

# Virtual Reality Escape Room: The Last Breakout

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**Abstract**— The simulation called VR Escape Room: The Last Breakout was developed to stimulate sense of fear by usage of sounds and mysterious elements for helping user with the phobia of dark and gloomy environment. The simulation was developed through benchmarking, texturing, modeling, and application mechanic with Unreal Engine 4. After it has been developed, the simulation was tested and evaluated to 22 users and the result proved that the simulation was entertaining, interesting, immersive, and has potential to launch on Steam for VR market.

**Keywords**—virtual reality; simulation; escape room

## I. INTRODUCTION

The use of Virtual Reality (VR) has been popular over the past few years. One of the most popular disciplines for VR is simulation. VR simulation is a simulation of 3D objects and 3D environment that is used for engaging learning experience [1]. VR simulation has been implemented in many platforms, such as, education [2, 3], medical [4], marine [5, 6], training [7, 8, 9], and military [10, 11].

In this paper, we present VR simulation called VR Escape Room: The Last Breakout. It is a VR simulation that requires players to escape from the scary abandoned apartment by solving series of riddles. Escape room in reality is a physical adventure simulation where players are locked in a room and required to use furniture of the room to solve series of riddles for escaping from the room [12]. It is usually provided in public space, such as, shopping mall. However, it is not easy to access escape room as it is rare due to the high cost for building it. Furthermore, the risky interaction, such as, falling door, is hardly implemented in the real world.

Commercial VR Escape room has been provided by Exitus VR [13]. It allows user to play games in a horror and space theme in a multiplayer platform. However, this is categorized as games, whereas, this study offers a simulation. The reason why the simulation was chosen because the main objective of the simulation is to stimulate sense of fear of user by usage of sound and mysterious elements in the virtual environment for helping user with phobia of dark and gloomy environment. By engaging in this virtual simulation, it is hoped user will have a reduced phobia once they get used to it by simulating it many

times [14;15]. Furthermore, this study preferred to simulate escape room in VR so it can be experienced anytime and anywhere. Also, to cut the cost for building and renting the escape room and simulate the risky interaction which hardly provided in real world.

The simulation was developed by using 3Ds Max, Google Sketchup, Adobe Photoshop, and Unreal Engine 4. After it has been developed, the simulation was evaluated and the result showed the simulation was entertaining, interesting and immersive.

This paper firstly presents the development of the simulation. Then, it describes the gameplay level design of VR Escape Room: The Last Breakout. Next, it reflects on the result of alpha testing and evaluation of the simulation. Finally, it concludes that result of development of VR Escape Room: The Last Breakout.

## II. DEVELOPMENT OF VR ESCAPE ROOM: THE LAST BREAKOUT

The simulation was developed through four steps, which are, benchmarking, texturing, modeling, and application mechanic. Each step provides the progress of development. The process of development is explained in the next sub-sections.

### A. Benchmarking

In order for having the real experience, developers went to the physical escape room twice. They also went through series of video simulation in order to find the mood of creating game environment. The lighting and sound of the environment is the main thing that were researched about. All information which found during benchmarking were noted and documented for references.

### B. Texturing

After benchmarking, developers did texturing for the 3D objects based on the references they obtained from the visit. The desired textures were obtained from internet. Then, these textures were imported to Adobe Photoshop. Besides, some brushes are applied onto textures to create old walls, broken

chairs, and old carpet. Meanwhile, for bumps, the textures were made later.

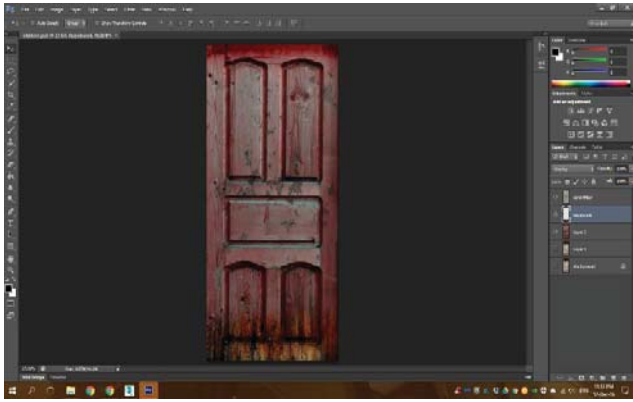


Fig. 1. The textures implementation in Adobe Photoshop

### C. Modeling

After texturing done, the step continued to model the 3D objects. The 3D objects were modeled in SketchUp. The dimensions were referred from the internet. Then, after the models have built, they were transferred to 3Ds MAX to apply the texture. Then, UVW layer also was applied to do texturing for multiple surfaces at the same time.

