Skedel Tower Defense

Kai Friese
and
Jasmin Knott

Games: User Experience and Analysis
Game Development Diary

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0.1 Work distribution

The project was created by a two-person team, Kai Friese and Jasmin Knott. Together, we brainstormed ideas, made crucial design decisions, and crafted the Game Development Diary.

Jasmin Knott took on the important role of visual artist, creating all the graphics and sprites entirely by hand. Her art shaped the aesthetics of the game and provided a coherent and visually captivating experience for the players. In addition, Jasmin developed the menu and user interface and implemented the underlying code. She also selected and integrated the music and sound effects to enhance the audio experience and immerse players deeper into the game world. Jasmin also came up with the setting and the story of the game.

Since Kai Friese has more experience with Unity, he took on the primary responsibility for the technical aspects and implemented the core game mechanics. He designed the code structure and patterns, ensuring a robust and scalable foundation for the game. He developed the mechanics for turrets and their placement, programmed the behavior of enemies, and implemented the kinematic abilitiy. Additionally, Kai handled the player input, added particle effects and took care of balancing.

0.2 Game description

Our game is a tower defense in which the player has the task of defending the passage between hell and the human world. More and more undead, represented by burning skulls, break out of the gate to hell and try to get through the opposite gate to the human world.
To stop these waves of enemies, the player has several towers to choose from, which he can build with gold. There are different ways to get gold. On the one hand, the player receives one gold passively every second and another 10% of his current gold as income every 30 seconds. In addition, each enemy is worth a certain bounty, which the player receives when he kills the enemy.

The turret selection is the arrow turret, which is the cheapest turret and good against weak opponents, as it attacks quickly but does little damage. The next cheapest tower is the cannon tower, which has a very long range and high damage, but has a low attack rate. There are also two elemental towers, ice and fire. The ice tower radiates an aura around itself, which slowly drains a small amount of life from all enemies within range. More importantly, it also slows down all enemies within range, giving the player more time to deal damage. The fire tower shoots flames at its target and sets it on fire. The enemy receives a number of burning stacks, which are reduced every second and cause armor-ignoring damage. Finally, there is a gold tower, which does not attack but increases the passive gold income.

There are different types of skull enemies. The standard enemies which have no special characteristics. Fast enemies, which are easier to kill but run across the map much faster. Flying skulls, which can move over towers and move in a straight line to the gate. There are also slow and particularly resistant enemies and those that split into standard enemies when they die. In addition, there is a scaling opponent who gets stronger with every round. Another special type of enemy is the golden skull. This enemy is very resistant and gives a particularly high bounty, but the life and bounty of golden enemies are doubled each time one of them is defeated, and they do not drain the player's life when they reach the exit. But golden skulls only appear by luck with a low probability. As additional actions, the player can upgrade his towers for gold or sell them for half the total cost. He also has an ability at his disposal with which he can defeat all opponents on the map. However, this ability also costs gold and the price doubles with each use.

You can also click on towers and opponents to see information about them.

As the game is intended as a side activity and therefore the player has more control, he can interrupt the game at any time or increase the speed of the game.
Press "Escape" to call up the menu and end the game.

1.1.1 LoL – Jasmin Knott

My favorite game is the MOBA League of Legends in which two teams of five players fight against each other online. The goal of the game is to destroy the opponent's Nexus (the main building). To do this, all towers and an inhibitor must be destroyed on at least one of the three lanes. To achieve this, each player controls a character which they can choose each round. The players are divided into different positions and roles on the map. Four players divide themselves between the three lanes and try to gain gold and experience in the early game until the first towers have been destroyed. The fifth player in the team defeats neutral monsters in the jungle and helps the other players on the lanes. In the middle game, the lanes are swapped, team battles take place and objects are fought over. In the late game, there are usually more team fights and attempts are made to destroy the opponent's base and also the Nexus.
The rules of how the game is normally played are determined by the so-called meta. The meta describes the currently strong characters, equipment, strategies and more, which have a particularly high winrate.

Gold can be earned by killing NPCs, enemy characters and objects such as towers or strong neutral enemies, which can be used to buy equipment. In the same way, experience is also gained in order to level up and obtain new abilities and increase basestats. Each character has a life bar and some have mana or similar resources such as energy and rage to cast abilities.
The conflicts in the game are mainly the other players. Of course the opponents who are trying to win the game themselves, but being on the same page with random team members is not always easy. On the non-player side, there are the towers, which are strong, shooting buildings that have to be destroyed, as well as the minions that regularly spawn and run across the lanes.
The game is limited to a few maps where the player's movement is restricted by buildings and walls (especially in the jungle). Each round the player starts with a new character at level one and should not leave the round until one team has won, otherwise the teams will be unbalanced and the leaving player will receive a penalty.
The game can also be played in different ranked modes where you can earn league points at the end of each round to rank up.

1.1.2 Witcher – Kai Friese

My favorite game is the singleplayer RPG The Witcher 3 Wild Hunt. You find yourself in the role of Geralt of Riva. The player is a witcher, a magically mutated monster hunter. The player travels and explores the fantasy world, interacts with NPCs, investigates tracks and fights monsters and humans.
The main objective of the game is to follow the main quest line, which is to find the foster daughter Ciri. To level up faster and earn gold, you can also take on side quests, such as the so-called witcher quests or treasure hunts. The quests usually consist of interactions, battles, searching for and following tracks or objects.
There is also a built-in collectible card game called Gwint, which can be played against numerous

NPCs throughout the world.

