

# Within Reach

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## ABSTRACT

How do game designers create experiences that engage with a player? It's an important question, one on the minds of many game designers across the industry, and it's a question with no single answer. It was with this question in mind that we began designing and developing *Within Reach*, a third person rock-climbing game. In attempting to create an experience that engaged with the player, we designed our game with the psychological concept of Motivation in mind. Our design mostly focused on providing players with simple gameplay, difficult levels, and a timer, with the aim of creating a balanced gameplay experience that was easy to learn and difficult to master, something that would keep bringing players back to improve upon their skills and completion time. Once our prototype was complete, we conducted various usability tests which utilized a pre-game questionnaire and a post-game interview to determine whether they were motivated to play the game or not, and if they were motivated, why exactly that was the case. We received very useful feedback for our prototype from the usability testers, which then gave us a clear path forward for further development of the game.

## INTRODUCTION

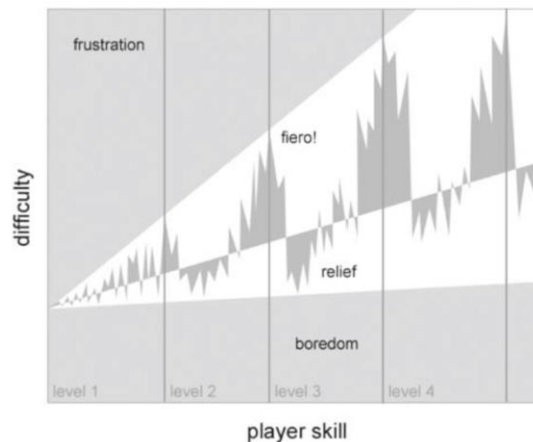
Nowadays, video games have become known as a virtual platform where players can emerge themselves to a fictional world whether they can be themselves, be someone else or hang out with other players. Some encourage players to open up more, some help players unlock their inner competitiveness, and some push players to the limit to achieve their goal. While video games now have emerged to the Online concept where players can interact with each other, there are games that set goals and achievements to motivate players to keep on playing. Our project aims at the psychological concept of Motivation for which we drive players to be motivated both intrinsically and extrinsically on playing a particular game level in our prototype '*Within Reach*'.

*Within Reach* is a 3D game which uses a wide range of terrain generation tools and is built on Unreal Engine. The game revolves around a character aiming to prove themselves and climb up the mountain as far as they can. The idea of the game is inspired by a Unity platform game "Getting over it" by Bennett Foddy ([2](#)). Although *Within Reach* doesn't have many

complex game rules or social interactions with other players, it tackles the sense of players wanting to challenge themselves on reaching the highest score possible.

## PSYCHOLOGICAL CONCEPT

In *Within Reach*, two psychological concepts are mainly used which are motivation and emotion. In the reading *A Motivational Model of Video Game Engagement*, Przybylski, Andrew K., et al. states that motivation can be separated into two types, intrinsic motivation extrinsic motivation (155). The intrinsic motivation means that the players are motivated by their own interest. They want to play the game because they like it. The extrinsic motivation means that the players are driven by external rewards such as money, fame, grades, and praise. The intrinsic motivation satisfies three basic human needs which are competence, autonomy, and relatedness (Przybylski, Andrew K., et al. 155) (4). Competence relates with balancing the level difficulty and players skill. If the game is too difficult for the player, players will feel frustration and may quit the game easily. If the game is too easy, players may also quit the game. Another research which relates to competence is *The Four Fun Key* by Nicole Lazzaro.



**Hard Fun PX Model.**

Lazzaro argues that games are self-motivating activities which inspire players to learn new features (317). Lazzaro states that there are four kinds of fun which help players create different emotions. They are:

Hard Fun: challenge and mastery

Easy Fun: inspiring imagination, exploration, and role play

Serious Fun: changing a player's internal state or doing real work

People Fun: social interaction

*Within Reach* uses the difficulty curve to let players experience hard fun. Players will feel an emotional cycle which first feels boredom, and then move to frustration. The next emotion players may experience is Fiero which is the key emotion of hard fun, and then finish at relief. These emotions will repeat in order while players play the game.

Autonomy refers to the choices which players can make, allowing the game to continuously produce content (Przybylski, Andrew K., et al. 156). By offering choices, players can create their own strategy in order to complete the level. Choices can come from different aspects. Players can change the appearance of the characters. Players can choose which ability they want to use. Players can choose which storyline they want to explore. These can all be the choices that designers offered to the players.

Mastery of Control is also a key of game design. One key characteristic that distinguishes real-world from gaming contexts is that the latter lack physical substance (Przybylski, Andrew K., et al. 156). Because players always sit at the same place while playing the game, the in-game control is extremely important. By controlling the in-game characters, players can interact with the interface. Also, this can contribute to autonomy since players can choose different types of movement according to the situation.

## **GAME DESIGN**

### **1. Title Page**

#### **1.1 Game Name**

*“Within Reach”*

#### **1.2. Tag line**

*“It’s a Long Way to the Top”*

#### **1.3. Team**

Sai Krishna, Neal Cox, Jiafan Xue, Minh Nguyen and Zijin Li

#### **1.4. Date of last update**

3 - 2 - 2021

### **2. Game Overview**

#### **2.1. Game Concept**

The player is a rock-climbing enthusiast and the gameplay loop of ‘Within Reach’ is to motivate players to reach greater heights every try by climbing up a rock mountain located in a forest-like theme, and set out a record for his/her highest point reached on the peak.

Falling, and restarting the game would measure how highly the player is motivated to climb up each run, the set obstacle is the highest score created by the players themselves on previous tries to beat out in future climbs.

In the final version of our game, we plan on increasing the player's motivation to replay the game by introducing a goal mark on the mountain where the player's previous best height was recorded.

## **2.2. Target Audience**

Within Reach is playable by every single and race group without any bias. The target audience for our game is everyone with an ESRB rating of Everyone suitable for all age demographics as in this game there are no violent and suggestive themes present.

This game is aimed to be released for both the PC and Mobile game markets at the initial launch. This game will be playable by one player at a standalone machine. Facility to allow two players for a competitive mode may be added later on in both PC and Mobile machines.

We target the real rock-climbing enthusiasts out there to play the final version of the game and share their experience on if or not 'Within reach' motivates them to replay it multiple times. And how realistic do the mechanics used in our prototype feel when compared with real rock-climbing experience.

## **2.3. Genre(s)**

Within Reach game title falls under the extreme sports game genre along with a slight experience of adventure game genre.

