

DM

Splinter Studio
Narrative and game mechanics with cultural context

MASTER DISSERTATION

João David Martins de Freitas
MASTER IN INTERACTIVE MEDIA DESIGN



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Abstract

Lucky Hero's Legacy is an adventure game based on the cultural heritage of Madeira Island. Aiming, to mitigate the lack of interest of teenagers in cultural heritage. The game was designed so that teenagers can explore various scenarios of Madeira Island involving the region's legends and heritage.

This document covers the entire process behind creating the narrative based on Madeira legends, the game mechanics that provide entertainment and educational content as well as how all of this was implemented technically.

To show the effectiveness of the videogame as a media of transmitting information regarding cultural heritage. Therefore, an evaluation was carried out involving 15 teenagers. In which it showed positive results in retaining information from young people as well as their learning about the cultural heritage of Madeira. So, Lucky Hero's Legacy contributes with a new approach for teens to engage with Culture Heritage, as well as serving as a way of preserving it.

Keywords: Game Development, Adventure Game, Unity, Narrative, Game Mechanics.

Resumo

Lucky Hero's Legacy é um jogo de aventura, com base no património cultural da Ilha da Madeira. Com objetivo de mitigar a falta de interesse dos adolescentes referente ao património cultural. O jogo foi pensado de forma que os adolescentes explorem vários cenários da Ilha da Madeira envolvendo lendas e patrimónios da região.

Este documento aborda todo o processo por detrás da criação da narrativa com base em lendas da Madeira, como também mecânicas de jogo que ofereçam entretenimento e conteúdo educacional.

Para mostrar a eficácia do videojogo como meio de transmissão de informação relativamente ao património cultural, foi realizada uma avaliação envolvendo 15 adolescentes. Em que esta mostrou ter um resultado positivo na retenção de informação dos jovens como também a sua aprendizagem sobre o património cultural da Madeira. Então, Lucky Hero's Legacy contribui com uma nova abordagem para os adolescentes interessarem pelo património cultural, como também servindo como meio para a sua preservação.

Palavras-chave: Desenvolvimento de jogos, jogos de aventura, Unity, Narrativa, Mecânicas de jogo.

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Acronyms

NPC – Non-Playable Character

MMORPG – Massive Multiplayer Online Role-Playing Game

RPG – Role-Playing Game

I. Introduction

Cultural Heritage throughout the years has been forgotten, and to immortalize all this historical knowledge Ethnography museums were created. However, there seems to be a general lack of interest from people in visiting those museums, since a recent report regarding the current state of museums in Portugal revealed that Ethnography museums in Portugal were on the top of the least attended museums, with only 3.9% of attendance (Figure 1).

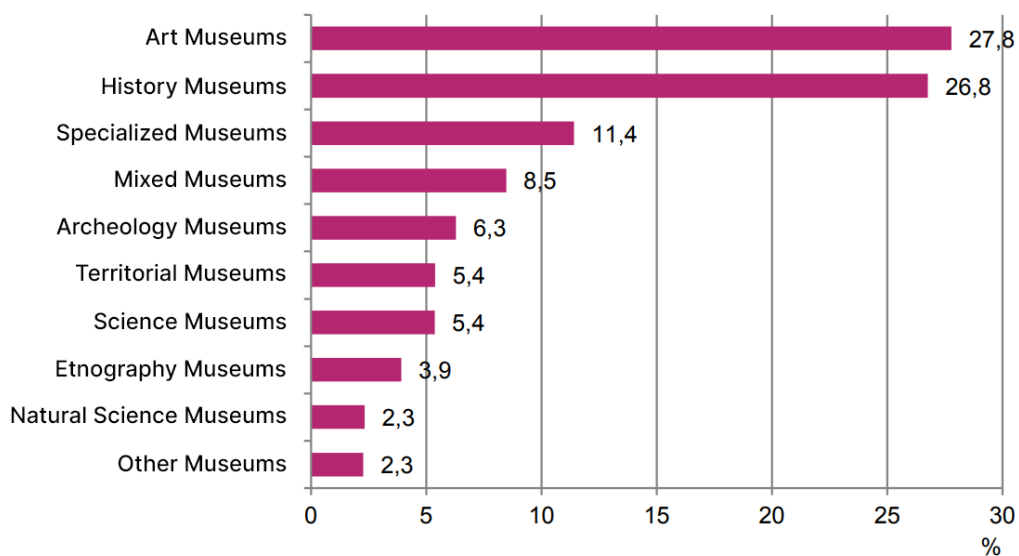


Figure 1 - Total of visitants, per genre of Museum (%). Adapted from [1]

In Madeira, it was verified that museums were mostly visited by tourists [1], exactly 63,2%, compared to Portuguese people both from mainland and locals, 47.6% (Figure 2).

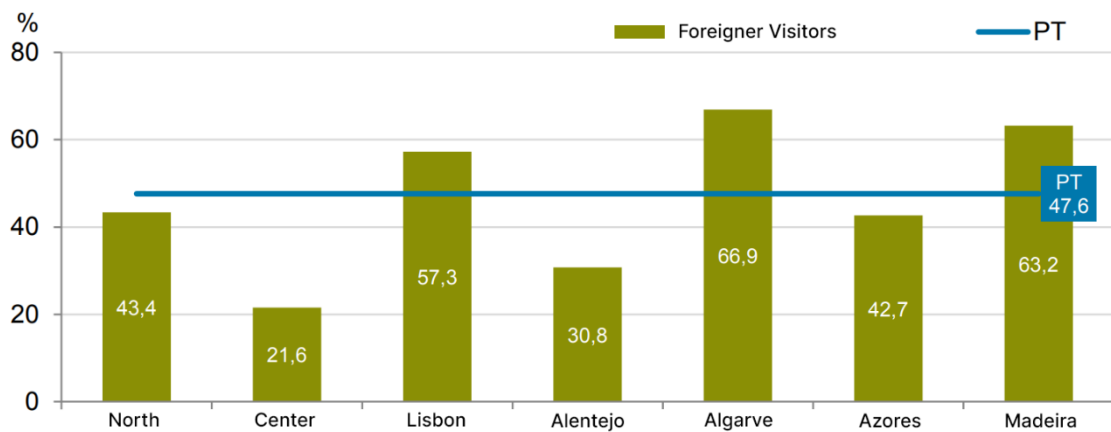


Figure 2 - Total of foreign visitants of museums by NUTS II (%), 2018. Adapted from [1]

In addition, it was wanted to compare if locals' interest in museums were the same as other countries in the EU [2]. Thus, confirmed that EU countries have more interest on their own cultural and historic background compared to locals from Portugal (Figure 3). We concluded that Portugal in a whole has a lack of interest related to Portuguese cultural heritage. Speculating that this factor is mostly influenced by the lack of information distributed around the community. Also, an improvement in how this information is distributed alongside practical activities related to each region's culture (Figure 4).

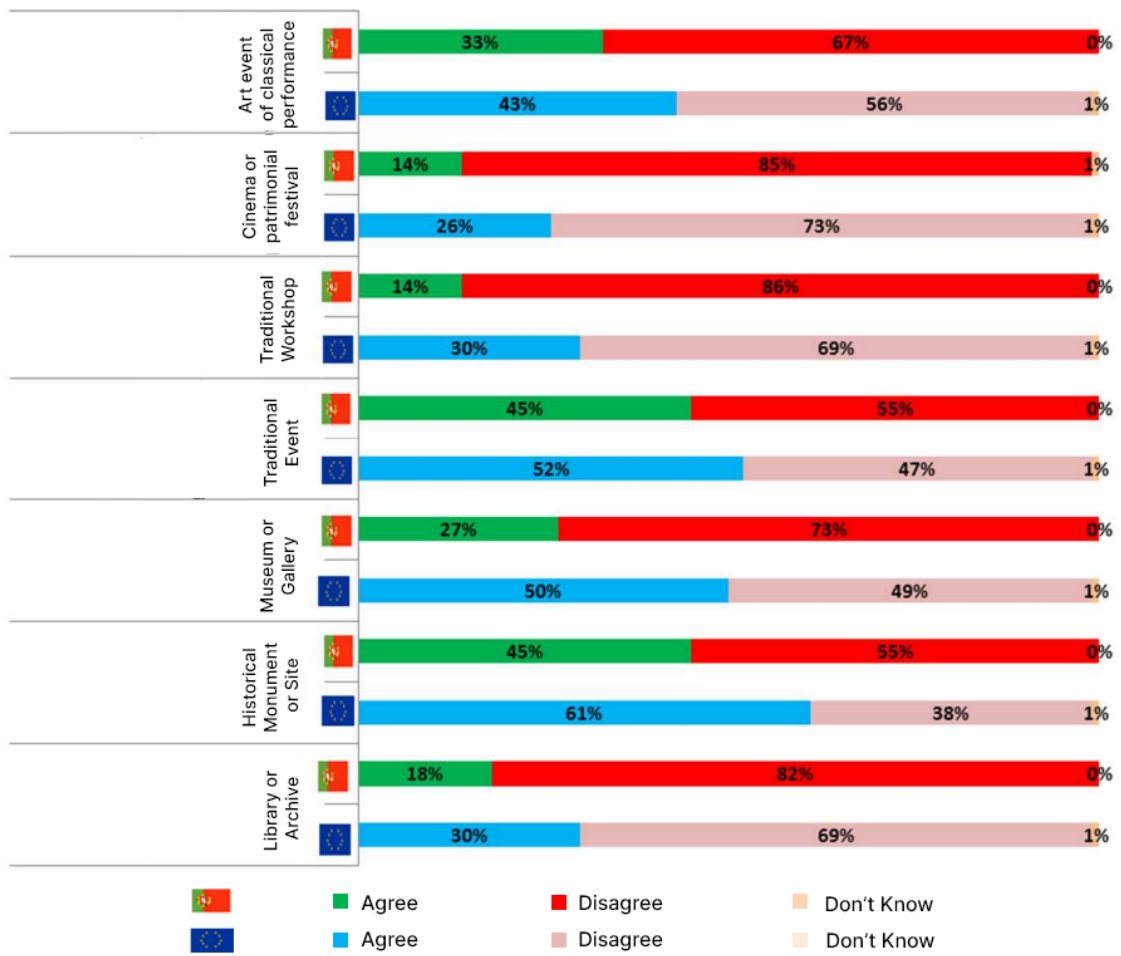


Figure 3 - Comparison Portugal and EU relative to Cultural Heritage. Adapted from [2]

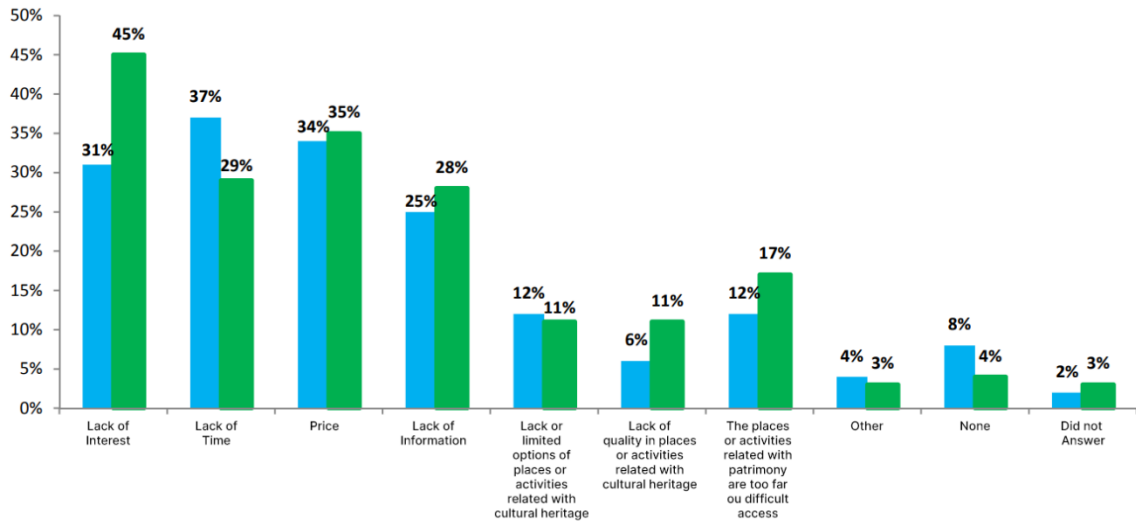


Figure 4 - Primary barriers for cultural heritage access. Adapted from [2]

Following this, according to (Figure 5), most of the Portuguese point out the local and mainland government to be responsible of preserving and enhancing the way that cultural heritage is divulged inside the community [2]. As well, referring that universities or investigation centres should help the government in preserving and divulging information relative to Cultural Heritage[2], by creating new methods to spread knowledge between the community.

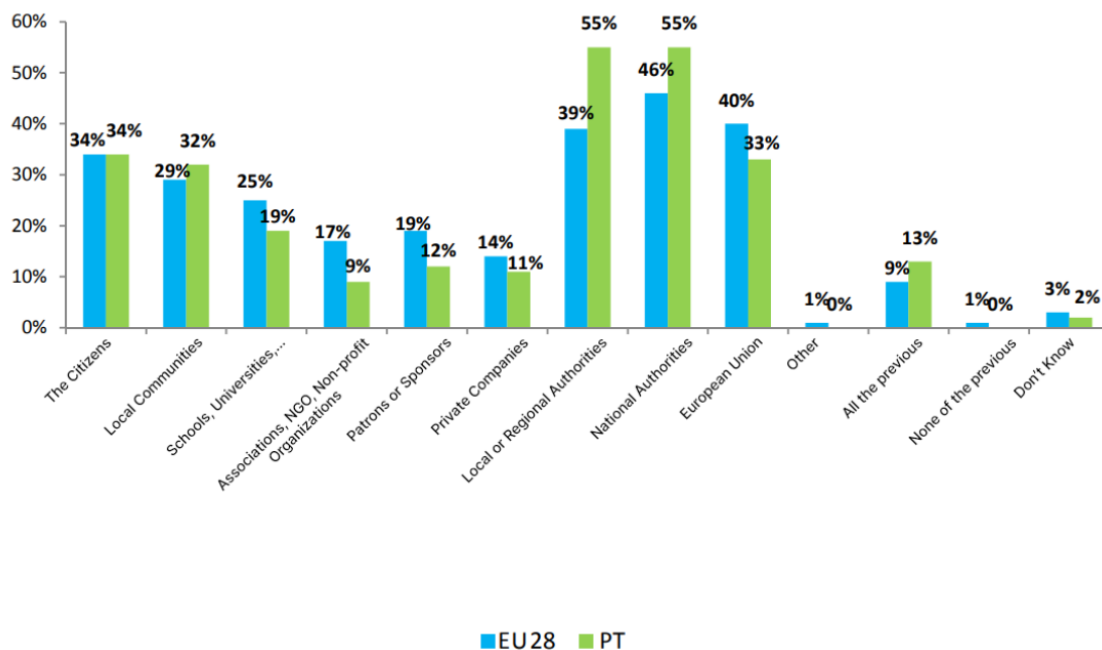


Figure 5 - Who should do more to protect the European cultural heritage. Adapted from [2]

Furthermore, a visit to the “Museu Etnográfico da Madeira” was carried out to understand at the local level what were the challenges. The museum's pedagogical team confirmed numerous difficulties to capture the attention of a specific target group, the teenagers. Since this target group is the future of our society, we decided to tackle the challenge to engage teenagers in cultural heritage relative to Madeira

Therefore, there was a need to redirect the attention of the younger audience into the cultural aspect. By the Dale’s Cone of Experience (Figure 6) [3], where it uses many methods of learning and measuring those methods to achieve the best approach to retain the information that was learned. It was achieved by surveying students about learning through simulation of the real-world usage of a given subject instead of traditional learning methods. Thus, the study showed that Dale’s Cone of Experience [3] works and in fact students are more capable of retaining information by doing than just hearing or reading. Furthermore, with some analysis it was possible to verify a higher interest in video games by teenagers and these

video games linked with some cultural context can be an ideal educational media to deliver knowledge[4]. Currently, video games have great potential of entertaining anyone that comes across it. There is a great opportunity to use that potential to implement cultural heritage information to leverage learning and immortalization of this historic knowledge. The aforementioned idea of using video games for educational purposes is already being put into practice, denominated as serious games. This type of game ignores all the entertainment aspects present in entertainment games, which could be used for their advantage. Since, according to Zyda, even if the educational aspect is the goal for a serious game, it should always be secondary compared to entertainment [5]. Serious games should use some design ideas and resources from entertainment games to boost their interest among their target audience.

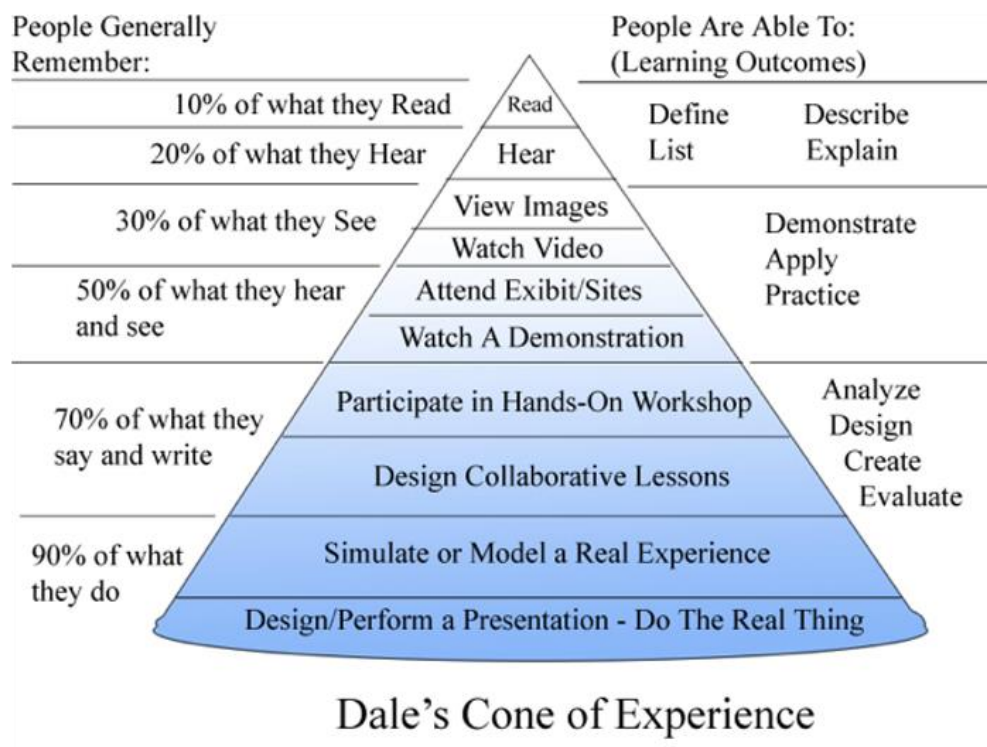


Figure 6 - Dale's Cone of Experience[3]

For all those reasons, the group saw an opportunity of contribution and became motivated to develop a project which consists of a video game with cultural context, to achieve primarily the teenagers' interest in Madeiran culture heritage and deliver knowledge in an entertaining way.

Therefore, this project is developed by two students at University of Madeira from the Master of Design Media Interactive, namely, Louis Michael and João Freitas. For this collaboration it was created a studio like any other video game development group in the video game development business, designated as Splinter Studio. In order to develop this project, tasks were distributed among the two contributions. One referring to all 3D processes and visual aesthetics of the game for cultural preservation in the contribution of Louis Michael – *“Modelação 3D englobando o Património Cultural”*. This contribution *“Narrative and Game Mechanics with Cultural Context”* approaches all the game mechanics implementation and narrative development with cultural context. Could be achieved by resourcing to most possible design ideas used in entertainment games and developing an educational game with an entertainment edge. Highlighting that both contributions share the same objective, to draw the interest and educate the youngsters about Madeiran Culture.

Furthermore, this project will be divided in phases, being the first phase the development of the storyline by resourcing to the Madeiran Myths and Legends to build the backbone of the narrative. By developing a fictional main character, his allies and enemies. Hence, developing the core game mechanics and interactions of the game to be implemented in the first prototype used for pilot testing.

The final phase will incorporate all the feedback received and improve the overall functionality of the game and include more levels based on the full narrative and cultural information available. This type of content

will be present in form of quests and cinematics through the levels in the game.

A. Research Objectives

In order to mitigate the lack of awareness of Madeiran Culture between teenagers, the main objective of this research is to develop a videogame that includes in its narrative and game mechanics knowledge about the Madeira Cultural Heritage and legends with the aim to encourage teenagers to know more about their culture and past.

Therefore, this research effort will be to design an engaging Narrative and Game Mechanics that includes Cultural heritage. To achieve this, we will investigate how we can design a fictional narrative that ties in legends of Madeira and which game mechanics can better support the delivery of such narrative and cultural knowledge. Hence, the efforts of this research will concentrate into answering the following research questions:

RQ1: Can a fictional narrative developed for a video game deliver cultural information to be retained by the teenagers?

RQ2: What kind of game mechanics and level design can be used to instigate interest and engagement among teenagers to Madeiran Cultural Heritage?

According to the previous points design factors pointed by other researchers, specially [6]. Allowed for a better sight for the development of the project. Therefore, this project had several phases of development, being the first phase the development of the storyline by resourcing to the Madeiran Myths and Legends to build the backbone of the narrative, described in section *Narrative Development*. By developing a fictional main character, his allies and enemies. Hence, the following phase is for developing the core game mechanics and interactions of the game to be

implemented in the first prototype used for pilot testing, described in section *Game Implementation*.

Following with the final phase will incorporate all the feedback received and improve the overall functionality of the game and include more levels based on the full narrative and cultural information available. This type of content will be present in form of quests and cinematics through the levels in the game. Finally, an evaluation is realized to discover the effectiveness of the experience, in section *Final Prototype Evaluation*.

II.Literature Review

Cultural Heritage is often explained and displayed in museums, through real representations, real tools used at that time or digital scans to preserve old items. Another approach can be impactful by transmitting this knowledge about culture through a video game.

In order for the video game to have an impact on teenager's attention, there is a need to structure a story for it. There are two structural ways of narrative, linear and non-linear.

In one hand, there is Linear which is more straightforward and simple way of telling a story, that are usually fixed in a chronological order. In the other hand, there is Nonlinear storytelling, which divides in subcategories depending on genre of video game and chronological order[7]. These subcategories primarily are, Open World narrative, where there is more than one narrative which are considered side-quests or side-stories, in which each individual story has their own branching being linear or not. After, there is branching structure, which the beginning of the narrative starts from one point and as the player as to take a decision it branches into different endings, giving more endings for the same narrative depending on the actions of the player. Finally, there is Parallel Narrative, which independently of the decisions that the player makes, it all branches down to the same ending. This allows for players to play the game multiple times and take different paths each run of the story but achieve the same goal at the end. Each type to structure will be revised and taken in consideration when shaping the narrative for the video game, keeping in mind that the target audience are teenagers who will affect the complexity of the narrative for better information transmission.

The approach of a video game based on Cultural Heritage has been done more than once, in fact case studies have shown a great potential of

this approach. These types of games are categorized as Serious Games (SG) [8] in which they are developed solely to educate users about Cultural Heritage. Another type of Serious Games was developed by introducing a Sandbox feature in the educational matter of the game. In which, all the knowledge to be delivered in the game should be spatially organized and should be simple activities for the user to embody the knowledge that can be discovered. Thus, this type of approach opened a new world on how we could immortalize the cultural heritage of a given area and a new way to induce knowledge to every user of this type of game. Although, it is not only how the knowledge is distributed in the game but also the environment design surrounding that game. A virtual representation of Cultural Heritage can create adventures and reconstruct places where the player can have a contextualized experience through gaming.

Another perspective of serious games in which their main objective is learning, is to include a genre of video game. In which, it can improve focusing on some key aspects for example: Cultural Awareness, Historical Reconstruction, Artistic/Archaeological Heritage Awareness, Architectural/Natural Heritage Awareness [6].

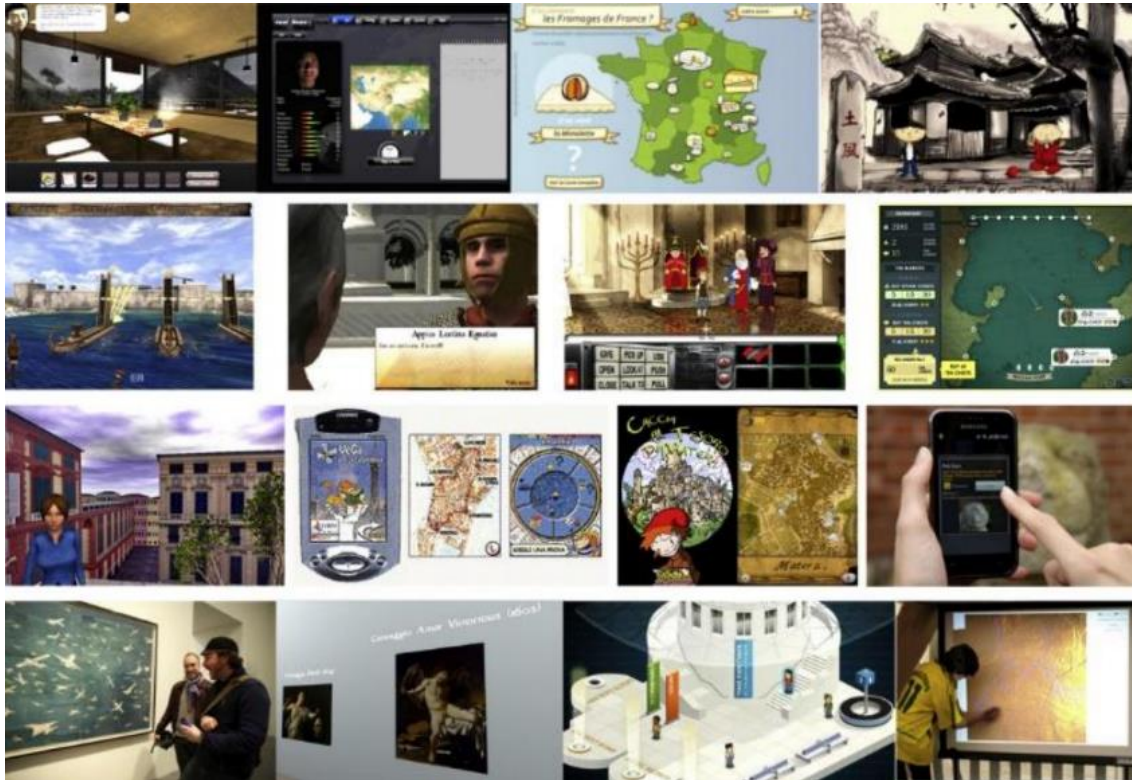


Figure 7 - Serious games for cultural awareness [6]

As a result, the adventure type games combined with quiz and puzzle can improve the learning process, because of their 3D realistic environment and allows the user to interact with the world. Furthermore, video games can be suited to deliver knowledge through a creation of a game character and a plot, in which we can create empathy between the player and character, also in which the plot can help a better understanding of historical events and different cultures [6].

