

UNIVERSITY OF TARTU
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**Cross-Country Horse Run – Hyper-Casual Mobile
Game**

Bachelor's Thesis (9 ECTS)

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Cross-Country Horse Run – Hyper-Casual Mobile Game

Abstract:

The thesis gives an overview of the development process of a 3D endless runner game called *Cross-Country Horse Run*. The purpose of the game is to give players an enjoyable experience through visual design and to create the feeling of riding a horse through the mountains. Thesis begins with an introduction to the world of mobile- and hyper-casual games. Then the design and implementation of the *Cross-Country Horse Run* game will be reviewed. Testing was conducted with players belonging to the target audience to assess the quality of the game and provide feedback on problem areas. Based on the collected results, some improvements were made, and some larger improvements are planned.

Keywords: Mobile game, endless runner, 3D, playtesting, game design, Unity

CERCS: P170 Computer science, numerical analysis, systems, control

Cross-Country Horse Run – *Hyper-Casual* mobiilimäng

Lühikokkuvõte:

Käesolev lõputöö kirjeldab 3D lõputut jooksumängu pealkirjaga „Cross-Country Horse Run” arendusprotsessi. Mängu eesmärk on anda mängijatele nauditav kogemus visuaalse disaini kaudu ning luua tunne nagu ta ratsutaks hobusega maastikul. Töö algab sissejuhatusel mobiili- ja *hyper-casual* mängude maailma. Seejärel antakse ülevaade „Cross-Country Horse Run” mängu disaini ja implementatsiooni kohta. Testimine viidi läbi sihtgruppi kuuluvate mängijatega, et hinnata mängu kvaliteeti ja anda tagasisidet probleemsetele kohtadele. Kogutud tulemuste põhjal viidi sisse mõned parandused ning mitmed suuremad korrastused on plaanitud tulevikku.

Keywords: Mobiilimäng, lõputu jooksumäng, 3D, mängu testimine, mängudisain, Unity

CERCS: P170 Arvutiteadus, arvutusmeetodid, süsteemid, juhtimine (automaatjuhtimisteooria)

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1 Introduction

Hyper-casual games are a genre of mobile games characterized by straightforward gameplay and short sessions¹. The genre was popularized in 2013 and is still known today. There are plenty of 2D and 3D hyper-casual games out there, but not many realistic horse-themed games. Thus, a new 3D endless runner game *Cross-Country Horse Run* was created for this thesis.

The purpose of the bachelor's thesis was to create a 3D endless runner game *Cross-Country Horse Run*, which offers players an enjoyable experience and the feeling of riding a horse in nature. The game design follows the principles of the main hyper-casual game genre and includes challenging aspects that require quick reflexes from the player.

Cross-Country Horse Run takes place on sandy roads between mountains where the player can control the horse's movements. The goal of the game is to avoid obstacles and run as far as possible. Obstacles are randomly placed on the road, so the player does not know what is coming next. Players can collect coins while running and use them to buy more lives.

Chapter 2 gives a short introduction to mobile and hyper-casual games to understand *Cross-Country Horse Run* and its design. The chapter ends with a comparison of similar games and *Cross-Country Horse Run*.

Chapters 3 and 4 focus primarily on *Cross-Country Horse Run* design choices and implementation. An overview of the used and alternative technologies is given, and the problems encountered in the development of the game are described. Game mechanics and levels have also been discussed from the point of view of game development.

To evaluate the quality of the game, playtesting was conducted, where 4 people from the target audience participated. Based on feedback, improvements were made to the game to make the game even more enjoyable for players. The entire feedback and testing methodology can be familiarized with in the fifth chapter. All source codes, glossary and more can be found in the Appendix chapter. Also, the readability of the text of this thesis has been improved by OpenAI model called ChatGPT².

¹ <https://gamedevworks.com/dev-blog/key-elements-for-a-successful-hyper-casual-game/>

² <https://openai.com/blog/chatgpt>

2 Background

It is important to know what mobile games and the hyper-casual genre all are about in order to understand *Cross-Country Horse Run* and its design. Subchapter 2.1 gives a brief overview of mobile games. Subchapter 2.2 describes the history of hyper-casual games and how the game of this thesis fits into the genre. The final subchapter 2.3 compares similar games to *Cross-Country Horse Run*.

2.1 Mobile Games

Mobile games have become a big part of the gaming industry in recent years. In a world with ever-increasing use of phones, the mobile industry market has exploded, with revenue reaching over \$92 billion in 2022³. The popularity is boosted by easy accessibility, and their playing and downloading have been made convenient for the common people.

The year 1997 can be considered the beginning of mobile games, when Nokia launched mobile game called *Snake* (Illustration 1). This game became very popular and that is why the year 1997 is considered as the beginning of mobile game industry. Another revolutionary event was the iPhone release in 2007, because developers had the opportunity to sell their games to people on a completely new platform⁴.

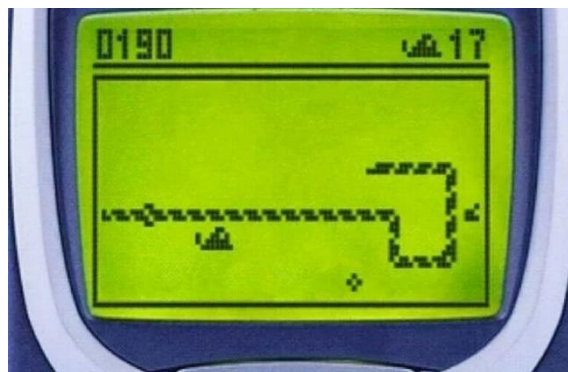


Illustration 1. Snake⁵

In order to develop a very successful and popular mobile game, developers need to pay attention to some nuances. In the game, for example, the music must be intuitive and the

³ <https://www.statista.com/statistics/511639/global-mobile-game-app-revenue/>

⁴ <https://www.gameopedia.com/the-history-evolution-and-future-of-mobile-gaming/>

⁵ <https://community.phones.nokia.com/discussion/44549/snake-through-the-ages>

sessions must start quickly so that players do not have to wait long⁶. This knowledge has also been used in the development of the *Cross-Country Horse Run*.

Mobile games have gained a lot of popularity over the years and many different genres have been added. In recent years, a new subgenre of mobile games called hyper-casual games has gained popularity.

2.2 Hyper-Casual Games

Hyper-casual games have taken the mobile gaming world by storm in the last years. Currently, the market earns revenue over 2 billion and records around 17 billion installs annually⁷.

The first known hyper-casual game is *Flappy Bird* (Illustration 2), which was released in 2013. It was a mobile side-scroller where the player had to navigate a bird through green pipes without colliding with them. Its user interface, gameplay mechanics and learning curve were the key factors that led to its popularity. These methods were also used by other developers, and this led to a great growth in the genre⁸.