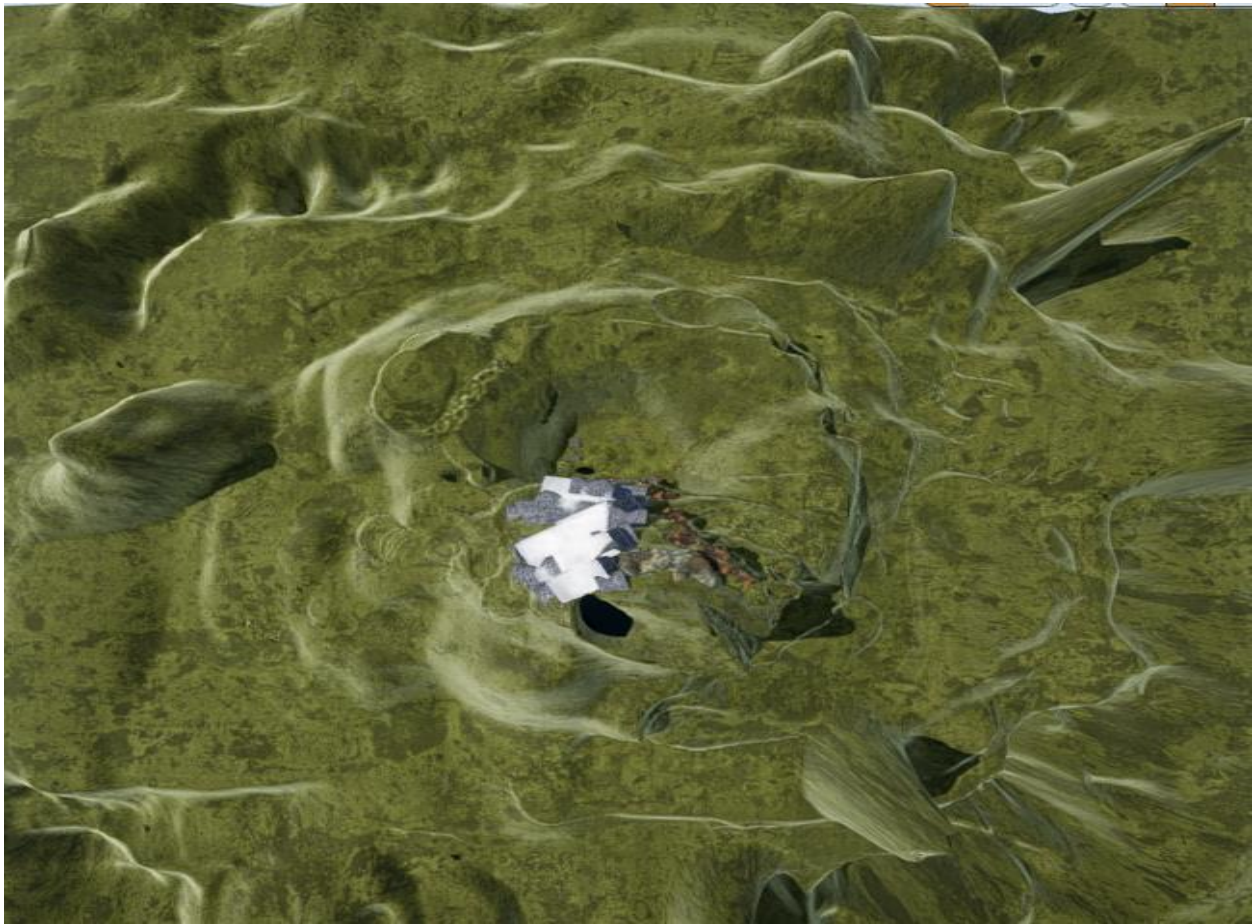
## **2.4. Game Flow Summary**

The players start the game with a brief tutorial of both the basic player movement controls and the advanced rock-climbing controls in the tutorial phase of main level.

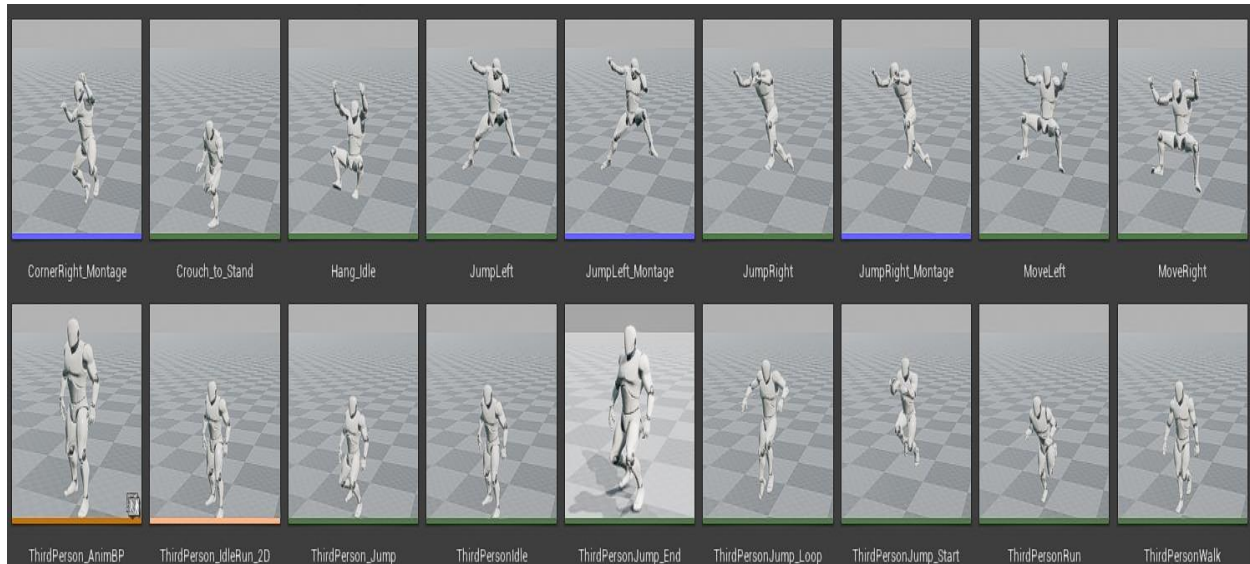
After the tutorial level they get access to the main level in which they will have to climb a mountain and set a record for the height climbed. There is a dynamic HUD showcasing the health bar, height/score the player has reached in current level and the highest height/score reached in previous trials on that standalone machine.

## **2.5. Look and Feel**

We have built a realistic looking mountain climbing level using unreal engine [\(5\)](#) terrain and landscape tools and the captured a few visual images of the aesthetically-pleasing mountain presented below:



The feel of the game is also aimed to match with real rock-climbing mechanisms by coding corner detection and different kinds of jump systems. (Side Jumps, Upward Jumps, Etc.) We have successfully built both left and right corner movement systems, through which we will help players feel one of the best hanging mechanics experienced in real rock climbing. And for better character experience we applied animations for each of the movement systems mentioned above.



