Raid – Multiplayer Hero Survival

A Warcraft 3 Custom map called "Boss Battle", made by the user Varcklen, but with a twist that is taking the game rules and making a 3D, First-Person, Multiplayer, Action, RPG.

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1. Background and Topic overview

Warcraft 3 (Blizzard Entertainment, 2002) custom maps have been the source for many of the top game genres we see today, MOBAS from the custom map DOTA which Valve (Valve Corporation, 1996) then saw potential and made DOTA 2 (DOTA 2, 2013) and League of Legends (League of Legends, 2009)by Riot Games (Riot Games, 2006).

Legion TD (Legion TD, 2017) was a custom map made by friends and was then turned into a standalone version and published on Steam.

I can say with no doubt that their custom maps are made with fun first, I believe that is the way a game should be developed, that it why it is a genius idea to use these not as known game modes to inspire others to develop standalone versions.

Figure 1 - Warcraft 3 boss fight.

Warcraft 3 is a game with a top-down view, the graphics are old. That is why it is not played by new people, they are looking for something higher-paced and updated graphics, like most First-person games now a days.

Figure 2- Town Shopping.

This Topic is very interesting and not as touched as shooters, this project feels like a "shoot" in the right direction, I am very enthusiastic about this game. It has a very big scope which I can grab to develop the game along the years after university, providing maybe my income and a portfolio to help into the games industry.

The scope is very big considering I do not have a team behind me, its needs are as follows, following the article "How to identify the scope of your game" by Pontus Lindgren (Lindgren, 2016) ;

- High mechanical needs
- Medium aesthetic needs
- Medium technology needs

2. Project Aim

Develop a fun action, RPG, Multiplayer with 6 levels and good gameplay!

3. Project Objectives

Main Objectives

- Make a Prototype, end by 11th February.
- Research about the game, end by 26th of February.
- Implement 2 RPG Classes (Healer, Rogue), end by 22nd of March.
- Implement 6 Map Levels, end by 15th of April.
- Development of the game, end by 30th of April.
- Test the game, end by 6th of May.

Stretch Objectives

- Add Another RPG Class
- Publish on Steam, end by 7th May.

4. Research

4.1. Game Inspirations

As mentioned before this game took inspiration in a game mode from Warcraft 3 (Blizzard Entertainment, 2002) called Boss Battle, so my research was done by *playing* and watching videos on YouTube (Youtube, 2005) from which I could analyse what were the most fun parts of the game mode. The conclusion was simple, I mean it is right in front of everyone's eyes, it is the challenge, it is coordinating strategies with friends, it is the feel of your character growing. This research influenced the design of the game to provide bosses which can only be defeated with good coordination.

Another very inspiring game was Risk of Rain 2 (Hopoo Games, 2020), it is a rogue like game that manages to be fun every time you replay it, the levels are the same, but the challenge keeps you trying again and again. The best way for me to find the points would be to read the reviews for the game and what other people like about it, (King, 2020) as the review mentions Risk of Rain 2 is best at allowing you to transform the game allowing different play styles every time you play it. This research proves that my project requires the ability to allow many play styles.

4.2. Pain Points

Taking a read at Josh Bycer (Bycer, 2020) article on video games pain points it just becomes more apparent that game testing is one big part of how to make your game fun, because if they cannot even play the core game and get annoyed by bad UI design or getting stuck somewhere then all those bosses won't even be reached, and not because they are difficult. With this I will go into the project knowing to have my friends become test slaves.

4.3. Artistic Direction

After taking a deep dive into artistic art styles, currently the prototype is in a good place, but I found out that I will have to change some stuff to get it going in the right direction, this thought was articulated thanks to "Jess's" (Jess, 2020) article on how she did her grass in UE4, and Jasmin's (Habezai-Fekri, 2020) amazing bird house scene.

4.4. Should I release my game as early access?

This article on early access games by (Bycer, 2021) goes into why you would want to do it. It talks about the testing and how it helps with the development of the game and how you also make money while at the same time testing and being able to see if the game itself is a fun concept liked by the players.

It then develops into the right games for early access as not every game is good because it can affect its image and hurt the game more than help. In the case of my game, it fits every category, a "rogue-like", Multiplayer game.

When to enter early access? I agree very much with the article which explains that to go into early access my gameplay needs to be as good as it would be on release, which is why it will not release as early access.

4.5. Making the game fun

This article by (Bycer, 2020) which as the title says, goes over the already known factors, how game feel dictates if the game is fun, if the player, when playing, feels it is easy to navigate your UI, the game visuals bring your attention and immerse you, the gameplay is responsive.

Goes over how important it is to have good art that will bring the attention of players and keep their interest, how hard it is to get the art right, how players these days are looking for quality. Going over this article made me certain that I had to cut some gameplay as a trade-off for art.

4.6. First-Person game inspiration

When going into making this project, I was wonder on how to get the first person right, although the I learned a lot from this research, I was not able to put everything into the project as they would be massive time commitment. My research was done mainly watching this GDC talk by (Boehm, 2017) , many things piked my interest, how animations were so fluid and how great the game of their first-person game feels, although as mentioned I don't have the time to develop everything I managed to learn about spring animations and how they give more movement to the game and Improved my animation by a lot.

One thing I wanted to do but noticed it wasn't possible since the prototype development of my game was to make the first-person animation different while providing a similar animation to the other players, this is because of the camera field of view in the game can make it very hard to have the animations look good in both first and third person.

4.7. Best Networking Solution

Choosing to use photon (photon, 2021) was a whole process of research, I had previous experience with Unity's Multiplayer Services, and I knew If I wanted to have a fast-paced RPG game it just was not going to cut it. So, then I went into a long search of what technology to use, I even came cross this forum (Serinx, 2019), at first there was Mirror (Mirror Networking, 2021) which had very strong points and unlike photon it seemed to be easier to implement cheater prevention. But photon was chosen in the end, because, my logic is, if you are playing with friends why would you ever cheat, it is a party game, but also photon just proved to be easier to implement and work with, it was also free compared to other solutions.

5. Product Specification

5.1. Description

Raid – Multiplayer Hero Survival, after entering a lobby of friends you will be able to choose your RPG class which will dictate how you start your gameplay style and how you will help your team succeed. After making your rooster of 4 RPG classes to best challenge the bosses and enemies you will face, you can enter the first Map Level, the village which you will come back to after each level you clear, here you are able to buy, sell, gamble and mess around.

You're now ready for the first set of enemies, so all 4 players get ready on the bell and you enter a dungeon where you can gain XP(experience) and levels to improve and or gain new skills, after killing the enemies you will be rewarded, with a random item depending on the difficulty, you then go back to the village where you will build and improve your build of items and skills to best fit the situation and team.

It's the 2nd Level after you clear that first dungeon, you can challenge a map level where the longer you last the more gold you gain, as you can guess this doesn't take lives off your team, ah lives, yes during this challenge your team has 3 lives, once you lose them all it's over, done, no more, it means having to start all over again.

You finish the special level, then you also finish the 2nd Map Level, you are going to the 3rd Map Level, which is quite special, this Map Level will have the first boss you face, and probably where you and your team will fail many times.

This process is now repeated, with a huge variety of map levels, enemies, items, and skills. That is until your team capable of conquering all the levels and stand in the spotlight of victory.

5.2. Key Features:

Multiplayer

Being able to connect with other players. By connecting to a lobby and inviting them to join you in defeating all the bosses in this challenge.

RPG elements

Providing the very known parts of RPG elements seen in games of this genre, such as health, mana, skills, and equipment.

Bosses

As mentioned, the bosses are the main objective of the game, they allow you to progress further, but they are also a very big challenge for the player's party.

There will be 2 Bosses, one every 3 Levels.

First Person

The player will only be able to see in first-person allowing for more immersion and removing the advantages of 3rd person viewing that makes the games easier with a wider field of view.

Movement

Being able to move, whether with skills or just simple movement is a big part of the game, which allows you to dodge attacks on you.

Enemies

Enemies are very dangerous, although not on as much as the bosses, they are strong in numbers.

Enemies also provide you with XP(Experience) which when it reaches a threshold provides you with a level up that also grants skill points, used to gain, or upgrade skills.

There will be 3 different enemies every 3 levels, enemies can be ranged, melee, tanks, or healers.

Shopping

Being able to buy equipment and consumables is one of the main features as it allows you to get stronger.

You are also able to sell your equipment or even combine it to make it stronger.

He can do so at the village.

Ex.:

- **Consumable:** Health Pot – Grants player 30 health and uses the item.
- **Item:** Armor – Grants player 5 Endurance (Max Health) while equipped.

Gambling

Although not needed to be used it is a fun mechanic where you can take a gamble to win or lose Gold. He Is able to gamble at the village.

Ex.: Players puts 100 gold and has a 46% chance to gain 200.

6. Potential Solutions

6.1. AI and AI Algorithm

For the development of the enemies AI, I plan to use the Decision Trees algorithm, mostly because of the ease of use and I already have reusable code from previous an AI module, I plan to make a modular script where I can change what AI the enemy uses and his properties.

I could have instead gone for a simple AI that just follows the player, but I decided I wanted the game to be more in depth.

6.2. 3D Modelling, Textures, Rigging and Animation

For the development of character models and enemies models I have many solutions, going from high poly to then retopologize or just building from low poly.

For the textures I plan on doing a simplistic, stylized art opposed to realistic as it would require too many resources to fully develop a map level from the uncanny valley.

The Rigging process may use auto rigging assets for few assets that would be more complex, outside of that I plan on doing a lot of simple rigs without helpers (Objects that allow ease of bone manipulation of the rig).

6.3. Level Design and Art

For the map art and design, I plan on doing a simplistic block out and then slowly develop it with detailed props and others.

There was the potential of using map tools from unity, but I choose to model the block out in blender instead as the transition is seamless to unity.

6.4. Game Engine

Before the development of this project, a very vital part of the project was the choice of game engine, in my mind I had 3 in mind, Godot, Unity, Unreal Engine 4**:**

Godot – Godot proves to have its strong points being free to use, compared to Unity's and Unreal Engine 4's free to use until you reach a certain amount in sales, then having to pay for either a subscription or shares of the game. It also proves to be evolving fast but when looking at its features, in the (Godot, 2020) features it seems to be very lacking when it comes to 3D.

The available network solution for Godot is its built-in solution, (Linietsky, 2016), which as mentioned is simple to use, but provides no server.

Unreal Engine 4 – Unreal Engine 4 is a powerhouse, from the incentives from Epic Games for publishing the game on their games Platform to the amazingly polished features which are known for being very stable, having also previous experience with it on several projects, it was of course a very big contender.

Unreal Engine 4's solution, (Epic Games, 2020), is very similar to Godot as it also provides no server, thankfully Photon works with Unreal Engine 4 too.

Unity – Unity provides their users ease of use with also many resources from its extensive community, they have a large set of features, also mentioning that Unity has been my main Game engine while in university because of that I have specialized mostly in C#.

As mentioned in my network solution research unity has several good options for multiplayer, but my choice was photon which unity does provide.

Final Verdict

The choice was very close to make, as I had known both engines, but I wouldn't feel comfortable programming in C++ using Unreal after using C# for so long, also worth mentioning I had used Photon with Unity in a previous project as testing, and it would make sense to go with the least risk inducing one, which would be **Unity**.

6.5. 3D Assets Tool

As for my choice of 3D modelling software, I had two software in mind, this is because they are both standard for indie developers, because they are well known in the industry and because I have personally used both for years.

Software's of choice

Blender – Blender, an open-source software capable of doing every step needed, very easy learning curve with the most active community out of all other modelling software, although it is growing faster than other it can be missing a few features.

It is Free.

3Ds Max – 3Ds Max is the standard software for many industries like Arch-Viz and has been acknowledged by many as the best tool for the job, it has a very clunky interface and is quite hard to learn with a very old community but not too active.

It is Pay to use.

Final Verdict

Even though I spent most time with 3Ds Max (since 2012), my final choice was **Blender**, because of its cost.

6.6. Multiplayer Implementation

For implementing multiplayer, I have talked about my choices of network solutions, but there is the potential it fails, so in that case Photon (photon, 2021) does provide an easy way to switch to single-player.

7. Tools and Technologies

- Photon (photon, 2021), Multiplayer
  - Easy to Use.
  - Upgradable, I can pay a subscription to be able to have more servers.
  - Free.
  - Reliable.

- Unity (Unity, 2005), Game Engine
  - Good Interface
  - Many Resources, Able to find people with same problems and many references.
  - Free to Use.

- Blender (Blender, 1994),3D assets
  - Free.
  - Easy to Use.
  - Resources, community is very active, so you can learn how to do certain works.
  - Incredible Program, many industries have been starting to use it, it's becoming an industry choice.

- Photoshop (Adobe Photoshop, 1990),2D Art
  - Industry choice for Art.
  - Most accustomed To, as in I have used the most.
  - Reliable, does not crash as often and has a good auto save feature.

- Illustrator (Adobe Illustrator, 1987), UI Art and design
  - Vector Based, vector based allows to make scalable UI elements without quality loss.
  - Same Package as Photoshop.

- Reliable.

- Substance Painter 2021 (Substance Painter 2021, 2021), 3D Model Textures
  - Ease of use.
  - Most accustomed to.

- GitHub (GitHub, 2008), Source Control
  - Ease of Use.
  - Most Accustomed to.
  - Reliable

8. Technical Design

8.1.

8.2. Menu and Lobby

Figure 28 - UML Menu

As the previous attached image shows, I make use of the Photon API to create a new lobby which can be joined by other players using the Menu Manager.

The Steam Manager is there to verify that the player has a copy of the game.

8.3. Player

Figure 27 - UML Player

The player contains 5 main classes:

PartyManager- Responsible for syncing all the player stats and displaying the health, mana, and stamina in the user interface.

Stats- Responsible for handling the client-side health, mana and stamina and the methods for healing and dealing damage.

InventorySystem- Responsible for the inventory and being able to buy and sell items.

CharacterController- As the name suggests it handles all the player movement.

Skills- Handles the skill bar and passive and active skills.

8.4. Enemies

Figure 29 - UML Enemy

The enemy uses the same stats script but, in this case, makes use of OnPhotonSerializeView() from the photon library, and the Decision tree that is only updated on the main client.

8.5. Test Plan

Figure 30 - Testing Plan Phase1

8.6. General Flowchart

Figure 10 - Overall game flow

9. Project Development Methodology

9.1. Planning Process

During the first week of development the procedure went from a very basic notepad to a WBS, which allowed to measure the project feasibility, then grabbing the WBS Figure 3 - WBS structure a task list Figure 11 - Excel Task List with detailed hours was done, afterwards a Gantt chart Figure 14 - Gantt Chart V1 was developed following the task list.

As of the 24th of March 2021, changes were made to the Gantt chart Figure 15 - Gantt Chart V2 to best fit the circumstances, and to fit a better testing methodology.

During the development phase, for the implementation of enemies AI a Diagram Appendix E – Enemies AI was made for referencing during its implementation.

For the development of the talents tree a diagram Appendix C – Talent Trees was made to reference and represent the ones to be or were implemented, and for design of the skills.

9.2. Project Implementation

For project implementation I choose to follow a Waterfall model, where I put the dependencies in order, in the Gantt chart, and made sure to implement them following each block of time, during this Waterfall method other tasks may be done whether a task was done too quickly, and time could be spent elsewhere or a task was not finished, in which case it would require overtime, which would be 12 hours compared to the daily 6 hours.

10. Risk Register

Figure 24 - Risk Analysis Part 1

Figure 25 - Risk Analysis Part 2

Figure 26 - Risk Analysis Part 3

11. Project Management

11.1. Weekly Development

The following weeks will be explained as what the **focus** of each week was, the **goal** of said week, so the goal of the focus, a **description** of how each week should go and its objective following the Gantt chart, which dictated how each week should go, the **end result** which explains how the week went and all that was finished and not finished, the **evidence** will show evidence that was saved, in most cases evidence takes place in time lapses and images taken at the time, some weeks do not have evidence as it was either difficult to find or no evidence was left behind, for example the student could have instead of updated the GitHub repository said week he could've instead only done it after 2 weeks, therefor it does not show the time at which certain task was done.

11.1.1. Week One – February (days 1-7)

Focus – Prototype

Goal- Test Viability

Description- This week I focused on the development of the prototype, I started off testing the viability to see if multiplayer was possible, and I managed to build a working lobby system and was able to have a look into the RPC system of Photon which made me confident in being able to have it working.

End Result-Tests were successful, and the development went very smooth. Should be mentioned that during this week I had my first meeting, where I decided to show the prototype the week after and explained the project to the supervisor.

Evidence:

- **Creation of character and character movement.**
  Footage\TimeLapse1.avi
  As shown in the following video, I proceeded to create a character by modelling following a blueprint image, then I proceeded to give it a flame head by creating a visual effect. After although difficult to see I test the character movement, making few changes.
  Then I dedicate the rest of the time to mess around with post effects and changing the visual of the world as trying to find an artistic visual I was appeased with.

11.1.2. Week Two – February (days 8-14)

Focus – Prototype

Goal- Finish Prototype by 11th

Description-This week I followed through with finishing the prototype and made all the needed features as a proof that it was indeed possible to develop.

End Result-Managed to finish the prototype and started the WBS, here was told to start working on the documentation by the supervisor and had comments about the prototype and had talks about viability.

Evidence:

- **Creation of character and character movement.**
  Footage\timelapse2.avi

  The video goes into the rigging and animation of the character, the workflow between blender and unity can be seen and how simple it was.

- **Creation of first level and AI**
  Footage\TimeLapse3.avi
  The video show how I created and designed the level at the start, I start with a simple plane and a modifier that extrudes the plane making an enclosed space and show how I had future design in the development, as I created objects called chests(could have been added feature) and named where the exit was.
  It also shows the start of me making the AI script and the Decision Tree
- **Creation of Enemy AI and player animations**
  Footage\TimeLapse4.avi
  Footage\TimeLapse5.avi
  Footage\TimeLapse6.avi
  The following videos go into the character animation, the first person view first tests and animation of masking holding the dagger on top of another animation.
  It can be seen how I complete the AI script and decision trees.
  It shows how I delve into the level design and artistic feel.
- **Creation of Shop**
  Footage\TimeLapse7.avi
  It can be seen, mostly, the UI aspect of how I made the shop, and the programming parts can be seen too.
  Then it has a short part where it can be seen me adjusting animations and testing the game.

11.1.3. Week Three – February (days 15-21)

Focus – Documentation

Goal-Make a WBS, Task list and Gantt Chart

Description-This week I continued development of the game following the Task list which was the earlier version of the Gantt chart.

End Result-WBS and task list were finished, the task list was used to make the Gantt chart and was very helpful to give an idea of hours and task time, during this week the meetings with the supervisor were mostly to help with the progress report.

11.1.4. Week Four – February (days 22-28)

Focus – Documentation

Goal-Finish Gantt chart and do some concept art.