The player earns gold to buy armor and weapons, with a distinction being made between steel swords and silver swords, which are more effective against humans or monsters. There are also potions, bombs and weapon oils which can be produced from herbs, monster parts and other ingredients. Through experience, the player increases in level and receives skill points. In battle, there is life and stamina and poisoning as a resource.
Conflicts in the game are some difficult decisions in dialogs, fights with enemies and the limitation of potions and bombs.

Borders in the game are various areas which the player can only enter and leave by fast travel. These areas must be unlocked by progressing through the main quest. In addition, there are many rivers, rocks, trees, buildings and other obstacles in the world that restrict free movement. Outside of battles, you can save and end the game at any time.
The game has different storylines and endings depending on the decisions the player has made. However, even after completing the main quest line, the player can continue playing at will.

1.2 Team up

Our team consists of only two members, Jasmin Knott and Kai Friese, who both have basic experience in Unity and game development. We have already worked on various game projects together during our studies. In the course of the team building we were assigned additional members, but none of them participated in the course or responded.

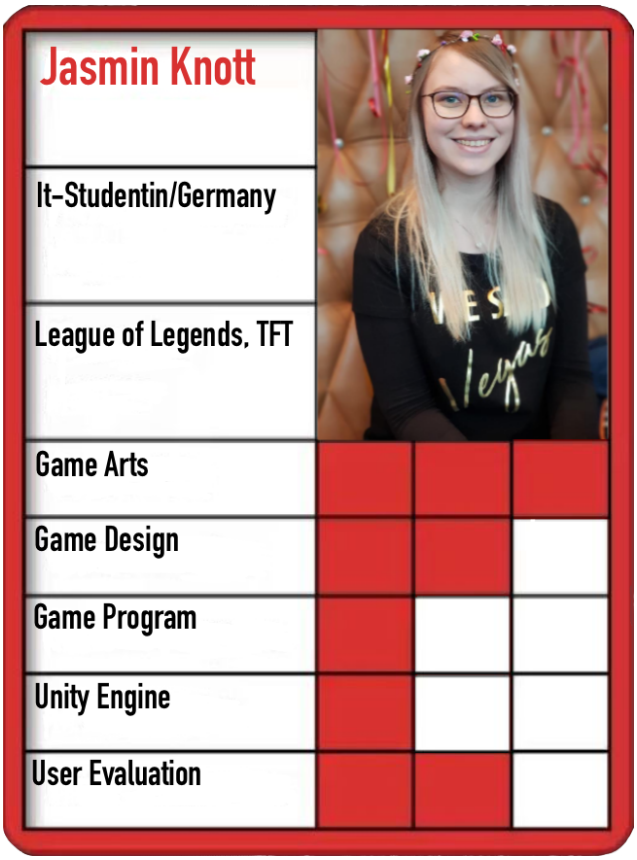

Figure 1 Presentation board Jasmin Knott

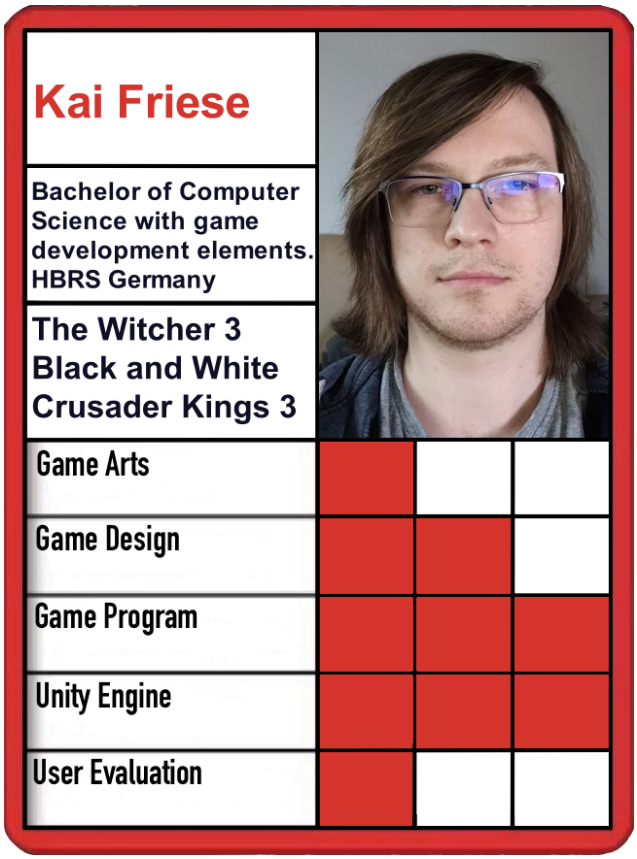

Figure 2 Presentation board Kai Friese

1.3 Create Conflict

Set#1 – Jasmin Knott

Random Words: Tower, Distraction, Wave

Players:

The player takes part in the game by placing and managing towers. The game can be played as a side activity, creating a feeling of distraction. The game is supposed to be a single player game in which the player fights waves of enemies. The player takes on the role of a strategist and is effectively the commander of the towers.

Objectives/Goals:

The goal of the game is to survive as many waves of enemies as you can. Possible objectives are the destruction of enemy waves and the construction of defenses such as towers. As part of the story, it can be an objective to rescue the world from waves of enemies through towers.

