides having information about movement and keys, this menu allows the player to change the game audio volume using a slider, changing the game graphics quality using a drop down box and set the game to be full screen or windowed mode through a checkbox. This is done using Unity built in libraries and functions as seen on the code bellow.

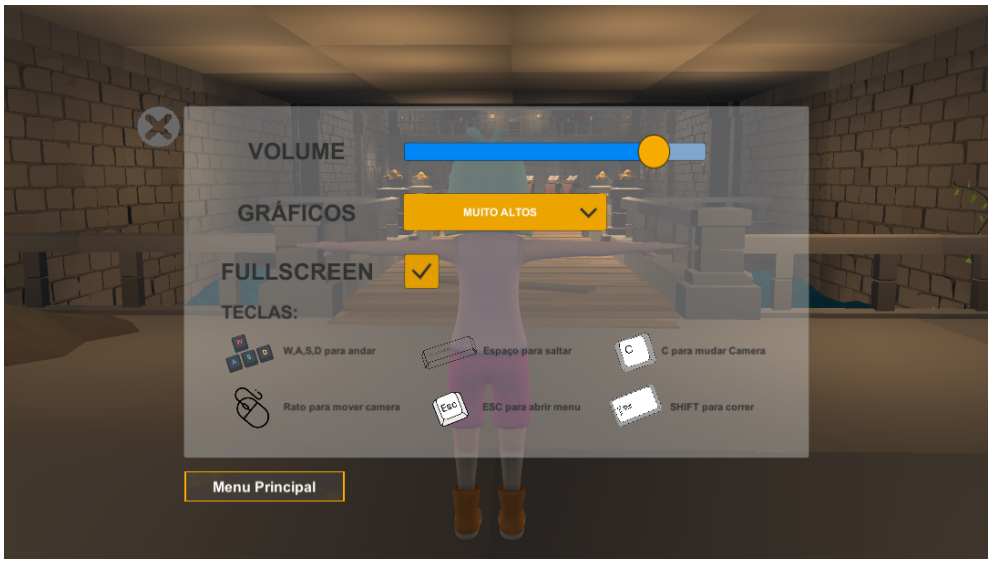


Figure 6.6: Settings Menu.

```
1  public void SetVolume(float volume)
2      {
3          audioMixer.SetFloat("volume", volume);
4      }
5
6      public void SetQuality(int qualityIndex)
7      {
8          QualitySettings.SetQualityLevel(qualityIndex);
9      }
10
11     public void SetFullscreen(bool isFullscreen)
12     {
13         Screen.fullScreen = isFullscreen;
14     }
```

In the above code **audioMixer** is an Unity Audio Mixer created in the project that is the output object of all the game objects that have an Audio Source Component.

Chapter 7

Testing and Results

GamEmotion was originally intended to be tested with its target audience, adolescents, but due to the pandemic situation we are facing and all the restrictions associated with it this was not feasible. Given this scenario there was the need to adapt and make choices. The chosen route was to test the usability of the game with a convenience sample of young adults, and leave as future work the usability testing with the target users, adolescents.

It is also worth mentioning that the testing of the therapeutic capabilities of the game were not in the scope of this dissertation however it is contemplated in the global GamEmotion project and will be conducted using RCTs, the gold standard method, to evaluate new therapeutic methods. This method has three evaluation phases, the first one is before the test subject plays the SG, the second is after the playing session, and a third phase is conducted three and six months after to evaluate the effect the SG had in the subject comprehension of emotions and how competent he/she is regarding ER. These time constraints were the main reason that this test was not part of this dissertation work.

According to Veermere et al.[68] since the user experience is subjective, objective usability metrics like time on task, number of clicks or errors, are not enough. There is a need to know how the user feels about a system. To meet these needs multiple methods to evaluate user experience have been proposed aimed at specific types of apps like mobile applications, desktop application, web services, games and so on.

To evaluate GamEmotion The Game Experience Questionnaire[69], designed to evaluate user experience in games, was chosen due to being a popular and widely used tool in multiple studies with different game genres.

7.1 Procedure

The participants where ask to take part in the survey mostly by e-mail and social media. They were asked to download and play the game, and fill a google form right after they've finished playing.

Since we were not testing the therapeutic and learning effects of the game with the target audience, due to the restrictions explained above, but rather the usability of the game, the participants were all adults.

The form started with a informed consent about the use of the collected data that the user must agree on to partake in the survey.

After this, there is a small set of sociodemographic questions that the participant must fill, this questions are about age, gender, education and also two questions regarding how proficient the participant is with technology (computers, tablets and smartphones) and with digital games.

After this, the participant must fill the actual Game Experience Questionnaire (GEQ), both the core module and the post game module

Finally there is a small section to fill regarding the presented material. Since the participants were not the target audience, these questions are not about the content of the material bur rather if they were presented clearly and perceptibly and also if they've like the form in which they were presented. Along with an optional open text box with opinions and suggestions.

The full questionnaire used can be found in the appendix B of this document, in Portuguese, exactly as it was presented to the participants.

7.2 Measures

The GEQ is a questionnaire that contains sentences regarding the user experience while interacting with a digital game. The user answers the questionnaire selecting from scale on how much he/she agrees with each sentence. The scale is defined with five levels of agreement: (0) not at all, (1) slightly, (2) moderately, (3) fairly, (4) extremely.

The questionnaire is divided in three different modules: (1) the Core Module, which concerns the user experience **while** playing the game and contains thirty-three sentences, (2) the Social Presence Module, which concerns psychological and behavioural involvement of the player with other social entities and contains seventeen sentences, and (3) the Post-game Module, which concerns the user experience **right after** playing the game and also contains seventeen sentences. The GEQ analyzes the user experience in several different dimension which are detailed in the table bellow (Table 7.1).

Table 7.1: GEQ dimensions.