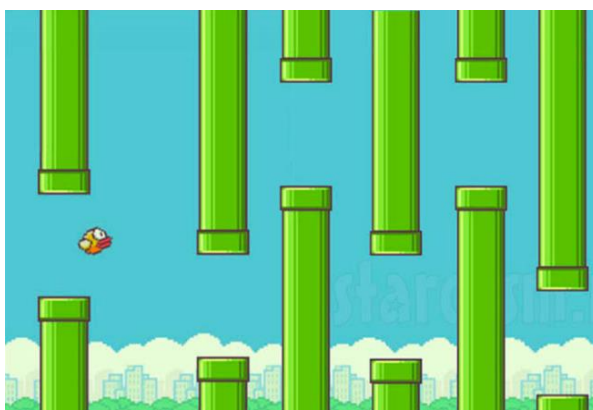


Illustration 2. Screenshot from *Flappy Bird*

The hyper-casual game is characterized by straightforward gameplay, which means it can be learned in seconds and does not require special training. The games are designed so that they do not last more than a few minutes. Leaderboards and challenges are commonly found in most of the games⁹.

Endless runners are a popular subgenre of hyper-casual games on mobile devices. These games typically feature a character constantly running, with the player controlling the character's movements by swiping left, right, up or down to avoid collisions and collect

⁶ <https://www.gamedeveloper.com/design/what-are-the-top-ten-features-for-mobile-games->

⁷ <https://www.is.com/community/blog/the-hyper-casual-gaming-industry-past-present-and-future/>

⁸ <https://goama.com/what-are-hyper-casual-games/>

⁹ <https://machinations.io/articles/what-are-hypercasual-games/>

power-ups. Endless runners are known for their straightforward mechanics, accessibility, and high replay value, making them a perfect fit for the hyper-casual gaming market¹⁰.

Hyper-casual games have gained popularity in the mobile gaming industry. All the characteristic features mentioned in this subchapter of the game are found in *Cross-Country Horse Run*. Since *Cross-Country Horse Run* is an endless runner game, it is logical to compare its elements with other similar games.

2.3 Similar Games

Market research is a critical component of game development since it gives developers better understanding what players want to play and what developers want to create [1]. To ensure this thesis stands out from the competition, this chapter will analyze similar hyper-casual games for inspiration. By examining these games, the thesis can draw insights from any ideas that set it apart from competitors.

2.3.1 Horse Racing: Unicorn Run Game

Horse Racing: Unicorn Run Game or simply *Unicorn Run* is a game available on the Google Play Store and this app has been downloaded more than 10 million times. The last update was on December 7, 2022. The game is developed by a video game company called SOCEM.

The acceptance of *Unicorn Run* has been very positive, with an overall review score of 4 out of 5. Mainly, the suitability of the game for younger children has been praised, and child-friendly colorful graphics attract a lot of attention. Some people have given a score of 1 because they did not like the idea of watching a lot of ads while playing and the game design was more aimed at the younger ones. Players attempted to purchase the game in an effort to avoid viewing ads but were unable to find an option to do so¹¹.

Since the big problem was large amount of ads in the *Unicorn Run* game, Diley Irem Turam [2] explained in his article which ads are annoying and which ones would be useful to use in hyper-casual games to keep players and make a profit. Hyper-casual games derive their

¹⁰ <http://jerrymomoda.com/analysis-endless-runners/>

¹¹ <https://play.google.com/store/apps/details?id=com.mtsfreegames.unicorn.runner.magical.little.ponyrun&hl=en&gl=US&pli=1>

primary revenue from advertising and in-app purchases. So, there are many different techniques used in advertisements to entice customers to download the app. Banners, rewarded ads and interstitials are the ones that bring a lot of downloads to the game.

One of the big goals in *Unicorn Run* is to collect gifts, coins, words and props in the fantasy unicorn world while running. The player has to avoid obstacles with the unicorn for as long as possible and survive in order to get the highest possible score (Illustration 3). While traversing the game's environment with a unicorn, they can acquire coins and subsequently earn rewards.

Unicorn Run and *Cross-Country Horse Run* share similarities in their theme and objectives. Both games are endless and require players to navigate obstacles to survive and collect items to win prizes. However, *Unicorn Run* distinguishes itself with its vibrant and colorful aesthetics and the use of vehicles as obstacles. In contrast, *Cross-Country Horse Run* incorporates realistic showjumping, cross-country, and water obstacles.



Illustration 3. Screenshot from *Unicorn Run*

In *Unicorn Run*, players can recover after hitting an obstacle, as long as they avoid subsequent hits within the recovery time. However, in *Cross-Country Horse Run*, players can only hit three obstacles before the game ends. Additionally, *Cross-Country Horse Run* lacks the swipe-down control feature found in *Unicorn Run*, limiting the player to only left, right and up movements.

2.3.2 Temple Horse Run: 3D

Temple Horse Run is an endless running game developed for Android devices by Play Gadgets Games. The game is still in its early stages, with only a little over 10,000 downloads on Google Play. The game was last updated on 02.08.2022.

The goal of the game is to get out of the temple as quickly as possible so the ghost chasing the horse does not catch the fleeing rider. The player can choose between different weapons

to kill monsters and get gold coins for it. With gold coins, the player can buy new weapons. Within the game, one can descend stairs leading to the crypt, ascend to the main temple, and explore additional regions of the game world¹².

In some ways, the game mechanics of *Temple Horse Run* are similar to the *Cross-Country Horse Run* ones. Player must collect items to get prizes and needs to avoid obstacles in both games to survive (Illustration 4). The difference is that the *Cross-Country Horse Run* is an endless running game where the player does not have to do anything other than avoid obstacles and collect items. In the *Temple Horse Run*, the player must also escape from the ghost and solve various missions. The missions are battles with monsters. Missions are not featured in the game of this thesis.



Illustration 4. Screenshot from *Temple Horse Run*

The gameplay of both games is similar as both are made in rear view and have 3 lanes to move. The design of *Temple Horse Run* is also detailed and uses dark and realistic tones, which are also used in *Cross-Country Horse Run*. Also, in the *Temple Horse Run* the player can swipe down to slide but in *Cross-Country Horse Run* there is no such player control.

¹² <https://play.google.com/store/apps/details?id=com.pgg.temple.horse.running.game&hl=en&gl=US>

3 The Game Design

The design of *Cross-Country Horse Run* was based on an iterative game design process, where the developer prototypes, tests and analyzes as often as possible [3]. It helps to quickly find errors and the project is constantly developing. This chapter provides an overview of the different parts of *Cross-Country Horse Run* game design. Game mechanics are discussed in subchapter 3.1. Subchapter 3.2 gives a good overview of the whole aesthetics and 3.3 describes how the level was designed.

3.1 Game Mechanics

This chapter provides a basic understanding of the important elements that create the foundation for the gameplat experience. The following subchapters explain more about the obstacles in the game, how they are randomized, as well as the significance of lives and coins.

