



## Game Design Document

Developed by



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## 1. Design History

- 1.0 - 04/04/2016:
  - GDD first release
  - First description of the gameplay, target audience, platforms, story and artwork.
- 2.0 - 22/05/2016:
  - Game logline has been modified
  - New age range
  - Socializer profile has been added in the target audience section
  - Improved system requirements section
  - Added “Boom beach” as competitor
  - Added the business model
  - Added in-game controls.
  - Added rules for each mode.
  - Added multiplayer’s scoring system
  - Added the winning conditions for each mode
  - Additional game modes
  - Added Game characters’ section
  - Added descriptions to the mood board and concept arts.
- 3.0 - 19/06/2016:
  - Added Item’s price in the business model
  - Added Breakeven in the business model
  - Added Legal Analysis
  - Added Interfaces (Mockup)
  - Added Interfaces (In-game)
  - Added Rewards for each mode
  - Added a paragraph about the Camera
  - Added a paragraph about the Artificial Intelligence
  - Added all the balancing about PCs and NPCs
  - Added Flowcharts
  - Added Level Design’s paragraph
  - Added a paragraph about the Media Lists
  - Added a paragraph about the Prototype

## 2. Vision Statement

### 2.1 Game logline

*Choose your side of the arena and fight for your life in a post-apocalyptic world!*

### 2.2 Gameplay Synopsis

C.L.A.N.G. proposes is a 3D battle arena game with a unique and singular style, obtained by mixing the genre action with the strategic, pointing to entertain consumers through two different gaming experiences, facilitated by an easy and intuitive control system.

The game features two different core mechanics: an action-based part, and a strategic one. The portion of action game requires that the player uses a gladiator, whose purpose is to survive against hordes of enemies and traps until the end of the match. On the other hand, the portion of the strategic game requires that the player impersonates a strategist, whose sole purpose is to obstruct the Gladiator by unleashing enemies on the battlefield, trying to defeat him before the end of the match.

C.L.A.N.G. is a competitive game in which a player, who can impersonate the gladiator or the strategist, competes against another player through an online connection, or an artificial intelligence in the offline case. The opposing player, regardless of whether it is a person or artificial intelligence, will use the character complementary to the one chosen by the other player. As an example, if a player chooses the strategist, the opposing player must choose the Gladiator.

Our game features a post-apocalyptic scenario, where the slave trade is legal. The clans are selling and buying slaves to make them fight in arenas, just for fun. The only choice for a slave is to fight for survival, to please his clan boss and get a moment of glory.

This game is entirely 3D and relies on simple yet attractive 3D aesthetics to create an immersive and engaging atmosphere as the player enjoys the world around him.

Each fighter has a unique style: their outfits are the result of the scarce resources a shattered world can offer.

### **3. Audience, Platform, and Marketing**

#### **3.1 Target Audience**

In order to discover the tastes, trends and demographic data necessary to understand our target audience, we used Google AdWords. This tool is incredibly useful: indeed, by entering keywords, we were able to identify what are the age, the gender and the type of top performer device used by potential consumers of the specified product.

Investigating and analyzing the top seller games, both action and strategic, we concluded that:

- the demographic distribution is more or less equally distributed between 18 and 54 years, whereas there is a large market share whose age is unknown;
- the ratio between the genders, respectively male and female, is around 1.5 to 1;
- the most widely used device is mobile phone, followed by tablet.

Bearing in mind all these factors, and considering the moderate amount of violence that our game contains and the skills necessary to play, we want to target a young audience, ranging from 7 to 35 years.

Despite our target audience is mostly composed by young people, we must also take into account a new phenomenon that looks at the mobile gaming world - a new category of players that we can call "EX hard-core gamers". These players defined themselves "hard-core gamers" during their youth and used to play action and strategic games on PC, but that nowadays have no longer the desire and the time to devote to such challenging games. For this reason, their focus has shifted on mobile games, where there is a large variety of games they offer hybrid experiences between the casual and the hard-core. This is the reason why we decided to include them as potential buyers.

Our gameplay style may attract different kind of players, modelled on "[The Bartle Test of Gamer Psychology](#)":

- Killer: Causing mayhem among computer-controlled people and things may be fun to the Killer, but nothing amounts to the joy of pitting one's skills against an actual player-controlled opponent. For most, the joy of being a Killer results from a friendly competitive spirit. They are in it for the sport, trying to read their opponent's moves and generally acting with honor.

- Achiever: One of the appeals of online gaming to the Achiever is that he or she has the opportunity to show off their skill and hold elite status to others. As they achieve more, they are no longer easy targets of the Killers and may enjoy their new position on the food chain. These gamers also tend to like seeing their user names at the top of scoreboards and ladder systems.

- Socializer: The online environment is very appealing to the socializers. They start filling up their friends lists as soon as they start meeting people, and get to know them better through private messages and sometimes even voice chat. They take full advantage of the ability to join guilds or kinships in many online games, and form fast friendships and try to help other people out.

### 3.2 Platform

Mobile platforms represent the best choice to develop casual games, especially in our case, since we know that there are several top performers who are proving a huge hit in both action and strategic.

Users accustomed to simple and fast matches are the ideal consumers of our game. Keeping in mind this type of customer, we designed a game mode that is perfectly suitable for them, as usually they do not have much time: therefore, it is possible to play a match during a coffee break or even while using public transports. Consequently, mobile platforms are the ideal ones for our game.

In addition to this, the game will adapt perfectly to displays of any size, whether they are mobile or tablet screens. We will develop both for Android and iOS operating systems but due to time constraints in the prototype we will consider only the Android version.

### 3.3 System requirements

- Android 4.0 Ice Cream Sandwich or later, with GPU support for OpenGL ES 2.0  
 The 4.0 version of Android was chosen essentially for two reasons:
  - o This version represents the first attempt of unification between interfaces for smartphones and tablets. Therefore, setting this version of Android as a minimum requirement, we will develop for one platform halving the necessary efforts;
  - o Google Play services support devices that have at least version 4.0 of Android. In addition, the need of support for version 2.0 of OpenGL ES is essential to enable graphics acceleration, a prerequisite for an application developed through Unity.
  - o Choosing the minimum version 4.0 for the project, we can cover up to 97.7% of Android market, excluding only the versions 2.2 and 2.3 (2.3% of the market) which moreover would be left out anyway, since Google Play Services does not support devices with Android lower than 4.0.

Version	Codename	API	Distribution
2.2	Froyo	8	0,1%
2.3.3	Gingerbread	10	2,2%
2.3.7			
4.0.3	Ice Cream Sandwich	15	2,0%
4.0.4			
4.1.x	Jelly Bean	16	7,2%
4.2.x		17	10,0%
4.3		18	2,9%
4.4	KitKat	19	32,5%
5.0	Lollipop	21	16,2%
5.1		22	19,4%
6.0	Marshmallow	23	7,5%

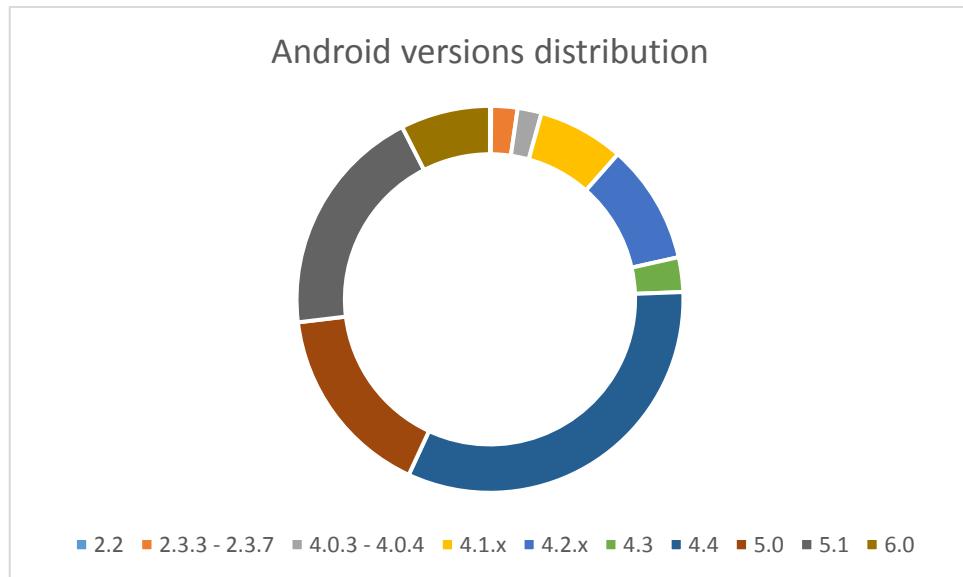


Figure 1 - Android versions distribution

<https://developer.android.com/about/dashboards/index.html>

- iOS 7 or later

This version was chosen essentially for two reasons:

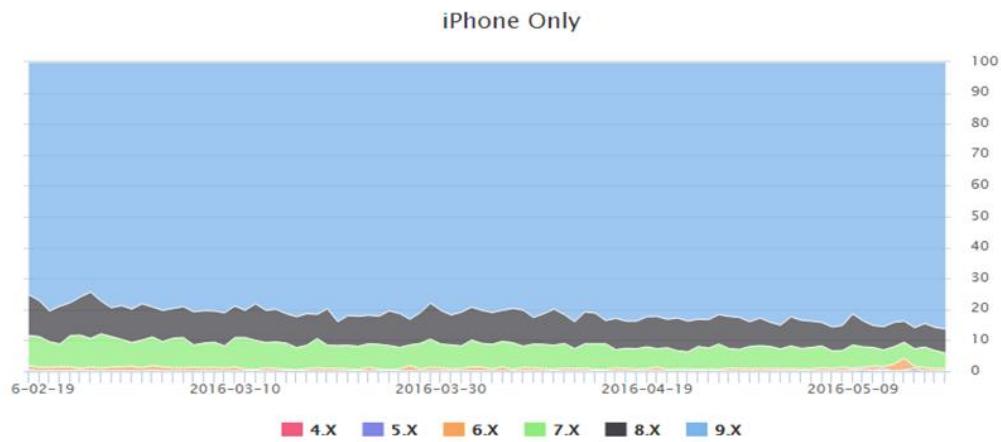
- The version of Unity which we used, 5.3.4f1, only supports from version 7 or higher, the 6.0 or earlier are no longer supported;
- Game Center, the Apple's social gaming network, is only supported on iOS7, iOS8 and iOS9.

These considerations were made based on data released by Apple and David Smith, a developer iOS.

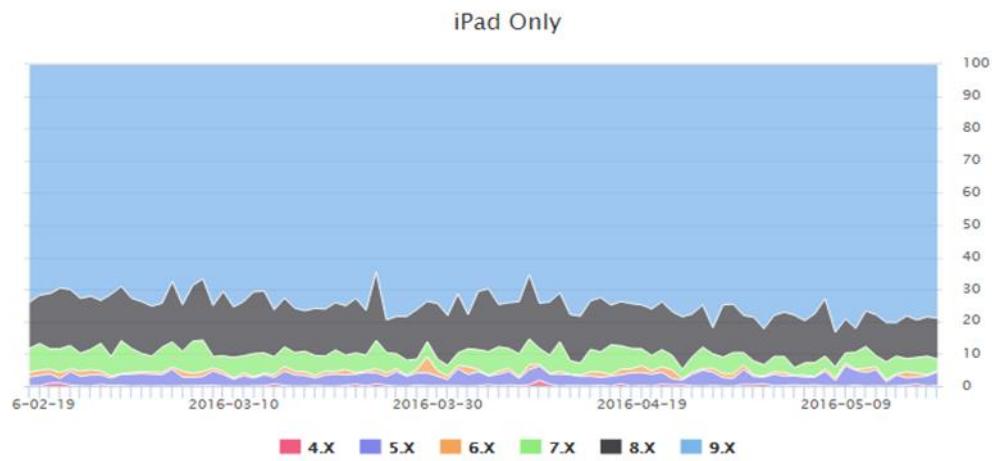
Indeed, in recent statistics is easy to observe that roughly 80% of the holders of our interest, iPhone and iPad devices, use iOS 9. X.

**iPhone Only:**

<b>9.X</b>	86.3%
<b>8.X</b>	7.8%
<b>7.X</b>	5.1%
<b>6.X</b>	0.7%
<b>5.X</b>	0.1%
<b>4.X</b>	0.0%

*Figure 2 - Iphone iOS versions used in 2016*<https://david-smith.org/iosversionstats/>**iPad Only:**

<b>9.X</b>	78.8%
<b>8.X</b>	12.7%
<b>7.X</b>	3.7%
<b>6.X</b>	0.3%
<b>5.X</b>	4.2%
<b>4.X</b>	0.2%

*Figure 3- Ipad iOS versions used in 2016*<https://david-smith.org/iosversionstats/>

### 3.4 Top performers

C.L.A.N.G. is based on two main components: strategy and action. For this reason, we will divide the top performers in two different categories:

- Strategy games
  - Clash Royale



**Developer:** Supercell  
**Platforms:** iOS, Android  
**Publication:** January-March 2016  
**Theme:** Fantasy  
**Game Mode:** Multiplayer online  
**Sales Figures:** 812.714 dollars per day estimate  
**Genre:** Strategy  
**Downloads:** 10.000.000-50.000.000

**Plot:** Collect and upgrade dozens of cards featuring the Clash of Clans troops, spells and defences you know and love, as well as the Royals: Princes, Knights, Baby Dragons and more. Knock the enemy King and Princesses from their towers to defeat your opponents and win Trophies, Crowns and glory in the Arena. Form a Clan to share cards and build your very own battle community.

- Plants Vs Zombies



**Developer:** PopCap Games  
**Platforms:** iOS, Android, Windows Phone and others  
**Publication:** May 2009  
**Theme:** Horror, Insane  
**Game Mode:** Single-player, Multiplayer  
**Sales Figures:** 13.449 dollars per day estimate  
**Genre:** Strategy  
**Downloads:** 1.000.000-5.000.000

**Plot:** A mob of fun-loving zombies is about to invade your home, and your only defence is an arsenal of 49 zombie-zapping plants. Use peashooters, wall-nuts, cherry bombs and more to slow down, confuse, weaken and mulchify 26 types of zombies before they can reach your front door. Each zombie has its own special skills, so you'll need to think fast and plant faster to combat them all. But be careful how you use your limited supply of greens and seeds... as you battle the fun-dead, obstacles like a setting sun, creeping fog and a swimming pool add to the challenging fun.

- Boom beach



**Developer:** Supercell  
**Platforms:** iOS, Android  
**Publication:** March 2014  
**Theme:** Fantasy  
**Game Mode:** Multiplayer online  
**Genre:** Strategy  
**Downloads:** 50.000.000-100.000.000

**Plot:** Boom Beach is a strategy game that combines attacks on other players with attacks against computer generated bases. The game's storyline is set in a tropical archipelago with the player on an island with defences and troops.

Players can build their base, upgrade their defences and other buildings, and unlock troop upgrades. Boom Beach combines single player campaign play as well as the ability to attack other players in multiplayer mode on the same map. It has been a top 10 game in 22 countries at its launch.

- Action games
  - Monster Shooter Platinum



**Developer:** Gamelion Studios  
**Platforms:** iOS, Android, BlackBerry  
**Publication:** December 2011  
**Theme:** Fantasy  
**Game Mode:** Single-player  
**Genre:** Action, Arcade  
**Downloads:** 100.000-500.000

**Plot:** Monster Shooter is a top-down 'twin stick' shooter, with the role of the absent second stick bestowed upon the face buttons. You can move and fire in any direction independently, as is the standard, and there are touch screen buttons to use other helpful items such as med kits, mines and grenades, as well as for cycling through weapons - though it's easier to use the shoulder buttons for that purpose.

- Dungeon Quest



**Developer:** Shiny Box, LLC  
**Platforms:** iOS, Android  
**Publication:** April 2014  
**Theme:** Fantasy  
**Game Mode:** Single-player, Multiplayer  
**Genre:** Action, Rpg  
**Downloads:** 1.000.000-5.000.000

**Plot:** Embark on a journey to find the best loot and become the most powerful Hero in this free-to-play Action RPG. Featuring random loot, random dungeons, and 4 Acts each with their own legendary Boss guarding it. Journey through 200 floors of increasingly difficult enemies while collecting the best weapons possible and compete with your friends on our in-game Leader boards.

Equip your Wizard or Warrior with infinitely customizable weapons and armour to help destroy the elemental evils plaguing the land. There are always new ways to vanquish your foes! Upgrade your gear with our Enchanting system and customize your character with our gear-based skill and talent systems.

### 3.5 Feature comparison

The current market of mobile is full of 3D games that require the user's skills in order to combat, reactivity, decide resource allocation and study strategies.

Through C.L.A.N.G. our team wants to cast off these skills in a unique gaming experience, in such way that the player is not becoming mired on a single game mechanics. In addition, the asymmetry of the game increases reasonably the duration of the single-player mode in case the player use both approaches, as well as in multi-player mode.

Our sources of inspiration regarding the strategic component are "Plant VS Zombies" and "Clash Royale" because they provide the player a chance to field objects and NPCs according to its own strategic plan, as well as, for the action component, Monster Shooter players have all the necessary tools to face a battle against different types and amount of enemies.

On the other hand, what C.L.A.N.G. wants to convey, differently from these competitors, is a more mature and deep experience.

### 3.6 Business model

Our Business Model is the free-to-play (F2P).

Free-to-play games do not represent a new genre, but the determined a deep revolution that is still affecting most aspects and actors of the game industry: marketing, publishing, hardware, manufactures, and of course, designers and developers.

This model allows our player to enjoy the major part of the game without paying, and eventually provide fees and extra contents. Five techniques are used to generate revenues:

- Item-purchasing
- Affiliate marketing
- Advertising
- Freemium
- Restricted access

Our sources of income are:

- **Item-Purchasing**

This is the main revenue source for our game. We use one type of currency (gold) that can be earned in-game by completing tasks or by spending real money (euros, dollars, etc.). In any case, the player is never forced to use real money, in fact he can buy every single game-object just spending the gold earned while playing; for most expensive and powerful objects, the player can decide whether to persevere with the game or buy them immediately by credit card. In addition to this, we give the player a chance to buying stock of currency, only and always if he wants.

- **Affiliate Marketing**

With this method we want to sponsor affiliate partners by carrying out some in-game items (for example: weapons designers, costume designers, etc.). In this way we increase the game's popularity and the manufacturer's popularity too. In addition, we offer a portion of the proceeds obtained from the sale of the object itself.

### 3.6.1 Items' prices

According to a [recent analysis](#), mobile gamers spend an average of \$87 per year on in-app purchases, putting them only \$5 behind what PC and console players pay, on average, for gaming entertainment. Moreover, it is interesting to point out that the 10% of mobile gamers who spend money making up 90% of mobile gaming sales. It means that every object in our shop must have specific price cuts for different types of users, from the user that downloads the game and does not spend anything until that rare user who decides to spend a fortune on it.

The items that can be purchased in our store belong to 3 categories:

- Lockboxes
- Gold bags
- In-game objects
  - Gladiator: weapons, bonuses
  - Strategist: cards, bonuses

The real currency can be converted into in-game currency (gold) through the purchase of gold bags, designed in 6 different sizes. Those cuts are designed taking into account the market needs, as there are many people who spend little (several 1300-10K gold bags) and a few users who spend a lot (a few 150K-310K gold bags).

GOLD BAGS	Euros	Dollars	Pounds
1300	0,99€	0,99\$	0,79£
10000	4,99€	4,99\$	3,99£
24000	9,99€	9,99\$	7,99£
50000	19,99€	19,99\$	16,99£
150000	49,99€	49,99\$	39,99£
310000	99,99€	99,99\$	79,99£

Lockboxes contain a certain quantity of gold and cards, and the player can buy 3 different types:

LOCKBOXES	Gold	No. of cards	No. of rare cards	No. of epic cards	Price (gold)
Small	430-530	20	1	0	4200
Big	160-200	10	2	1	6400
Huge	960-1200	40	6	4	40000

Price cuts of lockboxes are justified by the choices made on the currency conversion method, from the real one in game currency:

- Small lockbox: this lockbox is obtained through the purchase of 4x1300 Gold Bags ( $4200 \leq 1300 \times 4$ )

- Big lockbox: this lockbox is obtained through the purchase of 5x1300 Gold Bags ( $6400 \leq 1300 \times 5$ )
- Huge lockbox: this lockbox is obtained through the purchase of 1x50000 Gold Bag ( $40000 \leq 50000$ ) or  $1x24000 + 1x10000 + 5x1300$  gold Bags ( $40000 \leq 40500$ )

Every object in the game can be purchased from the store, whether for Gladiator or the Strategist, belongs to a particular class of rarity:

IN-GAME OBJECT RARITY	Price (gold)
Common	30
Rare	500
Epic	2000

### 3.6.2 Breakeven

The Breakeven is how many units of the game have to be sold before the publisher makes back the money that they put into the game.

As written in the Technical Design Document, C.L.A.N.G.'s investment costs including salaries, advertising, spaces, hardware, software and maintenance are: **1.584.618€**.

Taking into account the numbers found on the web about our competitors, especially for games like Boom Beach and Clash of Clans, we have calculated how long we could recoup the costs spent by any publisher for C.L.A.N.G.

Recent research and information leaked, Supercell's titles record around 30-40 million daily users per game, with a turnover ranging from 8 to 9 million dollars per day.

