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Immotion - Exergame for Warm Up Guidance and Motivation

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Saarbrücken, March 2018

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Abstract

Past research related to exergames has found that they can help to motivate people to exercise by converting physical activity into an enjoyable game. However, these exergames have been single purpose usually fitness only. In this thesis, we designed an exergame for warm up guidance and motivation. This exergame is designed to be used in gyms and fitness centers before physically more strenuous exercise. We utilized immersive technologies based on the hypothesis that they can be used as a guiding tool for warm up procedures and would improve motivation to engage in warm up procedures more often. By making the game interactive and appealing, with intervals that last as long as the player chooses to, the warm up procedure undergoes a shift from a repetitive and tiresome activity to an entertaining and challenging necessity. In order to evaluate our exergame, we conducted a user study comparing warm up procedure without a game to a warm up procedure with two versions of the game: one using the Kinect sensor, and one displayed on a screen. The usage of the exergame, with or without the Kinect sensor showed a small but statistically significant increase in exercise performance relative to the non-gaming condition, with the screen condition faring slightly better than the Kinect condition. The exergame showed a significant increase in user motivation and enjoyment when compared to the non gaming condition, with the Kinect condition found to be slightly more motivating than the screen condition.

Acknowledgements

Contents

Abstract	iv
Acknowledgements	v
Contents	vii
List of Figures	ix
List of Tables	xi
1 Final Design Overview	3
1.1 A Modular Design Approach	3
1.2 Home Window Overview	4
Start Menu	5
Help Menu	6
Volume Menu	7
High Score Menu	7
Quit Menu	7
1.3 Game Segments Overview	8
1.4 Game End Overview	13
Bibliography	21

List of Figures

1.1	Home screen.	4
1.2	User Info Menu.	5
1.3	Countdown screen.	6
1.4	“Waiting for user” popup screen.	6
1.5	Help menu.	7
1.6	Adjust volume menu.	8
1.7	High score menu.	8
1.8	Overview of game segments - top view.	9
1.9	Right hand up segment.	10
1.10	Bridge segment.	11
1.11	Right or Left hand up segment.	11
1.12	Right or Left hand up segment.	12
1.13	Star jump segment.	12
1.14	Jump left segment.	13
1.15	Jump right segment.	14
1.16	Jump up segment.	14
1.17	Left hand up segment.	15
1.18	Right hand up segment.	15
1.19	Squat segment.	16
1.20	Squat and move right segment.	16
1.21	Squat and move left segment.	17
1.22	Filler segments.	18
1.23	Individual scores menu.	19

List of Tables

Chapter 1

Final Design Overview

The overall exergame development was user centered. Based on the feedback gathered from the prototype game review, discussions with experts, new movements have been introduced and modifications have been made to the existing design in order to make the exergame more engaging, enjoyable, and intuitive to use for the future users. This section outlines the design and development of the final version of the Immotion exergame for warm up routine guidance and motivation.

1.1 A Modular Design Approach

In order to make the exergame easily adjustable for user requirements we followed a modular design approach. That is, each movement (exercise) that is required from the user to be performed is represented by one distinct game segment. To put it differently, the whole game system was subdivided into smaller parts, that could be independently created and then used accordingly. That way, by combining multiple segments randomly, we were able to generate a unique game map each time the user played the exergame. The game is not constrained by one global map, but a dynamic one created on each game run. Moreover, having segments as the basic game artifacts, allowed us to easily add new segments that make the game richer and the set of required movements bigger. Also, this way we easily discarded segments and movements users disliked or were difficult to perform. We believe this is a major feature that makes the our exergame scalable and extensible for future user requirements and preferences.

1.2 Home Window Overview

When the user starts the exergame, the *Home screen* that is depicted in Figure 1.1 is showed. Apart from starting the game, other options are available to the user. The user can then chose from the following options:

- Start
- Help
- Volume
- High Score
- Quit

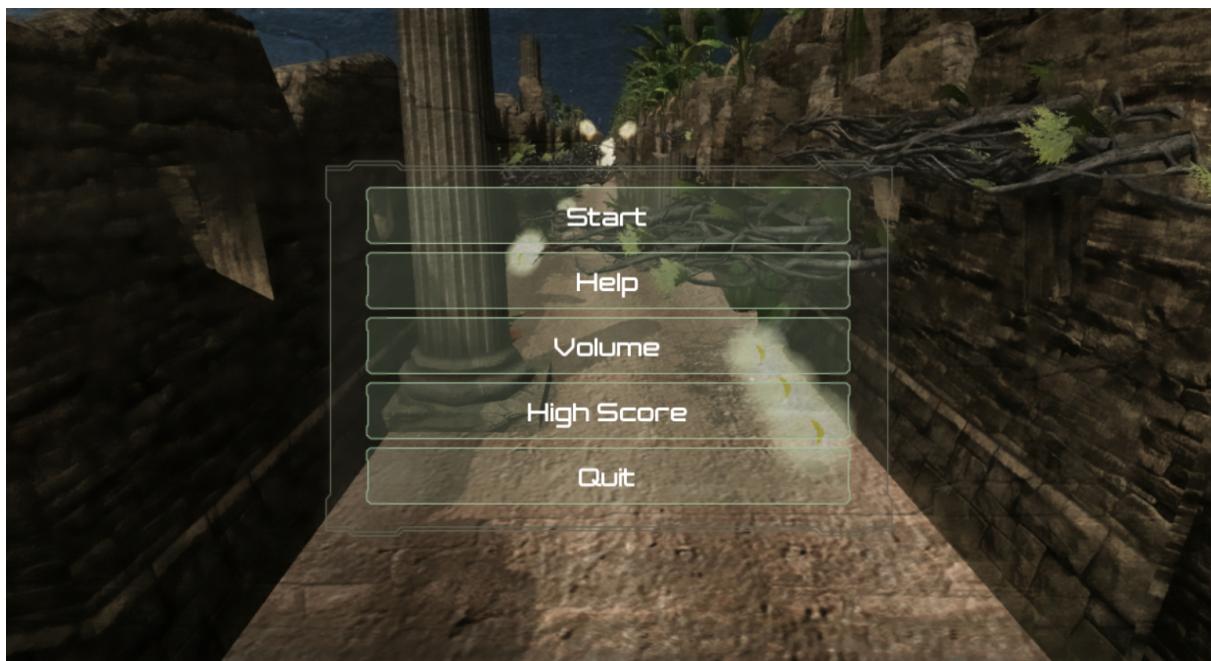


FIGURE 1.1: Home screen.

Next, the above listed options will be further detailed.

Start Menu

By selecting the Start button, the user is presented with a new screen showed in Figure 1.2 where user input is required.