Module	Dimension	Sentences/Items
Core Module	Competence	Items 2, 10, 15, 17, and 21.
	Sensory and Imaginative Immersion	Items 3, 12, 18, 19, 27, and 30.
	Flow	Items 5, 13, 25, 28, and 31.
	Tension/Annoyance	Items 22, 24, and 29.
	Challenge	Items 11, 23, 26, 32, and 33.
	Negative affect	Items 7, 8, 9, and 16.
	Positive affect	Items 1, 4, 6, 14, and 20.
Social Presence Module	Psychological Involvement – Empathy	Items 1, 4, 8, 9, 10, and 13.
	Psychological Involvement – Negative Feelings	Items 7, 11, 12, 16, and 17.
	Behavioural Involvement	Items 2, 3, 5, 6, 14, and 15.
Post-game Module	Positive Experience	Items 1, 5, 7, 8, 12, 16.
	Negative experience	Items 2, 4, 6, 11, 14, 15.
	Tiredness	Items 10, 13.
	Returning to Reality	Items 3, 9, and 17.

For GamEmotion only the core module and the post game module were used, although one can argue that the narrator and the NPC's are social entities in the game, after analysing the Social Presence Module items the decision was that these entities did not represented the social entities that this module aimed to evaluate.

It is also worth noticing that the GEQ was not validated in its Portuguese translation, however it has been vastly used in Portuguese studies [68][70].

The full original GEQ can be found in the appendix A of this document.

7.3 Results

As can be seen in Table 7.2 there was a sample of twenty-eight participants, with the mean age of 25.5 years old with a 5.94 standard deviation, with the youngest being nineteen years old and the oldest fifty-two. From these 53.6% were male, 39.3% female and 7.1% of participants of other gender, given us a somewhat balanced distribution between both genders. Regarding education, 57.1% had completed a masters degree, 32.1% had completed high school, 7.1% had finished the first cycle of higher education and finally 3.6% had a PhD. Finally regarding digital proficiency 78.6% selected the highest possible level when asked how comfortable they were with digital technology (Computers, tablet, smartphones), and no one chose a level lower than 3, on a scale from 1 to 5. The last question was also on a scale from 1 to 5, 1 being the lowest and 5 being

the highest and was about how comfortable or accustomed they were regarding experience with digital games, in his question only 50% of participants choose the highest level in contrast with the 78.6% from the previous question, also 39.3% of participants considered they had an average or lower than average experience with this type of games, with 10.7% considering they had very low to no experience at all.

Table 7.2: Survey Sociodemographic Data.

Sociodemographic Data		
Characteristic	**N**	**%**
Age		
19	3	10.7%
20	1	3.6%
21	2	7.1%
23	4	14.3%
25	2	7.1%
26	12	42.9%
28	1	3.6%
29	1	3.6%
32	1	3.6%
52	1	3.6%
Total	28	100%
Gender		
Female	11	39.3%
Male	15	53.6%
Other	2	7.1%
Total	28	100%
Education		
High School	7	25%
Technical Education	2	7.1%
College degree	2	7.1%
Masters degree	16	57.1%
PhD	1	3.6%
Total	28	100%
Proficiency with digital technology(Computers, tablets, smartphones,...)		
Average(3)	3	10.7%
High(4)	3	10.7%
Very High(5)	22	78.6%
Total	28	100%
Proficiency with digital games		
Very Low(1)	3	10.7%
Low(2)	1	3.6%
Average(3)	7	25%
High(4)	3	10.7%
Very High(5)	14	50%
Total	28	100%

The data collected from the GEQ itself, the core and post-game modules were studied quantitatively to obtain the percentages on the levels of agreement scale. The items were grouped by the respective dimensions of each module, like it is shown in the previous table.

Figure 7.1 shows the results obtained for each item of the GEQ core module divided by dimension.

Competence	Nada [0] (%)	Um pouco [1] (%)	Moderadamente [2] (%)	Bastante [3] (%)	Extremamente [4] (%)
2-Senti-me habilidoso	0	14	32	43	11
10-Senti-me competente	0	7	43	36	14
15-Fui bom no jogo	0	11	32	43	14
17-Senti-me bem sucedido	0	14	29	54	4
21-Fui rápido a alcançar os objetivos do jogo	0	14	32	43	11
Sensory and imaginative immersion	**Nada [0] (%)**	**Um pouco [1] (%)**	**Moderadamente [2] (%)**	**Bastante [3] (%)**	**Extremamente [4] (%)**
3-Estava interessado na historia do jogo	0	7	14	50	29
12-O jogo é esteticamente agradável	0	4	36	29	32
18-Senti-me criativo	11	32	25	25	7
19-Senti que podia explorar coisas	0	7	21	54	18
27-Achei o jogo impressionante	0	21	29	39	11
30-Senti que foi uma experiencia enriquecedora	0	11	39	32	18
Flow	**Nada [0] (%)**	**Um pouco [1] (%)**	**Moderadamente [2] (%)**	**Bastante [3] (%)**	**Extremamente [4] (%)**
5-Estava completamente focado no jogo	0	4	11	43	43
13-Esqueci tudo ã minha volta	7	32	29	18	14
25-Perdi a noção do tempo	14	39	25	18	4
28-Fiquei profundamente concentrado no jogo	11	18	36	29	7
31-Desliguei-me do mundo exterior	7	25	29	29	11
Tension/Annoyance	**Nada [0] (%)**	**Um pouco [1] (%)**	**Moderadamente [2] (%)**	**Bastante [3] (%)**	**Extremamente [4] (%)**
22-Senti-me chateado	68	25	7	0	0
24-Senti-me irritado	68	25	7	0	0
29-Senti-me frustrado	61	29	7	4	0
Challenge	**Nada [0] (%)**	**Um pouco [1] (%)**	**Moderadamente [2] (%)**	**Bastante [3] (%)**	**Extremamente [4] (%)**
11-Achei o jogo difícil	25	43	29	4	0
23-Senti-me pressionado	82	7	11	0	0
26-Senti-me desafiado	14	18	29	39	0
32-Senti a pressão do tempo	75	11	7	7	0
33-Tive de me esforçar bastante no jogo	29	29	32	11	0
Negative Affect	**Nada [0] (%)**	**Um pouco [1] (%)**	**Moderadamente [2] (%)**	**Bastante [3] (%)**	**Extremamente [4] (%)**
7-O jogo deixou-me mal disposto	75	21	4	0	0
8-Pensei em outras coisas durante o jogo	32	36	29	4	0
9-Achei o jogo cansativo	32	43	25	0	0
16-Senti-me entediado	39	46	14	0	0
Positive Affect	**Nada [0] (%)**	**Um pouco [1] (%)**	**Moderadamente [2] (%)**	**Bastante [3] (%)**	**Extremamente [4] (%)**
1-Senti-me satisfeito	0	0	29	57	14
4-Achei o jogo divertido	0	4	29	39	29
6-Senti-me feliz	0	0	50	32	18
14-Senti-me bem	0	7	43	43	7
20-Gostei do jogo	0	4	14	46	36