Procedures/Actions:

The player's starting action is to use the gold available to him at the beginning to place towers. The progression is to get more gold through time and defeating enemies to build or upgrade more towers. A special action can be to use an ability, such as a shockwave, a buff for towers or a debuff for enemies. The game can have resolving actions such as losing all lives or defeating enough waves of enemies.

Set#4 – Kai Friese

Random Words: Skull, Wall, Fire

Procedures/Actions:

As a starting action, the player begins by building a wall. As a progression action, the player expands the wall into a kind of maze, through which enemies pass in the form of burning skulls. Meanwhile, the walls fire at the enemies. A special action could be to tear down walls again or to upgrade them to elemental variants such as ice and fire in order to burn or slow down opponents. Resolving actions could be to defeat all enemies (skulls) or to build a complete maze.

Rules:

Some rules could be that skulls disappear when they have 0 lives. That enemies cannot pass or destroy walls. The path to the exit must not be completely blocked. That the player loses life when an opponent comes through the maze to the exit. The player earns money by defeating enemies.

Boundaries:

The limits of the game could be that it becomes a single player game. This makes it possible that the player can theoretically pause or stop playing at any time. In addition, the player only has a limited building area where each wall placed means less space is available and is also blocked by opponents.

1.4 Create Team Conflicts

Due to our small group, we only have two sets that can be put together. From the existing conflicts we have decided to create a simple tower defense game and adapt the missing conflicts.

Players:

The player takes part in the game by placing and managing towers to create a mazelike path. The goal is to create a game that can be played as a side activity, providing a feeling of distraction and occupation. The game is supposed to be a single player where the player fights the game. The story of the game is that undeads (flying, burning skulls) are trying to break out of hell and get through the gate to the world. The player's role as commander of the towers is to protect the world.

Objectives/Goals:

The goal of the game is to survive as many waves of enemies as possible. Objectives are the destruction of waves of enemies and the construction of towers as maze-like defenses. The story objective is to rescue the world, which turns out to be an endless battle for the player.

Procedures/Actions:

The player's starting action is to use the gold available to him at the beginning to build towers. Over time and by defeating enemies, he will receive more gold to build or upgrade more towers and thus create a maze-like structure. The enemies pass through this maze in the form of burning skulls in order to reach the gate. Meanwhile, the towers shoot at the enemies on their own. The player can choose different tower types to combine their advantages and disadvantages.
As a special action, an ability can be used, which is implemented as a shockwave to defeat all current opponents at once. There is also a special action with which the player can sell towers at half price. The game resolving action is to lose all lives.

Rules:

Some rules for our game are:

- The path to the exit must not be completely blocked.
- The player loses life when an enemy passes through the gate.
- Enemies have life and armor.
- Armor reduces the incoming damage by a fixed value.
- Enemies disappear when they have 0 lives.
- Enemies cannot pass through or destroy towers.
- The player receives bounty gold by defeating enemies.
- The player receives one gold every second.
- The player receives 10% of his gold every 30 seconds.
- Towers have a limited range, attack speed and damage.
- Towers cannot be placed on enemies or other towers.
- Towers can only be built or upgraded if enough gold is available.

Resources:

The resources available to the player are gold and life. While gold is actively used and increases and decreases over the course of the game, lives can only decrease and cannot be actively used. However, the game ends when there are no more lives left.
There was also the idea of using mana as a resource for the special ability. The game can also be expanded later to a rougelite, in which additional resources can be used to enable progress across rounds.

Conflict:

Conflicts arise from opponents, as they can get in the way of the player building towers. Furthermore, it is very difficult and requires several attempts to build the best possible labyrinth. In addition, the current gold supply also limits the player's options. Of course, the loss of life is also a conflict.

Boundaries:

The limitations of the game are that it is a single-player game. The player can pause or end the game at any time. In addition, the player only has a limited building area, on which less space is available with each tower placed and which is also blocked by opponents. In addition, there is a natural limit to the number of towers that can be placed, so once they have all been placed and upgraded, the player can do nothing more than use the special ability.

Outcome/Feedback:

Outcome/feedback occurs in different variants in our game. On the one hand, the player receives a bounty for every enemy defeated. There is also the chance to spawn a golden enemy in every wave, which is difficult to defeat, but cannot drain any lives and gives an extra large bounty.
As a more personal outcome, the player will meet decisions with direct consequences and it's fun to try out new strategies.
There are also plans to include a high score and statistics on, for example, enemies killed and bounties received.

Requirements:

- *3 procedures (build tower, upgrade tower, sell tower, cast ability, select enemy or tower)*
- *1 dynamic object (tower, enemies)*
- *2 resources (gold, life)*
- *3 forms of feedback/outcome (highscore (still in development), statistics (still in development), bountygold, luck to spawn golden enemy, decision making, learning strategys)*
- *1 static or dynamic camera (static camera)*

2.1 Interactive Experiences

The primary experience players have with the game revolves around making decisions and experimenting with various strategies. The thrill and joy stem from the process of learning, trying out new approaches, and mastering the intricacies of maze building. This aspect of the game offers a continuous sense of achievement and discovery, as players refine their techniques and uncover the most effective ways to construct mazes.

Moreover, playing the game provides a relaxing experience. It is an activity that can be enjoyed leisurely, allowing players to unwind and de-stress. The gameplay's calm and methodical nature makes it an ideal companion for unwinding after a long day or while multitasking with other activities.