### 3. Gameplay

#### 3.1. Objectives

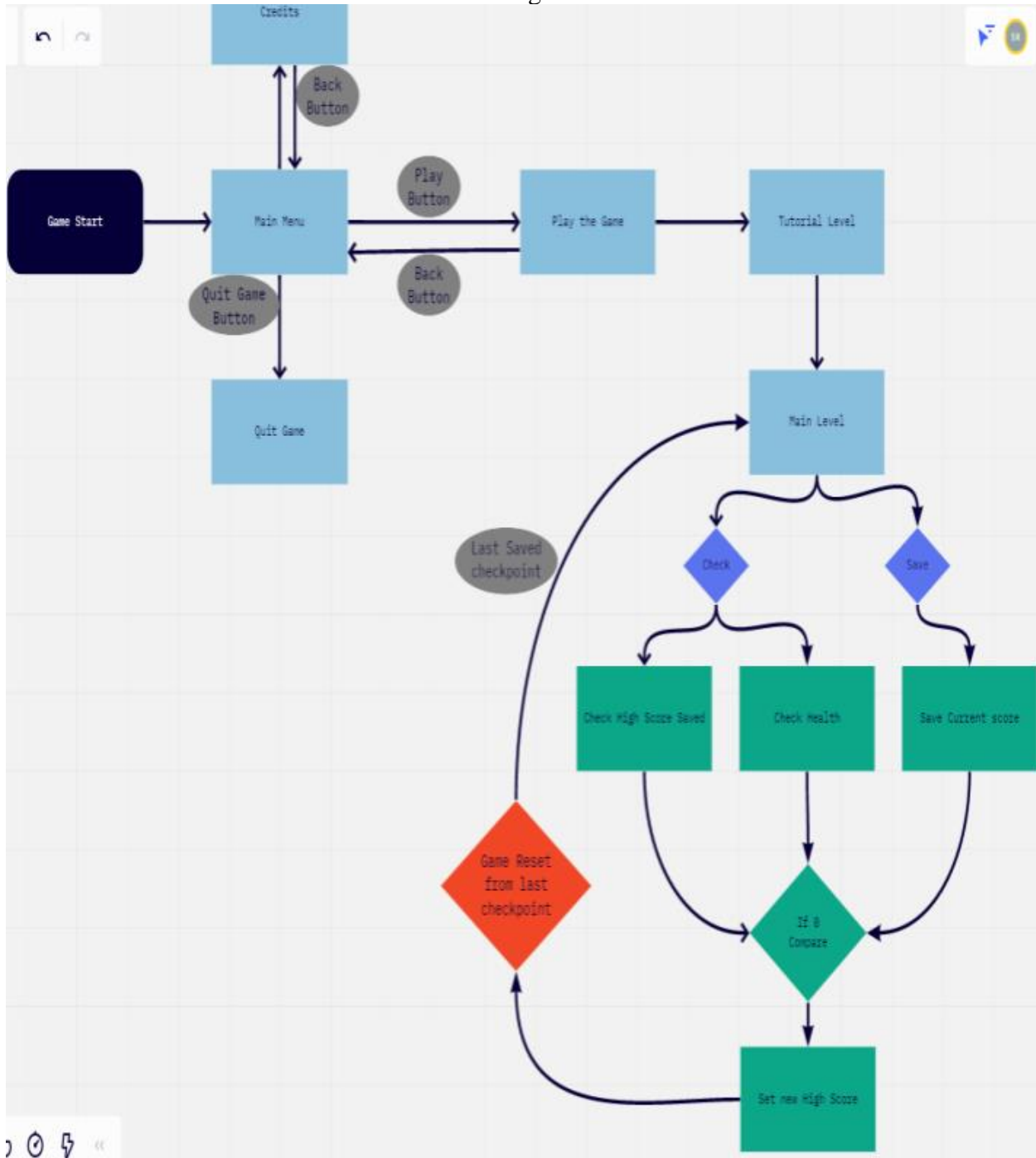
The main objective in our game 'Within Reach' is to try and reach the highest point on the peak using various rock-climbing jump techniques and try to avoid any obstacles present along the way.

Making the objective of players to beat their own highest point on the mountain until they are satisfied with their highest height/score achieved.

#### 3.2. Game Progression

The game progresses in a single level core-loop where the player will get to climb a rock mountain and once, they fall / take damage they get to replay the level and beat their previous high score.

### Game Progression:



### 3.3. Mission/challenge Structure

The main challenge structure for the game is twofold. The first challenge the player must complete is to complete the level, or get to the top of the mountain they are climbing. Once they accomplish this, they will be able to continue on to the next level. The second challenge is a timer system, which tracks and tells players how quickly they completed the level. Upon initial

completion of the level, the player will be entered onto a leaderboard, which will display how long it took them to complete the level. They player can increase their standings on the leaderboard if they complete the level faster than they did before.

## **4. Mechanics**

### **4.1. Rules**

Explicit Rules:

- The player needs to reach the top of the mountain to complete the level.
- To reach the top of the mountain, the player must use handholds.
- If player interacts with a faulty handhold or trap, or is struck by falling rocks, they will be knocked off of the mountain.
- If the player falls over ten feet to the ground, they will die and have to restart the level.

Implicit Rules:

- To move upwards, players will need to climb between handholds.
- In some instances, the player must navigate around traps if they don't want to be knocked down.
- Sometimes the player will need to traverse both laterally and vertically on the mountain.
- If the player gets knocked off of the mountain, they will usually die and restart the level.

### **4.2. Model of the game universe**

There are a few meshes present in the Within Reach game universe. In our current prototype we have a single character mesh attached with a third person camera system following the character from a set distance which will be controlled by the player to interact with the 3D game world generated on Unreal Engine which consists of a massive height map landscape built on a single level.

There are multiple 3D blocks all along the player path which will be used by the player to hang on and jump to other nearest blocks to progress through the mountain. In the final version we will replace these 3D blocks with rock meshes to make the game feel more realistic. Apart from these 3D blocks, players will experience a beautiful forest-like landscape with a wide range of foliage view with a combination of bird chirping sounds to make the level more realistic to real-world rock-climbing experience.

### **4.3. Physics**

To maintain the balance between the real-world physics and game physics we use parameters like gravity and friction on the character movement to make the player feel a realistic rock-climbing experience through different jump actions present in Within Reach.



In our current prototype for Within Reach game we use a score system which updates dynamically based on character height/distance from set ground level. The greater the distance between player character and the ground level, the higher score obtained by the player and vice versa.

In Within Reach we use a Health system for player character which also checks for the distance between the player height and ground level which is then used to decrease the health on the Health bar HUD to increase the replayability of the game by motivating player to not fall off from a ledge and try their best to use different mechanics available to climb the rock mountain.

#### **4.4. Economy**

Our game is based on an extreme sports community aimed for rock climbing enthusiasts. This game falls under the sports genre and can be set up on standalone machines like PC, Mobiles, etc. As our community grows, we will have a healthy advertising cycle on social media including video ads, posted ads, and even a minor ARG to advertise for the next game levels and multiplayer game modes. Other than that, we will also set up our fans channel on platforms such as Discord and Reddit to enable fans to submit their rock climbing stories to be turned into possible future games. These would be voted on by community members, and would also offer up the possibility of the winner being able to play for free or be part of the design process. We would also seek out sponsorships with rock climbing events and other sports game companies to help them design a branded game as their own ads for their intellectual properties.

#### **4.5. Character movement in the game**

As character movement is one of the main features we had to focus while developing our rock-climbing game prototype, we successfully developed a few advanced movement mechanisms which helps players to experience how real rock-climbing works. We developed the sideways jump for both left and right sides along with backward and upward jump systems with the help of tracers in Unreal Engine.

Apart from these advanced jump systems we developed both left and right corner detection systems and used them to give player's access to corner movement systems in both left and right directions.

And to perform all these advanced mechanics in a consistent manner we developed a hanging state for the player which makes all the advanced features more interactable with casual player movements. Movement is a key part of our game and these advanced systems help us maintain the flow state in our game.

Hanging State:



Backward Jump:







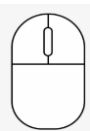




#### 4.6. Objects

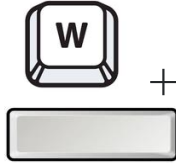


N/A in the initial prototype.