FIGURE 1.2: User Info Menu.

For the purpose of tracking users' progress over time and their achievements, we asked them to input their name or username they would like to use in during the gameplay. Based on the username, we displayed users current and highest scores in the Individual score board showed in Figure 1.23. After the user set the username and clicked on the Start button, a countdown screen as displayed in Figure 1.3 was first presented. The countdown was set to 5 seconds. We opted for this duration because it showed as the most optimal in our pilot study previously conducted with the university personal. This amount of time was sufficient for the test players to prepare for the upcoming exercise by moving to the correct position. In case the user was not in the Kinect sensor range at the beginning of the game, a popup screen informed the user about this. Also, this screen was shown in case the connection to the Kinect sensor failed. The info screen is presented in Figure 1.4. By selecting the *Back* button, the user can go back to the previous Home screen.



FIGURE 1.3: Countdown screen.

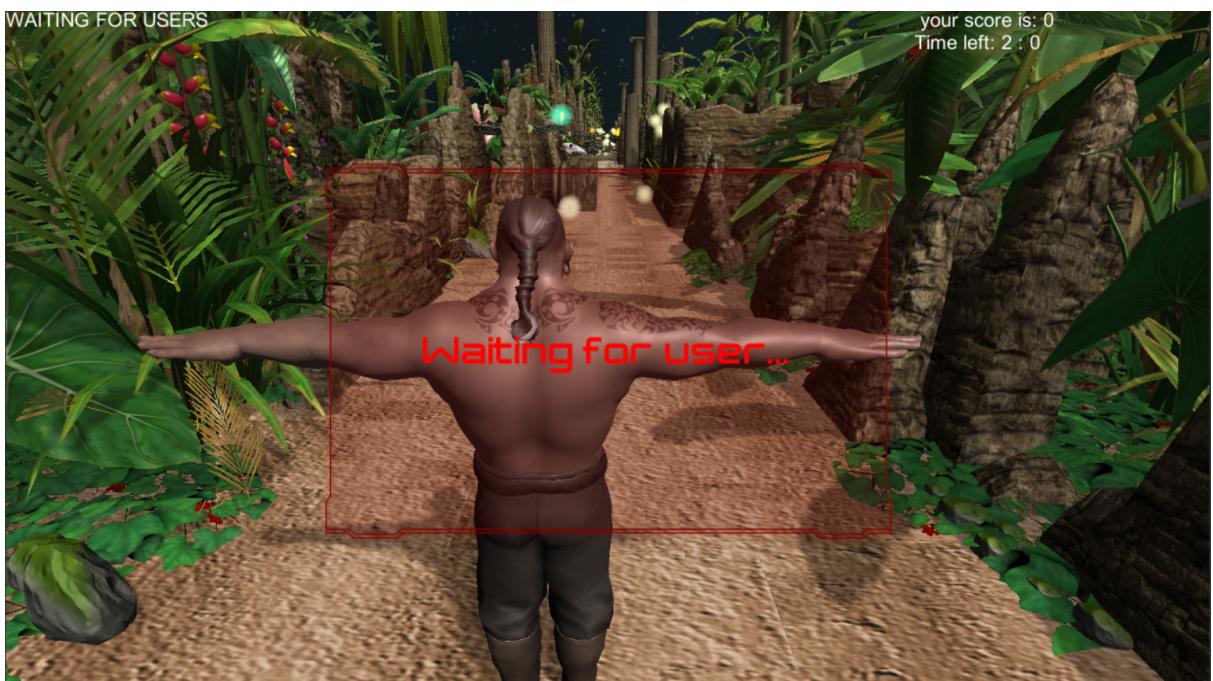


FIGURE 1.4: “Waiting for user” popup screen.

Help Menu

The help menu, as presented in Figure 1.5 lets the user know how to interact with the game, change the speed of the game, and start or stop the game. The Back button allows the user to

go back to the Home screen.

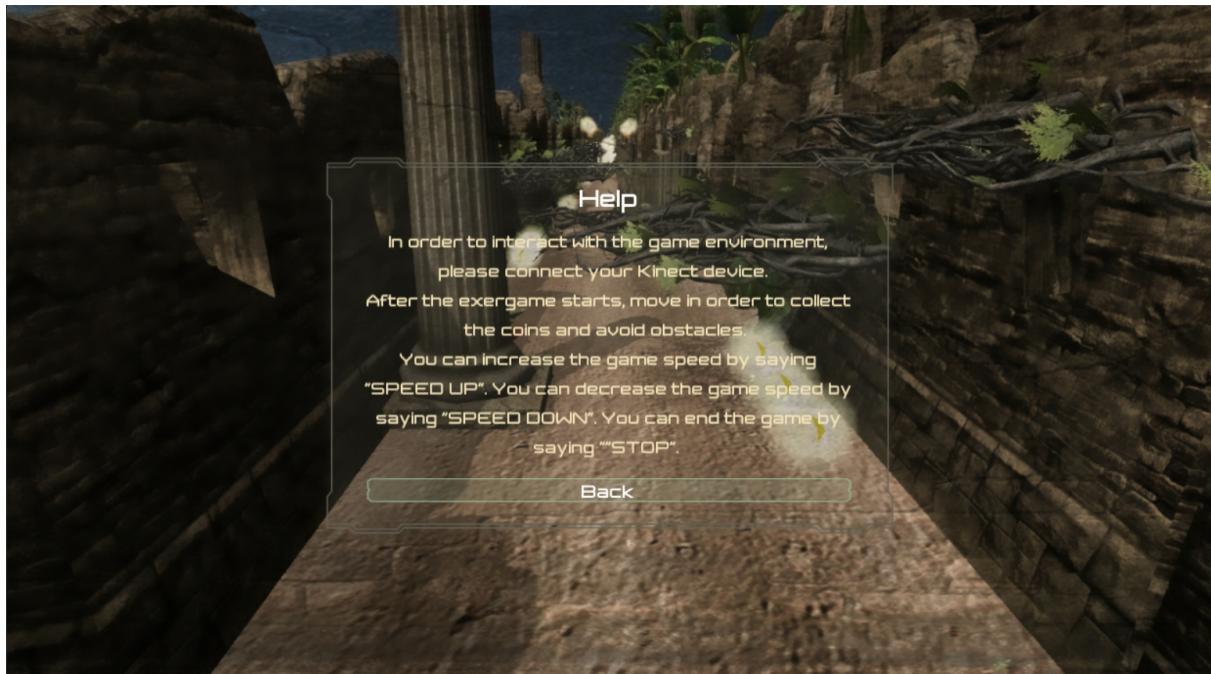


FIGURE 1.5: Help menu.