Description-This week I aimed to get some concept art done after the Gantt chart was complete.

End Result-Gantt chart was finished, and concept art started.

Evidence:

- **Concept Art**
  Appendix K – Concept Art

11.1.5. Week Five – March (days 1-7)

Focus – Concept and Development

Goal-Finish concept art and start development.

Description-During this period I aimed to implement buffs and debuffs, the class system, and weapons.

End Result-All tasks were complete and tested as I spent some time making sure I was getting no bugs with the buffs in Multiplayer although I, from a previous module, had tested making a buffs script I wasn't sure how it would handle in multiplayer.

Evidence:

- **Creation of RPG classes, Buffs and Debuffs**
  Footage\TimeLapse8.avi
  Figure 31 - Health Synchronization

  I create a base script which contains my class objects, and how I test around with the party status script and health synchronization, sometimes a scene can be seen that was my test seen, it shows another version of grass, which was later added and replaced the grass seen here and previous videos.

- **Game Testing**
  Figure 32 - Game test 4 players

11.1.6. Week Six – March (days 8-14)

Focus – Development

Goal- Further Development of the game.

Description-Along this week, this player art as in model, rigging, animation, texturing, and the weapons models, rigging in some cases and texturing were the aim for this week.

End Result-Tasks were not fully complete as weapons do not have textures, but side tasks were taken too as I managed finish previous tasks from last week, such as Stats, Inventory, and skills.

Evidence:

- **Development of Skills and skill book**
  Footage\TimeLapse9.avi
  Here can be seen how I developed the skills script and made the skill book; it can be seen the use of handler for mouse events which made it easier to implement drag functions to the UI.
- **Creation of Character, Stats, Inventory, and development of skills**
  Footage\TimeLapse10.avi
  This footage, shows the development of the Stats script, Inventory, the continuation of the skills script and the start of sculpting the character.

11.1.7. Week Seven – March (days 15-21)

Focus – Development

Goal- Further Development of the game.

Description- For this week I aimed to do 2 NPCs which would be in the main village, one would be the shop keeper, other would be the gambling business owner.

End Result- One NPC could not be finished on time, as during this week another focus was on the progress report.

Evidence:

- **Creation of NPC**
  Footage\TimeLapse11.avi
  Following footage shows how I modelled the Shop NPC using an image reference that was made during the concept art task, which is shown in the Gantt chart.

11.1.8. Week Eight – March (days 22-28)

Focus – Progress Report

Goal- Progress Report Finished

Description- This week was used to mainly focus on the progress report and finishing it.

End Result- Tasks was finished after a long week focused on writing, formatting and so on, making changes related to previous meeting to check on the report and touch needed to be done.

11.1.9. Week Nine – March-April (days 29-4)

Focus – Development.

Goal- Further Development of the game.

Description- This week was the development of 5 enemy AI and the start of enemy models.

End Result- Tasks were finished, and Attacks/Skills were also done during this week beyond the aim, this week was also tested, as with finally a way to cause damage I was able to fully test the health synchronization.

11.1.10. Week Ten –April (days 5-11)

Focus – Development

Goal- Further Development of the game.

Description- The aim was to make 4 enemy models with rigging and animation and implement them this week.

End Result- Tasks was not completed because of personal reasons, was only able to finish one and start another.

By finishing one it is meant 3 enemies, as all those 3 enemies use the model of a skeleton with changes to weapons and animations.

Evidence:

- **Other created but unfinished character**

[Figure 45 - Goblin enemy]

The image shows two models, one is the retopologized version and the other is the high poly version, all the models in the game have a higher poly version except for the shop NPC, this is because of future development thoughts that were had, which would involve using texture baking from high poly to low poly to increase the quality of the models with the use of said textures.

11.1.11. Week Eleven –April (days 12-18)

Focus – Development

Goal- Further Development of the game.

Description- This week's aim was to make the boss AI and model with rigging and animations, at the start there were tries to fix week ten but that was abandoned to try and not hurt the boss tasks, the levels were supposed to be finished this week.

End Result- Boss AI was finished, a boss model was started, other tasks were not done, the level scripting was done although not planned to be done this week, that involved making the player progress through the levels while going to the village too, the levels were done 2-6 this week as to meet the objective.

11.1.12. Week Twelve –April (days 19-25)

Focus – Development

Goal- Further Development of the game.

Description- This week the biggest aim was to do the boss skills and some boss art.

End Result- This week was instead used to focus of level scripting and finishing the boss model retopology, rigging and animation, also some testing was done to the boss with the help of a friend, it proved quite difficult as some bugs were found related to not seeing each other, later, next week, was solved and found to be due to a client loading faster than the main client, there for not spawning on said client's game.

11.1.13. Week Thirteen –April-May (days 26-2)

Focus – End of Development and Start of Postproduction

Goal- Finish tasks and polish the game.

Description- This week was focused on level programming, level art, and implementation of sound.

End Result- This week's tasks were done, level programming and level art were done, also sound was implemented, and tests were ran to check if audio was synchronized correctly and to fix bugs found.

11.1.1. Week Fourteen –May (days 3-7)

Focus – Postproduction and Submission

Goal- Polishing and Submission

Description- This week was used to test, bug solve, postproduction and project report.

End Result- This week was used as to fix remaining bugs, it was considered implementing free assets to replace the boxes in levels 4-6, but it was then dropped as lacked time and bugs could come out of that, this week was mostly used to write the Project report and these very words.

11.2. Tools and Planning Overview

11.2.1. Tools

During the development of this project, the student made use of several tools which helped to reach this final state, they were all vital for this project and will be going over how useful they were and how happy, personally, felt with them.

The student believes all tools used were mentioned, if any were forgotten it was not on purpose, also believes all tools did their job and the decision to use them wasn't wrong in general as opposed to use another tool

- **Unity**

  Having used unity before the experience was as expected, it was smooth to work with and provided all the needs and wants, although sometimes it crashed, and I think because of the version it sometimes took too long to compile, also found some weird bugs, but guessing that counts as the average unity experience.
  Overall, the feeling about the engine was that of happiness, with the use of unity, and firmly believe this tool was the right one for the job.

  Unity Tools

  - **Dynamic Bones**
    Dynamic bones are a unity tool I had bought a few years ago, it allows me to give physics to bones making me able to give fun movement to weapons(healer weapon) and such.
    Although this tool was not needed, I made use of it to give a little sparkle to the game, I am happy with it, and it gave no problems.
  - **Speed Tree**
    Having used this tool before, it provides free tree assets, but you are also able to make your own, which is where the name comes from, you make fast trees.
    This time I used the free asset and then edited the textures, making the trees fit the environment better.
    As always, I am very happy with this tool, but I still would rather make my own trees to better fit the style, that is, without using this tool, which usually makes the trees too realistic.
  - **Photon**
    Although Photon is not an exclusively Unity tool, I put it under unity as that is where I mainly used it, as a tool to achieve multiplayer in Unity.

Photon was easy to use and gave me no strange bugs or crashes, their website is user friendly, and their community provided answers to questions.
Must say I am very happy with Photon and will use it again.

- **Shader Graph**
  Unity shader graph was easy to use but I have to say, it could make changes to the search feature, and I believe it is still missing many features, most of the time you spend looking at why something is not working is time you feel like you could have just written the shader yourself.
  I think the tool is very nice but requires tons more documentation with ease of access.
- **URP(Universal Rendering Pipeline)**
  At first URP proved very nice, it was all working splendidly, until I ran into a problem, a maximum of 8 additional lights, I mean, what year are we in. I get it this rendering pipeline is made to also be able to run on mobile, but it has also made to be universal while providing the best quality. I not satisfied with this tool; I believe it could be better not just because of the described encountered problem but also because of the lack of tools that support URP.

- **Blender**
  Blender was everything I wanted from a 3D modelling program, there were no strange quirks to deal with, it was fast and smooth to work with, and provided many more tools than other programs.
  I am very happy with this tool and will use it in the future.
- **Photoshop**
  I am very used to photoshop so I will say, it does all I want from it, but the price tag is too big, my opinion of it, is, if I can afford it, then yes, it is a great tool which I am happy with.
- **Illustrator**
  Illustrator felt nice, they provide great tools to use and make shapes with, the quality of life felt top notch too. The tool gave me no problems, and know not many tools that can replace it, it hard to make the argument I made with photoshop, although it is similar.
  If needed then I would purchase this tool, although expensive.
- **GitHub**
  GitHub provided the needed safety to back up my project with ease.
  I am very satisfied with it and will keep using it.
- **Substance Painter (did not use)**
  Although I planned on using this tool, the limited time made it so I could not make use of it, so I will leave no comments other than mentioning I have used it before, and It was great.

11.2.2. Planning Methodology

My planning methodology was a Waterfall one where I had put the requirements and dependencies first and then left the rest to be done as I finished the dependencies. The planning was followed thoroughly, the tasks on the Gantt chart had to be finished the week they are supposed to be finished and I have to say, the planning was not perfect.

The current idea of good planning for me, after seeing how this one went, would be to instead of separating most stuff although not all, I would instead join the tasks related to each other and then during those weeks that are related to those tasks in specifying, I would then focus on making a polished and working feature instead of half a feature that then I would have to finish weeks after making.

I would also mention that I believe Waterfall was the best method for a single developer like me, as it provides me an easy-to-read list of tasks which is also easy to change. This is great for when I am thinking about game logic and having to know the dependencies.

Although I say the methodology was correct and the tasks placement wasn't the best, it is worth mentioning that I firmly believe that the planning took the biggest effect in the project, and that it is very possible that with a little more time put into the planning most mistakes and risks could have been avoided.

Testing Methodology

During testing I asked for the help of friends, they would download the game on Steam using a beta access code, then I would open a notepad and note every bug mentioned, then the same day I would try to fix them and mark them as fixed too. This was done several times a week and is not mentioned as much and when in the Gantt chart.

Testing was also done when a feature was implemented, these bugs were not taken note of as they were fixed on the spot.

- **Several bug notepads:**

Appendix M – Bug Notepads

11.2.3. Project Risks

Addressing the risks encountered during the development of this game and correlating them to the risk analysis if they correspond to mentioned ones, these are the risks encountered:

- **Loss of Motivation, mental health issues resulting in low performance.**

  During the development of this project, there were times where motivation was lost, this of course affected the development of the game. As mentioned in the risk analysis there was a mitigation plan, which was applied, but did not account to everything, being stuck at home due to covid and other reasons.

  The way to fix such loss of motivation, was to go outside and relax from the project, to not overwork myself to reset my mind state and be able to focus again on the project.

- **Game Engine limitations.**

  I faced a few limitations with the unity game engine, mostly related to art, there were limitations by the rendering pipeline not allowing a certain number of additional lights, that hurt the level art. Although I mention changing the design, when that was noticed it was too late to change the design.

- **Not Satisfied with Art and Spending too much time on it.**

  I gave this risk the same as on this risk analysis, but in truth this was a risk caused by the first one mentioned about loss of motivation.
  I did spend too much time in Art but also worth mentioning that the plan was made with that in mind, but yes that did affect the project as not all assets were done.
  The contingency was applied, and it did help, but too many risks on top of each other had a result which could not be mitigated at such point in the development or even be accounted for.

That's as far as it goes for risks that were mentioned in the risk analysis that occurred during the development of this project, other than that no other risks were found during the development.

12. Project Conduct

The development of this project went mostly as planned, all the objectives were achieved.

The objectives were all achievable and the planning was done so that they could be completed by the 15th of April which allowed me to have a smooth experience when developing said objectives and left time to further polish game features and add more content.

12.1. Objectives:

12.1.1. Make a Prototype

This objective was set to be finished by the 11th of February, which is exactly the date it was finished, and the 12th was when it was presented to the Supervisor.

Reaching this objective took a lot of crunch, as the objective was to prove the viability of the project, that required me to make an enemy, character, working multiplayer and a shop, all in less than 2 weeks.

I believe this objective was where I was the most productive, looking back I was so motivated I would spend 12 hours everyday testing multiplayer, learning about it and testing out the new waters.

12.1.2. Research about the game

Researching about the game, also includes the documentation needed for the development of the game, at the start this part was not as focused on, after being reminded by the supervisor, this objective was then focused on to be able to finish with a nice and presentable document, on time.

During this objective it was hard to maintain a balance between documentation and development, sometimes it would feel overwhelming not know which objective to focus on, whether I should be further developing the game, or should I just focus on documentation to provide a better explanation and presentation of the game, here is where the supervisor comes into consideration and helps steer the project in the right direction.

12.1.3. Implement 2 RPG Classes

This objective was completed on time, yes, although if I were able to go back, I would done some choices differently for this objective, instead of making a rogue class I believe a Tank would provide better gameplay for the players, as without one it is quite impossible to play without cheat Items.

This task was very important to show the scalability and modularity of the game, how it could be expanded on and how many styles of gameplay the project can provide, making it a repeatable and fun experience every time.

12.1.4. Implement 6 Map Levels

This task was completed, although it took crunch to finish on time, the 6 levels were implemented, but I must clarify they are not fully implemented, as levels 4-6 are do not have all the assets to a personally satisfactory level.

This task was a great way to show how different the environments could be, going from a dungeon to a ravine full of snow and frost with completely new enemies, this is what makes the project stand out.

12.1.5. Development of the game

This objective means that I was able to do the tasks of the development phase on my Gantt chart, they are not all finished, but I still believe that 90% total completion is enough to count as the development complete.

This task was put by me to evaluate if the game is in a good state, if the game wasn't playable or it didn't have the base of the game functioning, this task would be the judge of it.

12.1.6. Test the game

Game testing was done way before the time set, with the game being multiplayer I had to test it almost twice a week with the help of a friend, I was always making sure that certain features worked on multiplayer, this one I can say for sure is completed, as my noted bugs list is quite big.

12.2. Supervisor Feedback

As mentioned before, supervisor feedback was vital for me to finish my documentation on time and to help with tons(tons) of questions related to the documentation. The help of the supervisor was also great when it came to quality assurance, that the documentation formatting, references, and all were in place mostly because of such help.

During our weekly meetings it was very helpful to note everything that was mentioned and then while doing the documentation being able to look back at them as a support for ideas on what I could fix, change, or add to make the report highest quality I could.

The feedback from the supervisor relating to the project was also very appreciated as it provided motivation and insight from someone who isn't playing the game but watching, which is very different feedback compared to a tester.

The supervisor allowed for flexible schedules, they were able to change from Friday to Monday and sometimes before deadlines they would allow to have a meeting Friday and then the next Monday to check up on writing, this this gave me insight on the quality of the project and the report before said deadline.

The relationship between supervisor and student went great, as they were able to understand each other while also providing their own perspective, this was wonderful as it allowed for casual, friendly talk. This greatly improved the learning and development of the reports.

- **Notes written taken by student:**

[Appendix J – Supervisor Notes]

13.Conclusion and Reflection

13.1. Evaluation

Starting the project, the aim was clear, and the planning was done, I was certain of being able to finish it to my likings, this was during the first week, where motivation was high, I was feeling pumped about the project, I will first tackle how the weeks went by.

The first 3 weeks I had everything working, multiplayer lobby, movement, enemies, attacking, syncing stats, UI. That said there were no obstacles, I was working 8-12 hours every day, I woke up I knew what to do and how, although some days I admit they were harsh as I wanted to work on other stuff but instead I had to work on documents I powered through it all this went on until 28th of march or so, by then I was doing mostly art, I had a test phase so I was also fixing bugs and doing quality of life, and that's when the burn started, I had already finished the AE1, next task was to model the enemies, but after months locked at home it hit hard, in terms of mentally and physically I felt tired, took a while to realise the hit in motivation. I was burned, unable to work for more than 4 hours, some days I could not work, but it was fine at the start I was quite ahead, that is until I was not, when I started falling behind plans were changed, and tasks were left unfinished.

Those unfinished tasks just fuelled my demotivation and having to sometimes before the end of a tasks power through with 16hours fully trying to finish before the burnout hit harder. I took some time for myself when I realised that, I started going on walks and hanging out with other people as tough I'm **not** satisfied with the end product knowing that it **was** possible to be how I wanted it to look, with more skills, more models, textures, I'm still **happy** with how it is and think it's a project I'm proud of as it isn't easy to achieve something like this in such a short time.

I can say in the end that this project was a success as I was able to prove I can make this game, and I am proud of how much work I was able to put in and how well it turned out, as a Multiplayer game is so hard to get done right and with little to no bugs, even AAA games done by the biggest industry names can't get a multiplayer game with no bugs, so I'll take what I have as a big win for me and this project.

13.2. What I learned

I learned about myself, and how much I can overwork myself and my needs, that I must take better care of my mental and physical help to keep being productive, kind of like investing in yourself.

Something very worth mentioning is that I learned blender… yes, I came into this with the objective of learning blender while also developing my FMP in 3D, mostly because I wanted to maximize my learning, I have done this many times and I will keep doing it, might have been detrimental now, but I believe it will help me in the future. If I had not learned blender, I would have done my work in 3Ds max but wouldn't've learned as much from this experience.

I learned more about networking, I learned about the various network tools for Unity, Godot, and Unreal Engine 4. I was able to have a fully working multiplayer experience with photon which will help me following through with my multiplayer game ideas which I usually throw aside.

Although it is not the first time, I make plans I learned to follow through with them and it is thanks to those plans that I was able to make as much as I did.

I feel more experienced with shaders too, after using Unity's Shader Graph, I also found to really like working with shaders, so I have found something to learn even more.

I have learned that putting time into the task allocation is very important, and that perhaps making different graphs to judge the tasks allocation from many perspectives is very important to allow a clear judgement of all possible risks.

13.3. Good Experiences

I was really surprised with how well the multiplayer worked, it was seamless, real time, it felt insane when testing with a friend, we spent tons of time challenging each other with the wall jump skill trying to reach high spots and that is when the project felt like a game to me, the good experience of this game cannot be seen when playing single player, after all it's an experience for you to experience with friends.

Another happy moment was when the health synchronization was first working, it felt like it was all working and it just felt good to see an enemy taking damage or your losing health, so much I even took a screenshot.

Figure 31 - Health

The project was the best experience, it felt good when I was programming, when I was doing the Art, it was cosy and motivating, learning, and seeing improvement, being able to perform better and faster every other model I make was also a very nice feeling.

13.4. Bad Experiences

As mentioned, before it felt bad when I could not finish the game to my liking with all the assets I wanted to have, it does leave a bad taste, but it is not like my project ends here, what have I not have time restrictions I would of course only spend as much time as needed until it felt ready for even early access on Steam.

Working previously on a similar industry I can say that this scope is possible, but that is if you are taking care of yourself on all fronts, and with motivation from money which can help a lot., also, the motivation from working on a team that is also there to help you, the obligation to have it complete because of the job and so on.