This type of relation between cultural and historical factors by using a fictional character to create empathy with addition of a plot related to the history and culture of a certain region was and is still done by big game companies like Ubisoft. This title, “Assassin’s Creed” [9], was one of the biggest hits of that time, because of its immense world and fascinating plot. This game was developed alongside with historians and cultural heritage specialists. Some studies have tested this game and its impact on locals and

non-locals' players [10]. Where each test subject was evaluated through each environmental piece, from architecture, patterns, and player character. The environment of the game had a greater impact on locals than non-locals. Locals most of the time had a nostalgic feeling when exploring through the map and meeting interest points in the game. Where non-locals were basically focusing on gameplay and not paying attention to all the architectural patterns. As for the atmosphere and crowds that fill the big cities, there were a mix of races but nonetheless it was a great experience for the local players.

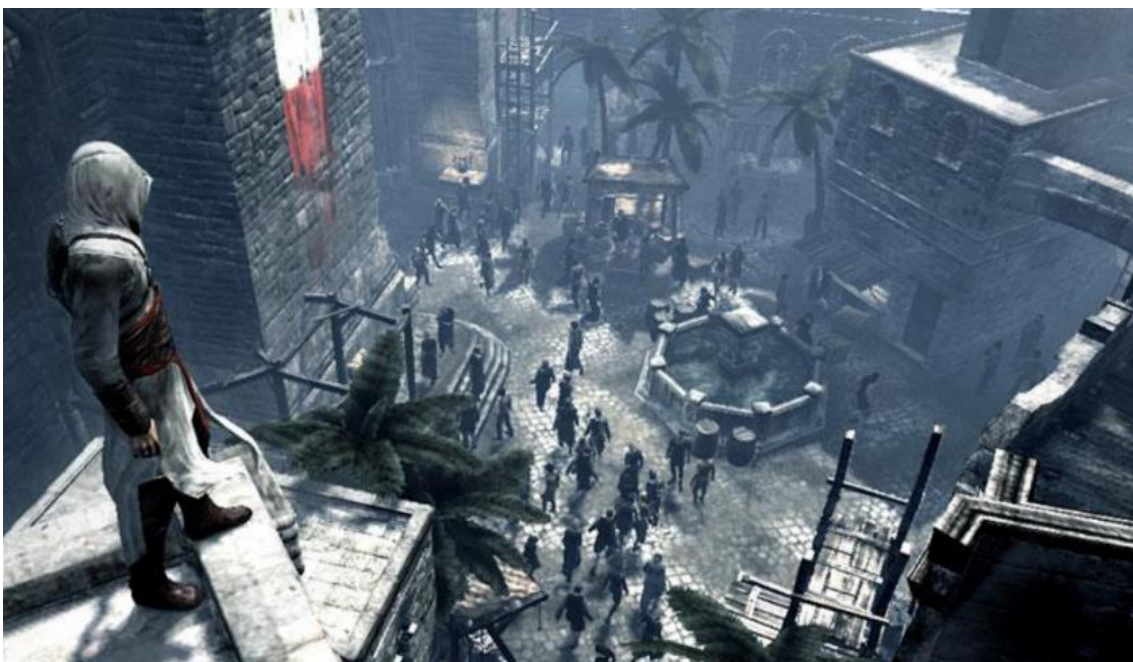


Figure 8 - Assassin's Creed city NPC's ("Assassins' Creed ©Ubisoft")

The research concluded that video games with this type of cultural and historical factor provide a better understanding of each culture and their differences [10].

Additionally, to include a character to the game we want this character to create empathy with the player and also try to create a sense of embodiment. The physiological response to threats was more relevant in first-person perspective than for third-person perspective [11]. In this case

the virtual body is assumed as a virtual self of the person interacting with the virtual environment. Although, first person perspective provides the most immersion for the player, a third person perspective gives a wider point of view (POV), where the player sees the character, they are controlling and the world around him. Hence, in this study they experimented both perspectives in the same game, in which was Skyrim [12]. This game allows the player to switch from first person to third person point of view (Figure 9), resulting in equivalent results from both perspectives.



Figure 9 - Third Person and First Person on Skyrim ("In-game screenshot of Skyrim")

However, first-person perspective being more immersive and making the player feel connected with the world, it can also be challenging in action packed situations, reducing the orientation capabilities of the players, and knowing their surroundings. Compared with, third person where with a higher point of view the player is always on alert about their surroundings, giving a better navigation through the environment of the game [12]. Another study suggested that third person can be as immersive as first person, through character animation. If the animation does not confuse or replace everyday life, how the bodies behave or act upon the world [13]. As well as movies are not produced in first person perspective for more empathy and immersion and resources for the third person perspective.

Therefore, we can achieve immersion and empathy with the character that we are controlling.

After all the previous information gathered, most of the serious games were approached in an adventure type. Which is frequently a synonym of role-playing [14]. Role-playing games allow various cultures to recreate what has existed inside a video game and place users in that time frame. Recruiting myths and folklore, incorporating them in the plot [15]. As well as, previously done by the game company Ubisoft with the game "Assassin's Creed". Where they have been resourced through folklore from middle east history and incorporated in the game, as you role-play as an assassin in a third person perspective [10].

Additionally, the usage of computer games as a virtual learning environment, has been more commonly used for development of serious games. With the intention to provide new interactive learning experiences that aid understanding of new cultures or languages rather than resourcing by books. Although, there is a huge gap between the general public and their appreciation of the past [16]. Therefore, games and simulations can close that gap, but there are still many problems related to this and very few solutions [17]. Even though some museums test some games among students during visits but even those games do not provide any information of what is being done in the game. So, the teenager is not learning anything from that experience [16].

In conclusion, Cultural Heritage can be acknowledged through games, also known as serious games. Most of the research acknowledge that an implementation of a game genre like adventure, with an implementation of storyline and rich environment filled with Non-Playable Characters (NPCs) [6]. Thus, it was done on an entertainment game like "Assassin's Creed", but it did not replicate well enough the culture surrounding that region according to research done using this game as test

subject [10]. Acknowledging all this information from previous research, allowed for a better vision for the project that was developed.

A. Discussion Literature Review

From the literature previously reviewed and conclusions taken, it was gathered the key factors needed to create a more immersive and complete game for cultural learning. Wanting to include the entertainment factor from big company games like the previously mentioned Ubisoft [10]. It was strongly believed it was the best way to call attention and drag interest from teenagers.

Since from the articles reviewed about serious games referenced in [6], [8] all of them lacked entertainment games design resources that allow for an increased draw of attention to the content provided such as, visual effects and improved visuals for a better overall experience. Also, the lack of a storyline and Non-Playable Characters (NPC) can have influence in the interest of the users.

Therefore, there is an opportunity to contribute with a video game with cultural heritage context, with entertainment design ideas, such as, an interesting storyline, an environment filled with NPC to increase immersion. Therefore, it was decided to develop a video game which will combine both with the intention of succeeding on retaining knowledge.

III. Lucky Hero's Legacy Development Process

This chapter provides a description of the whole ideation process behind the game narrative as well as the first gameplay ideas to be implemented in the production phase. Firstly, it focuses on the narrative, from the gathering of all the myths and legends of Madeira Island, as well as the iteration between myth selection, the development of the Hero's Journey and character creation. Lastly, the first gameplay ideas alongside some basic game rules for the project are described.

A. Narrative Development

Lucky Hero's Legacy is centred on action adventure with elements of brawling in a fantasy setting. One notable aspect is the use of Madeira Island as the main setting. With almost real recreation of some locations present in the island. The plot arc focuses on a lizard character named Lucky and his mentor called "Old Man", who are intertwined in an adventure involving the pearl of knowledge (VI.A).

This section describes the whole concept behind developing a narrative for the game, resourcing Madeiran myths and legends. This process had four stages, mythology research, story, creation of the hero's journey and character development.

This stage of the development process needed to be locked before the game implementation for both projects in terms of game storyline and 3D visuals this can be seen on the other contribution, in the section *Pré-Produção*. Hence, the following sections are various iterations between each other to achieve the final narrative present in the experience.

1. Mythology, Legends and Folklore Research

The initial gathering of information was done by visiting the Ethnography Museum of Madeira where it was presented with many cultural objects that could be included in the game. The core of the narrative was done by resourcing to the internet, from two websites in general ([18], [19]). There were many legends related to Madeira Island, so it was decided to remove any religion-related myths as well as less interesting ones that added no value to the narrative. After this a list of eight (Figure 10) potential myths to be used in the narrative were gathered. The initial goal was to design a fictional narrative that weaved in the several myths, introducing in this way knowledge on fascinating facts that took place on the island. However, creating a narrative that incorporates all the myths was not an easy task since there was no direct connection between myths. Also, as much as it was wanted to include a myth for each location of the island it was not possible since some of the myths are from the same location or were impossible to know the exact position where they took place. As well as the effort needed to create all the scenarios and a narrative that would fit and link all their content. Therefore, an adaptation was made to ensure the whole story of the game followed a pattern of interest, as we call the interest curve. This factor was important to catch the player's attention to all the content that the narrative provides. From the list all eight myths were chosen to be included in the first iteration of the whole design of narrative/game. After listing those eight myths according to year (Figure 10), it was possible to analyse a large time gap between them. Therefore, an idea to be implemented in the narrative was to give the main character or an ally the ability to travel through time so each myth would be in the correct year.

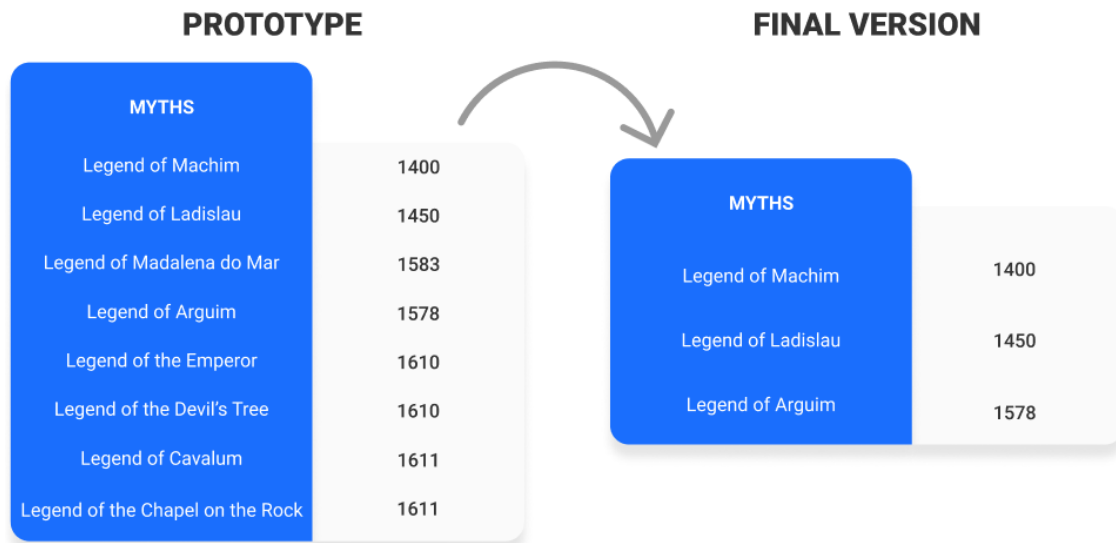


Figure 10 - List of eight Legends and conversion to three Legends

After discussion the whole concept of having this number of myths and the whole idea of time travel would induce complexity to the narrative. Therefore, a reduction of the number of myths was needed alongside a more linear narrative for better understanding of the target audience. Which led to a reduction of myths to three in total, being these three the most interesting and doable in terms of game development. The three myths were:

1. Legend of Machim, which is related to the first city or village of Madeira, Machico. It is about a young soldier from England who ran away with his lady before her wedding. Sailing in the direction of France. However, they were caught in a storm making them sail away from it and reach a green Island. The lady became ill, refuging among the roots of a big tree the woman perished. Days later, Machim joined his beloved in death. Years later the first discoveries were able to identify the big wooden cross and the inscription. Giving them the name of Machico to that place.

2. Legend of Arguim, which tells the story about a submerged island near Madeira. Where the Portuguese king D. Sebastião did not perish in battle but fled to the island of Arguim. While doing his route to that

mythical island, he passed by Madeira and speared his sword on to a rock near Garajau. The sword stayed stuck and enchanted, hoping that one day he would return to reconquer Portuguese land.

3.Legend of Ladislau, was about a king of Poland, Ladislau III, who lost a battle against the Turks and disappeared. Years later a mysterious knight appeared in Madeira in which after a visit from a Franciscan group recognized him and asked him to return to his homeland. Refusing to go back to Poland, the knight one day was called to Algarve to meet with the Portuguese king but met his tragic death on his way to the meeting, after a landslide in Cape Girão.

2.Narrative Development

The narrative went through many iterations. The iterations included building upon the hero's journey, character development, going back to the myths and analysing the narrative's interest curve of the story in concurring with the game progress before an exciting narrative was reached, one that would bring some sort of satisfaction for the user and be as rewarding as possible.

As for the story in game it was thought about doing a non-linear storyline, giving the option to choose where to progress and how the player wanted to progress but all the paths leading to main critical points of the narrative. This type of narrative is called concentric narrative which takes the same path as a linear narrative (Figure 11) but adds some extra steps to make the narrative different every time if played in different ways.

#2 Narrative structures

A typology of interactive narratives

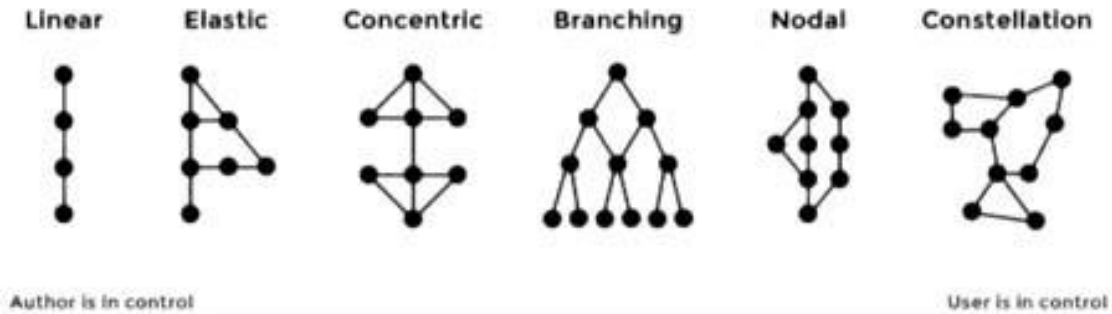


Figure 11 - A typology of interactive narratives (www.small-world.travel.blog/2018/03/19/narrative-structures/)

This first iteration was based on the first list of myths that was gathered with the idea of linking each legend and create physical representations of each protagonist of the legend as a non-playable character that would give insight to the main character of what needed to be done. Resulting in an extensive list of characters to be created later in 3D. An alternative was to create an ancient character that had all the knowledge from the Island, and it would guide the main character to the end of his journey. Therefore, only needing one non playable character to guide the main character for the whole storyline. The final question for this implementation was to figure out a way to implement a meaning for each pearl fragment gathered from each Legend. In total with eight fragments, it was impossible to categorize each fragment as a piece of knowledge referent to each location. Then by placing each myth in chronological order it was able to define an interest curve (Figure 12) based on each content of the legends. Later, the Game Design section will be shown how each legend is connected to each other and what were the approaches for linking them.



Figure 12 - Interest curve for the first eight legends

On a later iteration there was a refactoring of the curve of interest for the video game by spreading the three myths through the timeline. To connect these legends, it was thought of including a background story before the present one. Thus, made the link between legends more manageable. However, since there were only three myths there is a need to fill the gap between myths. Hence, by filling the gaps between each legend and including more information based on Cultural Heritage buildings allowed for a more concise storyline, as can be seen from the image below.

It was planned for each Legend represented on the curve and Cultural Building to be implemented on a real representation of the environment. Thus, conveys the sense of familiarity enabling a boost of interest for users during the experience. Therefore, it was planned to have the following locations regarding the order displayed in the image (Figure 13).

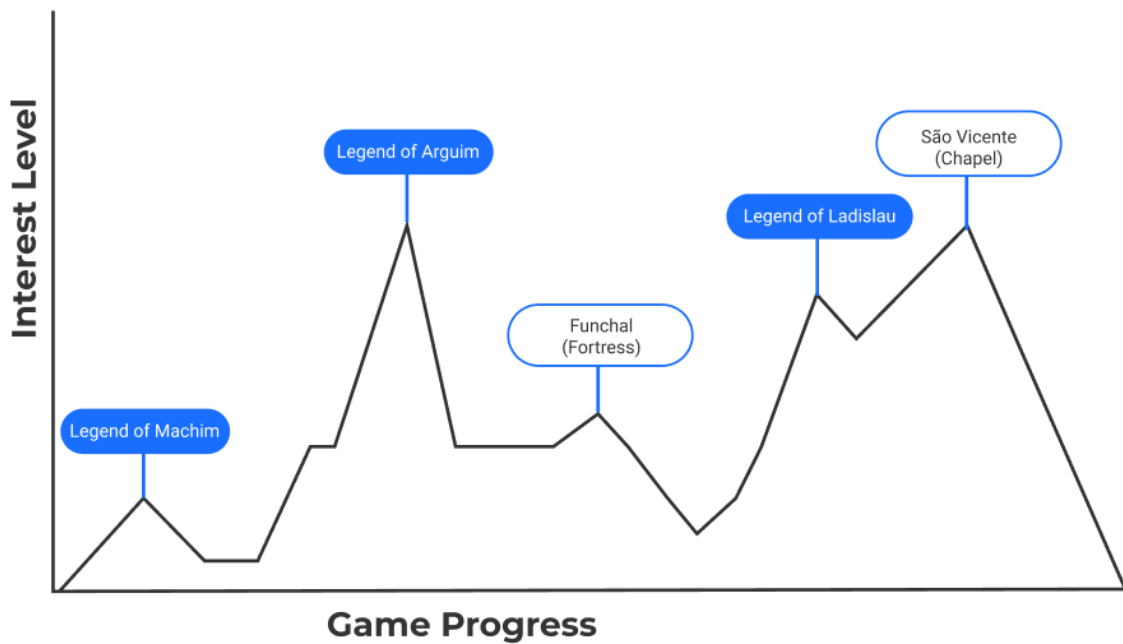


Figure 13 - Interest curve of the three legends

1. Legend of Machim - Machico
2. Legend of Arguim - Garajau
3. Fortress of Funchal - Funchal
4. Legend of Ladislau - Câmara de Lobos
5. Chapel of São Vicente - São Vicente

After all these iterations, it was possible to identify the main plot points of the narrative that are related to the hero's journey, which are:

- Lucky goes on an adventure in search of the fragments of knowledge. Which is related to Legend of Machim that is also about the first time someone discovered the island by accident.
- Lucky grows in power after finding a mythical sword. Thus, is related to the Legend of Arguim in which the sword reassembles the one that D. Sebastião speared on the cape of Garajau.
- Wilson II captures the Old Man leaving Lucky hopeless. The fortress of Pico is used as a cultural reference and is one of the villain's lair.
- A crow helps Lucky to complete his adventure and become much stronger by defeating Ladislau in Câmara de Lobos.
- Lucky defeats Wilson II and unshackles the old man. Allowing Lucky to place all the pearl fragments on the Chapel of São Vicente near the sea.

3. Shaping the Narrative

The fictional narrative of Lucky's Hero's Legacy was based on the Hero's Journey by Joseph Campbell [20]. The hero's Journey is a sort of template used to help structure a story with useful key points for a basic narrative. Thus, in sum it involves a hero that goes on an adventure, which he is a key factor for the crisis happening in that story and grows in character development during his journey and comes back home transformed.

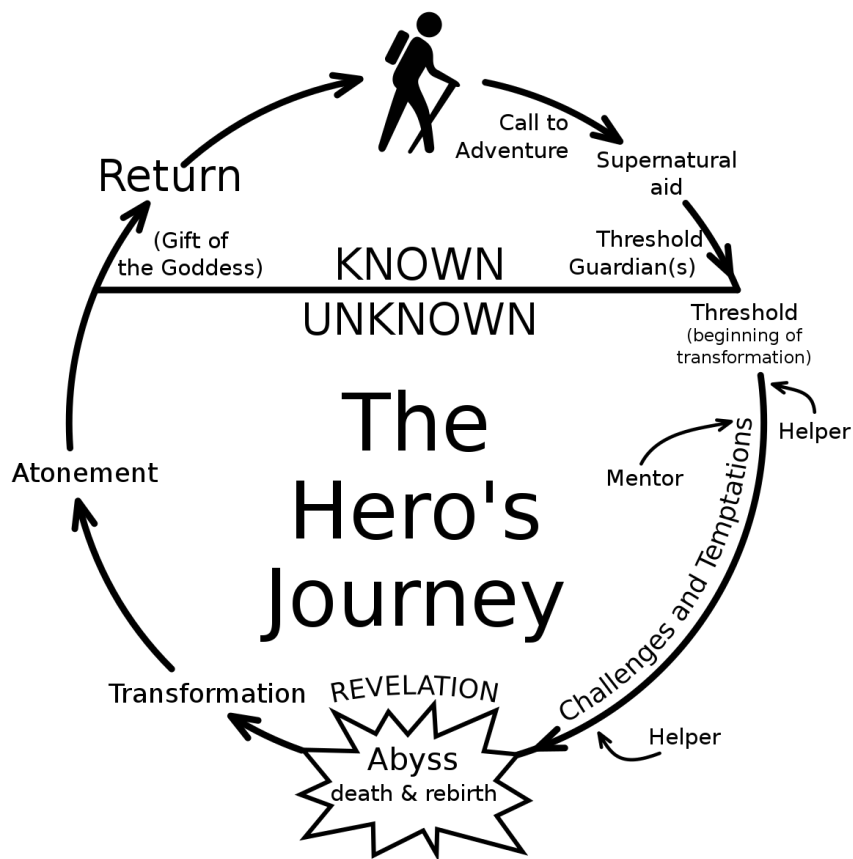


Figure 14 - Hero's Journey
 (https://en.wikipedia.org/wiki/Hero%27s_journey)

Once the number of legends and locations were more less defined, proceeded to develop the main character for the story alongside with a key character to help this hero in his journey. Based on the hero's journey it was developed a custom one (Figure 15) that was used to identify crucial points to be present in the game that would make the whole storyline more interesting. Where there is an ordinary character landing randomly on the island that is aided by an old figure. This old figure tells a tale about the island and the guardian of the pearl in which Wilson II tried to steal away. The guardian in order to save the island broke the pearl into fragments which are spread across the island. This tale is the call for help or call to adventure. Lucky the hero, agrees to help the old man in his journey to save the island. Thus, is the call for adventure of the storyline, where the hero

begins to grow in power and knowledge as his adventure progresses. When it seems that the hero has reached his peak of power, in this case when he collects the mighty sword, it is introduced to a moment of downfall. Where the hero loses all his hope and help, in this case when invading the Fort, the old man is captured by the antagonist Wilson II. This part is crucial to unlock interest of saving the mentor and destroy the evil guy in the story. Which leads to the rebirth or transformation of the hero, in this case Lucky is led to an evil figure which held a powerful armour, Ladislau a supernatural figure that was tormenting Câmara de Lobos. This brings a greater challenge with high reward for the hero, which again bumps the interest and determination up to achieve such goal. After, the fully transformed hero, he is led to the final place. Where all the skills learned, and power acquired will be put to a final test. Lucky in São Vicente must fight his way to Wilson II in order to save the old man and put an end to the story. After replenishing the pearl fragments, the old man transforms into the guardian of his tale. Revealing his true identity and the world returns to its normal state.

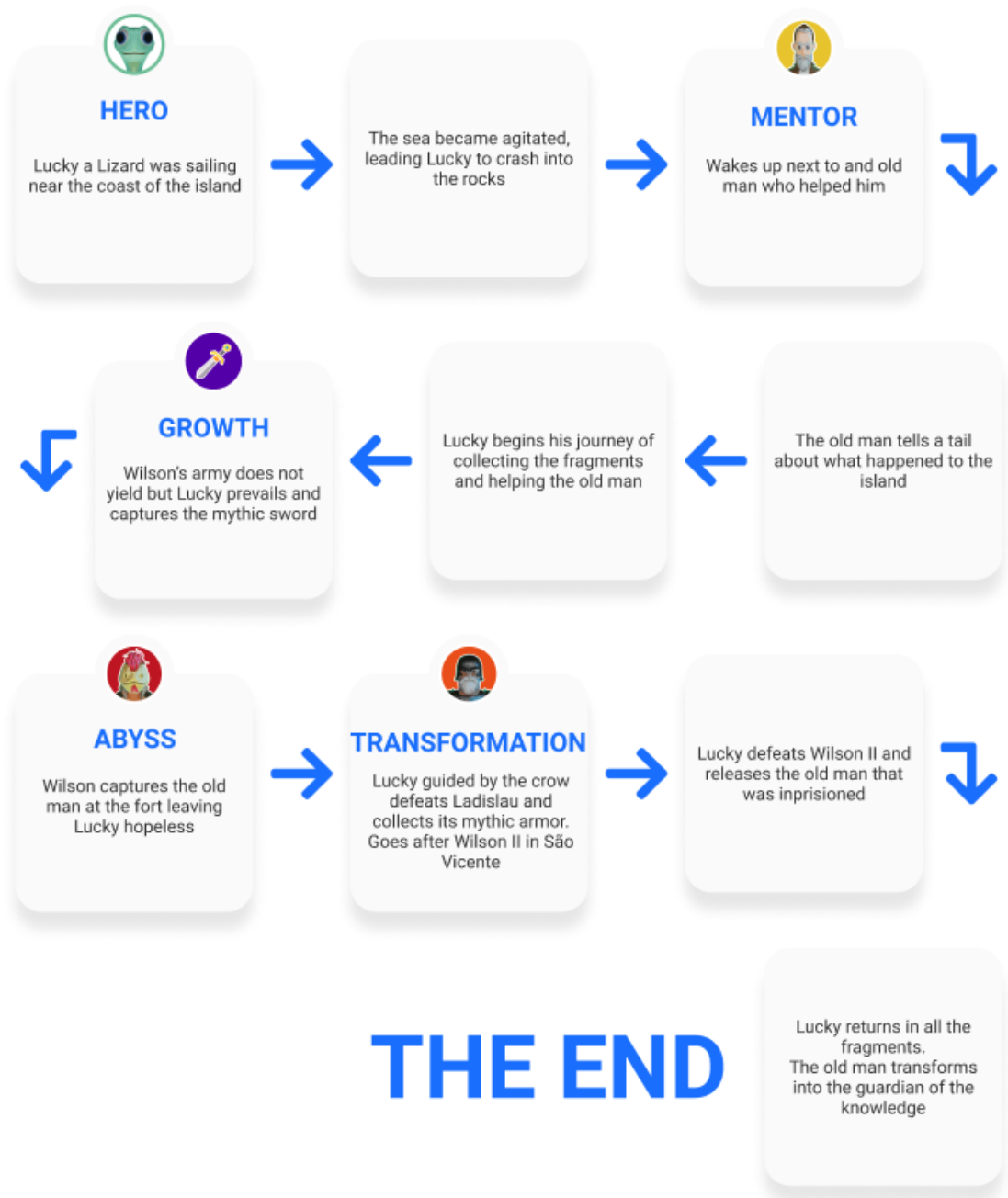


Figure 15 - Lucky Hero's Legacy, Hero's Journey

4.Character Development

a)Lucky (the Hero)



Being the main character there was a need for him to be something out of the ordinary, to grab the attention of the younger audience. Choosing him as a reptile, a traditional species from Madeira because it is commonly seen in our island and since youngsters prefer creatures or strange things above human look-alikes. It helps them create that bond much easier and identify the main protagonist.

b)Old Man (The mentor)



The old man was supposed to be a sage from that island, having this mentor figure for Lucky that would help him through the course of the storyline. This character would also hide a backstory to himself and reveal it later. So, there was this rewarding feeling at the end of the game despite liberating the island from the curse. Therefore, this character was friendly, mysterious, and vague sometimes. Giving emphasis to his mystery.

c) Wilson II (Villain)



The main antagonist from our story, being a gecko, was a foreign species that invaded Madeira and is an invasive species which now lives among our lizards from the island. This choice creates the clash between lizard and gecko, already giving the upper hand to geckos. Since they are predators related to lizards.