Figure 7.1: GEQ Core Module results.

Figure 7.2 shows the results obtained for each item of the GEQ post-game module divided by dimension.

Positive Experience	Nada [0] (%)	Um pouco [1] (%)	Moderadamente [2] (%)	Bastante [3] (%)	Extremamente [4] (%)
1-Senti-me renovado	32	36	25	7	0
5-Senti-me vitorioso	11	32	25	32	0
7-Senti-me estimulado	0	18	50	29	4
8-Senti-me satisfeito	0	18	36	43	4
12-Senti-me poderoso	50	18	21	11	0
15-Senti-me orgulhoso	25	14	25	18	18
Negative Experience	**Nada [0] (%)**	**Um pouco [1] (%)**	**Moderadamente [2] (%)**	**Bastante [3] (%)**	**Extremamente [4] (%)**
2-Senti-me mal	89	0	11	0	0
4-Senti-me culpado	93	7	0	0	0
6-Achei um desperdício de tempo	71	18	11	0	0
11-Achei que podia ter feito coisas mais uteis	46	36	14	4	0
14-Fiquei arrependido	93	7	0	0	0
16-Senti-me envergonhado	93	4	0	4	0
Tiredness	**Nada [0] (%)**	**Um pouco [1] (%)**	**Moderadamente [2] (%)**	**Bastante [3] (%)**	**Extremamente [4] (%)**
10-Senti-me exausto	82	14	4	0	0
13-Senti-me cansado	82	14	0	4	0
Returning To Reality	**Nada [0] (%)**	**Um pouco [1] (%)**	**Moderadamente [2] (%)**	**Bastante [3] (%)**	**Extremamente [4] (%)**
3-Achei difícil voltar à realidade	89	7	4	0	0
9-Senti-me desorientado	64	25	7	4	0
17-Senti-me como se tivesse voltado de uma jornada	14	25	43	14	4

Figure 7.2: GEQ Post-Game Module results.

To visualize the data in a graphical way bar graphs were generated representing the percentage of participants that selected a certain agreement level to each sentence, divided by dimension. The horizontal axis represents the scale of agreement to each sentence and the vertical axis represents the percentage of participants that selects that level of agreement to each sentence. The labels contain the select level to the corresponding sentence.

The following graph (Figure 7.3) contains data related to the GEQ Core competence dimension, that regard how the participant evaluated his/her ability and performance in the game. From looking at this dimension as a whole we can see that the vast majority of participants evaluated the game with the agreement levels 2 and 3 which means that the difficult level of the game is quite balanced or a little on the easier side but not a lot, which can indicate that the game is not so hard that it would frustrate the player nor so easy that is would not be challenging.

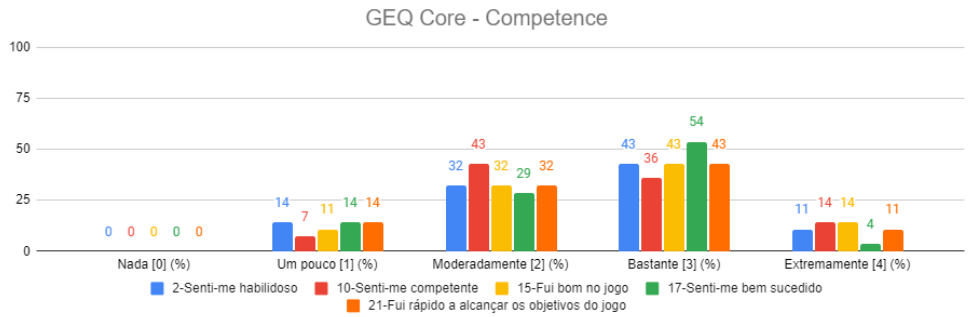


Figure 7.3: GEQ Core - Competence results.

The following graph (Figure 7.4) contains data related to the GEQ Core Sensory and Imaginative Immersion dimension, that regard how much the player felt immersed in the game world. This graph also show us a big incidence on the right most side of the agreement scale which could indicate that the participants found the story line and environment enjoyable and pleasant. However

item 18 could be considered an outlier in this dimension since this item was the one the participant rated the lowest, this can mean the creativeness of the player in game could be improved.

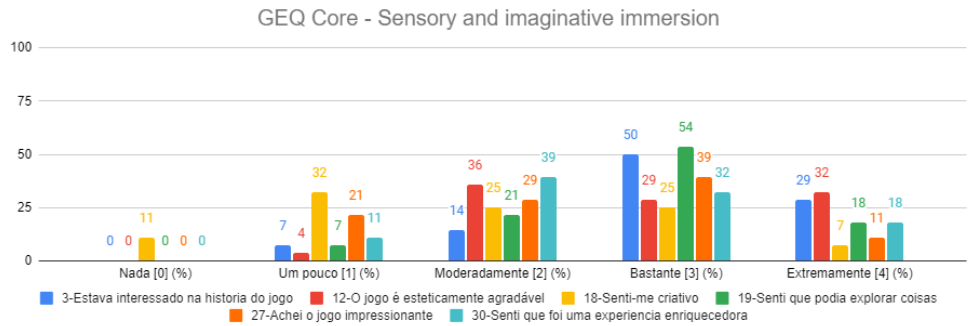


Figure 7.4: GEQ Core - Sensory and Imaginative Immersion results.