I can say at the start I wanted to treat this like I was in the industry, knowing that working overtime is nothing new and that you are supposed to be always learning and performing, in the end I learned that my mental must be taken care of, this experience will help me deal with my future jobs in the industry.

13.5. Future Development

Although I do not have plans to keep on developing this project as it currently is, I might come back to it and change the scope and mechanics to make the development less time consuming and viable for a single game developer.

During the development of this game, I gained motivation to develop other skills, mostly in the art department but also in the programming department.

As I worked with shaders, I gained an interest in learning more deeply about them, I grew interest in the programming side of shaders after using shader graph in unity.

Working with Blender was a smooth experience, although there was a learning curve switching from 3D programs, Blender was a way better experience than 3Ds max, it does not crash nearly as much and feels about 10x faster, although I am aware I did not exactly put much time into this project's animations, I grew interest in learning how to make better animations in blender which is something I have not had for a while and noticed to be lacking at.

I've only really started doing AI this January, yes, a month before starting the FMP, during the AI module I had, and I can say it was a really fun and enjoyable experience, to make the AI in a flowchart and then seeing them actually working, it made me curious to experiment with other AI, and I also believe It helped me develop my programming skills the most, so in the future I will for sure work more with AI.

I have been gaining an itch to draw more so in the future I will be developing that skill which I've only worked on a few weeks a year, this time I'll dedicate myself daily, as I'm sure it will help develop my sculpting skills.

Now talking the job development, I am aiming to learn C# , SQL, and many other API to widen my IT job search, I have been making use of the free courses provided by the University at LinkedIn Learning which are being a great help to improve my skills and employability, the reasoning being because of how competitive the Indie industry is I first need a great game or a great portfolio to get a position anywhere, not mentioning the luck needed and how the jobs are usually in bigger cities and so on.

14.References

Adobe Illustrator. 1987. [Film] s.l.: Adobe Inc..

Adobe Photoshop. 1990. [Film] s.l.: Adobe Inc..

Blender. 1994. [Film] Directed by Ton Roosebdaak. s.l.: s.n.

Blizzard Entertainment, 2002. *Warcraft III,* s.l.: Blizzard Entertainment.

Boehm, M., 2017. *The First-Person Animation of Overwatch.* [Online]
Available at: https://www.gdcvault.com/play/1024319/Animation-Bootcamp-The-First-Person
[Accessed 7 February 2021].

Bycer, J., 2020. *The Not so Secrets to Success in the Game Industry.* [Online]
Available at:
https://gamasutra.com/blogs/JoshBycer/20201209/374978/The_Not_so_Secrets_to_Success_in_the_GameIndustry.php
[Accessed 13 February 2021].

Bycer, J., 2020. *Understanding Pain Points in Game Design.* [Online]
Available at:
https://gamasutra.com/blogs/JoshBycer/20201203/374630/Understanding_Pain_Points_in_Game_Design.php
[Accessed 15 February 2021].

Bycer, J., 2021. *The Successful Steps of Early Access Games.* [Online]
Available at:
https://gamasutra.com/blogs/JoshBycer/20210113/376120/The_Successful_Steps_of_Early_Access_Games.php
[Accessed 22 February 2021].

DOTA 2. 2013. [Film] s.l.: Valve.

Epic Games, 2020. *Networking Overview.* [Online]
Available at: https://docs.unrealengine.com/en-US/InteractiveExperiences/Networking/Overview/index.html
[Accessed 2 February 2021].

GitHub. 2008. [Film] s.l.: Microsoft.

Godot, 2020. *List of Features.* [Online]
Available at: https://docs.godotengine.org/en/stable/about/list_of_features.html
[Accessed 26 February 2021].

Habezai-Fekri, J., 2020. *Bird House: Working on a Stylized Landscape in UE4.* [Online]
Available at: https://80.lv/articles/bird-house-working-on-a-stylized-landscape-in-ue4/
[Accessed 22 February 2021].

Hopoo Games, 2020. *Risk of Rain 2,* s.l.: s.n.

Jess, 2020. *Z-Up Normals: Stylized Wind Blown Grass.* [Online]
Available at: https://jesshiderue4.wordpress.com/materials/stylized-wind-blown-grass/
[Accessed 22 February 2021].

King, A., 2020. *Risk of Rain 2 review.* [Online]
Available at: https://www.gamespot.com/reviews/risk-of-rain-2-review/1900-6417527/

League of Legends. 2009. [Film] s.l.: Riot Games.

Legion TD. 2017. [Film] s.l.: AutoAttack Games.

Lindgren, P., 2016. *Hot to identify the scope of your game.* [Online]
Available at:
https://www.gamasutra.com/blogs/PontusLindgren/20160524/273375/How_to_identify_the_scope_of_your_game.php
[Accessed 28 February 2021].

Linietsky, J., 2016. *Godots now high level networking preview.* [Online]
Available at: https://godotengine.org/article/godots-new-high-level-networking-preview

Mirror Networking. 2021. [Film] Directed by vis2k. s.l.: noobtuts.

photon. 2021. [Film] s.l.: Exitgames.

Riot Games. 2006. [Film] Directed by Nicolo Laurent. Santa Monica: s.n.

Serinx, 2019. *What are the pros and cons of available network solutions/assets.* [Online]
Available at: https://forum.unity.com/threads/what-are-the-pros-and-cons-of-available-network-solutions-assets.609088/
[Accessed 27 January 2021].

Substance Painter 2021. 2021. [Film] s.l.: Adobe Inc..

Unity. 2005. [Film] s.l.: Unity Technologies.

Valve Corporation. 1996. [Film] Directed by Gabe Newell. Bellevue: s.n.

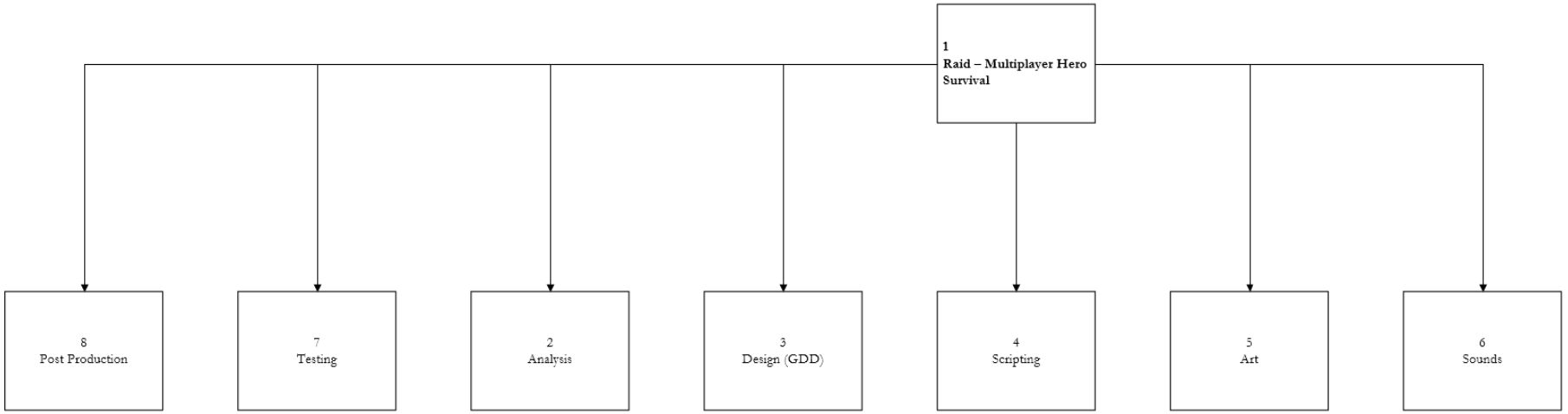
Youtube, 2005. [Online]
Available at: https://www.youtube.com

15.Bibliography

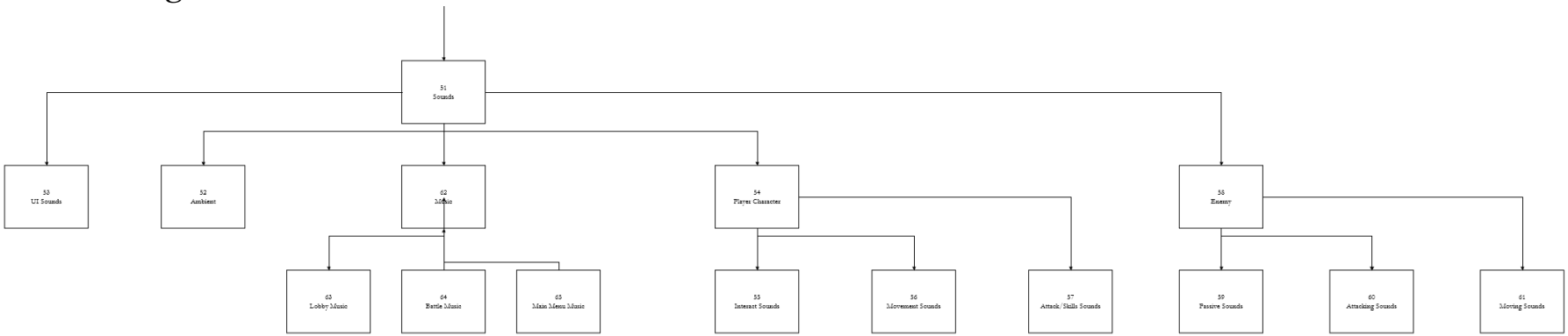
David, 2020. *Meadows: Creating Stylized Nature in UE4*. [Online]
Available at: https://80.lv/articles/meadows-creating-stylized-nature-in-ue4/
[Accessed 27 January 2021].