3.1.1 Obstacles

Obstacles play a crucial role in *Cross-Country Horse Run* as they guide the player's decision-making process to avoid collisions and prevent the loss of lives. It also adds difficulty for the player to achieve a better high score.

There are 3 different types of obstacles in the game, which are the classic showjumping obstacle, the water obstacle and the cross-country obstacle (Illustration 5). Obstacles appear randomly so the player never knows what will come next. The choice of place is made between three lines and placed on the ground, and there is a 75% chance that a second obstacle will also be placed on the same row as the first one. The choice of place of the second obstacle comes between the two remaining lines. If the player jumps too late or accidentally touches an obstacle, the given fence is destroyed.

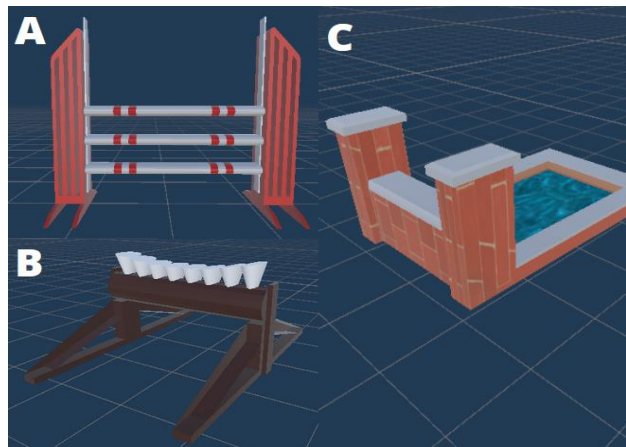


Illustration 5. Obstacles from *Cross-Country Horse Run*: showjumping obstacle (A), cross-country obstacle (B) and water obstacle (C)

3.1.2 Lives and Coins

As Salen *et al.* [3] mentioned, punishments play a very important role in games and rewards should be balanced with punishments, so the player has a good experience of the game. This is why in *Cross-Country Horse Run*, players' lives are limited, so they cannot run endlessly and create the will to keep playing.

At the start of the game, the player is given a total of three lives and each time an obstacle is touched causes the loss of a life point. If a player runs out of lives, they have the option to purchase three more lives for a fixed price. This ability only occurs once per game to limit endless running and makes it harder to get a better high score. The number of currently available lives can be seen in the upper left corner (Illustration 6).



Illustration 6. Lives panel

Lives can be bought with coins and coins can be collected by playing the game. Coins are placed on top of each obstacle, which encourages the player to jump over the obstacles (Illustration 7). All coins rotate around their y-axis, which adds a visual effect to the player. After picking them up, the total number of coins will increase, and the object will be deleted.

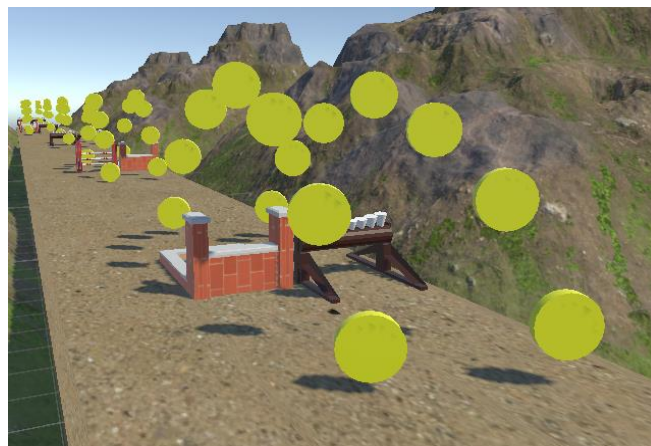


Illustration 7. Coins placement

3.2 The User Interface

User interface (UI) is where the player and game communicate with each other. A good interface makes players feel like they are in control of their experience [4]. In hyper-casual mobile games, the screen shows important details to the player through the user interface. This could be how many lives they have left or how many coins they have picked up. All the colors and textures used in the *Cross-Country Horse Run* design are photorealistic to create a natural feeling for players. *Cross-Country Horse Run* has a user interface on the gameplay screen because there is important information that needs to be shown. This information is located at the top left and right corners of the screen. Many users do not read long texts, they scan instead. This means that reading is stopped when something catches the eye. Therefore, the z-pattern has been used which helps highlight the most important elements, because Western readers scan the text from top left to bottom right [5]. The Z letter layout is also used in *Cross-Country Horse Run* where lives information is on the left and the rest of the information on the right (Illustration 8).



Illustration 8. Screenshot from *Cross-Country Horse Run*

3.3 Level Design

Rudolf Kremers [4] says in his book that a good level design should teach the player how to play the game and at the same time enjoy it. A level in a game should make players want to use the game's rules to finish the level in a way that feels enjoyable and satisfying. This knowledge has been used in the creation of the *Cross-Country Horse Run* level and has been achieved by redesigning the basic gameplay mechanics of the level explained in chapter 2.1. A single, infinite level was developed for this thesis. It is designed to have an ascending difficulty curve. Difficulty helps to keep players motivated, engaged and the right curve increases the popularity of the game¹³. The game starts at the middle line and the players' speed is slow at the beginning so the player can settle into the game nicely and it is not very

¹³ <https://ricardo-valerio.medium.com/make-it-difficult-not-punishing-7198334573b8>

difficult. This means the player gets some time to understand how the game works in detail. As time passes, the players' speed increases and it makes it difficult to get a new high score. Obstacles are placed randomly on the road and lives are lost when running into them. Basically, the faster the player runs, the more difficult it is to avoid obstacles. As an incentive, coins are placed on the obstacles and by collecting them, it is possible to use them once during the game to buy more lives. So, bumping into obstacles and losing lives teaches the player a lesson and teaches how the game should be played. Collected coins provide enjoyment and a sense of achievement when it comes to buying lives.

In general, *Cross-Country Horse Run* level is designed to be challenging, but care has also been taken not to overburden players in the beginning. The level design was created through iterative design, so it is essential to test it on real players. Before that it is important to understand the main parts of the *Cross-Country Horse Run* implementation.

4 The Implementation

Once the basics of the quality requirements and design of the application were in place, the next goal was to start implementing the design. During the implementation phase, the game was redesigned. This chapter gives an overview of the tools that were used in the development process and explains how the important game mechanics were integrated into the game.

4.1 Technologies Used

According to Schell [6] there are two types of technologies: *foundational* and *decorational*. Foundational technology contains practically everything needed for the game and decorative technology makes them better. Therefore, two tools have been used to develop the game: Unity game engine and Blender for 3D making models.

4.1.1 Unity

Cross-Country Horse Run's foundational technology is the Unity game engine. This technology can be used in game development for at least 17 different platforms¹⁴. This means the *Cross-Country Horse Run* game can be further developed for IOS phones or even developed into a computer game.