Volume Menu

The volume menu showed in Figure 1.6, gives users the possibility to modify the volume of the background music, sound effects (coins and obstacle collision sounds).

High Score Menu

The high score menu depicted in Figure 1.7 ranks the user who played the exergame based on the points collected during one gameplay. The leaderboard also displays the duration of the gameplay. This is a global highscore board. It is different than the one presented in Figure 1.23 since it includes all the players and their scores. Contrarily, the individual score board, displays only the scores of the user who currently played the exergame. The Back button allows the user to go back to the Home screen.

Quit Menu

The quit menu button exits the game.

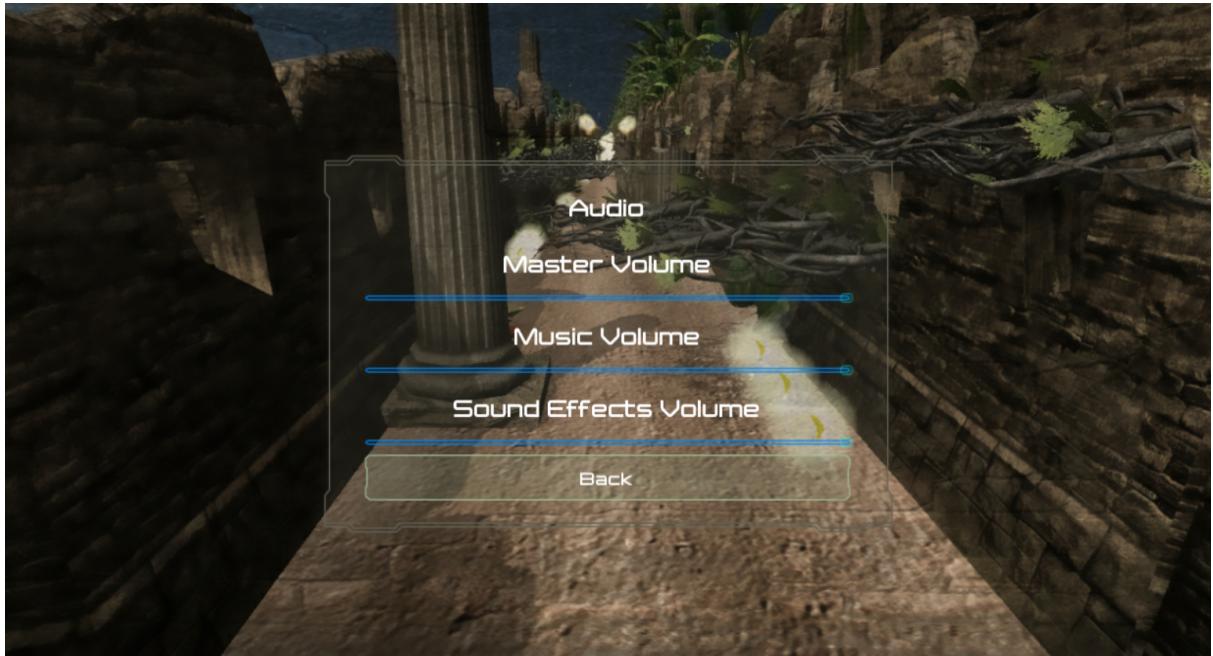


FIGURE 1.6: Adjust volume menu.



FIGURE 1.7: High score menu.

1.3 Game Segments Overview

Following recommendations from experts, available literature, and results from the first study, the list of warm up movements the users were required to perform during the game play has been updated. As already mentioned, each warm up movement the user was required to perform

has been represented by a game segment. Additionally, we introduced so called *filler* segments. In these segments no movements were required to be performed. Their only purpose was to give users a short amount of time to prepare for the subsequent game segment. By generating the segments randomly during gameplay, each game play was unique. Our main goal was to make the exergame intuitive to use. That is, the movements should come natural to the users and should not require further explanation. This was the result of our iterative and user centered design approach. We designed the segments based on the movements that can help users to warm up, and not contrarily. Figure 1.8 gives an overview of all the segments used in the exergame.

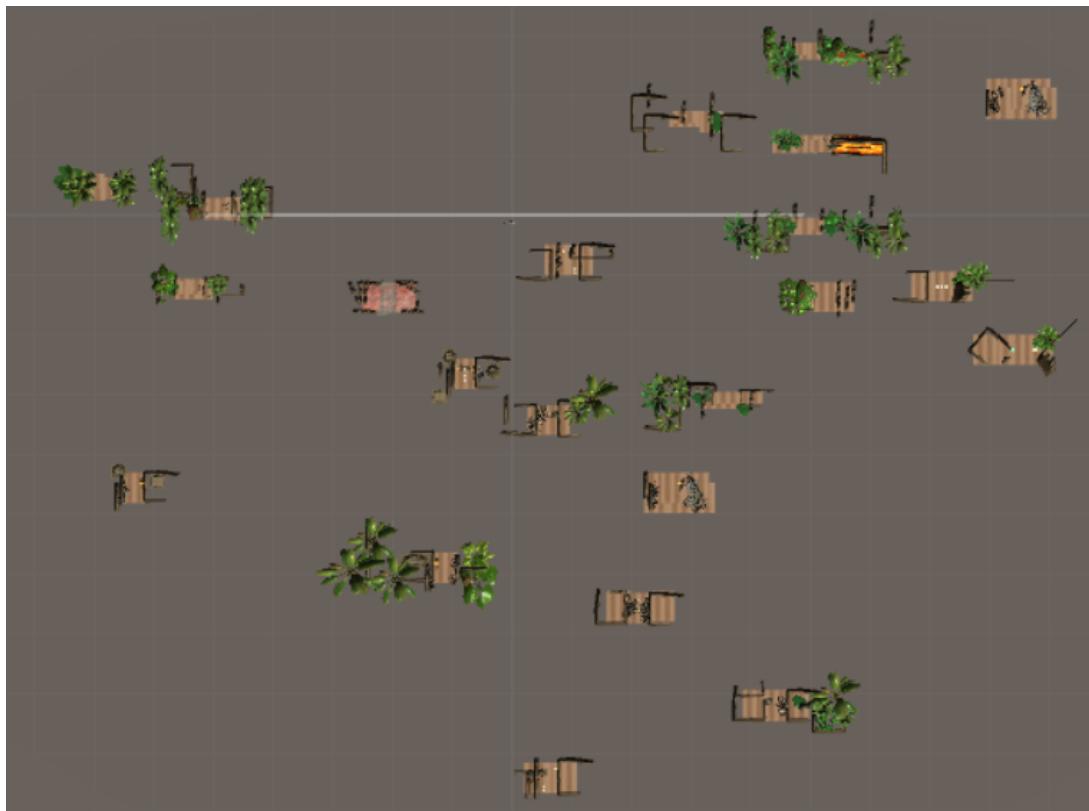


FIGURE 1.8: Overview of game segments - top view.