16.Appendix A - WBS

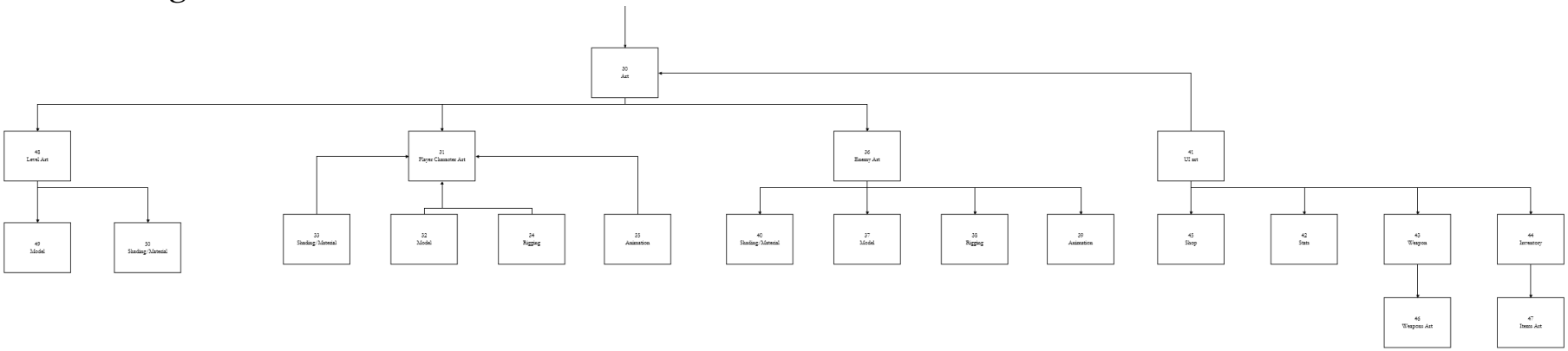
16.1. Figure 3 - WBS structure



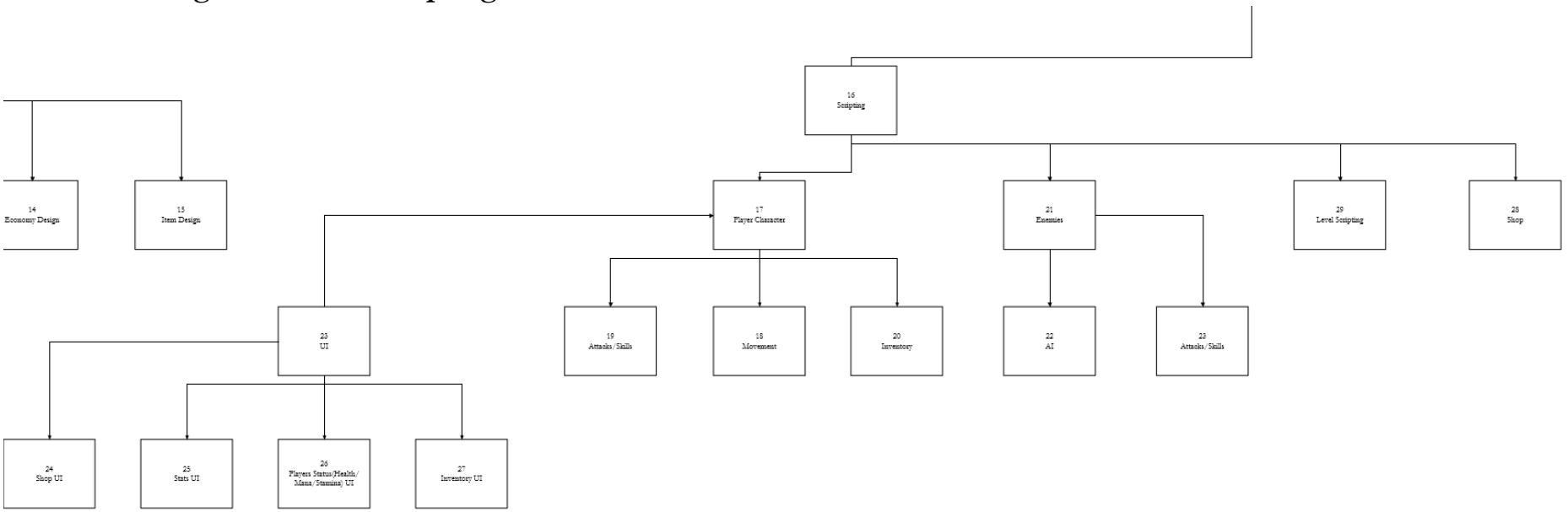
16.2. Figure 4 - WBS Sound



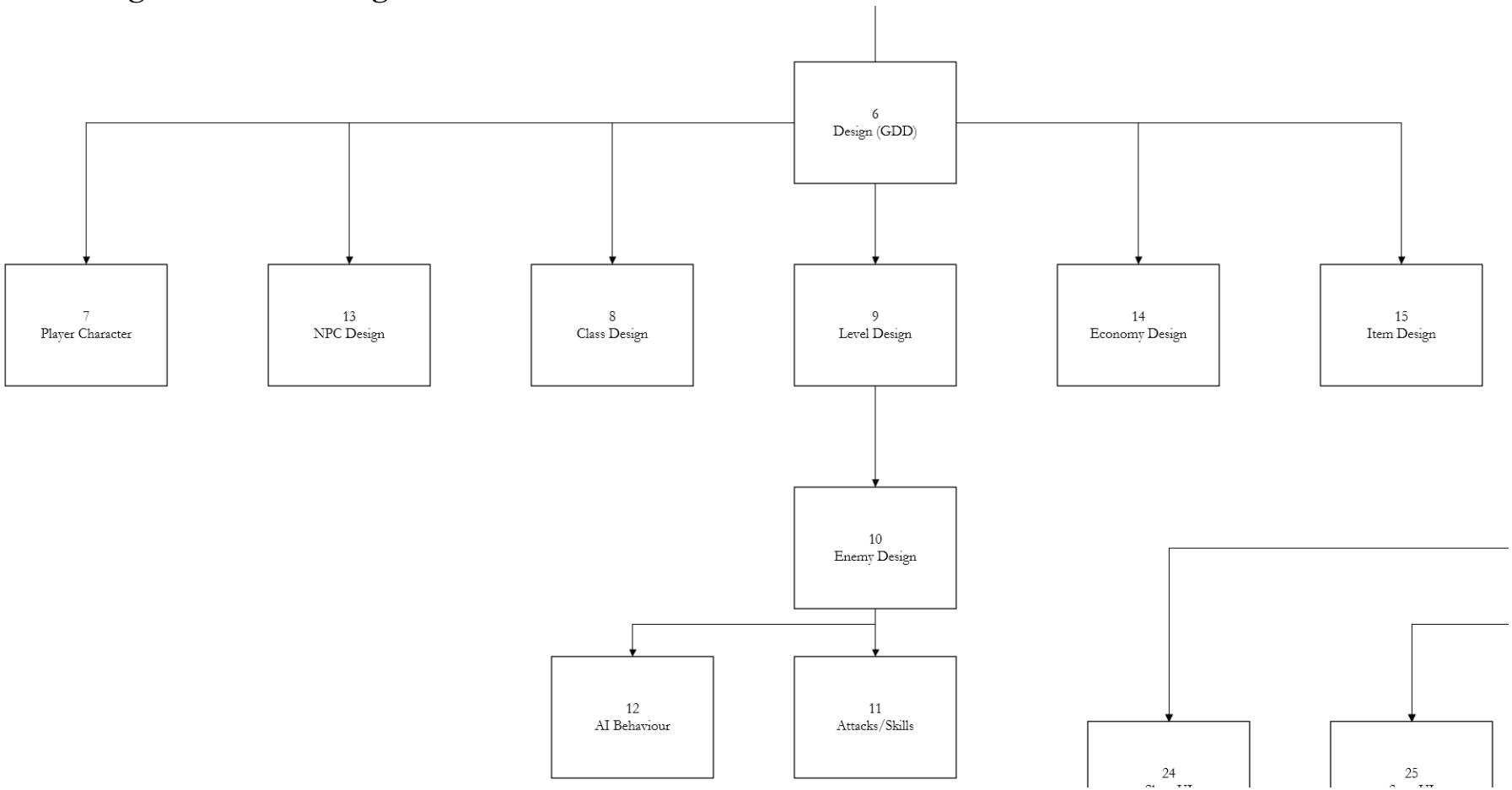
16.3. Figure 5 - WBS Art



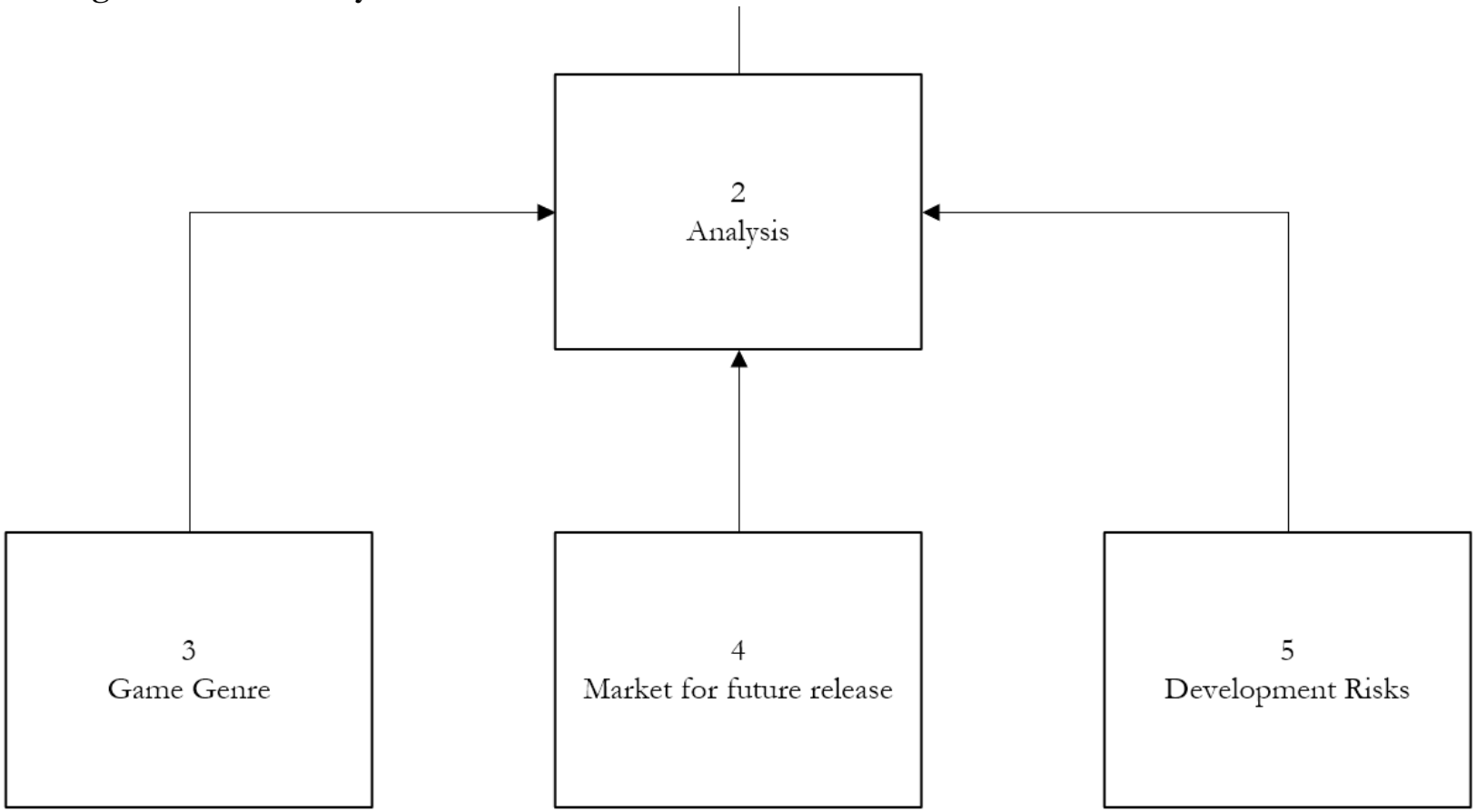
16.4. Figure 6 - WBS Scripting



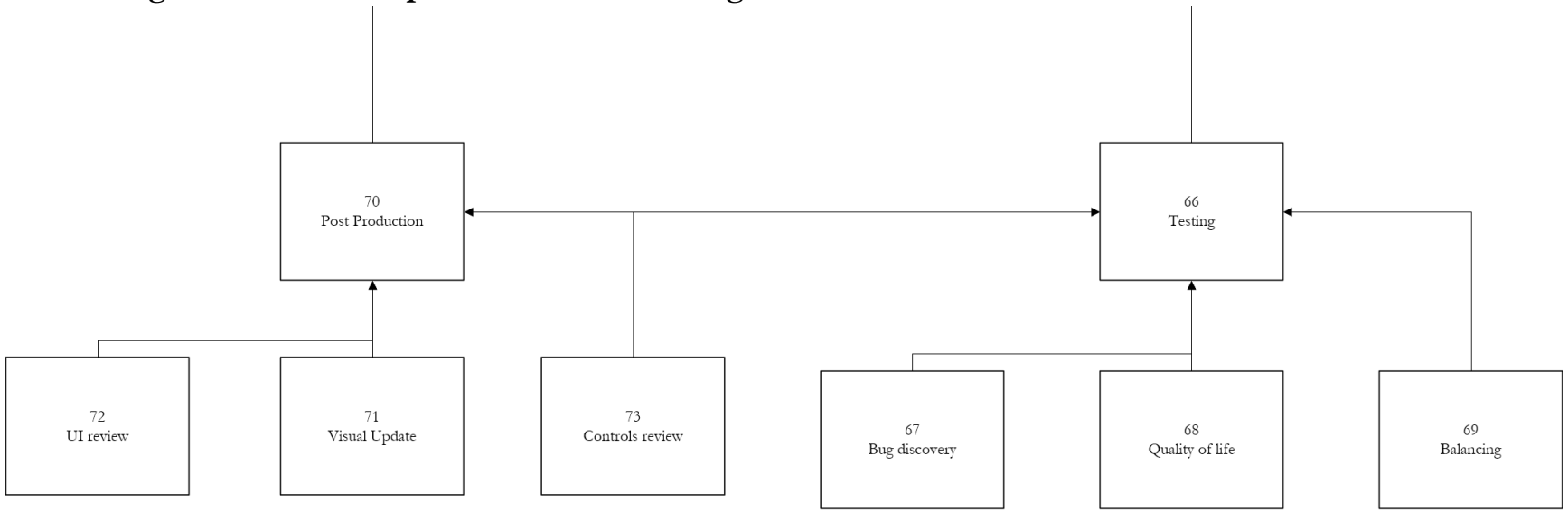
16.5. Figure 7 - WBS Design



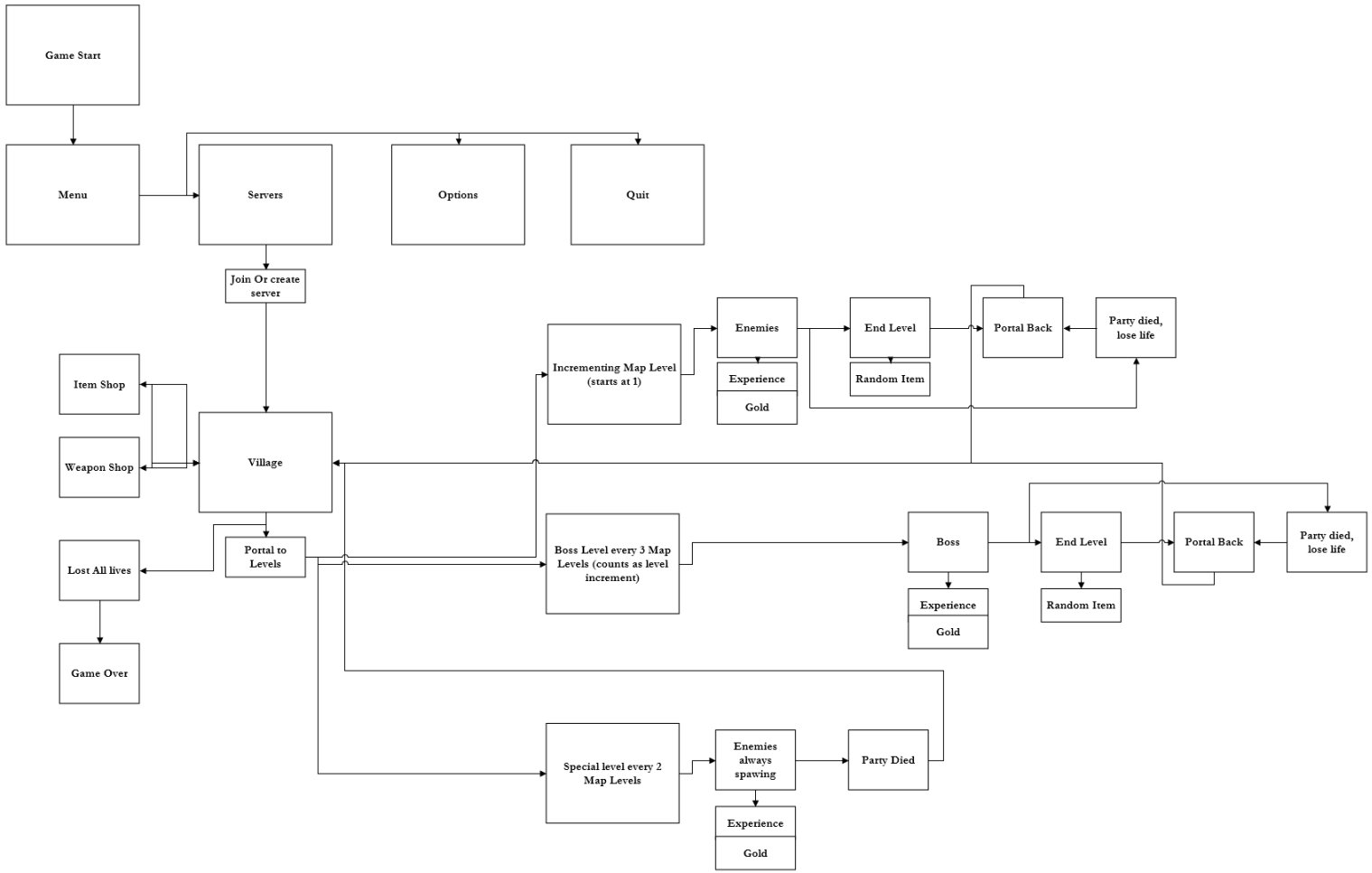
16.6. Figure 8 - WBS Analysis



16.7. Figure 9 - WBS Postproduction and Testing



16.8. Figure 10 - Overall game flow



17.Appendix B – Excel Task List

17.1. Figure 11 - Excel Task List

Task List

Task	Hours Planned	Hours Done	Planned Finish Date	Finished Date
Prototype	*Any Time*	60	11/02/2021	11/02/2021
Documentation	**88**	0	27/02/2021	
WBS	7	7		
Gantt Chart	6	6		
Task List	7	7		
Game Design Document	38	10		
Concept Art	30	20		
		0		
		0		
Development	**326**	0	16/04/2021	
Player		0		
Class Implementation	12	0		
Weapons and Skills	25	3		
Player Art	35	0		
Items/Weapons	10	2		
Buffs and Debuffs	2	0		
NPCs		0		
Npcs Art	20	0		
Enemies		0		
AI	20	0		
Enemy Art	45	0		
Attacks/Skills	30	0		
Bosses		0		
AI	10	0		
Boss Art	50	0		
Attacks/Skills	20	0		
UI		0		
Menu	6	0		
Game Interface	10	0		
Shop	4	0		
Levels		0		
Level Programming	7	0		
Level Art	10	0		
Sound Implementation	10	0		
Testing	**10**	0	30/04/2021	
		0		
		0		
		0		
		0		
Post Production	**7**	0	06/05/2021	
Visual Update	7	0		
		0		
		0		
Release	Milestone Reached	0	07/05/2021	

Convert Hours to Days	17.95833333

Statistics

Deadline	07/05/2021
Days Left	42
Hours Left	1008

Total Hours Done	115
Total Hours Planed	431
Hours Left To Finish	316
Hours Left (No Prototype)	376