His main goal was to take control of the island and erase all the cultural knowledge from that island and build it from scratch. This character being so powerful makes the journey for our protagonist more challenging, with his army protecting him at all costs.

B.Game Design

In this section the overall idea of the game. will be approached as well as the e game mechanics. Defining this was a key subject for the pre-development process to guide the video-game implementation.

1.Game Overall

The thinking process started on a wider scope of how the player would interact with the world and what were his options while progressing in the game. The first ideas for the game design of the game (Figure 16) began with the possible implementation of a Main city in the game. During the player's progression in the game, he would find teleportation devices through the map that would allow him to come back safely to the city. Thus, allowed the player to have a choice to upgrade his equipment or not.

Lastly, to add a more diverse way of playing and the game not being always fighting and running, we wanted to add some puzzles that would in some way help with the narrative and the distribution of the knowledge.

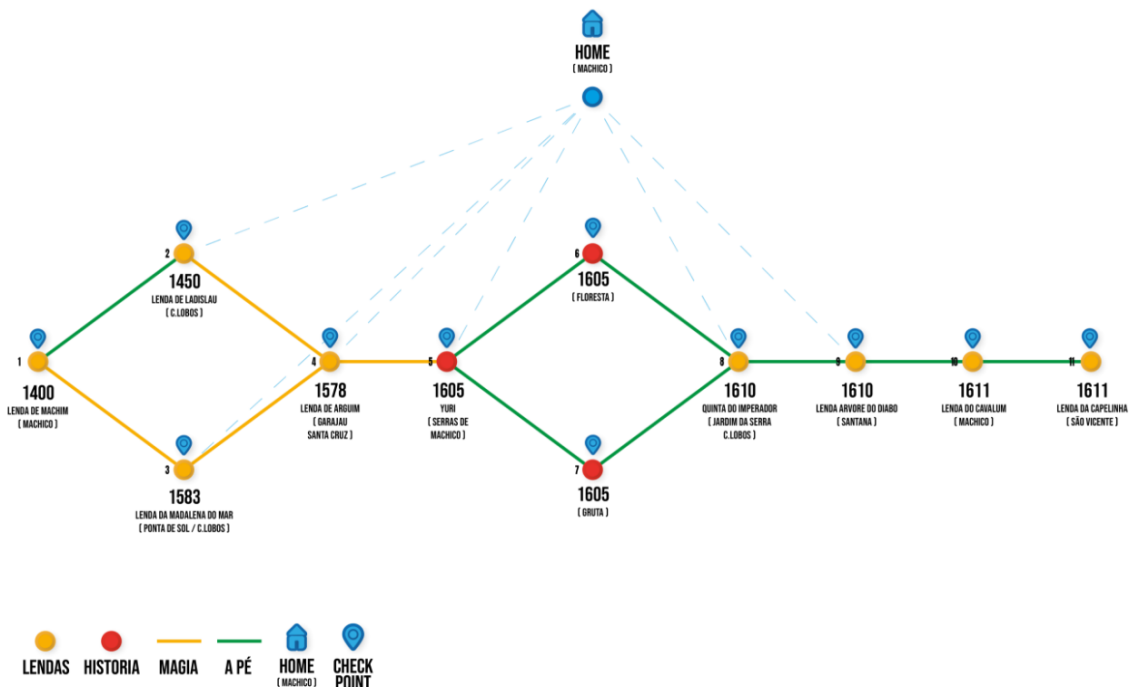


Figure 16 - First Game Design Idea for the game

2.Game Features

The game was aimed to include some features that would provide the player with rewards and plenty of interactions with the world. The possibility of performing attacks and combinations against enemies and jumping through the level. As mentioned, it is planned to have different locations or levels. Each level represents a location related to a myth or any specific building that belongs to the Madeiran Cultural Heritage. In addition, each specific building or object might have interactions for the player that should trigger a cinematic where it is delivered in form of text or sound useful information about that specific object in question.

Lastly, for rewards it was planned not only by resourcing through quests as a way of getting rewards but adding items spread across the levels in the form of chests. Each chest will be placed in most levels hidden from the player, so each run is different and adds a bit of randomness to the game.

In short, all these elements work together to provide a nice experience for users and help them to interiorize all the information that is delivered in many aspects or forms.

C.Production

Lucky Hero's Legacy had several key moments in its production that guarantee its effectiveness on the learning aspect. After previous iterations to build the story that would complement the gameplay. The production phase of the game had two major milestones, the implementation and pilot evaluation of Lucky Hero's Legacy Alpha and then the refinements done based on the evaluations results that resulted in Lucky Hero's Legacy.

This section starts by giving an overview of all the tools used to develop the video game, then we delve into the first prototype, explaining the user interface, and the implementation.

1.Development Tools.

In this section will be presented the three main tools used for our project. Adobe XD, Unity and Visual Studio (Figure 17).

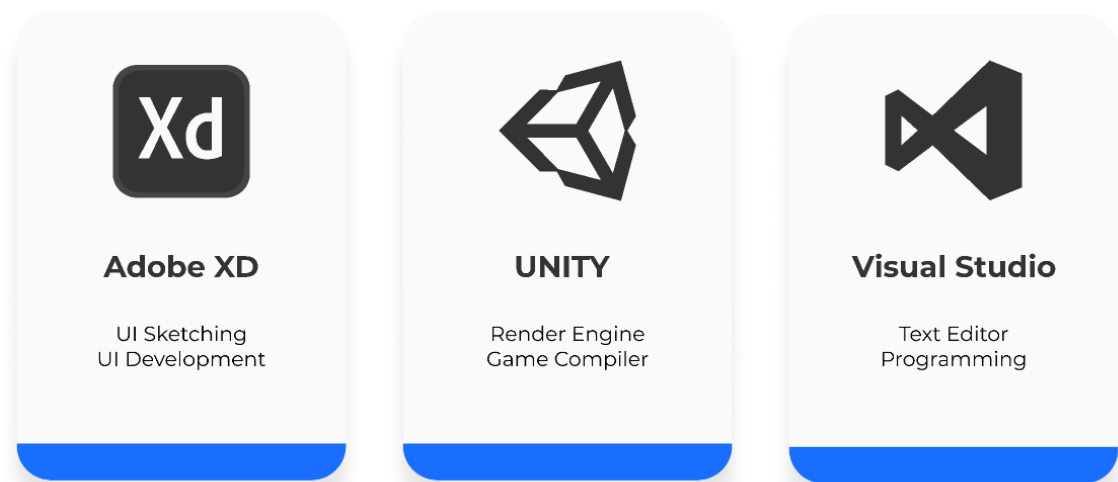


Figure 17 - Development Tools used

a)Adobe XD

Adobe XD is a tool used to sketch, design and prototype applications, from mobile, websites or even video games. In this project, this tool was used in all user interface iterations. From sketching to final implementation.

Being a simple and free tool by Adobe, it allows the creation of fast prototypes relative to design and is easy to use. All the interfaces implemented in Unity are derived from Adobe XD, by exporting panels, icons and accents to the engine itself in PNG format.

b)Unity

After comparing Unity to other free options like Unreal and Godot for example, Unity was picked to be the engine of choice. Since it is very simple to learn due to its pre-done components that speed up the developing process, as well as the less cluttered interface and the documentation related to each component is well explained and easy to follow. Having already some expertise with the engine itself, there was no need to learn a new engine from scratch.

Unity provides with some pre-done functions that can be used in C# due to its library making the thinking process behind the scripts easier. To add on this, Unity uses by default Visual Studio as text editor, where all the documentation functions and structures are already implemented in the library of the editor. Unity has a better resource use compared to Godot and from Unreal out of the box. Unreal can surpass it if the scripts are coded correctly following the right pattern. Thus, C# language already manages resources for us without us having to intervene.

In the other hand, Unreal engine allows for artists to implement their art easily compared to Unity, were it needs more tweaking to achieve the same quality results. However, the main focus here was the programming

aspect, where C# deals with memory management and garbage collector much better than C++ where both have to be managed while developing.

A small component research can be seen in the next attachment (Figure 18):




	 Unity	 Unreal	 Godot
Language	C#	C++	C++/C#/Python
Visual Script	✓	✓	✓
Physics Component	Rigidbody 3D/2D	✗	Rigidbody 3D/2D
Animation	Animator Controller	Anim Blueprints	Animation Tree
UI Events	Event System	Widget Blueprint	Script Event System

Figure 18 - Unity Engine Comparison with other Game Engines

Overall, Unity has a wider coverage on its engine, the asset store has plenty of content that is free of use if needed, alongside the community is vast and friendly that will help fix many bugs that might show up during development. All these factors sealed the deal of us using Unity for this project.

2.Game Development - Lucky Hero's Legacy Alpha

The goal of this first prototype of the Lucky Hero's Legacy consisted of building a playable tutorial of the video game, showing the basic mechanics and the first UI implementation. This first implementation phase was developed to test any anomaly with the interactions between player and the other elements in the game, like structures, enemies and NPC. As well as the overall usability of the user interface.

3.User Interface

User interface (UI) is used to give additional information to the player for example (Health Bar, Level, inventory items, etc.). Being an adventure third person game, there are some default UI necessities that need to be present. First, we needed a title screen with a menu which consisted of starting the game or exit from the game. Consequently, the in-game UI was planned, consisting of health bars, experience bars, mini maps, quest panels, interaction panels, notifications, etc.

a) Low Fidelity UI

(1) Menu

The menu is the first screen that the user sees when opens Lucky Hero's Legacy. Simple looking menu with a header with the name of the game and for background it was planned to have an environment and Lucky running at real-time. The menu offers four options being the first to continue if the user previously has saved the game, he could resume his run. The second, is the new game where the game begins by showing a cutscene like it is possible to see on the image below (Figure 19) identified as the number one screen. The third option is relative to the options menu, where the user can adjust video quality and sensitivity for the mouse. Last, option of the menu is the Exit button which closes the game.

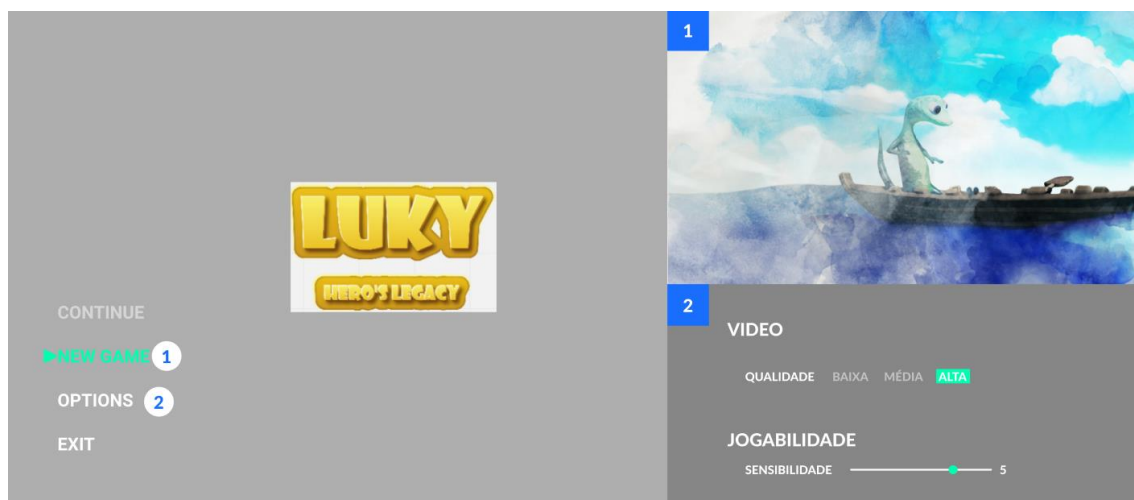


Figure 19 - Main Menu Low Fidelity User Interface

(2)Heads Up Display – HUD

Three options were considered to arrange all the information needed for the player, like health, map location, active quest, etc. While still leaving a clear view of the game action.

Images (Figure 20), (Figure 21), (Figure 22) showcases the three different possibilities for the HUD:

Overall, all three possibilities try to give a clear view of the player and environment without cluttering the screen, each attempt tries to fix what the previous had as the most negative aspect. Each design is described fully in this section.

The first possibility (Figure 20) was by placing the health bar and level indicator at the bottom right below the character view and the weapon indicator on the bottom right corner since the right side of the screen would be cleaner and less cluttered with information, allowing the player to take a quick glance at this information very quickly if needed. As for the mini map and quest information on the top left corner since it will be less often used or just seen one time per quest. Overall, it was believed as a good starting point, but the orientation of each indicator was not well placed.

This second time (Figure 21) it was approached by a more Massive Multiplayer Online Role-Playing Game (MMORPG) style of HUD, where the health bar is up on the right corner alongside with the level, as for the mini map and the quest log on the right side of the screen. Reducing the number of options related to quick buttons previously presented. Now the user could only swap between weapons quickly. In a whole the concept was not far from what was desired but still one more idea was left to try out before choosing a layout.

A third and final concept (Figure 22) was to include the health bar and player level around the Mini map. This way all the useful and quick

information was all packed in one place and easily distinguishable from each other. On the top left corner, we have the quest log as for the quick buttons remaining on the right side. Being very pleased with this type of orientation so it was decided to keep this layout for the first prototype.

Player UI (1)

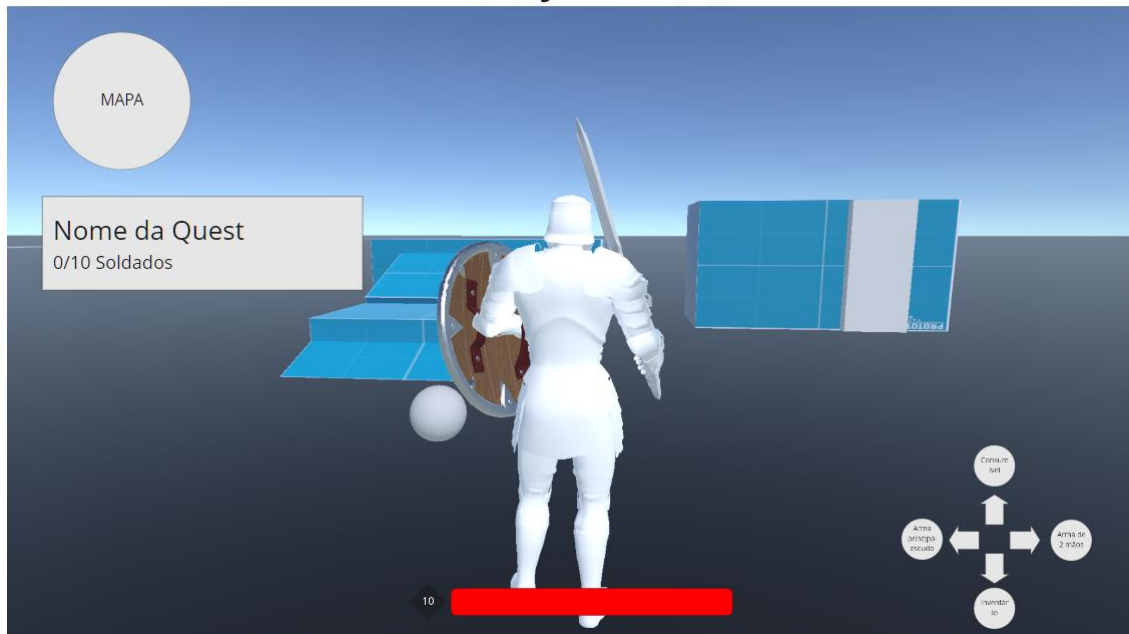


Figure 20 - Heads Up Display (1) Low Fidelity User Interface

Player UI (2)

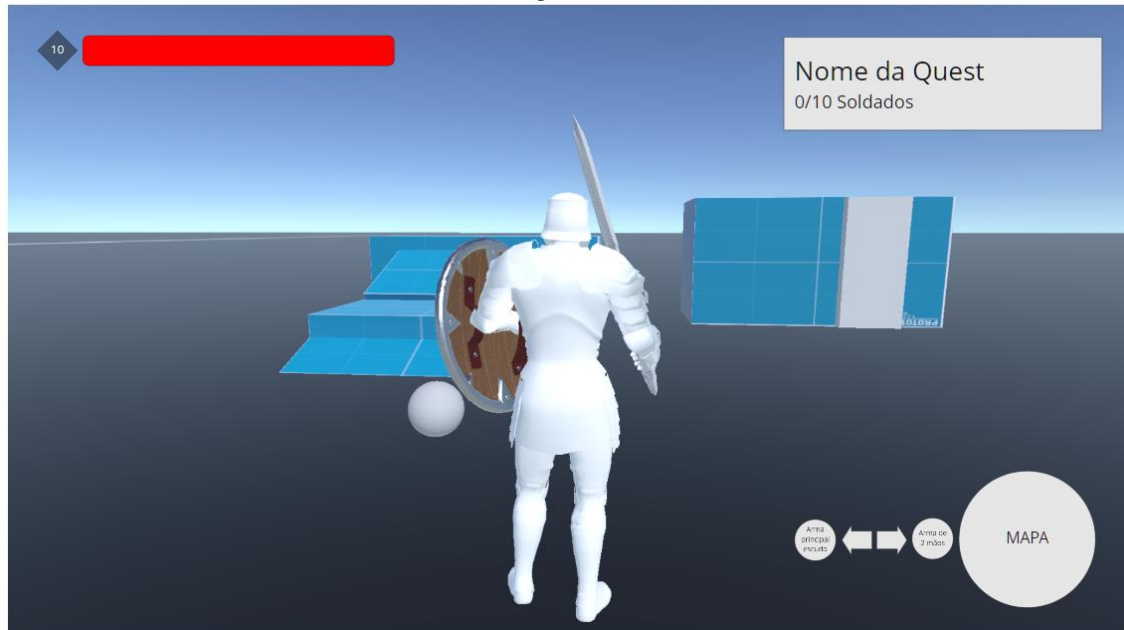


Figure 21 - Heads Up Display (2) Low Fidelity User Interface

Player UI (3)



Figure 22 - Heads Up Display (3) Low Fidelity User Interface

(3)Interaction & Quest Panel

Additional features need to be included to inform the player when he is near an object or an NPC it will trigger the interaction panel (Figure 23) to inform that this object can be interacted with. In the case of the NPC, it opens a Quest window for the player to accept or decline the mission.

Object/NPC Interaction

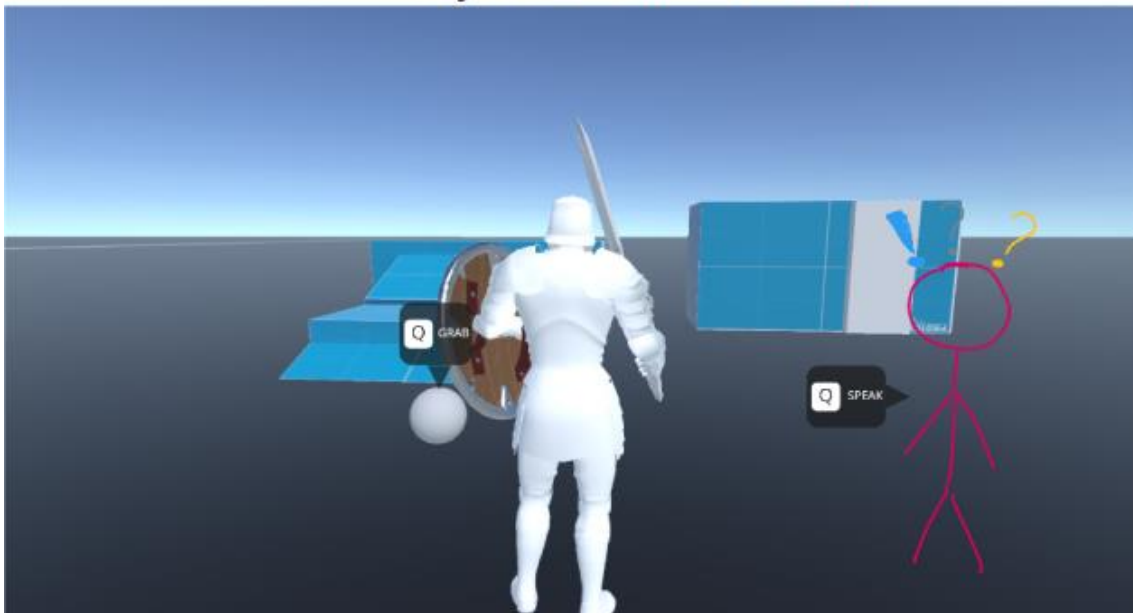


Figure 23 - Interaction Low Fidelity User Interface

Therefore, when the player interacts with an NPC, the usage of empty space available from layout three of the HUD to place these temporary indicators. The quest panel (Figure 24) is always on the right side since there are no HUD indicators in that position and allows the player to switch his focus to the quest box and pay attention to the information there written.

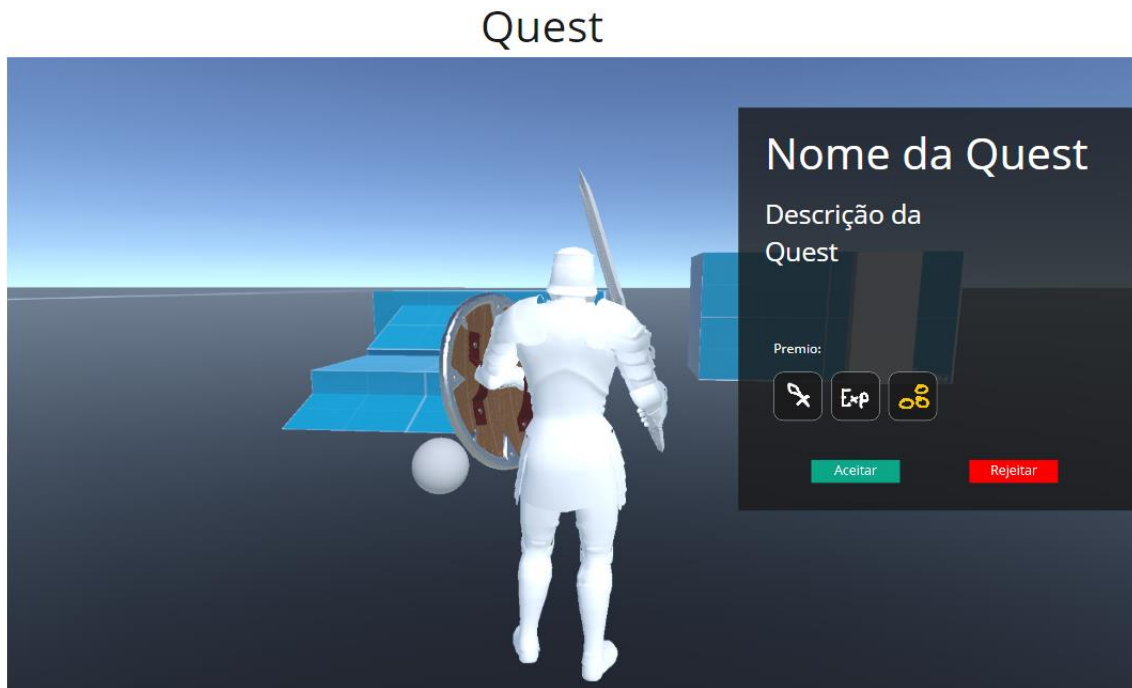


Figure 24 -Quest Panel Low Fidelity User Interface

(4)Inventory Panel

There was a need to include an Inventory Panel to allow the player to equip and switch items that he collects. Whenever he is rewarded, each item is placed in the inventory. Therefore, when the user presses the escape or start button, it opens the pause menu, in it there are various options from inventory, equipment, options, save and exit as can be seen on the image (Figure 25).

At this stage of low fidelity, it was only designated the inventory panel, the other panels were not defined in this stage. The inventory is categorized in different item types from weapon, armour, food, etc. Each item is identified by colour each colour represents the rarity level, being white a common item and orange being legendary. When hovering each item there is a panel that temporarily shows up, giving all details about the item.

With all the sketches and first designs of the UI completed. Proceeded with the low fidelity of the UI to be implemented in the game and ready for first prototype testing. Therefore, a better version of these sketches for it to be implemented in Unity, which can be treated as high fidelity for the time being.



Figure 25 - Inventory Panel Low Fidelity User Interface

4. Game Implementation

This section details how the abilities for each character, player, enemy and NPC, were implemented. Starting from the level planning of this first prototype then the creation of scripts and their hierarchy, to visualize how they interact with each other.

a) Level Planning

Before proceeding to the implementation stage, it was necessary to lay out all the character actions and game rules. (Figure 26) represents the blueprint of this first prototype. It maps in the 3D environment of Machico which involves quests through the level, filled with interactable objects like NPC and Buildings. Also, some action moments with combat against training dummies and an AI enemy.

The first pilot test of the game is actually the tutorial level. It was to do an in-game tutorial to show all the features and test them, as well as for players to get acquainted with the gameplay. In the image below (Figure 26) it is possible to see Machico terrain (this location was chosen due to its link to Machim legend). The player starts on top of the hill where it is presented with a tutorial identifying each component from the HUD (step 1 from the image). After, it is presented mini tutorials about the keybindings to perform actions like moving, running and interacting. Once the player reaches the NPC on step 2, it opens the quest panel giving a mission to the player. This mission leads to the first interactive building that triggers a cinematic which gives some information about Machico. Once the player returns to the NPC, he receives an item which triggers the Inventory Tutorial to teach the player how to use it. As he goes down the hill another tutorial is triggered giving the ability to jump which is repeated on step 5 and 6. Approaching step 7 the player is taught how to perform attacks with dummies, as he learns light and heavy attacks and some combos.

Moreover, on step 8 the player is challenged with a moving enemy, which runs and fights the player until death. The player is given the ability to dodge the incoming attacks which is one of the defensive mechanics present in this state of development. Step 9 the player is asked to interact again with a building through quests given by the NPC. This building triggers a cinematic which unveils the Legend of Machim. Last and final step comes step number 10, which asks for the player to interact with the vendor NPC and buy a weapon from it. Once done, the game finishes with a thank you for participating screen finishing the tutorial.

This stage of planning was critical to elaborate a list of actions and abilities for each character present in the game like Player, NPC, Enemy. Being much easier to follow during the implementation of those mechanics in Unity.



Figure 26 - Machico Level Panning, Pilot Prototype

b)Game Abilities and Mechanics

From the level planning of the first prototype, it was possible to know all the actions that the player could do.

The following image contains the list of all the abilities and interactions to be implemented.

