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## BOUNCE IT - VR GAME

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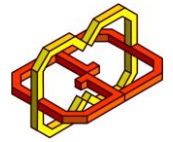
# BounceIt



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## INTRODUCTION

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We developed a VR game which was inspired by several games including: BBTAN by 111% - Mobile game, Hurl VR – VR game and Let's Bounce – Arcade game.

Our application simulates several environments with diverse difficulty levels. In each level you have colored cubes organized in different configuration. The player's main goal is to throw balls at the cubes and hit all the colored cubes on the level, by hitting a cube, the cube is turned black. The more balls the user used the less score the user will get, namely, the user strives to minimize the number of used balls.

Score diverse from 1 to 3 stars while 3 stars is the best. The player can enjoy both the game and the VR experience using VR goggles, trackers and gloves. The application gives the player an extraordinary experience that enables him to use several senses in order to get a high score.



## SYSTEM

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We developed a game that runs on PC and is played with VR gear, targeted specifically for the HTC Vive.

The game was developed using Unity 2017.4.8f1 (64-bit) game engine, scripted with C# in Visual Studio 2017.



Microsoft Visual Studio is an integrated development environment (IDE) from Microsoft. It is used to develop computer programs, as well as websites, web apps, web services and mobile apps. Visual Studio uses Microsoft software development platforms.



Unity is a cross-platform game engine developed by Unity Technologies.

Unity gives users the ability to create games in both 2D and 3D. The engine offers a primary scripting API in C#, for both Unity editor in the form of plugins and games themselves, as well as drag and drop functionality.



The HTC Vive is a virtual reality headset developed by HTC and Valve Corporation. The headset uses 'room scale' tracking technology, allowing the user to move in 3D spaces and use motion-tracked handheld controllers to interact with the environment.



Manus VR is the first virtual reality glove input device created specially for general consumers. Manus VR uses an assortment of sensors to track hand movement in real time and use the captured data to faithfully reproduce the movement in virtual reality. It operates completely wirelessly and comes with an open source SDK that developers can use to integrate the hand tracking functionality into their applications and games.

Equipment required:

1. HTC-Vive Headset
2. HTC-Vive trackers
3. Manus-VR Gloves

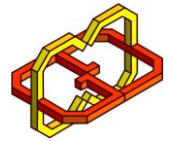


Relevant links:

<https://unity3d.com/>

<https://www.vive.com/us/product/vive-virtual-reality-system/>

<https://manus-vr.com/>



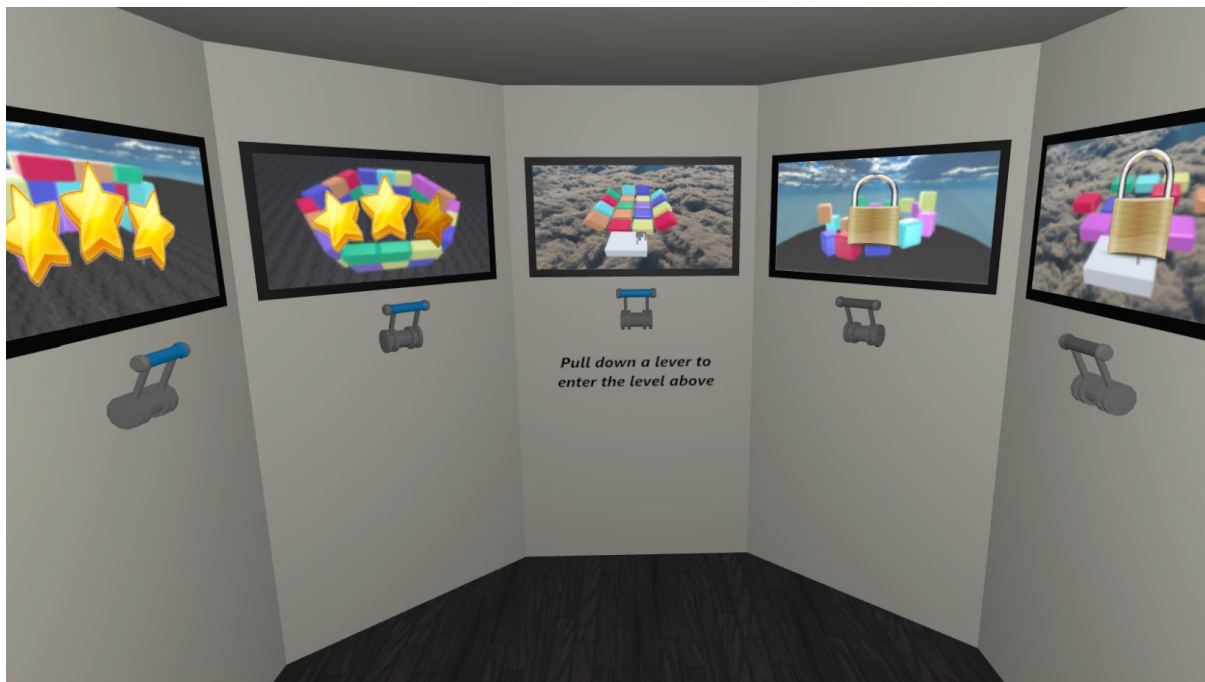
## SCENES OVERVIEW

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The game consists of 6 different scenes for the user to navigate, a Main Menu scene, and 5 play scenes with different environments.

### THE MAIN MENU SCENE

The Main Menu scene allows the player to pull a lever to start a level he already played or the next level to play. The levels the player didn't reach yet will appear with a blurred photo of the level and a lock sign on it, which indicates the player isn't allowed to start this level. Moreover, the lever below a locked level photo is locked and grey colored, while the working levers are blue. The next available level for the player will appear with a photo of the level and to start this level the player should pull the lever below the level image. The levels the player already made will appear with score on it, one to three stars score. The player can play an open level as much as he wants.





At the back of the main menu room you can see logos relevant to our game:

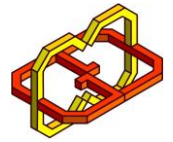
- Bounce It logo
- GIP lab logo
- AVR logo

Credits for our game:

- Supervised by Boaz Sternfeld and Yaron Honen
- Oran Shuster for consulting and designing our logo
- Developed by Amit Shuster & Michal Guttman







## THE PLAY SCENES

There are five different levels to play, each level has a different cubes structure and a different environment. The game starts with the easiest level and ends with the most difficult level. The difficulty is affected by the room structure, number of cubes, gravity and different velocity moving cubes.

In each level the player's goal is to turn all the colored cubes to black, in order to turn a colored cube to black, the player needs to hit it with a ball he gets.

To get balls the player must push the red button on the balls machine – each press gives 5 balls.

When all the colored cubes are black, the level is considered as finished and a score will appear on player's screen. In all the levels the player hears a motivating theme music, appropriate noises when a ball hits a cube and a winning melody when finishing a level.

At the first level, game instructions will appear for the first game experience. The instructions include the player's goal and technical instructions of how to get more balls, how to throw and more. Finally, the score is calculated as the following:

$$\begin{aligned} & \text{Number\_of\_received\_balls} \\ & \leq \text{Difficulty\_factor} \cdot \text{Number\_of\_cubes} \end{aligned}$$



$$\begin{aligned} & \text{Number\_of\_received\_balls} \\ & \leq \text{Difficulty\_factor} \cdot \text{Number\_of\_cubes} \cdot 1.5 \end{aligned}$$

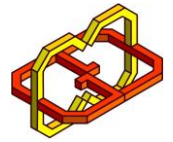


$$\begin{aligned} & \text{Number\_of\_received\_balls} \\ & \geq \text{Difficulty\_factor} \cdot \text{Number\_of\_cubes} \cdot 1.5 \end{aligned}$$



The *difficulty\_factor* equals to 0.7 for the scenes with no gravity, as these levels are easier, and equals to 1 for the scenes with gravity.