Capable Hour Invesment With Days Left	252
Capable Hour Crunch With Days Left	504

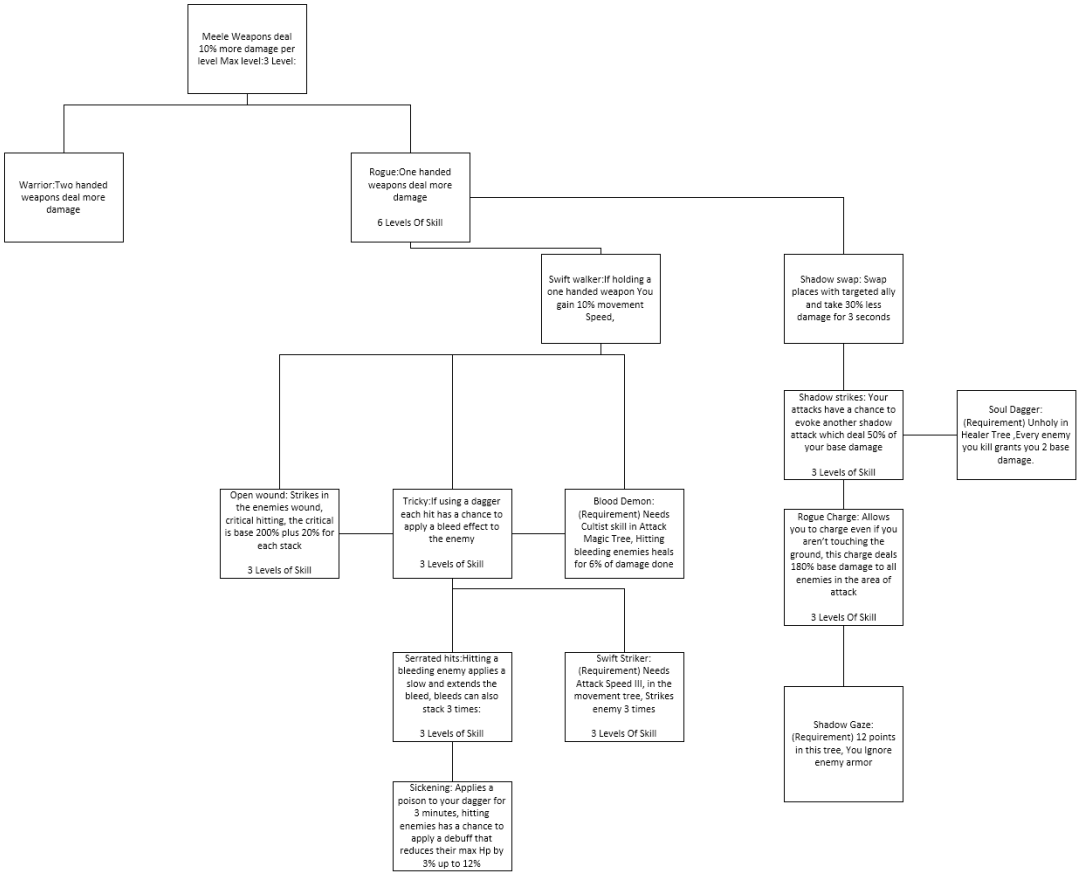
Crunch Hours Required So Far	124

Variables

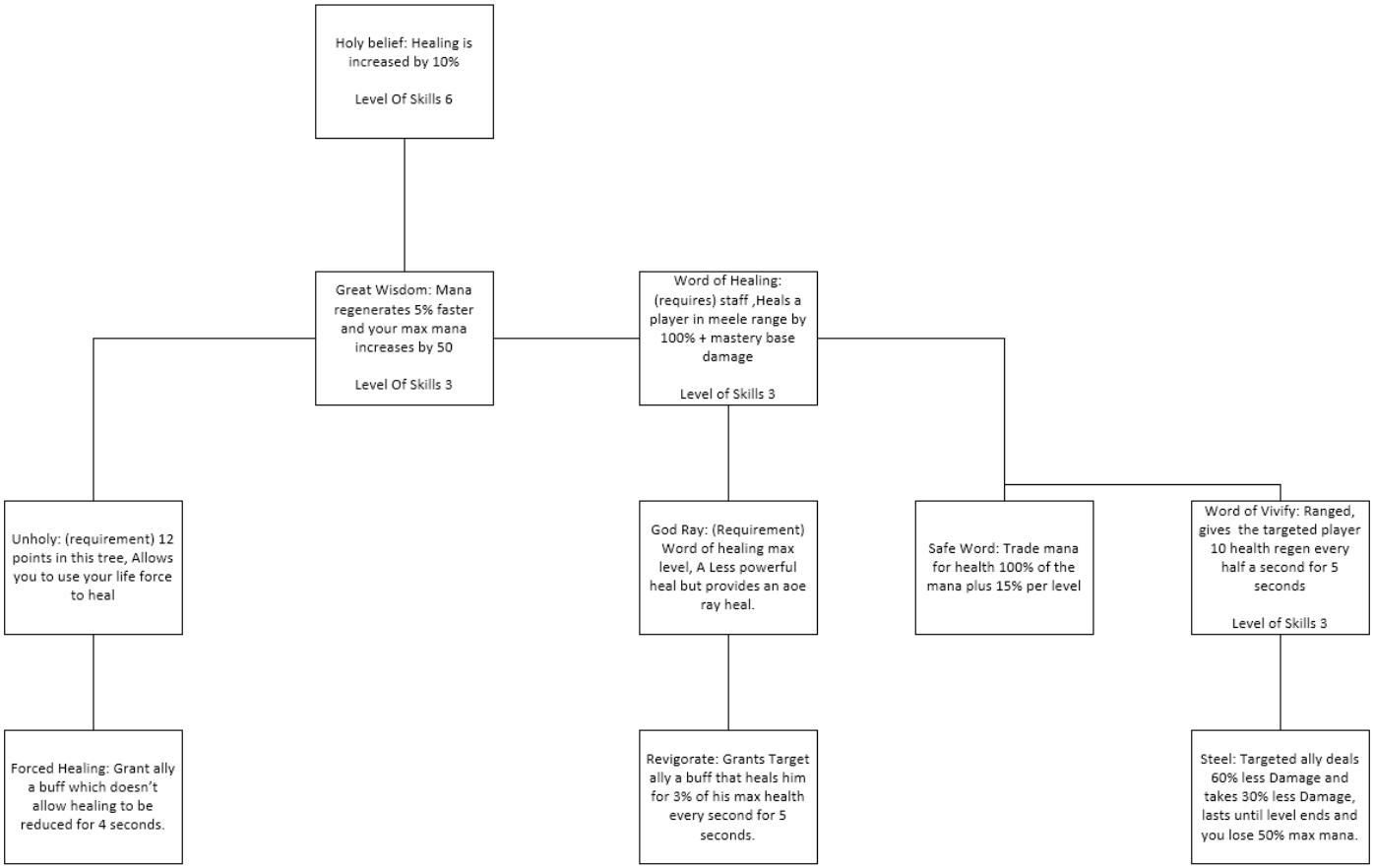
Average Daily hours	6
Crunch Hours	12

18.Appendix C – Talent Trees

18.1. Figure 12 - Melee Talent Tree



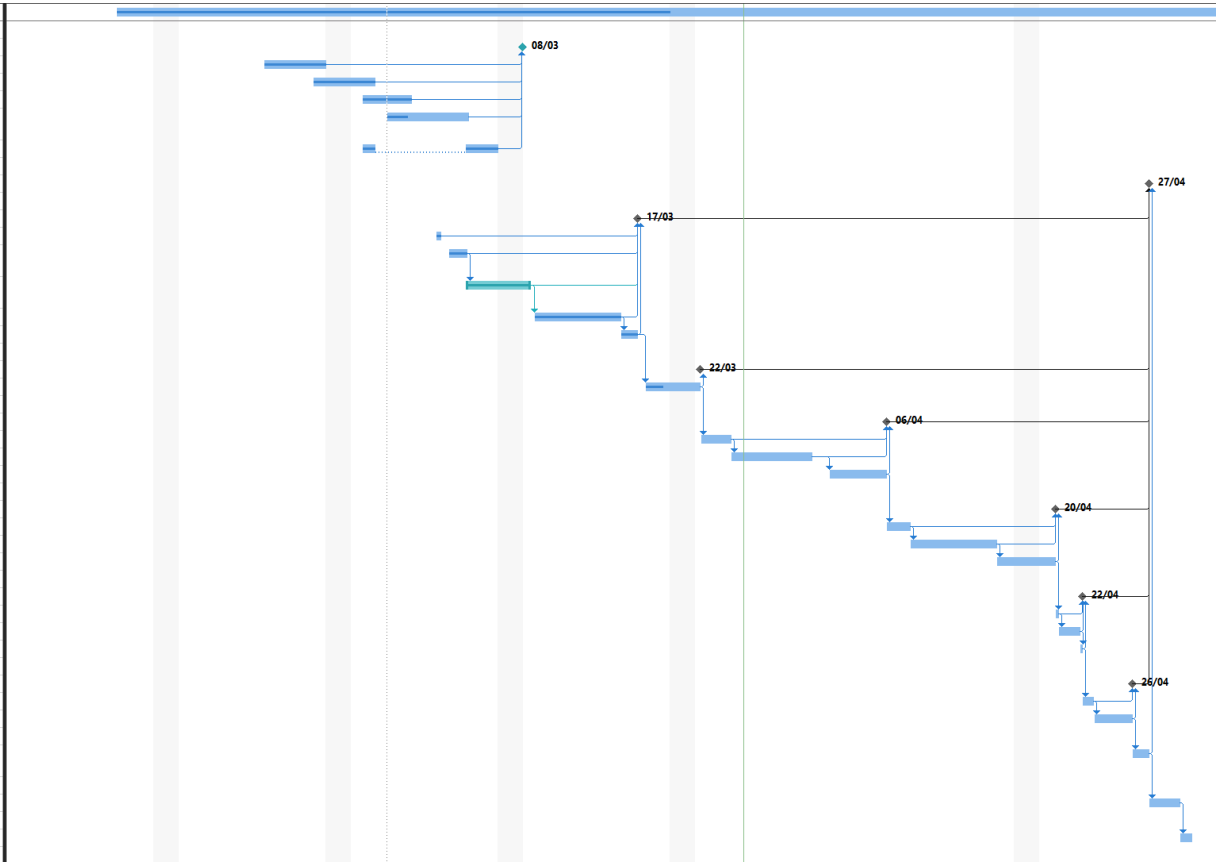
18.2. Figure 13 - Healer Talent Tree



19.Appendix D – Gantt Chart

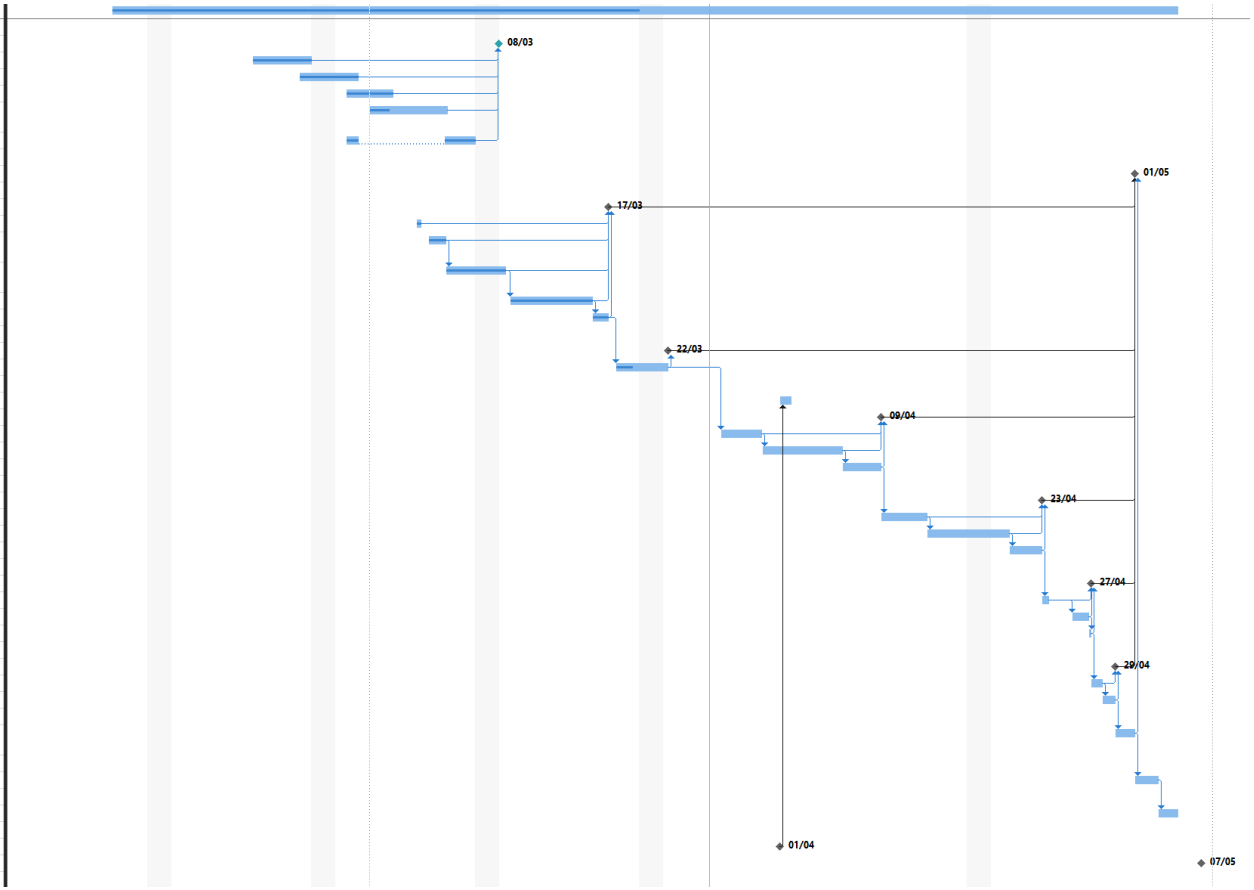
19.1. Figure 14 - Gantt Chart V1

	Final Major Project	68 days?	Wed 03/02/2	Tue 04/05/2	
	Documentation	0 days	Mon 08/03/2	Mon 08/03/2	4,5,6,7,8
✓	WBS	5 days?	Mon 15/02/2	Fri 19/02/21	
✓	Task List	3 days?	Fri 19/02/21	Tue 23/02/2	
✓	Gantt Chart	4 days?	Tue 23/02/2	Fri 26/02/21	
	Game Design Document	38 hrs	Thu 25/02/21	Wed 03/03/21	
✓	Concept Art	30 hrs	Tue 23/02/2	Fri 05/03/21	
	Development	0 days	Tue 27/04/2	Tue 27/04/2	12,19,22,27,32,3
	Player	0 days	Wed 17/03/2	Wed 17/03/2	13,14,15,16,17
✓	Buffs and Debuffs	2 hrs	Mon 01/03/2	Mon 01/03/2	
✓	Class Implementation	12 hrs	Tue 02/03/21	Wed 03/03/21	
✓	Weapons and Skills	25 hrs	Wed 03/03/21	Mon 08/03/21	14
✓	Player Art	40 hrs	Tue 09/03/2	Mon 15/03/2	15
✓	Items/Weapons	10 hrs	Tue 16/03/2	Wed 17/03/2	16
	NPCS	0 days	Mon 22/03/2	Mon 22/03/2	20
	NPCS Art	20 hrs	Thu 18/03/2	Mon 22/03/2	17
	Enemies	0 days	Tue 06/04/2	Tue 06/04/2	23,24,25
	AI	20 hrs	Mon 22/03/2	Wed 24/03/2	20
	Enemy Art	45 hrs	Thu 25/03/2	Wed 31/03/2	23
	Attacks/Skills	30 hrs	Fri 02/04/21	Tue 06/04/2	24
	Bosses	0 days	Tue 20/04/2	Tue 20/04/2	28,29,30
	AI	15 hrs	Tue 06/04/2	Thu 08/04/2	25
	Boss Art	40 hrs	Thu 08/04/2	Thu 15/04/2	28
	Attacks/Skills	20 hrs	Thu 15/04/2	Tue 20/04/2	29
	UI	0 days	Thu 22/04/2	Thu 22/04/2	33,34,35
	Menu	6 hrs	Tue 20/04/2	Tue 20/04/2	30
	Game Interface	10 hrs	Tue 20/04/2	Thu 22/04/2	33
	Shop	4 hrs	Thu 22/04/2	Thu 22/04/2	34
	Levels	0 days	Mon 26/04/2	Mon 26/04/2	38,39
	Level Programming	7 hrs	Thu 22/04/2	Fri 23/04/21	35
	Level Art	10 hrs	Fri 23/04/21	Mon 26/04/2	38
	Sound Implementation	10 hrs	Mon 26/04/21	Tue 27/04/21	39
	Testing	20 hrs	Wed 28/04/2	Fri 30/04/21	41
	Post Production	7 hrs	Fri 30/04/21	Sat 01/05/21	43



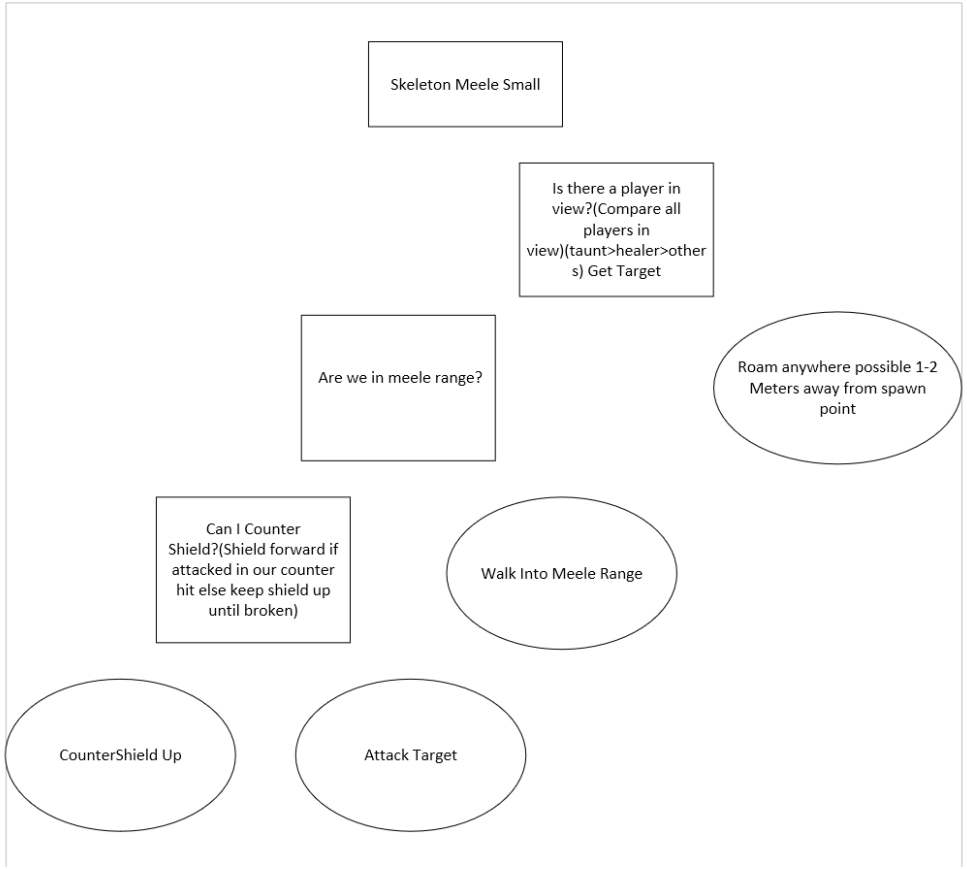
19.2. Figure 15 - Gantt Chart V2

	Task Name	Duration	Start	Finish	Predecessors
	Final Major Project	68 days?	Wed 03/02/2	Tue 04/05/2	
	Documentation	0 days	Mon 08/03/2	Mon 08/03/2	4,5,6,7,8
✓	WBS	5 days?	Mon 15/02/2	Fri 19/02/21	
✓	Task List	3 days?	Fri 19/02/21	Tue 23/02/2	
✓	Gantt Chart	4 days?	Tue 23/02/2	Fri 26/02/21	
	Game Design Document	38 hrs	Thu 25/02/21	Wed 03/03/21	
✓	Concept Art	30 hrs	Tue 23/02/2	Fri 05/03/21	
	Development	0 days	Sat 01/05/21	Sat 01/05/21	12,19,23,28,33,3
	Player	0 days	Wed 17/03/2	Wed 17/03/2	13,14,15,16,17
✓	Buffs and Debuffs	2 hrs	Mon 01/03/2	Mon 01/03/2	
✓	Class Implementation	12 hrs	Tue 02/03/21	Wed 03/03/21	
✓	Weapons and Skills	25 hrs	Wed 03/03/21	Mon 08/03/21	14
✓	Player Art	40 hrs	Tue 09/03/2	Mon 15/03/2	15
✓	Items/Weapons	10 hrs	Tue 16/03/2	Wed 17/03/2	16
	NPCS	0 days	Mon 22/03/2	Mon 22/03/2	20
	NPCS Art	20 hrs	Thu 18/03/2	Mon 22/03/2	17
	Testing Phase 1	8 hrs	Thu 01/04/2	Thu 01/04/2	48
	Enemies	0 days	Fri 09/04/21	Fri 09/04/21	24,25,26
	AI	20 hrs	Sat 27/03/21	Tue 30/03/2	20
	Enemy Art	45 hrs	Tue 30/03/2	Tue 06/04/2	24
	Attacks/Skills	30 hrs	Tue 06/04/2	Fri 09/04/21	25
	Bosses	0 days	Fri 23/04/21	Fri 23/04/21	29,30,31
	AI	15 hrs	Fri 09/04/21	Tue 13/04/2	26
	Boss Art	40 hrs	Tue 13/04/2	Tue 20/04/2	29
	Attacks/Skills	20 hrs	Tue 20/04/2	Fri 23/04/21	30
	UI	0 days	Tue 27/04/2	Tue 27/04/2	34,35,36
	Menu	6 hrs	Fri 23/04/21	Fri 23/04/21	31
	Game Interface	10 hrs	Mon 26/04/2	Tue 27/04/2	34
	Shop	4 hrs	Tue 27/04/2	Tue 27/04/2	35
	Levels	0 days	Thu 29/04/2	Thu 29/04/2	39,40
	Level Programming	7 hrs	Tue 27/04/2	Wed 28/04/2	36
	Level Art	10 hrs	Wed 28/04/2	Thu 29/04/2	39
	Sound Implementation	10 hrs	Thu 29/04/21	Sat 01/05/21	40
	Testing	8 hrs	Sat 01/05/21	Mon 03/05/2	42
	Post Production	15 hrs	Mon 03/05/2	Tue 04/05/2	44
	AE1 MileStone	0 days	Thu 01/04/2	Thu 01/04/2	
	AE2 MileStone	0 days	Fri 07/05/21	Fri 07/05/21	