The following graph (Figure 7.5) contains data related to the GEQ Core Flow dimension, that regards the participants perception of the story line and the direction imposed by the game. In here we can also see that the majority of responses lay in the middle between level 1 and 3, which means that there is room for improvement but there is an overall balance. It is important to say that 86% of participants rated item 5 on the top two levels of the scale, saying that they were totally focused on the game, which is a positive indicator.

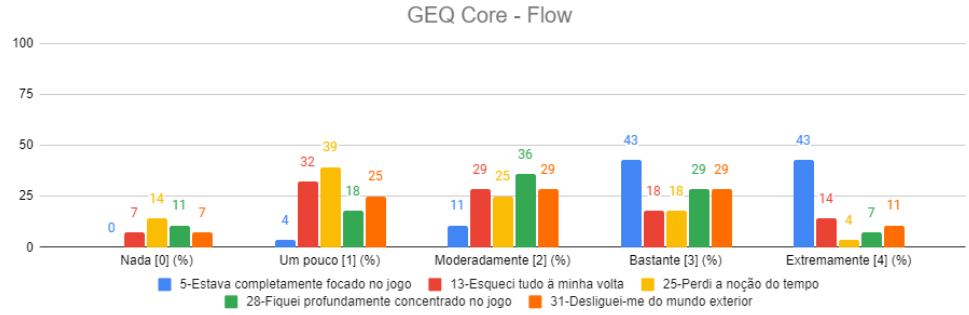


Figure 7.5: GEQ Core - Flow results.

The following graph (Figure 7.6) contains data related to the GEQ Core Tension/Annoyance dimension, which evaluates if the player felt tense or annoyed while playing the game. We can see that all items in this dimension had at least 89% of their evaluations on the two left most scores of the scale, which means that the game did not tense up or annoy the player.

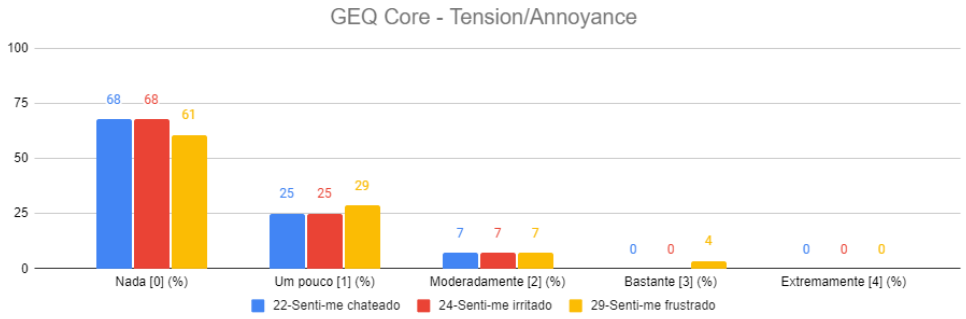


Figure 7.6: GEQ Core - Tension/Annoyance results.

The following graph (Figure 7.7) contains data related to the GEQ Core Challenge dimension, which evaluates how the player perceives the challenges presented to him/her as well how difficult or easy they were. In here we can also see that most of the answers fell on the left half of the graph except for item 26 which was more evenly distributed with 39% of participants rating it on the upper side of the scale in level 3. These are positive results which mean that the participants did not find the game to be too difficult while also making them fell like a challenge and thus giving a purpose to the play session.

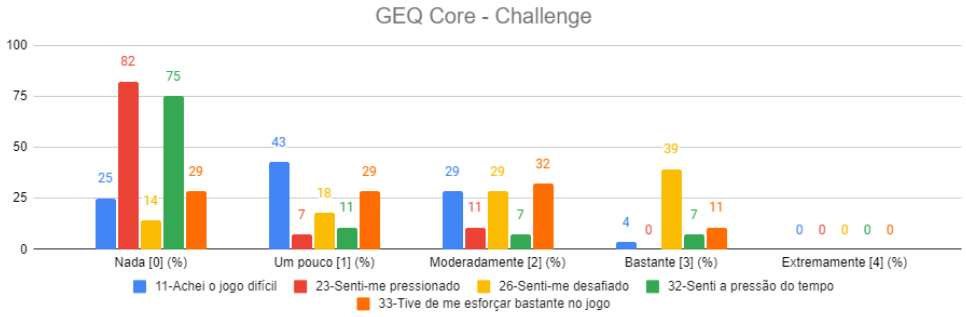


Figure 7.7: GEQ Core - Challenge results.

The following graph (Figure 7.8) contains data related to the GEQ Core Negative affect dimension, which evaluates if the game caused an affect on the player that was perceived as negative. Looking at the graph we can easily see that 96% of all answer fall on the left most half which in this case is a good indicator. However its noticeable that item 9 had a quarter of the participants rating it at level 2, I believe this could be to the fact that given the translation some people may have interpreted item 9 as "I found the game boring" instead of "I found the game tiring".

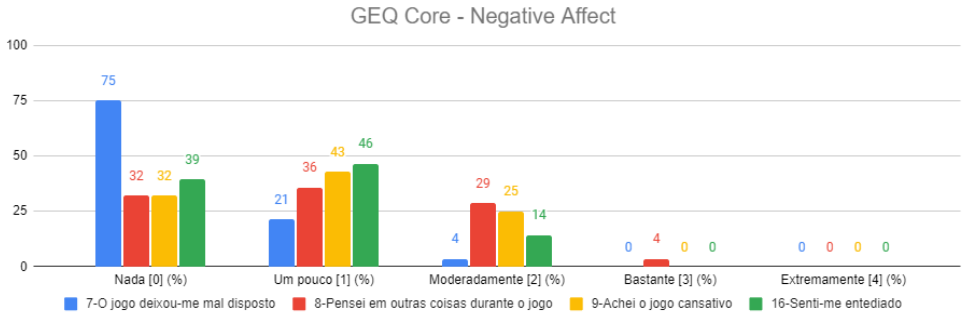


Figure 7.8: GEQ Core - Negative affect results.