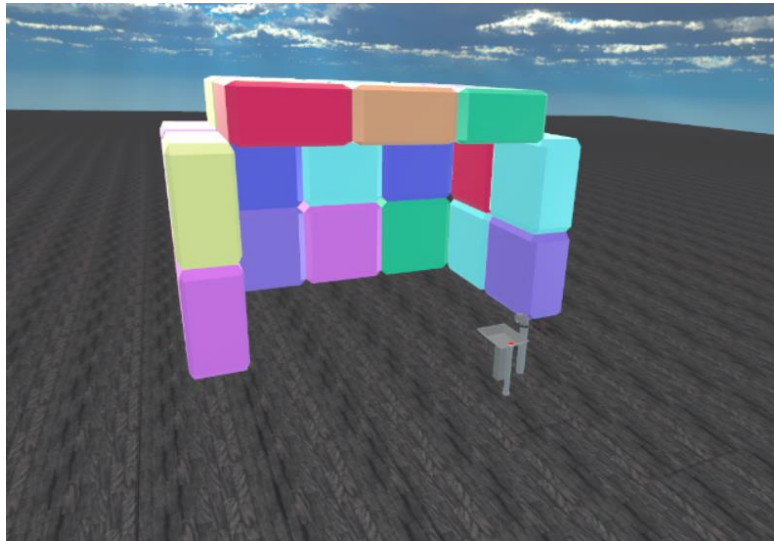
### FIRST LEVEL

Number of Cubes – 20

Gravity – X

Moving Cubes – X

Difficulty Factor – 0.7



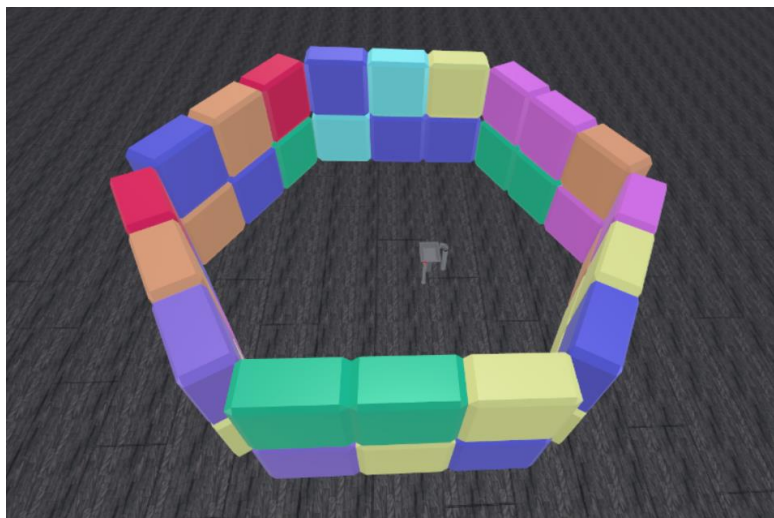
### SECOND LEVEL

Number of Cubes – 36

Gravity – X

Moving Cubes – X

Difficulty Factor – 0.7





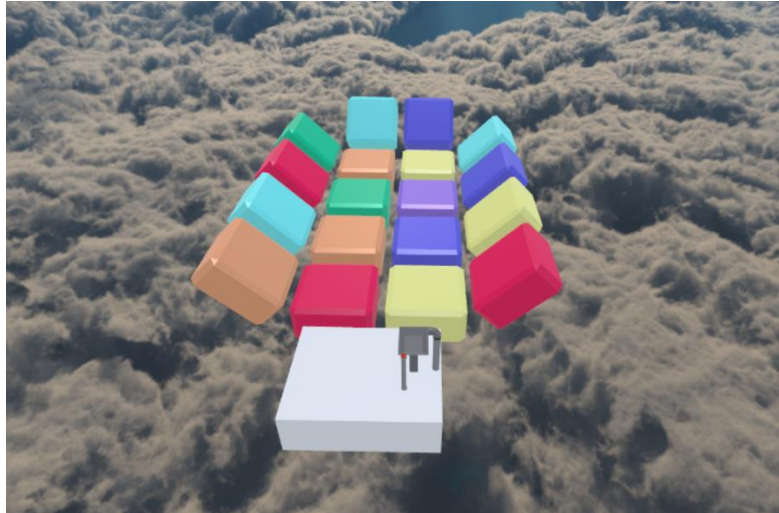
### THIRD LEVEL

Number of Cubes – 18

Gravity – V

Moving Cubes – X

Difficulty Factor – 1



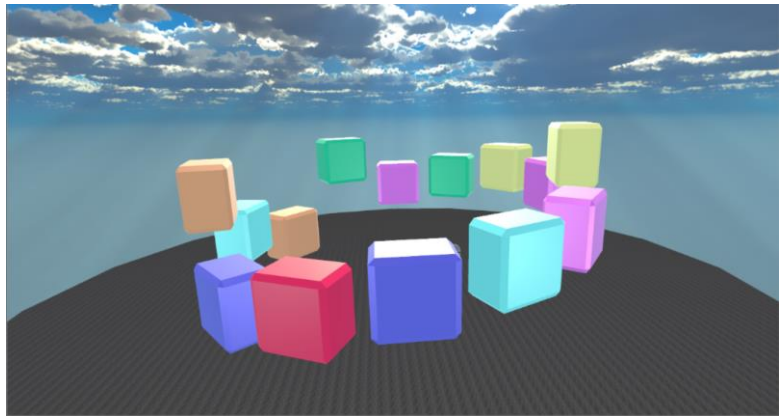
### FOURTH LEVEL

Number of Cubes – 14

Gravity – X

Moving Cubes – V

Difficulty Factor – 0.7



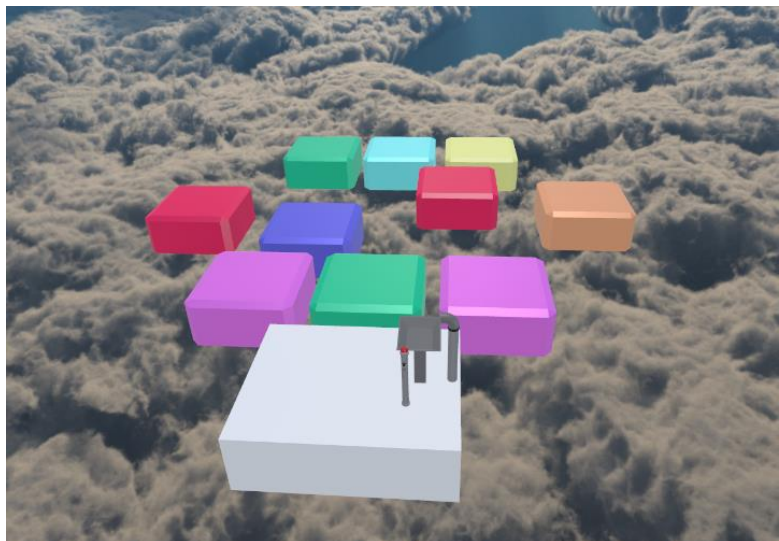
### FIFTH LEVEL

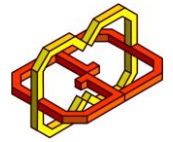
Number of Cubes – 10

Gravity – V

Moving Cubes – V

Difficulty Factor – 1





## DEVELOPMENT PROCESS

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To accomplish our final application, we used unity 2017.4.8f1 (64-bit). We used ManusVR, and SteamVR SDKs, we searched online for designed cubes assets and different environments assets, some of the assets are original. We worked hard trying to make the gloves feel as much as real as we can. We did this by diving into the Manus-VR SDK code to improve the catch and throw actions with the gloves, in addition we added a vibrate on the gloves when the player successfully catches a ball. However, the Manus-VR gloves are far from working perfectly, mostly due to the hardware - the sensors are not as accurate as we would want them to be.

We wanted to take advantage of the VR experience to upgrade our game and the user's experience, thus, we created different environments in which all the cubes' colors are randomized, by doing it, the player will have a little different experience when repeating a level. We created levels with gravity and levels with no gravity to make the user experience variety of options in VR. We thought of creative levels and decided to add levels where the cubes are moving to make it more challenging. The main goal was to create different levels and to vary the difficulty between the different levels. We added sound effects for physical actions and environment sounds to make the user feel totally disconnected from the world and being fully focused on the game. We wrote a lot of scripts to make all our features work and we also made it very generic, so the game is very flexible to develop and change.

For conclusion, our main challenges during the process were making the gloves react as real as possible and create a fun and challenging game. We made this game with a lot of thinking and we are sure the players will love it!