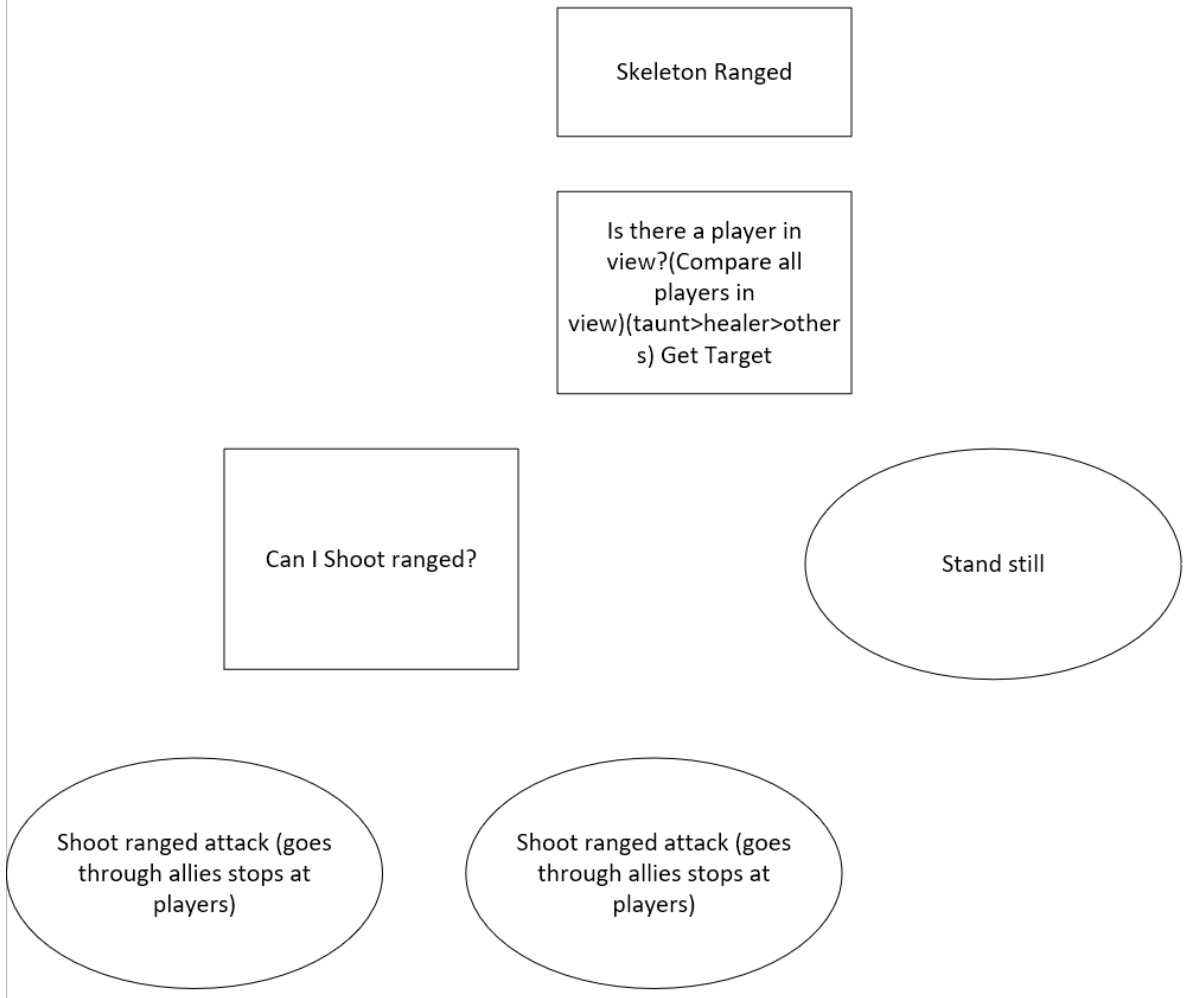


20. Appendix E – Enemies AI

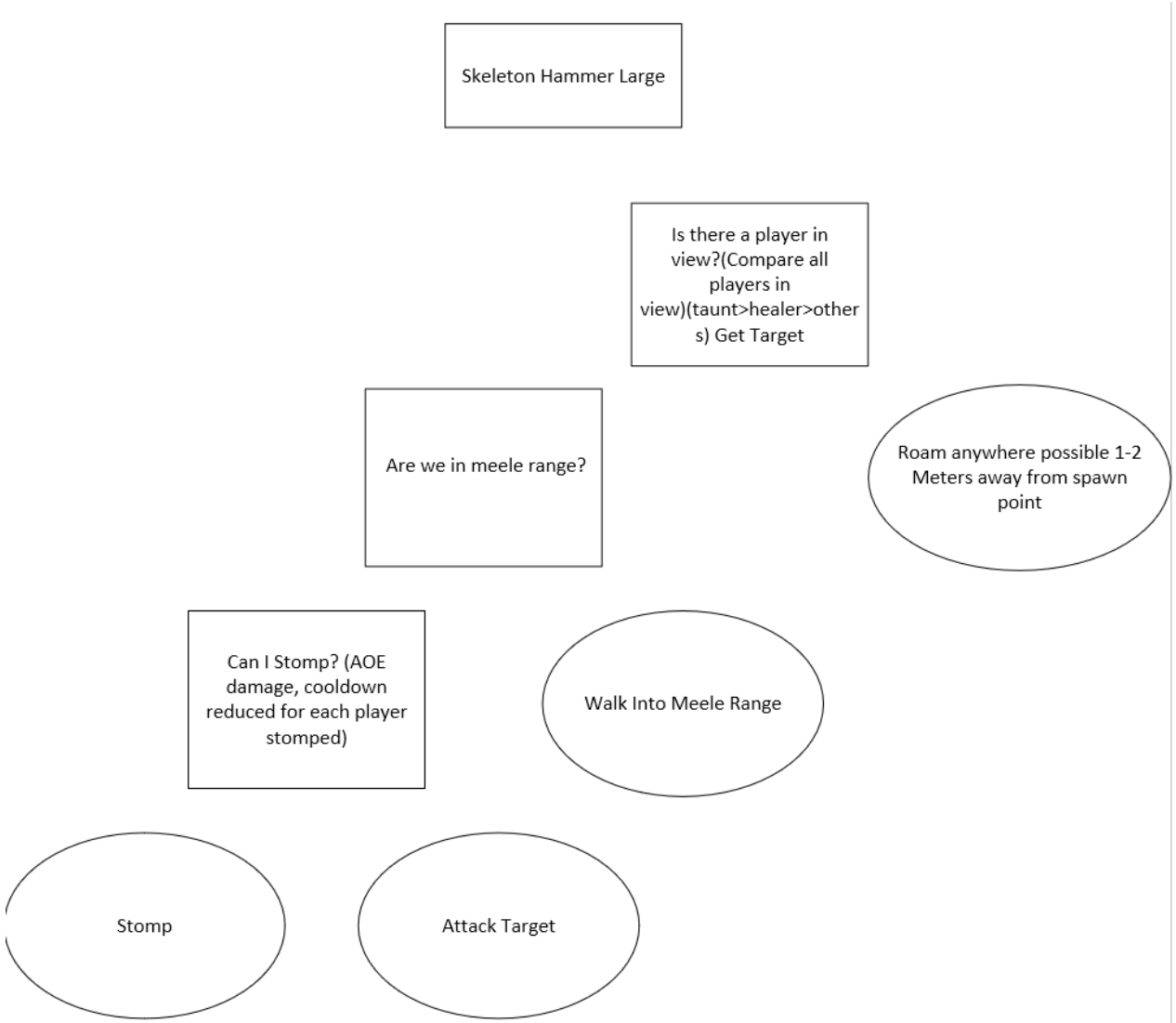
20.1. Figure 16 - Melee Skeleton AI



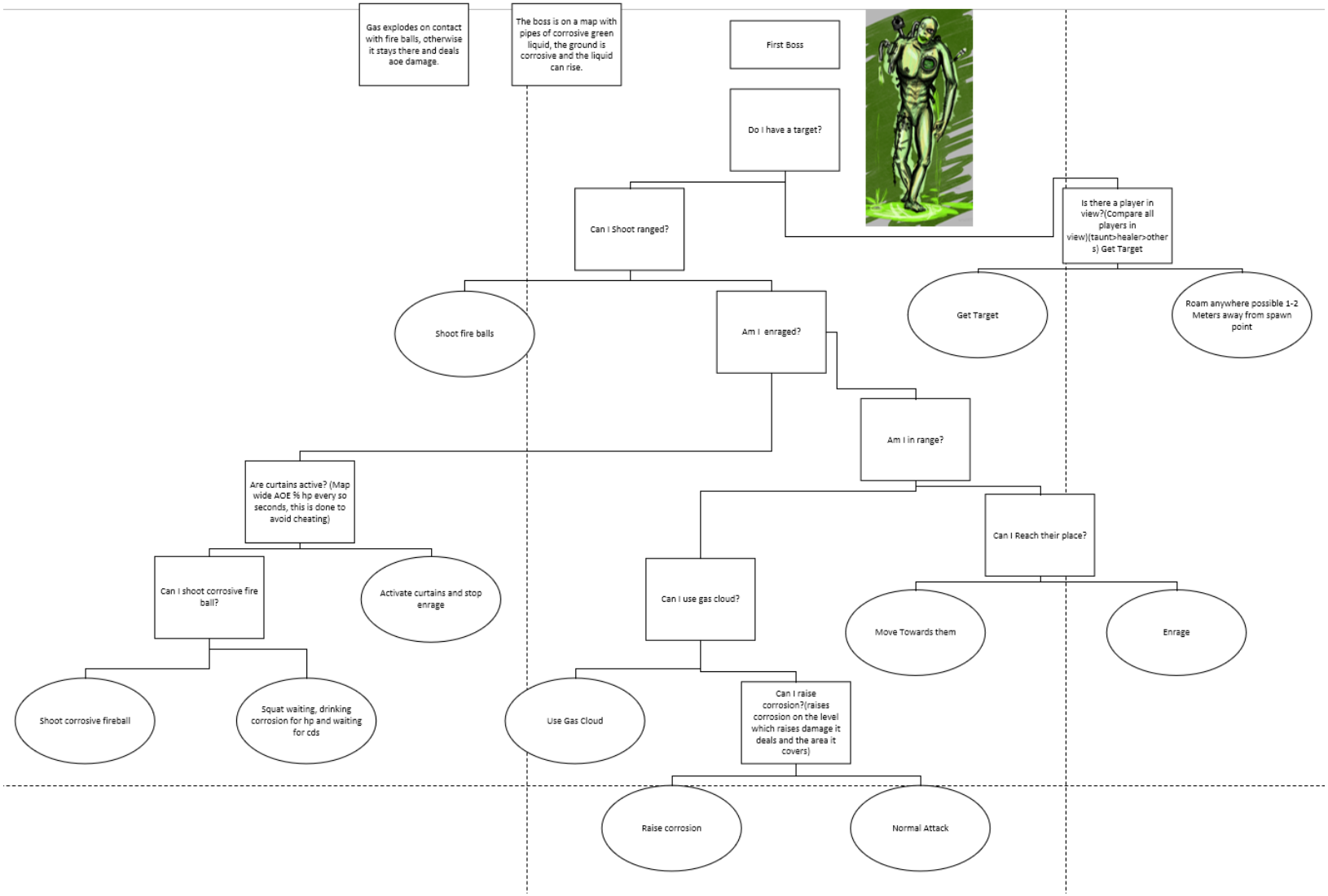
20.2. Figure 17 - Ranged Skeleton AI



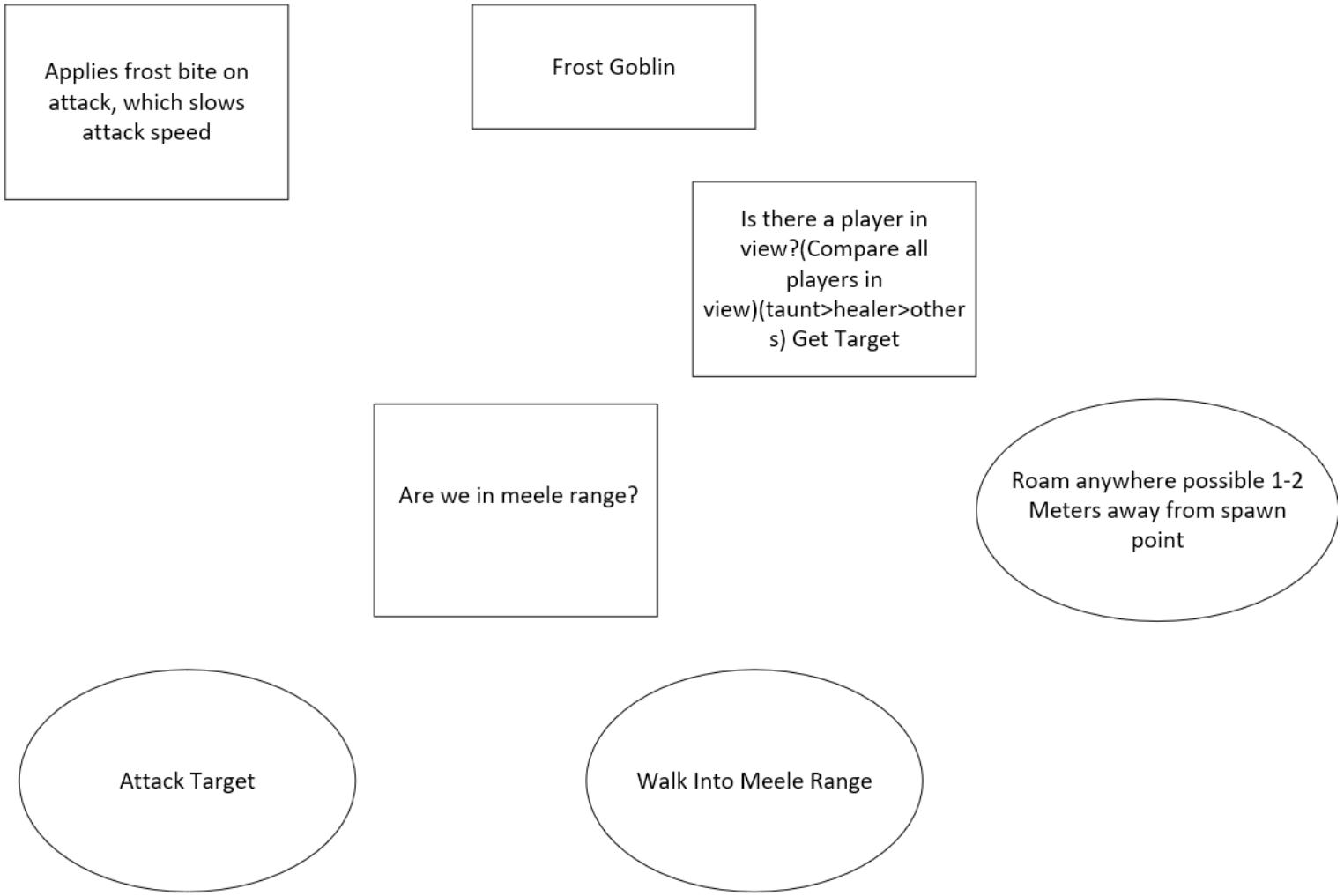
20.3. Figure 18 - Skeleton Hammer Large AI