Other alternatives were Unreal Engine¹⁵ and Godot¹⁶, which are also video game engines and can be used on different platforms. However, Unreal engine is designed for high graphics games and Godot offers less tools and support than Unity nowadays. *Cross-Country Horse Run* is designed to be a mobile game, so it is not necessary. This is why Unity was chosen because it has an intuitive user interface, a simple architecture and uses C#, which is straightforward to learn. Meaning the whole game engine is straightforward for the beginner¹⁷.

¹⁴ <https://unity.com/solutions/multiplatform>

¹⁵ Unreal Engine <https://www.unrealengine.com/en-US/features>

¹⁶ Godot <https://godotengine.org/>

¹⁷ <https://www.incredibuild.com/blog/unity-vs-unreal-what-kind-of-game-dev-are-you>

4.1.2 Blender

Almost all game models such as obstacles, ground and coins that are seen in the environment are made using the 3D computer graphics software Blender¹⁸. It was chosen over others because it is free and open source. Since the author of this thesis is not very experienced with modeling, it does not make sense to pay large sums for licenses. Blender is a powerful tool that allows user to create everything from animated movies to 3D printed models¹⁹.

Blender was primarily used to create models of obstacles and other models seen in the game (Illustration 9). Models were created with keeping their goals in mind. This means some models were created as game decoration and some had a certain use case. A model with the purpose of decoration is a gravel road found in the game and models with a specific use case are for example obstacles and coins. Players lose lives by bumping into obstacles and can buy more lives with coins.

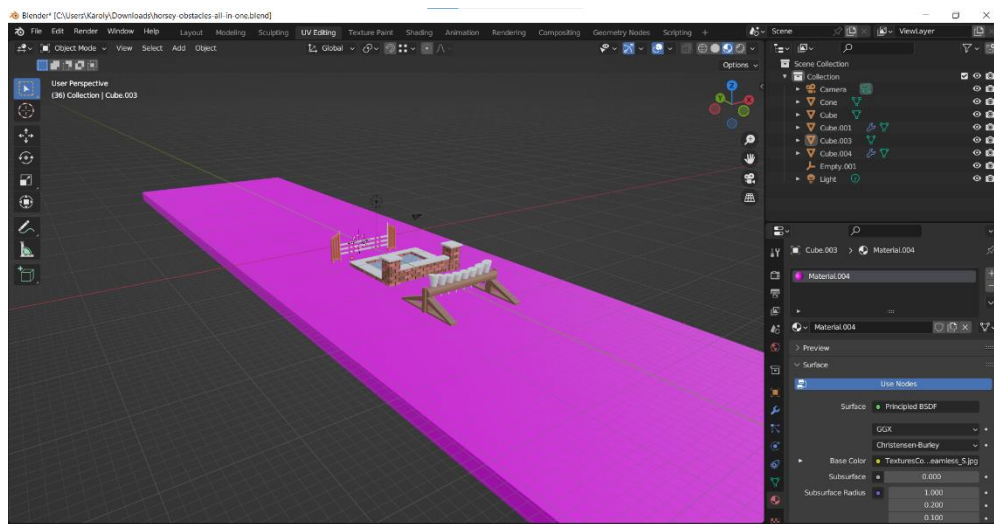


Illustration 9. Obstacles inside Blender

4.2 Overall Game Flow

The overall game flow of *Cross-Country Horse Run* is built around a panel system in which the player can navigate between the game and the various panels. All the logic is managed by the `PlayerManager` class, which gives permission to a specific panel to become visible. The player has the option to restart the game and also to end it. As shown, at the beginning the player cannot do anything but start the game (Illustration 10). Although, at

¹⁸ Blender <https://www.blender.org/>

¹⁹ <https://www.epidemicsound.com/blog/blender-software/>

the end of the game there is a choice if they want to buy lives with coins and continue or end the game session. At the game over panel, the choice is whether to exit the game completely or restart (Illustration 11). With this system the player has options and is never stuck in one panel. In addition to the general flow of the game, the programming of scene interactions and events is important.

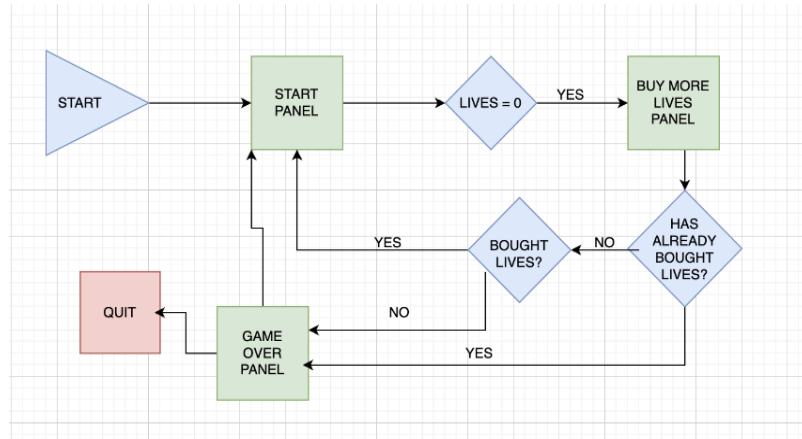


Illustration 10. *Cross-Country Horse Run* system panel



Illustration 11. Game over panel

4.3 Programming

Cross-Country Horse Run uses different programming techniques to create different interactions and events. Each of the following paragraphs describes the various game objects and mechanics in the game and how they were programmed.

The most important game element for the players is the horse, which they can control themselves (Illustration 12). The horse can be moved left, right, and up, and these controls are handled by `SwipeManager`. `PlayerController` monitors and defines how high it is possible to jump up with a game object or run at the beginning.



Illustration 12. Side view of the horse

Over time the speed increases, but the subspeed is defined. An animator is also attached to the horse according to the current state which gives the horse movement the player sees while playing the game. States are triggered by boolean parameters defined in the animator (Illustration 13). So, it is possible to better control the flow of the game.