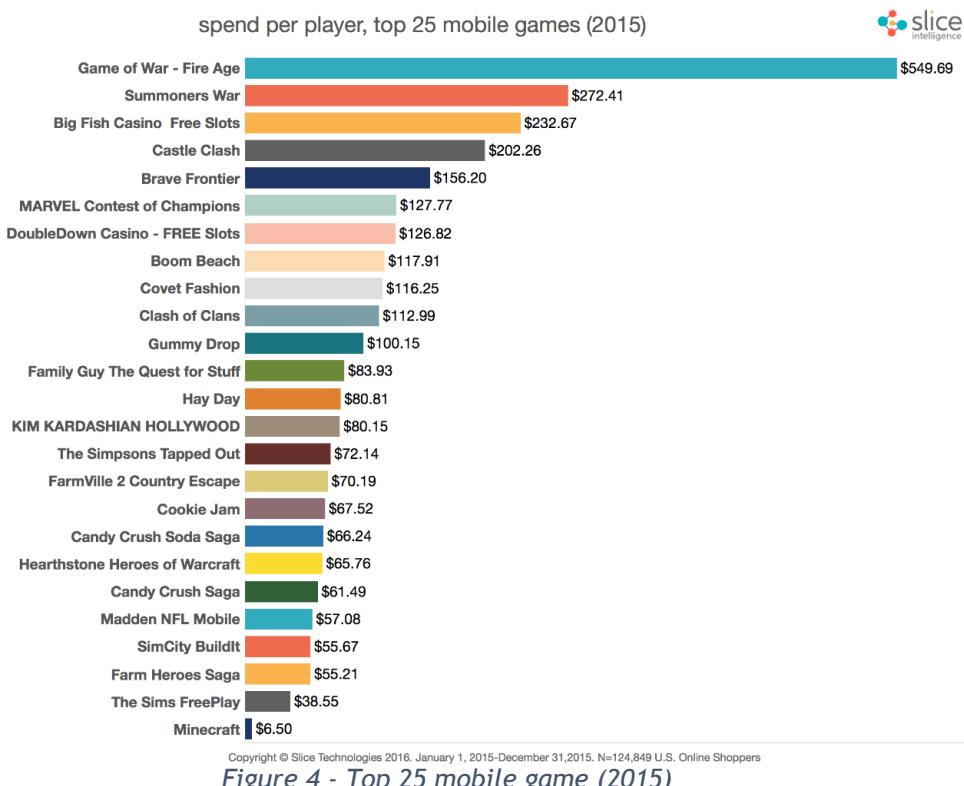


Figure 4 - Top 25 mobile game (2015)

All the transactions that occur in their shop are related to the purchase of virtual currency, needed to buy some in-game items. The shop on which we based C.L.A.N.G. is different in content but very similar in price cuts. For this reason, we have taken into account a user's average monthly expenditure (8-10 \$) and we have halved for our game.

According to this calculation on average a user who play C.L.A.N.G. could spend **4\$ monthly** and whereas we aim to attract 500.000 monthly active users, (see TDD) our Breakeven would be achieved after one month since the game's launch, earning 2.000.000 \$ equal to **1.775.000 €**.

## 4. Legal Analysis

For our prototype we used some elements belonging to third parties.

In particular, having developed a 3D game, we use some models available free, from [TurboSquid](#).

In using these models we totally respected the terms of agreement present in the website: indeed, we have not removed any watermark, decompiled or did reverse engineering.

The models used are:

- [Medipack](#)
- [Barrels](#)
- [Stadium Fence](#)
- [9mm Bullet](#)
- [Medieval Shield](#)

All other 3D models and interfaces are a property of the project's artist, Emanuele Ricci and Cristina Lubas.

## 5. Gameplay

### 5.1 Overview

C.L.A.N.G. is a 3D battle arena game that takes the best from the top performers on the market, both for strategic and action stages, mixing them to create a unique gameplay.

### 5.2 Gameplay description

The most important feature of C.L.A.N.G. is definitely its asymmetric gameplay, able to test different types of players and at the same time to experiment a different genre.

The part of the gladiator is purely action: the player's purpose is to survive for 90 seconds (the entire time of a match). To do that, once in the arena, he/she will have to use all possible resources to deal with the enemies that will spawn.

Initially the Gladiator has only his basic weapon with which can only unleash melee attacks. Afterwards, facing different enemies and ingratiating itself the crowd, the Gladiator can also use ranged weapons such as firearms or throwing weapons. This situation will not change its basic equipment. The weapons found on the field clearly do not have infinite life but this is proportional to its use - also the Gladiator will defend itself with its dodges and armour found on the field. More blood will be spilled in the arena, the higher the chance to receive gifts from the audience, like armor, weapons and med kit. The Gladiator has 3 different attacks types available, one for each type of weapon; Basic weapon, special weapon and weapon launched; in addition, the Gladiator

has the ability to Dodge to avoid traps and enemies. The reinforcement allows the Gladiator to reduce damage from enemy attacks, while the med kit regenerates partially the health.

The part of the strategist instead, as the name suggests, is strategic and the player's aim is to kill the Gladiator through the evocation of traps and creatures in the arena.

The strategist can summon two types of objects in any position of the pitch: traps and enemies. The traps should be used to surprise the Gladiator, causing damage and slowing his/her advance in the field. The enemies are essentially of two types: monsters and mutants. The aggressive behaviour of these enemies raise the level of the challenge.

The strategist has the power to summon objects in the field through the use of an energy called "electric pulse". Each object requires the sacrifice of a certain amount of electric pulse, which will regenerate over time. The strategist will make informed choices about which objects to evoke in the field because they each have different characteristics and costs of evocation. The strategist also has full control over what happens in the arena with the ability to freely control the game camera, zooming and moving the view anywhere on the map.

### 5.3 Controls

C.L.A.N.G. has two different approaches to the gameplay, each of which has special controls and interfaces:

- Gladiator

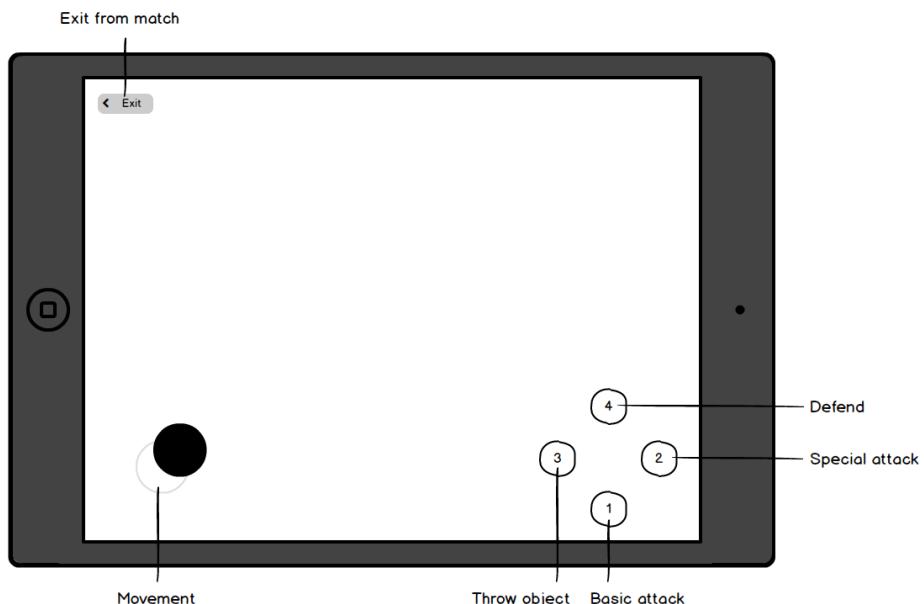


Figure 5 - Gladiator's controls

- Strategist

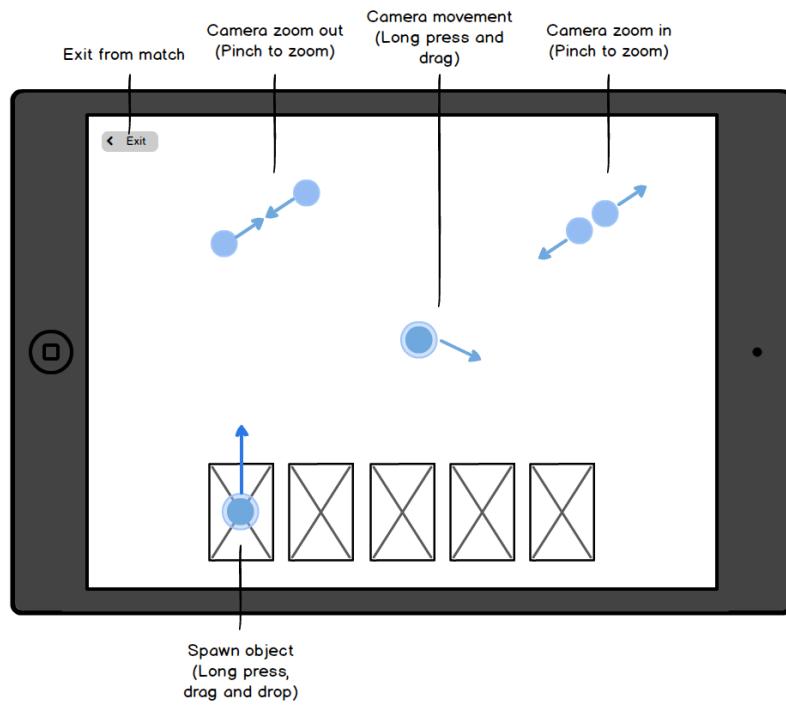


Figure 6 - Strategist's controls

### 5.3.1 Interfaces (Mockup)

- Start the game

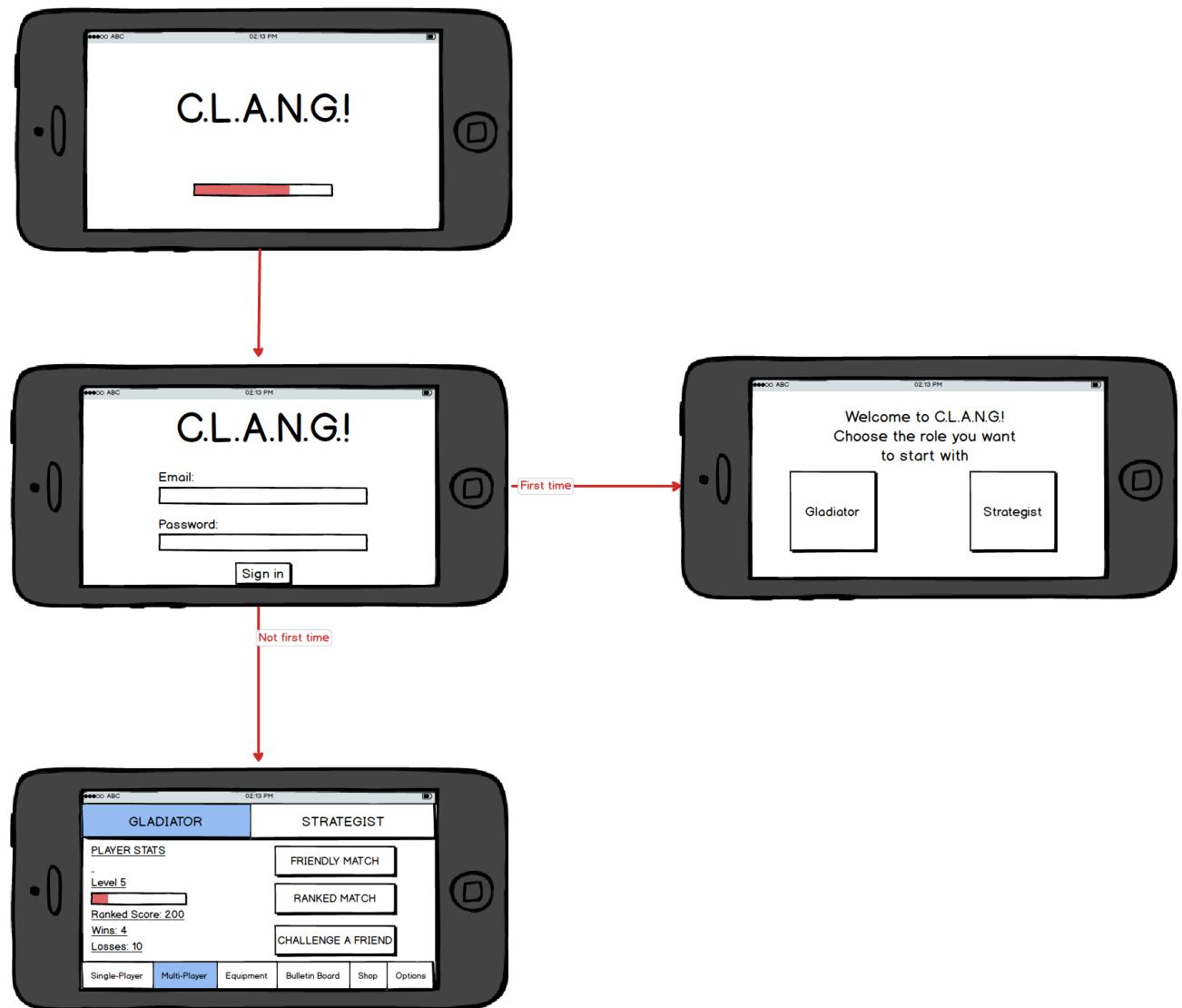


Figure 7 - C.L.A.N.G. start mockup

- Tutorial

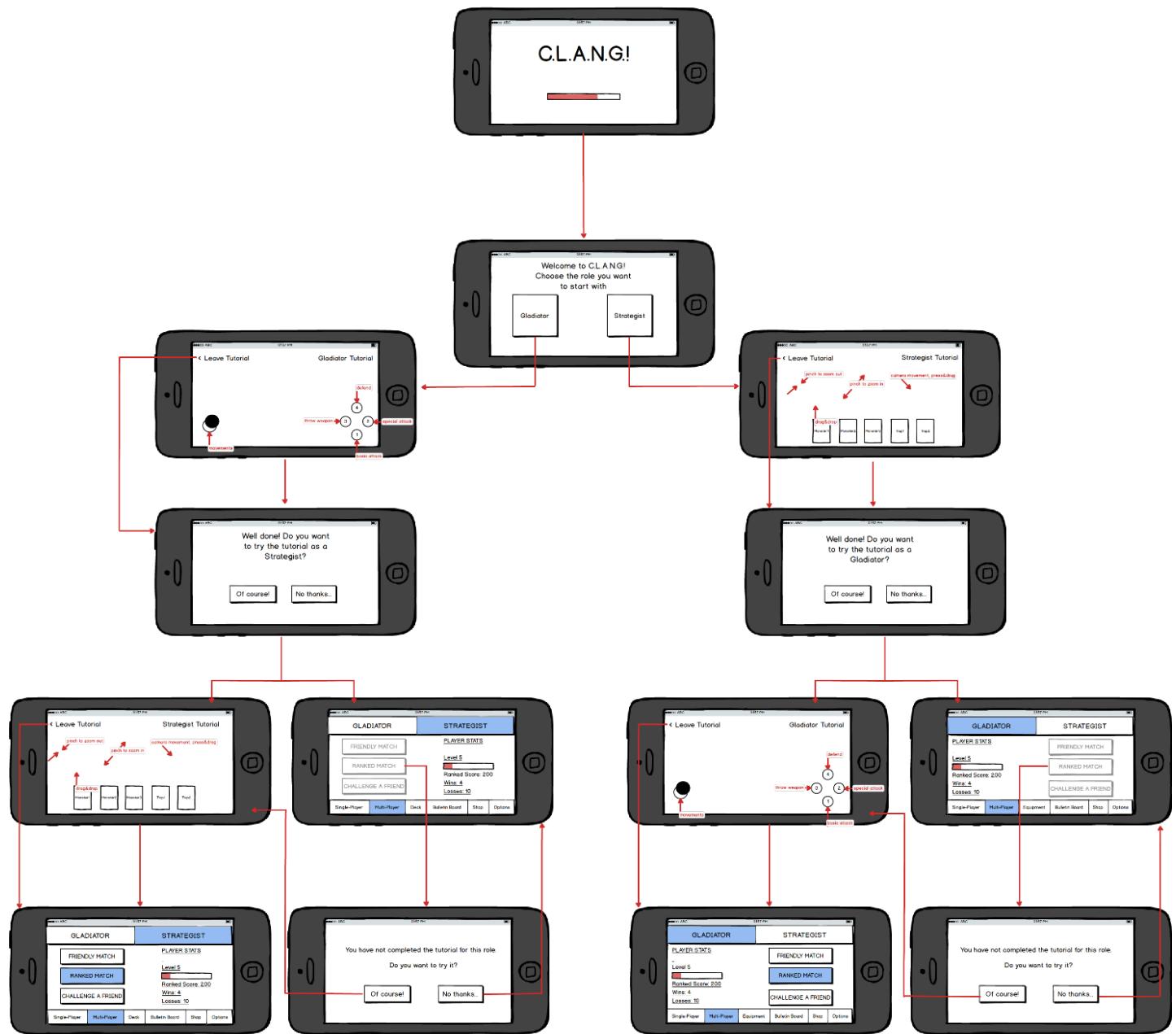


Figure 8 - C.L.A.N.G tutorial mockup

- Single player
  - General

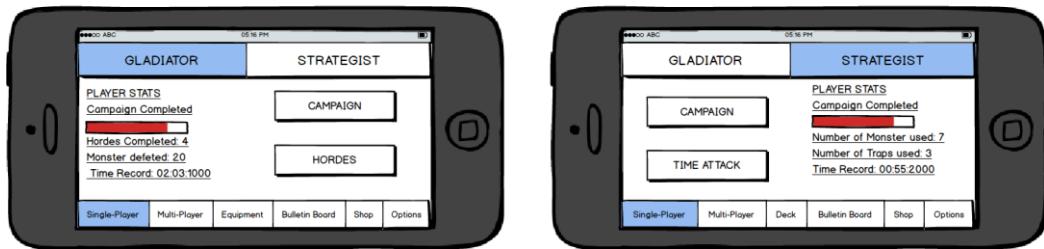


Figure 9 - C.L.A.N.G single-player mockup

- Campaign

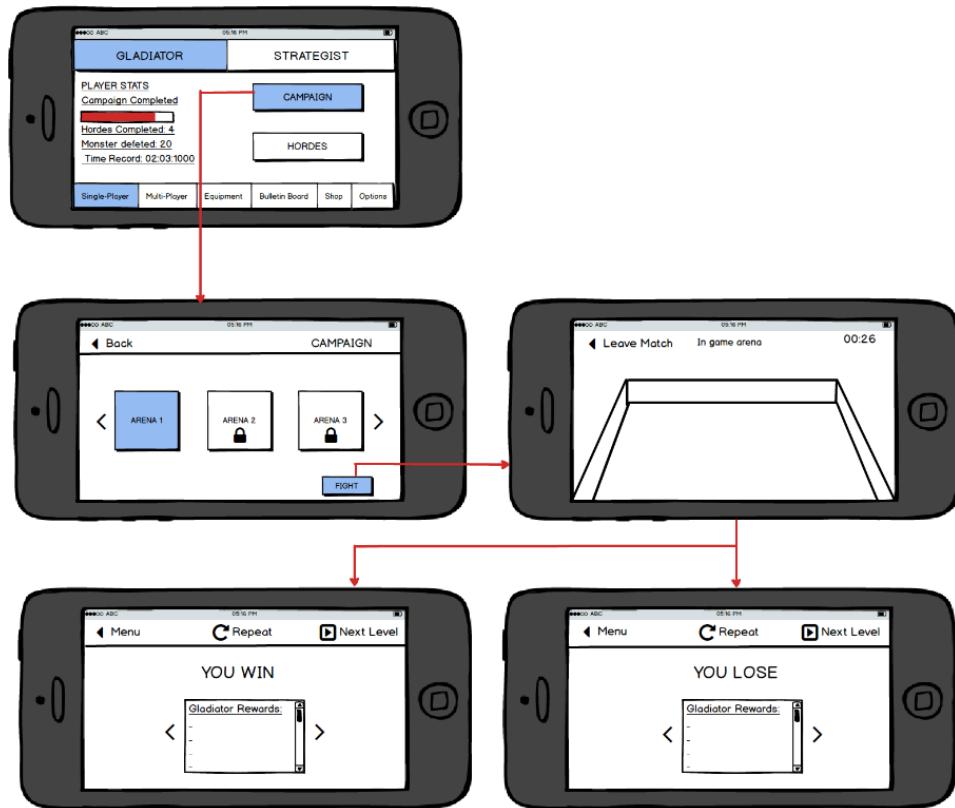


Figure 10 - C.L.A.N.G campaign mockup

- Hordes & Time Attack

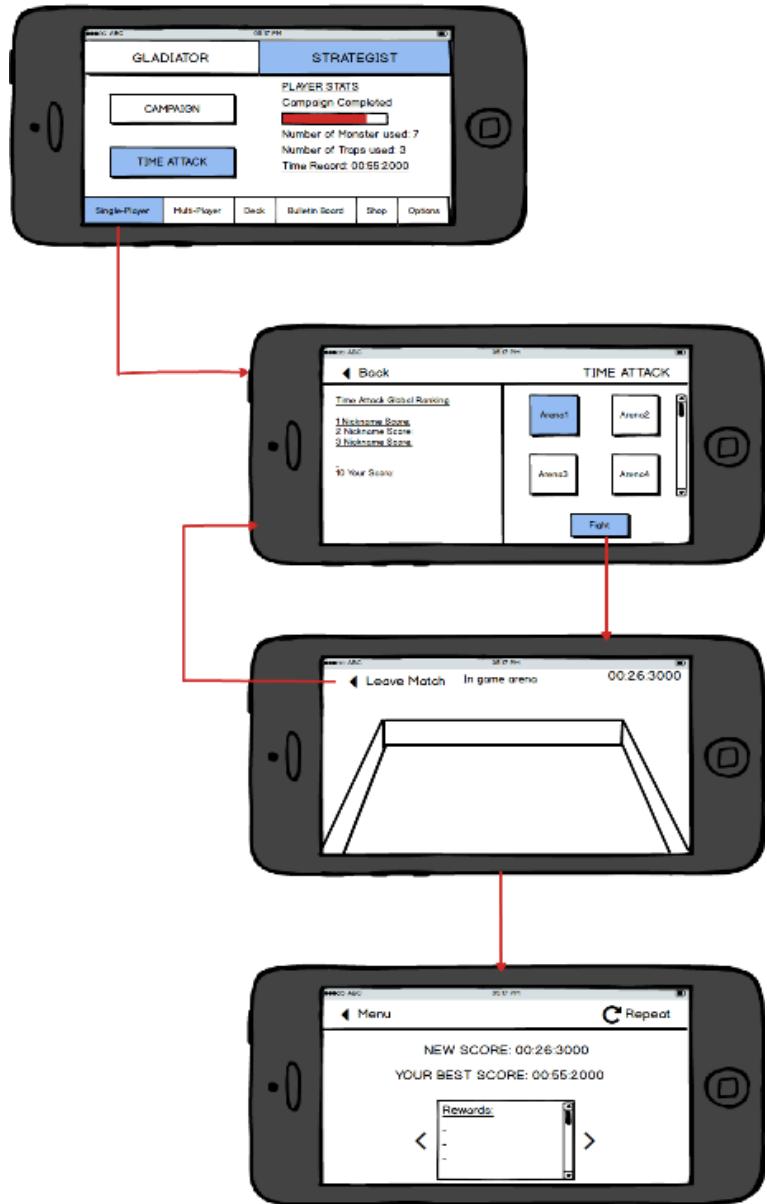
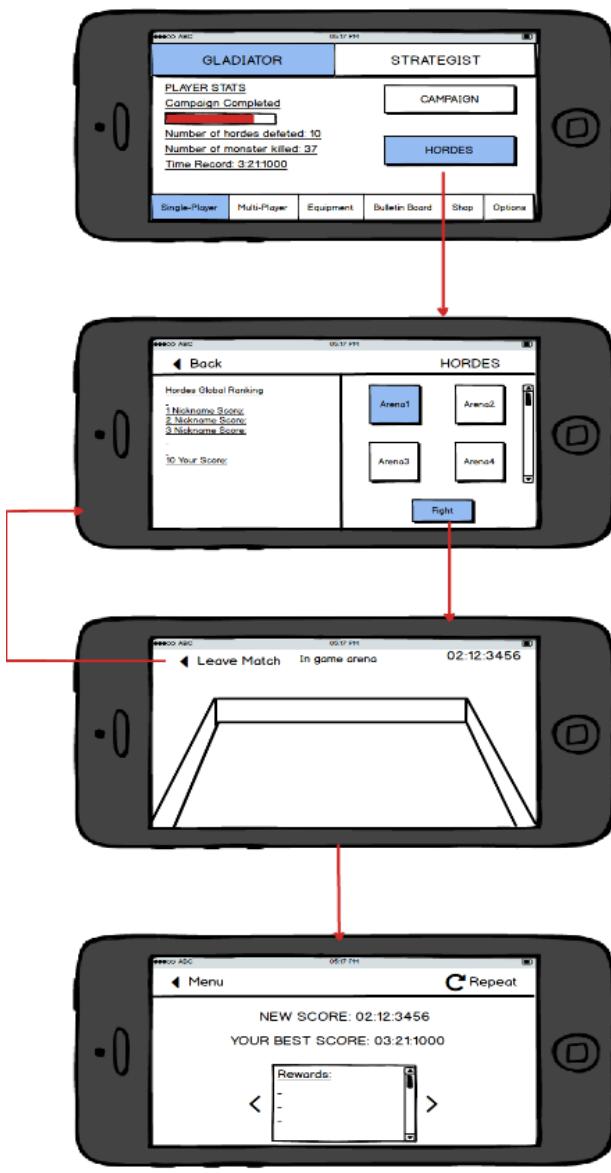