The following graph (Figure 7.9) contains data related to the GEQ Core Positive affect dimension, which evaluates if the game caused an affect on the player that was perceived as positive. I believe there are no particular outliers here as we can see the vast majority of answers falling in the right most half of the graph which is a good indicator.

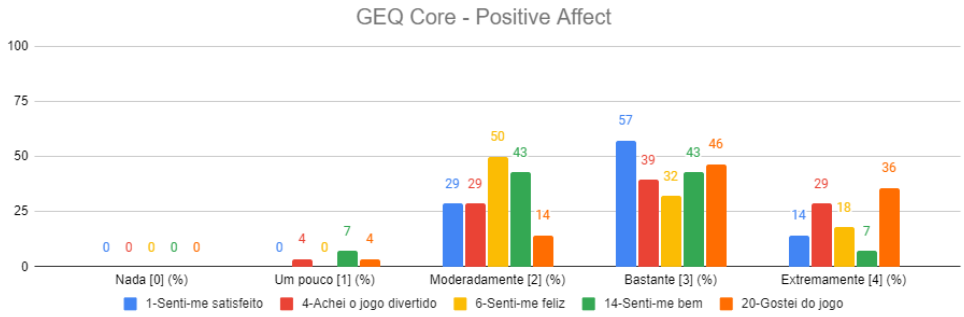


Figure 7.9: GEQ Core - Positive affect results.

For the GEQ Post Game module the same type of graphs were generated also divided by dimension. The first graph (Figure 7.10) contains data related to the GEQ Post Game Positive Experience dimension. The graph show us a more or less even distribution in the middle, between levels 1, 2 and 3. This means there are still room for improvement but the overall score is not negative.

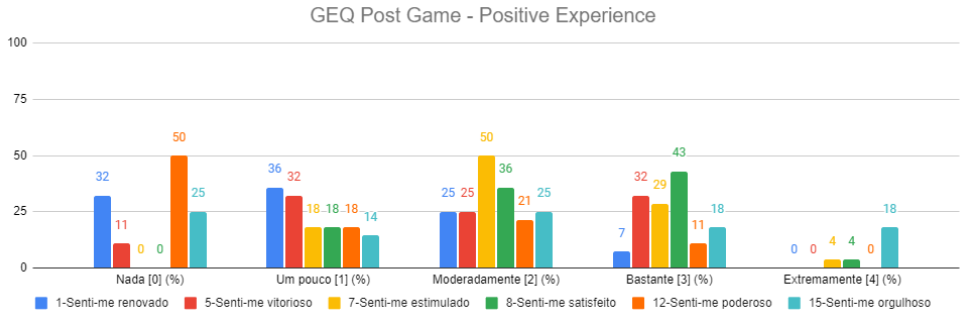


Figure 7.10: GEQ Post Game - Positive Experience results.

On the other hand when looking at the GEQ Post Game Positive Experience dimension graph (Figure 7.11) we can see the vast majority of the responses are on level 0 which means the participants disagree with the items sentence. This is a positive result for GamEmotion indicating that the game did not had a negative impact on the guilt, shame, regret or well-being of the player after the play session.

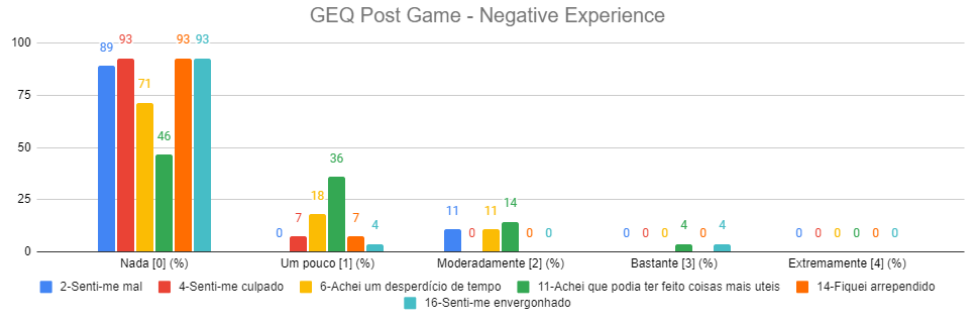


Figure 7.11: GEQ Post Game - Negative Experience results.

The following graph (Figure 7.12) contains data related to the GEQ Post Game Tiredness dimension, it is also easily seen that at least 96% of the participants felt little to no tiredness at all after playing the game, which is also a good indicator.

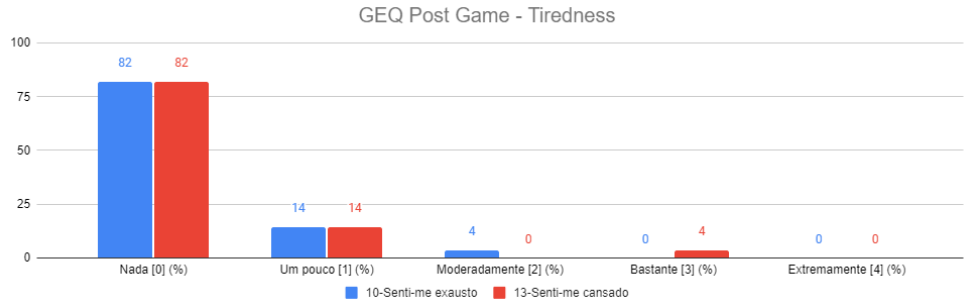


Figure 7.12: GEQ Post Game - Tiredness results.