#### 4.7. Actions, including whatever switches and buttons are used, interacting with objects, and what means of communication are used

The controls are slightly more complicated than a typical game, due to the nature of combining the keys to perform different attack moves.

Movement / Action:

	Move Forward
	Move Backwards
	Move Leftwards
	Move Rightwards
	View 360°.
	Jump
	Left Side Jump
	Right Side Jump
	Backward Jump

	Upward Jump
	While hanging in a left corner, press 'A' to move left while in hang state.
	While hanging in a left corner, press 'D' to move left while in hang state.

**4.8. Screen Flow**

Within our game prototype we have three Game Screens / Scenes. The first game scene is the Menu UI Widget Screen through which the player can either start the game or watch credits or exit the game.

The Second screen depends on player choice and can either be a Start game screen or a credits screen.

**4.9. Game Options**

N/A in the initial prototype.

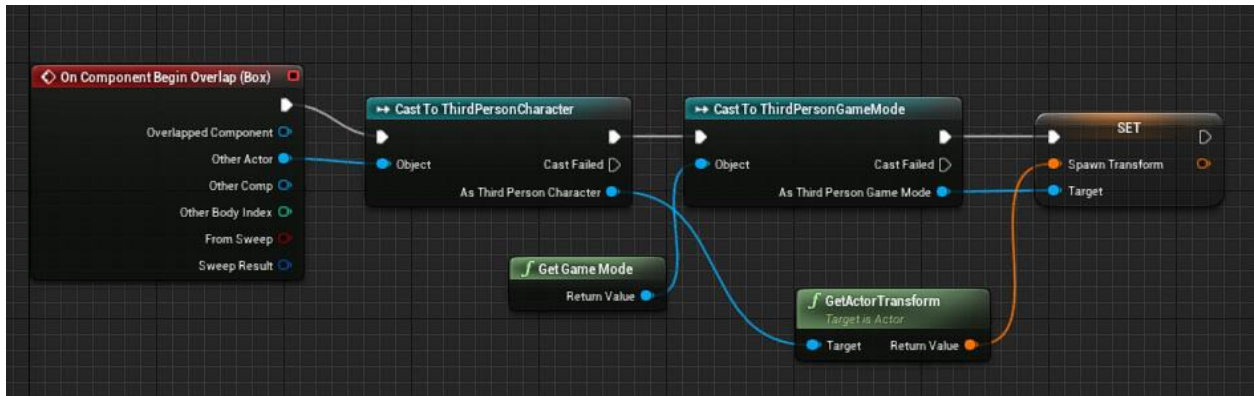
**4.10. Replaying and saving**

We save the previous high score achieved by the player for them to compete against it.

As replayability is one of the key ways we try to measure the motivation of the player, the game level resets once the player takes set fall damage, enough to fully reduce health from the health bar of the character to reset the game level.

In 'Within Reach' there is a checkpoint system available where the player can restart from the last saved checkpoint.

Check Point Event graph:



Invisible checkpoint triggers located in the level:



## 5. Game World



### 5.1. General look and feel of world

We want players to feel unstoppable when they play Within Reach game as it is one of the key motivations which drive real world mountain climbers to succeed in their journey on reaching the peak of the summit.

In Within Reach game prototype, we use foliage ranging from grass moving with wind to trees and rock meshes baked with 8K resolution. We use a wide range of realistic forest elements to aesthetically please the players in both visual and audio elements of the game.

The heightmap of the game is beautifully designed with randomly placed foliage present in real world forests including flowers and trees. And the audio is modulated with randomly generated sounds ranging from bird chirps to stick snapping on a distance.

### 5.2. Areas

In Within Reach there are two game areas present for the player to access. The first area is the tutorial area, where the player is introduced to all the available actions and understand them for better game progression.

#### 5.2.1. General description and physical characteristics

N/A in the initial prototype.

### **5.2.2. How relate to the rest of the world**

The training area is directly connected with the main game level.

Players will only be able to access the training area in the beginning of gameplay and once they reach/activate the checkpoint placed near the main level heightmap, players access to the training ground will be restricted.

## **6. Levels**

### **6.1. Training Level**

The training level is a small space laid out before the main level for the players to understand all the possible actions they can perform in game to help them in game progression.

### **6.2. For each level**

The players will use their knowledge obtained on mechanics available in Within Reach tutorial layout and try to perform various actions like side jumps or corner jumps at different situations in the main level.

#### **6.2.1. Required introductory material and how it is provided**

All the required material to perform actions are provided to the player in the training level using text panels. These text panels direct the player to understand all the key mechanics available in Within Reach title.

#### **6.2.2. Objectives**

- The key objective in the training level is to understand different mechanics available in Within Reach title.
- The key objective in the main level is to obtain a maximum score or in other terms reach the maximum height until the player is satisfied with their result.