Figure 11 - C.L.A.N.G hordes mockup

Figure 12 - C.L.A.N.G time attack mockup

- Multiplayer
  - Friendly match/Ranked match/Challenge a Friend

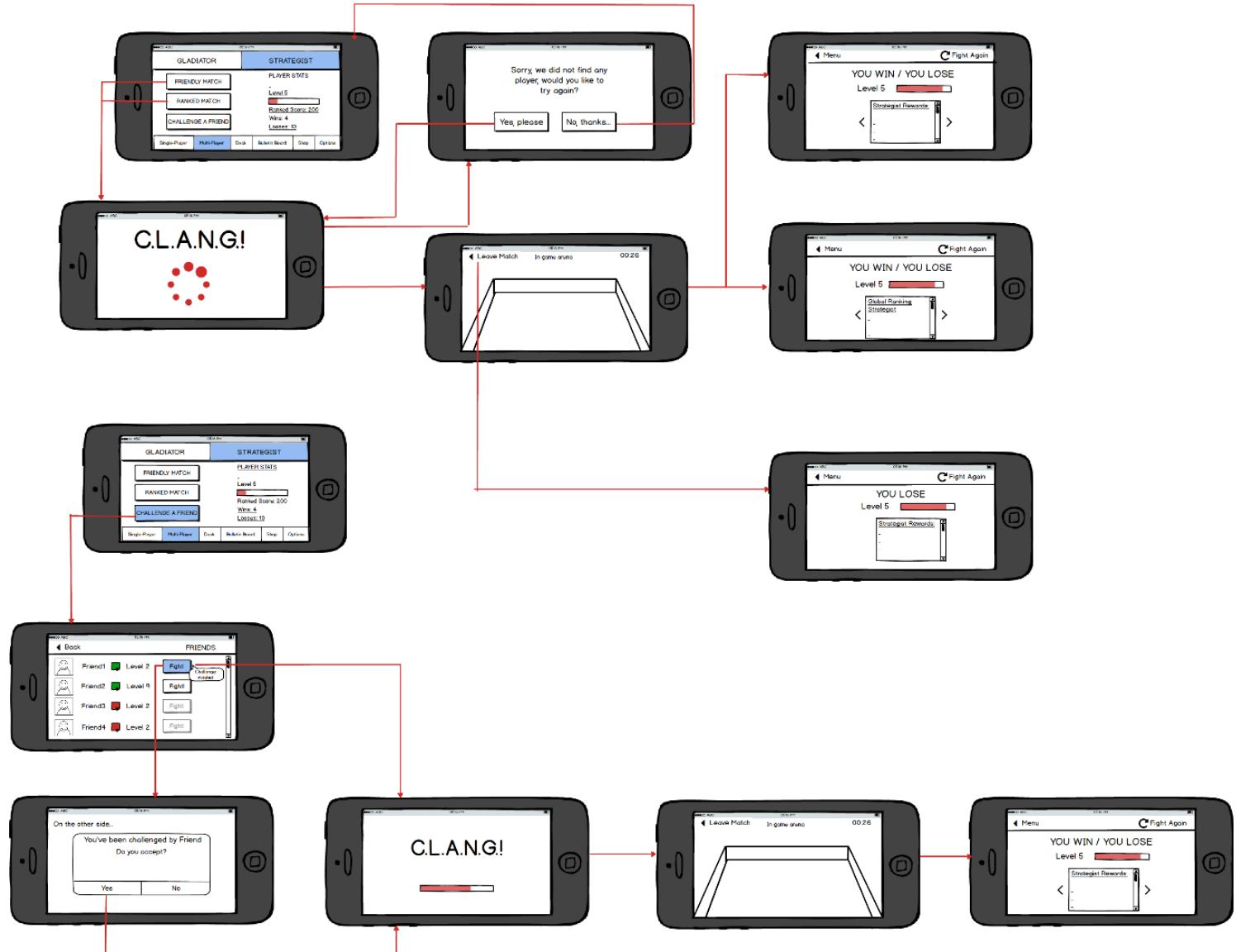


Figure 11 - C.L.A.N.G multi-player mockup

- Equipment

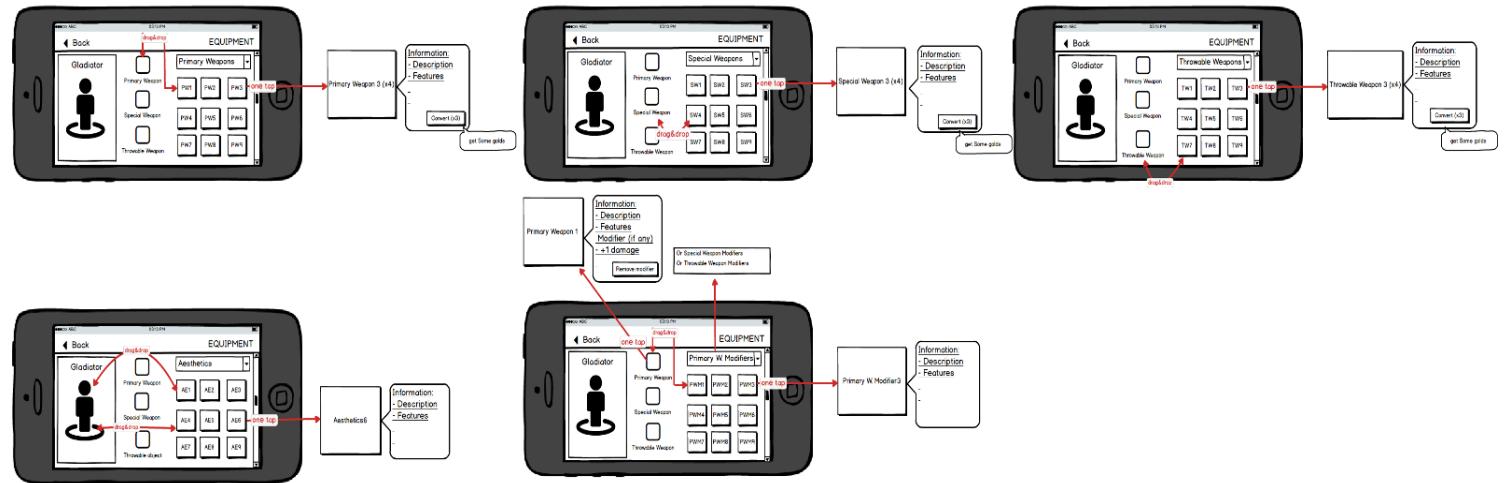


Figure 12 - C.L.A.N.G equipment mockup

- Deck

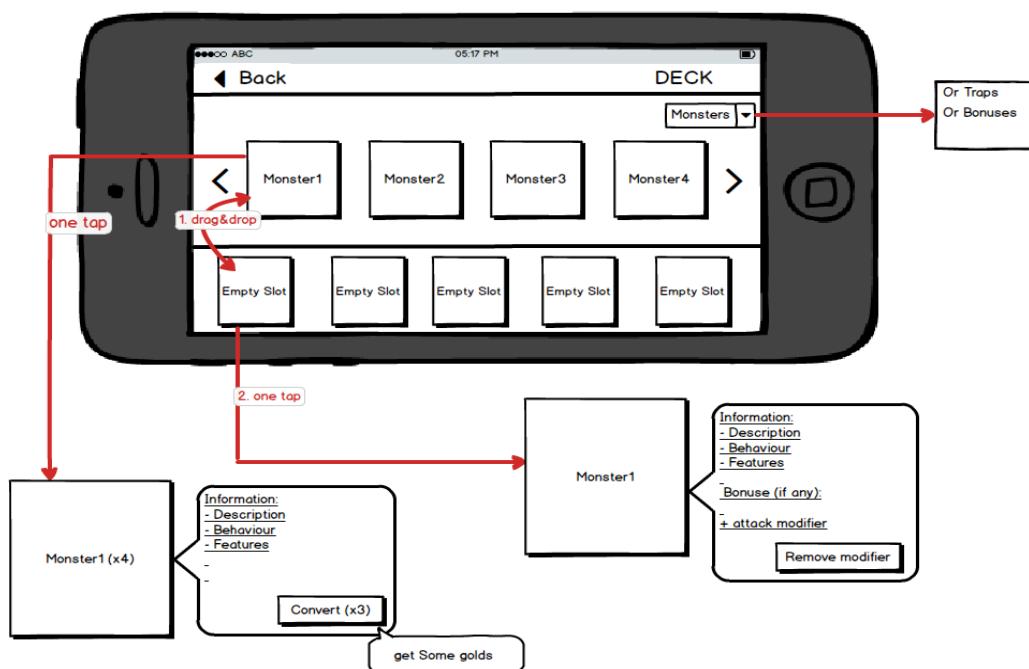


Figure 13 - C.L.A.N.G deck mockup

- Bulletin board



Figure 14 - C.L.A.N.G bulletin board mockup

- Shop

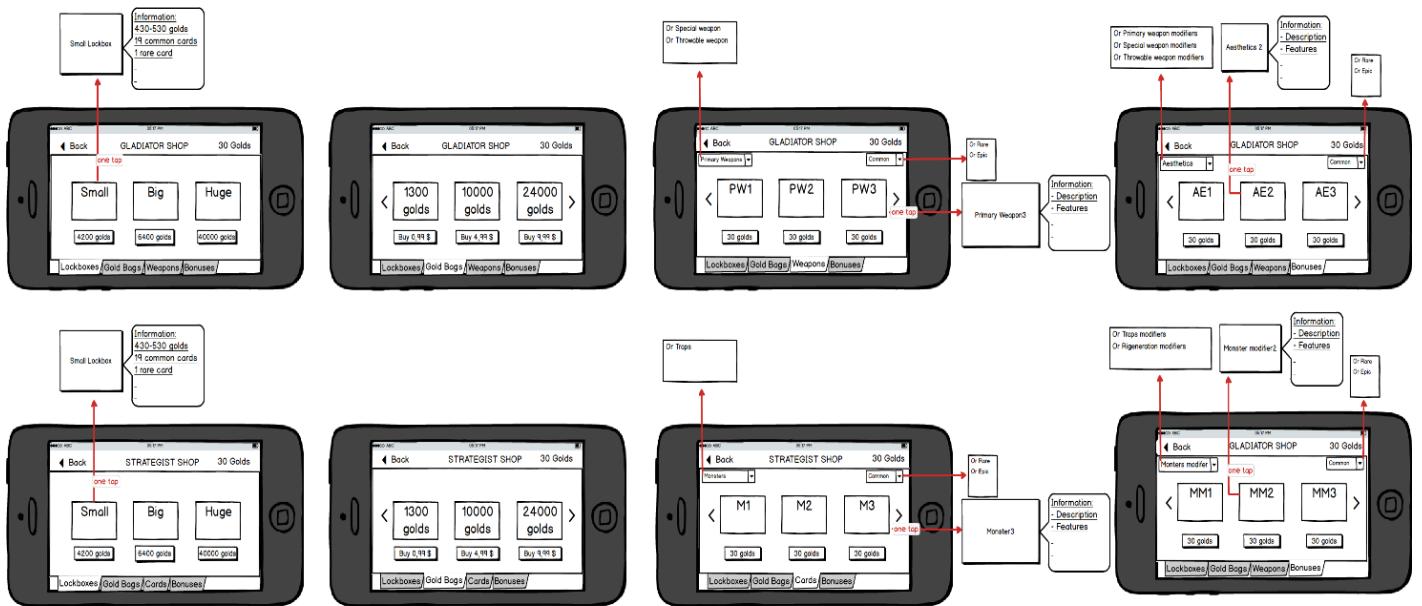


Figure 15 - C.L.A.N.G shop mockup

- Options

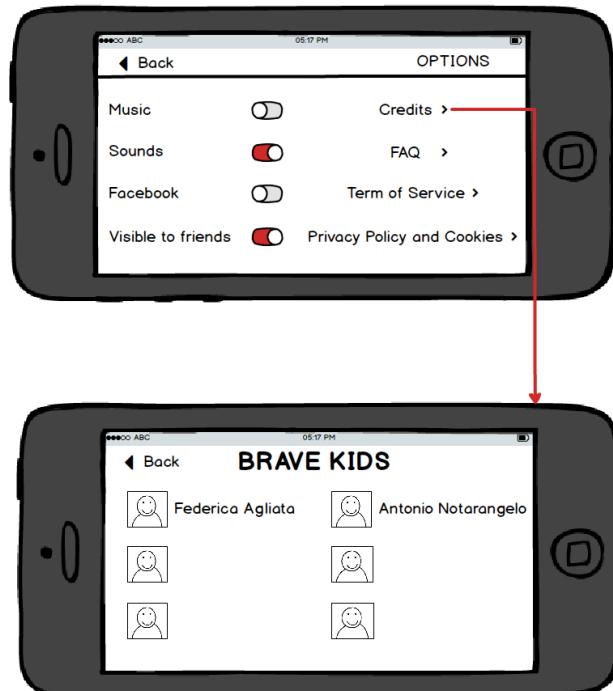


Figure 16 - C.L.A.N.G options mockup

### 5.3.2 Interfaces (In-game)



Figure 19 - C.L.A.N.G. splash page interface



Figure 20 - C.L.A.N.G. login interface



Figure 21 - C.L.A.N.G. loading interface



Figure 22 - C.L.A.N.G. multi-player interface



Figure 23 - C.L.A.N.G. end of match interface



Figure 24 - C.L.A.N.G. choice interface



Figure 25 - C.L.A.N.G deck interface



Figure 26 - C.L.A.N.G challenge friends interface



Figure 27 - C.L.A.N.G equipment interface

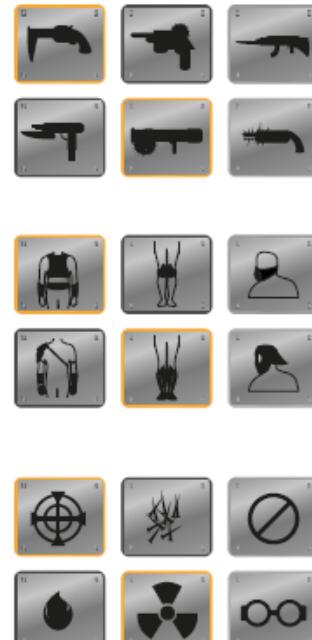


Figure 28 - C.L.A.N.G gladiator's objects

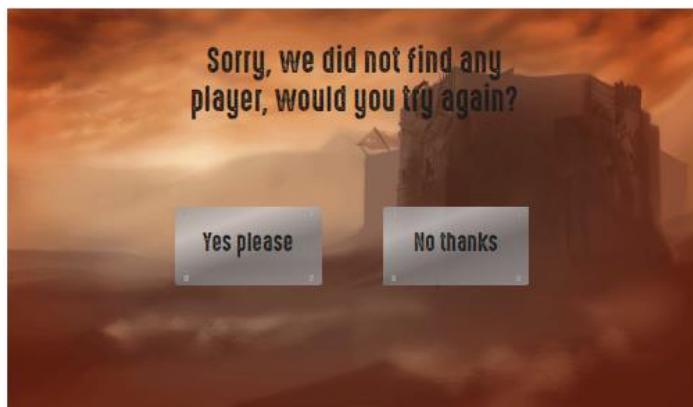


Figure 29 - C.L.A.N.G choice interface

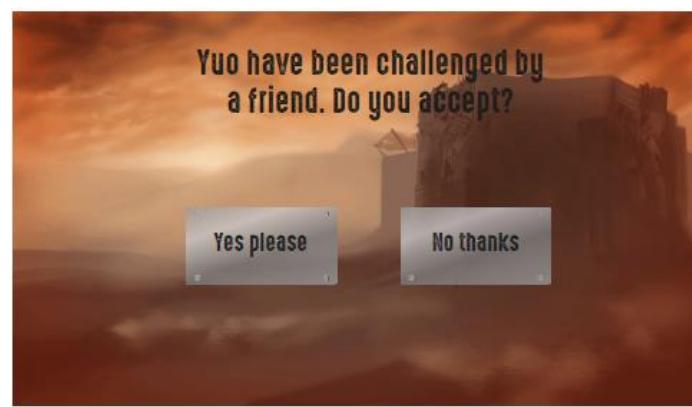


Figure 30 - C.L.A.N.G choice interface

### 5.3.3 Camera

#### Gladiator's side

The Gladiator's camera follows the player on the X and Z axes of Unity, while the Y axis is fixed.



*Figure 31 - Gladiator's camera*

The camera points and follows the player blocking the rotation.

It is positioned higher on the Y axis and further back on the X axis than the player in order to provides a third person view.

#### Strategist's side

Provides a top view of the arena with a rotation of  $60^\circ$  on the X axis from the origin of the camera. The user can move the camera along the X and Z axes of Unity by using the touch with one finger.



*Figure 32 - Strategist's Camera*

Moreover, the zooming is usable by the pinch in/pinch out, that translate the camera in space, in relation to the speed of the pinch (in order to provide a closest or farthest view of the arena) based on user interaction. The camera's move on the axes is limited by defined values (and limited the angle of view of the arena). Moreover, is not possible "zoom in" the camera beyond a certain limit, or "zoom out" within a certain limit. The zoom involves a translation of all the three axes.

### 5.3.4 Rules

#### 1 VS 1 ONLINE

1. The game was designed for two players: the first player selects a role to play (gladiator or strategist), the opponent must choose a complementary role to that chosen by the other player.
2. Each game consists of three rounds, 30 seconds each.
3. Each game initially assigns maximum health to the player who plays as a gladiator, and maximum "electric pulse" to the player who plays as a strategist.
4. The strategist summons monsters and traps to inflict damage and kill the gladiator.
5. A card can be spawned by the strategist, only if he/she has got the required "electric pulse" points.
6. The gladiator must survive fighting enemies and traps summoned by the strategist.
7. The arena audience sends on the field objects that could be useful for the Gladiator in case of bleeding (both from gladiator and enemies)
8. The game ends when the time is over or when the gladiator dies.
9. The gladiator wins if he/she is still alive at the end of the match.
10. The strategist wins if he/she defeats the gladiator before the end of the match.

#### CAMPAIGN

In this mode, the rules are the ones defined previously, excepting for the first one:

1. The game was designed for two players: the first player selects a role (for ex. strategist), and the CPU plays as the complementary role (gladiator).

#### TIME ATTACK

1. The game was designed for two players: the player selects the strategist; the CPU selects the gladiator.
2. The game has no time limit.
3. Each game initially assigns maximum health to the player who plays a gladiator and maximum "electric pulse" to the player who plays as strategist.
4. The strategist summons monsters and traps to inflict damage and kill the gladiator.
5. A card can be spawned by the strategist only if he/she has got the required "electric pulse" points.
6. The gladiator must survive fighting enemies and traps summoned by the strategist

7. The arena audience sends on the field objects that could be useful to the Gladiator in the event that blood will be spilled (both from gladiator and enemies)
8. The game ends when the strategist kills the gladiator.

## HORDES

In this mode, the rules defined by Time Attack mode are the same, excepting for the first one:

1. The game was designed for two players: the player selects the gladiator; the CPU selects the strategist.

### 5.3.5 Scoring (online only)

Our online ranking system includes 30 levels of experience, which will be received at the end of each ranked match. Each level is defined by the following attributes: a range of experience points needed to belong to that specific level (lower and upper limit), experience points needed to pass from that level to the next one.

$$\text{Exp points to move from level } x \text{ to level } x + 1 = 4x^3 - 6x^2 + 20x - 9$$

As mentioned above, each level is defined by a range of experience points, bounded by a lower bound and an upper bound.

$$\text{Lower bound for level } x = ((x - 1)^2 + 4)^2 = x^4 - 4x^3 + 14x^2 - 20x + 25$$

$$\text{Upper bound for level } x$$

$$\begin{aligned} &= \text{Lower bound for level } x + (\text{Exp points to move from level } x \text{ to level } x + 1) - 1 \\ &= x^4 + 8x^2 + 15 \end{aligned}$$

These expressions are valid from level 2 onwards, with the exception of level 1. If the level 1 was defined using the values of expressions defined earlier, it would possess meaningless values. For example, the lower limit calculated for the level 1 would be 16 ( $= (((x-1)^2 + 4)^2)$ ), this means that every player should own already 16 experience points with first connection: this reasoning makes no sense. For this reason, the interval considered for the first level is [0.24], with  $24 = (\text{lower limit of level 2}) - 1$ .