2.2 Game Feel Steps

In order to improve the experience of our game, we give the player control over the pace of the game. In other words, pause the game and increase time speed. Looking at the three main components of Swink, the game is already in real-time control and will be further enhanced by the control over the game speed.
Our simulated space is only 2D so physical interactions, collision and cinematic effects are not used as much. However, we still have collision detection when looking for turret targets and projectiles hitting enemies. In addition, the special ability is a shockwave which has kinematic effects. It applies force to enemies in waves and pushes them away.

The visual design of the simulated space of the level is adapted to the setting to create a suitable atmosphere.

As a polish, we have added particle effects for the ice towers so that the player can see where enemies are being slowed down. We have also added projectiles to the remaining towers to give the player visual feedback. The tower levels are also represented by small symbols so that the player can see at a glance which upgrade level a tower is at.

2.3 Unique kinetic gameplay

Since our game is a simple 2D tower defense, there are only a few options for kinetic elements. One option would be a special trajectory for the projectiles, but this is difficult to visualize in the 2D top-down perspective. An alternative could have been for the cannon turret's projectiles to trigger an explosion and push enemies a little bit away. However, this would have added even more visual effects to the screen and possibly overloaded the player, and this variant would also have involved more polishing and effort. Due to our small team size and the limited time available to us, we decided to add an ability instead. This triggers a shockwave consisting of five small thrusts that exert force on the opponents and thus gradually pushes all opponents off the map and thus defeats them. Each of the five waves has a separate collision check with the opponents and only exerts a small amount of force on the opponent. This creates a unique effect in which the opponents are not all eliminated at once, but gradually.

3.1 Decisions and predictability

In our game, the player has to make various immediate decisions in real time. The obvious ones are which tower to place and where. This is made even more profound by the fact that the player can also upgrade towers and must consciously save up gold to do so. In dangerous situations, the use of the ability comes into consideration as a dramatic decision that involves a trade-off between the loss of gold or life. Saving up gold is also a conscious decision, as more gold in the bank means a higher income on a regular basis and the player has a gold reserve to use the ability in an emergency. However, the defense is weaker as less is invested here.

Some of these decisions are informed decisions. For example, the player always knows how much gold to spend on an action and knows the stats of the opponents and towers. In contrast, there are also uninformed decisions where the player lacks information. The player does not know how many and which enemies are coming in a wave and therefore does not know exactly whether he can save up gold or place gold towers to make more profit, or whether he needs more towers and upgrades for defense.

The use of gold towers and the decision of which tower to place where are long-term decisions. The gold tower is a trade off between less defense and getting more gold in the long run. The position of the towers can be corrected by selling them, but this also means a loss of gold and it will be difficult to reconstruct the labyrinth afterwards. The position of the towers is also important in order to be able to use the available building area effectively and to use towers such as the ice tower with its slowing aura and the canon towers with their long range as effectively as possible. Placement is therefore a long-term decision that requires careful consideration.

The player's wide scope for decision-making has a different influence on the game depending on the phase. The placement of a single tower only has a small influence on the current wave and at most determines whether the player loses one more or one less life. However, every decision made beforehand becomes more and more influential as the game progresses, because with stronger waves, the longest possible path for the enemies and a well thought-out distribution of the towers (especially the ice towers) is a critical function that determines whether the player survives or not.

In terms of predictability, the player has the opportunity to foresee the behavior of the opponents and the influence of his towers to a certain extent. As long as the path is not blocked, the opponents always follow the same route and always look for the shortest way to the goal. This means that the range of towers can be exploited and strategically important points can be considered in advance.

The information starvation and glut is represented in our game primarily by the information about towers, enemies and wave patterns. As far as starvation is concerned, we have deliberately omitted some information about the enemy waves, such as spawn count, spawn speed, spawn patterns and enemy types, in order to keep the player in the unknown and not provide too much information. However, there are still some places where unwanted information starvation takes place. Especially information about towers before you buy them and what an upgrade improves as well as the explanation of the income system are still missing. Until the final version, we want to add these by adding tooltips or a tutorial. There may currently be a small amount of information overload in terms of how detailed information is given about selected enemies and towers.
In terms of decision pacing, the player has to make quick decisions, especially in the early stages of the game. As the game progresses, the pace slows down and develops into a calmer game in which the player has more time to think about their decisions. The player also has the option of adjusting the pace to suit their needs by increasing or pausing the game speed.

With regard to the question of what future possibilities exist, we have two different points of view. First, from the player's point of view, which decisions he plans ahead or which decisions are foreseeable for him. The main decision for the future progress of the game is the layout of the

labyrinth, the planning of expensive upgrades and the anticipation of having enough gold to use the ability. From the developer's point of view, we can expand the game and add more decision-making options. Our idea was to expand the game into a rougelike. The player would always receive another resource such as experience or gems after finishing a game (reaching 0 life points), with which he can buy improvements, new towers or abilities for all future games. With this approach, it could also be implemented that the player has to put together a set from his collection of towers and abilities at the start of a new game.

3.2 Beta optimization

To enhance the overall experience of the game, we have introduced several new features and improvements. We have added music and sound effects to enrich the auditory experience, making the gameplay more engaging and enjoyable. Alongside this, we have incorporated more visual feedback to provide players with clearer and more satisfying responses to their actions. We have also updated the user interface with a slightly more interactive menu. Players now have control over the game speed, allowing them to adjust the pace according to their preference, whether they want a more relaxed playthrough or a quicker, more intense challenge. In terms of gameplay, we have implemented numerous balancing changes to ensure a fair and challenging experience. While these adjustments have significantly improved the game, we acknowledge that further refinement is necessary to perfect the balance.