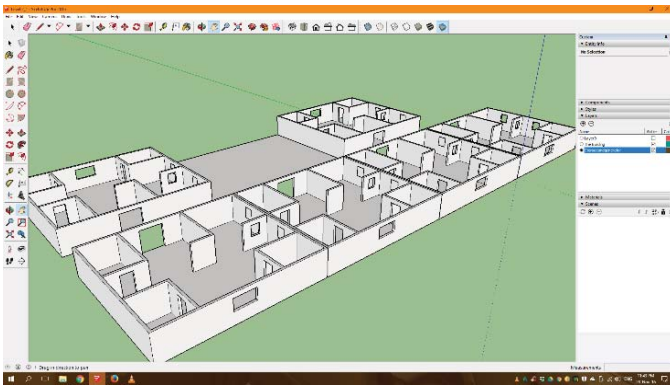


Fig. 2. The 3D Modeling in SketchUp

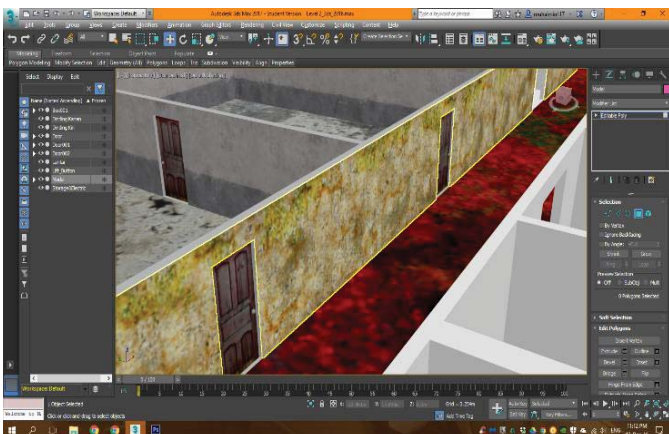


Fig. 3. The Texture implementation in 3Ds Max

### D. Application Mechanic

After the environment has been modeled and textured, the application then developed and scripted. The software is Unreal Engine 4 and Blueprint scripting. Blueprint scripting was used to enable player to perform navigation and interaction (animating doors, sounds, opening doors, picking up papers, and picking up fuse) also to apply the VR device as the display, Oculus Rift and Xbox controller. Meanwhile, Blueprint Editor is an application where all application mechanics were applied. It is the main tool to edit a visual scripting node known as blueprints.

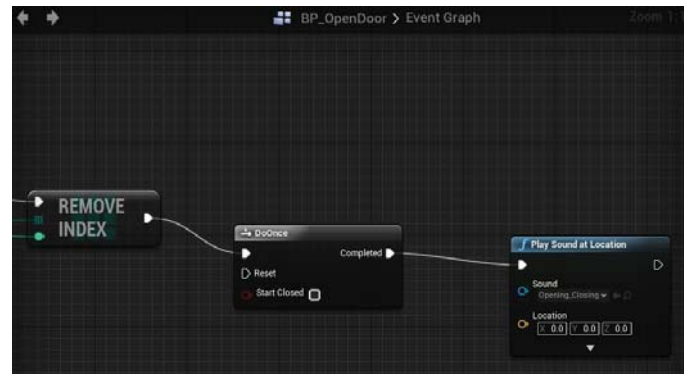


Fig. 4. Programming script for open door

## III. GAMEPLAY LEVEL DESIGN

Overall, the simulation is in a first person view. The player can do simple interaction with the environment, such as, open the door, pick up things and use flash light. There are series of riddles to be solved for proceeding to the next level. The next subsections explain the gameplay in each level.

### A. Level 1 (Small Room)

The player wakes up and find himself trapped in a room. He observes his surrounding and finds a note that states he is trapped. So, his task is to escape from the room by finding a clue that lead to a key for the bathroom. Then in the bathroom, he will find the main door key which will be used to open the main door entrance in order to proceed to level 2.