To understand how many wins are needed to move from a level to the next, we started at level 1. As long as that level remains low, the number of wins needed to advance level must also remain low. So we set to 1.2 victories to move from level 1 to level 2. For all other levels, the number of wins is equal to that required for previous levels + 0.2. For example, to move from level 2 to level 3 will need 1.4 wins, and so on.

The experience obtained after a victory depends on several factors: the experience points needed to advance to the next level and number of wins needed to advance to the next level.

$$\begin{aligned}
 & \text{Exp points gained after a win at level } x \\
 &= \frac{\text{exp points to move from level } x \text{ to level } x + 1}{\text{number of wins needed to move from level } x \text{ to level } x + 1}
 \end{aligned}$$

There are also extra points to consider, specifically those experience points that are missing in order to move to the next level after a user wins a game.

$$\begin{aligned}
 & \text{Missing exp points to move to level } x + 1 \\
 &= (\text{exp points to move from level } x \text{ to level } x + 1) \\
 &\quad - (\text{exp points gained after a win at level } x)
 \end{aligned}$$

Levels	Exp lower bound	Exp upper bound	Exp points to move to the next level	No. of wins to move to the next level	Exp points gained after a win	Missing exp points to move to the next level
1	0	24	25	1,2	20,83333333	4,1666667
2	25	63	39	1,4	27,85714286	11,142857
3	64	168	105	1,6	65,625	39,375
4	169	399	231	1,8	128,33333333	102,66667
5	400	840	441	2	220,5	220,5
6	841	1599	759	2,2	345	414
7	1600	2808	1209	2,4	503,75	705,25
8	2809	4623	1815	2,6	698,0769231	1116,9231
9	4624	7224	2601	2,8	928,9285714	1672,0714
10	7225	10815	3591	3	1197	2394
11	10816	15624	4809	3,2	1502,8125	3306,1875
12	15625	21903	6279	3,4	1846,764706	4432,2353
13	21904	29928	8025	3,6	2229,166667	5795,8333
14	29929	39999	10071	3,8	2650,263158	7420,7368
15	40000	52440	12441	4	3110,25	9330,75
16	52441	67599	15159	4,2	3609,285714	11549,714
17	67600	85848	18249	4,4	4147,5	14101,5
18	85849	107583	21735	4,6	4725	17010
19	107584	133224	25641	4,8	5341,875	20299,125
20	133225	163215	29991	5	5998,2	23992,8
21	163216	198024	34809	5,2	6694,038462	28114,962
22	198025	238143	40119	5,4	7429,444444	32689,556
23	238144	284088	45945	5,6	8204,464286	37740,536
24	284089	336399	52311	5,8	9019,137931	43291,862
25	336400	395640	59241	6	9873,5	49367,5
26	395641	462399	66759	6,2	10767,58065	55991,419
27	462400	537288	74889	6,4	11701,40625	63187,594
28	537289	620943	83655	6,6	12675	70980
29	620944	714024	93081	6,8	13688,38235	79392,618
30	714025	817215	103191	7	14741,57143	88449,429

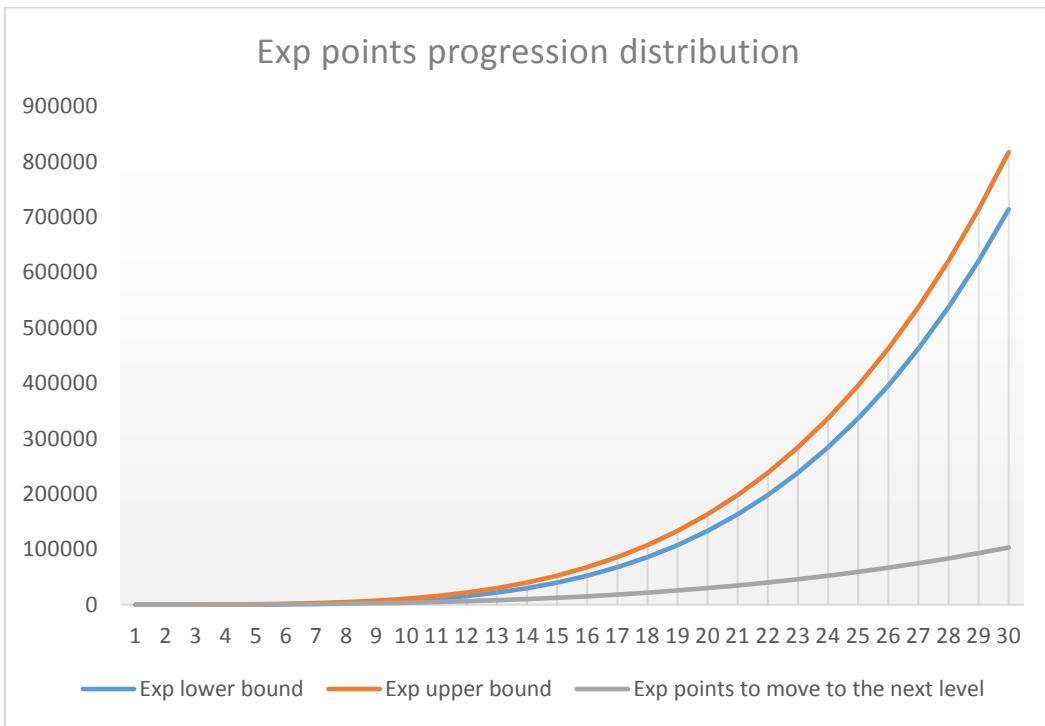


Figure 33 - Experience points distribution

These missing experience points allow us to do more thinking on how to reward the player when he/she plays well during the game. A parameter that evaluates player's skill with a certain accuracy is time, both for the strategist and the gladiator.

The evaluation of this parameter plays a different role depending on the type of character, in fact the strategist is evaluated more positively if it takes less time to defeat the Gladiator, instead the Gladiator is evaluated more positively if it survives longer. So the extra experience points for the strategist will be inversely proportional to the elapsed time, in spite of those for the Gladiator that will be directly proportional to time.

We consider time as a discrete set 30, 60 and 90 whose values are seconds, and a collection of cases whose values are excellent, average and worst. Time values are labelled with excellent, average and worst depending on the character that is used during the game. In fact, the worst case of the Gladiator (30 seconds) is different than the worst case of the strategist (90 seconds) because the Gladiator is penalized in scoring if he dies early, instead the strategist is penalized in the score if the Gladiator survives at the end of the game. Much the same for the excellent case, instead the average case coincides.

$$\text{Time} = \{30, 60, 90\}$$

$$\text{Case} = \{\text{Excellent}, \text{Average}, \text{Worst}\}$$

$$\text{Strategist extra points} = 90 \frac{1}{t} \text{level}$$

$$\text{Gladiator extra points} = \frac{t}{90} \frac{9}{3} \text{level}$$

STRATEGIST				GLADIATOR			
Level	Excellent	Average	Worst	Level	Excellent	Average	Worst
1	3	1,5	1	1	3	2	1
2	6	3	2	2	6	4	2
3	9	4,5	3	3	9	6	3
4	12	6	4	4	12	8	4
5	15	7,5	5	5	15	10	5
6	18	9	6	6	18	12	6
7	21	10,5	7	7	21	14	7
8	24	12	8	8	24	16	8
9	27	13,5	9	9	27	18	9
10	30	15	10	10	30	20	10
11	33	16,5	11	11	33	22	11
12	36	18	12	12	36	24	12
13	39	19,5	13	13	39	26	13
14	42	21	14	14	42	28	14
15	45	22,5	15	15	45	30	15
16	48	24	16	16	48	32	16
17	51	25,5	17	17	51	34	17
18	54	27	18	18	54	36	18
19	57	28,5	19	19	57	38	19
20	60	30	20	20	60	40	20
21	63	31,5	21	21	63	42	21
22	66	33	22	22	66	44	22
23	69	34,5	23	23	69	46	23
24	72	36	24	24	72	48	24
25	75	37,5	25	25	75	50	25
26	78	39	26	26	78	52	26
27	81	40,5	27	27	81	54	27
28	84	42	28	28	84	56	28
29	87	43,5	29	29	87	58	29
30	90	45	30	30	90	60	30

The number of losses required to move to the next level must be greater than the number of victories needed to pass to the next level, so we set to 1.7 losses to move from level 1 to level 2. For all other levels, the number of losses is equal to that required for previous levels + 0.7. For example, to move from level 2 to level 3 will need 2.4 losses, and so on.

The experience obtained after a loss depends on several factors: the experience points needed to advance to the next level and number of losses needed to advance to the next level.

$$\begin{aligned}
 & \text{Exp points gained after a loss at level } x \\
 & = \frac{\text{exp points to move from level } x \text{ to level } x + 1}{\text{number of losses needed to move from level } x \text{ to level } x + 1}
 \end{aligned}$$

From what it appears, the earned experience points after a defeat at the first level are 1.5 times lower than those earned after a victory. And the gap of difference continues to widen as topside.

It was decided to severely punish players who decide to leave the game once started, so we increased the number of games required to move to the next level when a player leaves the match of 3 times than that required in case of defeat. Consequently, the obtained experience points after a left match will be 3 times lower than those received after a defeat.

$$\text{Exp points gained after a leave at level } x = \frac{\text{exp points to move from level } x \text{ to level } x + 1}{\text{number of left matches needed to move from level } x \text{ to level } x + 1}$$

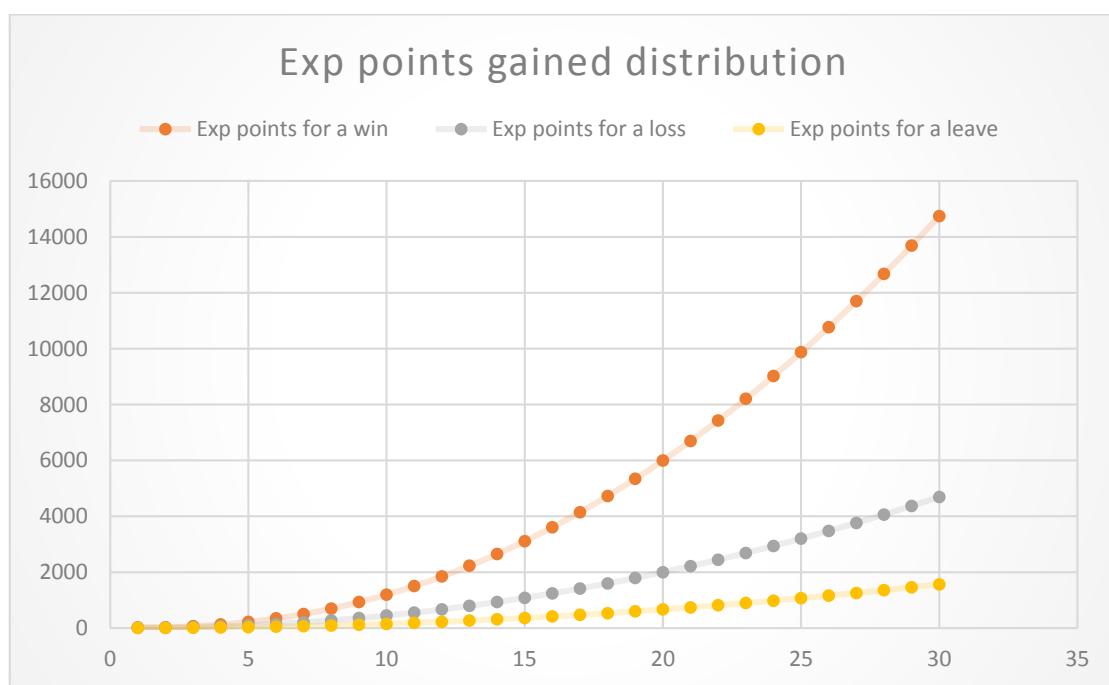


Figure 34 - Experience points distribution

### 5.3.6 Winning conditions

	Gladiator		Strategist	
	Victory	Loss	Victory	Loss
1 VS 1/Campaign	Health > 0 Match: end	Health = 0	Gladiator's Health = 0	Gladiator's Health > 0 Match: end
Time attack	-	-	Gladiator's Health = 0	-
Hordes	Health = 0	-	-	-

## 5.4 Modes and other features

- **Tutorial:** The player is introduced to the game through the tutorial. At the first start of C.L.A.N.G.! after logging in, the player will choose the role to start with. Once he/she has chosen the role, the controls he/she has use will be shown. As for the Gladiator, the first thing the player must do is to learn how to move, so the video screen will present the relevant command. Then the player has to learn how to fight: this is the reason why we decide to let him/her try a combat with a base weapon and a puppet monster. Similarly, the player learns how to use the other controls: special weapons, throwable weapons and defense. After that, we will have to explain the audience interaction. Indeed, the audience might occasionally act in gladiator's or strategist's favor. In this case, the audience can provide some prizes, that he can collect directly inside the arena, for example: weapons, medipack or pieces of armor. Then it will be the turn of screen components, in fact we will show to the player to keep an eye on timer, as essential to understanding his chances of victory or failure.

The tutorial from the perspective of the strategist will be markedly different. First of all, we will explain how to interact with his command's console, composed of a set of cards. In fact, for moving monsters on the arena, he must use the appropriate command: drag and drop on the screen. Then we will explain how he can closely monitor the Gladiator's and monster's actions by moving the camera and making zoom in and zoom out in different parts of the arena. Once he figured out how to interact with the game arena, we will explain what is the electrical pulse and how it is important to use monsters and traps. We'll show to the player the electrical pulse's recovery and how each card of the deck needs a regeneration time. Then we'll note that also for the strategic component is always very important to keep an eye on the timer to figure out the chances of victory and failure.

- **Campaign:** The single player campaign features a series of arenas that will be addressed in a linear order to be completed. At the beginning there will be only one arena unlocked, all others will be unlocked as the player completes the previous arenas, for a total of 10 arenas. The campaign can be played by choosing only one role, then you can play two campaigns completely parallel, one as Gladiator and another as Strategist, independent of each other. Completing a level involves the release of various objects in the game which can be used also in multiplayer mode.
  - **Rewards:** The campaign allows the player to obtain rewards only the first time it is addressed, both as a gladiator and as strategist. You can obtain by completing the campaign a total of 1200 golds and 3 different cards.

Arenas	Cards	Golds
1	-	30
2	-	50
3	Epic	70
4	-	90
5	-	110
6	-	130
7	Rare	150
8	-	170
9	-	190
10	Rare	210

We get this distribution using this formula, that comes from the sum of an arithmetic progression:

$$Terms\ of\ succession\ T(i) = \begin{cases} \frac{2 * \frac{s}{n} - (n - 1) * d}{2}, & if\ i = 1 \\ T(i - 1) + d, & if\ i \neq 1 \end{cases}$$

Where:

s = sum;

n = number of terms;

d = common difference.

In our case these parameters are replaced by:

s = 1200 golds (we use the Huge Lockbox as a reference);

n = 10 arenas;

d = 20.

- **Time attack:** This single-player mode is exclusively designed for the role of strategist. There will be no countdown that will end the game, the only thing that matters is the skill of the player in trying to defeat the Gladiator opponent as quickly as possible. The time spent to defeat the Gladiator can be shared on online leader boards, so as to compare it with that of his/her friends in order to compete with them and improve.
  - **Rewards:** Due to the global ranking of the time attack, the player gets a reward of 10 golds, if she scales at least one position. Otherwise she doesn't obtain anything.
- **Hordes:** This single player mode has very similar dynamics to "time attack", but allows the player to have a different perspective playing as the Gladiator. Even in this mode, the time does not define the duration of the match, but will measure the resistance of the Gladiator. The challenge will be to resist as long as possible against hordes of enemies stronger and stronger as time passes. Again, the time will be uploaded to an online leader board to compare it with that of the player's friends.
  - **Rewards:** Due to the global ranking of the hordes, the player gets a reward of 10 golds, if she scales at least one position. Otherwise she doesn't obtain anything.

- **1 VS 1:** Through this multiplayer mode the player can challenge anyone, including friends in ranked and unranked matches. The player, once he/she has chosen one of the two roles, will look for a new match against an opponent who has chosen the opposite role. The result of the match will help change the online players' stats and reach the top of the charts for the best Gladiators and the best Strategists.
  - **Rewards:** As mentioned above in this mode the player can challenge opponents in friendly matches and not. Before mentioning the rewards is fair to point out that the classification will be scalable if the player decides to play classified. So in general we can say that:

		Gladiator		Strategist
	Condition (duration in seconds)	Reward	Condition (duration in seconds)	Reward
<b>Ranked Match</b>	Victory	Big Lockbox	Victory (0~30s)	Big Lockbox
	Loss (60~90s)	Small Lockbox	Victory (31~90s)	Small Lockbox
	Losses (0~30s)	10 Golds	Losses	10 Golds
	Mission completed	Golds related on mission	Mission Completed	Golds related on mission
	Leave Match	-	Leave Match	-
<b>Friendly Match</b>	Victory	Big Lockbox	Victory (0~30s)	Big Lockbox
	Loss (60~90s)	Small Lockbox	Victory (31~90s)	Small Lockbox
	Losses (0~30s)	10 Golds	Losses	10 Golds
	Mission completed	Golds related on mission	Mission Completed	Golds related on mission
	Leave Match	-	Leave Match	-
<b>Challenge a Friend</b>	Victory	5 Golds	Victory	5 Golds
	Losses	-	-	-
	Mission completed	Golds related on mission	Mission Completed	Golds related on mission
	Leave Match	-	Leave Match	-

- **Missions:** The missions don't represent a real game mode but a set of tasks, weekly updated, that the player is free to deal with or not. These tasks are divided on the basis of the two roles, and may be facing only 1 in multiplayer mode.
 

Missions example:

  - Spawn 2 different traps in any arena
  - Use the rifle to kill at least 3 monster
  - Complete 1 vs 1 match with the Gladiator

- **Rewards:** For each mission exceeded the player gets 15 Golds. Whereas twice a week will be loaded 3 mission for the Strategist and 3 mission for the Gladiator, a player who exceeds all of it can get 180 Golds per week.

## 5.5 Levels

### 5.5.1 Inspiration



*Figure 35 - Levels inspiration moodboard*

For the realization of the arenas we needed places that remember in some ways a post-apocalyptic world, degraded by time.

For this reason, we were inspired by locations that support these ideas.

As you can see from the moodboard, the arenas are essentially places often forgotten, acts only to contain the battle, in other cases are built specifically for the fight, but still with makeshift elements.

So, in our imagination, the arenas can be: stadium destroyed, abandoned pools, landfills, building sites previously under construction, etc...

### 5.5.2 Conceptualization

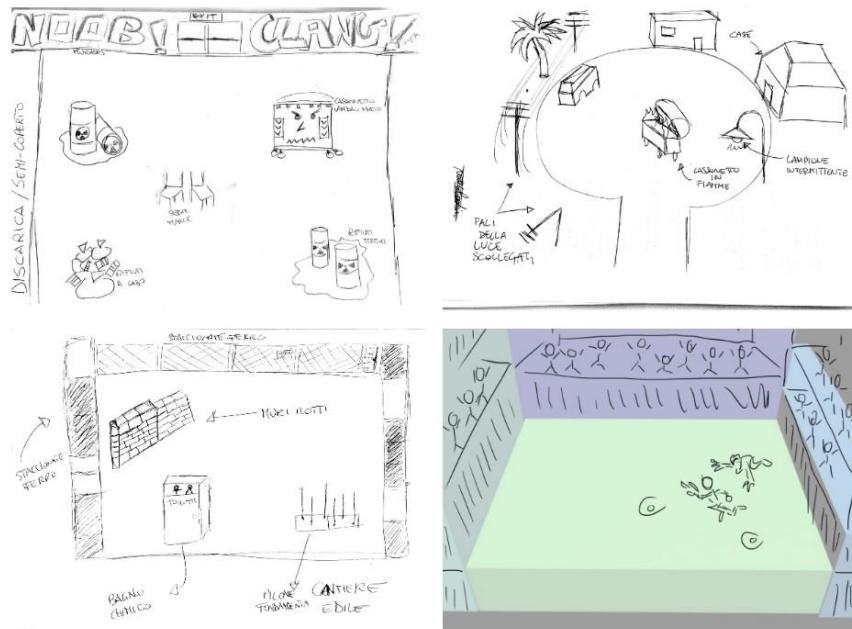


Figure 36 - Levels conceptualization moodboard

After we get an idea of how the arenas could be, we made some design on paper to explain to the artistic sector the structure of the game's levels.

Considering that the campaign mode (single-player) includes a series of arenas to deal with, we have tried several different styles that would characterise the levels. In fact, inspired by previous images, we sketched several possibilities, placing within each scenario useful elements for the Gladiator that were consistent with the game environment.

Moreover, for the arenas set in a landfill, we assumed the inclusion of items like bins, toxic waste and other features that aren't only an artistic component but also a shelter for the Gladiator during the fight.