Looking ahead to the final release, we plan to implement tooltips and a simple tutorial to reduce information starvation and help new players familiarize themselves with the game mechanics. Balancing improvements will continue to be a focus, along with the addition of preprocessing to beautify the game.

If time permits, we aim to implement a highscore table and detailed statistics. These features will provide players with better feedback on their performance and encourage them to strive for higher achievements, adding an extra layer of outcome, motivation and competition to the game.

4.1.1 Game Play Examination

For the first user analysis, we let a few friends play the game and observed them. What we noticed immediately was that the towers were not yet well balanced. The players quickly came up with the tactic of building only the cheap arrow towers, as these were very strong and the low price meant that a large maze could be built quickly to keep the opponents running for as long as possible. Likewise, the percentage interest system was far too strong, allowing players to receive endless gold. This also made it not worth building gold towers, as the interest earned more gold.

We also noticed that the game is generally too easy.

Furthermore, one player came up with a strategy in which he built a symmetrical maze with two identical paths. Then he let the enemies run almost to the end, blocked this path and opened the one on the other side so that the opponents had to turn around and run back through the entire maze. When they reached the other side, the first side was simply reopened and the one by the enemies closed. This meant that the opponents were held in the maze for an infinitely long time.

The BOOM button was particularly well received, as it was fun to use and helpful in case several enemies came through. The speed control was also very popular, as the normal game speed is too slow in the long run; one player even played at maximum speed all the time. The music and the fitting setting were also perceived as positive, as was the clean gaming experience with suitable mechanics.

The testers found it annoying that there are no hotkeys and no multi-selection of towers. The lack of these elements led to unnecessary clicking and greatly disrupted the gaming experience. There was also a desire to be able to influence the target selection of the turrets in order to have more control over the game, and finally there was a desire to receive more information about the turrets so that decisions could be made better.

Suggestions for future expansions were to include more abilities such as the BOOM button, as this was a lot of fun, and to offer alternative upgrade options for towers, so that new decision options are created there.

Based on this analysis, we have developed a number of hypotheses.

1. The use of hotkeys and multiple selection makes the game more enjoyable to play.
2. The customization of the gold mechanic makes the game more challenging.
3. A new ruin mechanic makes the player have to plan his strategies better.
4. The balancing adjustments and additional information provide more interesting decision making.

We have also put forward another hypothesis based on our own opinion.

5. Additional sound effects help the player to better perceive important game information.

4.1.2 Game Changes

We have made several changes since the beta version was submitted.

For better balancing, we have adjusted all towers, especially the arrow tower. In addition, the opponents receive a small buff every five rounds so that the game can't go on for too long.

Furthermore, we have removed the interest system, as percentage values are always difficult to balance and quickly become too strong, instead the gold towers now give more gold.

In order to prevent the use of pathfinding through a symmetrical labyrinth, we have added the ruins mechanic. When a tower is sold, a ruin remains, which continues to block the path. This ruin is only removed at the end of the enemy wave. This means that players are no longer able to quickly open and rebuild a path.

As requested by the testers, we have added hotkeys for every action in the game, and there are now two types of multi-selection. On the one hand, all towers of the same type can be selected with one click, and on the other hand you can add and remove particular towers from the current selection. In addition, there are now six different target selection options for the towers, which can be set separately for each tower.

To provide players with more information, there is now additional text for fire, ice and gold towers when they are selected. In addition, a small icon is displayed when an enemy is on fire and the gold towers show a small animation each time they produce gold. Furthermore, there is a small tutorial text and tooltips are now displayed when the mouse is hovered over interactable UI elements. There is also a small feedback if a tower can not be placed.

To make it easier for new players to get started, the first wave only begins when the first tower is placed. This also allows players to take their time at the beginning to develop a new strategy.
For a better gaming experience, the player is now also shown the playing time and there are additional sound effects when a new round starts or the player loses a life.

To better analyze the game metrics, we have added a data collection feature that automatically sends us statistics about the game via email.

Last but not least, we have removed some bugs from the game so that everything now works smoothly and a clean gameplay is possible.

4.2 Game Evaluation

In order to be able to evaluate our game, we have collected numerous game metrics. These include, for example, playing time and round time, when which tower was built, sold or which upgrade level was upgraded. We have also collected statistics on gold, the BOOM button and lives and all data is linked to the respective round number. This data is saved as a json file and automatically sent to us by email after each game run.

In order to also obtain user analyses, we have created a questionnaire on SosciSurvey.de in German and English. Our questionnaire is divided into 3 parts. The first part is the classic System Usability Scale (SUS) questionnaire with ten questions. For the second part, we came up with another ten questions ourselves, based on the Game Experience Questionnaire (GEQ). The last part consists of four small free text questions about what the player liked or disliked. In addition, what they would change about the game and finally a field for other comments.

After testing the game and the questionnaire ourselves and making sure that we received all the necessary data, we sent the game and the questionnaire to over 30 test subjects. These were made up of fellow students, friends, relatives and acquaintances, resulting in a well-mixed test group. The age group varied from around 20 to 55 years old, with people with medium to a lot of gaming experience, as well as game developers, but also those with little to no experience with computer games.