The last graph (Figure 7.13) contains data related to the GEQ Post Game Returning to Reality dimension, that regards how the participant felt after disconnecting from the game after the play session. In this graph most of the answers also fall on the left most half of the graph, this can be good for item 9 but could also mean that the game could be a little more immersive or thought provoking if we take into account item 3. However 61% of the participants evaluated on the right most half of the graph item 17 saying that "They felt like they've returned from a journey" which I also believe is a good indicator.

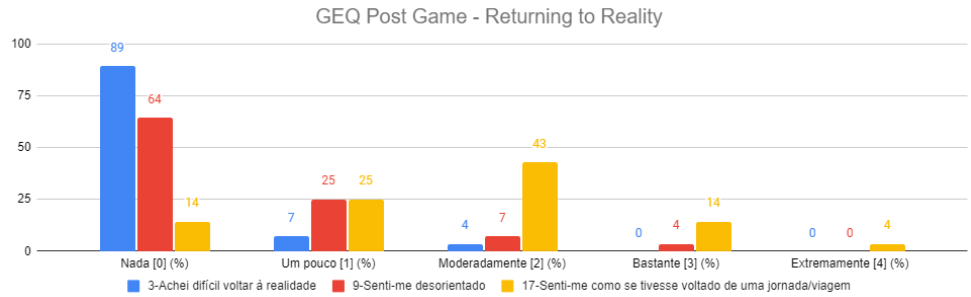


Figure 7.13: GEQ Post Game - Returning to Reality results.

Has the final section of the surveys the participants were asked to rate the clarity and presentation form of the materials, on the following graph (Figure 7.14) we can see that the result was very positive specially on how clear and easily understandable the materials were, some participants believe however that the form of how the materials are conveyed to the player could be improved upon.

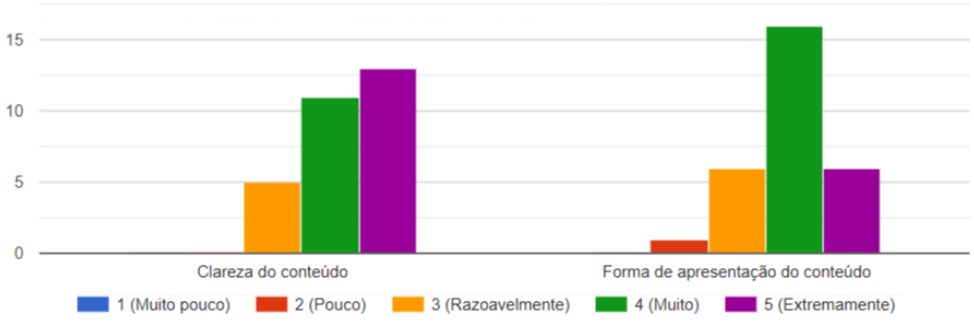


Figure 7.14: Graph regarding the materials presentation.

The most pointed out concern was that had the highest number of complaints in the open text box at the end of the survey was the font chosen to use in the player journal during the castle level, participants complained that it was hard to read and did not contained all UTF-8 characters and thus not being able to display some accentuated words. There was also one participant that said that the character movement, particularly the mouse movement in third person view could be improved on. And finally one participant said that it could be a good idea to better explore the architecture structure of the castle and use the layout to separate the emotions instead of separating the different emotions on a different castle, since this approach did not reflect what happens in the real world.

In conclusion, after analysing all the results from the GEQ one can see that, despite having some aspects that can be worked and improved upon the overall score was very positive, which represents that the participants had a good and pleasant experience while playing GamEmotion.

Chapter 8

Conclusions and Future work

In this section thew will be the conclusion of the performed work as well as the future work that could be done on the project.

8.1 Conclusions

From the beginning of this project it was evident that there was a lack of SG directed towards emotion regulation targeting adolescents, it was also clear that this is an emerging topic and there is a lot of market and demand for these types of applications, both from adolescents and from educators/therapists.

Game development is a fascinating field but it is replete with details and little nuances. It was also obvious from the literature and also from experience that game development is a multi-disciplinary field. In this project I had the assistance from my supervisor Eliana Silva, who is a psychologist with experience in the study of emotions in adolescence, and Luís Paulo Reis, head of the Artificial Inteligence lab at FEUP. They helped me with with the script writing and some technical directions, respectively, which were much appreciated, but there were some limitations in regard of 3d models an sound assets since these fields are not a part of my personal skill set as a developer. Given these constrain and also the time frame available to develop this product I can say that I'm really proud of how the final product turned out, and I believe this proudness is backed up by the GEQ results, which indicates a very good user experience from the participants.

In the end a unity based 3D action-adventure game aimed at teaching adolescents about emotions and emotional strategies regulation was developed, with working builds to Windows, MacOS and Linux.

8.2 Future work

As future work for this project the biggest improvement I believe it would be to add more emotional strategies to the game since due to time constrains only two were developed. Also all the suggestions that emerged from the survey participant should be considered, namely the mouse controls and jump mechanics, that could be improved upon. Besides this there are some small bugs in the game the are easily fixed.

Out of the development scope the game could and should be also tested with the target audience in order to access the therapeutics value of GamEmotion.