In most of the segments depicted in Figure 1.8, one specific movement is required to be performed. Some segments are without obstacles and are present in order for the users to prepare for the next segment (and movements). Also, segments without any obstacles are used at the beginning of the exergame. At the very start, ten filler segments are generated, however this number has made adjustable. The empty segments are placed at the beginning in order to avoid any sudden movements by the player risking injuries. Moreover, not having to perform any movements gives the player time to adjust to the gameplay and prepare for the movements.

Figure 1.9 shows the segment in which the user is required to move the hand in the upper

position and, in the same time, avoid the *wolf* obstacle. In case the user comes in contact with the wolf obstacle that is dynamic and is moving, the user is substracted one point from the overall score.



FIGURE 1.9: Right hand up segment.

Figure 1.10 is one of the filler segments used for the users to prepare for the next movement. However, in case the user does not use the bridge and comes in contact with the walls or lava obstacles, the user is loses a point.

Figure 1.11 and 1.12 represent segments where the user is given an option to chose which movement to perform. Both the movements include rising hand in the upper position. The decision is left to the user. In case the user opts for the left side, the possible reward is a *blue coin* that is worth five points. However, there is a possibility to lose points by colliding with the obstacles. On the other hand, by choosing right side, the user can collect four coins without worrying about losing points.

Figure 1.13 depicts a game segment where the user was required to perform a *star* jump in order to collect all the coins.

In Figure 1.14 and 1.15 shows game segments where the user was required to perform jump to the left and jump to the right in order to avoid the obstacles. In case the user hit one of the obstacle, the overall user score was reduced by one.

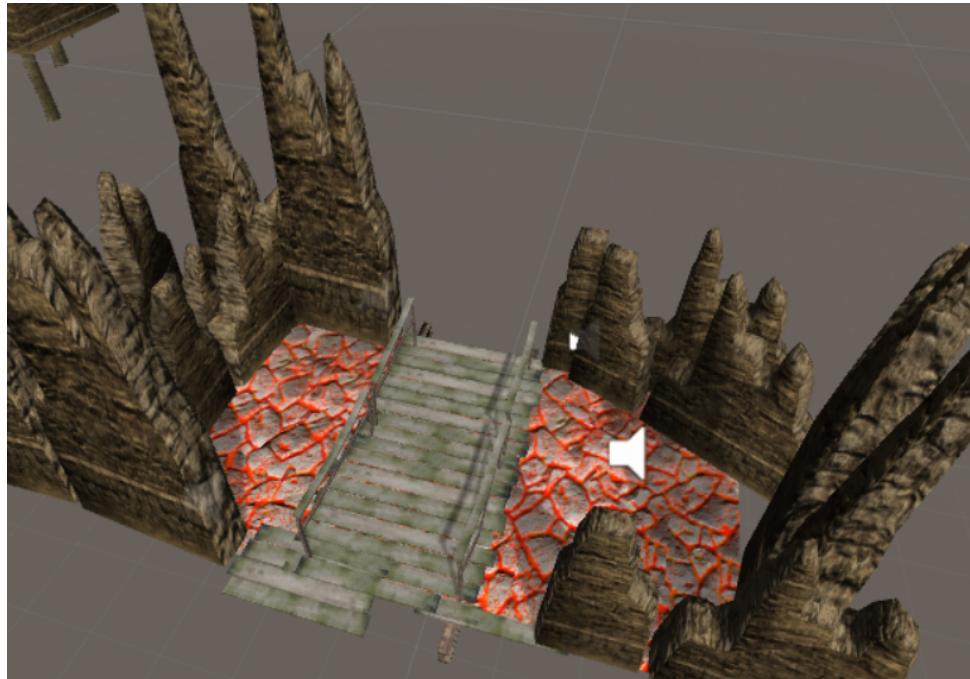


FIGURE 1.10: Bridge segment.

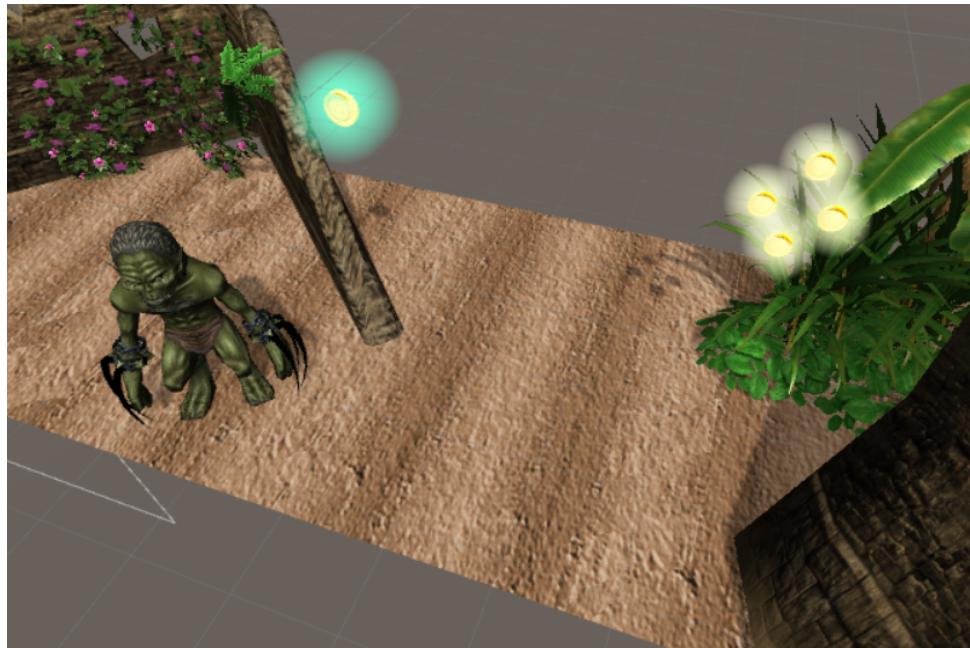


FIGURE 1.11: Right or Left hand up segment.

In the following Figure 1.16, the user was required to perform a jump in order to avoid the obstacle and collect the coins. The obstacle depicted was the lowest in the middle and would result in three collected coins in case performed correctly without colliding with the obstacle. In the meantime, the user is presented with a choice of collecting a coin that was worth four points. These coins were, however, placed in a position that required higher jump in order to be



FIGURE 1.12: Right or Left hand up segment.