4.3 Game Data Analysis

A total of 15 questionnaires were completed and data was collected from around 100 playthroughs. The evaluation of the SUS questions resulted in an average rating of 78. This is a good score for the first analysis of the game, but there is still room for improvement. In principle, however, no single question stands out with negative results, so small improvements are needed in all areas.
The second part of our questionnaire focuses on how the players felt while playing the game. For example, whether they had fun, were frustrated or stressed and how satisfied they were. Basically, the players had fun trying out new strategies and it was a good side activity, but for some it was also a bit boring. Most players found the game challenging, with mixed opinions on how frustrating and stressful it was. In the end, however, almost all players were very satisfied and many would play the game again.

We were able to extract some more information from the free text responses. The strategic aspect of the game was most often mentioned positively, the control over the playing time was popular, but the BOOM button and the fact that the game is bug-free were also praised.
The font and the tutorial text were criticized in particular. A restart button in game was also missed and more visible information about the opponents was desired. There were also testers with older hardware who had problems with the resolution. The testers would also like the UI and UX design to be reworked.

Players were particularly dissatisfied with the balancing, as it suddenly becomes more difficult after a certain point. Early mistakes in the game can also have longterm negative effects.

We saved the game metric data as json files and read them in using a Python script, which generated various diagrams for us. Above all, we were able to recognize weaknesses in the balancing system from these diagrams. In diagrams 1 (life and life loss), 2 (lost per round) and 3 (average use of BOOM) it can be seen that from round 10 onwards most players have problems and lose the game, or often have to resort to the BOOM button. This indicates that the opponents suddenly become too strong.

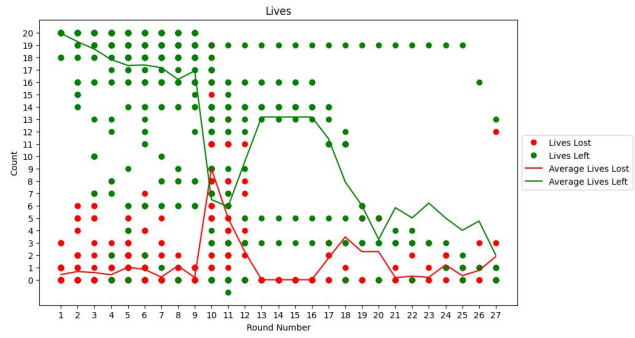

Diagram 1: Life and life loss

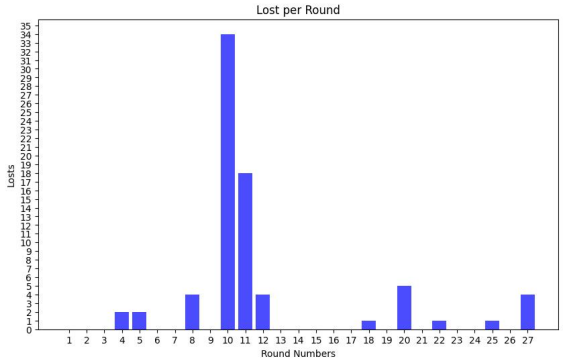

Diagram 2: Lost per round

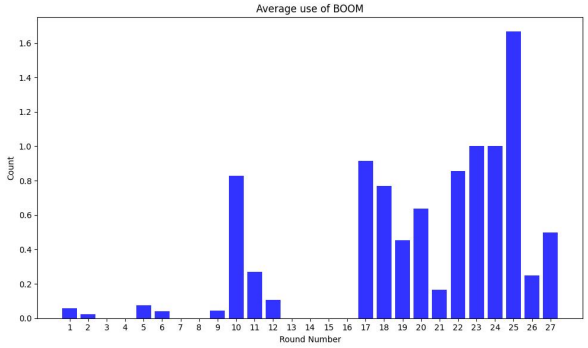

Diagram 3: Average use of BOOM

However, diagrams 4 (gold per round) and 5-9 (tower upgrades per round) show that the game really gets going after round 10. The players receive significantly more gold and can upgrade many towers, a function that is rarely used before round 10.