Appendix A

Game Experience Questionnaire - Original

A.1 Core Module

Please indicate how you felt while playing the game for each of the items, on the following scale:

not at all	slightly	moderately	fairly	extremely
0	1	2	3	4
< >	< >	< >	< >	< >

1 I felt content
2 I felt skilful
3 I was interested in the game’s story
4 I thought it was fun
5 I was fully occupied with the game
6 I felt happy
7 It gave me a bad mood
8 I thought about other things
9 I found it tiresome
10 I felt competent
11 I thought it was hard
12 It was aesthetically pleasing
13 I forgot everything around me
14 I felt good
15 I was good at it
16 I felt bored

17 I felt successful
18 I felt imaginative
19 I felt that I could explore things
20 I enjoyed it
21 I was fast at reaching the game's targets
22 I felt annoyed
23 I felt pressured
24 I felt irritable
25 I lost track of time
26 I felt challenged
27 I found it impressive
28 I was deeply concentrated in the game
29 I felt frustrated
30 It felt like a rich experience
31 I lost connection with the outside world
32 I felt time pressure
33 I had to put a lot of effort into it

A.2 Social Presence Module

Please indicate how you felt while playing the game for each of the items, on the following scale:

not at all	slightly	moderately	fairly	extremely
0	1	2	3	4
< >	< >	< >	< >	< >

1 I empathized with the other(s)
2 My actions depended on the other(s) actions
3 The other's actions were dependent on my actions
4 I felt connected to the other(s)
5 The other(s) paid close attention to me
6 I paid close attention to the other(s)
7 I felt jealous about the other(s)
8 I found it enjoyable to be with the other(s)
9 When I was happy, the other(s) was(were) happy
10 When the other(s) was(were) happy, I was happy
11 I influenced the mood of the other(s)
12 I was influenced by the other(s) moods

13 I admired the other(s)
14 What the other(s) did affected what I did
15 What I did affected what the other(s) did
16 I felt revengeful
17 I felt schadenfreude (malicious delight)

A.3 Post-Game Module

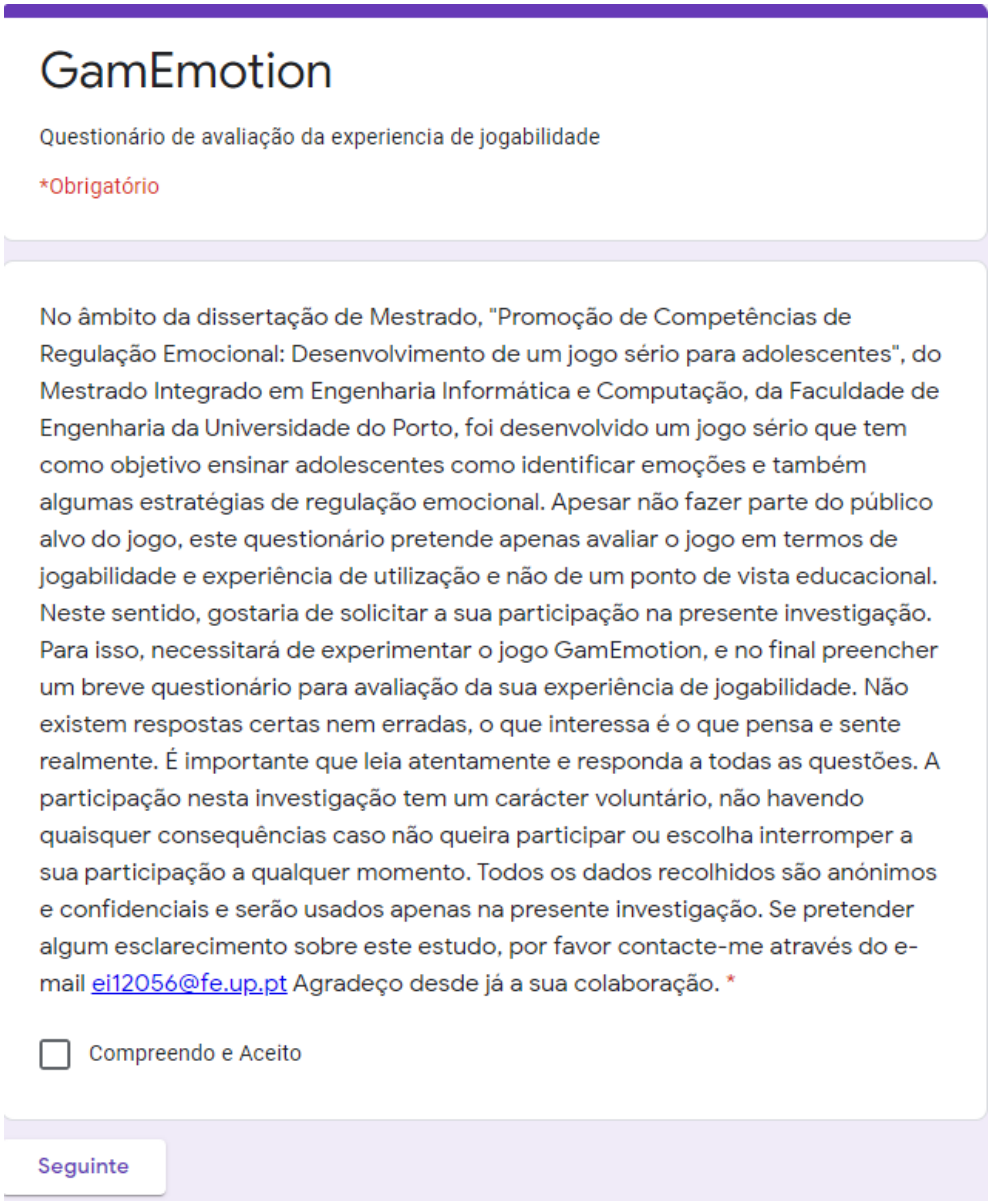
Please indicate how you felt while playing the game for each of the items, on the following scale:

not at all	slightly	moderately	fairly	extremely
0	1	2	3	4
< >	< >	< >	< >	< >

1 I felt revived
2 I felt bad
3 I found it hard to get back to reality
4 I felt guilty
5 It felt like a victory
6 I found it a waste of time
7 I felt energised
8 I felt satisfied
9 I felt disoriented
10 I felt exhausted
11 I felt that I could have done more useful things
12 I felt powerful
13 I felt weary
14 I felt regret
15 I felt ashamed
16 I felt proud
17 I had a sense that I had returned from a journey