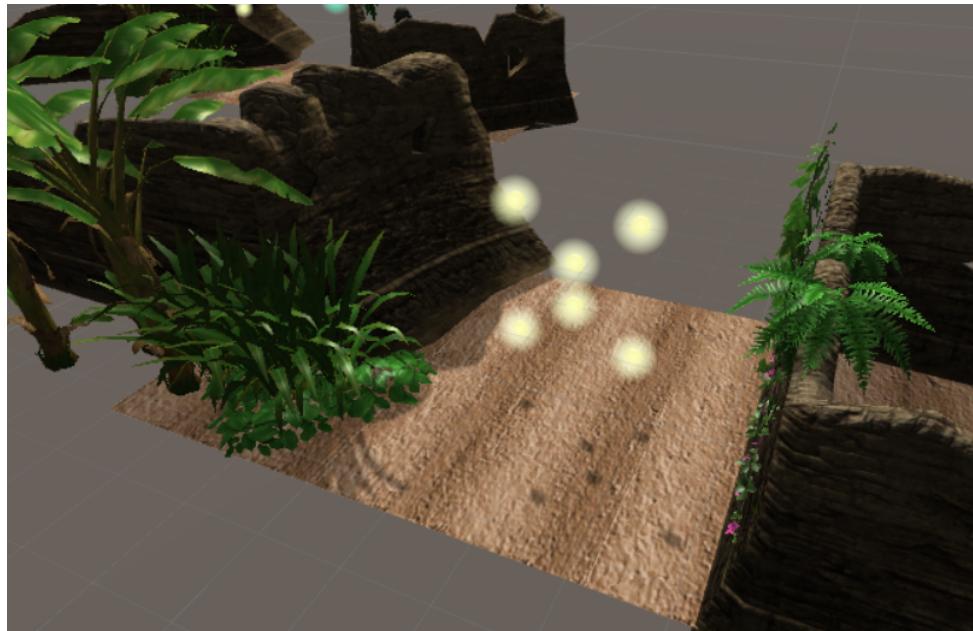


FIGURE 1.13: Star jump segment.

collected. There was also a higher chance to hit the obstacle since it was placed higher.

Figure 1.17 and 1.18 depict segments in which the user was required to perform a movement with the left and right arm in order to collect the coins. The obstacle was placed below the coins and one point is reduced from the user's overall score in case it was hit.

Figure 1.19 depicts a game segment in which the user was required to perform a squat and by doing that collect coins. In case the user hit the obstacles placed above the coins, the overall

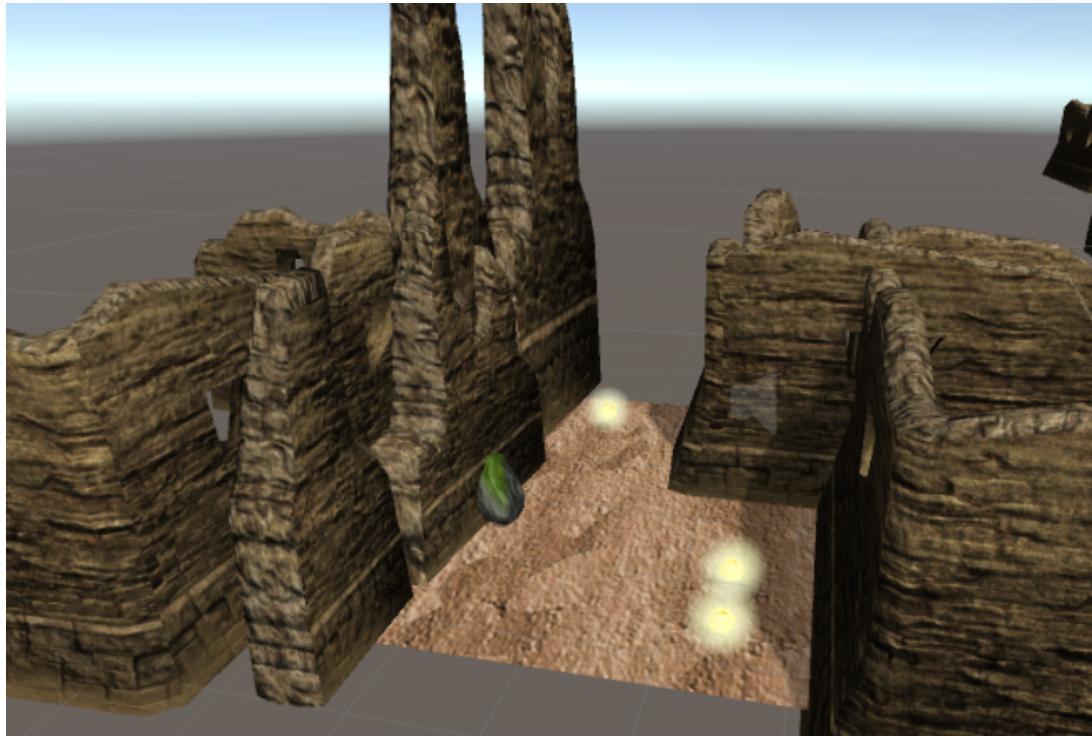


FIGURE 1.14: Jump left segment.

score was reduced by one.

In Figures 1.21 and 1.20 the user was required to perform a jump left or right and perform a squat. As in previous segments, in case an obstacle was hit, the overall score was reduced by one.

The following figures depict the filler (empty) segments that are placed at the beginning of the game and in between segments with obstacles.