According to the previous map plan shown (Figure 26), the player had a list of abilities to be performed. Therefore, walking and running was the primary component to be developed and later the jumping so it could progress from the first sector of the game. As well as its first interactions with the structures, inventory and NPC. Only after it is introduced the attacking component gives the possibility for the player to defeat enemies and as well as a dodge component to defend himself from incoming attacks. Lastly, the possibility of interacting with items, from equipping, buying or receiving them through quests with the NPC or the Shop available at the village on the map (Figure 27).



Figure 27 - Player Abilities and Mechanics List

The same list was done for the enemies, this object was treated the same way as the player character and had almost the same capabilities regarding game mechanics but less in interactions (Figure 28).



Figure 28 -Enemy Abilities and Mechanics List

Being a non-playable character (NPC), the enemy needs to move in order to perform attacks. So, it has the same capabilities as the player character. Making the experience more exciting and challenging for the player. This type of character will be spread through the levels, being stationary and only triggered when the player is in range of his detection zone.

Another type of NPC is present in the game, being friendly its purpose is to guide our player with missions and resource it with rewards. These missions will be later used as a method of delivering useful information about the storyline.

As can be seen below (Figure 29), the NPC won't have movement and attack aspects like the player and the enemy. It will work more as a stationary guide than a companion, providing quests and items for the player.

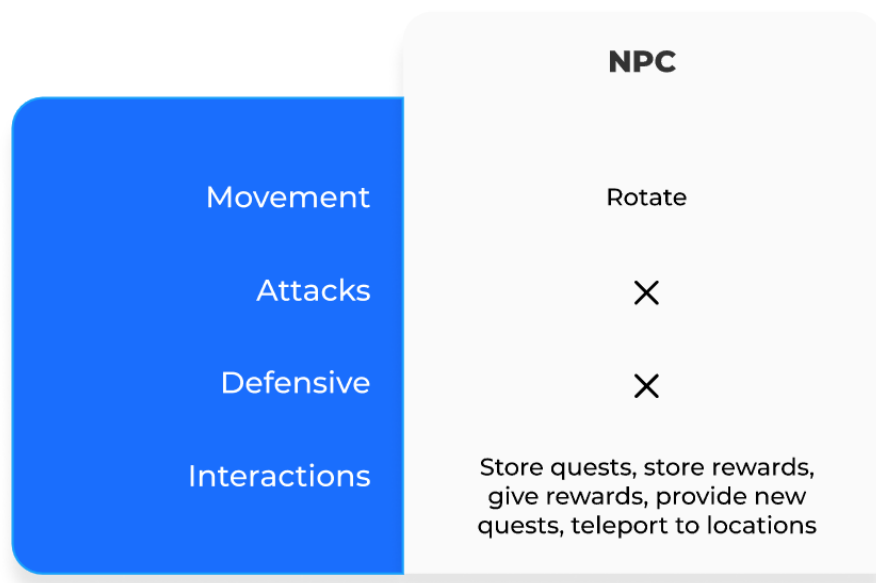


Figure 29 - NPC Abilities and Mechanics List

After this process was described, it was possible to move on into implementation in Unity, where the scripts were planned to maximize usability and variety in the experience.

5.Game Architecture

In this section we present an overview of game architecture, Figure 30 represents its overview. Over the next sections we explain into further detail each of the components: Player, Enemy, NPC and Interactable (Items and Structures) (Figure 30). Since, they are the main components of our game.

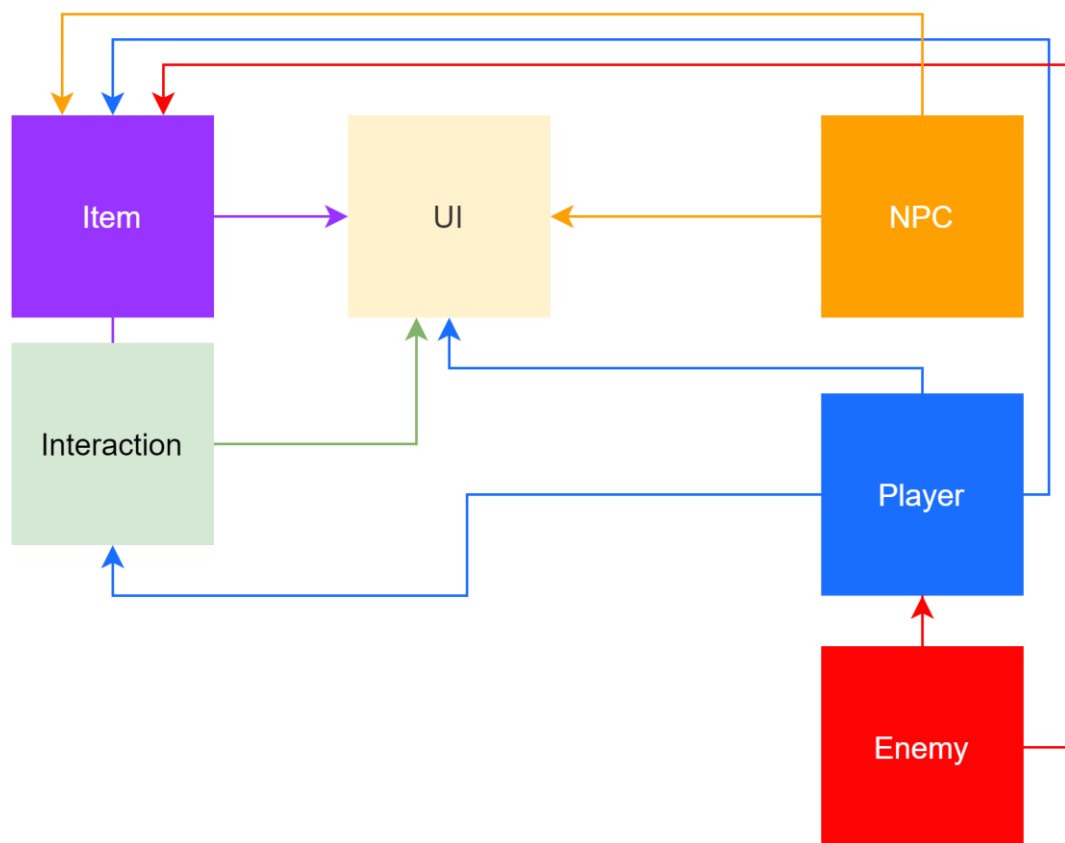


Figure 30 - Overview of the game architecture

Each component reassembles as a manager, where it nests multiple scripts involving that specific game object. This was done to ensure that only was needed a reference of the manager of the object to access all that needed for a specific mechanic or behaviour. In this way it is possible to communicate between scripts when anything changes, or an action is

played between objects. Furthermore, this allowed for the scripts to grow without breaking other managers functionality and as well allowed for reuse of scripts in multiple objects in the game.

a)Player

The game begins by creating our player, since it is the only way for our users to interact with the world in the game. Three major scripts were created: 1) *Player Manager*, 2) *Input Handler* and 3) *Animator Controller* (Figure 31). The *Player Manager* functions as a parent for all functions from other scripts like, player movement, interactions, camera and detection capabilities. The *Input Handler* script stores all the data provided from user interaction with buttons pressed and mouse movement. Lastly, the *Animator Controller* manipulates the animations used by the player abilities in this way making it easier to be re-used in different actions that the player performs. It also allows to control when or not to use *Root Motion*. *Root motion* is a way of letting the animation take control of the character movement for a more realistic movement, instead of looking a bit odd when performing any activity. Also, the animation manager script, allowed for functions to be called on animation frames also known as Animation Events, that allows for a precise position the trigger of that specific function during a frame of an animation. This is used during attacks, to perform combos, activate and deactivate the collider of the weapon, which will be approached with detail later in this chapter.

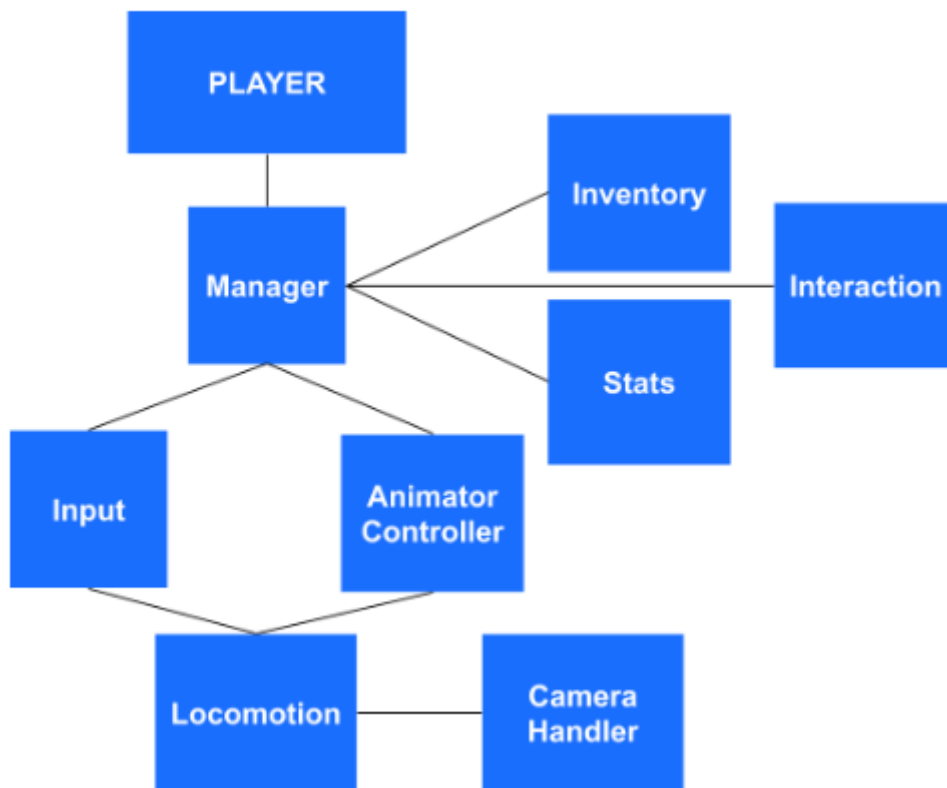


Figure 31 - Player Game Architecture

b)Enemy

The image (Figure 32) exemplifies the enemies in game script structure. Very similar to the player, the enemy has an enemy manager that controls which state is active at any given time. *Animator Controller* is the same as the player, in fact both derive from the same class since the attacks and actions work with *Root Motions* there must be a way in the script to enable it or disable it once an animation is performed. Finally, the interaction of the AI with the player, for this behaviour all enemy actions are divided by states, each state as an action that allows the AI to interact with the player.

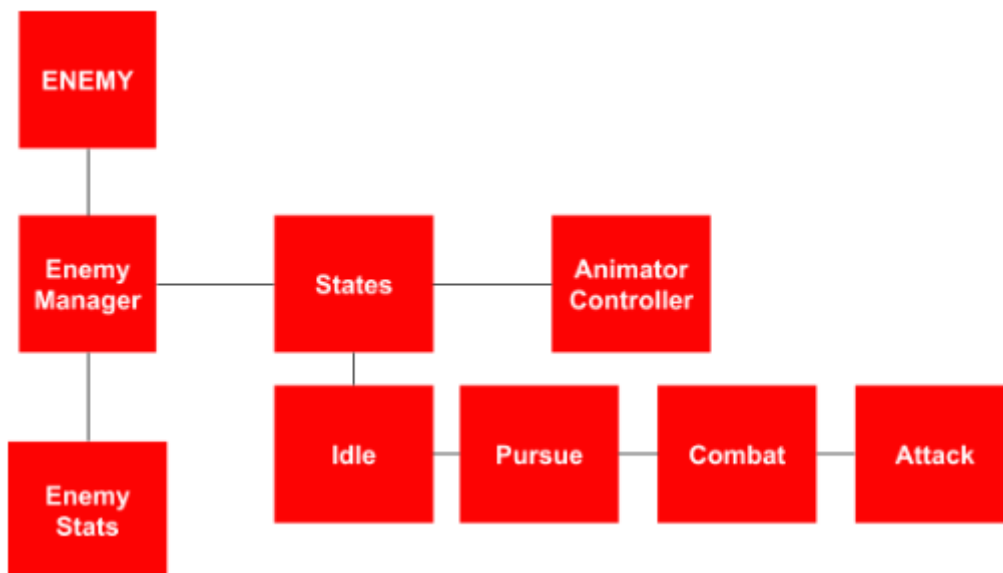


Figure 32 - Enemy Game Architecture

c) NPC

As said before, the NPC is in charge of providing quests that will guide the player through the level and items. Since not all the quests given will be directed to kill it was needed to create a “type” field for the category of quest in use. Each type will trigger different functions when the quest is fulfilled (Figure 33).

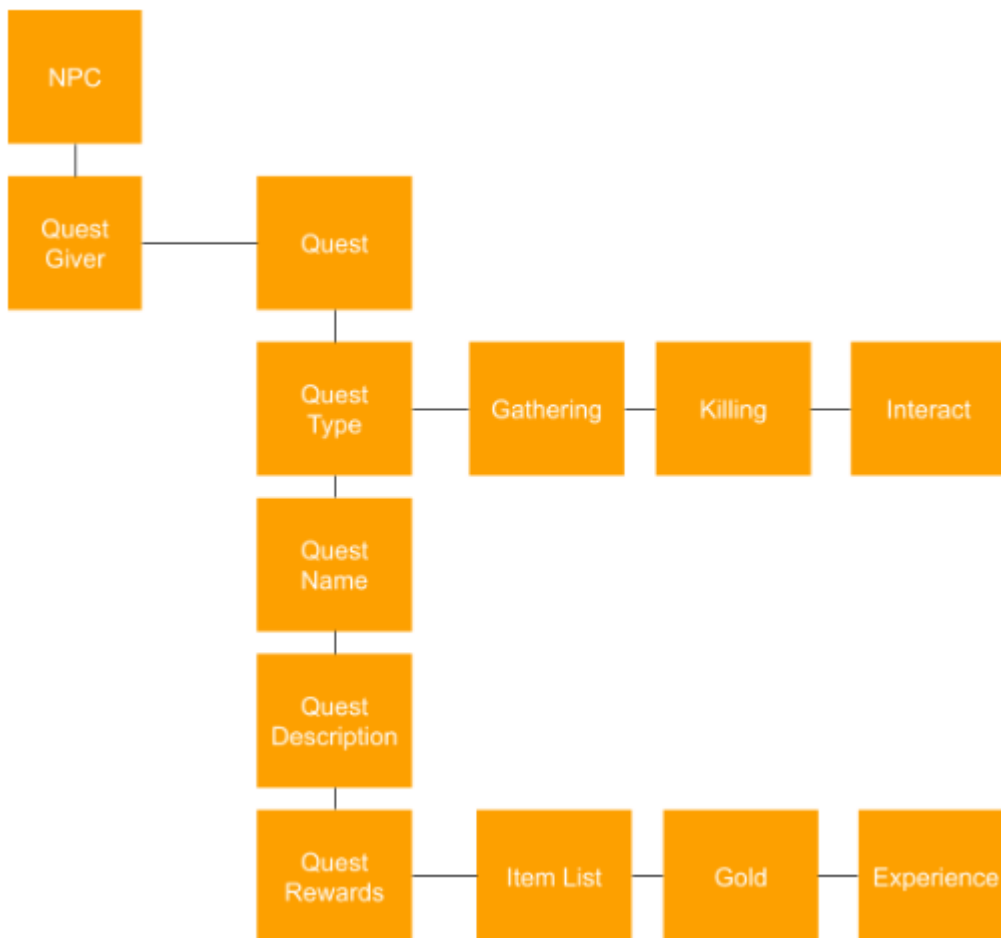


Figure 33 - NPC Game Architecture

d)UI

The *UI manager* is responsible to inform the player of what is happening in the game, like the health bar for example, allows the player to know how much health he has left or when getting hit how much did he lose. Thus, other components like the inventory where the player can see the items he has collected. The *UI manager* is responsible for collecting all the objects related to the UI that can be used by other scripts like player, NPC and interactions (Figure 34). Also, to have functions that can be used by other scripts which modify the state of any UI component or refresh its values ex: health bar, death panel.

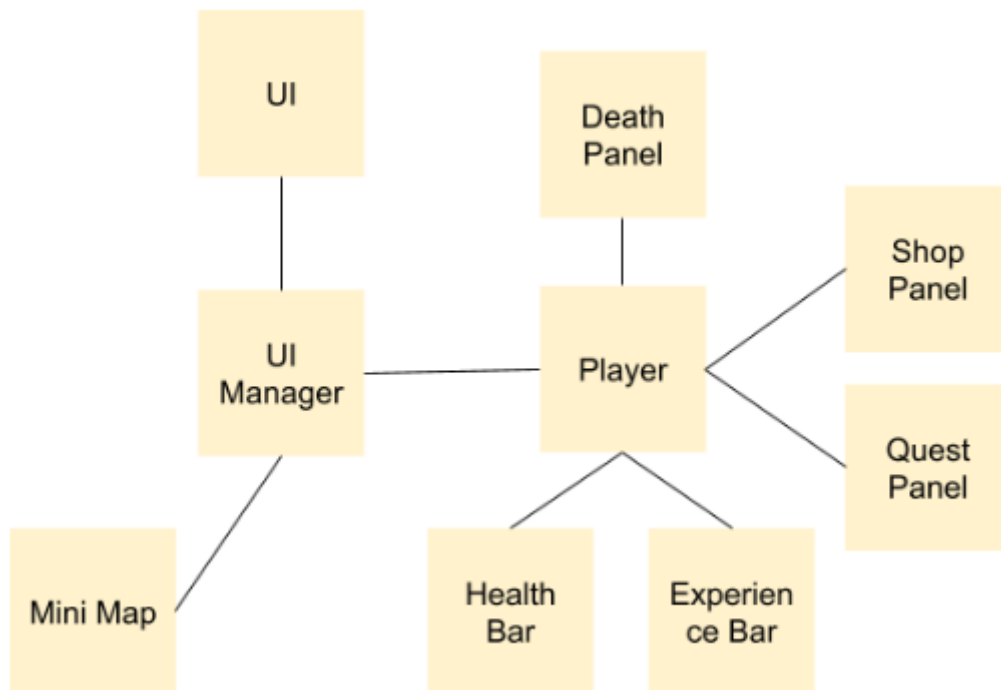


Figure 34 - UI Manager Game Architecture

e)Item

Being the items in game a limited number, there was no need to build a database for gathering all the items that could be used. Since it was manageable to track each individual item present in game. So, the most practical solution was to use Scriptable Objects. This is a component in Unity that allows the creation of game objects that function as a script that contains data inside that cannot be modified. Their content stays the same each run. This was used on all items, but they vary between types. For example, the type of weapon would store, the animations name for attacks and idle states and the weapon stats like damage, critical chance and bonus damage. The same applies to consumables that are stored the value of regeneration it applies.

Scriptable objects (Figure 35) allowed for a better tweaking of each item in detail without dealing with changing the code usage of these objects in other functions.

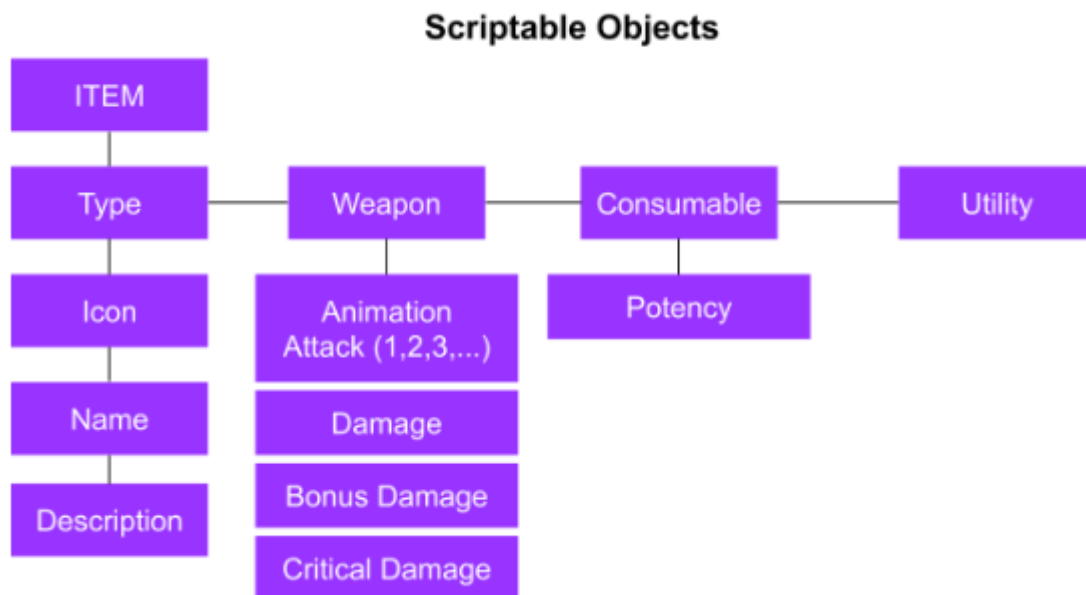


Figure 35 - Item Game Architecture

f)Interaction

Lastly, there are the interaction scripts which need to be reused in many objects, but for this first prototype there were only three types of interaction (NPC, Item pick up and Cinematic). The following image (Figure 36) shows how each interaction type is linked to the main script.

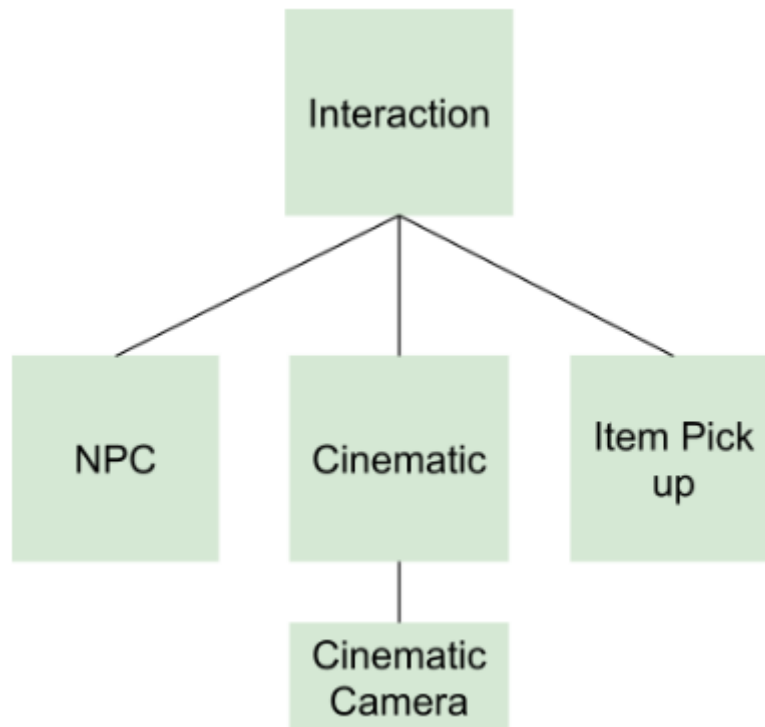


Figure 36 - Interaction Game Architecture

6.Unity Components

Unity has predefined some components that can be implemented on 3D objects to give them the ability to move and interact with other objects in the scene. In *Lucky Hero's Legacy* there is a list of components that are frequently used through different game objects (Figure 37).

Starting with *colliders*, which allow for collision detection and for making each object like a real object and not clipping through the level. Next component is *rigidbodies*, *rigidbody* is a component of Unity used to simulate realistic physics during runtime. This is mainly used on objects that

need realism in movement and collision. Allowing to define weight and forces for the object that alter the behaviour when colliding with other *rigidbodies*.

Animator Controller is used to list all the animations of a certain object, so it's easier to tell an object to do a specific animation when something happens in game, for example, attacking. Although each animation can have their own functionality during their play time, through animation events it is possible to run a function from script through a specific *keyframe* of the animation.

Moving to AI in Unity, there are some pre-built components for it to work, each *AI* object needs to have a *NavMesh Agent* which allows for the computer to move the object in the scene by usage of waypoints. Although *NavMeshAgent* won't work without a baked *NavMesh*, which is the virtual mapping that the agent follows. The agent relies on this *NavMesh* to move through the level without any constraint.

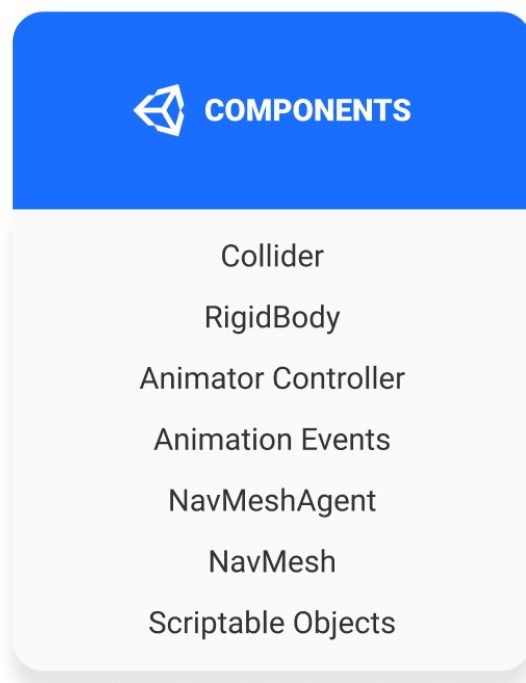


Figure 37 - List of components used in Unity

For last, there are scriptable objects, which are scripts that function as a game object that do not change their data during run time, allowing to store the same information during different runs. This is mostly used when the game has a small number of items for example and there is no need to create a database from it, scriptable objects are one way of doing the job.

a)Player Components

The image (Figure 38) shows how the player is set up, having a *Game Object* with a *rigidbody* and a raised *collider* attached.

The raised *collider* allows for the player to walk on stairs or deformed terrain more easily without too much hassle. The way it works is with the script of ground detection it uses a *Physics* component that allows it to use rays to detect the environment around the player. This *ray* is casted directly below the player, with the distance of the gap between the bottom end of the collider to the ground and sets the position of the *rigidbody* on the Y axis up relative to that distance. Thus, this is all managed by the function that handles the player grounded system present on (Figure 82). Where, whenever the ray casted below the player raised collider is not in contact with another object, triggers the falling animation until it touches with another object, resetting the animation back to idle.

Also, this *game object* has all the scripts related to, *Inventory, Stats, Actions* and *Manager*. As for the graphical part of the player there is another *game object* inside which is responsible for all the animations and prefabs that needed to be loaded inside the player body.