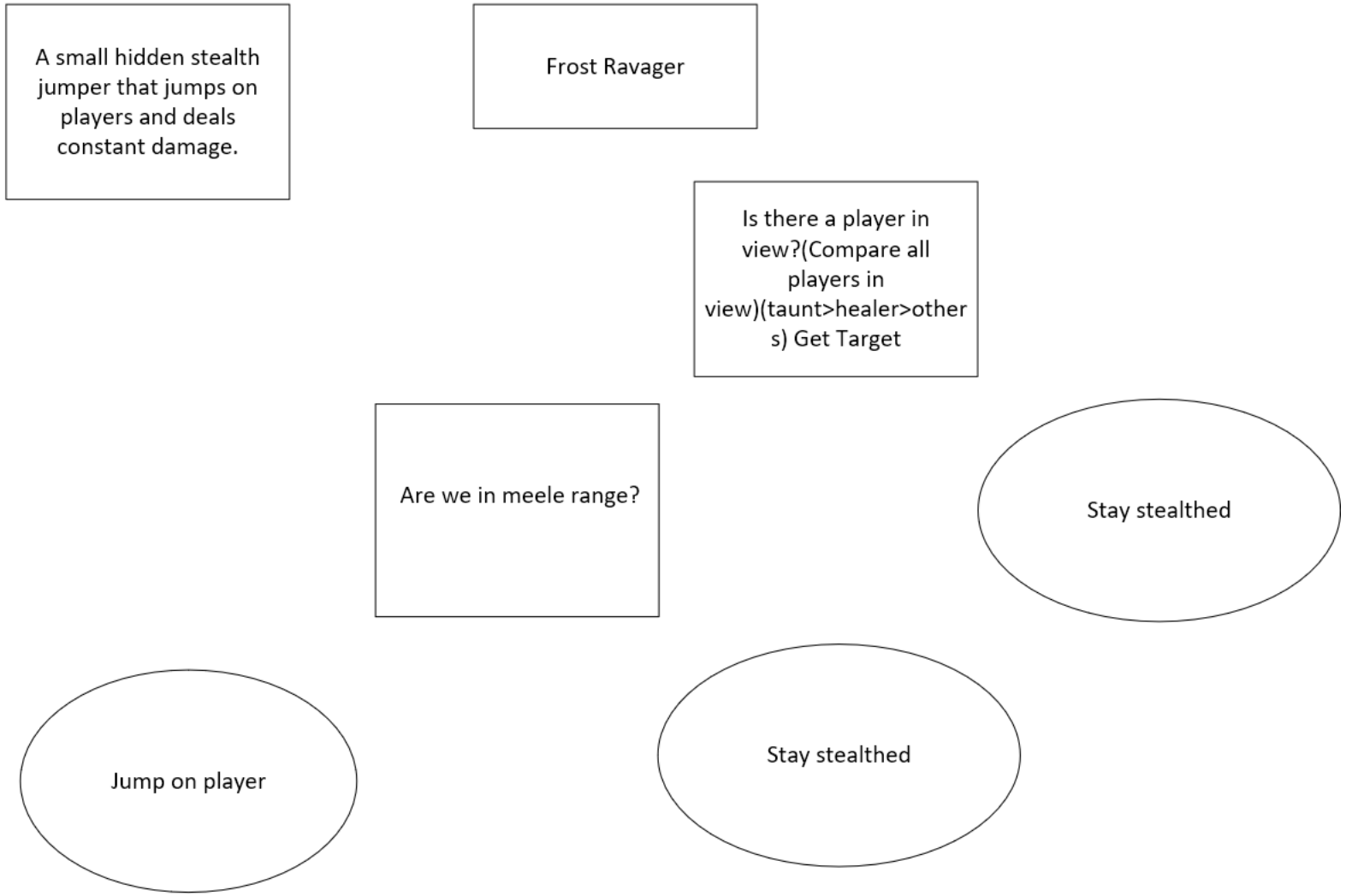
20.4. Figure 19 - First Boss AI



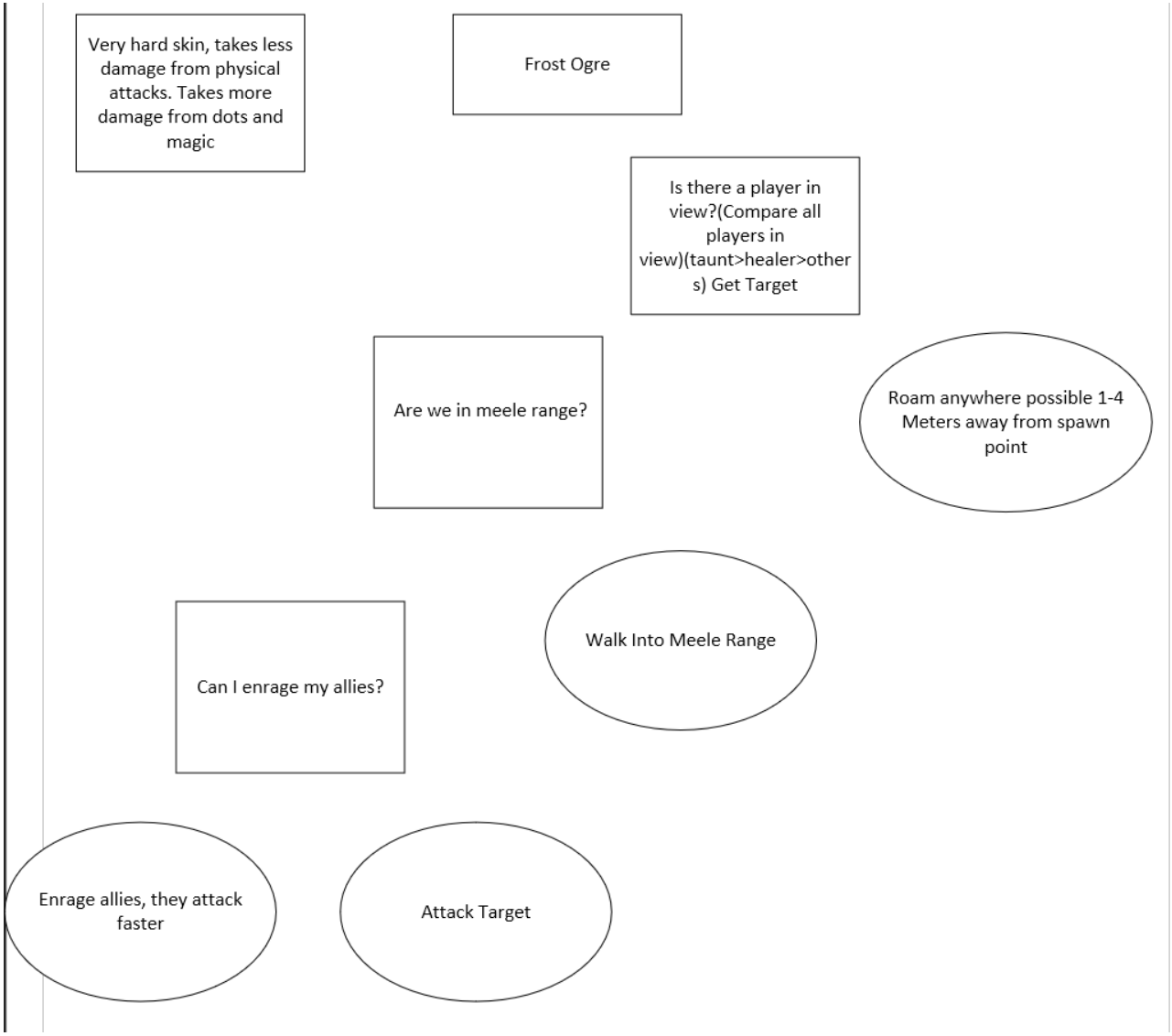
20.5. Figure 20 - Frost Goblin AI



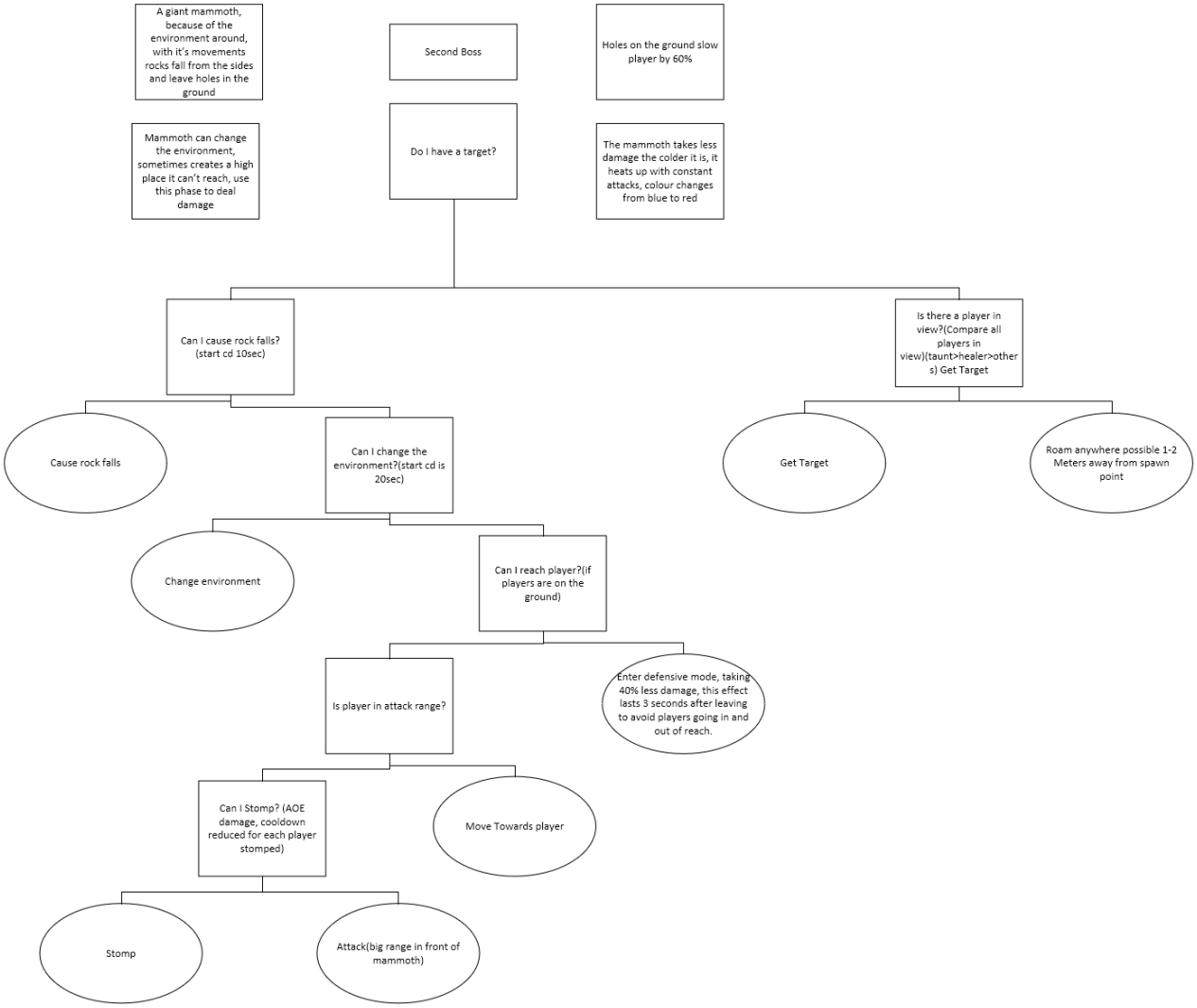
20.6. Figure 21 - Frost Ravager AI



20.7. Figure 22 - Frost Ogre AI



20.8. Figure 23 - Second Boss AI



21.Appendix F – Risk Analysis

21.1. Figure 24 - Risk Analysis Part 1

ID	Description	Probability	Impact	Actions	Deadline
1	Photon, the server provider for my game shutdown or doesn't allow for free use.			Mitigation: N/A Contingency: Host my own server locally which wouldn't provide best performance but would allow to showcase the game. I'm also able to play it offline.	07-May
2	Too many tasks and too big of a project milestone			Mitigation: Good planning. Contingency: Lower how much content the game will provide in the early access.	Ongoing
3	Loss of work due to disk failure or anything else.			Mitigation: Use of GitHub to save the changes every day. Contingency: Restore from GitHub.	Ongoing
4	Game isn't fun.			Mitigation: A lot of testing. Contingency: Change design, art or sound.	Ongoing
5	Game Engine limitations.			Mitigation: N/A Contingency: Change design depending on limitation.	Ongoing

21.2. Figure 25 - Risk Analysis Part 2

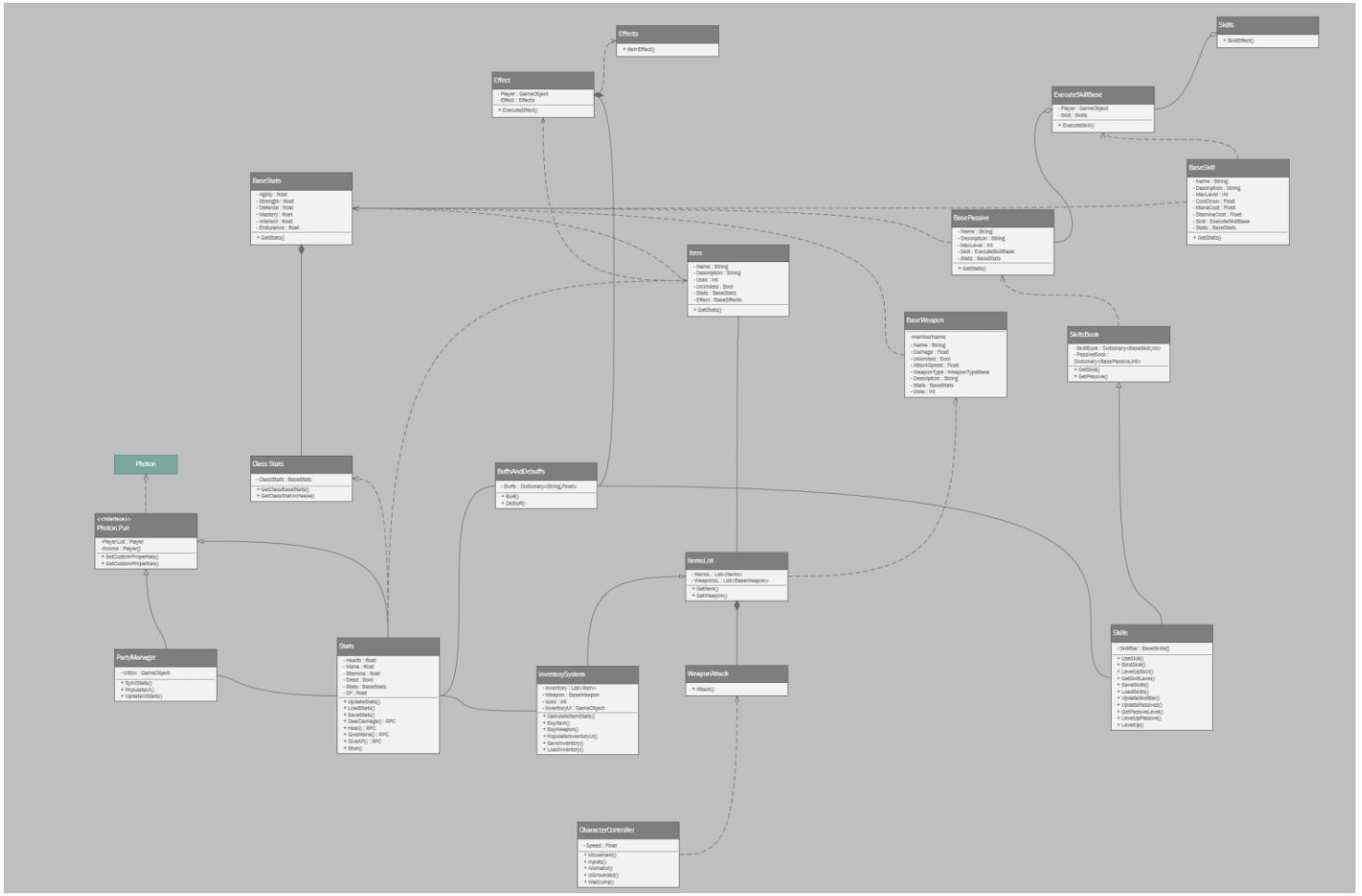
6	Unable to publish on Steam.			Mitigation: Prepare a good plan for publishing. Contingency: Publish on Itch.	07-May
7	Real Life health Issues.			Mitigation: N/A Contingency: N/A	Ongoing
8	Balancing the game difficulty.			Mitigation: A lot of Testing. Contingency: More Testing.	Ongoing
9	Loss of Motivation, mental health issues, resulting in low performance.			Mitigation: Plan to divide Documentation and Development as to not get burnout. Contingency: N/A	Ongoing
10	Burning hot bugs in Code.			Mitigation: Good code plan (heh…) Contingency: 24/7 bug fixing.	Ongoing
11	Computer dies. (Water cooler making weird noises)			Mitigation: Cleaning and do maintenance. Contingency: RIP	Ongoing

21.3. Figure 26 - Risk Analysis Part 3

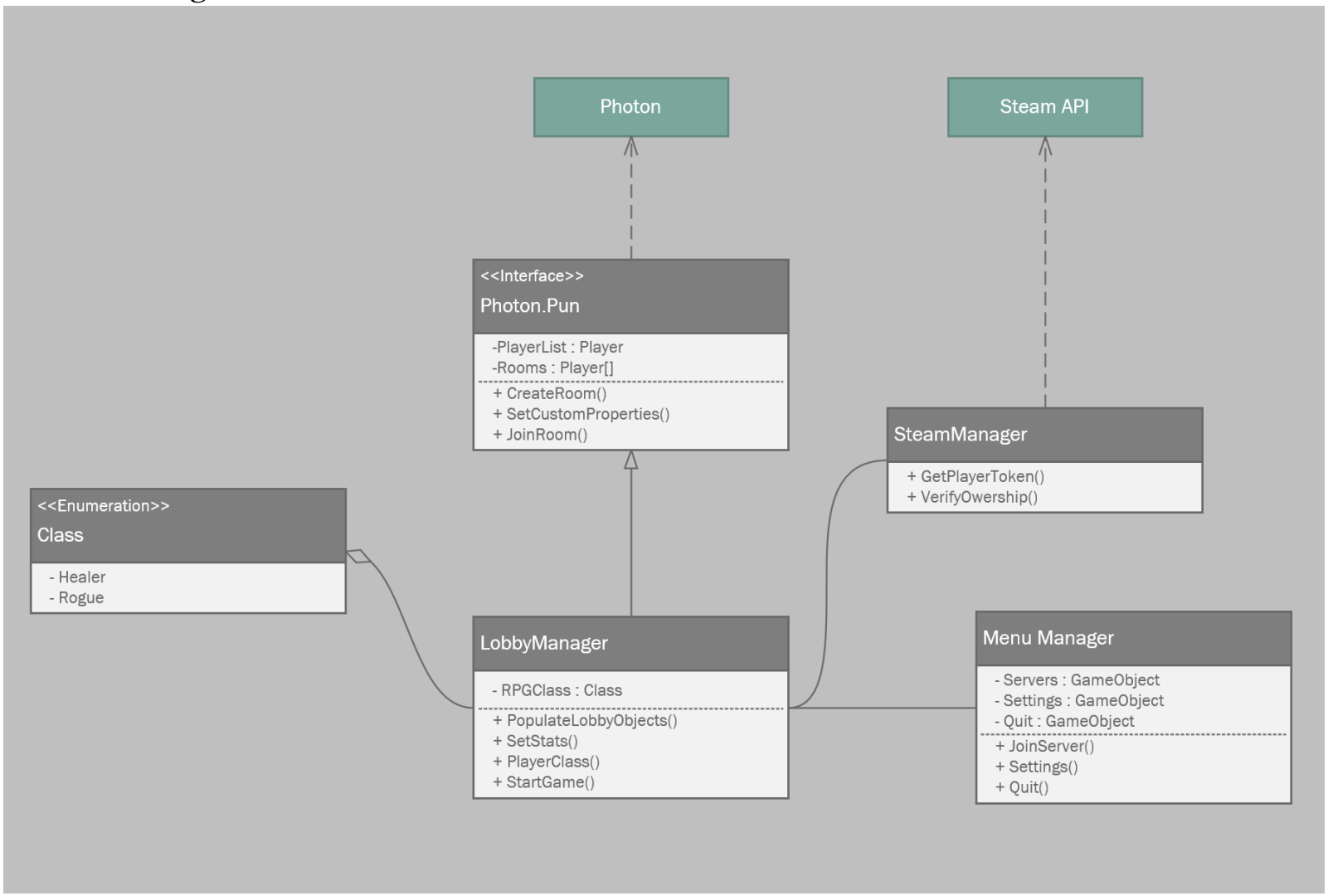
12	Not satisfied with Art style and spending too much time getting it right.			Mitigation: N/A Contingency: Ask friends for opinions before rigging, animating, texturing so I don't have to redo everything.	Ongoing