Appendix B

Game Experience Questionnaire - Versão Utilizada



GamEmotion

Questionário de avaliação da experiencia de jogabilidade

*Obrigatório

No âmbito da dissertação de Mestrado, "Promoção de Competências de Regulação Emocional: Desenvolvimento de um jogo sério para adolescentes", do Mestrado Integrado em Engenharia Informática e Computação, da Faculdade de Engenharia da Universidade do Porto, foi desenvolvido um jogo sério que tem como objetivo ensinar adolescentes como identificar emoções e também algumas estratégias de regulação emocional. Apesar não fazer parte do público alvo do jogo, este questionário pretende apenas avaliar o jogo em termos de jogabilidade e experiência de utilização e não de um ponto de vista educacional. Neste sentido, gostaria de solicitar a sua participação na presente investigação. Para isso, necessitará de experimentar o jogo GamEmotion, e no final preencher um breve questionário para avaliação da sua experiência de jogabilidade. Não existem respostas certas nem erradas, o que interessa é o que pensa e sente realmente. É importante que leia atentamente e responda a todas as questões. A participação nesta investigação tem um carácter voluntário, não havendo quaisquer consequências caso não queira participar ou escolha interromper a sua participação a qualquer momento. Todos os dados recolhidos são anónimos e confidenciais e serão usados apenas na presente investigação. Se pretender algum esclarecimento sobre este estudo, por favor contacte-me através do e-mail ei12056@fe.up.pt Agradeço desde já a sua colaboração. *

☐ Compreendo e Aceito

Seguinte

GamEmotion

*Obrigatório

GamEmotion

Questionário de avaliação da experiencia de jogabilidade

Antes de começar o questionário, por favor indique

A sua idade *

A sua resposta

O seu sexo *

Selecionar

Habilitações Literárias *

Selecionar

Sendo 1 o nível mais baixo e 5 o nível mais alto, avalie de 1 a 5 a sua proficiência relativa a: *

	1 (Muito Baixa)	2 (Baixa)	3 (Média)	4 (Elevada)	5 (Muito Elevada)
Experiencia com tecnologias digitais (Computadores, tablets, smartphones, ...)	○	○	○	○	○
Experiencia com jogos digitais	○	○	○	○	○

GamEmotion

Questionário de avaliação da experiencia de jogabilidade (1/3)

Por favor indique como se sentiu enquanto jogava o jogo, para cada um dos seguintes itens: *

	Nada [0]	Um pouco [1]	Moderadamente [2]	Bastante [3]	Extremamente [4]
Senti-me satisfeito	○	○	○	○	○
Senti-me habilidoso	○	○	○	○	○
Estava interessado na historia do jogo	○	○	○	○	○
Achei o jogo divertido	○	○	○	○	○
Estava completamente focado no jogo	○	○	○	○	○
Senti-me feliz	○	○	○	○	○
O jogo deixou-me mal disposto	○	○	○	○	○
Pensei em outras coisas durante o jogo	○	○	○	○	○
Achei o jogo cansativo	○	○	○	○	○
Senti-me competente	○	○	○	○	○
Achei o jogo difícil	○	○	○	○	○
O jogo é esteticamente agradável	○	○	○	○	○
Esqueci tudo ä minha volta	○	○	○	○	○
Senti-me bem	○	○	○	○	○
Fui bom no jogo	○	○	○	○	○

Senti-me entediado	○	○	○	○	○
Senti-me bem sucedido	○	○	○	○	○
Senti-me criativo	○	○	○	○	○
Senti que podia explorar coisas	○	○	○	○	○
Gostei do jogo	○	○	○	○	○
Fui rápido a alcançar os objetivos do jogo	○	○	○	○	○
Senti-me chateado	○	○	○	○	○
Senti-me pressionado	○	○	○	○	○
Senti-me irritado	○	○	○	○	○
Perdi a noção do tempo	○	○	○	○	○
Senti-me desafiado	○	○	○	○	○
Achei o jogo impressionante	○	○	○	○	○
Fiquei profundamente concentrado no jogo	○	○	○	○	○
Senti-me frustrado	○	○	○	○	○
Senti que foi uma experiencia enriquecedora	○	○	○	○	○
Desliguei-me do mundo exterior	○	○	○	○	○
Senti a pressão do tempo	○	○	○	○	○
Tive de me esforçar bastante no jogo	○	○	○	○	○

Por favor indique como se sentiu logo após parar de jogar, para cada um dos seguintes itens: *

	Nada [0]	Um pouco [1]	Moderadamente [2]	Bastante [3]	Extremamente [4]
Senti-me renovado	○	○	○	○	○
Senti-me mal	○	○	○	○	○
Achei difícil voltar à realidade	○	○	○	○	○
Senti-me culpado	○	○	○	○	○
Senti-me vitorioso	○	○	○	○	○
Achei um desperdício de tempo	○	○	○	○	○
Senti-me estimulado	○	○	○	○	○
Senti-me satisfeito	○	○	○	○	○
Senti-me desorientado	○	○	○	○	○
Senti-me exausto	○	○	○	○	○
Achei que podia ter feito coisas mais uteis	○	○	○	○	○
Senti-me poderoso	○	○	○	○	○
Senti-me cansado	○	○	○	○	○
Fiquei arrependido	○	○	○	○	○
Senti-me orgulhoso	○	○	○	○	○
Senti-me envergonhado	○	○	○	○	○
Senti-me como se tivesse voltado de uma jornada/viagem	○	○	○	○	○

GamEmotion

Questionário de avaliação da experiencia de jogabilidade (3/3)

Sendo 1 o nível mais baixo e 5 o nível mais alto, avalie de 1 a 5, o seu nível de satisfação RELATIVAMENTE AO CONTEÚDO: *

	1 (Muito pouco)	2 (Pouco)	3 (Razoavelmente)	4 (Muito)	5 (Extremamente)
Clareza do conteúdo	○	○	○	○	○
Forma de apresentação do conteúdo	○	○	○	○	○

(Opcional) Se não gostou da forma como foi apresentado o conteúdo indique porque e de que outras formas gostaria de ver o conteúdo apresentado

A sua resposta

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