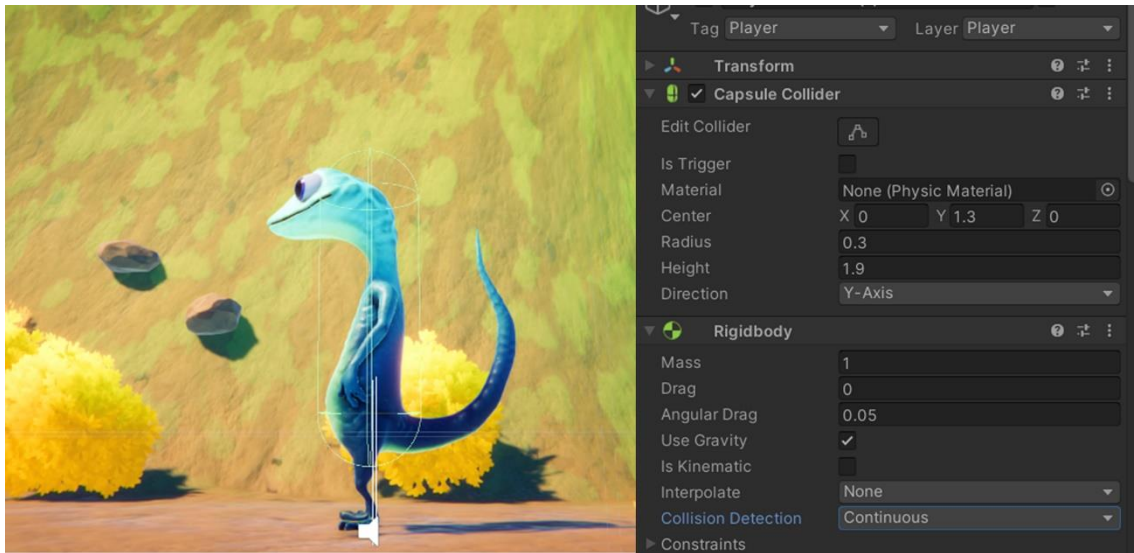


Figure 38 - Player Model in Unity

This Object incorporates the Animator which is used to catalogue all the animations that will be used in runtime, as also as responsible to enable *root motion*. *Root motion* is used to move the *rigidbody* and the *collider* with the motion used in the animation. The animation takes control of the forces induced on the object, making the animation more realistic. This feature is activated through script, mainly used in attacks since most of the attacks have forward movement when performing. All the Root Motion animations are managed by script, since not always there is need to let the animation take control of the character speed. The function responsible for the root motion speed values are present on the Animator Manager script (Figure 84). Whenever an animation is played the trigger *isInteracting* is responsible for the usage of root motion on that given animation. So, whenever that trigger is true, it updates the XYZ positions of that animation and divides it by a real time to have a smooth animation in any given framerate, then those

values are assigned to the rigidbody velocity which allows movement on our player collider. Reflecting the animation speed on the collider. Also, this *GameObject* has the audio source component which is responsible for playing audio from the player when he performs an action like footstep sounds, attacks, jumps, etc.

All these sounds can be synced using *Animation Events*, therefore the scripts that use functions on the animation event need to be in the same *gameObject* as the *animator* (Figure 39).

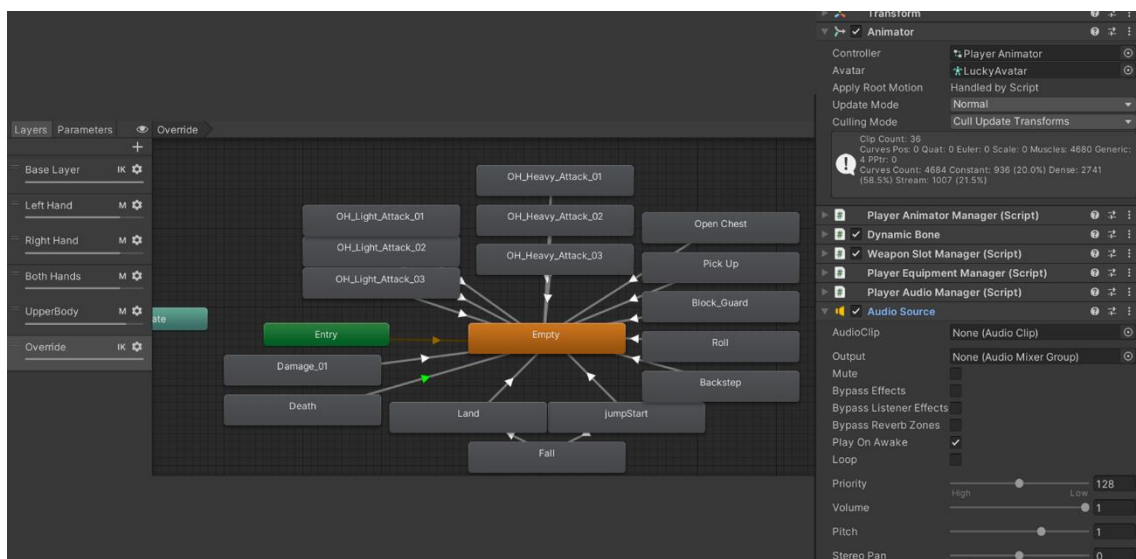


Figure 39 - Animator Component in Unity

These events (Figure 40) come handy when there is a need for synchronization between functions and animation frames. For example, each attack animation has events that at some point in the animation, enables the damage collider and disables after the attack swing is over, also for the combos it is set a time frame to perform a combo.

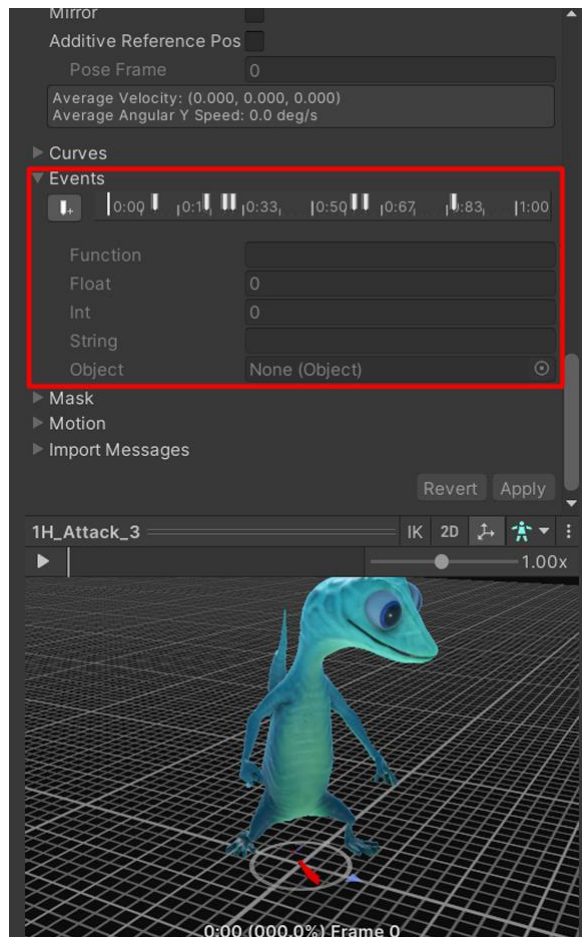


Figure 40 - Animation Events of the Player in Unity

b) Enemy Components

Since the enemies are treated equally to the player, they have the same components, the only difference is the *NavMeshAgent* that controls his movement through the environment.

Although NavMeshAgent is easy to implement and make any non-playable character move freely through the map, his movement is not equally matched with his animation speed. Therefore, in this project we use NavMeshAgent only to point the goal location that AI needs to travel (Figure 41). The moving component belongs to the *Animator Controller* through the use of *root motion*, which makes his movement compatible with the animation speed, using the same script and process from the player character. Thus, *NavMeshAgent* cannot work simultaneous with *rigidbody* and root motion, so it is required scripts to control all his actions to enable and disable each component when performing an action.

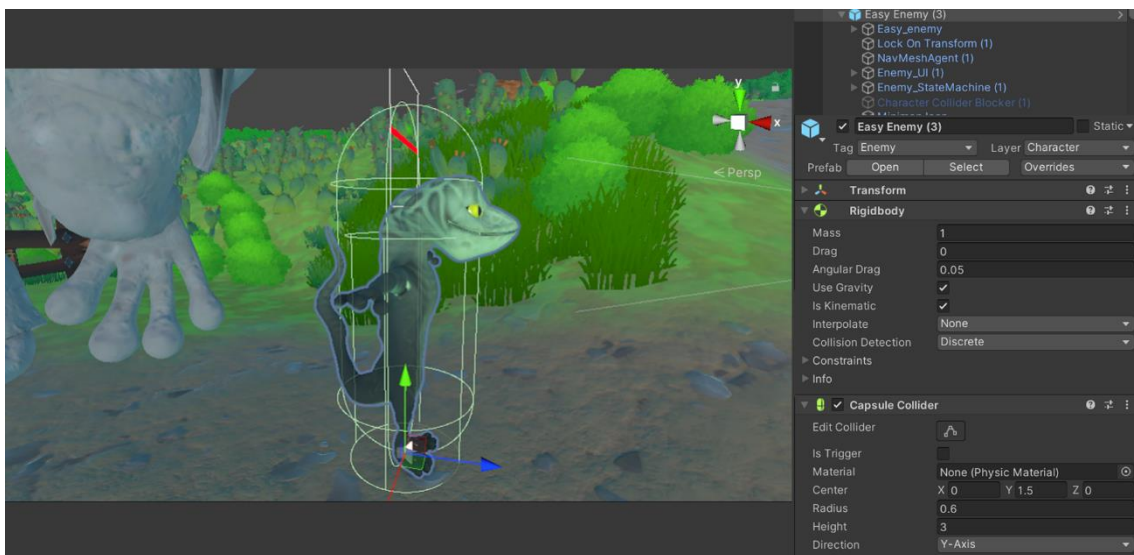


Figure 41 - Enemy Model in Unity

In order to achieve such complexity, it is required to create a *State Machine* (Figure 42) for the enemy AI, which should have the following states.

For idle actions we have *Idle and Ambush*, the difference between both is that Idle is a more stationary position while ambush it is possible to put the enemy doing something else like working or sleeping. Both have the

job of detecting the player and move to the next state which is *Pursue Target State*.

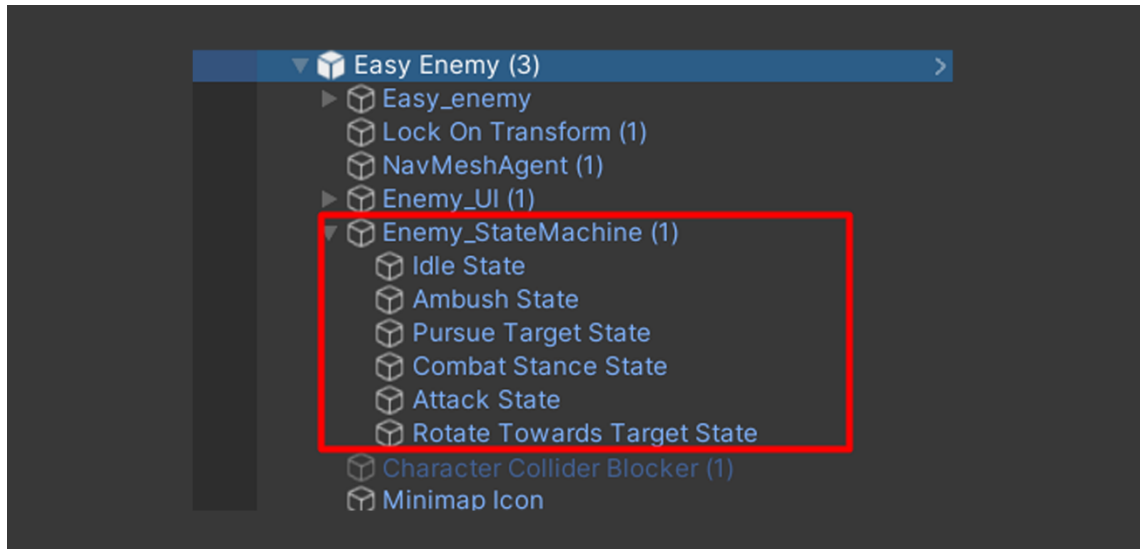


Figure 42 - Enemy State Behaviour Objects in Unity

This state is responsible to enable and disable the *NavMeshAgent*, root motion and the movement animation to be played. By looking at the (Figure 83) it shows the code about the Pursue State, where it always updates the distance between the enemy and the player and the angle that the player is in perspective of the enemy point of view. Whenever the player is out of peripheral vision of the enemy, the enemy changes State to the Rotate Towards Target State. Whenever the distance from the player is equal or inferior of the combat radius it changes the state for the combat. Which is responsible for choosing what kind of attack will be used if it will combo or not. Once it decides he triggers the *Attack State* to disable the *NavMeshAgent* and enable root motion as well.

c)Map NavMesh

NavMesh is baked on the map to generate walkable paths for the *NavMeshAgent* to walk on (Figure 43). Without it the agent won't set a point or move the object on the scene. This baking process can be quite taxing

on huge terrains like the ones built, so to minimize the processing time each terrain was divided in large chunks, which allowed it to only bake the chunks needed for the AI.



Figure 43 - NavMesh Component in Unity

d) NPC Components

The NPC (Figure 44) in the game is composed of a *rigidbody*, a *collider* and an *animator controller*. Since they won't have complex features like enemies, this is more than enough for their interaction and presence in the game.

Their only function is to give quests and rewards to the player through the levels. Despite this, its simplicity is a key aspect in guiding the player through the map.

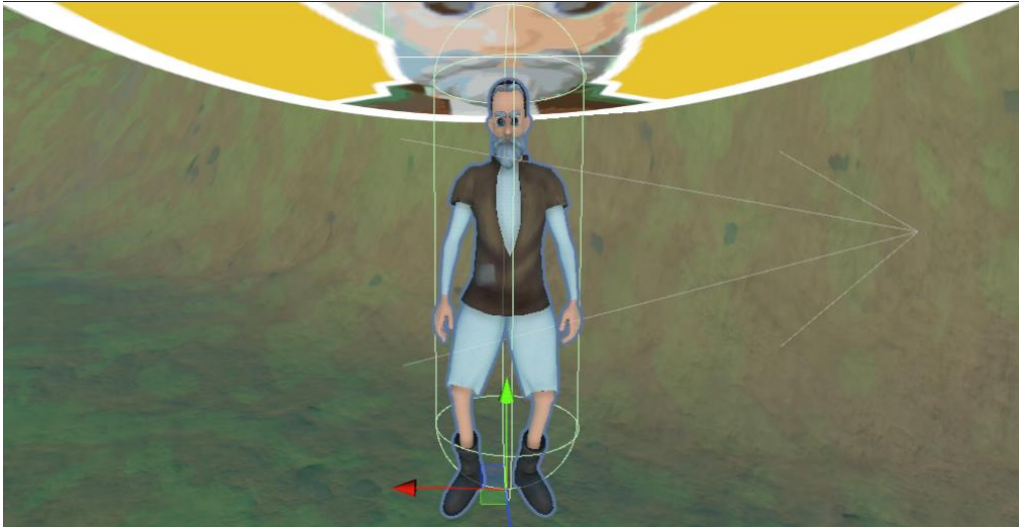


Figure 44 - NPC Model in Unity

e)Items

Each item in the game derives from the same class, in this case Item (Figure 86). Since there will be different types of items, the usage of an identifier is a must have in this situation, by establishing a list of item types and the most basic factors used in all type of items for later development, like, name, icon, description, etc.

For example, the weapons in the game all derive from the class Item (Figure 85). In this new script it is only added important information relative for its usage later by the character. Since this is all Scriptable Objects (Figure 45), they can be filled out with all the information and images needed for it to be used and shown in game, like animations names for the light and heavy attacks, as idle animations and the 3D model associated to that item and finally the most important the damage that weapon does. All

this data will not be lost unless the object itself is deleted from the project files.

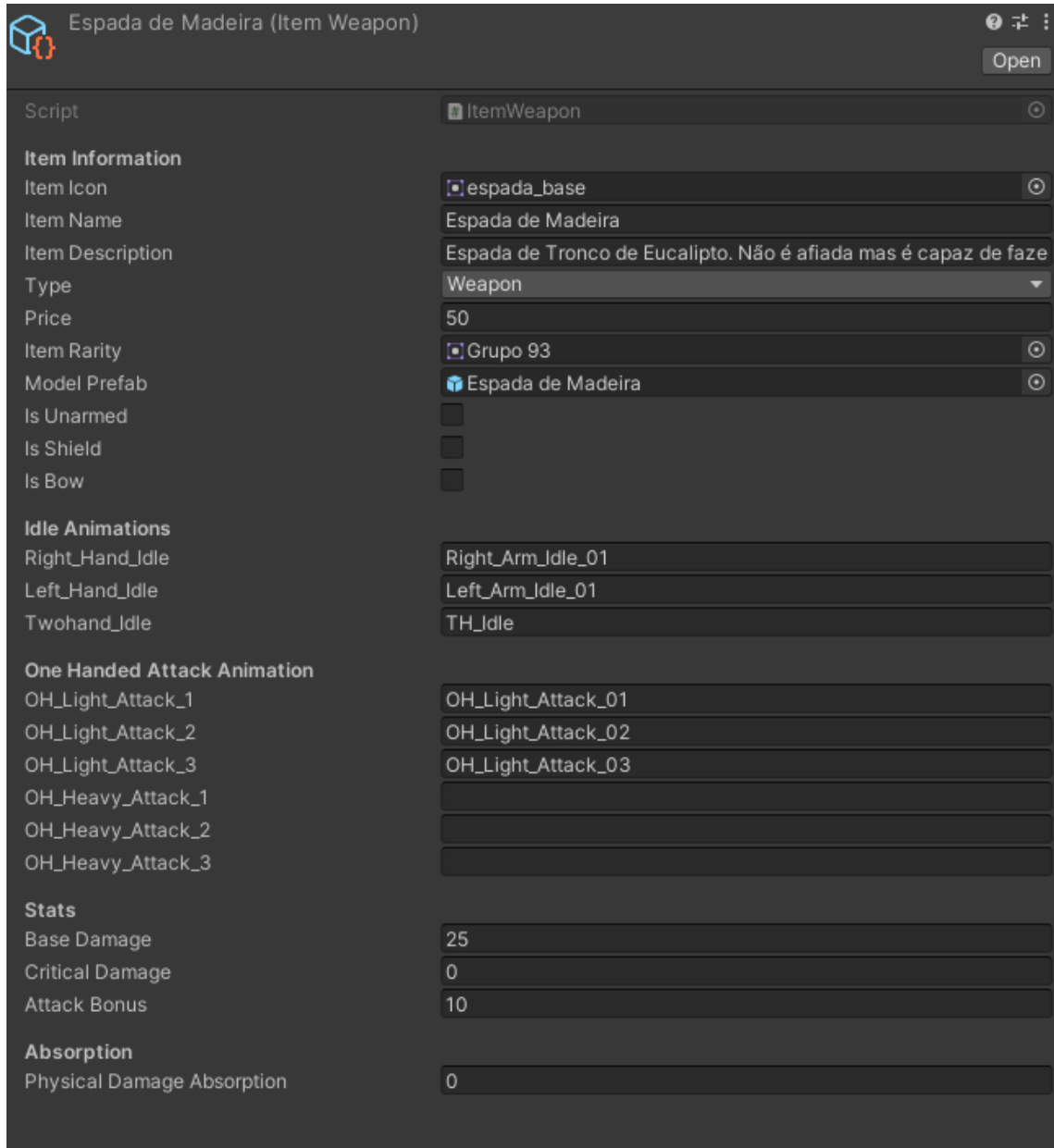


Figure 45 - Scriptable Object Weapon Item in Unity

7. Prototype 1 Pilot Testing

This section describes a pilot evaluation of the first prototype of *Lucky Hero's Legacy*. This was conducted in order to test the overall concept of using a video game to provide cultural knowledge about Madeira. As well as if the game mechanics and UI implemented for this version was functional and to know if anything needed to be changed or improved. Also, if it was needed to change the game type to ensure that each user learns something new during the playtest.

a) Protocol and Measures

For this test we enquired five users from our target audience. All the process was done online by resourcing to the application *Discord*, since the testing could not be done in person because of the pandemic at the time it occurred. The game executable was shared with the players who then would run it on their own computers. Each experience was observed via share screen, voice chat and audio. Hence, we also asked each user to talk while playing to know what goes on their mind while playing, this process is called Think Aloud. At the end of the playtest participants would be told to fill in a qualitative survey, consisting of seven questions. With questions such as:

1. Did you get excited with the game?
2. If yes. Which elements were more interesting?
3. From a scale from 1 to 7 (being 1 easy and 7 very hard) would you rate this game.
4. Which elements or moments were difficult?
5. Enumerate the moments you felt lost.
6. Tell 3 elements that you liked about the game.
7. Tell 3 elements that you disliked about the game.

b)Results and Conclusions

According to the results all the participants were from the male gender, where two had the age of 15 and the rest an age of 14 years old. Everyone gave positive and negative feedback during and after the experience.

As shown from the graphic (Figure 46), it can be seen which feature in the game the users complained the most. Targeting the lack of orientation during missions. Thus, players after accepting any quest did not know which path to take or where to go, since there were no reference points. Other problems related to this was the camera where its movement was twitchy and not very smooth, it did not fit well with the whole game. Subsequent, two other parameters that need attention are, Player Animations and Enemies behaviour. Relative to player animations was due to the fact of the dodge action not looking like a dodge, the problem was that the model would perform the animation and stay in the same place, since *Root Motion* was used for the movement of the player model while performing an animation there was no *z axis* movement (forward movement) present in the animation used therefore *Root Motion* would not have impact on the forward movement of the character.

Lastly, for enemy behaviour, players pointed out that sometimes the enemy would never attack whilst getting hit by the player, as well as for the strange behaviour while chasing the player that the player would change direction and the enemy would run straight up without changing direction. For the first problem related to this behaviour, the enemy would enter in an animation loop while getting hit, it would not ignore some attacks received. This problem gave the AI no chance to strike back. For the upcoming problem, due to the fact of the *Root Motion* taking control of the character movement, for that to happen the AI navigation system had to be disabled momentarily and would reactivate once the enemy reached his destination.

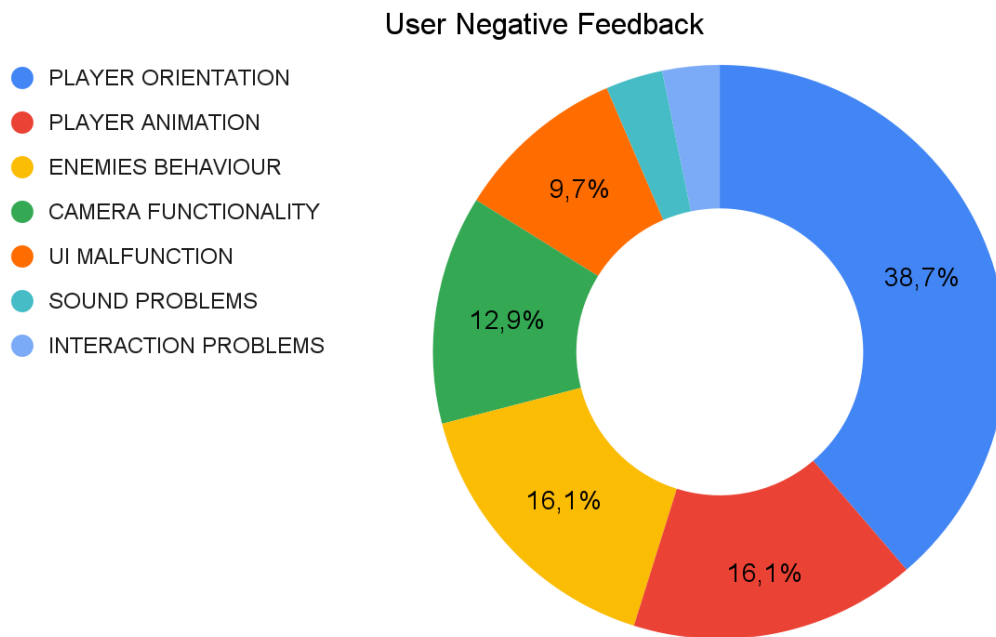


Figure 46 - User Negative Feedback Pilot Testing

Although, positive feedback was also attained in different components present in the game such as: Visuals, Attacks and Jump. For this evaluation it will be discarded the visual factor of the game and focusing more on the mechanics present in it. From the feedback received shown in the graphic (Figure 47) it is possible to verify that users enjoyed how the attack system works and how the player jumps in the game. No user mentioned anything related to the quests in both feedback sections. Therefore, it was impossible to know if the questing system could provide information related to the story or cultural heritage.

Regarding the feedback received from the questionnaire and the screen share during the testing. It was possible to verify what needed to be improved or changed. In this case new navigation features needed to be implemented for example, whenever the player gets a new quest, a marker would appear on the player's camera view pinpointing where the location of

that quest. Subsequently, improvements to the camera movement, in this case adding more smoothness to the camera so it becomes less twitchy. Change the dodge animation to be more fluid and capable of moving the player farther when performing a dodge. Lastly, an improved AI for the enemies, adding rotational movement whenever the player changes direction abruptly and also allows for the enemy to always verify where the player is in the map to follow him more precisely. Nonetheless, the combat against AI needed some improvements as well so it was added a percentage where the enemies would ignore incoming damage most of the time, allowing them to attack even if they get hit by the player.

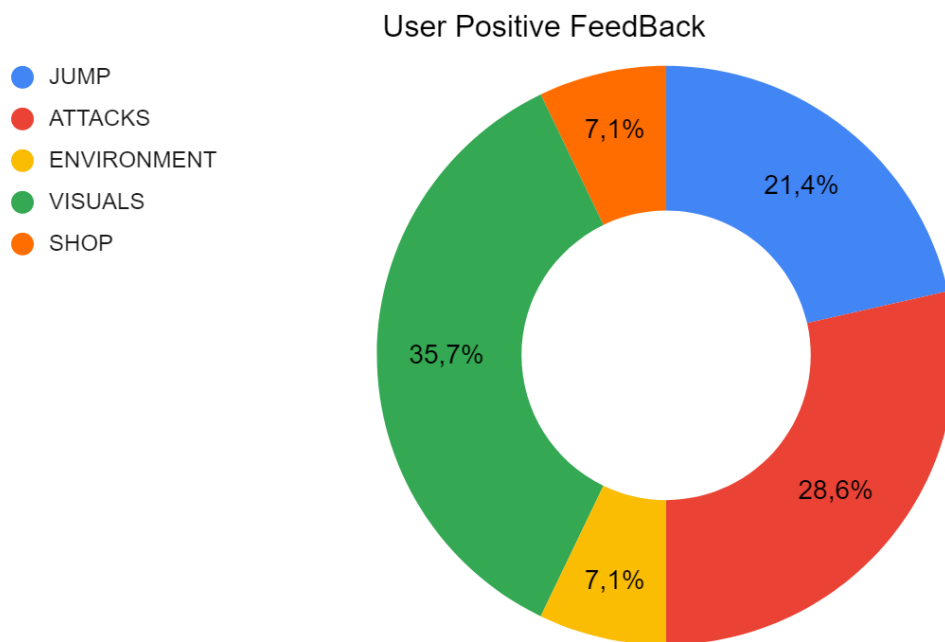


Figure 47 - User Positive Feedback Pilot Testing

IV. Game Development - Final Version

This section describes the final version of the *Lucky Hero's Legacy* prototype. All the new levels of the video game, showing all the available mechanics and redesigned UI are described. Furthermore, in terms of the implementation it describes new scripts and changes made to the existing ones. Towards the end of the section, it is described the evaluation done with the target audience and results obtained.

A. Level Planning

As a result of the testing done on the first prototype, some features needed to be added to the game as well others had to be modified. Proceeding with the level planning, there were five levels to be added in the game each of them containing various quests and interactions.

Therefore, it was necessary to do all the planning regarding the path which the player needed to do in order to complete the level. This was also essential for the development team to know where enemies, interactions and items are placed.