## **7. Interface**

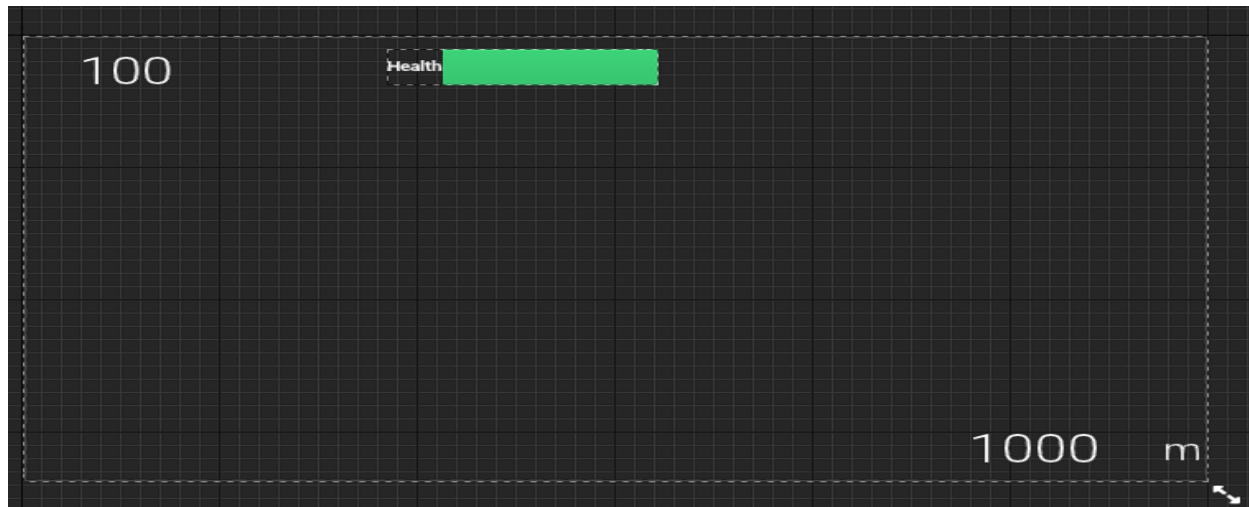
### **7.1. Visual System**

#### **7.1.1.HUD**

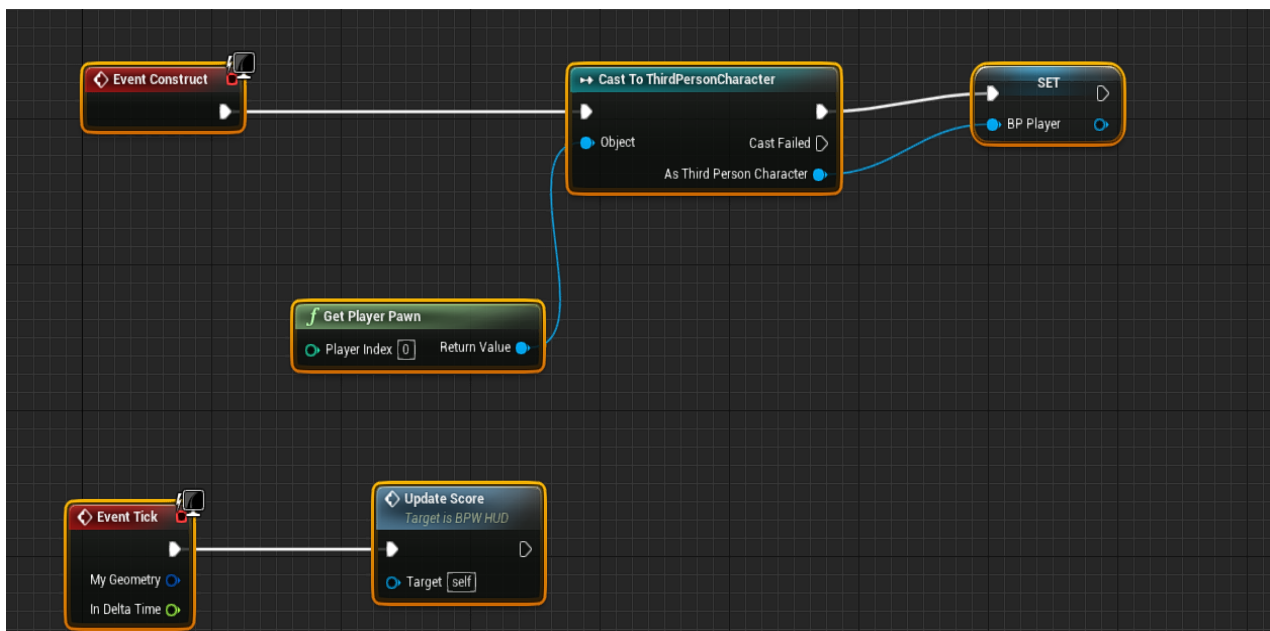
In Within Reach we feature the following HUD and GUI systems:

1. Health Bar
2. Height reached in meters
3. Current score

All the features update dynamically with player actions and how well they progress in the game. The HUD will appear at the top of the game in a separate panel.

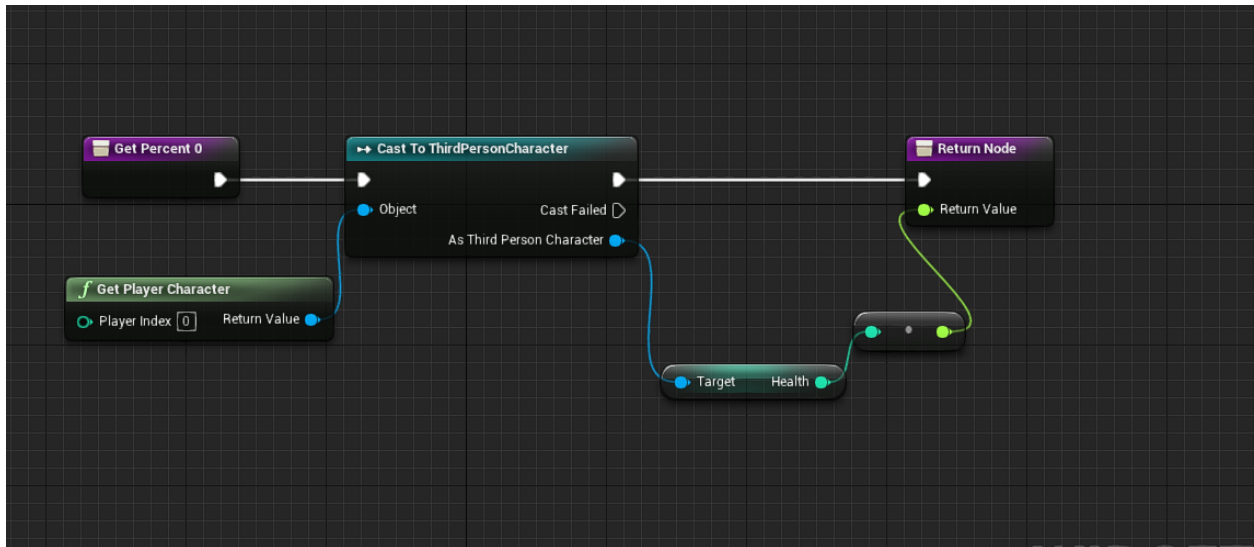


HUD Event graph:

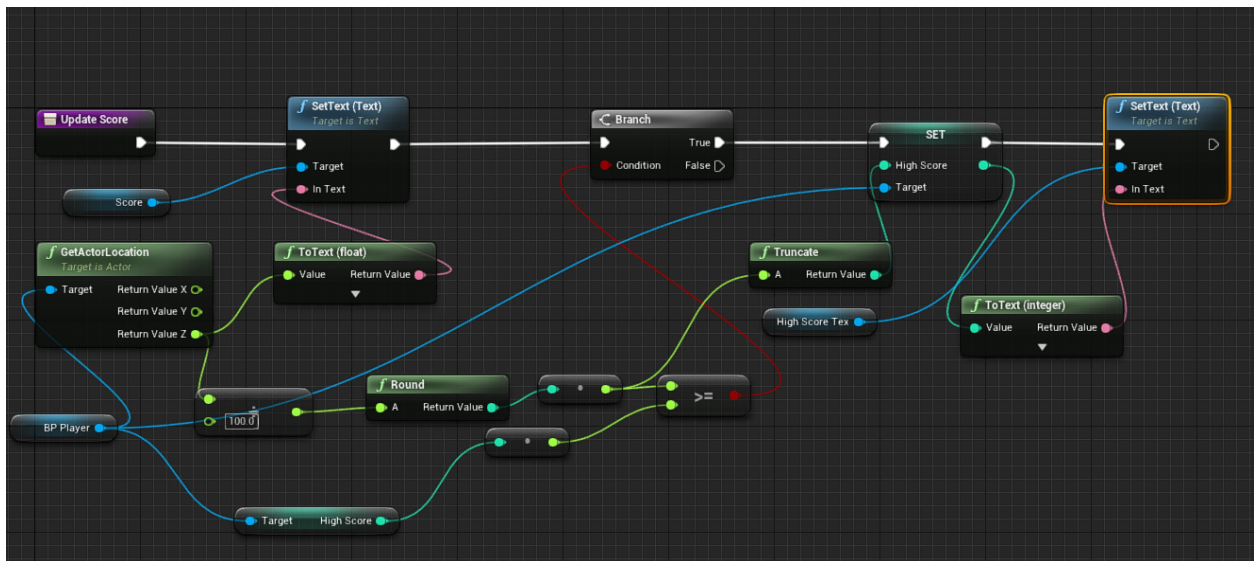




Health Event graph:



Score Event Graph:



## 7.1.2. Menus

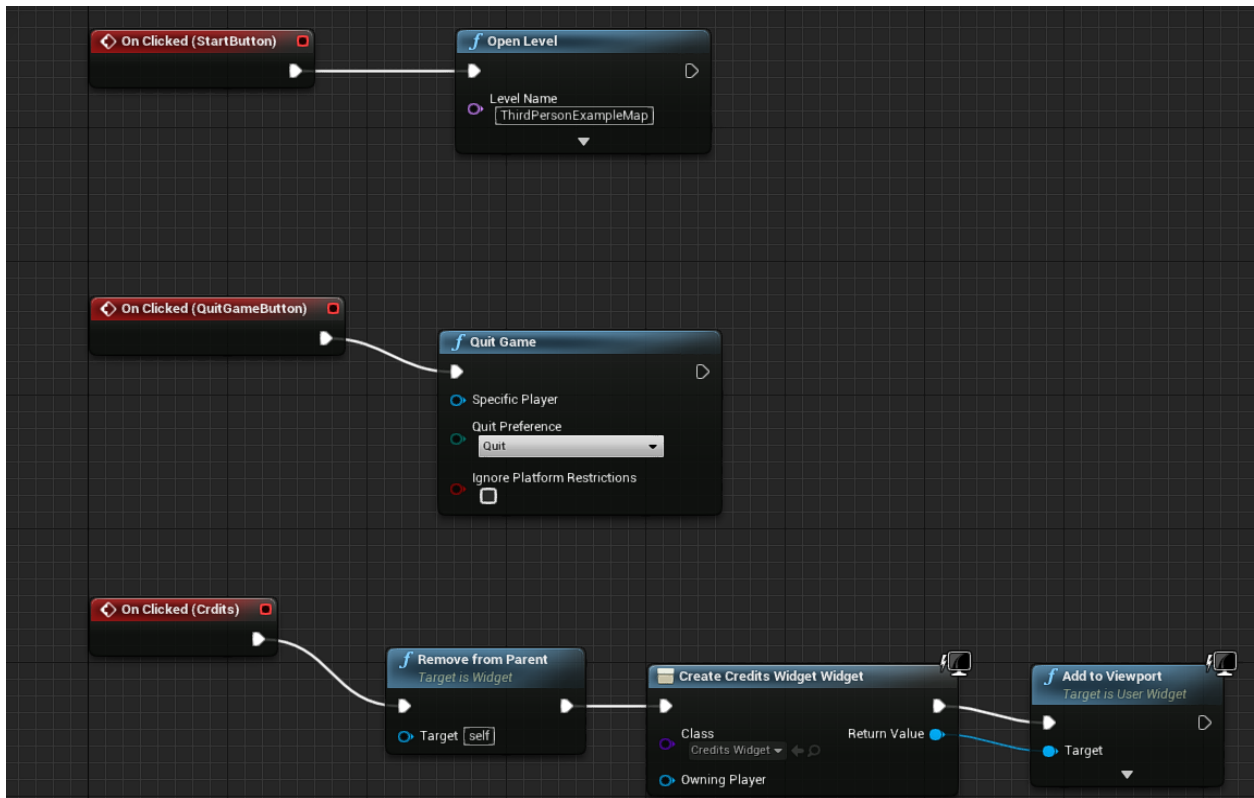
The menu will appear in the beginning of the game. In the menu there are three buttons:

1. Start game

2. Credits
3. Quit game



Menu Blueprint:



### 7.1.3. Camera model

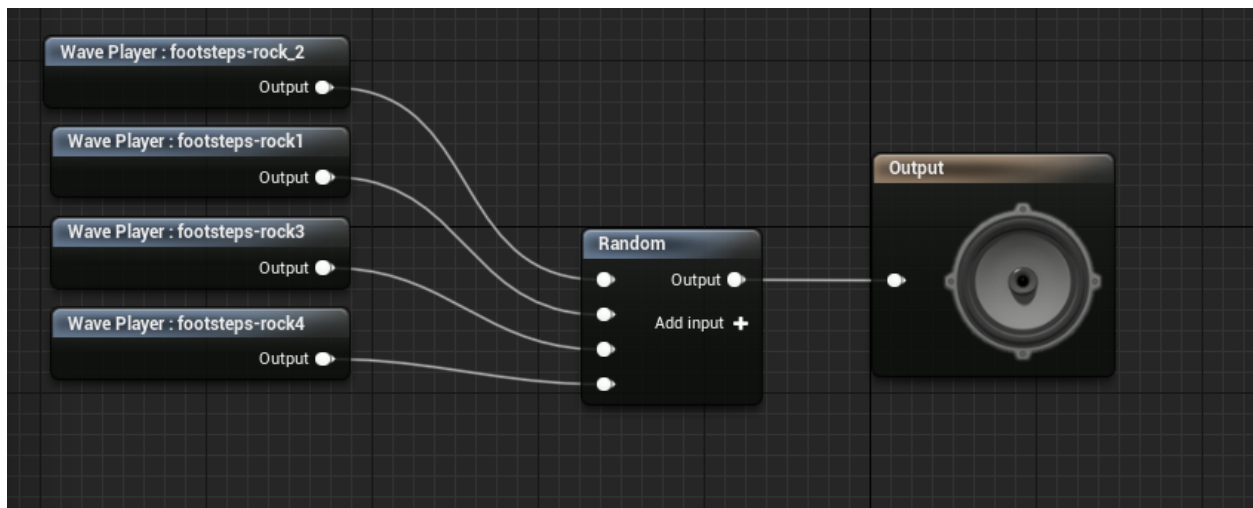
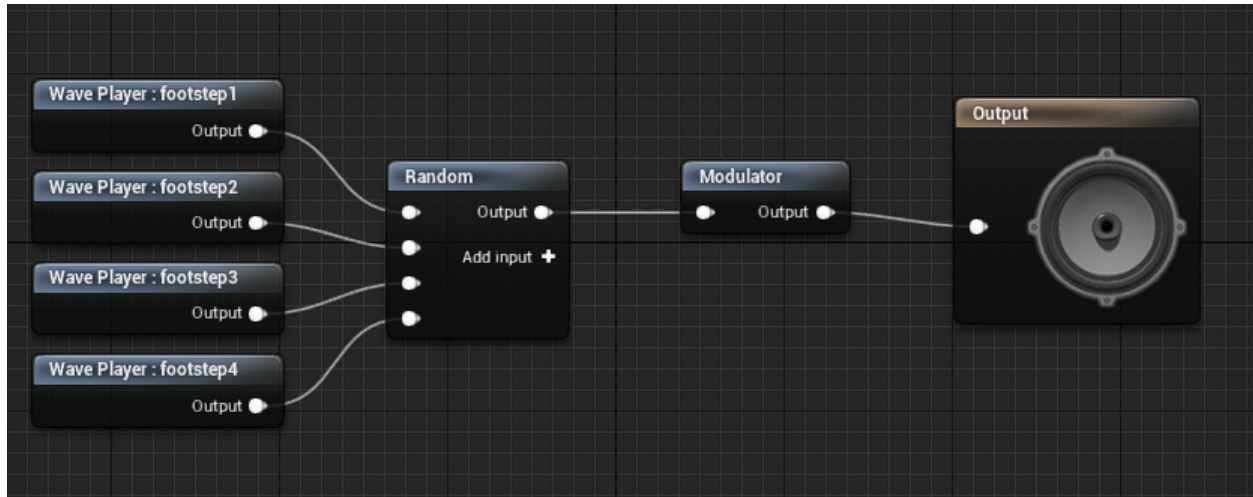
The camera model used in Within Reach is a third person camera system provided by the unreal engine which follows the player character from a set distance.