### B. Level 2 (Long hallway with doors)

The player finds himself in hallway. Then, player has to activate the elevator but the elevator is offline. Therefore, he has to find the fuse for supplying the power box. Player can pick up the fuse by walking to the box which contains the fuse that is in his sight. Then, automatically, the fuse will be picked up. Because, when player look back inside the box, the fuse will be gone once player walks towards and near it.

### C. Level 3 (The front side of building)

The player has to find the key to office room. Then, after he finds it, he will unlock the office room and finds the clue that leads him to toilet which has the final key. The final key is the

one that will be used to unlock the door so player can escape from the room.

#### IV. GAME MECHANICS – RIDDLES

The puzzles in the game are hidden objects and words with hidden message. These game mechanics are explained in following subsections.

##### A. Level 1

This level provides a small apartment size room with a living room, dining room, bathroom, and bedroom. The player is locked in the room and he/she has to find key hidden somewhere in the room. The clues and hints were located in the room where the player has to solve the hints which are given in riddles, math, hidden meaning in phrase and pictures. Some of hints are related to all levels and can be used to solve the puzzle in those levels.

##### B. Level 2

The player has to turn on the right switch in the power box located in the room. Then, to be able to use the power box, the player has to find a fuse and put power box in the right slot. Finally, player should put the fuse in a switch box to activate elevator.

##### C. Level 3

Player finds himself in the third level. He has to find the key to office room. There is a riddle needed to find the office key. The key is hidden somewhere in a picture frame. After the key is found, player can unlock the room and find paper with some clues. One of the clues leads player to toilet which has the key for main building to exit from the building.

#### V. TECHNICAL ISSUES

Technical issues that were faced related to the programming for the simulation. Since the developers were new to Unreal Engine, the interaction has some lacking. It works, but it is not perfect. There are three actions that can't be made because of the limited knowledge of programming of Unreal Engine: Firstly, the picking object. When user picks up an object, there is no indicator that the object was picked up. This is due to the programming is beyond developers' knowledge. Secondly, moving entity towards customer. The entity should move towards the player, but it can't be achieved because developers do not have clue on how to execute it in Unreal Engine. Thirdly, when a player picks a paper to read, the paper appears to be separated within the Oculus headset view. That is also because developers don't know how to make the programming for it in the Unreal Engine. Fourthly, the movement of the player. Movement of player should have been changed to "gaze and move only" rather than using Xbox controller as that would make the player feel nausea because of a too much freedom in the environment. And that too, it can't be executed because the limited knowledge for the Unreal Engine.

application and he/she will automatically move there slowly and steady with limited speed and movement).

#### VI. PROTOTYPE ALPHA TESTING

The simulation has been tested to 22 users. The users were in the range of 14 to 25 years old. The number between male and female participants were balance. There were 14 of them has not experienced VR before while 7 of them have experienced VR already.

The users played the simulation for 30 minutes. After the testing, users said the simulation is interesting, entertaining, and immersive. However, there are some comments related to dizziness, navigation, and product commercialization. The explanation about these issues are provided as follow:

##### 1) Dizziness

The dizziness comes from the sharp color of environment in Oculus Rift. Moreover, it is also because the fast movement of the player vision from the headset.

##### 2) Unclear navigation

The wayfinding is not clear to tell player where to go. So player is confused what to do and where to go next.

##### 3) Product commercialization on VR Steam

Users find the simulation are commercial to be available on Steam. However, the simulation is not completed yet. After the simulation are fully completed, it will be uploaded to Steam for commercialization.

#### VII. CONCLUSION AND FUTURE RESEARCH

In summary, we have developed VR Escape Room: The Last Breakout simulation which simulates the physical escape room for helping user with fear of dark phobia, enabling player to play it anytime, cutting the cost for building and renting also to implement the risky interaction in real world. This simulation has been developed through benchmarking, texturing (Adobe Photoshop), and 3D modeling (SketchUp and 3Ds Max), and application mechanic (Unreal Engine 4).

The result of evaluation showed that players had positive feedback towards the simulation and inquiries to be available on Steam so they can play it online. However, there are rooms for improvement for the simulation. The programming are needed to be improved so the interaction between user and the simulation will be better. Moreover, for the movement and fuziness, the 5-minute-gameplay has already made player was weak and dizzy. Therefore, the way to counter is to make a gaze system where player looks into some sort of circle dot placed around environment and player will move automatically and slowly to destination of where these circles are. All these factors are taken into action for future research for developing better VR Escape Room: The Last Breakout.

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