1. First Level: Lucky's Call for Adventure

The first level: **Lucky's Call for Adventure** Figure 48 is the same as the one present in the first prototype, known as Machico. Although there was a need to refactor all the path layout done previously there was also a need to keep the introduction of the basics of the game. So, the player had to progress through the level where the main objective was to collect all the knowledge available on that level and proceed to the next one. The player was presented with quick tutorials that help identify and learn the basic aspects of the game. Since this level is linked to the Legend of Machim, there was a need to introduce useful information not only about the legend but also about cultural buildings, in this case the traditional Madeiran house.

Through missions the player is guided at some point to these locations where he must interact with the building which begins a cinematic with an explanation about the structure (Figure 77).



Figure 48 - Lucky's Call for Adventure (Machico)

2.Second Level: Treacherous Trails

The next level presented is **Treacherous Trails** (Figure 49) related to the location of Garajau. This level there is a repetition of mechanics but with an increased difficulty. The main objective here was to find the missing mythical sword from the Legend of Arguim and proceed to the next area. The most difficult part of this level is the jumping section in the beginning (Figure 78). From that section onwards the player has to fight his way to the mythical sword and fight again to find his way to the next level.

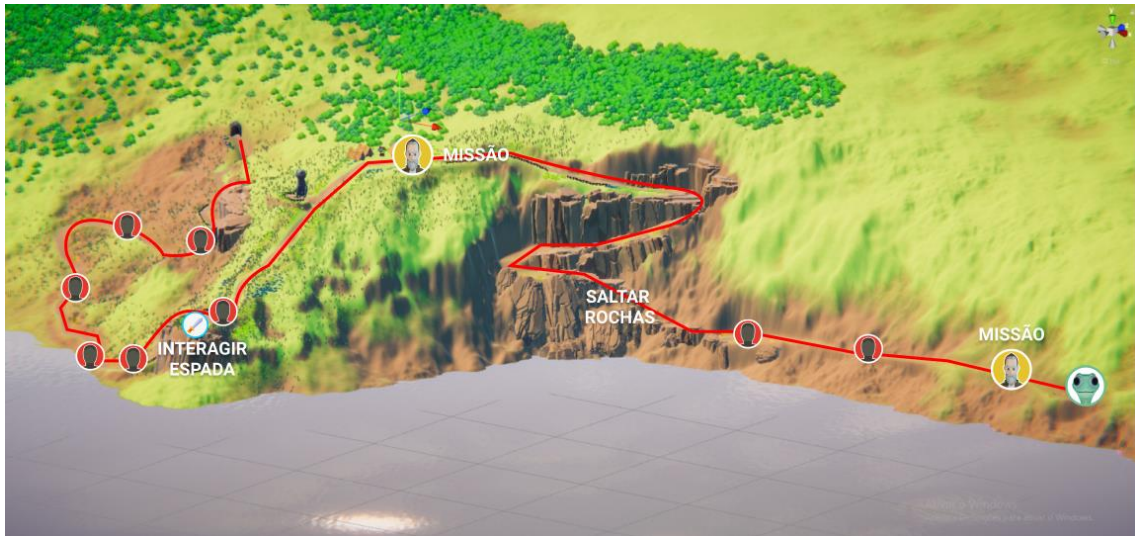


Figure 49 – Treacherous Trails (Garajau)

3. Third Level: Evil's Lair

Evil's Lair is the level displayed on the image below (Figure 50), remounting the fortress in Funchal at this stage the player is halfway from completing the game, in this level there is a turning point according to the game's narrative. The main objective is to infiltrate into the fortress and gather another pearl fragment. Therefore, the level is less challenging on the movement abilities but more focused on the combat aspect (Figure 79). Once the player reaches the main gate, a cinematic is triggered giving information about that fortress. Afterwards, the player reaches the top-level section and there is a mission where he has to find the key to open the gate for the pearl fragment. Finally, reaching the statue when interacting with the pearl another cinematic plays, revealing a part of the storyline where the Old Man is kidnapped by Wilson II leaving Lucky alone and hopeless. Which leads to the next level after the cinematic.



Figure 50 - Evil's Lair (Funchal)

4. Fourth Level: Ghost Town

Ghost Town (Figure 51) reassembling Câmara de Lobos is where all the skills learned from previous levels are all put to the test in the most challenging way. The player must fight his way through to reach the boss and defeat it. This enemy is Ladislau related to the Legend of Ladislau, since he tragically got killed while sailing near the Cape Girão, there was this idea to bring him back to life in ghost form while wearing his armour. Subsequently, the following challenge is once again the jumping mechanic in which the player must jump from boat to boat until reaching shore, if he falls into the water the player dies and has to start from the first boat Figure 80. Later the player is presented with a cinematic related to the traditional Madeiran boat followed by a new mission, where the player should find a key in order to proceed his way to the next level.



Figure 51 – Ghost Town (Câmara de Lobos)

5.Proof of Knowledge

The final level **Proof of Knowledge**, São Vicente, (Figure 52) that was planned with a straightforward direction and mission. Defeat the final antagonist, Wilson II (Figure 81), rescue the old man which was shackled on the other side of the river and place all the fragments in the chapel. After defeating Wilson II and releasing the Old Man, it was intended to add an in-game questionnaire that had to be done in the end after all his purpose was fulfilled. In order to complete the video game each player has to answer the questionnaire to test their knowledge obtained from the whole experience (Figure 87), to be declared the true hero worthy of that pearl, in order to proceed to the final cutscene of the experience.



Figure 52 - Lucky's Call for Adventure (Machico)

B.High Fidelity UI

Lucky Hero's Legacy final version has the last iteration of user interface implemented. This section aims to describe each UI aspect implemented compared to the first prototype used for pilot testing. Considering that the target audience are in majority Portuguese, the whole UI is in Portuguese.

1.Main Menu

The Main Menu (Figure 53) stayed almost the same as the first prototype, it only removed two options from the selection menu, continue and options. Since, there was no save system implemented in the final version and the options are present on the pause menu during gameplay. Once the player presses the "Novo Jogo" button it is taken to a cinematic about the narrative before entering the gameplay.



Figure 53 - Main Menu High Fidelity User Interface

2.UI Tutorial

The image (Figure 54) displays the first screen of the gameplay where the player gets a quick tutorial identifying the HUD present. The user can only start playing after pressing the Enter key presented on screen. The mini map is basically a camera that follows the player rendering all the environment excluding character models, whilst each model has an icon attached that can only be seen by the Mini Map Camera. Around the Mini Map there is the health bar, every time the player takes damage the bar becomes less filled. Finally, on top, there is the experience bar and the player level. Each time the player completes a quest or kills an enemy this bar gets filled and the level gets higher.



Figure 54 - Heads Up Display (HUD) Tutorial High Fidelity User Interface

3. Tutorial Tooltips

During this stage quick tooltips (Figure 55) will show on the right side of the screen giving information about each key binding and its related action. This panel only shows on the first level of the game since it works as an introduction of gameplay.

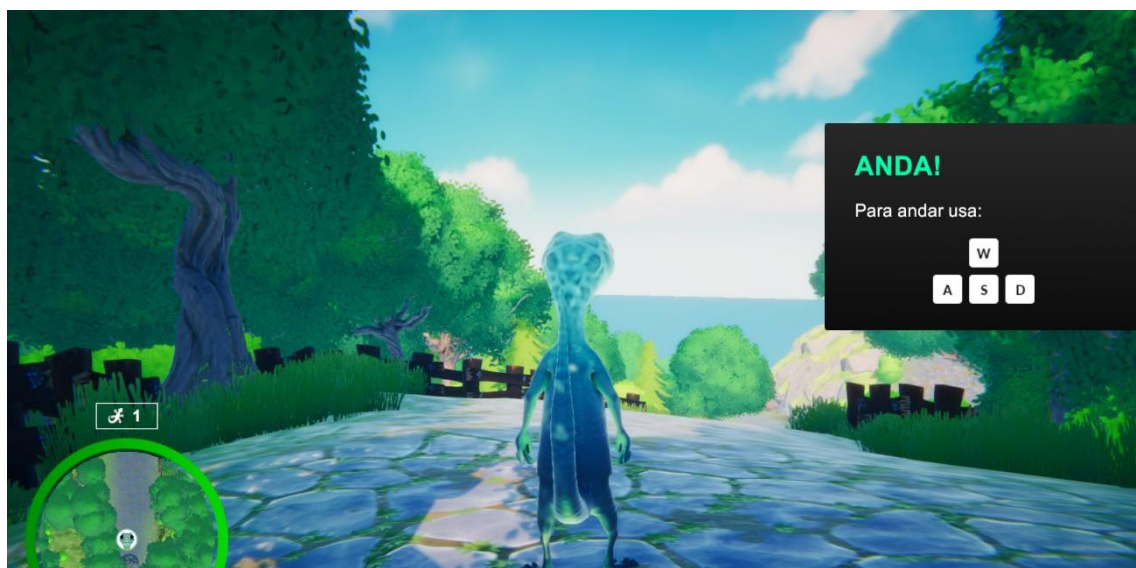


Figure 55 - Tutorial ToolTips High Fidelity User Interface

4. Interaction

The image (Figure 56) it is related to the interaction panel, which only shows up when near an NPC, interactable building or item. This was kept the same orientation and position as the first prototype.

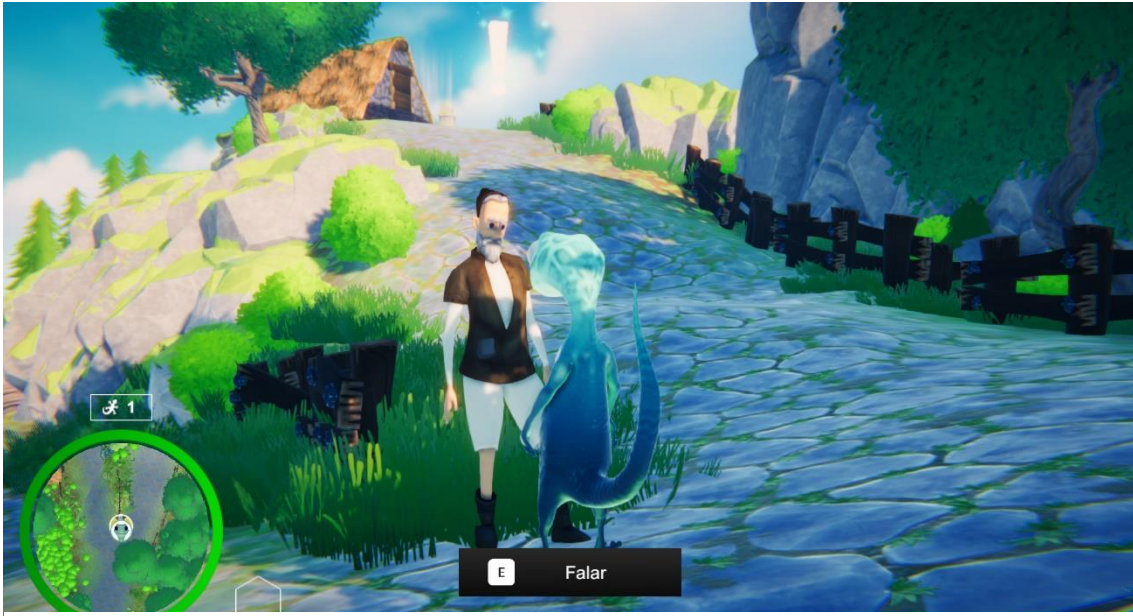


Figure 56 - Interaction Panel High Fidelity User Interface

5. Quest Panel

Upon interacting with the NPC, it opens the quest panel, where all the information about the mission is displayed (Figure 57).

From, what is the target and what to do if it is to kill, gather or interact. Alongside, there are the rewards that the player will receive if he completes the quest and finally is given the option for the player to accept or decline the mission.



Figure 57 - Quest Panel High Fidelity User Interface

6. Quest & Navigation HUD

Once the player accepts the quest a new HUD feature is activated, the quest log and a destination marker are placed on the target object needed for that specific quest (Figure 58). This marker helps to guide the player to the right path and location needed to perform an activity. As well as when finishing the quest, it will mark the NPC needed to turn in the quest to get the rewards.

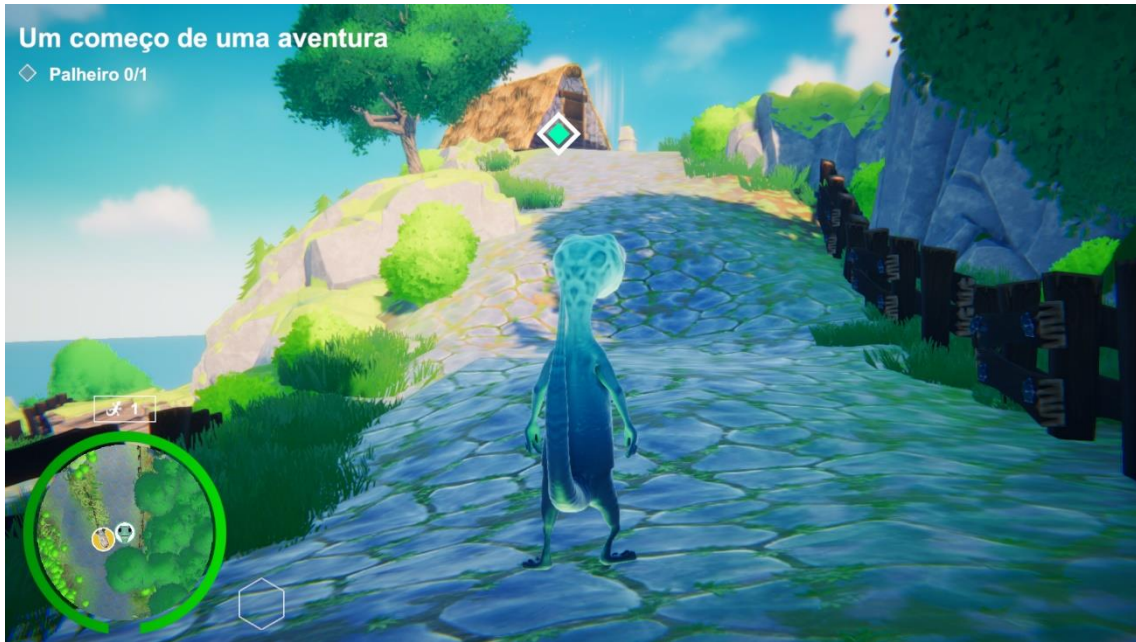


Figure 58 - Navigation Marker High Fidelity User Interface

7. Equipment Panel

The equipment panel (Figure 59) can be opened when pausing the game by pressing escape during gameplay, it is used to swap weapons or equip new items. This panel works in parallel with the inventory panel and each time that any weapon switches it will show a visual representation of that item on the player model present in the panel.



Figure 59 - Equipment Panel High Fidelity User Interface

8.Inventory Panel

The inventory panel (Figure 60) is where all the items gathered in the game are placed, giving the possibility for the player to filter the inventory by category, presented on the menu on the left. When hovering over an item a details panel appears giving more in depth information about the item selected.



Figure 60 - Inventory Panel High Fidelity User Interface

9.Options Panel

Finally, the last panel present in the pause screen. Keeping the same design presented on the previous version of the game. This feature allows for adjusting the sensitivity of the mouse for the camera looking and to adjust the quality of the graphics displayed in game (Figure 61).

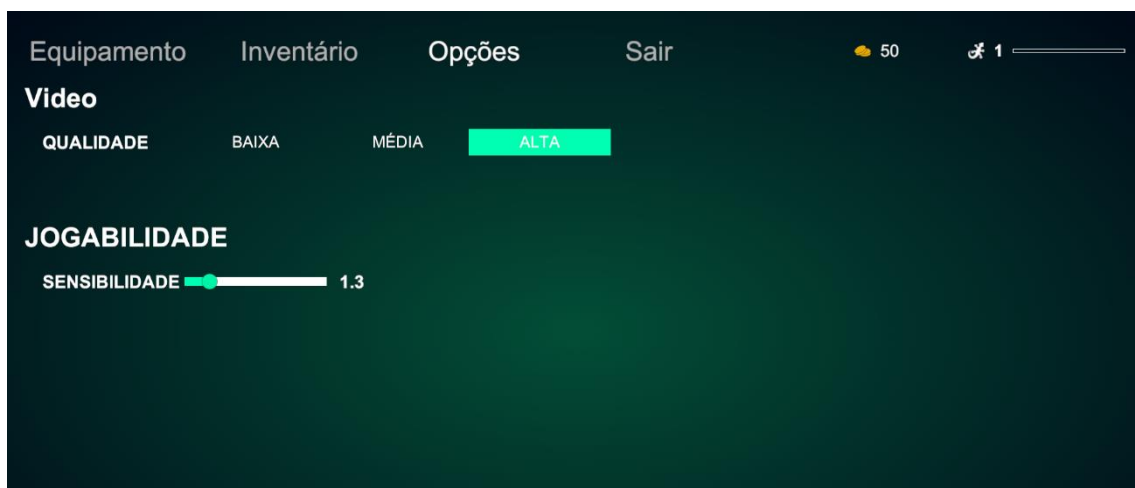


Figure 61 - Option Panel High Fidelity User Interface

10. In Game Questionnaire

The in-game questionnaire (Figure 62) is a feature implemented in the game to aid the evaluation process used for measuring the effectiveness of the experience and attentiveness of the users to the information provided.



Figure 62 - In-Game Questionnaire User Interface

C.Game Architecture Improvements

In contrast to the first prototype, the final version needed some extra components to be introduced. Namely, the Loading Manager, it must be introduced to the project to manage the loading between each scene in Unity. As well as Sound Manager for all the sounds played in the game from, background music, player interactions and actions, etc. Although, some scripts needed additional features, namely, the interaction, and NPC to cooperate with the ideas designated (Figure 63).

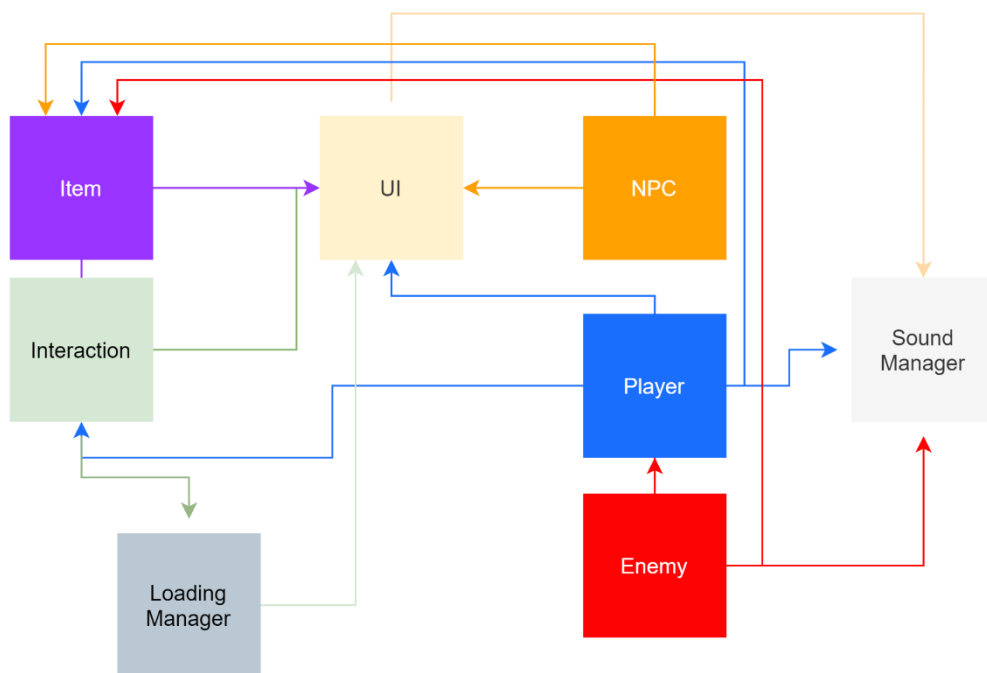


Figure 63 - Overall Game Architecture Changes

1.Loading Manager

The *Loading Manager* (Figure 64) is used to manage transition from level to level. In Unity each level is related to a Scene, so when moving from scene to scene the engine needs to load all the object models, textures, and scripts before it is playable. So, to minimize the freeze time between scenes it is added another scene on top which is categorized as Loading Screen. For Lucky Hero's Legacy, the use of static background images as loading screen is used, each image is referent to the level being loaded. Each final checkpoint present in the levels have a component referent to the loading manager, when the player collides with a hidden collider in them it triggers the functionality of the *Loading Manager*.

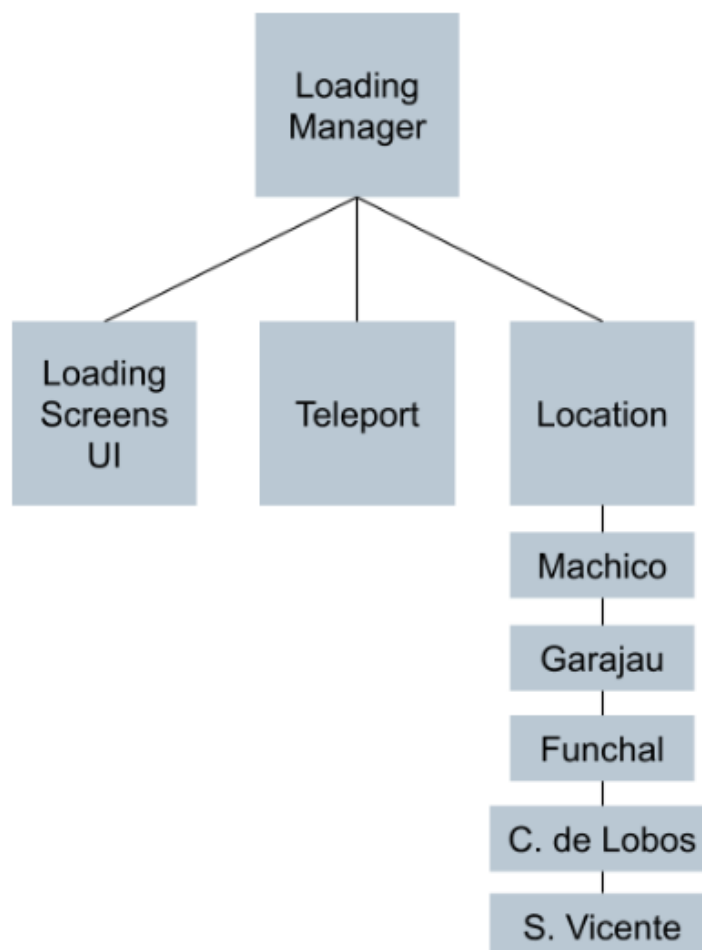


Figure 64 - Loading Manager Architecture

2.Sound Manager

The Sound Manager encapsulates all the sounds generated by the player, enemies, and UI. On the image (Figure 65) there are two types of sounds produced, the one takes sounds categorized as Sound and the Random Sound which is a repetition of various audio clips. One take sound is for actions in the game that cannot be overlapped, normally used in UI sound feedback or any single action like for the jump animation of the player. Next, there are the random sounds, which are commonly used for attacks and footsteps when moving around the scene. They are as well one take sounds, but they are played at a high rate coordinated with the animation being played. All the audio used in UI, Player and Enemies was collected in YouTube audio library [21] and a free audio pack by Kenney [22] and each audio clip was then placed inside the audio manager script to be used.

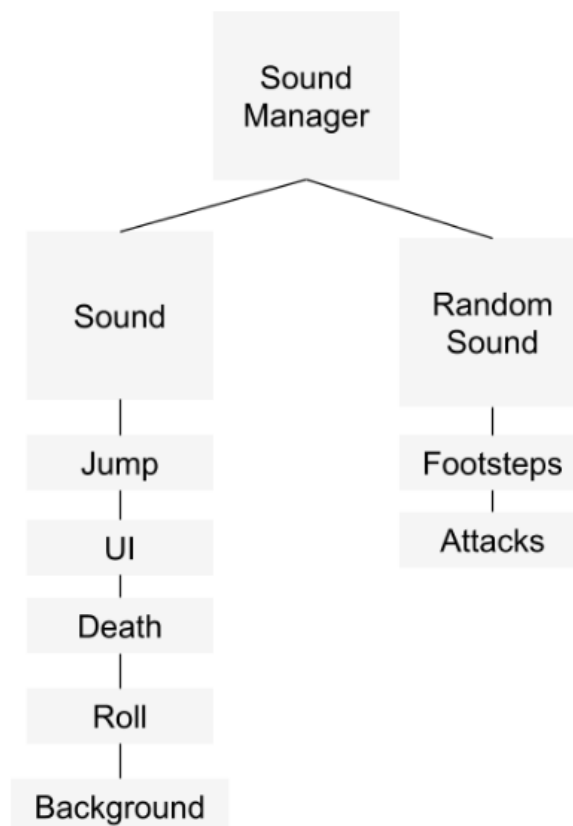


Figure 65 - Sound Manager Architecture

3.Interaction

Lucky Hero's Legacy has many interaction objects present in the game, from chests, NPC and buildings that trigger cinematics. Despite these interactions Figure 66, there was a need to include more interactions to trigger loading levels and allow interactions when the player has an item needed for it to happen.

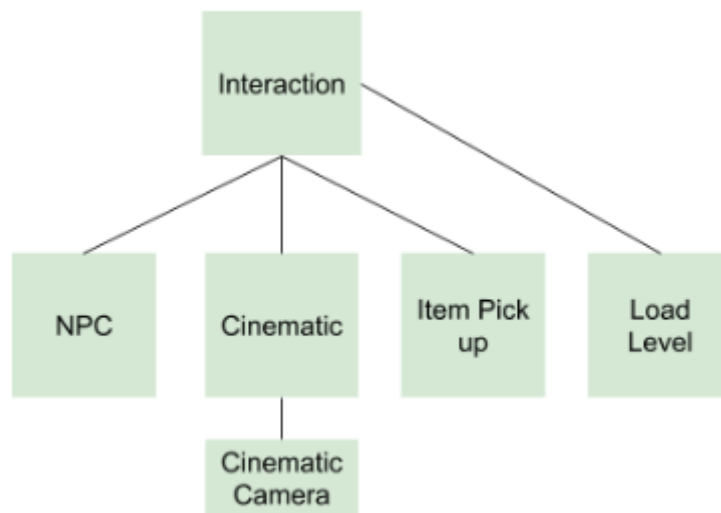


Figure 66 - Interaction Architecture Changes

4.NPC

Lastly, for the NPC (Figure 67) there is the implementation of quest location, used by the UI Manager to add a marker to the target location to guide the player for the right location of the quest. Thus, related to the feedback received from the pilot testing, most of the players felt lost sometimes during the experience.