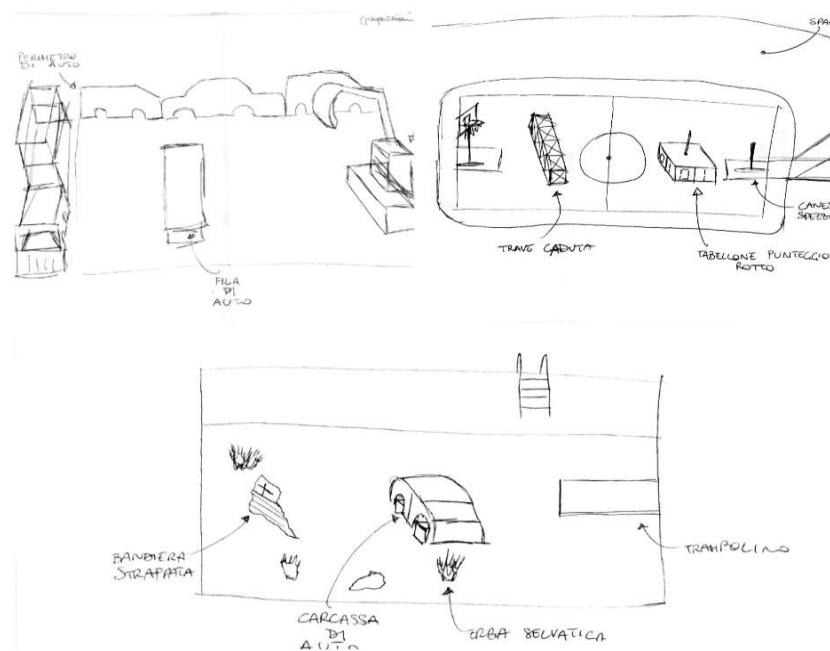
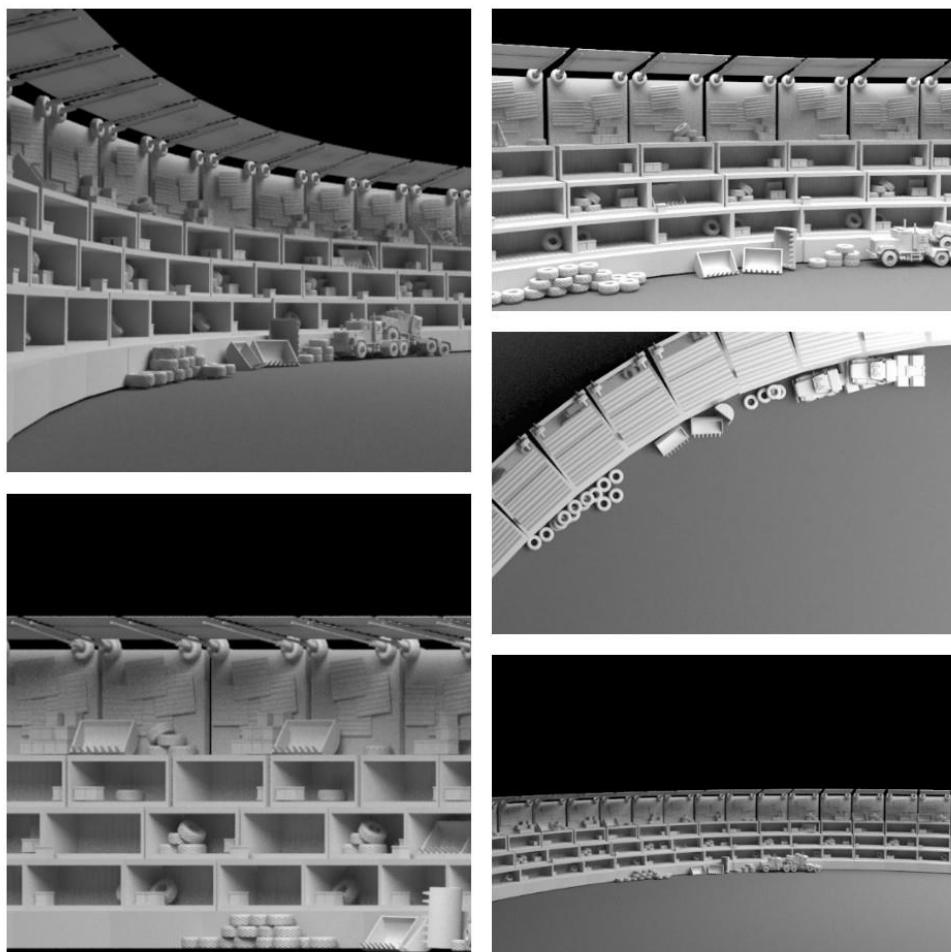


Figure 37 - Levels conceptualization moodboard

For arenas set in yards, we assumed the presence of chemical baths, walls cracked, chunks of cement and so on...

Other settings with other game's elements are: a crap scrapping site, an abandoned sports hall, a swimming pool and a degraded city district.

### 5.5.3 Realization



*Figure 38 - Level realization moodboard*

Consequently, on the basis of the previous sketches, the artists have begun to realize the arena on which our prototype is based.

In fact, considering some of the elements mentioned above, they have built an arena consisting of a semicircle of bleachers, which in turn, are nothing more than containers on top of each other. Above these stands, to close the view to the outside, there are a number of sheets welded together.

They were subsequently included aesthetic elements in context to the environment itself, such as: tires, bulldozers, trucks, barrels etc...

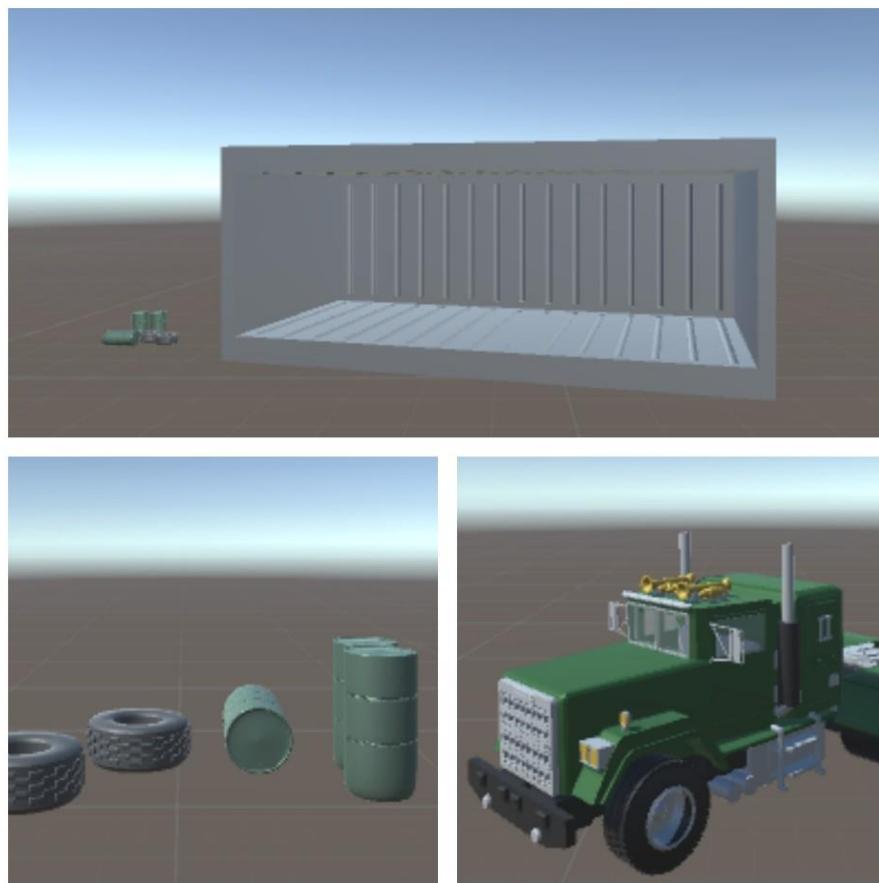
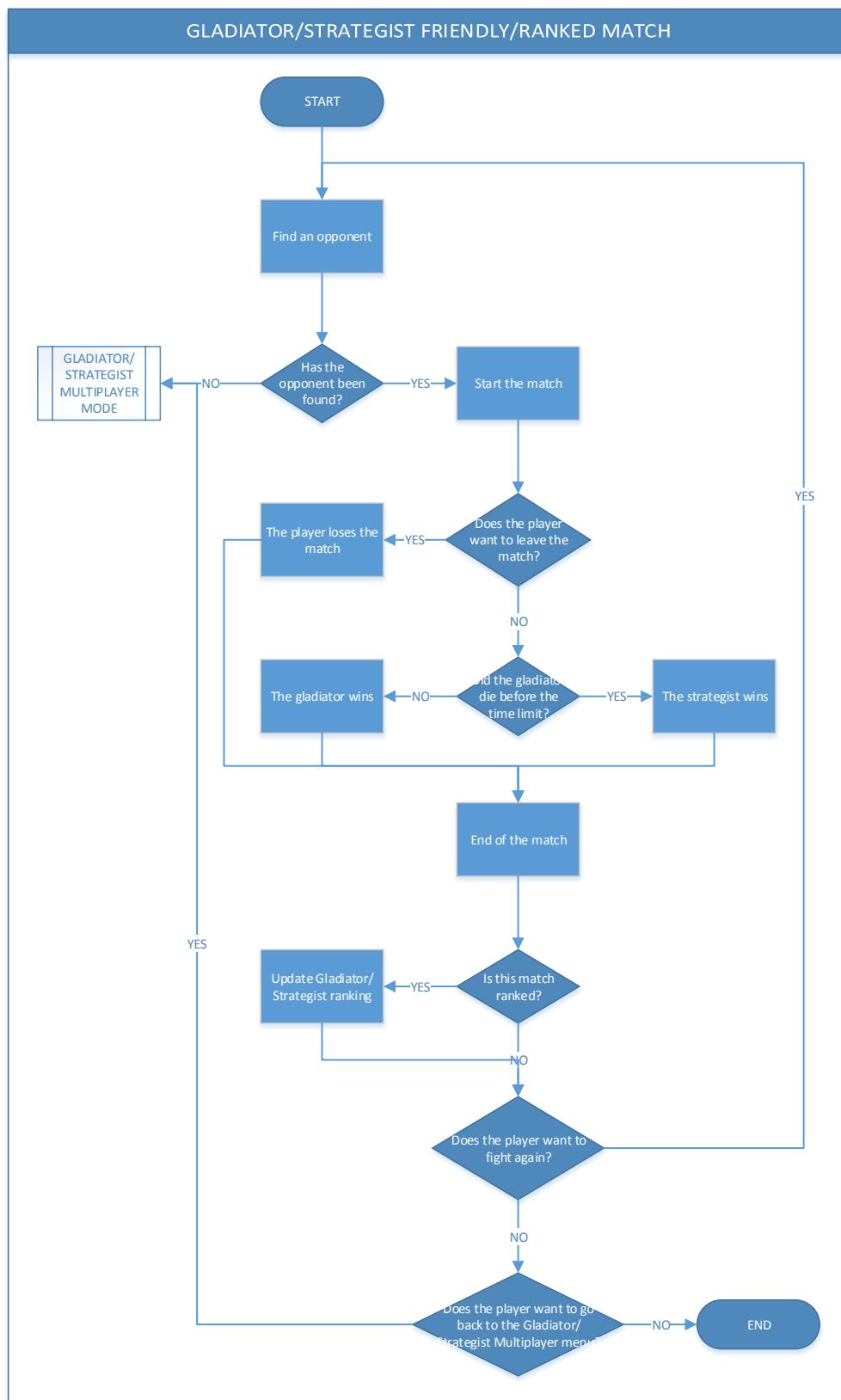


Figure 39 - 3D Models

After the realization of these components, the implementation in Unity has meant that the arena was slightly changed. In fact, considering the devices for which we developed the game and considering the camera view, the arena was shrunk to facilitate its implementation. Moreover, the area of semicircle has been significantly reduced, so you can always have a view to the stands and avoid to watch the environment outside the arena.

## 5.6 Flowcharts



There's an example of C.L.A.N.G.'s Flowchart. For the others, please check the PDF file in attachment.

## 6. Game Characters

C.L.A.N.G. offers two basic types of playable characters: The Gladiator and the Strategist.

As mentioned above the game completely changes depending on the character chosen. The Strategist offers the player a series of objects and enemies to be placed in the arena, each has different features in terms of appearance and behavior.

The Gladiator deploys his skills against enemies get spawn from the strategist inside the arena.

### 6.1 Characters design

Essentially the player characters and non-player characters of C.L.A.N.G. are designed in such a way that they were consistent with the post-apocalyptic world.

This means that we moved away from purely human or animalistic shapes to get closer to hybrid-looking beings, consisting of mechanical parts or by genetic mutations.

### 6.2 General Consideration

For each PCs and NPCs exists in the prototype, we have defined a series of attributes needed to balance the game.

In particular, we have calculated the damage caught by the Gladiator and by the Monsters according to certain formulas, taking into account that the data tend to change according to the level reached by the Gladiator and the Strategist.

Currently this progression is only guaranteed for the multiplayer.

#### 6.2.1 Gladiator side

$$\begin{aligned} \text{Damage suffered by an Enemy} \\ = \text{Damage of Enemy (at that level)} \\ - \text{Gladiator restistance (at that level)} * \text{constant} \end{aligned}$$

With “constant” we mean a number needed to rebalance the match. In the case of damage suffered by the Gladiator, it depends on the type of monster, in the case of damage suffered by Monster, it depends from the weapon used by Gladiator.

$$\begin{aligned} \text{Number of hits to die by an Enemy} \\ = \frac{\text{Gladiator's Health (at that level)}}{\text{Damage suffered by an Enemy (at that level)}} \end{aligned}$$

$$\begin{aligned} \text{Number of hits to die by an Enemy with Armor on} \\ = \frac{\text{Gladiator's Helath (at that level)} * \text{constant}}{\text{Damage suffered by an Enemy (at that level)}} \end{aligned}$$

### 6.2.2 Strategist side

*Damage suffered by the Gladiator with Weapon*

= *Damage of Weapon (at that level)*

- *Monster's resistance (at that level) \* constant*

*Number of hits to die by Gladiator with Weapon*

*Monster's Health (at that level)*

$$= \frac{\text{Damage suffered by Gladiator with Weapon (at that level)}}{\text{Monster's Health (at that level)}}$$

For all the information about the balancing, please consult the excel files in the attachment.

### 6.3 PCs



- **Gladiator man**

Rebellious to his clan membership, imprisonment and forced to fight in the arena built for the entertainment of the clan-bosses.

The Gladiator is a man of not particularly pronounced, who fights in the arena with makeshift or weapons that are granted by the public.

He is a man with a good physical stamina but his slow movement sometimes betrays him, especially when he has to escape the strange creatures of the arena.

Figure 40 - Gladiator man

Level	Health	Resistance	Dexterity	Damage by Maimed Mutant	N. of hits to die by Maimed Mutant	N. of hits to die by Maimed Mutant [with armor on]
1	32	14	11	2,9	11,03448276	16,55172414
2	35	15,5	12,2	3,075	11,38211382	17,07317073
3	38	17	13,4	3,25	11,69230769	17,53846154
4	41	18,5	14,6	3,425	11,97080292	17,95620438
5	44	20	15,8	3,6	12,22222222	18,33333333
6	47	21,5	17	3,775	12,45033113	18,67549669
7	50	23	18,2	3,95	12,65822785	18,98734177
8	53	24,5	19,4	4,125	12,84848485	19,27272727
9	56	26	20,6	4,3	13,02325581	19,53488372

10	59	27,5	21,8	4,475	13,18435754	19,77653631
11	62	29	23	4,65	13,33333333	20
12	65	30,5	24,2	4,825	13,47150259	20,20725389
13	68	32	25,4	5	13,6	20,4
14	71	33,5	26,6	5,175	13,71980676	20,57971014
15	74	35	27,8	5,35	13,8317757	20,74766355
16	77	36,5	29	5,525	13,93665158	20,90497738
17	80	38	30,2	5,7	14,03508772	21,05263158
18	83	39,5	31,4	5,875	14,12765957	21,19148936
19	86	41	32,6	6,05	14,21487603	21,32231405
20	89	42,5	33,8	6,225	14,29718876	21,44578313
21	92	44	35	6,4	14,375	21,5625
22	95	45,5	36,2	6,575	14,4486692	21,6730038
23	98	47	37,4	6,75	14,51851852	21,77777778
24	101	48,5	38,6	6,925	14,58483755	21,87725632
25	104	50	39,8	7,1	14,64788732	21,97183099
26	107	51,5	41	7,275	14,70790378	22,06185567
27	110	53	42,2	7,45	14,76510067	22,14765101
28	113	54,5	43,4	7,625	14,81967213	22,2295082
29	116	56	44,6	7,8	14,87179487	22,30769231
30	119	57,5	45,8	7,975	14,92163009	22,38244514

Damage by Hungry Worm	N. of hits to die by Hungry Worm	N. of hits to die by Hungry Worm [with armor on]	Damage by Swarm	N. of hits to die by Swarm	N. of hits to die by Swarm [with armor on]
6,9	4,637681159	6,956521739	2,4	13,33333333	20
7,475	4,682274247	7,023411371	2,575	13,59223301	20,38834951
8,05	4,720496894	7,080745342	2,75	13,81818182	20,72727273
8,625	4,753623188	7,130434783	2,925	14,01709402	21,02564103
9,2	4,782608696	7,173913043	3,1	14,19354839	21,29032258
9,775	4,808184143	7,212276215	3,275	14,35114504	21,52671756
10,35	4,830917874	7,246376812	3,45	14,49275362	21,73913043
10,925	4,851258581	7,276887872	3,625	14,62068966	21,93103448
11,5	4,869565217	7,304347826	3,8	14,73684211	22,10526316
12,075	4,886128364	7,329192547	3,975	14,8427673	22,26415094
12,65	4,901185771	7,351778656	4,15	14,93975904	22,40963855
13,225	4,914933837	7,372400756	4,325	15,02890173	22,5433526
13,8	4,927536232	7,391304348	4,5	15,11111111	22,66666667
14,375	4,939130435	7,408695652	4,675	15,18716578	22,78074866
14,95	4,949832776	7,424749164	4,85	15,25773196	22,88659794
15,525	4,959742351	7,439613527	5,025	15,32338308	22,98507463
16,1	4,968944099	7,453416149	5,2	15,38461538	23,07692308
16,675	4,977511244	7,466266867	5,375	15,44186047	23,1627907
17,25	4,985507246	7,47826087	5,55	15,4954955	23,24324324
17,825	4,992987377	7,489481066	5,725	15,54585153	23,31877729
18,4	5	7,5	5,9	15,59322034	23,38983051
18,975	5,006587615	7,509881423	6,075	15,63786008	23,45679012
19,55	5,012787724	7,519181586	6,25	15,68	23,52

<b>20,125</b>	5,01863354	7,527950311	6,425	15,71984436	23,57976654
<b>20,7</b>	5,024154589	7,536231884	6,6	15,75757576	23,63636364
<b>21,275</b>	5,029377203	7,544065805	6,775	15,79335793	23,6900369
<b>21,85</b>	5,034324943	7,551487414	6,95	15,82733813	23,74100719
<b>22,425</b>	5,039018952	7,558528428	7,125	15,85964912	23,78947368
<b>23</b>	5,043478261	7,565217391	7,3	15,89041096	23,83561644
<b>23,575</b>	5,047720042	7,571580064	7,475	15,91973244	23,87959866

Damage by Tank	N. of hits to die by Tank	N. of hits to die by Tank [with armor on]	Damage by Bear Trap	Damage by Toxic Cloud
<b>4,9</b>	6,530612245	9,795918367	2,9	1,9
<b>5,275</b>	6,63507109	9,952606635	3,075	1,575
<b>5,65</b>	6,725663717	10,08849558	3,25	1,75
<b>6,025</b>	6,804979253	10,20746888	3,425	1,925
<b>6,4</b>	6,875	10,3125	3,6	2,1
<b>6,775</b>	6,937269373	10,40590406	3,775	2,275
<b>7,15</b>	6,993006993	10,48951049	3,95	2,45
<b>7,525</b>	7,043189369	10,56478405	4,125	2,625
<b>7,9</b>	7,088607595	10,63291139	4,3	2,8
<b>8,275</b>	7,129909366	10,69486405	4,475	2,975
<b>8,65</b>	7,167630058	10,75144509	4,65	3,15
<b>9,025</b>	7,202216066	10,8033241	4,825	3,325
<b>9,4</b>	7,234042553	10,85106383	5	3,5
<b>9,775</b>	7,26342711	10,89514066	5,175	3,675
<b>10,15</b>	7,290640394	10,93596059	5,35	3,85
<b>10,525</b>	7,315914489	10,97387173	5,525	4,025
<b>10,9</b>	7,339449541	11,00917431	5,7	4,2
<b>11,275</b>	7,361419069	11,0421286	5,875	4,375
<b>11,65</b>	7,381974249	11,07296137	6,05	4,55
<b>12,025</b>	7,401247401	11,1018711	6,225	4,725
<b>12,4</b>	7,419354839	11,12903226	6,4	4,9
<b>12,775</b>	7,436399217	11,15459883	6,575	5,075
<b>13,15</b>	7,452471483	11,17870722	6,75	5,25
<b>13,525</b>	7,467652495	11,20147874	6,925	5,425
<b>13,9</b>	7,482014388	11,22302158	7,1	5,6
<b>14,275</b>	7,495621716	11,24343257	7,275	5,775
<b>14,65</b>	7,508532423	11,26279863	7,45	5,95
<b>15,025</b>	7,520798669	11,281198	7,625	6,125
<b>15,4</b>	7,532467532	11,2987013	7,8	6,3
<b>15,775</b>	7,543581616	11,31537242	7,975	6,475



- **Gladiator woman**

Similarly, the Gladiator woman was expelled from his clan for the purposes of combat. She was chosen because of its remarkable ability to escape from enemies, even in the most dangerous, therefore she is a source of big gains for the heads-clan.