1.4 Game End Overview

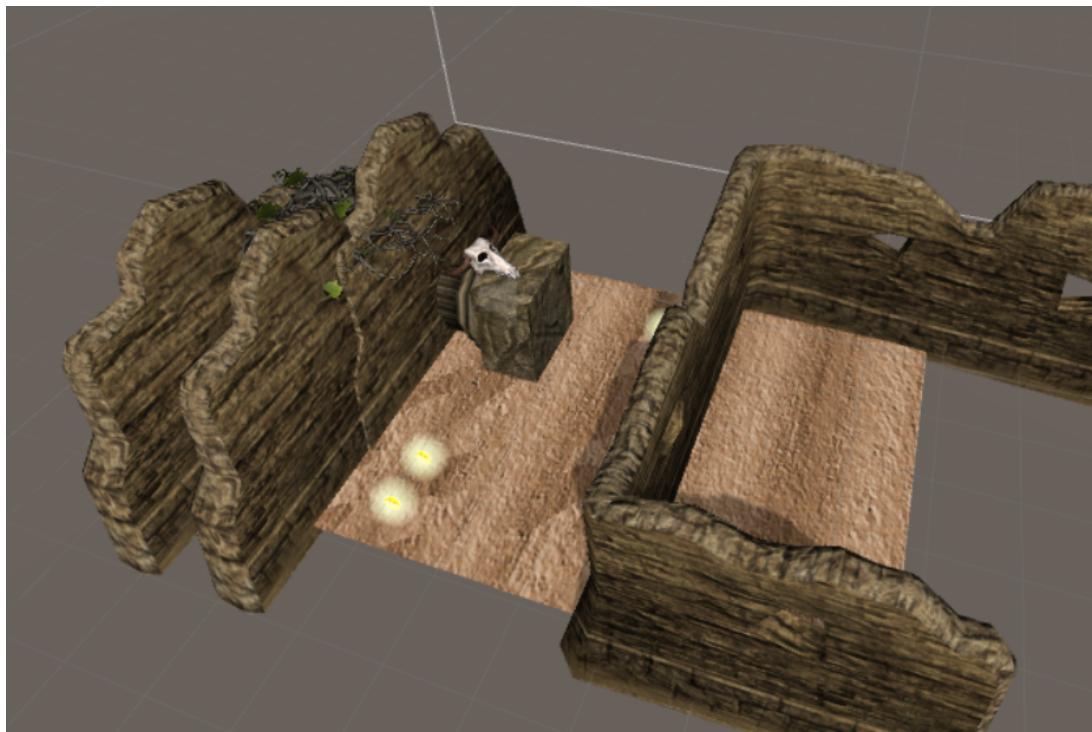


FIGURE 1.15: Jump right segment.

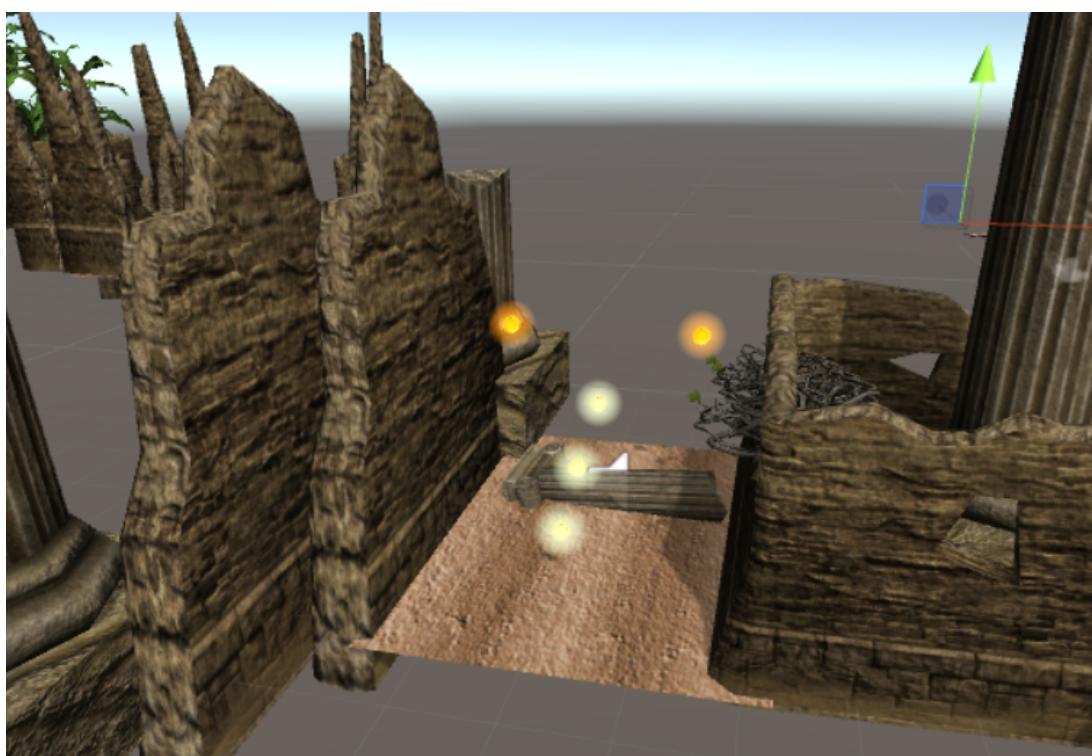


FIGURE 1.16: Jump up segment.

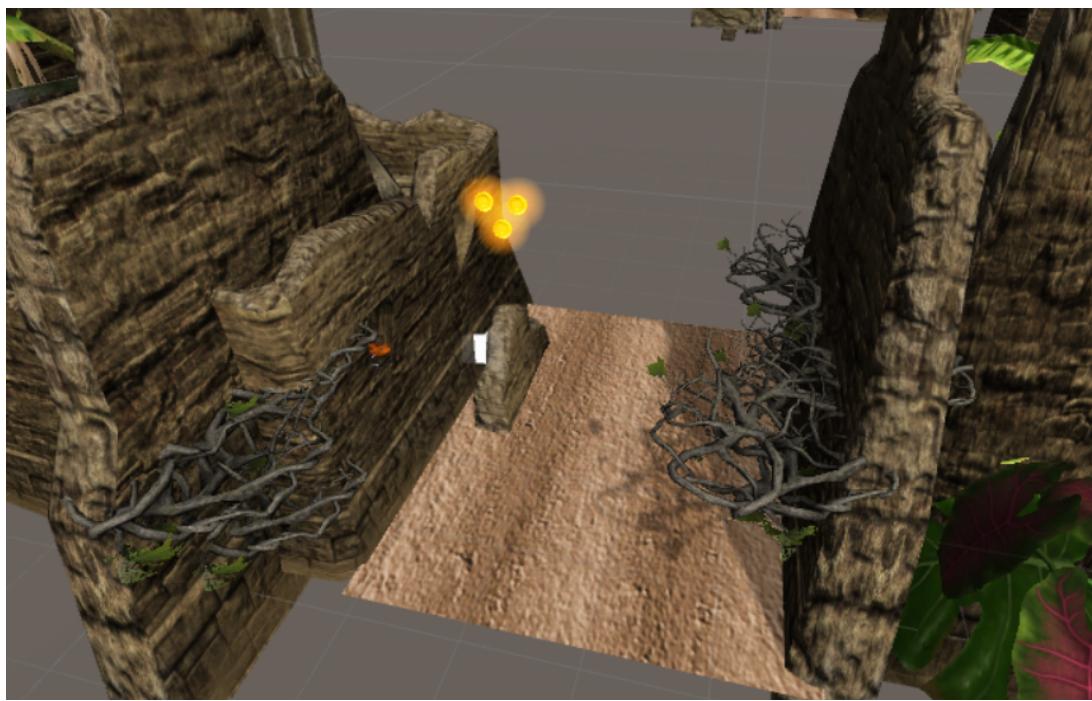


FIGURE 1.17: Left hand up segment.