We had to tweak the camera system code as we required different viewing angles for better game experience for players in hanging to a rock state and while performing different jump actions available in the prototype.

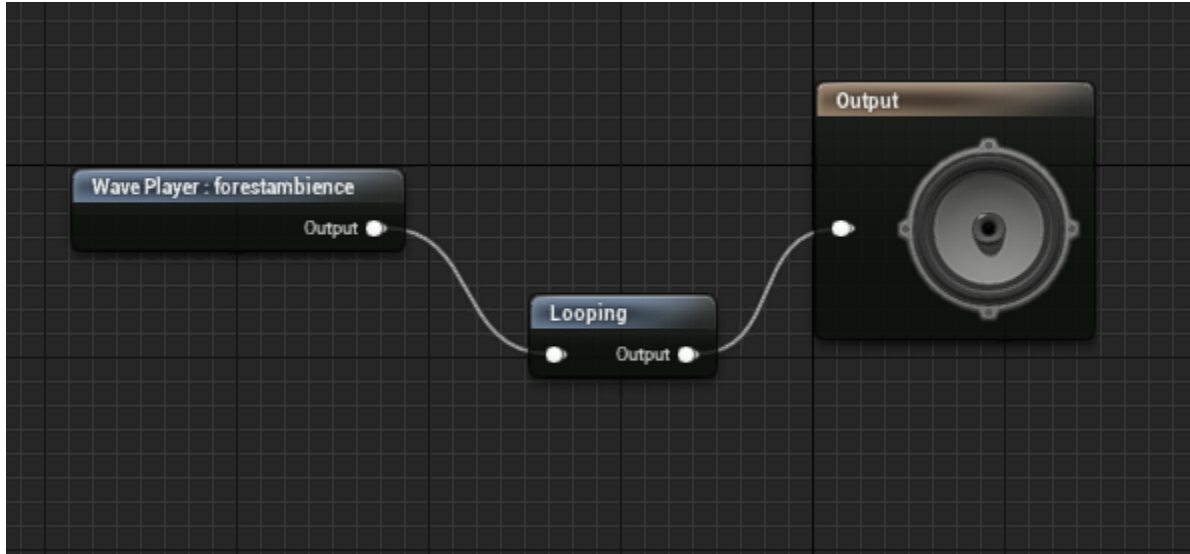
## 7.2. Audio, music, sound effects

In Within Reach we use two different audio modulators of which one modulator randomly generates realistic sound effects ranging from bird chirps to stick snapping at a distance based on player character position in the game world. And the other modulator is used to generate an aesthetically-pleasing forest background music being played on a loop throughout the game. All the sound systems were built referencing the ideas blueprints used by Valkyrie Sounds tutorial.[\(3\)](#)

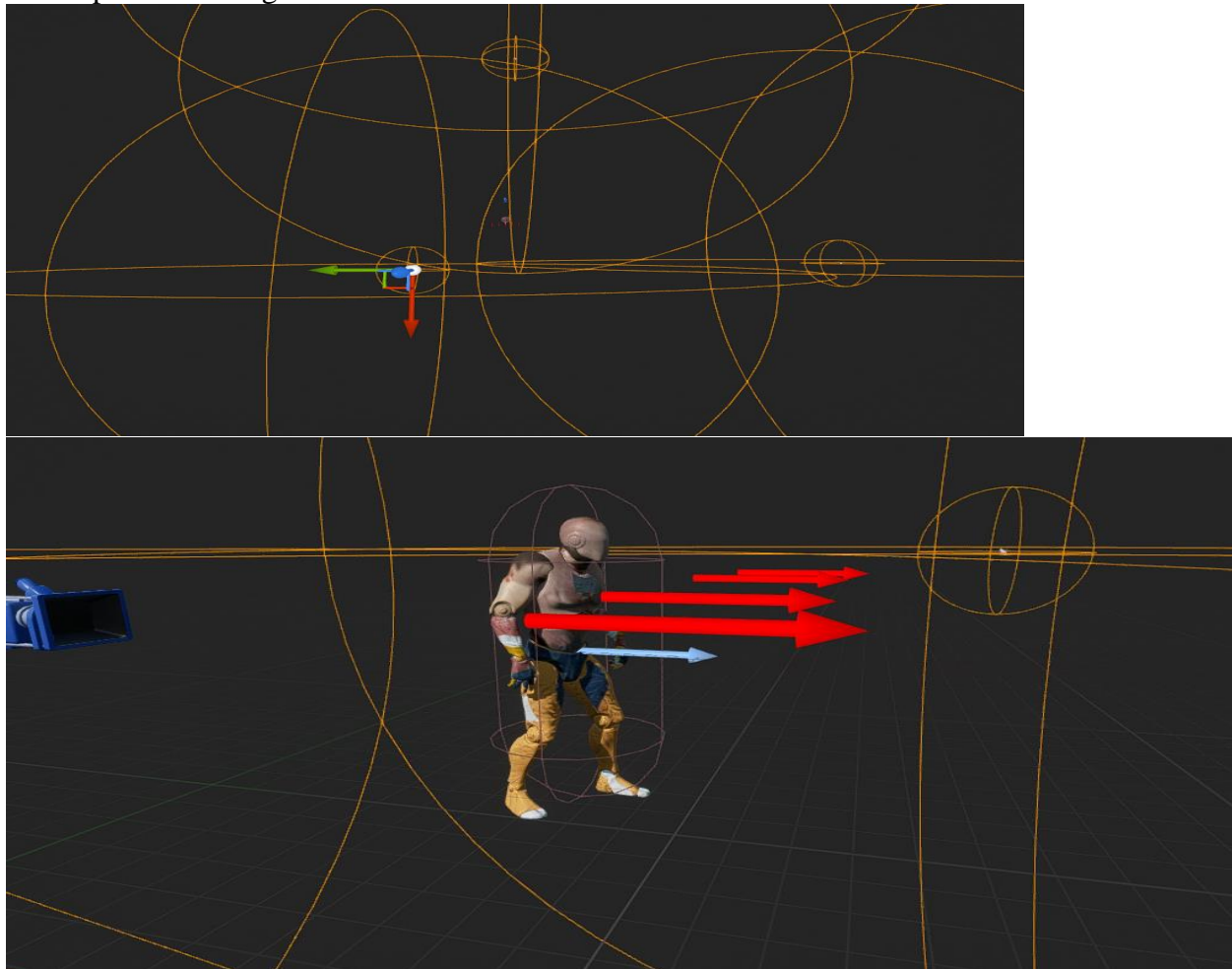
Footstep Audio:



Forest Ambience: It is a loop of forest ambience audio which plays in the background.



Audio placement in game level:



### 7.3. Game Art

We use 3D art meshes for both character and terrain generation in *Within Reach*. We used a wide range of realistic looking foliage to aesthetically-please the player's game vision.



### 7.4. Help System

N/A in the initial prototype.