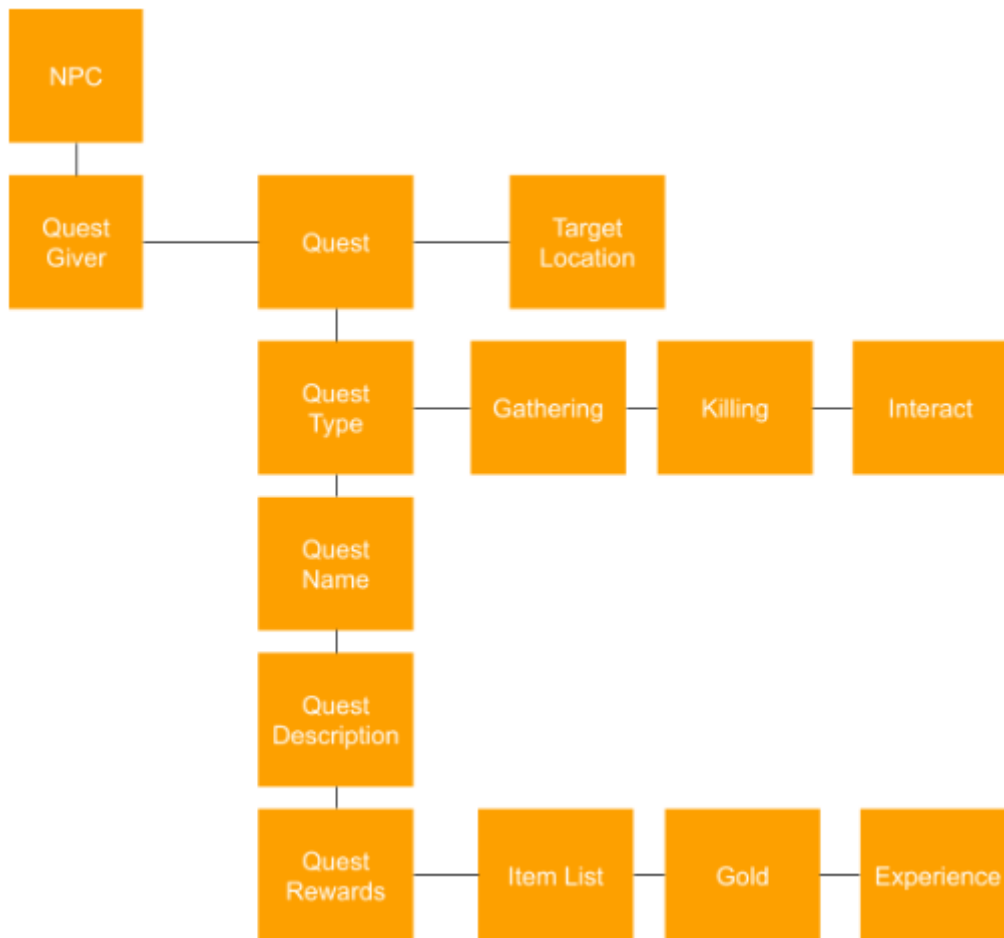


Figure 67 - NPC and Quest Architecture Changes

D.Final Prototype Evaluation

1.Protocol

Participants were recruited for this study, they needed a computer, mouse and keyboard, as well as audio output and internet connection. Each participant was given a link to a Discord server which was created with the purpose of this test. Each individual had access to a link to be able to download the game.

After accepting the protocol, a prequestionnaire is delivered before the experience. Thus, it consists of three sections:

- Consent of participation form, where the user accepts to volunteer to be part of this study evaluation.
- Demography (ID, Age, Gender), to test the experience with a variety of ages.
- Videogames Experience, to measure the knowledge on diverse videogames of our test subjects.
- Cultural Knowledge about Madeira Island, about myths/legends and some cultural heritage.

Before playing the game, each user was asked to share their screen, so it allows for observation of their behaviour during gameplay. When reaching the end of the game, each user was put through a test of five questions about cultural facts and legends present in the game that are needed to be answered to be able to complete the experience. Each response is collected by the observers and placed in a private questionnaire.

Once the experience ends, each user was asked to fill another questionnaire according to the post experience of the game. Which is

divided in three categories, general knowledge about the island, GUESS-18 scale, and general feedback of the experience.

The first section is composed about general knowledge, identical to the first questionnaire filled beforehand the experience. This allowed us to compare the influence of the experience in the answers. Resourcing to the GUESS-18 scale, could evaluate various parameters of the game. Lastly, before handing in the application, there is a feedback section that allows each user to give any feedback about the experience and thanking each one for their participation in the testing.

2.Measures

To evaluate the game, a GUESS-18 scale was resourced, which consists of eighteen questions of a total of eight parameters but for this project we had to remove one because it was related to communication and since our project does not support multiplayer or co-op features. However, this scale is related to the degree of satisfaction related to the experience: Usability, Narrative, Play Engrossment, Satisfaction, Creativity, Sound, Visuals and Self Gratification. This scale is a reduced version of the GUESS scale[22]. GUESS-18[23] uses an evaluation from one to seven points, being one point equal to completely disagree and seven completely agree.

Once the data is all collected the mean is calculated of each parameter, giving a result for each criterion. In the end, each result would be added forming a composite score that is later measured in a scale from nine to sixty-three points.

3.Results

a)Demography

Testing was done with fifteen users with ages between twelve to eighteen years old, of the masculine gender. The majority game frequently has a high count of hours in game, according to the data around 120 hours in total of gameplay Figure 68.

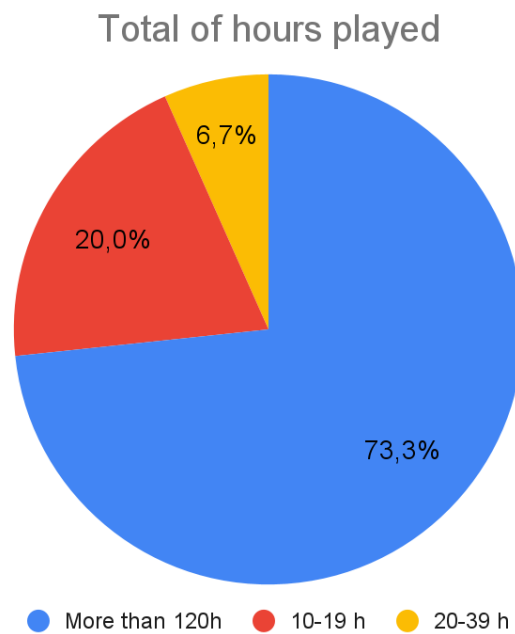


Figure 68 - Total of hours played of users tested

Hence, most of the users resource the use of the computer as the main source of entertainment Figure 69. As a result, having access to a wide variety of games, increasing their knowledge through various types of video games Figure 70.

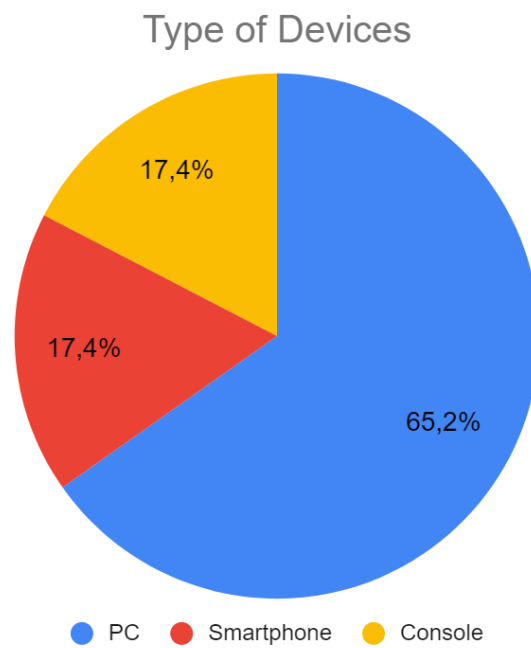


Figure 69 - Type of devices most used by the users

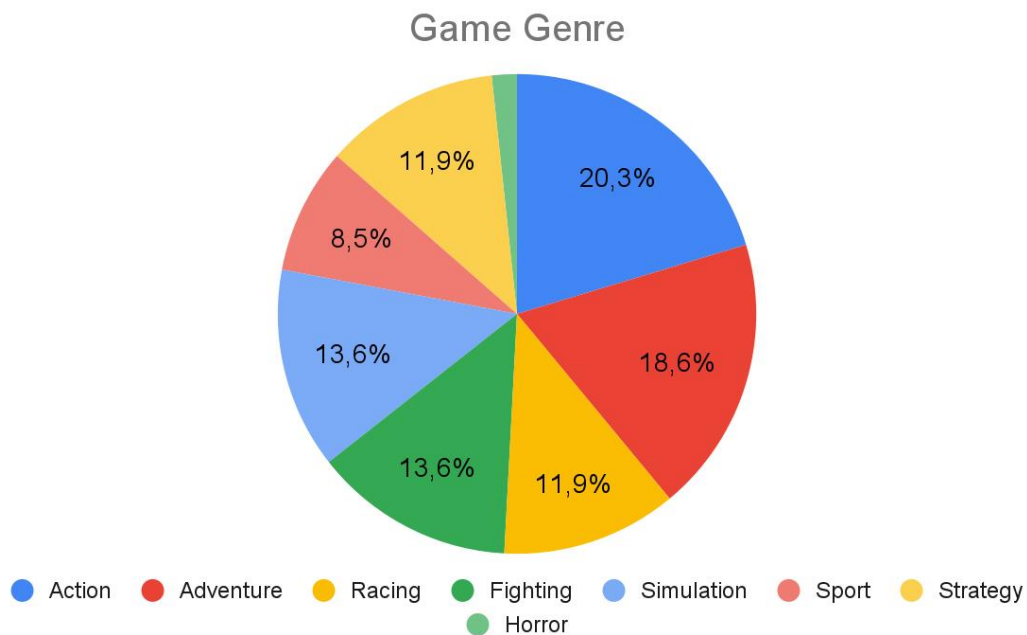


Figure 70 - Game Genre played by the users

b)Game Questionnaire

During the experiment it included a questionnaire which aids the effectiveness of the study and if it had any effect on the knowledge of the user. Thus, it consisted of five multiple choice questions about the cultural heritage and myths inside the game. Five multiple choice questions were made at the end of the video game, which were the following.

1. The Legend of Machim and Ana commenced which Chapel?

For the first question, 73.37% of the users got the correct answer, which was “Chapel of Senhor dos Milagres”, 20% selected the following option “Chapel of São Pedro” and only 6.7% locked “Church of Nossa Senhora da Conceição” as their answer.

2. Which material was used to cover the traditional houses?

The following question had 63.3% of the users answering the correct option (“Palha”), 6.7% selected (“Madeira”) instead.

3. The Fortress of São João Baptista do Pico was used to protect against attacks from?

On the third question, there was again a majority of 63.3% of the answers being “Piratas” which is the right answer and 6.7% on the option “Espanhóis” as their answer.

4. Which color is the interior of the boat “Xavelha”?

On the penultimate question, there were three different answers, the right one, the most selected “Azul” with 80%. The other two questions left one had 13.3% being “Amarelo” and 6.7% on the one being “Verde”.

5. For what reason was the Chapel of São Vicente built on a rock?

Finally, on the last question, most of the answers went for the right one “Proteger do Mar” with a total of 86.7%. Then the other two options selected were “Proteger contra os Piratas” and “Proteger do Clima do Norte” being both 6.7%.

Once the results from the in-game questionnaire were evaluated, it was possible to realise that the majority of our users had chosen the right answer (85.3%) and only (14.7%) were incorrect answers. This information can be confirmed with the graphic below Figure 71.

Total of Correct Answers

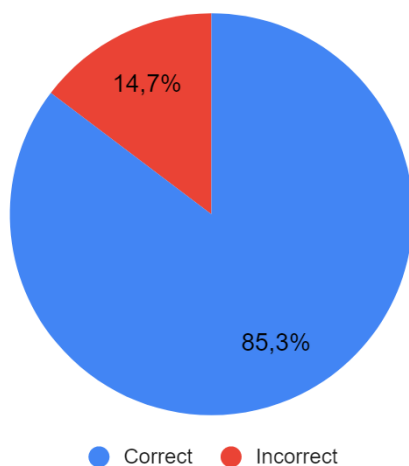


Figure 71 - Total of Correct Answers related to the in-game Questionnaire

c)Pre and Post Questionnaire

As previously shown, a pre and post application was done about the overall knowledge of the Madeiran culture. The first question is about myths of madeira island. One was from Madeira and the rest from mainland Portugal.

In this question the answers were quite diverse between all options, only 33.3% got the correct answer. Although, after the experience in the post questionnaire, being a flawless result of 100% of the users on the right answer (Figure 72).

Which Legend is from Madeira Island?

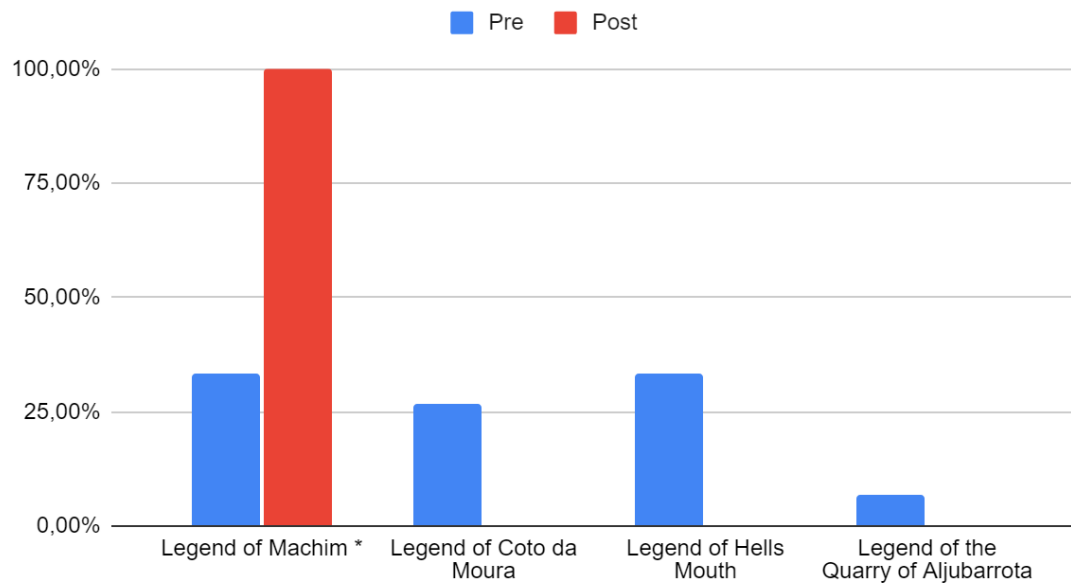


Figure 72 - Comparison Pre & Post Questionnaire, first question

The next question was about fortresses in the Island, where once again only one answer belonged to Madeira and the rest from mainland Portugal.

On the graphic (Figure 73), it is possible to compare the results from the pre to post. While in the pre application only two options had a 40% pick rate each.

However, on the post questionnaire, a significant increase on the correct answer up to 80% being 20% spread across three options.

Which of these Fortresses belong to Madeira?

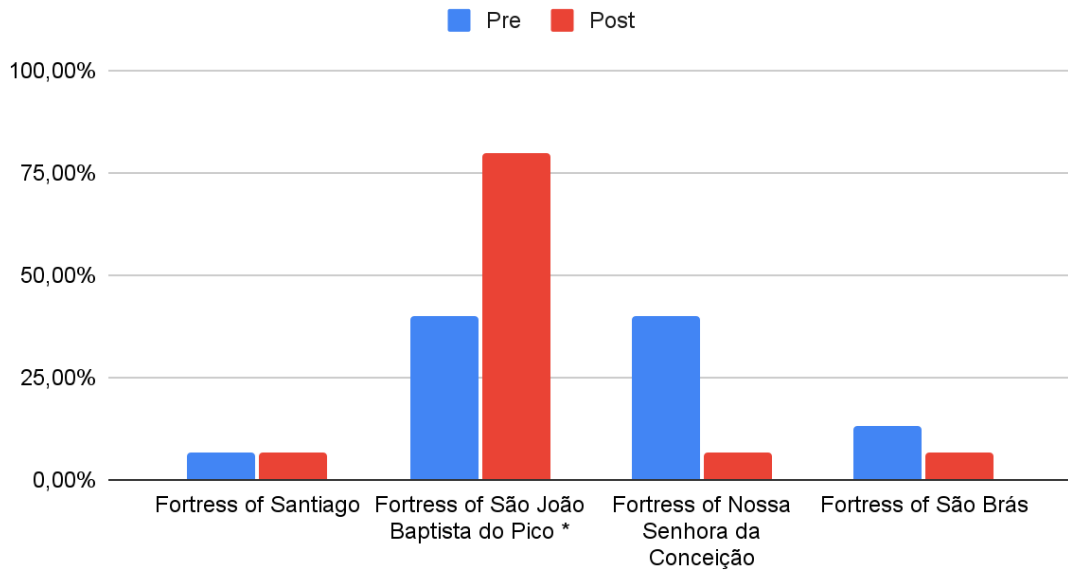


Figure 73 - Comparison Pre & Post Questionnaire, third question

Lastly, on the last question about general cultural knowledge, the name of the traditional Madeiran boat. Where for first instance we had very diverse answers being the “don't know” answer the most chosen with 40%.

Hence, after the experience on the post questionnaire, 80% of the users picked the right answer. However, 13.2% maintained the previous answer from the first questionnaire and only 6.6% added a new answer (Figure 74).

What is the name of the traditional Madeiran Boat?

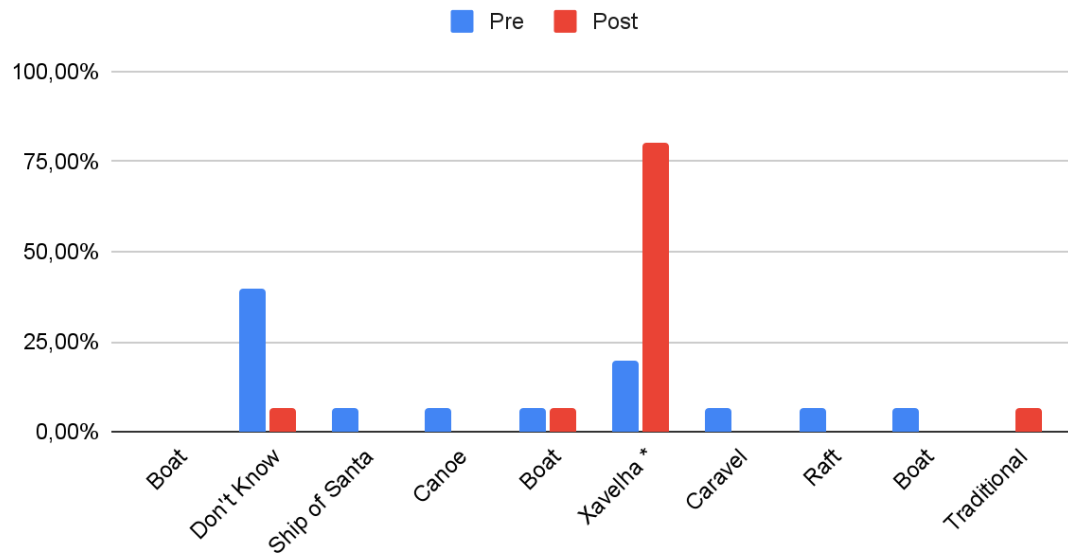


Figure 74 - Comparison Pre & Post Questionnaire, last question

To sum up, the comparison between pre and post (Figure 75) was a positive outcome. Thus, shows the experience was successful in terms of delivering knowledge to our users about the Madeiran Cultural Heritage. Since, more users got the right answer after the experience compared to the beginning.

Correct Answers Pre vs Post

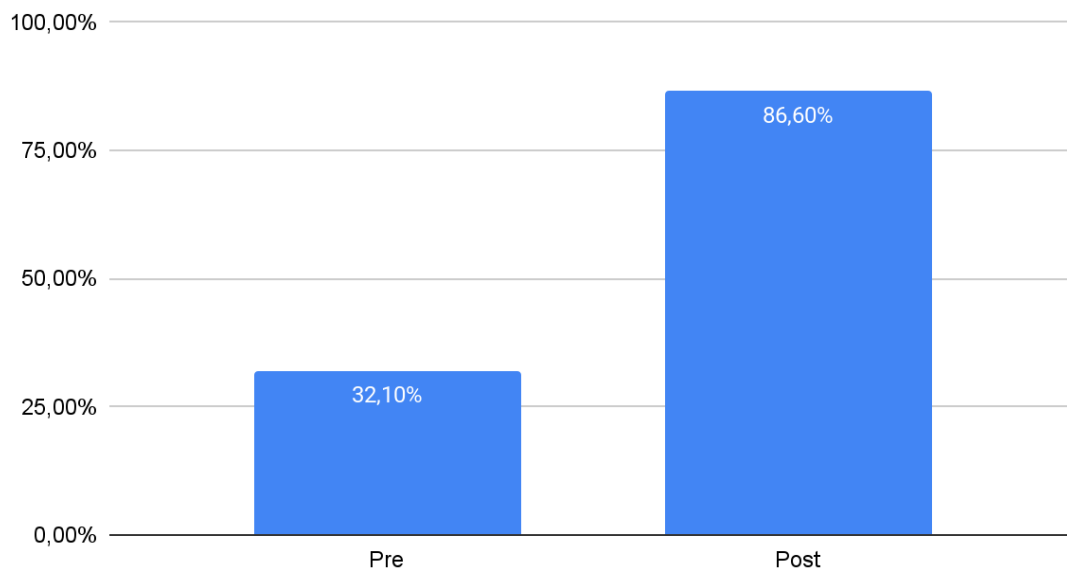


Figure 75 - Comparison of correct answers Pre vs Post Questionnaire

d)User Feedback

Overall feedback about the final version of the game was extremely positive. Only nine out of ten users gave feedback on the last questionnaire. All of them liked the fact of the game world being Madeira Island and the story developed for it. They found the game quite entertaining and very good looking.

e) GUESS-18 Scale

As the last parameter of evaluation, we used the GUESS-18 scale as a method of rating our game in general.

The fifteen users answered a total of sixteen questions which every two questions were related to a parameter. According to the table(x) below, the data was gathered from a scale of one to seven. Although the parameter E2 the scale is inverted.

The table Table 1 was possible to verify the mean obtained on each parameter per user. After adding that average to each parameter, we obtain the composite result that can be compared on a scale of nine to sixty-three.

	Usability	Narratives	Play Engrossment	Enjoyment	Creative Freedom	Audio Aesthetics	Personal Gratification	Visual Aesthetics
P1	6,5	3	7	6	6,5	5,5	4	5,5
P2	6,5	7	5	7	5	7	6,5	7
P3	7	7	4	7	7	7	7	7
P4	6,5	7	3	7	6,5	6	7	6,5
P5	3,5	5	4	6	6	5	6	3
P6	7	7	6	7	4	7	7	6,5
P7	7	7	5,5	7	6	6,5	7	7
P8	4,5	7	5	5,5	4	4,5	6	5
P9	7	6,5	6,5	6,5	7	7	7	7
P10	5	6,5	6,5	6,5	5	5,5	6,5	6,5
P11	4,5	6,5	5,5	6	6	7	6	6
P12	7	5,5	7	7	5	6	7	7
P13	6	6	5,5	6,5	6	6	5,5	6,5
P14	7	7	6,5	7	7	7	7	7
P15	6	5	4	5,5	1	6	6,5	6

Table 1 - Guess-18 Overall Scale

The graphic (Figure 76 - Guess 18 subscale demonstrates the mean of each parameter, with values between 5.4 and 6.5, on a scale from one to seven, which one reassembles (completely disagree) and seven (completely agree).

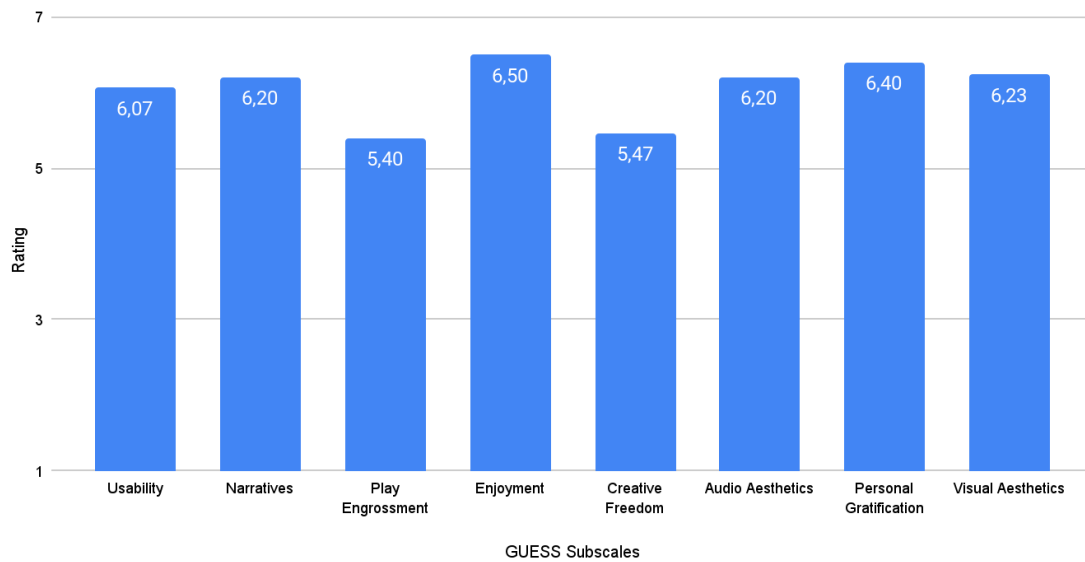


Figure 76 - Guess 18 subscale

E.Discussion

This section discusses the results from the evaluation divided in two sub-sections: *Research Questions, Limitations*.

1.Research Questions

1. RQ1: Can a fictional narrative developed for a video game deliver cultural information to be retained by the teenagers?

The fictional story implemented in the game allowed for the majority of the users to retain information about the Legends present in the game. This verified by the final questionnaire about content present in the game and its narrative where from the fifteen users tested, 85.3% got the right answer for all the 5 questions and only 14.7% got incorrect answers Figure 71.

Highlighting the following comment from one of the users: “I enjoyed the story in the game. I found it interesting the fact of being the first game with the map of Madeira Island, also the game is fun”, reinforcing that the story had an influence on their attention and motivation to focus and complete the game. With regard to the fictional storyline, it is possible to argue that the creation of a background story allowed for a better linking between myths and other cultural aspects present in the game. Without having to represent each myth fully and truly inside the game, with the help of the quest system implemented to give more insight about the narrative each task that the player would complete. It can be seen that results are popping out on the GUESS-18 scale Figure 76, where the Narrative category had 6.20 points out of 7 and Enjoyment factor was the highest point of the scale with 6.50 points out of 7.

2. RQ2: What kind of game mechanics and level design can be used to instigate interest and engagement among teenagers to Madeiran Cultural Heritage?

From both testing's it was verified a high interest and engagement among the user testers. Since, most of the users enjoyed the jumping sections and the combat of the game, basing these statements on the final feedback received and GUESS-18 scale rating Figure 76. These two factors were dragged to the final version testing where the majority was entertained with the challenging bits of the game like the jump section in Garajau, where the player had to jump uphill from rock to rock to reach the small village on top and combat against all kinds of enemies present in their path. Another aspect that had great influence on the interest and learning side of the teenagers were the interaction with the buildings. Each cultural object or building that had an interaction would trigger a cinematic with an explanation referent to that specific object. It was possible to verify in the data analysed that the cinematics had influence on their answers on the post questionnaire, being 32.1% got the right answer on the pre-form and 86.6% got the right answer on the post-form.