FIGURE 1.18: Right hand up segment.

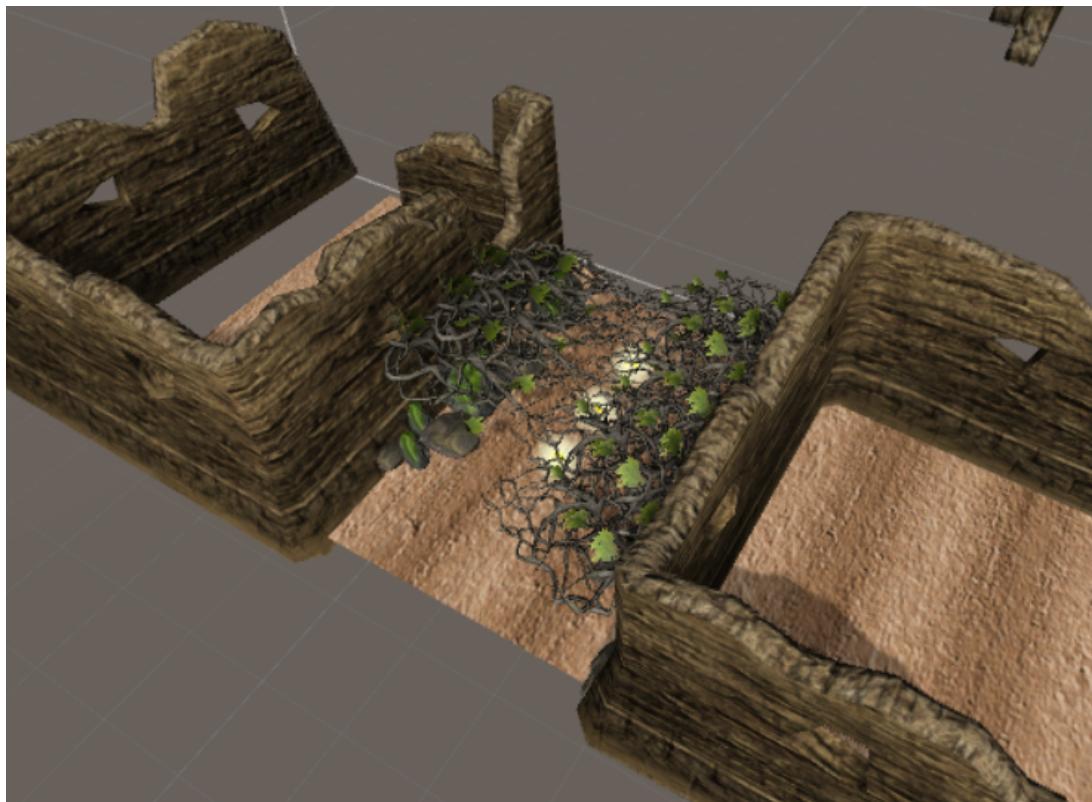


FIGURE 1.19: Squat segment.



FIGURE 1.20: Squat and move right segment.

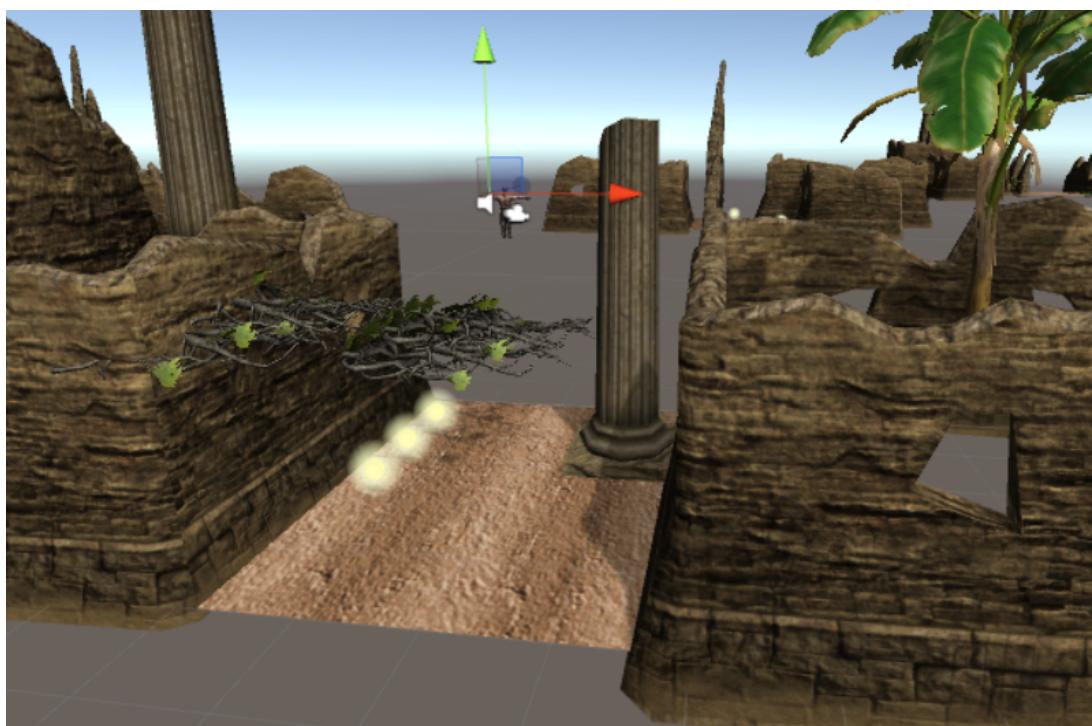


FIGURE 1.21: Squat and move left segment.