*Figure 41- Gladiator woman*

Level	Health	Resistance	Dexterity	Damage by Maimed Mutant	N. of hits to die by Maimed Mutant	N. of hits to die by Maimed Mutant [with armor on]
1	35	9	15	3,65	9,589041096	14,38356164
2	38	10,2	16,5	3,87	9,819121447	14,72868217
3	41	11,4	18	4,09	10,02444988	15,03667482
4	44	12,6	19,5	4,31	10,20881671	15,31322506
5	47	13,8	21	4,53	10,37527594	15,56291391
6	50	15	22,5	4,75	10,52631579	15,78947368
7	53	16,2	24	4,97	10,6639839	15,99597586
8	56	17,4	25,5	5,19	10,78998073	16,1849711
9	59	18,6	27	5,41	10,90573013	16,35859519
10	62	19,8	28,5	5,63	11,01243339	16,51865009
11	65	21	30	5,85	11,11111111	16,66666667
12	68	22,2	31,5	6,07	11,20263591	16,80395387
13	71	23,4	33	6,29	11,28775835	16,93163752
14	74	24,6	34,5	6,51	11,3671275	17,05069124
15	77	25,8	36	6,73	11,44130758	17,16196137
16	80	27	37,5	6,95	11,51079137	17,26618705
17	83	28,2	39	7,17	11,57601116	17,36401674
18	86	29,4	40,5	7,39	11,63734777	17,45602165
19	89	30,6	42	7,61	11,69513798	17,54270696
20	92	31,8	43,5	7,83	11,74968072	17,62452107
21	95	33	45	8,05	11,80124224	17,70186335
22	98	34,2	46,5	8,27	11,85006046	17,77509069
23	101	35,4	48	8,49	11,89634865	17,84452297
24	104	36,6	49,5	8,71	11,94029851	17,91044776
25	107	37,8	51	8,93	11,98208287	17,9731243
26	110	39	52,5	9,15	12,02185792	18,03278689
27	113	40,2	54	9,37	12,05976521	18,08964781
28	116	41,4	55,5	9,59	12,09593326	18,1438999
29	119	42,6	57	9,81	12,1304791	18,19571865
30	122	43,8	58,5	10,03	12,16350947	18,24526421

Damage by Hungry Worm	N. of hits to die by Hungry Worm	N. of hits to die by Hungry Worm [with armor on]	Damage by Swarm	N. of hits to die by Swarm	N. of hits to die by Swarm [with armor on]
7,65	4,575163399	6,862745098	3,15	11,11111111	16,66666667
8,27	4,594921403	6,892382104	3,37	11,27596439	16,91394659
8,89	4,61192351	6,917885264	3,59	11,42061281	17,13091922
9,51	4,626708728	6,940063091	3,81	11,54855643	17,32283465
10,13	4,639684107	6,95952616	4,03	11,66253102	17,49379653
10,75	4,651162791	6,976744186	4,25	11,76470588	17,64705882
11,37	4,661389622	6,992084433	4,47	11,85682327	17,7852349
11,99	4,670558799	7,005838198	4,69	11,94029851	17,91044776
12,61	4,678826328	7,018239492	4,91	12,01629328	18,02443992
13,23	4,686318972	7,029478458	5,13	12,08576998	18,12865497
13,85	4,693140794	7,039711191	5,35	12,14953271	18,22429907
14,47	4,699378023	7,049067035	5,57	12,20825853	18,31238779
15,09	4,705102717	7,057654076	5,79	12,26252159	18,39378238
15,71	4,710375557	7,065563335	6,01	12,31281198	18,46921797
16,33	4,71524801	7,072872015	6,23	12,35955056	18,53932584
16,95	4,719764012	7,079646018	6,45	12,40310078	18,60465116
17,57	4,723961298	7,085941946	6,67	12,44377811	18,66566717
18,19	4,727872457	7,091808686	6,89	12,48185776	18,72278665
18,81	4,731525784	7,097288676	7,11	12,51758087	18,77637131
19,43	4,73494596	7,10241894	7,33	12,55115962	18,82673943
20,05	4,738154613	7,10723192	7,55	12,58278146	18,87417219
20,67	4,741170779	7,111756168	7,77	12,61261261	18,91891892
21,29	4,744011273	7,116016909	7,99	12,640801	18,9612015
21,91	4,746691009	7,120036513	8,21	12,66747868	19,00121803
22,53	4,749223258	7,123834887	8,43	12,69276394	19,03914591
23,15	4,75161987	7,127429806	8,65	12,71676301	19,07514451
23,77	4,75389146	7,13083719	8,87	12,73957159	19,10935738
24,39	4,75604756	7,134071341	9,09	12,76127613	19,14191419
25,01	4,758096761	7,137145142	9,31	12,78195489	19,17293233
25,63	4,76004682	7,14007023	9,53	12,80167891	19,20251836

Damage by Tank	N. of hits to die by Tank	N. of hits to die by Tank [with armor on]	Damage by Bear Trap	Damage by Toxic Cloud
5,65	6,194690265	9,292035398	3,65	2,65
6,07	6,26029654	9,390444811	3,87	2,37
6,49	6,317411402	9,476117103	4,09	2,59
6,91	6,367583213	9,551374819	4,31	2,81
7,33	6,412005457	9,618008186	4,53	3,03
7,75	6,451612903	9,677419355	4,75	3,25
8,17	6,487148103	9,730722154	4,97	3,47
8,59	6,519208382	9,778812573	5,19	3,69
9,01	6,548279689	9,822419534	5,41	3,91
9,43	6,5747614	9,8621421	5,63	4,13
9,85	6,598984772	9,898477157	5,85	4,35
10,27	6,621226874	9,931840312	6,07	4,57
10,69	6,641721235	9,962581852	6,29	4,79
11,11	6,660666067	9,9909991	6,51	5,01
11,53	6,678230703	10,01734605	6,73	5,23
11,95	6,694560669	10,041841	6,95	5,45
12,37	6,70978173	10,06467259	7,17	5,67
12,79	6,724003127	10,08600469	7,39	5,89
13,21	6,737320212	10,10598032	7,61	6,11
13,63	6,749816581	10,12472487	7,83	6,33
14,05	6,761565836	10,14234875	8,05	6,55
14,47	6,772633034	10,15894955	8,27	6,77
14,89	6,78307589	10,17461383	8,49	6,99
15,31	6,792945787	10,18941868	8,71	7,21
15,73	6,80228862	10,20343293	8,93	7,43
16,15	6,811145511	10,21671827	9,15	7,65
16,57	6,81955341	10,22933011	9,37	7,87
16,99	6,827545615	10,24131842	9,59	8,09
17,41	6,835152211	10,25272832	9,81	8,31
17,83	6,842400449	10,26360067	10,03	8,53

- **Gladiators objects**

- **Armor**

The armor is one of the objects that are thrown into the arena from the public, under certain condition (see paragraph about the IA). Its function, both for the Gladiator woman and man, is to provide a bonus (1/3 of the health) to their life. So it's an object that absorbs enemy's shocks in such way that they don't influence the status of

user's health. Once the armor has absorbed the blows necessary to break itself, the character's health is again at risk.

Level (Gladiator)	Armor Gladiator Man (give more)	Armor Gladiator Woman (give more)
1	16	17,5
2	17,5	19
3	19	20,5
4	20,5	22
5	22	23,5
6	23,5	25
7	25	26,5
8	26,5	28
9	28	29,5
10	29,5	31
11	31	32,5
12	32,5	34
13	34	35,5
14	35,5	37
15	37	38,5
16	38,5	40
17	40	41,5
18	41,5	43
19	43	44,5
20	44,5	46
21	46	47,5
22	47,5	49
23	49	50,5
24	50,5	52
25	52	53,5
26	53,5	55
27	55	56,5
28	56,5	58
29	58	59,5
30	59,5	61

#### ▪ Medipack

The medipack is another object thrown from the public under certain condition. Its function, both for the Gladiator woman and man, is to restore 1/2 of the character's health when he/her pick it from the ground.

Level (Gladiator)	Medipack Gladiator Man (restore)	Medipack Gladiator Woman (restore)
1	10,66666667	11,66666667
2	11,66666667	12,66666667
3	12,66666667	13,66666667
4	13,66666667	14,66666667
5	14,66666667	15,66666667
6	15,66666667	16,66666667
7	16,66666667	17,66666667
8	17,66666667	18,66666667
9	18,66666667	19,66666667
10	19,66666667	20,66666667
11	20,66666667	21,66666667
12	21,66666667	22,66666667
13	22,66666667	23,66666667
14	23,66666667	24,66666667
15	24,66666667	25,66666667
16	25,66666667	26,66666667
17	26,66666667	27,66666667
18	27,66666667	28,66666667
19	28,66666667	29,66666667
20	29,66666667	30,66666667
21	30,66666667	31,66666667
22	31,66666667	32,66666667
23	32,66666667	33,66666667
24	33,66666667	34,66666667
25	34,66666667	35,66666667
26	35,66666667	36,66666667
27	36,66666667	37,66666667
28	37,66666667	38,66666667
29	38,66666667	39,66666667
30	39,66666667	40,66666667

- **Wrench**

The wrench is the basic weapon for the male Gladiator, always available. Its characteristic is to do some damage to enemies that approach him.

Level (Gladiator)	Wrench (damage)
1	5,5
2	6
3	6,5
4	7
5	7,5
6	8
7	8,5
8	9
9	9,5
10	10
11	10,5
12	11
13	11,5
14	12
15	12,5
16	13
17	13,5
18	14
19	14,5
20	15
21	15,5
22	16
23	16,5
24	17
25	17,5
26	18
27	18,5
28	19
29	19,5
30	20

#### ▪ Gun

The gun is a ranged weapon usable by both Gladiators. It is considered a special weapon that is not part of basic equipment of the character. Like armors and medipacks, even this type of weapon is launched by the public. Unlike melee weapons, the gun does more damage.

Level (Gladiator)	Gun (damage)
1	7
2	7,7
3	8,4
4	9,1
5	9,8
6	10,5
7	11,2
8	11,9
9	12,6
10	13,3
11	14
12	14,7
13	15,4
14	16,1
15	16,8
16	17,5
17	18,2
18	18,9
19	19,6
20	20,3
21	21
22	21,7
23	22,4
24	23,1
25	23,8
26	24,5
27	25,2
28	25,9
29	26,6
30	27,3

- **Grenade**

The grenade is a weapon with a certain area of explosion. It is considered as a throwable object from both the Gladiators but it's always the public to decide how to provide it, in support of them. Its amount of damage is slightly smaller than the gun but, having an area of action, we can also affect multiple enemies at once.

Level (Gladiator)	Grenade (damage)
1	6,5
2	7,1
3	7,7
4	8,3
5	8,9
6	9,5
7	10,1
8	10,7
9	11,3
10	11,9
11	12,5
12	13,1
13	13,7
14	14,3
15	14,9
16	15,5
17	16,1
18	16,7
19	17,3
20	17,9
21	18,5
22	19,1
23	19,7
24	20,3
25	20,9
26	21,5
27	22,1
28	22,7
29	23,3
30	23,9

- **Strategist**

Scientist and battles planner, the strategist is for many an unknown individual able to play as he pleases with the lives of the Gladiators.

Due to its large technological knowledge is able to manipulate and materialize at will creatures radically mutated from nuclear war.

The Strategist has two essential attributes useful for positioning elements in the battlefield:

- Deck (set of enemies and traps in the form of cards)
- Electrical pulse (amount of energy needed to spawn enemies and traps)

He performs an important action: brings up the NPCs within the arena in the points that he decided.

The electrical pulse of the Strategist is recharged of 10 pulses every 30 seconds, in particular, 1 pulse every 3 seconds.

The Strategist starts each match with 5 pulses, so in total he will have 35 pulses in 90 seconds.

Each monster or trap used by the Strategist have a certain cost in pulses.

Considering that each single pulse returns in the bar every 3 seconds, he will not be able to spawn the creatures or objects until he will have the right amount of pulses.

In addition, each card has its regeneration time once used, to add up to the total recovery time of pulses. For this reason, in 90 seconds of match, the Strategist can use a certain card a maximum number of times.

The following tables explain these features for every creature and object implemented in the prototype:

<b>Maimed Mutant</b>		
<b>Pulse Cost</b>	<b>Time Regeneration</b>	<b>Total Mutants in 90 seconds</b>
3	3 seconds	10

<b>Swarm</b>		
<b>Pulse Cost</b>	<b>Time Regeneration</b>	<b>Total Swarms in 90 seconds</b>
4	4 seconds	8

<b>Hungry Worm</b>		
<b>Pulse Cost</b>	<b>Time Regeneration</b>	<b>Total Hungry Worms in 90 seconds</b>
6	6 seconds	5

<b>Strong Mutant</b>		
<b>Pulse Cost</b>	<b>Time Regeneration</b>	<b>Total Strong Mutants in 90 seconds</b>
8	8 seconds	4

<b>Bear Trap</b>			
<b>Pulse Cost</b>	<b>Time Regeneration</b>	<b>Total Bear Traps in 90 seconds</b>	<b>Time of Life</b>
2	3 seconds	15	5 Seconds

<b>Level (Strategist)</b>	<b>Bear Trap (damage)</b>
1	5
2	5,4
3	5,8
4	6,2
5	6,6
6	7
7	7,4
8	7,8
9	8,2
10	8,6
11	9
12	9,4
13	9,8
14	10,2
15	10,6
16	11
17	11,4
18	11,8
19	12,2
20	12,6
21	13
22	13,4
23	13,8
24	14,2
25	14,6
26	15
27	15,4
28	15,8
29	16,2
30	16,6

**Toxic Cloud**

Pulse Cost	Time Regeneration	Total Toxic Clouds in 90 seconds	Time of Life
5	5 seconds	6	10 seconds

Level (Strategist)	Toxic Cloud (damage)
1	4
2	3,9
3	4,3
4	4,7
5	5,1
6	5,5
7	5,9
8	6,3
9	6,7
10	7,1
11	7,5
12	7,9
13	8,3
14	8,7
15	9,1
16	9,5
17	9,9
18	10,3
19	10,7
20	11,1
21	11,5
22	11,9
23	12,3
24	12,7
25	13,1
26	13,5
27	13,9
28	14,3
29	14,7
30	15,1

- Strategist's objects

- Tribbles

As well as the public may decide to help the Gladiator, the same way can be used to help the Strategist. In fact, according with specific conditions, the public may decide to throw into the field some tribbles to complicate the survival of the Gladiator. Their damage is not much considering the amount of enemies that the Strategist can spawn in the arena.

Level (Strategist)	Tribbles (damage)
1	2
2	2,4
3	2,8
4	3,2
5	3,6
6	4
7	4,4
8	4,8
9	5,2
10	5,6
11	6
12	6,4
13	6,8
14	7,2
15	7,6
16	8
17	8,4
18	8,8
19	9,2
20	9,6
21	10
22	10,4
23	10,8
24	11,2
25	11,6
26	12
27	12,4
28	12,8
29	13,2
30	13,6

## 6.4 NPCs

- **The Public**

The Public is a very important component for the progress of the match. Composed of commoners and clan-leaders, is able to participate actively to the battle by providing aid for the Gladiator and/or Strategist. Its only purpose is to continue the conflict as much as possible by helping the part that most need.



- **Mechanical Mutant**

Humanoid whose body parts have been replaced with mechanical parts.



- **Maimed Mutant**

Humanoid whose body parts have been removed, and in some cases replaced with makeshift.

Figure 42 - Mechanical mutant

Figure 43 - Maimed mutant

Level (Strategist)	Health	Resistance	Damage
1	9	4	5
2	10,2	5,2	5,4
3	11,4	6,4	5,8
4	12,6	7,6	6,2
5	13,8	8,8	6,6
6	15	10	7
7	16,2	11,2	7,4
8	17,4	12,4	7,8
9	18,6	13,6	8,2
10	19,8	14,8	8,6
11	21	16	9
12	22,2	17,2	9,4
13	23,4	18,4	9,8
14	24,6	19,6	10,2
15	25,8	20,8	10,6
16	27	22	11
17	28,2	23,2	11,4
18	29,4	24,4	11,8
19	30,6	25,6	12,2
20	31,8	26,8	12,6
21	33	28	13
22	34,2	29,2	13,4
23	35,4	30,4	13,8
24	36,6	31,6	14,2
25	37,8	32,8	14,6
26	39	34	15
27	40,2	35,2	15,4
28	41,4	36,4	15,8
29	42,6	37,6	16,2
30	43,8	38,8	16,6

Damage by Gladiator + wrench	N. of hits to die by Gladiator + wrench	Damage by Gladiator + gun	N. of hits to die by Gladiator + gun	Damage by Gladiator + grenade	N. of hits to die by Gladiator + grenade
3,9	2,307692308	5,8	1,551724138	5,3	1,698113208
3,92	2,602040816	6,14	1,661237785	5,54	1,841155235
3,94	2,893401015	6,48	1,759259259	5,78	1,972318339
3,96	3,181818182	6,82	1,847507331	6,02	2,093023256
3,98	3,467336683	7,16	1,927374302	6,26	2,204472843
4	3,75	7,5	2	6,5	2,307692308
4,02	4,029850746	7,84	2,066326531	6,74	2,403560831
4,04	4,306930693	8,18	2,127139364	6,98	2,492836676
4,06	4,581280788	8,52	2,183098592	7,22	2,576177285
4,08	4,852941176	8,86	2,23476298	7,46	2,654155496
4,1	5,12195122	9,2	2,282608696	7,7	2,727272727
4,12	5,388349515	9,54	2,327044025	7,94	2,795969773
4,14	5,652173913	9,88	2,368421053	8,18	2,860635697
4,16	5,913461538	10,22	2,40704501	8,42	2,921615202

4,18	6,172248804	10,56	2,443181818	8,66	2,979214781
4,2	6,428571429	10,9	2,47706422	8,9	3,033707865
4,22	6,682464455	11,24	2,508896797	9,14	3,085339168
4,24	6,933962264	11,58	2,538860104	9,38	3,134328358
4,26	7,183098592	11,92	2,567114094	9,62	3,180873181
4,28	7,429906542	12,26	2,593800979	9,86	3,22515213
4,3	7,674418605	12,6	2,619047619	10,1	3,267326733
4,32	7,916666667	12,94	2,642967543	10,34	3,30754352
4,34	8,156682028	13,28	2,665662651	10,58	3,345935728
4,36	8,394495413	13,62	2,68722467	10,82	3,382624769
4,38	8,630136986	13,96	2,70773639	11,06	3,417721519
4,4	8,863636364	14,3	2,727272727	11,3	3,451327434
4,42	9,095022624	14,64	2,745901639	11,54	3,483535529
4,44	9,324324324	14,98	2,763684913	11,78	3,514431239
4,46	9,551569507	15,32	2,780678851	12,02	3,544093178
4,48	9,776785714	15,66	2,796934866	12,26	3,572593801



Figure 44 - Strong mutant

- **Strong Mutant (Tank)**

Humanoid whose dimensions are intentionally exaggerated and his strength was intentionally doubled. On the battlefield is the strongest mutant.

Level (Strategist)	Health	Resistance	Damage
1	18	11	7
2	19,6	12,6	7,6
3	21,2	14,2	8,2
4	22,8	15,8	8,8
5	24,4	17,4	9,4
6	26	19	10
7	27,6	20,6	10,6
8	29,2	22,2	11,2
9	30,8	23,8	11,8
10	32,4	25,4	12,4
11	34	27	13
12	35,6	28,6	13,6
13	37,2	30,2	14,2
14	38,8	31,8	14,8

15	40,4	33,4	15,4
16	42	35	16
17	43,6	36,6	16,6
18	45,2	38,2	17,2
19	46,8	39,8	17,8
20	48,4	41,4	18,4
21	50	43	19
22	51,6	44,6	19,6
23	53,2	46,2	20,2
24	54,8	47,8	20,8
25	56,4	49,4	21,4
26	58	51	22
27	59,6	52,6	22,6
28	61,2	54,2	23,2
29	62,8	55,8	23,8
30	64,4	57,4	24,4

Damage by Gladiator + wrench	N. of hits to die by Gladiator + wrench	Damage by Gladiator + gun	N. of hits to die by Gladiator + gun	Damage by Gladiator + grenade	N. of hits to die by Gladiator + grenade
2,2	8,181818182	2,6	6,923076923	3,75	4,8
2,22	8,828828829	2,66	7,368421053	3,95	4,962025316
2,24	9,464285714	2,72	7,794117647	4,15	5,108433735
2,26	10,08849558	2,78	8,201438849	4,35	5,24137931
2,28	10,70175439	2,84	8,591549296	4,55	5,362637363
2,3	11,30434783	2,9	8,965517241	4,75	5,473684211
2,32	11,89655172	2,96	9,324324324	4,95	5,575757576
2,34	12,47863248	3,02	9,668874172	5,15	5,669902913
2,36	13,05084746	3,08	10	5,35	5,757009346
2,38	13,61344538	3,14	10,31847134	5,55	5,837837838
2,4	14,16666667	3,2	10,625	5,75	5,913043478
2,42	14,7107438	3,26	10,9202454	5,95	5,983193277
2,44	15,24590164	3,32	11,20481928	6,15	6,048780488
2,46	15,77235772	3,38	11,47928994	6,35	6,11023622
2,48	16,29032258	3,44	11,74418605	6,55	6,167938931
2,5	16,8	3,5	12	6,75	6,222222222
2,52	17,3015873	3,56	12,24719101	6,95	6,273381295
2,54	17,79527559	3,62	12,48618785	7,15	6,321678322
2,56	18,28125	3,68	12,7173913	7,35	6,367346939
2,58	18,75968992	3,74	12,94117647	7,55	6,410596026
2,6	19,23076923	3,8	13,15789474	7,75	6,451612903
2,62	19,69465649	3,86	13,36787565	7,95	6,490566038
2,64	20,15151515	3,92	13,57142857	8,15	6,527607362
2,66	20,60150376	3,98	13,76884422	8,35	6,562874251
2,68	21,04477612	4,04	13,96039604	8,55	6,596491228
2,7	21,48148148	4,1	14,14634146	8,75	6,628571429
2,72	21,91176471	4,16	14,32692308	8,95	6,659217877
2,74	22,33576642	4,22	14,50236967	9,15	6,68852459
2,76	22,75362319	4,28	14,6728972	9,35	6,71657754
2,78	23,16546763	4,34	14,83870968	9,55	6,743455497

- **Hungry Worm**

Carnivore worm whose size is radically increased due to radiation. Lives underground and grabs the enemy attacking with its mouth from the bottom up.

Level (Strategist)	Health	Resistance	Damage
1	31,5	8	9
2	33,1	9,6	9,8
3	34,7	11,2	10,6
4	36,3	12,8	11,4
5	37,9	14,4	12,2
6	39,5	16	13
7	41,1	17,6	13,8
8	42,7	19,2	14,6
9	44,3	20,8	15,4
10	45,9	22,4	16,2
11	47,5	24	17
12	49,1	25,6	17,8
13	50,7	27,2	18,6
14	52,3	28,8	19,4
15	53,9	30,4	20,2
16	55,5	32	21
17	57,1	33,6	21,8
18	58,7	35,2	22,6
19	60,3	36,8	23,4
20	61,9	38,4	24,2
21	63,5	40	25
22	65,1	41,6	25,8
23	66,7	43,2	26,6
24	68,3	44,8	27,4
25	69,9	46,4	28,2
26	71,5	48	29
27	73,1	49,6	29,8
28	74,7	51,2	30,6
29	76,3	52,8	31,4
30	77,9	54,4	32,2

Damage by Gladiator + wrench	N. of hits to die by Gladiator + wrench	Damage by Gladiator + gun	N. of hits to die by Gladiator + gun	Damage by Gladiator + grenade	N. of hits to die by Gladiator + grenade
3,1	10,16129032	4,6	6,847826087	4,1	7,682926829
3,12	10,60897436	4,82	6,867219917	4,22	7,843601896
3,14	11,05095541	5,04	6,884920635	4,34	7,995391705
3,16	11,48734177	5,26	6,901140684	4,46	8,139013453
3,18	11,91823899	5,48	6,916058394	4,58	8,27510917

3,2	12,34375	5,7	6,929824561	4,7	8,404255319
3,22	12,76397516	5,92	6,942567568	4,82	8,526970954
3,24	13,17901235	6,14	6,954397394	4,94	8,643724696
3,26	13,58895706	6,36	6,965408805	5,06	8,754940711
3,28	13,99390244	6,58	6,975683891	5,18	8,861003861
3,3	14,39393939	6,8	6,985294118	5,3	8,962264151
3,32	14,78915663	7,02	6,994301994	5,42	9,05904059
3,34	15,17964072	7,24	7,002762431	5,54	9,151624549
3,36	15,56547619	7,46	7,010723861	5,66	9,240282686
3,38	15,94674556	7,68	7,018229167	5,78	9,325259516
3,4	16,32352941	7,9	7,025316456	5,9	9,406779661
3,42	16,69590643	8,12	7,032019704	6,02	9,485049834
3,44	17,06395349	8,34	7,038369305	6,14	9,560260586
3,46	17,42774566	8,56	7,044392523	6,26	9,632587859
3,48	17,78735632	8,78	7,050113895	6,38	9,702194357
3,5	18,14285714	9	7,0555555556	6,5	9,769230769
3,52	18,49431818	9,22	7,060737527	6,62	9,833836858
3,54	18,84180791	9,44	7,065677966	6,74	9,896142433
3,56	19,18539326	9,66	7,070393375	6,86	9,956268222
3,58	19,52513966	9,88	7,074898785	6,98	10,01432665
3,6	19,86111111	10,1	7,079207921	7,1	10,07042254
3,62	20,19337017	10,32	7,083333333	7,22	10,12465374
3,64	20,52197802	10,54	7,087286528	7,34	10,17711172
3,66	20,84699454	10,76	7,091078067	7,46	10,22788204
3,68	21,16847826	10,98	7,094717668	7,58	10,27704485

- **Swarm**

Swarm of flying insects, genetically mutated, able to attack the enemy with their poisonous sting.