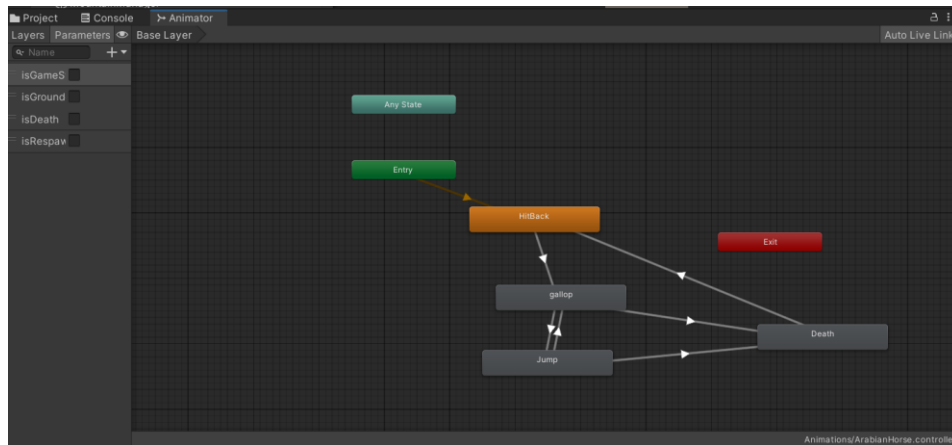


Illustration 13. Animator view

For the game to be played there must also be tiles on which the player can run. All this logic is controlled by the `TileManager` where tiles are added and removed. Adding them is necessary to allow the player to run endlessly. Deleting tiles is instead important to keep memory as low as possible, as many new tiles can slow down the game. For this, there is an Object Pool²⁰ pattern that avoids new additions and deletions. It has not been implemented, but there is a plan to do so in the future. It was not used now, because it was not necessary in terms of making a prototype. A total of 6 tiles are visible at the time and if the player has run over a tile, it will be deleted. The exact same logic is used when placing mountains, but it is controlled by the `MountainManager` and 4 mountains are visible to the player at the time.

²⁰ <https://gameprogrammingpatterns.com/object-pool.html>

On the tiles we find obstacles that the player has to avoid in order not to run into them. With the addition of each tile, obstacles are placed arbitrarily on top of it, and it is regulated in the same way by the `TileManager`. All obstacles are children of the tile, and it means if we delete the ground then the obstacles on it are deleted. It is also possible to destroy the obstacle by colliding with the horse, because every prefab has a box collider that defines the area where the object will disappear (Illustration 14).

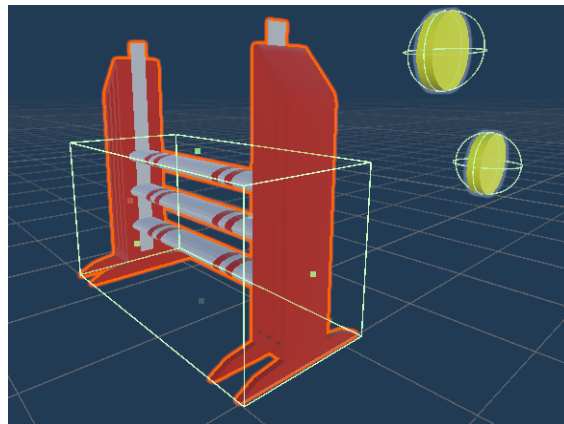


Illustration 14. Showjumping obstacle box collider

By colliding with an obstacle box collider, the players lose lives which they got at the beginning (Illustration 15). Lives are stored in the `PlayerManager` class and the `OnControllerColliderHit()` method makes appropriate corrections if the player

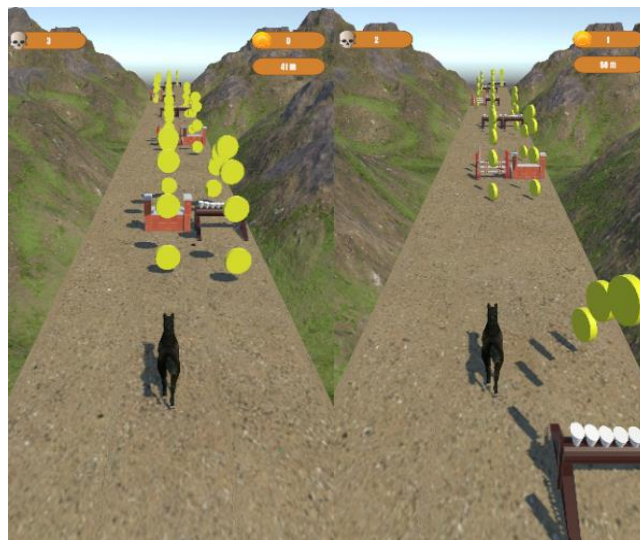


Illustration 15. Losing lives

has gone against the game rules. It is possible to buy more lives once during the game when the lives have reached zero (Illustration 16).



Illustration 16. Buy more lives panel

Coins are placed on top of obstacles in the game, and this means they can only be collected by jumping over the obstacles with the horse. The number of coins collected is kept in mind using the `PlayerPrefs`²¹ where they can be set and get the desired values. In this way, players can come back to the game at any time and continue where they left off. All this logic is done in the `Coin` class.

Coins have added audio and it is triggered when there is contact with the coin. All audio in the game is controlled by the `AudioManager` and called during the game. The sounds used give players a peaceful feeling and the illusion that they are riding a horse between mountains.

To see how the whole game works, we need to test the game on real players. To evaluate this, *Cross-Country Horse Run* was tested on potential target audience players.

²¹ `PlayerPrefs` <https://docs.unity3d.com/ScriptReference/PlayerPrefs.html>

5 Testing

Testing is very important for any software. Thus, testing was conducted to assess the quality of the game and collect feedback from the target audience. In this way, it is possible to find out how *Cross-Country Horse Run* design and implementation work on real players. Subchapter 5.1 explains the *Cross-Country Horse Run* testing strategy. Player feedback is described in subchapter 5.2, and improvements and future plans are explained in subchapter 5.3.

5.1 Methodology

Playtesting opens the developer's eyes and forces them to solve problems that have been avoided for a long time [6]. According to Jakob [7], it is best to conduct testing with 3-5 people, because when going over it, each person tells the developer less and less what could be improved.

Each tester received a Google Drive link from which they could download the *Cross-Country Horse Run* game. The developer was not present next to the tester, and everyone could choose the time and place where they tested the game. The game was unfamiliar to the testers, and they knew practically nothing about the game. This means they had to figure out how the whole app works while playing. After testing the game, the testers had to fill out a questionnaire. Questionnaire questions covered the tester's background, overall game experience, game mechanics, user interface and visual style. The collected feedback made it clear what designs worked in the game and what needs further development.

5.2 Results

Testers were asked various questions about the *Cross-Country Horse Run*. Subchapter 5.2.1 provides an overview of how much testers know about mobile and hyper-casual games. Subchapters 5.2.2 to 5.2.6 provide an overview of testers' feedback.

5.2.1 The Tester

Based on the feedback received, the two testers of *Cross-Country Horse Run* play mobile games at least once a week. There was one person who does not play these games at all and a player who plays practically once every day. The most popular genres among testers are puzzle and strategy games. Few people play endless runner type games these days, but

Subway Surfers and *Temple Run* have been favorites in the past. Thus, the testers' experience of the game can uncover important shortcomings.

5.2.2 The Overall Experience

In order to understand what kind of experience the game created for the testers, they were asked to rate it on a linear scale. The range was from 1 to 4, with 1 meaning “Did not like it at all” and 4 “Loved it”. They were also requested to give a rating on how hard the game was and to express their preferred and disliked elements of the game.

