

# EE 267 Project Report: *Toy Scary*

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## 1. Introduction

We implement a survival shooter horror game modified for an optimal virtual reality (VR) experience. A playable character navigates a nightmare where they have been miniaturized and forced to do battle with waves of iridescent toys. We title our game *Toy Scary*. The character fights across the giant bedroom and backyard landscapes using player input. The toy enemies that appear as the game progresses approach and damage the player through contact. The player has a limited health bar and must shoot or blow up these approaching enemies to survive for as long as possible. The game has no set ending and instead completes upon player death. We use a first-person camera perspective, orientation and pose-tracked hardware, vibrations, and noise-canceling headphones for a maximally immersive VR experience.

## 2. Motivation

Modern applications of VR are numerous, but the most ubiquitous use case is in gaming. The revenue for VR consumer software reached 554 million in 2017, and games comprised nearly 55 % of it [1]. It would be exciting to work on a project at the confluence of these two industries. We sought out to, and did, gain experience with using virtual reality hardware and designing interactive game environments. This project also introduced us the successes of and challenges still facing effective VR implementation. We developed skills for a range of jobs in mixed reality and a good foundation for future work on improving VR gaming experience.

## 3. Implementation Details

We implemented our survival shooter for multiple hardware platforms by following online game design tutorials, downloading assets from the Unity store [2,3], and writing custom code. We initially targeted the View Master Deluxe VR Viewer hardware (Fig. 1 a) [4,5] and got a preliminary version of the game to run on this successfully. We contin-

ued expanding our game for full integration with the HTC VIVE hardware (Fig. 1 b) to provide better image resolution, user field of view, and options for user interaction [6].



Figure 1. The hardware systems for which the game was designed and tested: a) the View Master Deluxe VR Viewer [4,5] and b) the HTC VIVE [6].

We began with a game designed for implementation on the View Master Deluxe. We followed the tutorial for *Survival Shooter* game and used the assets provided there [2,3]. Some of these initial assets included the enemies (zombears, zombunnies, and hellephants) (Fig. 2,3,4), game audio, portions of the starting room, and the player's shootable gun. The *w,a,s,d* keys were used for controlling player motion, and the mouse controlled the single-plane gun direction and firing. This resulted in a functional but limited game with an overhead third person camera perspective and little user immersion in the environment.

We then imported particle assets, explosion and gun fire effects from the unity store and added more custom scripts for grenade throwing, Heads up display of health and player movement. We more than doubled the size of the game environment and added more obstacles for the character to traverse. We also changed enemy behavior so as to build

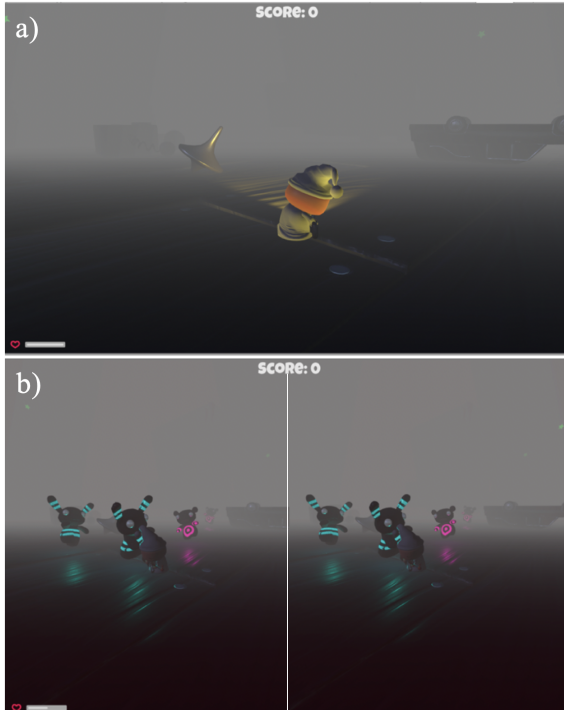


Figure 2. Comparison of the custom game formatted for a) a 2D display with 3rd person camera view and b) a stereo-rendered VR display with 3rd person camera view.

game difficulty, moved the camera closer to the player character, and improved the lighting. We added an option to throw grenades and a satisfactory resulting explosion effect. We also made a variety of smaller changes we will omit for brevity. Finally, by enabling the Mock HMD setting in Unity, we generated the stereo split-screen view compatible with the View Master Deluxe VR Viewer (Fig. 1 a ) [4,5]. We show the effect of this rendering in our customized game environment in Figure 2 by comparing it to the traditional 2D view.

To take full advantage of the HTC Vive hardware [6] (Fig. 1 b), we made significant changes to the game. We converted the camera view and game scripts to a first-person point of view (POV) to take better advantage of the new depth effects (Fig. 3). In this view, enemies appear to get much closer to the player, and pose tracking effects are more obvious.

We used the orientation and pose tracking of the HTC VIVE headset to update the camera view with user motion. We used the buttons and the pose tracking on the HTC VIVE controllers to update the positions of the grenades and gun while also triggering their actions (Fig. 4). We also coded these controllers to manage player movements, provide vibrations in response to events in the game and mapped weapon actions to them, creating an intuitive way



Figure 3. Completed game running on the HTC Vive. All three types of enemies are shown (blue zombunnies, pink zombears, and yellow hellephants) along with the heads-up display with the player score and health.



Figure 4. Completed game running on the HTC Vive. All three types of enemies are shown (zombunnies (blue), zombears (pink), and hellephants (yellow) along with the heads-up display with the player score and health.

of interacting with the virtual environment. To complete the user immersion in the virtual environment, we provided spatial-sound using wireless noise-canceling headphones. The HTC VIVE interfaces with Unity using the Steam VR application for key binding and transformation data [7].

## 4. Conclusion

We successfully created an immersive VR survival shooter experience compatible with the View Master Deluxe and the HTC VIVE. We began from a Unity tutorial, customized and expanded the game environment, converted the game to a first person shooter, provided a gun and a grenade attack option, set up wireless noise-canceling audio, took user input from wireless controllers, and used user pose and orientation data to dynamically update the scene. This level of interaction blurs the boundaries between the player's reality and virtuality.

## 5. References

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