## METHODS

The playtesting procedure for *Within Reach* can be broken down into three parts:

#### Part One: Pre-Game Questionnaire and Participant Profiling

Before playing the game, participants would be required to participate in a short questionnaire using modified questions from the Work Preference Inventory [\(1\)](#), including the following:

- I enjoy relatively simple, straightforward tasks
- I am strongly motivated by the recognition I can earn from other people
- I am not that concerned about what other people think of my work
- I enjoy playing games that are so absorbing that I forget about everything else
- It is important to me to have an outlet for self-expression
- I prefer games I know I can play well over games that stretch my abilities
- I believe that there is no point in doing a good job if nobody else knows about it
- I prefer playing games that set clear goals for me

## Part Two: Gameplay Sessions

Each participant will then have between 15 and 20 minutes to play the game. During these gameplay sessions, proctors will be taking notes about:

- The number of attempts each player required to complete the level
- The amount of time spent on each run, with time measurement beginning when the player begins the level, and ending when the player either dies or completes the level
- The posture, engagement, and reactions of each player to determine where exactly they are being engaged or immersed by the game

## Part Three: Post-Game Interviews

Following the end of the gameplay session, we will conduct post-game interviews regarding their overall experience with the game, with particular focus paid to the game's controls, difficulty, motivation, player experience, and player engagement. Questions include the following:

- Would you say that the game's control scheme is easy to understand?
- Please describe a memorable experience from today's gameplay session, and explain what makes it stick out in your memory
- Would you describe the difficulty of the game as fair?
  - If so, please explain why
  - If not, please explain why
- Would you say that the construction of the level made it difficult to get to the end?
  - If so, please explain why
  - If not, please explain why
- What feelings and emotions do you most associate with the experience of playing this game?
- Would you say that you were motivated to beat your previous time on each subsequent playthrough?
  - If so, please explain why
  - If not, please explain why

Playtests would be conducted either one on one, or with a small group of participants being observed and interviewed by one proctor. In the event of playtesting with a small group, interviews would be conducted one on one with each participant.

## RESULTS

The statistical analysis for this research was done using the Google Forms. The survey made with Google Forms had 4 participants. These participants were treated as an experimental group to study motivation in 'Within Reach' title.

We have asked participants to take a Pre - game questionnaire through which we try to determine if or not the rock-climbing game prototype 'Within Reach' helps players motivate themselves on rock climbing. And] evaluate whether players are either intrinsically or extrinsically motivated to replay the game based on the pre-game questionnaire.

A scale of 1 to 4 range between two variables (namely: 'Never true about me' - 'Always true about me') is used to read the Pre - game Questionnaire.

Pre - game questionnaire structure:

1. I enjoy relatively simple, straight forward tasks
2. I am strongly motivated by the recognition I can earn from other people
3. I am not concerned about what other people think of my work
4. I enjoy playing games that are so absorbing that I forget about everything else
5. It is important to me that I have an outlet for self-expression
6. I prefer games I know I can play well over games that stretch my abilities
7. I believe that there is no point in doing a good job if nobody else knows about it
8. I prefer playing games that set clear goals for me

All the participants showed similar interest towards the prototype stating that they replayed the game level multiple times because of extrinsic motivations over intrinsic motivations. A few of the thing's participants felt motivated to replay the game were "Highest Score, to reach the top to see waterfalls from up top, climb better height in comparison with other friends etc." One of the participants stated that he was intrinsically motivated by his prior adventure experiences like hiking and rock climbing, but critiqued that we should have built a VR version of the game.

## DISCUSSION

First of all, regarding the design part, our project has made a full understanding of the scientific research related to motivation. Based on the SDT theory, which is widely recognized by this type of research, we analyzed the competence, autonomy and mastery of control parts in detailed, designed specific game mechanisms based on these contents, provided a very rich gameplay mechanics and level complexity, as well as a high degree of freedom of

operation and an easy-to-use control system. However, the relatedness part of the SDT theory has not been properly integrated into the design of this game, and the satisfaction of relatedness needs has been proven that it could effectively motivate players. Therefore, follow-up projects and researches can try to improve in this respect, including but not limited to adding a richer worldview and plots to the game, and introducing NPCs to collaborate with players.

Then, for the development part, we used the powerful Unreal Engine and took advantage of the highly integrated development tools to successfully develop the game's demo in a relatively short period of time. However, due to the limited time of the project, The content of our final output is slightly thin for a complete game, which is reflected in the fact that the number of levels in the game is too small, the game process is short, the art resources in the game are repetitive, and the special effects are relatively simple. The main reason for this problem is that most people in the group are not familiar with Unreal, it is impossible for multiple people to develop separately and integrate different parts in the end. Therefore, the huge workload and development pressure are almost all burdened on one single developer, and other people can provide limited help in this regard. Therefore, future projects and research can choose game development engines that more people are familiar with, or let those who can participate in the development learn to use the engine in advance to promote multi-person cooperation.

Finally, regarding the testing part, our usability test mainly relies on pre and post survey as well as observation-based analysis, and almost no quantitative analysis combined with biometric technology is used. According to Vierra's Assessment of Fun study, due to the presence of observers in the analysis based on observations, players may be affected and the real test results cannot be obtained. The disadvantage of the pre and post survey is that when the players finish playing and start to fill in the questionnaires, they are no longer in the gaming state, and the result would be easily affected by the player's forgetting and misjudgment. In addition, there are too few people involved in the test. The test results are prone to large errors and deviate from reality if the sample size is too small. Therefore, follow-up research and projects can recruit as many testers as possible to expand the sample size of the test, and try to combine biometric technology for quantitative analysis, such as obtaining the player's heart rate and skin conductivity.

## **Future Work**

We plan to introduce many more features to improve both the player's intrinsic and extrinsic motivation in the next working prototype before final build. A few of the features we plan on developing in 'Within Reach' are a special mode with VR rock climbing experience and will mimic the visual style of 'The Climb' for this mode. Apart from the VR game mode, we plan to introduce one hand hang system and one hand side jump systems for an even better rock-climbing experience.<sup>(6)</sup> And from the current prototype participant cues and suggestions we will introduce a timed climb mode, where player's need to climb up a rock mountain as quickly as possible within a given timer. And a few other things we plan to develop for our next prototype are traps and falling obstacles which can cause damage to players health if triggered by the player character, collectibles which will increase players health if dealt with fall damage and obstacle damage. All these features are planned to improve both the player's motivation to play 'Within Reach' and intrinsically motivate players towards rock climbing.



## CONCLUSION

Our project deconstructs and analyzes the player's motivation model, and designs the corresponding in-game mechanics on this basis. The prototype has proved to provide enough of both intrinsic and extrinsic motivations to effectively motivate the player to continue playing a single level game for multiple number of times. We achieved this by controlling the difficulty curve of the level and designed the game process to be easy initially and gradually increase the difficulty to effectively meet the players' competition needs. This allows players to continuously adapt to the changing difficulty of the game and hone their abilities with the help of in game mechanics to be motivated on improving the challenge (High Score) created by them in the previous attempt/trial. In addition, we have designed an easy-to-use control system for the game, which makes the learning curve of the game very smooth, which helps reduce the learning burden of the player and successfully motivates them to focus on replaying the game level multiple times.

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