In general, the feedback was positive, but there was also criticism. Average rating for overall gameplay enjoyment was 3.5 out of 4 (Illustration 17). Some testers liked the obstacles and the overall theme the most. It was also pointed out by one of the testers that the obstacles lacked variety, i.e., there were many identical obstacles. One tester did not like picking up coins because the horse's speed and jumping did not go well together. Regarding the coins, it was also pointed out that coins do not have enough use cases and players could not choose horses of different colors. The game was praised for being easy to understand and play, even for those unfamiliar with the genre.

The simplicity of the game helped testers get into the game right away. This is also shown by the average score because the players had to rate the difficulty of the game on a 4-point scale. In this range, 1 meant “Impossible” and 4 “Too easy”. Everyone rated the game with 3 points, which means the average was also 3 (Illustration 18). The testers had the main difficulty with speed and jumping, because the more the game progressed, the less speed and jumping were in harmony. This meant either jumping too early or skipping the obstacle.

The overall experience with *Cross-Country Horse Run* was positive. There was constructive criticism and some shortcomings were found. To gain a better understanding of the criticisms and shortcomings, the testers were asked to provide ratings for each game mechanic.

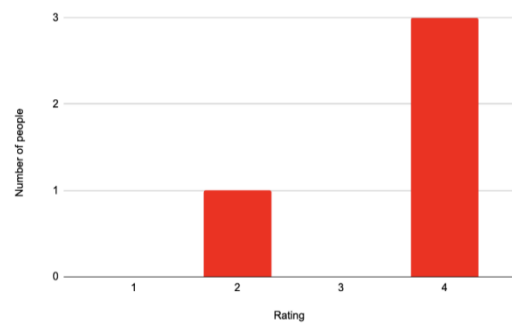


Illustration 17. Overall experience feedback

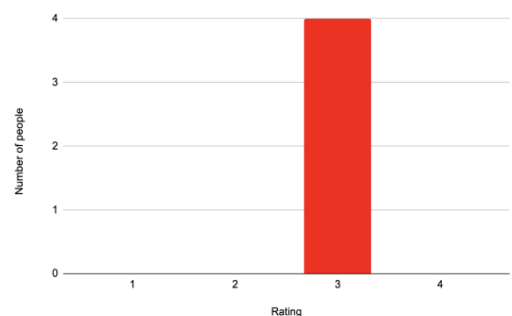


Illustration 18. Game's difficulty feedback

5.2.3 Game Mechanics

The testers had to evaluate the gameplay mechanics in the game. A total of five mechanics could be given feedback, which were avoiding obstacles, destroying obstacles, collecting coins, jumping over obstacles, and searching for lives. Each mechanic could be answered on a linear scale from 1 (“awful”) to 4 (“perfect”) and also testers had to choose favorite and not-so-favorite mechanics. It was also possible to give advice on how to improve the game.

The obstacle avoidance mechanic had an average rating of 3.5 out of 4, meaning it had some minor flaws (Illustration 19). Since the player does not have a swipe down control and the speed and jumping are not in sync, there may have been an issue where the player could not run away from the obstacle as quickly. This meant colliding with an obstacle and losing a life.

Obstacle destroying had an average rating of 3.25 out of 4 (Illustration 20). This means that testers liked this mechanic less than obstacle avoidance. One of the problems was the line change, because the horse changed lines very suddenly and this could confuse the tester. Also, upon touching an obstacle, it disappeared instantly without any visual effect. This meant, if testers accidentally touched an obstacle, they might not have noticed that the obstacle was gone.

The most problematic mechanic turned out to be the collection of coins, which is also confirmed by the average result with a score of 2.25 out of 4 (Illustration 21). With such a result, a lot of effort needs to be put into the improvement to keep the players satisfied. Testers had trouble with collecting coins, as some coins were not picked up as the speed

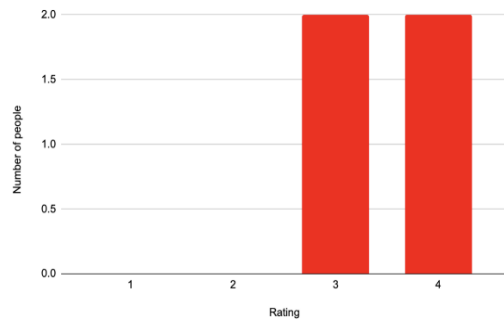


Illustration 19. Obstacle avoidance mechanic feedback

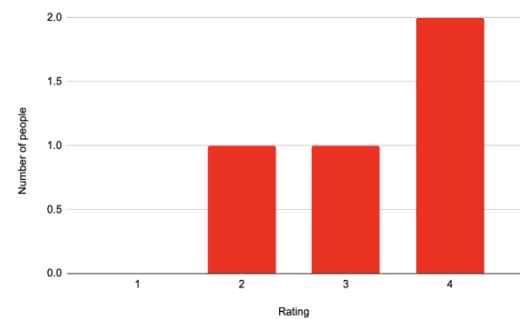


Illustration 20. Destroying obstacles mechanic feedback

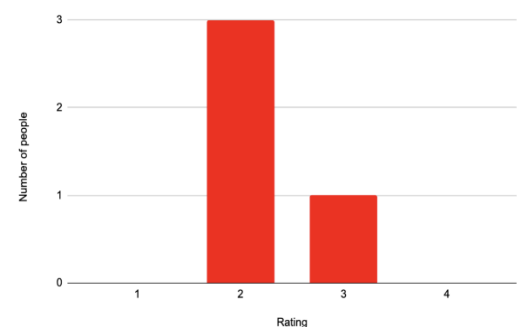


Illustration 21. Collecting coins mechanic feedback

increased. One tester suggested shortening the time in the air or adding a swipe down control to the player so that the coins behind the obstacle can also be collected.

The average rating for buying lives was 3.25 out of 4 (Illustration 22). Based on feedback, this mechanic had some minor flaws. Testers did not find anything wrong with buying lives, but they wished coins could have bought something other than lives. They mainly wanted a shop where they could buy horses of different colors. Developing this system requires a lot of time and patience.

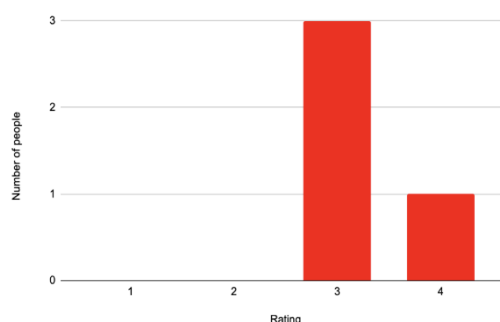


Illustration 22. Buying lives mechanic feedback

The testers' favorite mechanic turned out to be jumping over obstacles, which received an average score of 3.25 out of 4 (Illustration 23). The result was brought down by one tester's below-average rating. The problem was that the initial speed was too slow, and the box colliders of the obstacles were too big. The highlighted problem areas just need a bit of polishing so that players can enjoy the game even more.