From the data analysed, it is possible to confirm that the game mechanics and the way the narrative unfolds allowed for a better draw of attention to the cultural elements present in the game. Emphasizing as well that the questionnaire at the end of the game had some influence in the learning factor of each user leading to a great performance on the post form. Showing that the project developed has a great potential of delivering information in the educational aspect while keeping the teenagers motivated and entertained during the experience. In addition, each user played the game for a duration of one hour until completion and were able to retain cultural knowledge, which beforehand was low to non-existent.

As identified by other researchers, where they suggested an implementation of a storyline, NPCs and an adventure aspect implemented in a serious game to improve the interest on educational purpose games [6], was in fact an important factor for our project, confirming that these factors

previously approached are indeed crucial for keeping teenagers' interest in the game. However, another aspect as well approached by other researchers relative to the use of entertainment video games design ideas in serious games would as well trigger interest among users[5]. Therefore, gathering all this information it was possible to verify that video games can be a great tool for delivering knowledge and a learning tool for all teenagers. Also, allowing for replication of historical moments and to immortalize old habits from various cultural heritages. This can be used to implement many stories, objects or habits from cultural museums giving a new interactive way of presenting knowledge.

2.Limitations

During the development of this project, it was possible to verify some limitations. Namely, on development and testing. Hence, it was not possible to fully record and implement all sounds of the game, as well as, for the animations it was not capable of creating custom animations by resourcing to motion capture. Also, for some game mechanics like throwing/shooting systems for the player to add some variety in gameplay and puzzle features spread through the levels. Since, there were bugs that needed to be dealt with even on the final version there was a need to limit the number of features so the experience could happen in the designated time frame.

Moreover, it was a challenge to gather users from the female gender to enrich our demographic data and probably the outcome of the results. This is due to the fact the global pandemic and all the restrictions were ongoing at the time this evaluation was started made the diversification of users in terms of gender impossible. Having to recruit to online platforms to perform each individual test.

a)Future Work

There is a need to optimize each scene from the game since there were some users with difficulties to run the game smoothly. The solution not only revolves around the 3D assets present in the game but also how much memory is used to execute the functionality behind the game. Hence, future iterations of the game could include a game optimization by using C# event systems and a refactoring of the hierarchy.

To boost the immersion and interactivity in the game, there is the possibility of introducing new NPCs that give new quests to make the player completely new activities. These activities can be used to immortalize old methods that were performed at that time. As well as, including new game mechanics to add more variety in gameplay and new ways of transmitting information, such as puzzles with mysteries relative to myths or other cultural factors and throwing actions that complement the puzzle introduction to the game. In addition, a future evaluation is intended to approach a wider variety of users, from different genders to study in depth the effectiveness of the project.

V. Conclusion

In conclusion, this project can be a blueprint of a new way of delivering knowledge through entertainment, through fictional stories implemented in a video game. Thus, helping teenagers to understand and preserve their cultural heritage. It is believed that the digital world is the key to immortalizing morals that fulfill our past and our present. Therefore, with all the data recruited at the end of the project it is possible to verify that a video game can induce knowledge and motivation to teenagers to take care of their cultural heritage. Also, video games can bridge the gap between public appreciation and their past, if the activities and interactions present in that game have useful information to be delivered or present in those actions.

This project Narratives and Game Mechanics aimed to implement a narrative with cultural context with resources of myths or legends, delivering an engaging plot in a video game with the help of *Hero's Journey* template. While the game mechanics are adequate to keep the target, audience entertained and motivated throughout the experience. Hence, by adding action-based challenges through the levels to keep the user always active and determined to get to the final point of the game. Also, by adding a mini game at the end of the video game to emphasize all the information present about Cultural Heritage and verify if the user absorbed any knowledge from it. Overall, these aspects were introduced in the Master of Design Media Interactive and put into practice in depth for this contribution.

Considering that this project focuses only on Cultural Heritage of Madeira Island and uses the island as a game world for the users to explore and experience it can be concluded that this contribution of the video game for learning Cultural Heritage has potential in being a useful tool. Thus, keeping teenagers engaged and focused on learning while having fun.

Therefore, Lucky Hero's Legacy demonstrates that a video game can deliver a practical contribution in learning and preservation.

VI. Appendix

A. Lucky Hero's Legacy - Story

One day, a lizard called Lucky was sailing near the coast of an Island, unexpectedly, the sea became agitated leading the lizard to crash its boat to the rocks, making it unconscious. An old man that was wandering near the coast helped this creature by dragging it to land. After a while, Lucky woke up and the old man saw a creature capable of helping him. The old man tells an old tale to Lucky, in which talks about a curse that torments the island.

A new journey begins, Lucky tries to help the old man to recover all the lost fragments in the Island and cancel the curse. As they start their journey in Machico, the old man teaches Lucky some abilities that are vital for them to succeed. Arriving at the center of Machico, Lucky comes across with the Legend of Machim, which portrays the story of two unhappy lovers that perished near a big tree. Machim left written a message that years after a chapel was built in that exact place, this edification is called "Capela do Senhor dos Milagres". Since Machim was one of the protectors of a pearl fragment, Lucky, after interacting with the chapel he was able to recover his first fragment.

After successfully capturing his first fragment, Lucky and the old man proceed to Garajau. Where Lucky comes across another legend, in which it talks about a lost sword from an old Portugal king called D. Sebastião and Lucky's job was to find it.

Lucky finds the sword that made him more capable of clearing his path for the next encounter. Next location is Fortaleza de São João Baptista do Pico, where according to the old man another fragment would be there. Arriving at the fort, Lucky comes across Wilson II and its army. Lucky defeats his small army allowing him a free path to recover the fragment.

Suddenly, Wilson II kidnaps the old man away from Lucky, but before disappearing the old man leaves a hint to Lucky saying he should follow the crow and it would help him find the way.

With the help of the crow, Lucky is able to reach the city of Câmara de Lobos, to unveil another legend. Where a ghost lived there, the king Ladislau from Poland, he possessed legendary armour. If Lucky was able to defeat it, he would be one step closer to finally put an end to Wilson II dominance.

Once Ladislau was defeated Lucky went to his final destination, São Vicente, where Wilson II had imprisoned the old man. Lucky already equipped with the sword from D.Sebastião and the armour from Ladislau, he was ready enough to battle against Wilson II. In an epic battle Lucky puts an end to that dominance and unshackles the old man.

Lucky goes through a final test provided by the old man. This test was to make sure that Lucky was worthy of receiving the knowledge about the Island. After succeeding the final test, Lucky replenishes the fragments in Capela de São Vicente. Therefore, restoring the knowledge that was lost in that Island. The old man unexpectedly transforms into the guardian from the tale becoming young again.

B.Gameplay Images



Figure 77 - Lucky Interacting with the Chapel in Machico

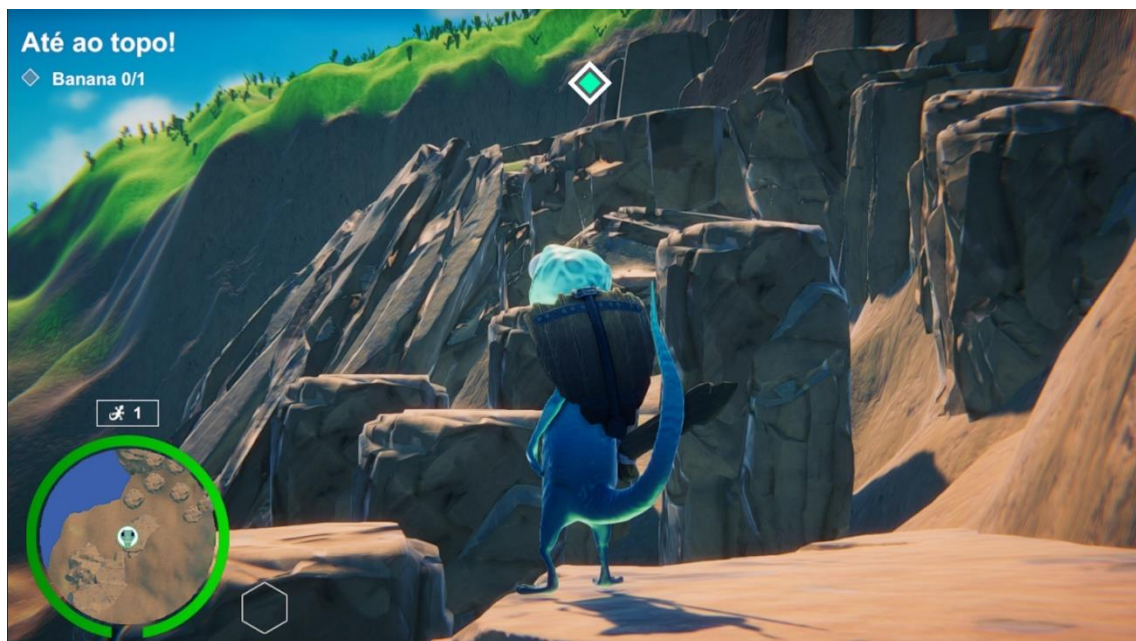


Figure 78 - Jump Section in Garajau



Figure 79 - Combat near the Fortress gate in Funchal



Figure 80 - Jumping Boats in Câmara de Lobos



Figure 81 - Fighting Wilson II in São Vicente

C.C# code of some components

```
341 public void HandleFallingV2()
342 {
343     RaycastHit hit;
344     Vector3 rayCastOrigin = transform.position;
345     Vector3 targetPosition;
346     rayCastOrigin.y = rayCastOrigin.y + rayCastHeightOffset;
347     targetPosition = transform.position;
348
349     if (!playerManager.isGrounded && !playerManager.isJumping && !playerManager.isHanging)
350     {
351         if (!playerManager.isInteracting)
352         {
353             animatorHandler.PlayTargetAnimation("Fall", false);
354             animatorHandler.UpdateAnimatorValues(0, 0, false);
355         }
356         Vector3 playerVelocity = moveDirection;
357         rigidBody.velocity = playerVelocity;
358         inAirTimer = inAirTimer + Time.deltaTime;
359         rigidBody.AddForce(transform.forward * leapingVelocity);
360         if (inAirTimer > 1)
361         {
362             fallingSpeed = 500;
363         }
364         else if(inAirTimer > 0 && inAirTimer < 0.5f)
365         {
366             fallingSpeed = Mathf.Lerp(fallingSpeed, 300, Time.deltaTime);
367         }
368         rigidBody.AddForce(-Vector3.up * fallingSpeed * inAirTimer);
369     }
370     if (Physics.SphereCast(rayCastOrigin, 0.1f, -Vector3.up, out hit, minimumDistanceNeededToBeginFall, groundLayer))
371     {
372         if (!playerManager.isGrounded && !playerManager.isInteracting)
373         {
374             animatorHandler.PlayTargetAnimation("Land", true);
375         }
376
377         Vector3 rayCastHitPoint = hit.point;
378         targetPosition.y = rayCastHitPoint.y;
379         inAirTimer = 0;
380         fallingSpeed = _fallingspeed;
381         playerManager.isGrounded = true;
382     }
383     else
384     {
385         playerManager.isGrounded = false;
386     }
387
388     if (playerManager.isGrounded && !playerManager.isJumping)
389     {
390         if (playerManager.isInteracting || inputHandler.moveAmount > 0)
391         {
392             transform.position = Vector3.Lerp(transform.position, targetPosition, Time.deltaTime / 0.1f);
393         }
394         else
395         {
396             transform.position = targetPosition;
397         }
398     }
399 }
```

Figure 82 - C# Code of the Ground Detection implemented on the player

```

144
145     private void OnAnimatorMove()
146     {
147         if (!playerManager.isInteracting)
148             return;
149
150         if (playerManager.isInAir)
151             return;
152
153
154         float delta = Time.deltaTime;
155         playerLocomotion.rigidBody.drag = 0;
156         Vector3 deltaPosition = anim.deltaPosition;
157         Vector3 v = deltaPosition / delta;
158         v.y = playerLocomotion.rigidBody.velocity.y;
159         playerLocomotion.rigidBody.velocity = v;
160         deltaPosition.y = 0;
161         Vector3 velocity = deltaPosition / delta;
162         playerLocomotion.rigidBody.velocity = velocity;
163     }

```

Figure 84 - C# Code trigger for the root motion on the Animator

```

public class PursueTargetState : State
{
    public CombatStanceState combatStanceState;
    public IdleState idleState;
    public RotateTowardsTargetState rotateTowardsTargetState;
    public override State Tick(EnemyManager enemyManager, EnemyStats enemyStats, EnemyAnimatorManager enemyAnimatorManager)
    {
        Vector3 targetDirection = enemyManager.currentTarget.transform.position - enemyManager.transform.position;
        float distanceFromTarget = Vector3.Distance(enemyManager.currentTarget.transform.position, enemyManager.transform.position);
        float viewableAngle = Vector3.SignedAngle(targetDirection, enemyManager.transform.forward, Vector3.up);

        HandleRotateTowardsTarget(enemyManager);

        if (viewableAngle > 65 || viewableAngle < -65)
            return rotateTowardsTargetState;

        if (enemyManager.isInteracting)
            return this;

        if (enemyManager.isPerformingAction)
        {
            enemyAnimatorManager.anim.SetFloat("Vertical", 0, 0.1f, Time.deltaTime);
            return this;
        }

        if (distanceFromTarget > enemyManager.maximumAggroRadius)
        {
            enemyAnimatorManager.anim.SetFloat("Vertical", 1, 0.1f, Time.deltaTime);
        }

        if (distanceFromTarget <= enemyManager.maximumAggroRadius && enemyManager.currentTarget.isDead == false)
        {
            return combatStanceState;
        }
        else
        {
            return this;
        }
    }
}

```

Figure 83 - C# Code of the Enemy pursuing State


```

public enum ItemType { None, Food, Weapon, Shield, Armor, Usable }
[CreateAssetMenu(fileName = "New Item", menuName = "Inventory/Item", order = 1)]

public class Item : ScriptableObject
{
    [Header("Item Information")]
    public Sprite itemIcon;
    public string itemName;
    public string itemDescription;
    public ItemType type;
    public int price;
}

```

Figure 86 - Scriptable Object code for the base of every item in the game

```

[CreateAssetMenu(fileName = "New Item", menuName = "Inventory/Weapon")]
public class ItemWeapon : Item
{
    public Sprite itemRarity;
    public GameObject modelPrefab;
    public bool isUnarmed;
    public bool isShield;
    public bool isBow;

    [Header("Idle Animations")]
    public string right_Hand_Idle;
    public string left_Hand_Idle;
    public string twohand_Idle;

    [Header("One Handed Attack Animation")]
    public string OH_Light_Attack_1;
    public string OH_Light_Attack_2;
    public string OH_Light_Attack_3;
    public string OH_Heavy_Attack_1;
    public string OH_Heavy_Attack_2;
    public string OH_Heavy_Attack_3;

    [Header("Stats")]
    public int baseDamage;
    public int criticalDamage;
    public int attackBonus;

    [Header("Absorption")]
    public float physicalDamageAbsorption;
}

```

Figure 85 - Weapon item Scriptable Object

D.Protocol – Pilot testing

Bem Vindos e desde já muito obrigado por participarem neste teste. O teste tem uma duração de 30/40min.

O Luky Hero's Legacy é um jogo de aventura-ação em terceira pessoa, baseado no património cultural da Madeira.

Vamos fornecer o jogo enviando um link na google drive, mas este não pode ser divulgado com ninguém, visto que ainda estamos numa fase de testar as mecânicas do jogo.



Figure 87 - Knowledge Questionnaire Final

Enquanto jogam, vão partilhar o vosso ecrã e esse será gravado para depois podermos analisar o vosso comportamento dentro do jogo. No final terão de responder a 5 perguntas.

Ficaste entusiasmado com o jogo?

Se Sim: que elementos tornaram o jogo entusiasmante/divertido?

Se Não: o que achas que poderia ser adicionado para tornar o jogo mais divertido?

Numa escala de 1 a 7 (em que 1 é fácil e 7 muito difícil quanto darias a este jogo.)

2.1 Que elementos /momentos foram difíceis?

Enumera os momentos em que te sentiste perdido (ou confuso conforme o que querem mesmo saber)

Digam 3 pontos que mais gostaram no jogo.

Digam 3 pontos que não gostaram no jogo ou que poderiam ser melhorados.

E.Questionnaire – Pilot Testing

Lucky - Splinter Studio (1º Game Test)

O Luky Hero's Legacy é um jogo de aventura-ação em terceira pessoa, baseado no património cultural da Madeira.

1. Nº User

2. Género

Marcar apenas uma oval.

Masculino

Feminino

3. Idade

4. Talk in loud

5. 1. Ficaste entusiasmado com o jogo?

Marcar apenas uma oval.

Sim

Não

6. 1.1 Se Sim: que elementos tornaram o jogo entusiasmante/divertido?

7. 1.2 Se Não: o que achas que poderia ser adicionado para tornar o jogo mais divertido?

8. 2. Numa escala de 1 a 7 (em que 1 é fácil e 7 muito difícil quanto darias a este jogo.)

9. 2.1 Que elementos /momentos foram difíceis?

10.3. Enumera os momentos em que te sentiste perdido (ou confuso conforme o que querem mesmo saber)

11.4. Digam 3 pontos que mais gostaram no jogo.

12.5. Digam 3 pontos que não gostaram no jogo ou que poderiam ser melhorados.

F.Protocol – Final Version

Dar as boas vindas aos participantes. Agradecer pela participação e fazer uma breve introdução que explique o projeto e o propósito do estudo.

Antes de mais obrigado por participarem neste user test. O Luky Hero's Legacy é um jogo de aventura-ação em terceira pessoa, baseado no património cultural da Madeira. Este jogo está a ser produzido no contexto de Tese por dois jovens Madeirenses - João Freitas (Programador) e o Louis Michael (Modelador 3D) e gostávamos que pudessem nos ajudar nos testes que vamos realizar.

Este trabalho teve início após o projeto em equipa de Game Design no segundo semestre do primeiro ano do Mestrado de Design Media Interativos. Em que este era partilhado por dois elementos. O objetivo do projeto era criar um jogo de aventura baseado na Ilha da Madeira e todo o seu Património Cultural. No entanto, para criar um jogo com tamanha dimensão foi necessário repartir o trabalho entre dois alunos.

O propósito principal do projeto é implementar um protótipo de um jogo funcional de aventura com contexto cultural. Um dos maiores desafios a ultrapassar é garantir um jogo com espírito de aventura enquanto este apresenta factos históricos e alguma informação cultural sobre a Madeira. Realçando também que é pretendido alcançar o fator nostálgico para os jogadores que sejam de origem madeirense.

Entregar os questionários aos participantes antes da experiência

Informar que os questionários são totalmente anónimos e que iremos usar um número de identificação para cada.

Ler o Consentimento de Participação no Estudo e concordar com a participação.

Entregar um questionário (PRE) antes da experiência onde iremos avaliar vários parâmetros.

Começar a experiência, Explicar resumidamente como eles devem manusear o equipamento.

Equipamentos:

PC + Rato + Teclado + Sistema de Som + Net

A primeira fase do teste será entrar num servidor Discord criado propositadamente para o teste.

No servidor terão um link para efetuarem o download do jogo.

Após iniciarem o jogo terão de fazer partilha de ecrã.

Processo de Observação

O utilizador enquanto estiver na experiência será-lhe pedido para “pensar alto” ou seja, para ir comentar tudo o que pensa do jogo e os investigadores irão tirar notas.

Depois da experiência: entregar os questionários para avaliação. Lembrar que usem os mesmos números atribuídos.

Entregar um questionário (POS) antes da experiência onde iremos avaliar vários parâmetros.

Game User Experience Satisfaction Scale (GUESS)

A Escala de Satisfação da Experiência do Usuário do Jogo (GUESS) é uma ferramenta de 55 itens que avalia nove construtos que descrevem a satisfação do videogame.

No fim: agradecer a participação

G.Pre - Questionnaire

Splinter Studio - Lucky Hero 's Legacy, PRE

Título: Splinter Studio - Lucky Hero's Legacy

Principais investigadores: Louis Michael e João Freitas

Propósito do estudo:

- O propósito deste estudo é para avaliar o efeito que os videojogos têm sobre o enriquecimento do conhecimento sobre os jovens.

Procedimentos:

- Primeiramente será pedido para que responda a dois questionários, um no início da experiência e outro no fim da experiência.

Esta sessão será feita online, através da plataforma Discord.

Requisitos do Participante:

- O participante é admitido para participar neste estudo, se este não apresentar problemas não motores, que interfiram com a compreensão, comunicação e execução das tarefas.

Conhecimento na língua portuguesa e motivado para participar.

Riscos:

- Os riscos ou desconforto associado com a participação neste estudo não são maiores que aqueles encontrados durante o dia a dia.

***Obrigatório**

Formulário de Consentimento de Participação no Estudo:

O participante é livre de cessar a sua participação a qualquer momento. Recusar a participação ou retirar o seu consentimento ou descontinuar a participação no estudo, este não receberá qualquer penalidade ou perda de benefícios ou direitos em que seja intitulado. O investigador principal pode ou não remover o participante do estudo por qualquer número de razões. Em qualquer situação, este não sofrerá qualquer penalidade ou perda de benefícios em que este seja intitulado. O participante tem o direito de fazer questões ou aceder a informação em caso de dúvidas acerca do estudo, deve fazê-las livremente agora. Em caso de haver questões mais tarde, por favor contacte o investigador principal para o seguinte endereço de email (meter email).

Consentimento de Voluntariado

Ao concordar em baixo, o participante concorda com todos os pontos acima referidos, e todas as suas questões foram esclarecidas. É encorajado a efetuar questões de qualquer aspecto sobre este estudo, durante qualquer momento deste estudo e no seu futuro. Ao concordar com este formulário, concorda em participar neste estudo.

1. Questão *

Marcar tudo o que for aplicável.

Eu concordo em participar

Demográfico

2. User ID *

3. Idade *

4. Gênero *

Marcar apenas uma oval.

- Feminino
- Masculino
- Prefiro não dizer

Experiência Anterior

5. Última vez que jogou *

Marcar apenas uma oval.

- Hoje
- Ontem
- Última semana
- Último mês
- Últimos 2-3 meses

6. Total de horas jogadas *

Marcar apenas uma oval.

- 10-19 h
- 20-39 h
- 40-79 h
- 80-120 h
- Mais de 120h

7. Tipo de dispositivos *

Marcar tudo o que for aplicável.

- PC
- Consolas
- Telemóvel

8. Estilo de jogo preferido *

- Acção
- Aventura
- Corridas / Carros
- Luta
- Música
- Puzzle
- Simulação
- Desporto
- Estratégia
- Outra opção...

Conhecimento Cultural

9. Qual destas lenda falam sobre a Ilha da Madeira ? *

Marcar apenas uma oval.

- Lenda da Boca do Inferno
- Lenda da Padeira de Aljubarrota
- Lenda de Machim
- 10.

11. Qual é a forma da casa tradicional madeirense ? *

12. Qual destas Fortalezas pertence a Ilha da Madeira ? *

Marcar apenas uma oval.

- Fortaleza de Nossa Senhora da Conceição
- Fortaleza de Juromenha
- Fortaleza de São Brás
- 13.

14. Qual é o nome do barco de pesca tradicional Madeirense ? *

H.Post – Questionnaire

Splinter Studio - Lucky Hero 's Legacy, -

POST

Título: Splinter Studio - Lucky Hero 's Legacy,

Principais investigadores: Louis Michael e João Freitas

Propósito do estudo:

- O propósito deste estudo é para avaliar o efeito que os videojogos têm sobre o enriquecimento do conhecimento sobre os jovens.

Procedimentos:

- Primeiramente será pedido para que responda a dois questionários, um no início da experiência e outro no fim da experiência.

Esta sessão será feita online, através da plataforma Discord.

Requisitos do Participante:

- O participante é admitido para participar neste estudo, se este não apresentar problemas não motores, que interfiram com a compreensão, comunicação e execução das tarefas.

Conhecimento na língua portuguesa e motivado para participar.

Riscos:

- Os riscos ou desconforto associado com a participação neste estudo não são maiores que aqueles encontrados durante o dia a dia.

***Obrigatório**

1. User ID

Conhecimento Cultural

2. Qual destas lenda falam sobre a Ilha da Madeira ? *

Marcar apenas uma oval.

- Lenda da Boca do Inferno
- Lenda da Padeira de Aljubarrota
- Lenda de Machim
- Lenda do Coto da Moura

3. Qual é a forma da casa tardicional madeirense ? *

4. Qual destas Fortalezas pertence a Ilha da Madeira ? *

Marcar apenas uma oval.

- Fortaleza de Nossa Senhora da Conceição
- Fortaleza de Juromenha
- Fortaleza de São Brás
- Fortaleza de São João Baptista do Pico

5. Qual é o nome do barco de pesca tradicional Madeirense ?

Experi
d
6.

Com base em sua experiência de jogar este jogo, classifique as seguintes afirmações em uma escala de "Discordo totalmente" a "Concordo totalmente"

7. Acho que os controles do jogo são simples *

Marcar apenas uma oval.

1 234567

DiscordoConcordo

8. Acho a interface do jogo fácil de navegar. *

Marcar apenas uma oval.

1 234567

DiscordoConcordo

9. Estou cativado pela história do jogo desde o início. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

10. Eu gosto da história fornecida pelo jogo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

11. Eu sinto-me desligado do mundo exterior enquanto jogo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

12. Eu não me importo em verificar eventos que estão acontecendo no mundo real durante o jogo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

13. Eu acho o jogo divertido. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

14. Eu sinto-me aborrecido enquanto jogo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

15. Acho que o jogo me permite ser imaginativo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

16. Eu sinto-me criativo enquanto jogo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

17. Eu gosto dos efeitos sonoros do jogo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

18. Eu sinto que o áudio do jogo (por exemplo, som efeitos, música) melhora a minha experiência enquanto jogo. * *Marcar apenas uma oval.*

1 234567

Discordo Concordo

19. Estou muito focado no meu próprio desempenho durante o jogo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

20. Eu quero fazer o melhor possível durante o jogo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

21. Acho que o jogo oferece suporte à interação social (por exemplo, chat) entre os jogadores. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

22. Gosto de jogar este jogo com outros jogadores. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

23. Eu gosto dos gráficos do jogo. *

Marcar apenas uma oval.

1 234567

Discordo Concordo

24. Acho que o jogo é visualmente atraente. *

Marcar apenas uma oval.

por

Discordo

Concordo

Obri

Obrigado por nos ajudar com este estudo. Você pode fornecer algum feedback geral na seção abaixo, ou pode terminar o estudo agora, se desejar.

partici

25. Feedback geral

I. Knowledge Questionnaire

A lenda de Machim e Ana deu origem a que capela:

- Capela do Senhor dos Milagres
- Igreja De Nossa Senhora Da Conceição
- Igreja De São Salvador
- Capela De São Pedro

Qual o material que era utilizado para cobrir as casas tradicionais?

- Palha
- Madeira
- Barro
- Pele de Animais

A Fortaleza de São João Baptista do Pico servia de proteção contra ataques de?

- Piratas
- Locais
- Espanhóis

- Franceses

Qual era a cor do interior do Barco "Xavelha"?

- Azul
- Verde
- Vermelho
- Amarelo

Porque a Capela de São Vicente foi construída num rochedo?

- Proteger do Mar
- Proteger contra os Piratas
- Proteger do Clima no Norte
- Proteger contra os Espanhóis

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