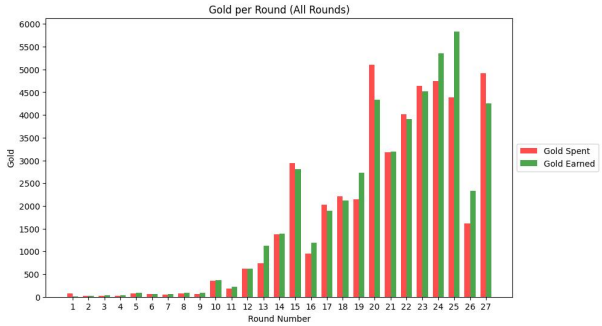

Diagram 4: Gold per round

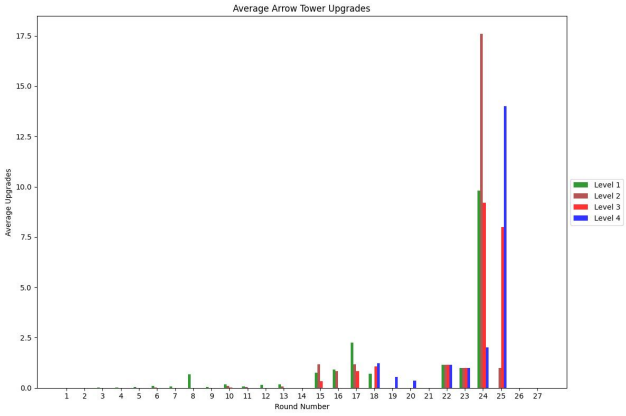

Diagram 5: Average arrow tower upgrade

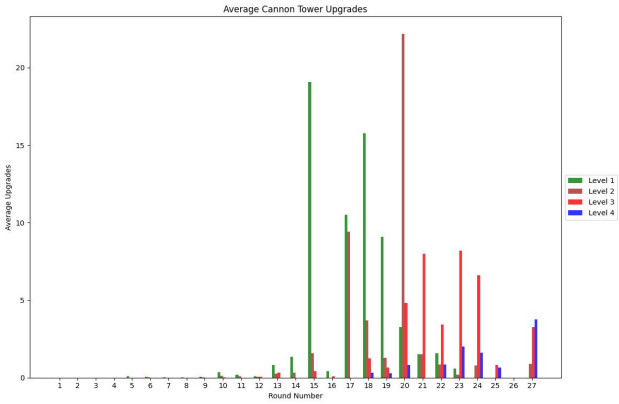

Diagram 6: Average cannon tower upgrade

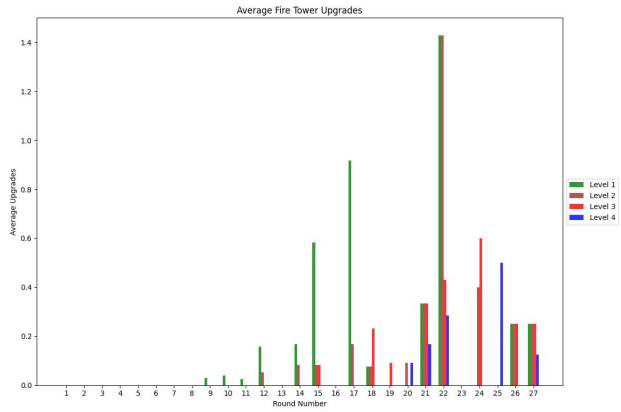

Diagram 7: Average fire tower upgrade

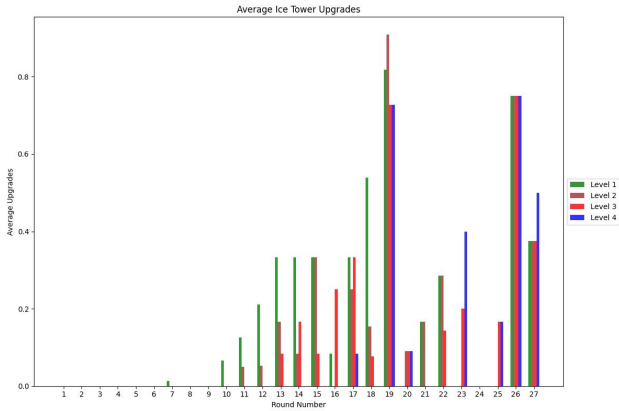

Diagram 8: Average ice tower upgrade

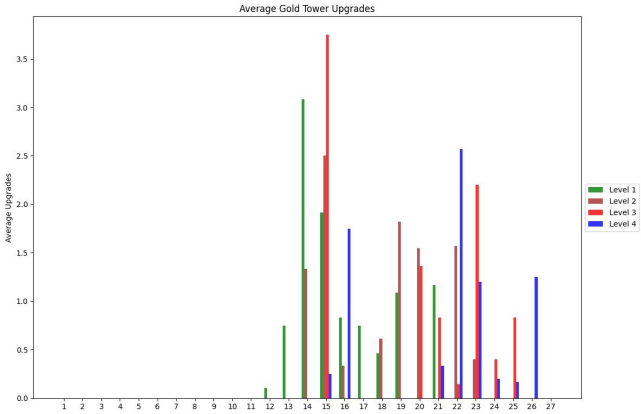

Diagram 9: Average gold tower upgrade

Diagrams 10 (tower placement) and 11 (tower sold) clearly show that the planned use of the towers basically worked as planned. The arrow towers are used a lot at the beginning, while the cannon towers are placed a lot in the middle of the game. However, the elemental towers are rarely placed and could benefit from an improvement. As expected, the sell towers function is rarely used and is spread over many rounds. Presumably it is only used when the player has obstructed himself or adjusts his strategy, both of which rarely happen.