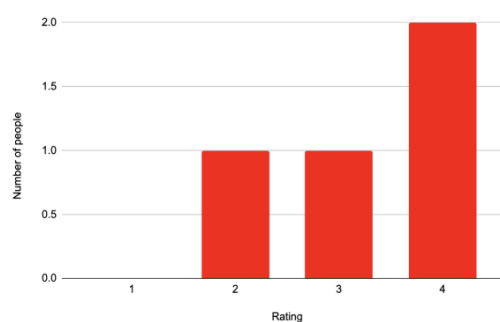


Illustration 23. Jumping over obstacle mechanic feedback

Based on the collected results, it can be said that all mechanics need some improvement. Avoiding obstacles turned out to be the top-scoring mechanic, while jumping over obstacles was the real favorite of the testers. The least favorite mechanic was collecting coins, and this was confirmed by the average score. Subchapter 5.3 provides a more detailed overview of what was improved and what are the future plans for the game. In addition to the mechanics, it is important to understand if the players understand the basics of the game. That is why the testers were asked to rate the user interface.

5.2.4 The User Interface

The user interface is the way the player interacts with the game and its purpose is to make the player's experience simple and intuitive²². To find out how the game really felt to the

²² <https://www.indeed.com/career-advice/career-development/user-interface>

testers, they were asked to rate the panel navigation, the process of finding lives and the horse controls. It was also possible to give suggestions on how to improve the user interface.

Testers had to rate how difficult it was to navigate between panels in the game. Players had to choose a number on a linear scale, where 1 meant very difficult and 4 meant very easy. The average rating was 3 out of 4, which means that it was easy to navigate, but there were still some issues (Illustration 24). No one raised concerns, but it can be assumed that testers did not like being stuck navigating and not getting to the panel they wanted right away.

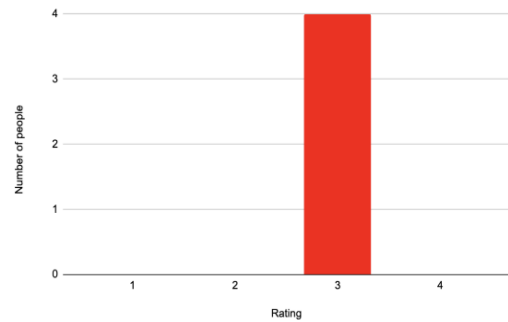


Illustration 24. Panel navigation feedback

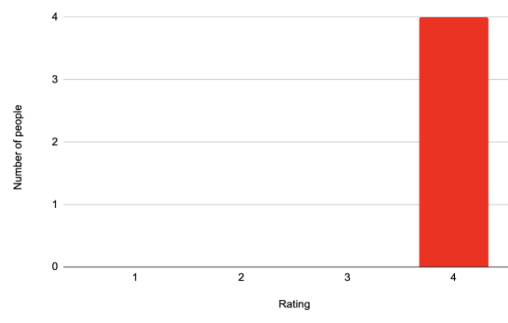


Illustration 25. Lives buying process feedback

The testers were also asked for their opinion on the ease of the life buying process. On a linear scale, an assessment could be given from 1 ("Very difficult") to 4 ("Very easy"). The average result was 4 out of 4, which means that everyone thought it was understandable (Illustration 25). None of the players had any problems with buying lives and understanding the panel.

Finally, testers were asked how responsive and intuitive the horse's controls were. The results are positive, mainly because the controls were thought to be very or mostly responsive and intuitive. As mentioned in sub-chapter 5.2.3, the problem can be the sudden change of line and jumping of the horse.

Based on the feedback, it can be said that the interface and controls of *Cross-Country Horse Run* were very easy to understand. However, there are still some areas for improvement such as the horse controls and panel navigation. The goal of the user interface is to create a simple and intuitive experience for the player and on the other hand aesthetics wants to create a visually engaging experience. So, it is important to know how the testers feel about the aesthetics of *Cross-Country Horse Run*.

5.2.5 The Aesthetics

The aesthetics of *Cross-Country Horse Run* are realistic and give the player the feeling of riding a horse through the mountains. To evaluate whether this is actually how it feels to others, testers were asked to rate the aesthetics, color scheme, and sound effects. They were also asked to explain their own feedback.

First, the testers had to evaluate whether the game gave them the feeling of riding a horse through the mountains. They had two options to choose from: yes or no. The answers were evenly split among the testers, indicating that not all players experienced that feeling. The aesthetics were praised for being very nice, and the background music contributed a lot to the atmosphere. However, some testers felt more like a horse than a rider, and the flat terrain took away from the experience, as more winding roads or riding over mountains could have been included.

The color scheme used in the game was rated on a linear scale from 1 ("Not at all") to 4 ("Extremely"). The average score was 3.75 out of 4, indicating that all colors used in the game were very similar to real life (Illustration 26). One tester suggested adding a dark theme to the game to make it more exciting and create a more realistic day and night cycle.

Various sounds were used in the game to enhance the experience. Their suitability was evaluated on a linear scale from 1 ("Not at all") to 4 ("Extremely"). Like the color scheme, the sounds in the game received an average score of 3.75 out of 4, indicating that most testers were satisfied with them (Illustration 27).

However, one tester didn't like that all the sounds in the game were so loud.

In conclusion, the aesthetics of *Cross-Country Horse Run* were well-liked by the testers. There were a few areas that needed some attention and further development. The feedback received so far has highlighted the game's strengths and weaknesses, making it important to evaluate and understand how the game performed overall with the testers.

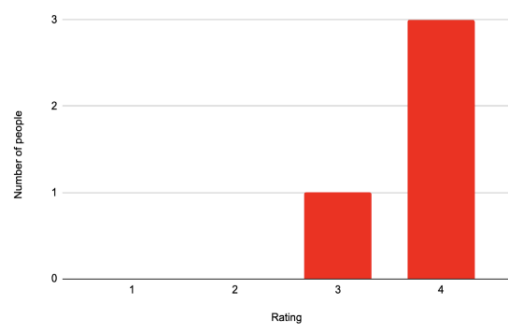


Illustration 26. Color scheme feedback

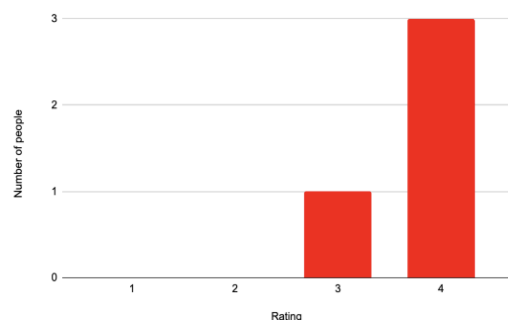


Illustration 27. Used sounds feedback

5.2.6 Conclusion

One of the main ways to find out the potential of a mobile game in a market is to test the product on a target audience. This data can be used to determine how the game would fare for humans [8]. Finally, testers were asked how likely they were to recommend *Cross-Country Horse Run* to other people. The assessment had to be given on a linear scale from 1 ("Very unlikely") to 4 ("Very likely"). The average

score was 3.5, which means that testers are very likely to recommend the game to others (Illustration 28). This in turn suggests that there will be players for *Cross-Country Horse Run* if the necessary improvements are made.