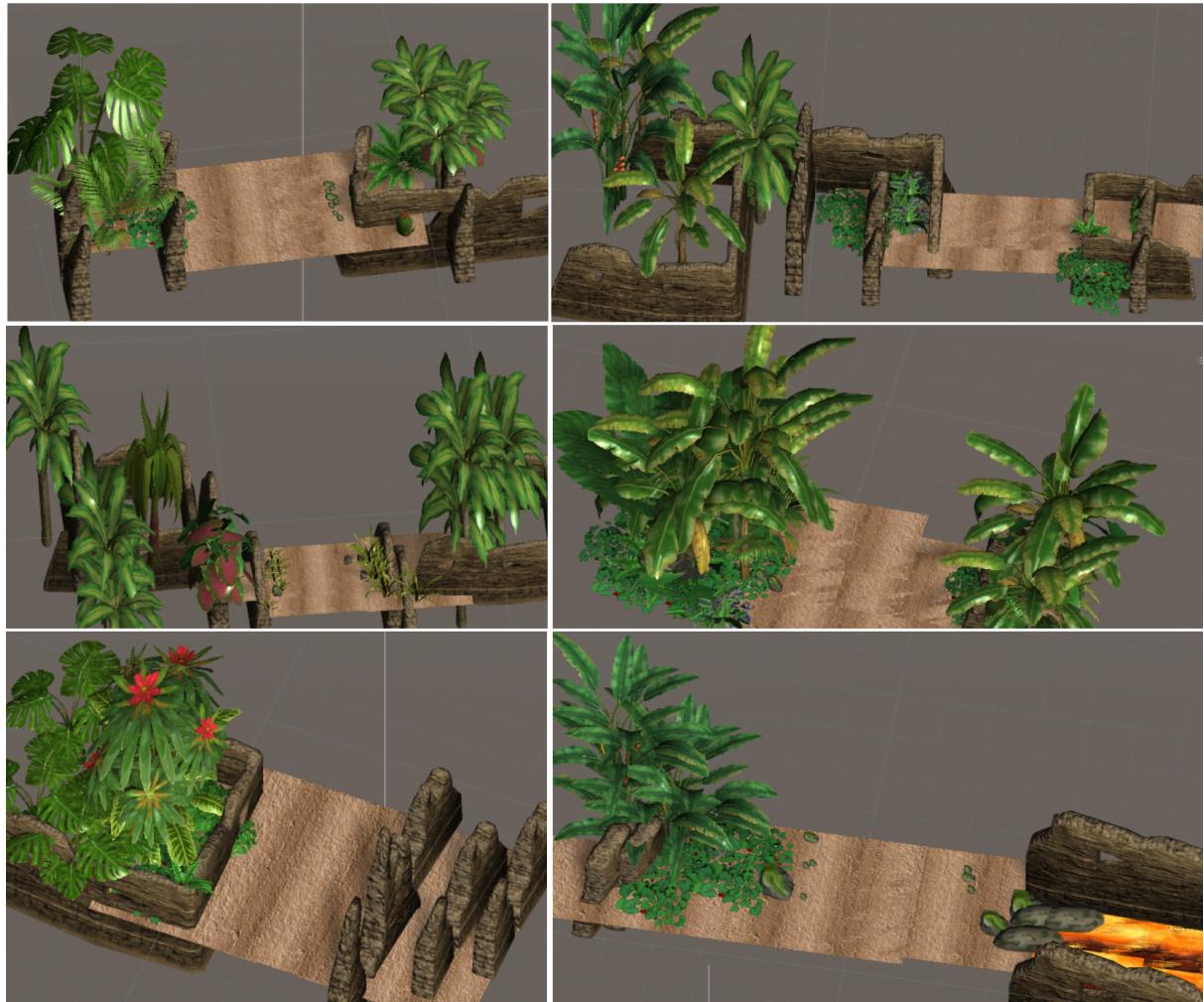


FIGURE 1.22: Filler segments.

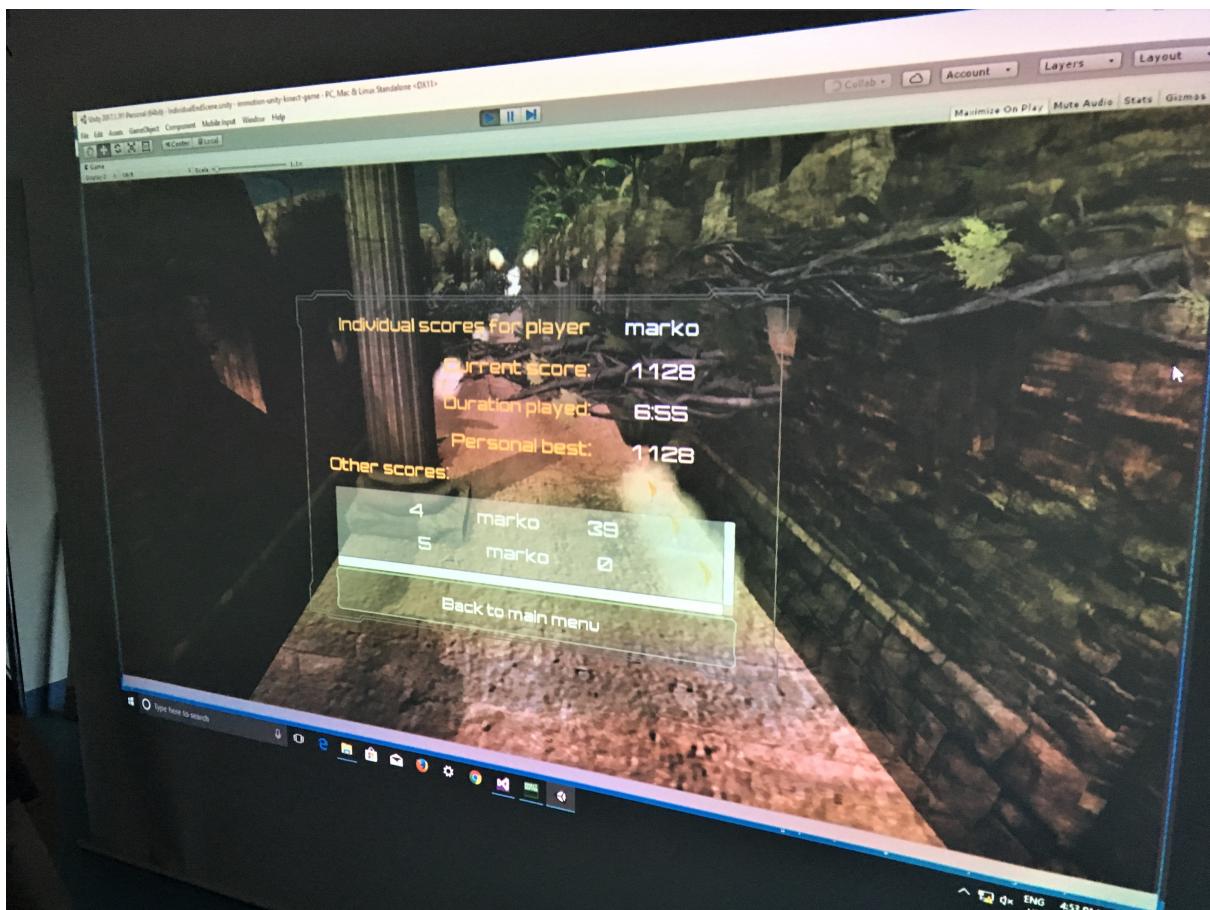


FIGURE 1.23: Individual scores menu.

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