Level (Strategist)	Health	Resistance	Damage
1	13,5	7	4,5
2	14,75	8,3	4,9
3	16	9,6	5,3
4	17,25	10,9	5,7
5	18,5	12,2	6,1
6	19,75	13,5	6,5
7	21	14,8	6,9
8	22,25	16,1	7,3
9	23,5	17,4	7,7
10	24,75	18,7	8,1
11	26	20	8,5
12	27,25	21,3	8,9
13	28,5	22,6	9,3
14	29,75	23,9	9,7
15	31	25,2	10,1
16	32,25	26,5	10,5
17	33,5	27,8	10,9
18	34,75	29,1	11,3
19	36	30,4	11,7
20	37,25	31,7	12,1

21	38,5	33	12,5
22	39,75	34,3	12,9
23	41	35,6	13,3
24	42,25	36,9	13,7
25	43,5	38,2	14,1
26	44,75	39,5	14,5
27	46	40,8	14,9
28	47,25	42,1	15,3
29	48,5	43,4	15,7
30	49,75	44,7	16,1

Damage by Gladiator + wrench	N. of hits to die by Gladiator + wrench	Damage by Gladiator + gun	N. of hits to die by Gladiator + gun	Damage by Gladiator + grenade	N. of hits to die by Gladiator + grenade
3,4	3,970588235	3,15	4,285714286	5,45	2,47706422
3,51	4,202279202	3,135	4,704944179	5,855	2,519214347
3,62	4,419889503	3,12	5,128205128	6,26	2,555910543
3,73	4,624664879	3,105	5,555555556	6,665	2,588147037
3,84	4,817708333	3,09	5,987055016	7,07	2,61669024
3,95	5	3,075	6,422764228	7,475	2,642140468
4,06	5,172413793	3,06	6,862745098	7,88	2,664974619
4,17	5,335731415	3,045	7,307060755	8,285	2,685576343
4,28	5,490654206	3,03	7,755775578	8,69	2,704257768
4,39	5,637813212	3,015	8,208955224	9,095	2,721275426
4,5	5,777777778	3	8,666666667	9,5	2,736842105
4,61	5,911062907	2,985	9,128978224	9,905	2,75113579
4,72	6,038135593	2,97	9,595959596	10,31	2,764306499
4,83	6,15942029	2,955	10,0676819	10,715	2,776481568
4,94	6,275303644	2,94	10,54421769	11,12	2,787769784
5,05	6,386138614	2,925	11,02564103	11,525	2,798264642
5,16	6,492248062	2,91	11,51202749	11,93	2,80804694
5,27	6,593927894	2,895	12,00345423	12,335	2,817186867
5,38	6,691449814	2,88	12,5	12,74	2,825745683
5,49	6,785063752	2,865	13,0017452	13,145	2,833777102
5,6	6,875	2,85	13,50877193	13,55	2,841328413
5,71	6,961471103	2,835	14,02116402	13,955	2,848441419
5,82	7,04467354	2,82	14,53900709	14,36	2,855153203
5,93	7,124789207	2,805	15,06238859	14,765	2,861496783
6,04	7,201986755	2,79	15,59139785	15,17	2,867501648
6,15	7,276422764	2,775	16,12612613	15,575	2,873194222
6,26	7,348242812	2,76	16,66666667	15,98	2,878598248
6,37	7,417582418	2,745	17,21311475	16,385	2,883735124
6,48	7,484567901	2,73	17,76556777	16,79	2,888624181
6,59	7,549317147	2,715	18,32412523	17,195	2,893282931

- **Mechanical spider**

Many old world species have become extinct by now. On the basis of the information collected over the centuries, some animals have been reconstructed in appearance and behaviour. These include the mechanical spider. It has the ability to attack and injure the enemy with its large paws, larger than normal...

- **Mechanical lion**

Another extinct species for centuries is the lion. Rebuilt mechanically, has much of the behaviour of the predator from the past, capable of eating large amounts of meat from other mammals.

The mechanical lion, however, cannot eat but only hurt to death his enemy without ingesting the body.

- **Scorpion**

The Scorpions are animals typical of desert environments, especially poisonous ones. Thanks to their ability to adapt, they managed to survive the nuclear and thrive after disaster. Thanks to experiments carried out by strategists they have become a very dangerous weapon of the arena.

- **Snake**

Particularly venomous animals, desert snakes can withstand high temperatures and this allowed them to survive. Put then in captivity, the way they hunt and eat prey has been exploited for fighting in arenas.

### 6.4.1 Artificial Intelligence

Each component of artificial intelligence used in this game has some special features. Excluding the public, all other NPCs have a behavior described by a finite state machine and use an algorithm of A\*, to follow the Gladiator.

- **The Role of the Public**

In C.L.A.N.G. the Public **is not** an element of pure contour, but represents an NPC with its own intelligence. It is able to decide, under certain conditions, if it must help the Gladiator or the Strategist.

We deliberately decided to reach out to the Gladiator, because referring it to a real situation, we know that, we feel a greater empathy for the fighter in trouble rather than a character not even visible in the arena.

To characterize this type of behavior we decided to use a Decision Tree.

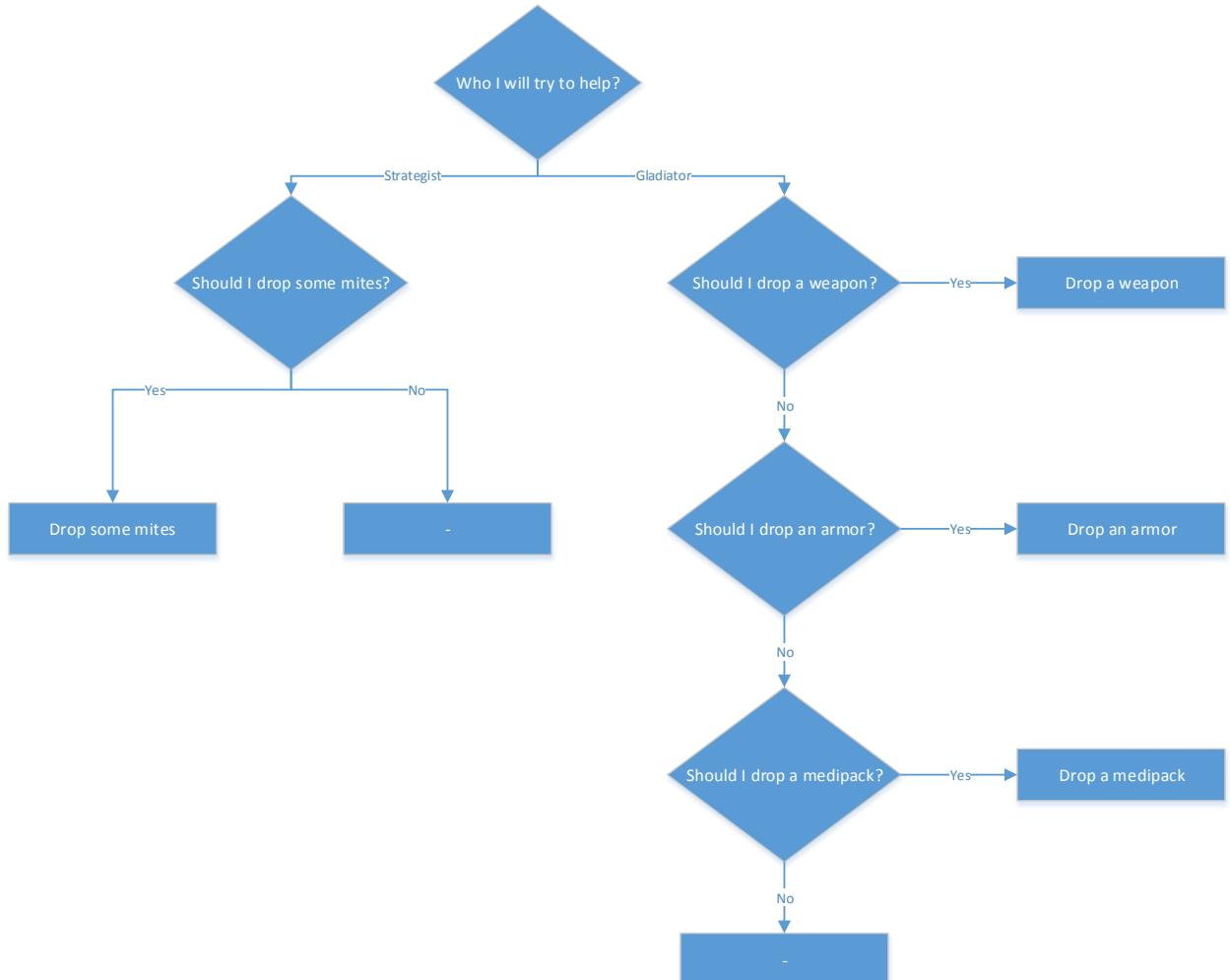


Figure 45 - Public decision tree

As you can see from the Tree, at the root node the public takes a big decision: which of the two sides help. To make this decision we make a check on the Gladiator's HP, in fact the chances to help the Strategist will be directly proportional to the Gladiator's life.

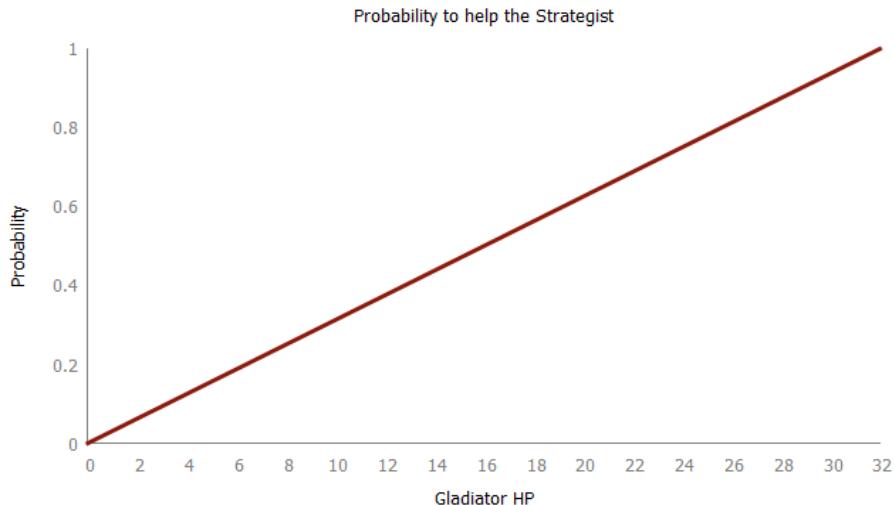


Figure 46 - Distribution of probability to help Gladiator or Strategist

$$P(x) = \frac{x}{32}$$

In fact, looking at the graph, you can see that if the Gladiator's life is at its maximum (32 HP) is also the maximum likelihood to help the Strategist. So if the Gladiator's life slowly decreases, the chance to help the Strategist will decrease accordingly.

If the public decides to help the Gladiator, the algorithms will perform a series of checks regarding: weapon, armor and health.

In particular, the first thing that is checked is if the Gladiator need a new weapon (a firearm or a grenade) in the arena. In fact, if there's no weapon collected in the arena, the public doesn't rise anything. Moreover, as long as the firearm is equipped and the firearm has the current integrity greater than or equal to half of total or, if he has a grenade, the public doesn't rise anything. Otherwise, there is a certain likelihood that one of it being launched.

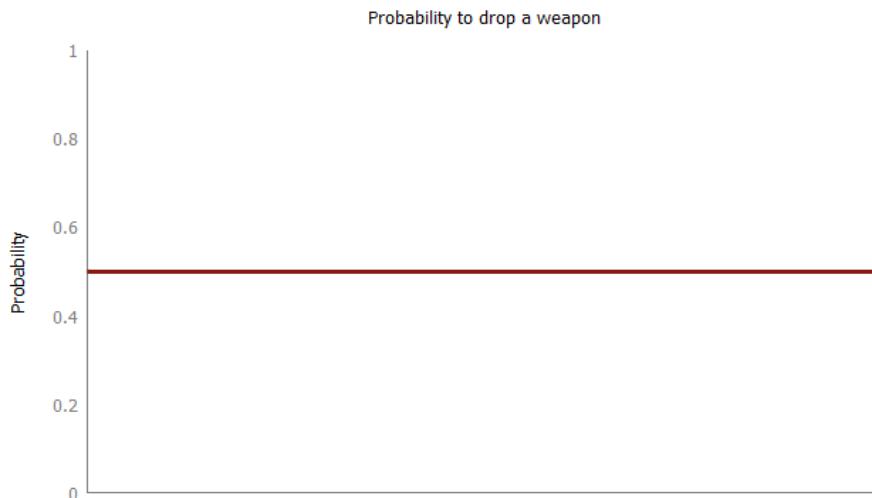


Figure 47 - Distribution of probability to drop a weapon

$$P(x) = 0,5$$

As we can see from the chart, in these case we opted for a constant probability distribution, in fact it will be constantly equal to 0,5.

In the case of the weapon is launched by the public, the algorithm starts from the root node after a certain number of seconds, otherwise continue to the next node.

The next node is the armor's node.

In this case if the Gladiator has the armor, this last one will not be raised by the public. Otherwise there is a likelihood to be launched.

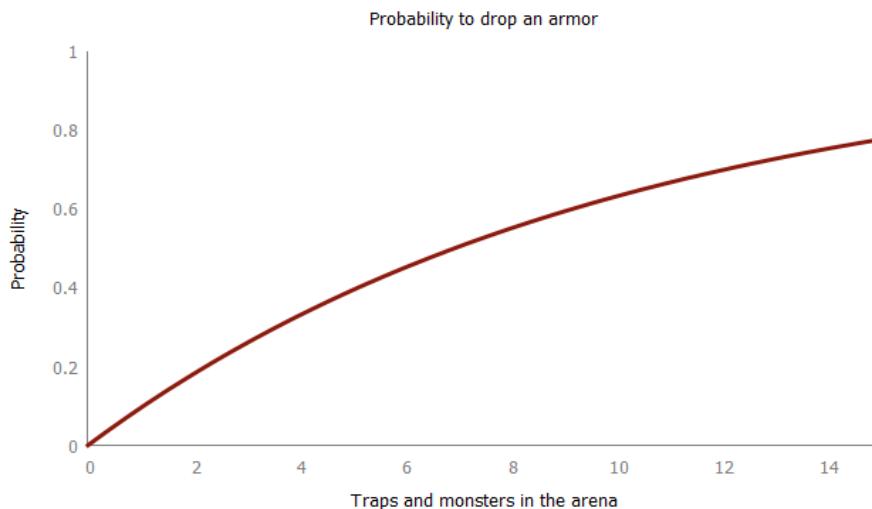


Figure 48 - Distribution of probability to drop an armor

$$P(x) = 1 - e^{-0,1x}$$

This probability depends to the number of traps and monsters on the field.

In the case of the armor is launched by the public, the algorithm starts from the root node after a certain number of seconds, otherwise continue to the next node.

The next node is the medipack's node.

In this case, a check is mad on the Gladiator's life. In fact, we can say that the probability to drop a Medipack is inversely proportional to the Gladiator's life up to a certain value.

After the Medipack is launched by the public, the algorithm starts from the root node after a certain number of seconds.

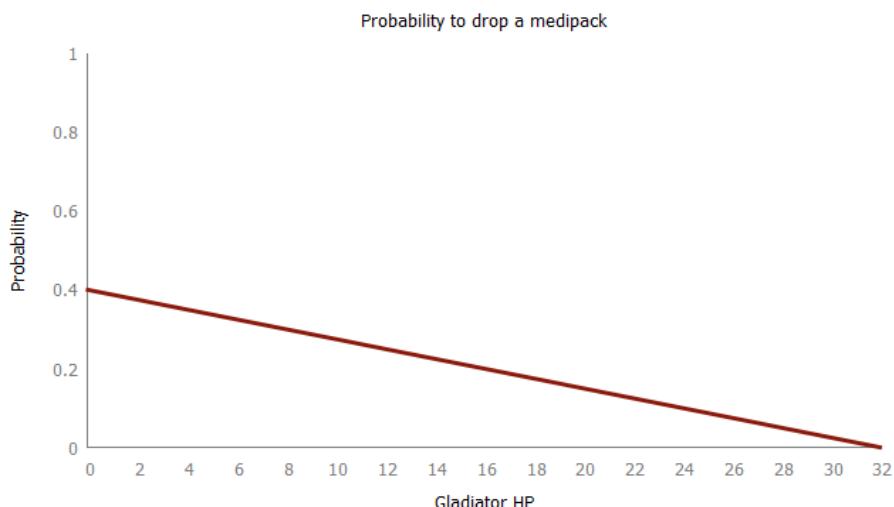


Figure 49 - Distribution of probability to drop a medipack

$$P(x) = 0,4 - \frac{0,4x}{32}$$

Returning to the root node and assuming the Public decides to help the Strategist instead of the Gladiator, a control over the amount of monsters and traps in the field will be made. If that number of monsters and traps is greater than a certain quantity, will not dropped anything in favour of the Strategist, otherwise there is a probability of 0.4 that some tribbles (mites) will be launched in the field.

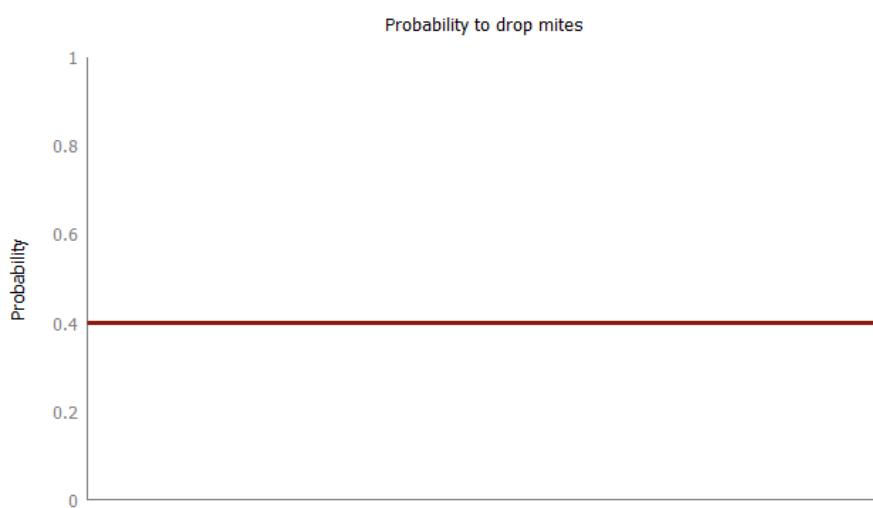
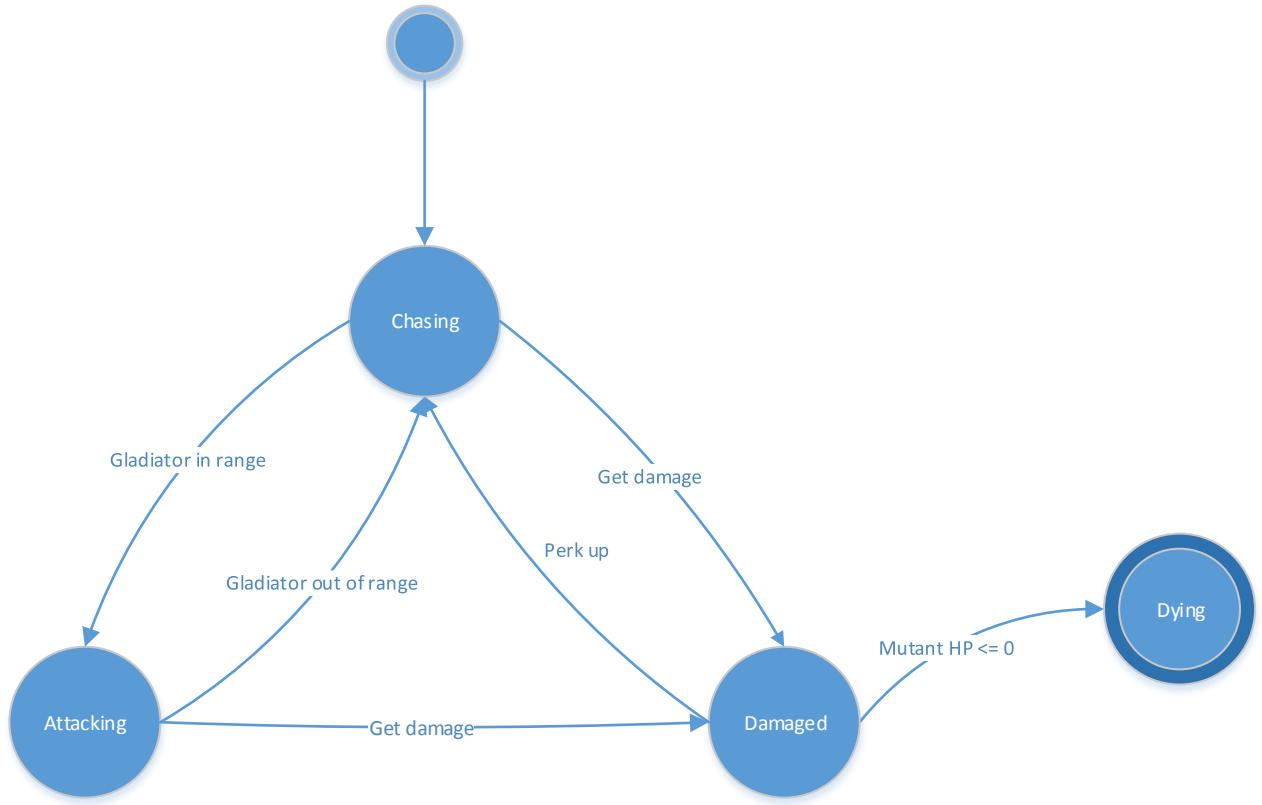


Figure 50 - Distribution of probability to drop mites

$$P(x) = 0,4$$

- **Maimed Mutant**



*Figure 51 - Maimed mutant finite state machine*

To describe the Maimed mutant's behaviour, we decided to use a Finite State Machine.