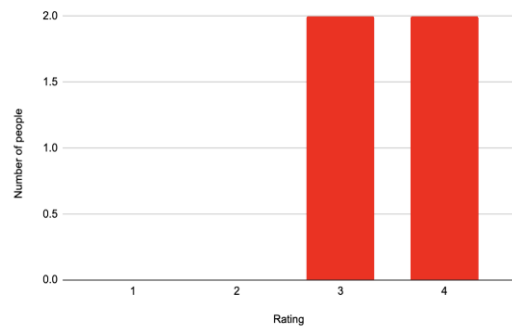


Illustration 28. Recommendation feedback

5.3 Improvements

Subchapter 5.2 gave an overview of feedback and problems found by testers. After testing, some changes were made based on the comments:

1. new swipe down control so players can collect coins and jump over obstacles better;
2. the speed is increasing faster, so that the game is a bit more intense at the beginning;
3. the side movements of the horse were improved, which means that movements are smoother. For this, an animation tool called DOTween²³ was used;
4. all sounds in the game were turned down a bit.

More improvements and fixes are planned for the future as they cannot be achieved within the scope of a bachelor's thesis. Some details will require additional attention:

1. a shop system for players, where players can buy a horse of a different color;
2. the change of day and night, which makes riding even more real;
3. new obstacles to make the game more diverse;
4. visual enhancements to add excitement to the player;
5. playtesting with new users to get new feedback.

²³ <http://dotween.demigiant.com/getstarted.php>

6 Conclusion

The 3D endless runner game *Cross-Country Horse Run* was developed as part of this thesis. The goal was to create a game that gives players an enjoyable experience and the feeling of riding a horse in nature. Similar games were researched, and playtesting was done in the final stages of development and after that improvements were made.

While making the game, various game mechanics were created like obstacles, player lives and coins. Blender, a 3D modeling software was used to create the models seen throughout the game. The entire world and logic were created with Unity using C# as the main programming language for scripting.

The game was playtested by 4 people in the final stages of game development. The purpose of the testing was to evaluate how *Cross-Country Horse Run* design and implementation work on real players. The feedback showed that the overall experience of the game and the concept of the game were highly appreciated, but there was also some negative feedback. It means the game has some shortcomings which can be improved in the future.

It was my first mobile game development experience, and I learned a lot from it. While working on the game, I was able to improve my skills and learn more about every aspect of designing games for mobile devices. I will develop this game further one day to give players an even better experience.

Many thanks go to the supervisor Daniel Nael, whose feedback and suggestions helped to improve the quality of the thesis. Also need to thank the *Cross-Country Horse Run* testers and Raimond-Hendrik Tunnel for giving the Bachelor's Thesis Seminar.

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Appendix

I. Glossary

1. **Mobile game** – type of game that is designed to be played on mobile devices and range from simple games to complex ones. The game is easy to download and suitable for everyone²⁴.
2. **Hyper-casual game** – a game characterized by short sessions, straightforward gameplay, suitable for everyone, easy to download and can be played everywhere²⁵.
3. **Endless runner game** – a game where character runs endlessly forward while avoiding obstacles and collecting power-ups²⁶.
4. **Banner ad** – ad format which displays at both the top and bottom of the screen on a device²⁷.
5. **Rewarded ad** – ad format which reward users for watching videos or interacting with ads and surveys²⁷.
6. **Interstitial ad** – full-page ad format where it is displayed at natural breaks such as level completion²⁷.
7. **Playtesting** – the game testing process where testers assess whether the gaming experience fulfills the requirements set by its game design [6].
8. **User interface (UI)** – the way users interact with the application and is designed to make users' lives easier²⁸.
9. **Foundational technology** – the technology that includes all the components required for a computer game [6].
10. **Decorational technology** – the technology that includes components which improve the creation and playing experience of a game [6].
11. **Z-pattern** – the design concept where the placement of content and elements are in a specific pattern that follows the shape of the letter Z²⁹.
12. **Animator** – tool used in the Unity to create and control animations for game objects³⁰.

²⁴ <https://www.applovin.com/glossary/mobile-gaming/>

²⁵ <https://www.applovin.com/glossary/hyper-casual-games/>

²⁶ https://www.wikiwand.com/en/Endless_runner

²⁷ <https://support.google.com/admob/answer/6128738?hl=en>

²⁸ <https://airfocus.com/glossary/what-is-a-user-interface/>

²⁹ <https://rockcontent.com/blog/z-shaped-pattern-for-reading/>

³⁰ <https://docs.unity3d.com/560/Documentation/Manual/class-Animator.html>

II. Launch Guide

Instructions to play *Cross-Country Horse Run*:

1. Find an Android phone.
2. Download and unzip *accompanying_files.zip*.
3. Find and download *Cross-Country-Horse-Run.apk* file.
4. After installation open application and start playing.

III. Assets

Table 1. Assets from the internet

Asset	Author	Source
UI pack	RR Studio	https://assetstore.unity.com/packages/2d/gui/icons/combo-of-awesome-game-ui-pack-8-9-10-11-12-and-13-197477
Water texture	LowlyPoly	https://assetstore.unity.com/packages/2d/textures-materials/water/stylize-water-texture-153577
Mountain Terrain	CG Creative Sets	https://assetstore.unity.com/packages/3d/environments/landscapes/mountain-terrain-rock-tree-97905
Horse model	4toon Studio	https://assetstore.unity.com/packages/3d/characters/animals/mamals/cartoon-animal-arabian-horse-18687
Ground texture	-	https://ambientcg.com/view?id=Ground054
All sounds used	-	https://pixabay.com/sound-effects/search/horse%20gallop/?manual_search=1&order=None

IV. Accompanying Files

- */Testing* – this folder contains the questionnaire and the testers' answers.
- *demo.mp4* – a small video demonstration of the *Cross-Country Horse Run*.
- *Cross-Country-Horse-Run.apk* – the installation package of the game.
- *Cross-Country-Horse-Run.zip* – this compressed folder contains game project files.

V. Source Code

The source code and assets of *Cross-Country Horse Run* are available via request on <https://github.com/karolyraudsepp/Cross-Country-Horse-Run>.

To request access please send an email to karolyraudsepp47@gmail.com.

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