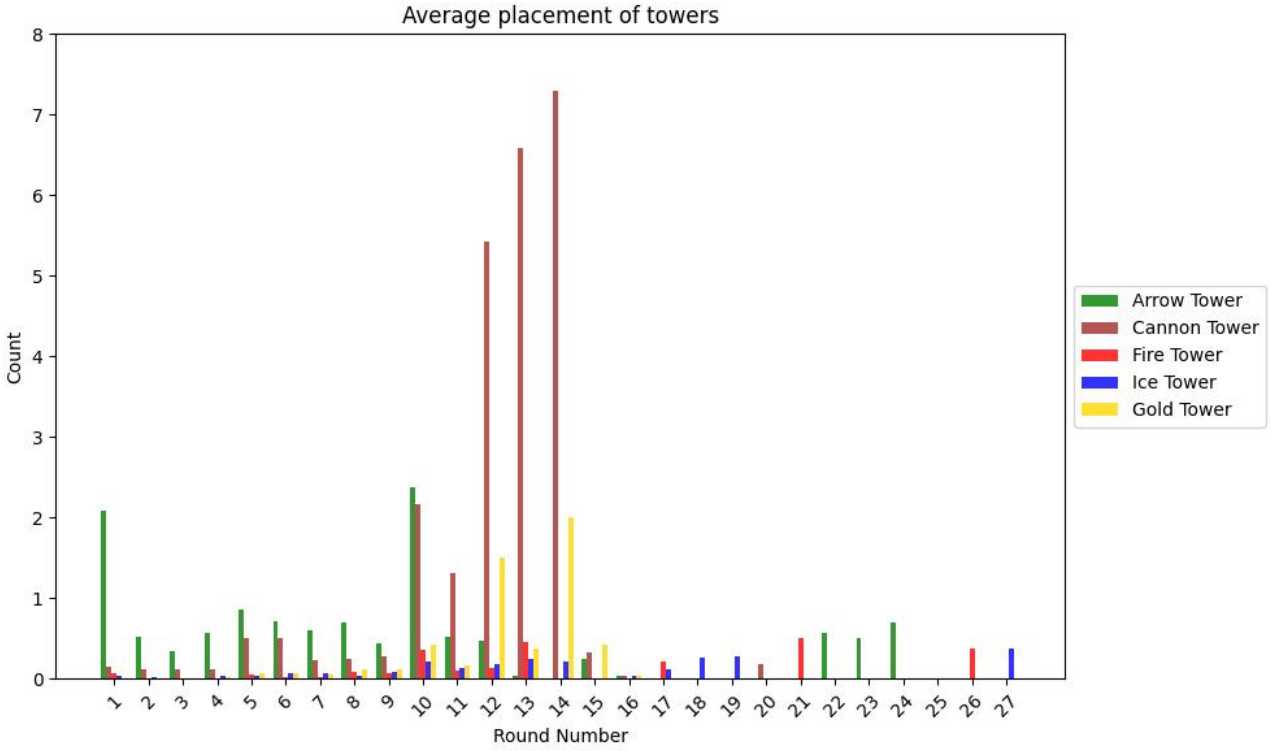

Diagram 10: Tower placement

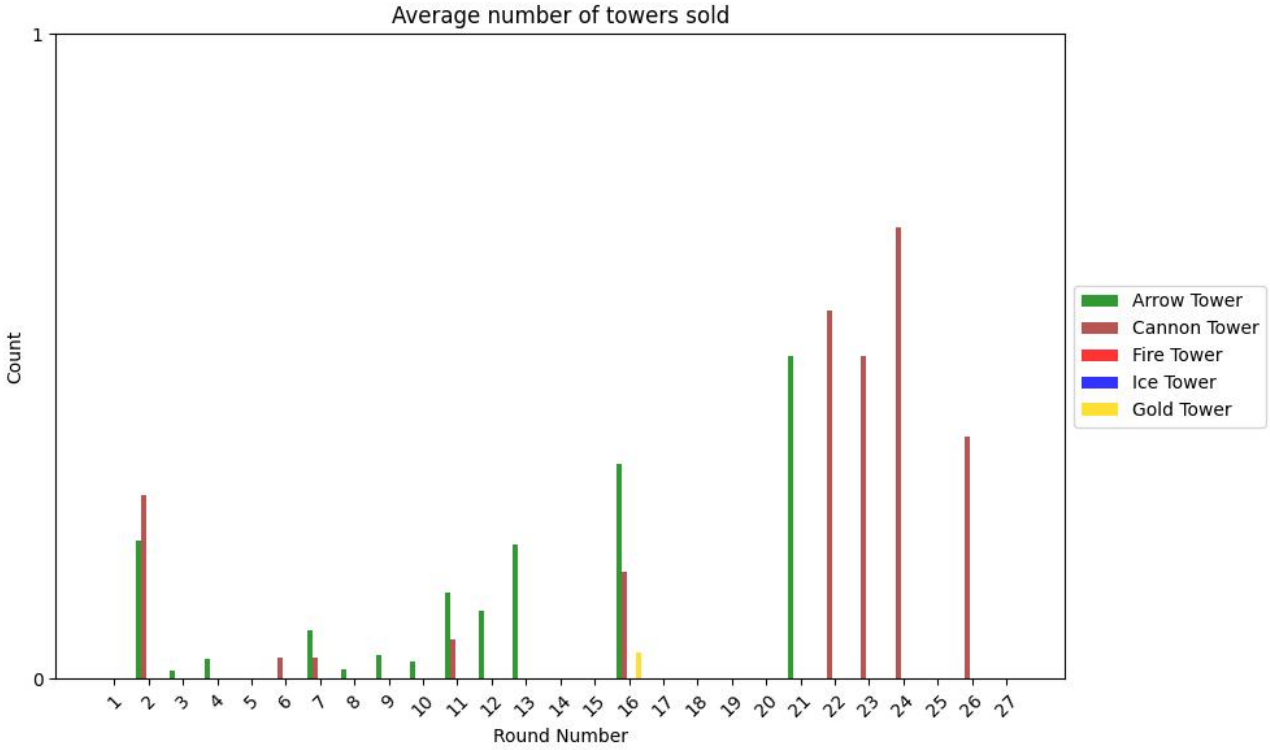

Diagram 11: Tower sold

5. Sources:

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