Initially the Mutant is in the state of “Chasing”; Once spawned from the Strategist, he chases the Gladiator.

Once the Gladiator is in his range, he passes to the “Attacking” state in which he will try to kill the player. From this last one state, it's possible to pass in two different states according to the conditions of the monster. In fact, if after the attack the Mutant gets some damage he will pass in the “Damaged” state, if the Gladiator is out of his range, he will pass in the “Chasing” state again.

From this last one state he can also pass in the “Damaged” state.

From the Damaged, if the monster's life is less or equal to zero, he will pass in the “Dying” state, otherwise, he can pass in the “Chasing” state again.

- Hungry Worm

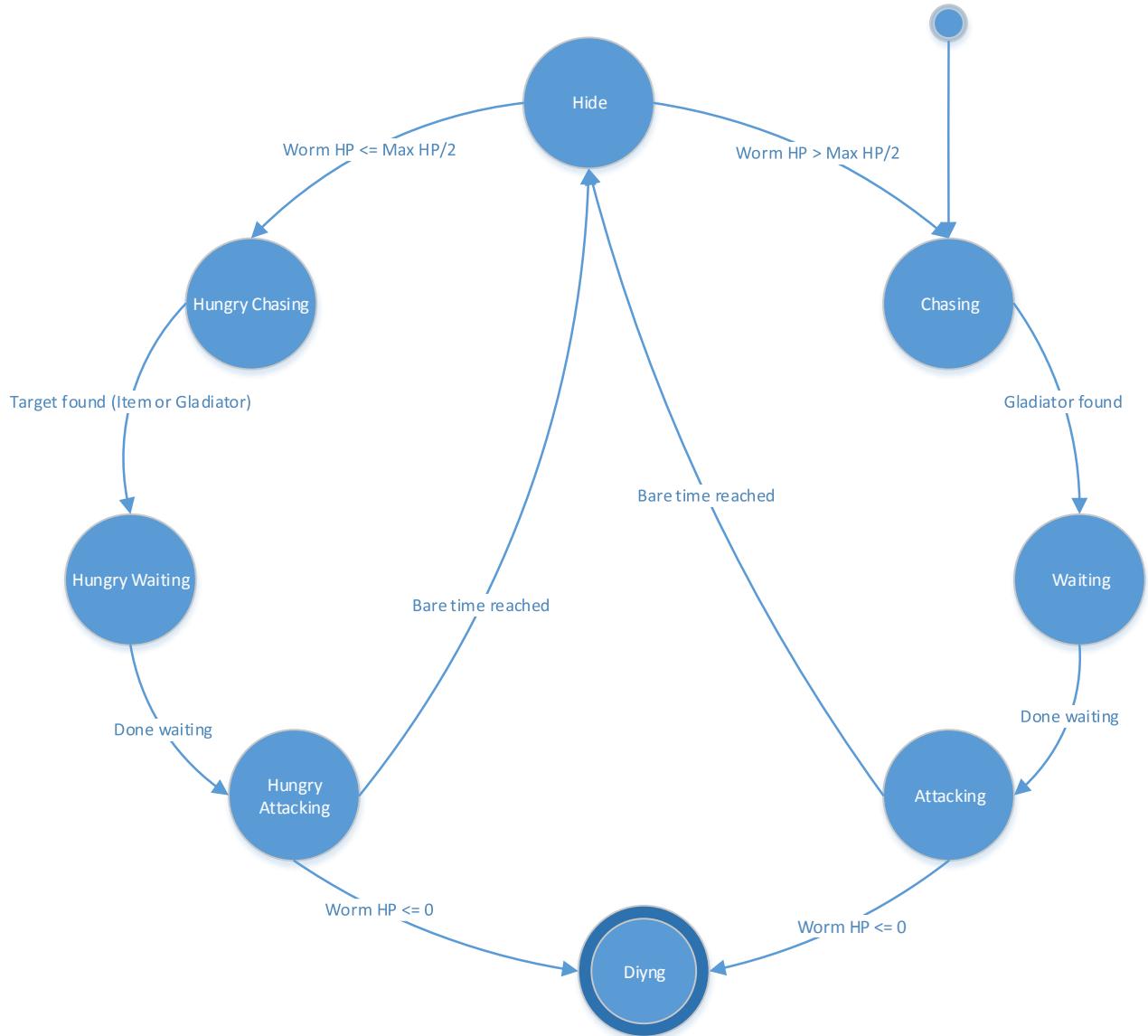
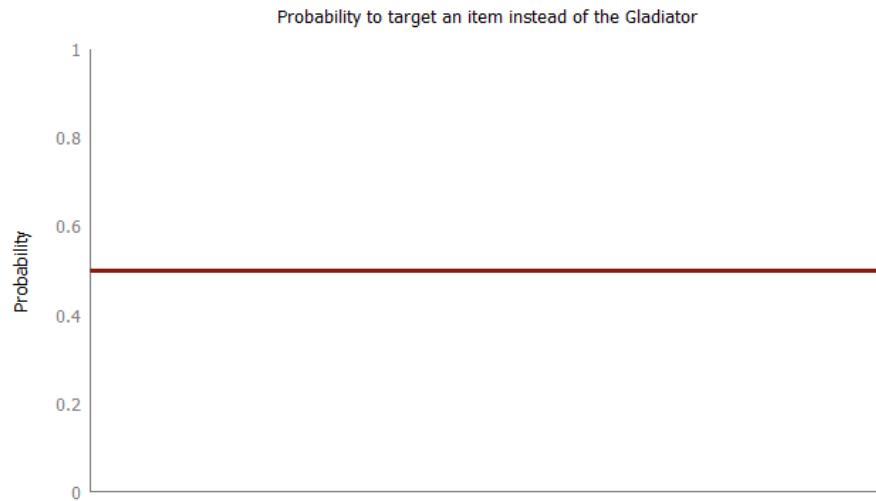


Figure 52 - Hungry Worm finite state machine

Another NPC that has an intelligence designed by us is the Hungry Worm. To describe its behaviour, we decided to use a Finite State Machine. Initially the Worm is in the state of “Chasing”; Once spawned from the Strategist, it chases the Gladiator from the underground. Once it finds the Gladiator, it passes to the “Waiting” state in which waits a few seconds before moving on to the next state, the “Attack”. Once the Worm is in this last state, it comes out of the ground and then wait some seconds before returning in the state of “Hide”. During this time, if its life drops below zero, it will go into the “Dying” state, disappearing from the scene. Returning in the “Hide” state, there are two ways: the Worm can go back in the “Chasing” state if its health is more than to the total life divided by 2, otherwise if its health is less than or equal to its total life divided by 2, it switches to the

status of “Hungry Chasing”. In this state the Worm will not only chase the Gladiator but it will chase objects like armors or medipacks. The Worm will decide to hit an object rather than the Gladiator according to a constant probability distribution, equal to 0,5.



*Figure 53 - Distribution of probability to target an item instead the Gladiator*

$$P(x) = 0,5$$

Once the Worm has chosen the target, it will go to the “Hungry Wait” state where the time to quit, unlike the simple “Waiting”, will be smaller. Subsequently it will pass in the state “Hungry Attack” doing greater damage compared to the damage mentioned above. After attacking, if its health will be less than or equal to 0 then it will pass in the Death’s state, otherwise will return to the state “Hide” after spending some time uncovered and vulnerable.

- **Strong Mutant (Tank)**

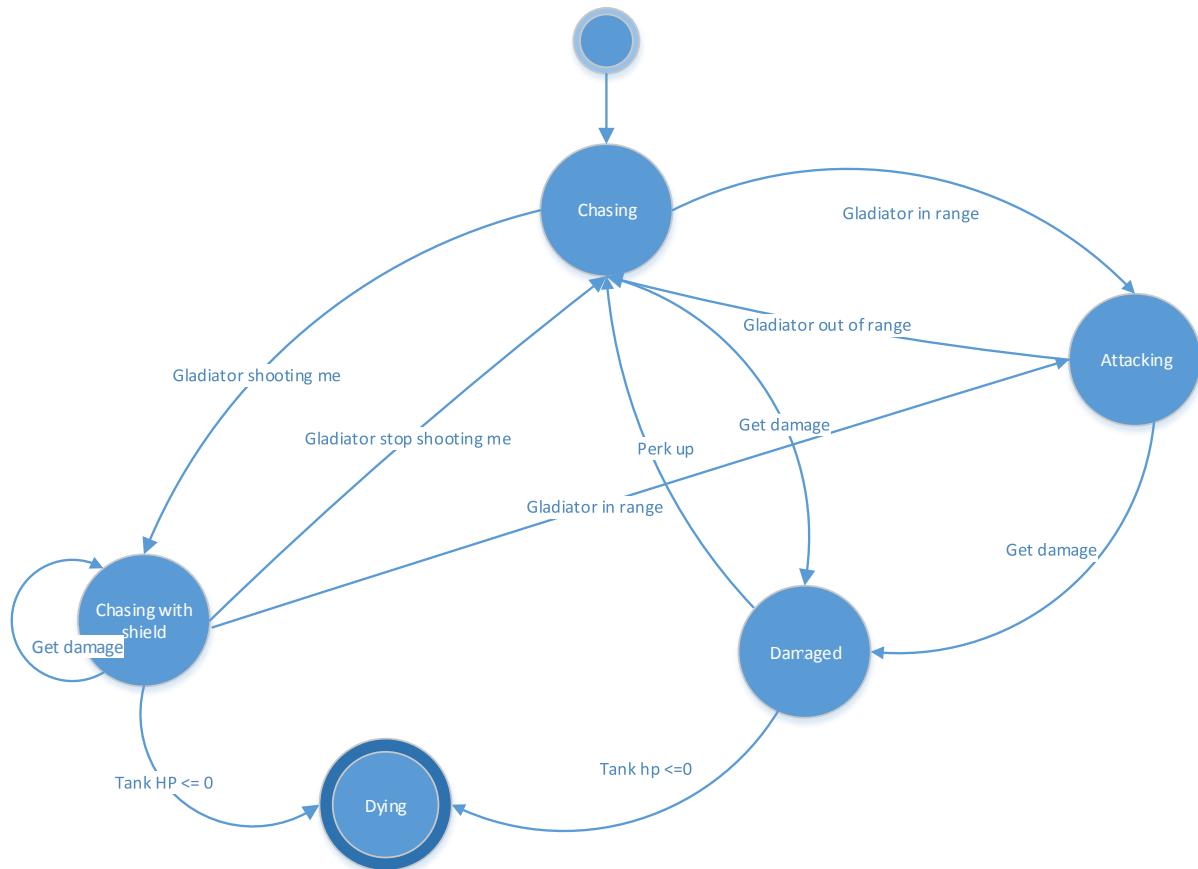


Figure 54 - Tank finite state machine

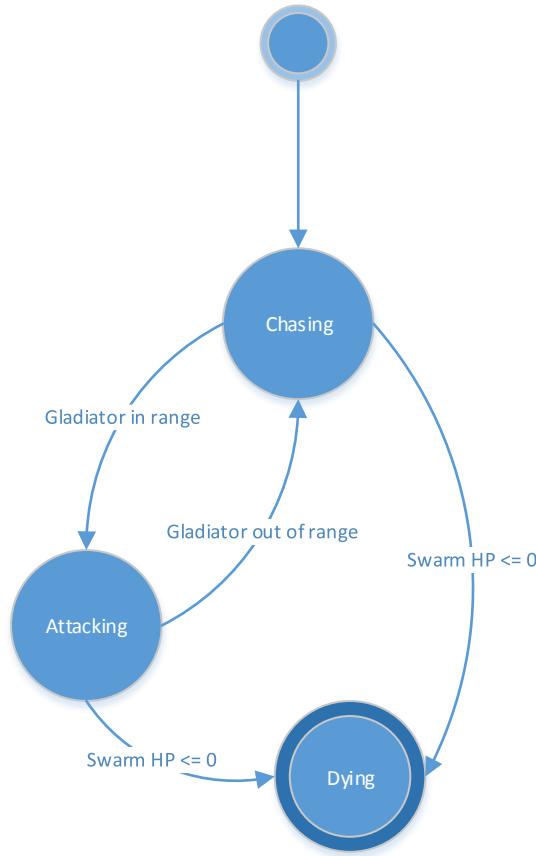
Another NPC that has an intelligence designed by us is the Strong Mutant (Tank). To describe his behaviour, we decided to use a Finite State Machine. Initially the Tank is in the state of “Chasing”; Once spawned from the Strategist, he chases the Gladiator.

Once the Gladiator is in his range, he passes to the “Attacking” state in which he will try to kill the player. From this last one state, it’s possible to pass in two different states according to the conditions of the monster. In fact, if the Tank gets some damage, he will pass in the “Damaged” state, otherwise if the Gladiator is out of his range, he will pass in the “Chasing” state again.

From the “Damaged” state, he can also pass in two different states: if his life is less or equal to zero, he will pass in the “Dying” state and then disappear from the scene, on the contrary, he will pass in the “Chasing” state again.

From this last one state, if the Gladiator begins to shoot him, he can also pass in the state of “Chasing with shield”. From here, if his health is less or equal to 0 then he will pass in the state of death, otherwise if the Gladiator will stop shooting him, so he will go back to chasing, or, if the Gladiator is in his range, he will pass in the “Attacking” state again. Despite the Tank has the shield, he may take equally damage.

- Swarm



As we said before, this NPC consists of a series of insects that move in groups, just like a flock. For this reason, we decided to use the *Flocking Behavior Algorithm*.

In the natural world, organisms exhibit certain behaviors when traveling in **groups**. This phenomenon, also known as *flocking*, occurs at both microscopic scales (bacteria) and macroscopic scales (fish). Using computers, these patterns can be simulated by creating simple rules and combining them. This is known as emergent behavior, and can be used in games to simulate **chaotic** or **life-like** group movement.

Each entity of group is called **agent**.

Basic models of flocking behavior are controlled by three simple rules:

- Separation: causes an agent to steer away from all of its neighbors;
- Alignment: causes a particular agent to line up with agents close by;
- Cohesion: causes agents to steer towards the "center of mass" - that is, the average position of the agents within a certain radius.

With these three simple rules, the flock moves in an extremely realistic way, creating complex motion and interaction that would be extremely hard to create otherwise.

To describe his behaviour, we decided to use a Finite State Machine.

## 7. Story

### 7.1 Synopsis

The world that we all knew and loved, doesn't exist anymore.

After the destruction of the world caused by a nuclear war, only few people survived providing a new beginning. But as the past teaches us, when total chaos reigns, the law of the jungle wins.

Those in power are people with real temper and strength that enslaved weak and rebels. Slavery is one of the largest sources of income in terms of entertainment and trade.

### 7.2 Complete story

The earth doesn't exist anymore as we knew it, people in power have contribute to destroy a planet to its knees.

Inflation, pollution, starvation, spread of disease hard to treat have started civil wars fueled by the fear of population.

To appease the revolts and stabilize the situation, the only way was move to the nuclear. All of this has caused the devastation of much of the planet.

Hundreds of years after the nuclear disaster, the political structure of the Earth is completely changed from the one that we used to know.

Many people have grouped into clans trying to facilitate survival in a devastated environment; but precisely because life became so difficult, finding food and other materials is a priority.

Something from the old world survived thanks to bunkers and supplies kept by forward-looking people but, precisely because rare, the survival of the fittest has taken over.

Clan bosses, people with real temper and strength, have started to trade slaves, the greatest source of wealth for any clan, and started to raid weapons and technology survived, for their please.

So slaves, weak people and rebels, are sold in exchange for large quantities of materials and to please clan bosses just for their thirst for entertainment.

Indeed, despite being completely submissive to their will, they are obliged to fight into messy arenas against hybrid creatures, born thanks to war radiations.

### 7.3 Backstory

Combat into the arenas represent a moment of leisure for the heads-clan of the new world. Some are limited to watch, while others are actively involved by signing up their strongest slaves into the competition.

Competitions are directed by a strategist, whose identity is unknown, which handles what happens inside the arena through a commands set.

Strategists, using an advanced technology shaped for the arenas, are able to set up really interesting shows.

Those elements caused a growing development of corruption and money laundering.

### 7.4 Narrative devices

Plot devices that will be used to introduce and tell the story of Gladiator Project are:

- Dialog boxes that introduce the player to the arena causing, in this way, an immediate immersion in the game world;
- The game environment defined by the Art department;
- The emergent gameplay that comes out from difficult situation defined by combat.

## 8. The Game World

### 8.1 Mood board



Figure 54 - Game World moodboard

The images shown a Mood board that represents our conception of the game world. C.L.A.N.G. starts from the concept of a post-apocalyptic world. We imagined desert, desolate environments, cities destroyed in the process of desertification and abandoned buildings.

The life of the survived clans is simple and everything is built with the remains of the old world or makeshift. The society is no longer what it once but an ongoing slave trade and small wars between clans. Only the arenas, despite being a barbarism, they maintained a certain degree of technological evolution.

## 9. Media List

- Video
  - **Trailer**  
Brief introduction to the history of the game with some accents at the main mechanics, narrated in the form of images.  
  
File.mp4
  - **Gameplay Trailer**  
Focus on most game dynamics, both side Gladiator and Strategist.

## File.mp4

• **Graphics**

- **Icons:** main images used in the demo and documents
  - clangLogo.png
  - braveKids.png
- **Interfaces (Mockup):** prototypes used to build in-game interfaces
  - Start.png
  - Single-player.png
  - Campaign.png
  - Time-Attack.png
  - Hordes.png
  - Bulletin Board.png
  - Deck.png
  - Equipment.png
  - Multiplayer gladiator.png
  - Multiplayer strategist.png
  - Options.png
  - Shop.png
  - Tutorial.png
- **Interfaces (In-game):** images and icons used in the demo
  - Pdf1.pdf
  - Main\_logo.png
  - Start\_gladiator.png
  - Strategist\_card.png
  - Start.pdf
  - Interexport2.psd
- **Environment:** all the 3D models used to compose the arena
  - Barile.obj
  - Base.obj
  - Camionprova.obj
  - Container.obj
  - Copertone.obj
  - Lamiera.obj
  - Modulo.obj
  - Muroepali.obj
  - Ruspa.obj
  - Transenna1.obj
- **Characters:** all the 3D models used to create the main characters of the game and their objects (Pc and NPc)
  - Tifoso.fbx
  - Gun.obj
  - Pappagallo.obj
  - Casco.obj

- Cinghiabraccio.obj
  - GuantoA.obj
  - GuantoB.obj
  - ScarpaA.obj
  - ScarpaB.obj
  - Spalla1.obj
  - Spalla2.obj
  - Torso.obj
  - Bendaggio.obj
  - Elmo.obj
  - Faccia.obj
  - Occhi.obj
  - Tagliola.fbx
  - CLANGBEE.fbx
  - sabbiaSmossa.fbx
  - WURM.fbx
  - tankCasco.obj
  - tankCorpo.obj
  - tankintero.max
  - tankSpallaccio.obj
  - tankSportello.obj
- **Animations:** all the animations used to give life to our Pc and NPc
    - Gcombo.fbx
    - Gdash.fbx
    - Gdeath.fbx
    - Ghidle.fbx
    - Grun3.fbx
    - Gshoot.fbx
    - Gthrow.fbx
    - Colpo.fbx
    - Ouchdeath.fbx
    - Run.fbx
    - Tankone.fbx
- **Music:** original score created for C.L.A.N.G.
    - Clang\_Mix\_Trailer.wav
  - **Sound Effects:** all the sounds used for the demo
    - CollectObject.wav
    - Defend.aif
    - DropObject.wav
    - EmptyGun.wav
    - FightReaction.wav
    - Grenade.wav
    - Gun (possibility).wav
    - Gun (possibility 2).wav
    - Melee Attack.wav
    - Running.wav

- Running2.wav
- Running3.wav
- DraggingWorm.wav
- GrowlingWorm.wav
- Mutant.wav
- Swarm.aif
- Tank.wav
- AudienceCheering.wav
- CardAvailable.mp3
- PulseRecharge.wav
- SpawningEnemy\_trap.wav
- BearTrap.wav

## 10. Prototype

Our digital prototype owns part of the components described in this document. Starting from the premise, of all the modes described, only one was actually implemented: the 1 VS 1. It is also accessible through a slightly different interface than expected; This is caused by the absence of all the modes and, as a matter of efficiency ad UI design, we did not feel functional leave part of the screen with buttons disabled.

For the Gladiator's part, we only planned the male character, as a matter of difficulty in delivering all models according to the schedule. Similarly, we realized only some components of his equipment such as the base weapon, the special weapon (gun). His actions actually implemented are: movement, basic attack, special attack, launch and dodge.

For the Strategist's part, his monsters and traps actually spawnable are: maimed mutant, hungry worm, swarm, strong mutant, bear trap and the toxic cloud. This choice is based on the deadlines too short to complete additional models and for a difficulty in balancing other NPc always in such times.

The same reasoning was performed regarding the equipment and deck modifiers.

Concerning the level design's part, just one arena was achieved for the prototype. Here again as a matter of time we preferred to give priority to the proper functioning of the demo, in all its components.

So, in the end, the demo consists simply of a battle Strategist Vs Gladiator with a series of standard features, such as weapons or cards.