22. Appendix G – UML Diagram

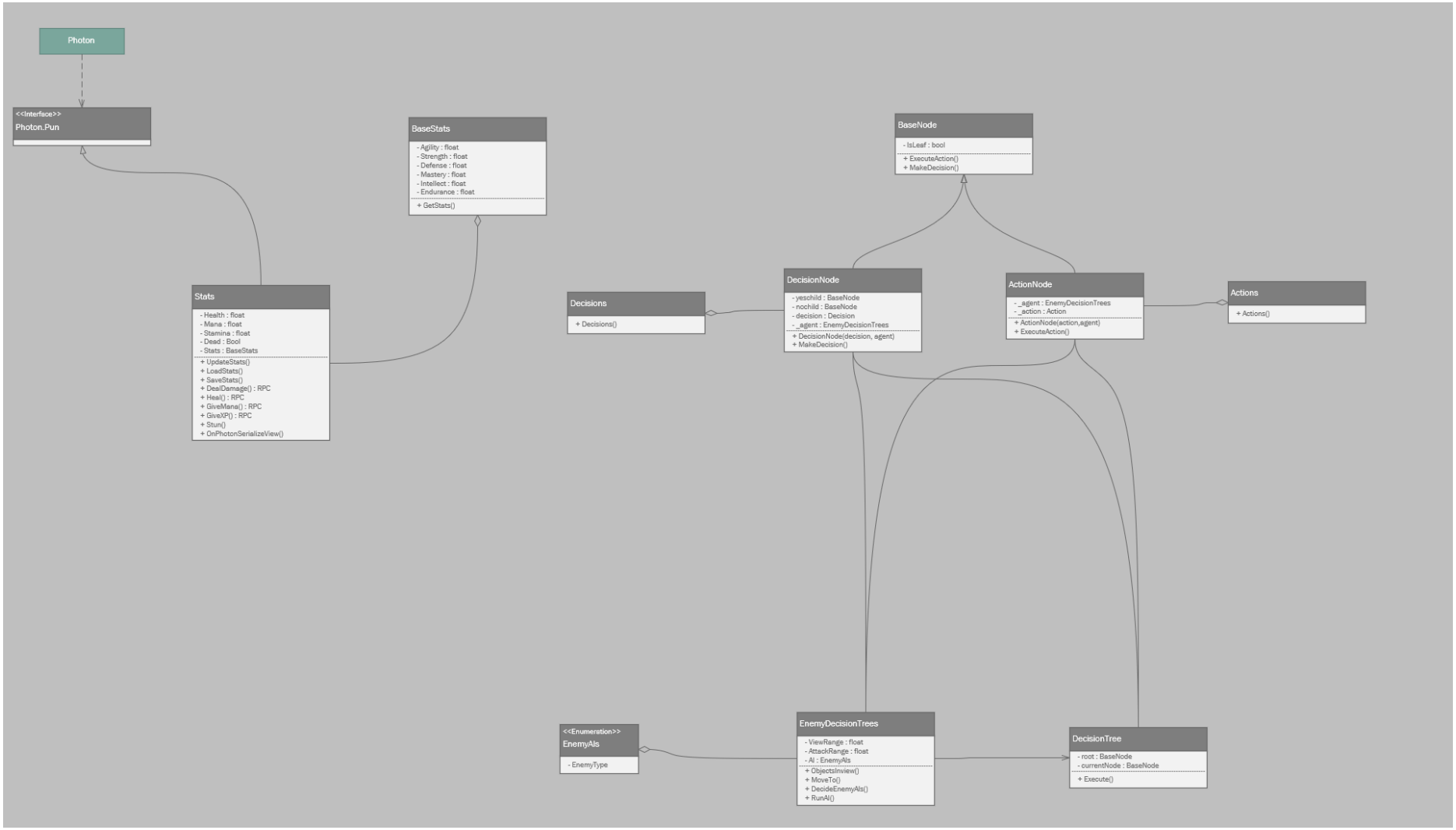
22.1. Figure 27 - UML Player



22.2. Figure 28 - UML Menu



22.3. Figure 29 - UML Enemy



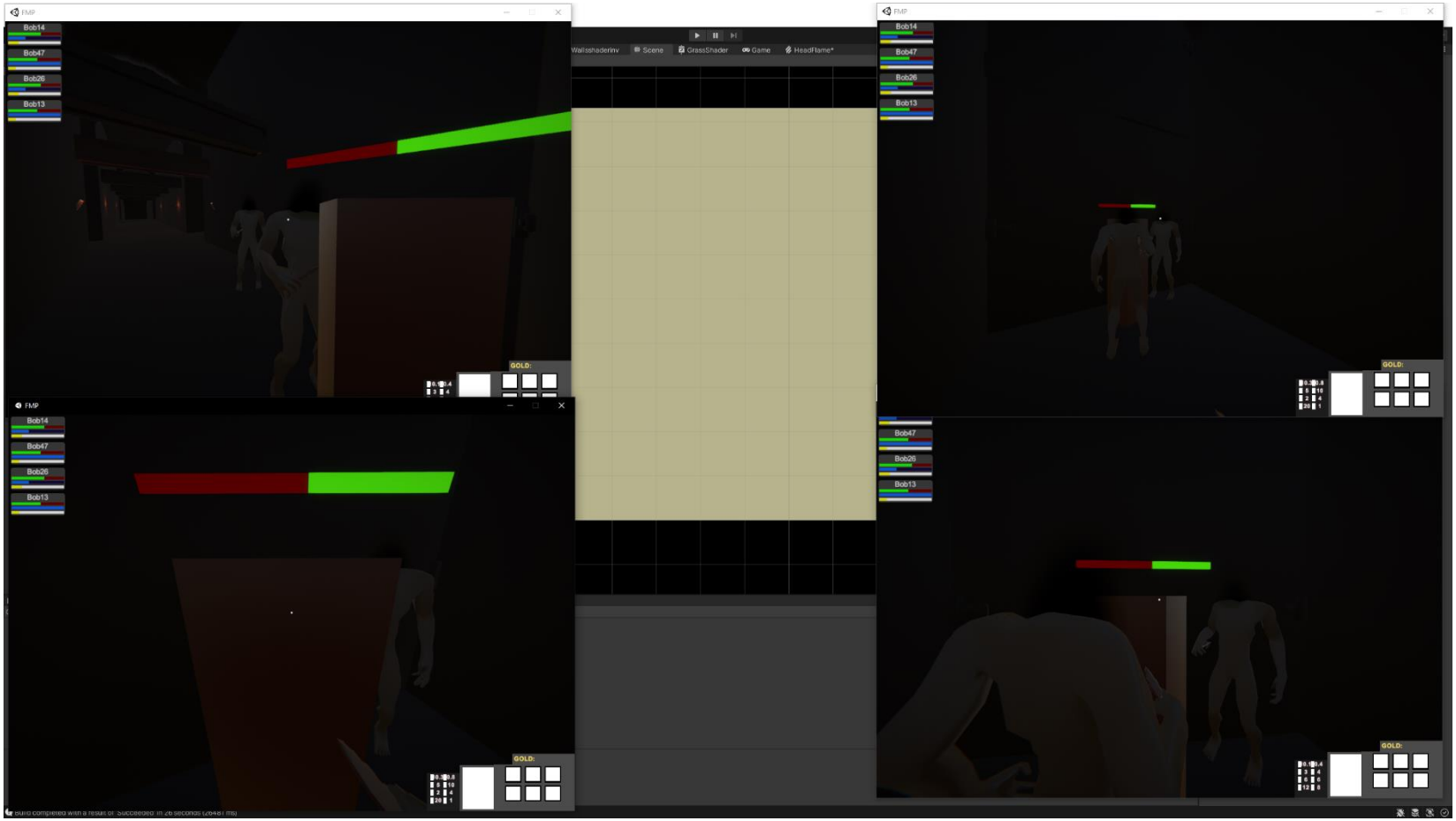
23. Appendix H – Testing Plan

23.1. Figure 30 - Testing Plan Phase1

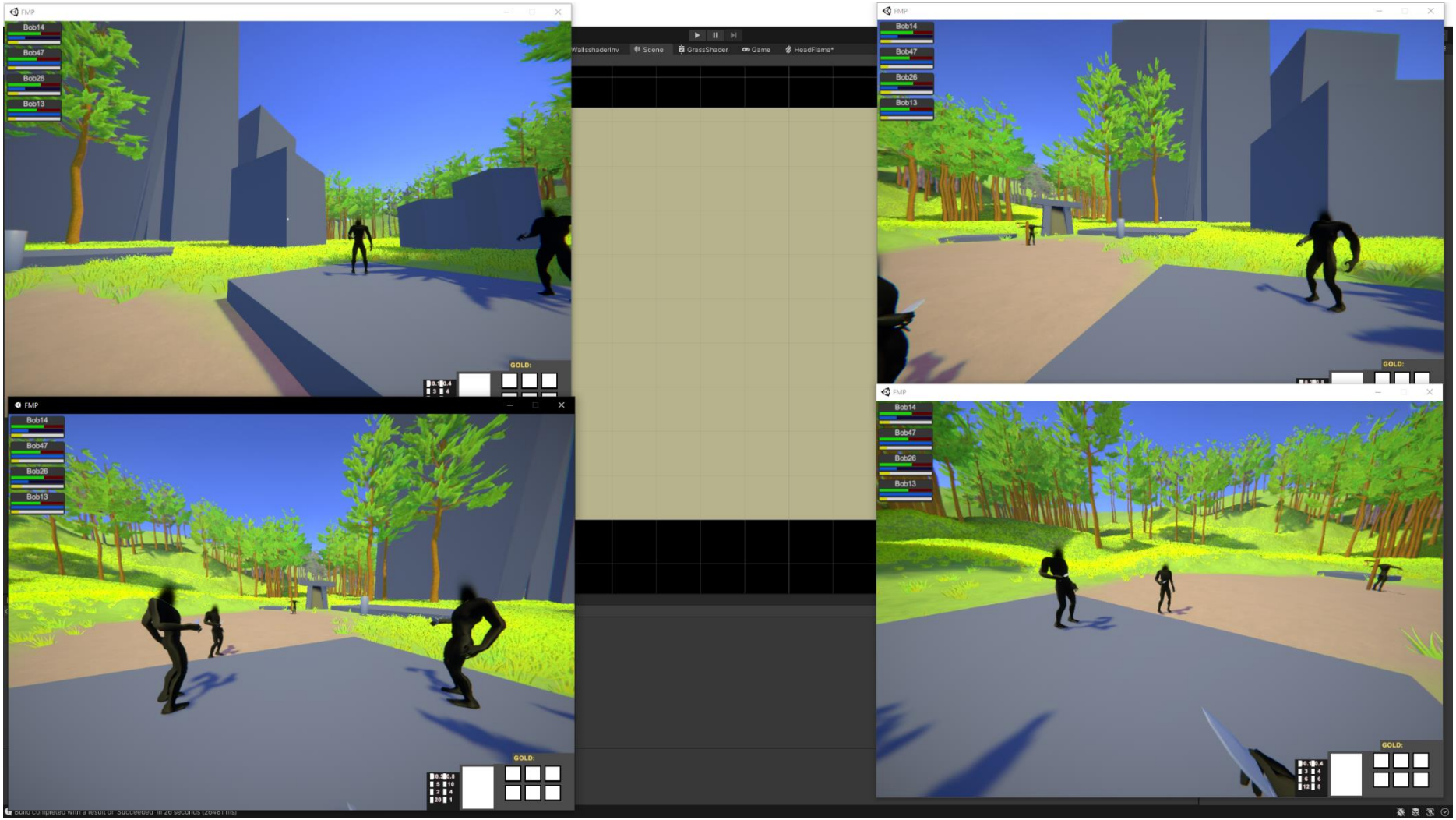
Test	Functions (y/n)	Description of malfunction
Can the character move correctly?		
Can the character jump?		
Is the menu working as intended?		
Is the Lobby working correctly?		
Are all the skills working?		
Are all the talents working?		
Is the UI buggy? Which?		
Are the enemies working?		
Can you attack?		
Can the enemy reach you?		
Can the enemy get stuck?		
Does the shop work?		
Does everything save correctly?		
Does leveling work correctly?		

24. Appendix I – Game Working Screenshots

24.1. Figure 31 - Health Synchronization



24.2. Figure 32 - Game test 4 players



25. Appendix J – Supervisor Notes

25.1. Figure 33 - Notes1

```
Go into detail with feature and specify details

Potential  solutions
"I plan to do boss like X and this could give x problem"

Reserch Results:
Games I looked at
Schoolar Articles
1000 words

Tool and technologies
Why I choose X engine etc
```

25.2. Figure 34 - Notes2

```
26/2/2021

Change tools and technology to bullet point

Go into further detail with key features

add dates to project objectives

Further deatail into background and topic
write on Warcraft 3
Can put images


Do Risk analisis


Talk about warcraft 3 modes and which modes are being used where and so on.

Add project milestones AE1 and AE2
```

25.3. Figure 35 - Notes3

```
Explain the game modes background and research


Sort by date main objectives




how many -bosses in the demo and final
         -enemies

examples on equipment and consumables


gamble how much gold used and gained where and when to gamble


add more action rpgs into inspiration research and research make it not biased



Tools and technology explain why it is upgradable
                     examples on all
                     why i need illustrator


Add an Apendix/Planning with gantt chart, wbs,game design document,risk analisys



writte gantt chart issues for AE2
if i go behind note them


appendix everything i did
```

25.4. Figure 36 - Notes4

```
Can mention

Real life isses can be broken up

have a look into other reports


Pontecial solutions
format potencial solutions
mention all ways of making it
networking and game engine solutions

Literature review everything about certain topic



what are classes (healer, rogue)

index references background and topic

In text referencing

Planning section
WBS, gantt, Risk analysis

technical design potentional design
     AI and Talents add link
     Potential solutions add links
```

25.5. Figure 37 - Notes5

```
Index referencing in background overview

Potencial solution about tools and technology

finish literature

more detail on potencial solutions

WBS add order

Explain the dependencies

save gantt chart new versions

fix technological report

appendix on bottom
```

25.6. Figure 38 - Notes6

```
Make them hyperlinks the references

flowchart of the whole game UML

Potential solutions, if multiplayer fails

Level design and art detailed
           point out map tools and options

potential solutions should have more than one solutions

add a test plan on technical design

Justify all paragraphs

cut final veredic of assets tool

cut game engine network choices

3400 words max
```

25.7. Figure 39 - Notes7

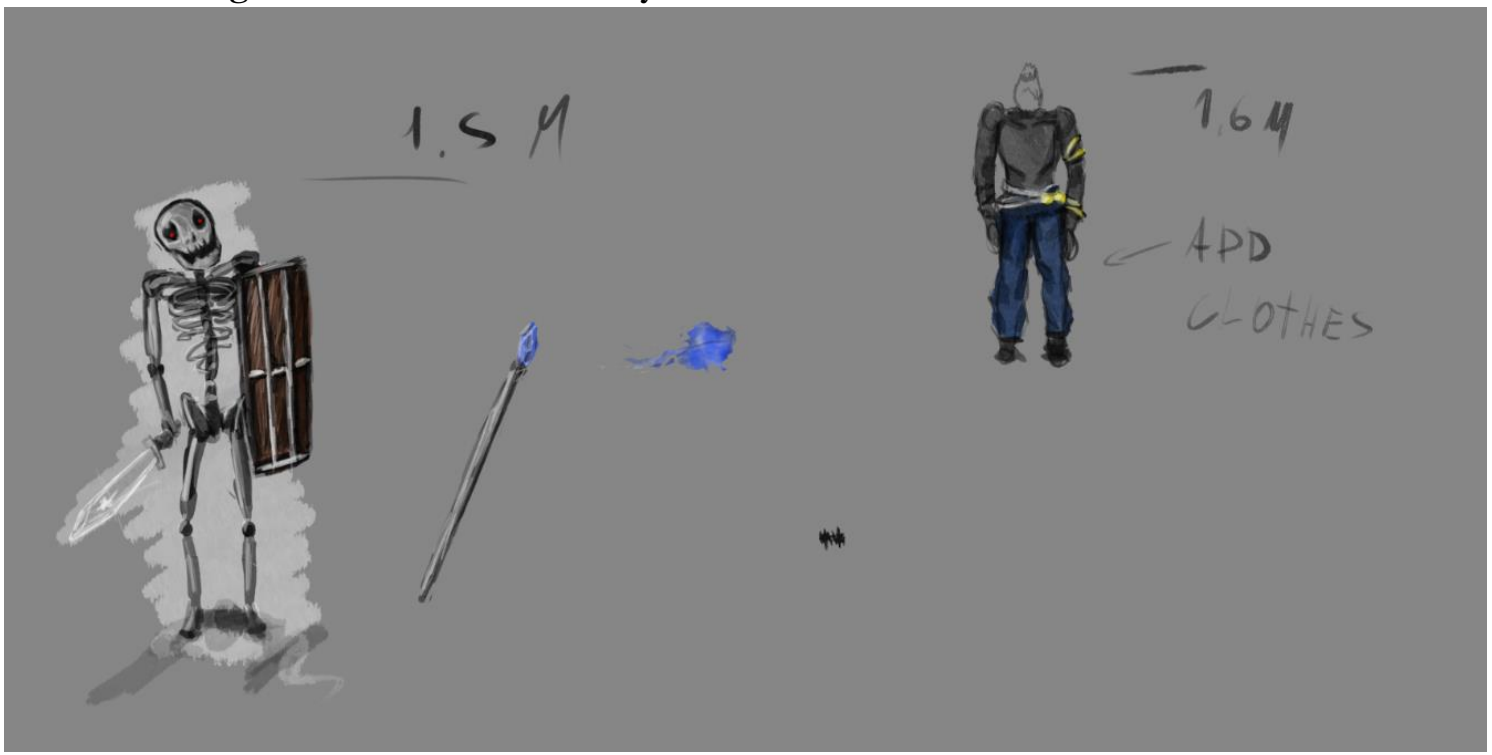
```
tracking supported by evidence, and screenshots, images on the weeks
Did I identify as a risk
Add changes to the weeks

start writting on changes and talks with supervisor
Video of game demonstration

Implementation – a complete narrative describing the conduct of the project
continuing from the Progress Report. It will include a review of the processes
and tools used, effectiveness of planning, monitoring and control methods.
Evidence should be available for any claims made.

Conclusion and Reflection - A post-mortem discussion of the project, product and
your evaluation of the outcomes and lessons learned. Here you should critically
review the results outputs by comparing them to the original project aims,
objectives and product specification.

reflections = learning
                Improvements


Project management <- next

Premade models instead of boxes
```

26. Appendix K – Concept Art

26.1. Figure 40 - NPC art

26.2. Figure 41 - NPC art zoom

26.3. Figure 42 - Skeleton and Player Art

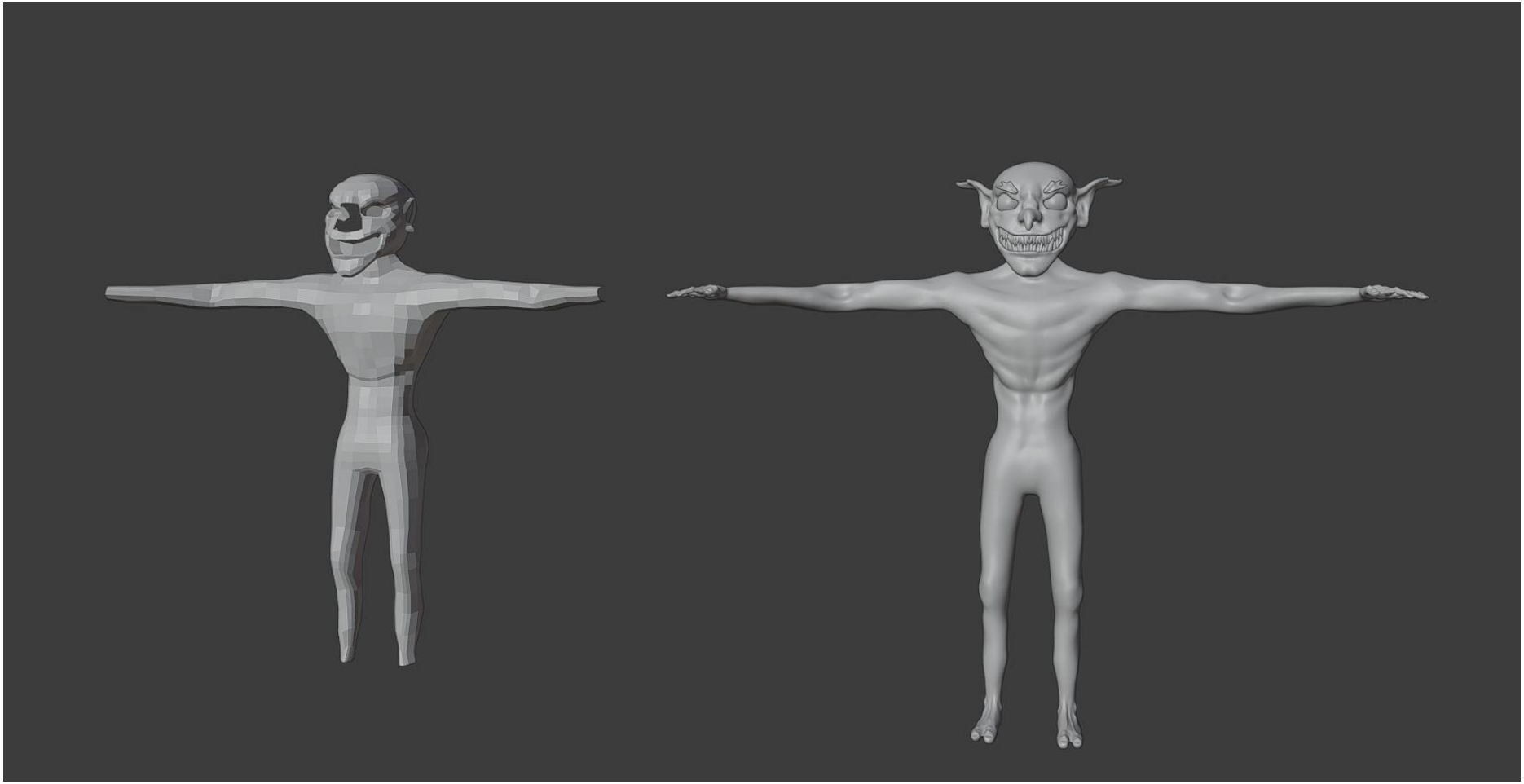


26.4. Figure 43 - Boss1 Art

26.5. Figure 44 - Gambling NPC Art

27. Appendix L – Other Models

27.1. Figure 45 - Goblin enemy



28. Appendix M – Bug Notepads

28.1. Figure 46 - BugNodepad1

```
Buffs being applied to other player instead of current


Position of enemies isn't correct
Enemy collision is bad


Make health mana and stam maxed at start

Save skill bar - done
save talent points - done
save gold - done
save talents -done
Save Skills - done
```

28.2. Figure 47 - BugNotePad2

```
1 Bugs 2
2 No flame head -done
3 Weapon used is wrong -maybe
4 One level up other one doesn't - non repeatable?
5 Healer mana not lsing on first cast - done
6 enemies not moving when main host dead???? - bug of bug? idk
```

28.3. Figure 48 - Bugnotepad3

```
make quit button quit -done

Make skeletons destroy em selves tb- done


Not seeing one another,  transform bug - fix needed

Weapons are wrong - done

Health is wrong on other clients making them unable to be healed
(make sure i sync all stats and xp and so on) - done <-

make enemy only die on main client - done



fireball on boss parent - fixed




Add anim sync easy - to be tested

Make pool transform sync higher res - to be tested


```