Virtual Marimba
User Manual

December 2016

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I. Introduction

1. Overview

This project was created for the graduate Virtual Reality course CSCI-715 at the Rochester Institute of Technology. Using the Unreal Engine, a marimba (a large xylophone-like percussion instrument), has been constructed in a Virtual Reality environment. The user plays the marimba by wearing the HTC Vive and using the Vive’s controllers as mallets for the instrument. This project is open source and available here: https://github.com/VR-Instruments/MarimbaModel

2. Technology

The project was built using the following technologies:

- HTC Vive
- Unreal Engine 4
- Steam VR

This project was only built and tested on a 64-bit Intel-based Windows 10 machine running Steam VR. It may be possible to build this project for Linux, at least for Debian-based distributions as Steam VR has support for Debian. This has not been attempted so with fair warning, *here be dragons*.

3. Building and Running

Running the project can be done in one of two ways:

a. For Developers

Install the latest versions of Unreal Engine 4 and Steam. A Steam account is required to install and run the Steam VR library which is used to work with the HTC Vive. After that, the project can be pulled from the public GitHub repository (with the method of your choosing), then opened and built using Unreal.

We recommend using a Windows 10 development machine with a relatively recent Nvidia graphics chipset. We have attempted to install Unreal on Linux but as of writing, it has to be built from the Unreal source tree on GitHub. This process did not jive well with the kernel version we attempted this with.

b. For Players

For those who just want to play with the Virtual Marimba, we have built a standalone Windows executable. However, before running it, we recommend that you plug in and turn on the HTC Vive and start Steam VR.

4. Design

The project is made by extending and modifying an existing VR template from Unreal Engine 4. This template gives basic boilerplate functionality for simple movement and hand controls.

Using this template we created a simple note block and a marimba which is constructed using several note blocks and varying the internal sound of each individual block. With a completed marimba model we created mallets that could strike a note block and have a sound be played.

5. Issues Encountered

VR is still very much an experimental field. In the early stages of development, we ran into a lot of issues with headaches and motion sickness. For someone new to VR, phasing through objects like a ghost is unsettling. Projecting the wrong camera view to the Vive is nauseating.

For a while in our development phase we were stuck using left and right hand models that came with one of the Unreal templates and the Steam VR driver would keep mapping the virtual hands to the wrong controllers. Initially we wanted to use the hand models to heighten the sense of immersion. We wanted the user to be able pick up the marimba mallets from a table. But having backwards hands is incredibly disorienting for the user so we simplified the design and now the user only controls the mallets in the virtual world.

On another note, we also wanted to create video recordings of marimba performances using the screen capture utility built into Unreal. However at the time of writing this does not work well on the Vive. While the screen capture tool is running, the framerate will drop on the desktop's game viewport while the Vive will interlace empty white frames with frames of the VR world. This is very disorienting for whoever is wearing the Vive at the time.

II. The Experience

1. Terminology

Here are some terms we have come up with to describe some aspects of working with the HTC Vive and VR in general:

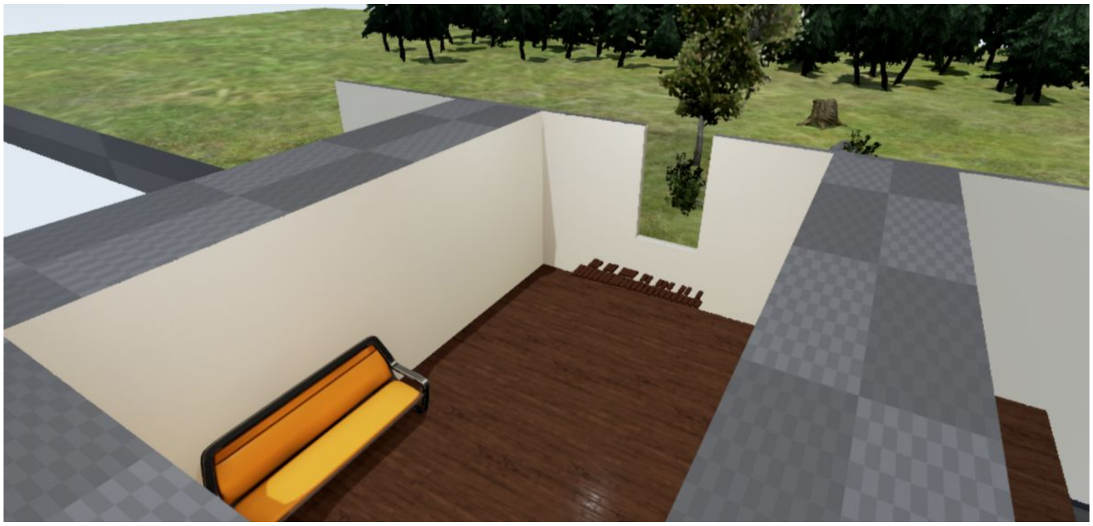
- Holodeck
    - Default view when running Steam VR
    - Geodesic room with radial direction markers and camera position visualisations
- Hell
    - Device is off and the user is completely in the dark or Unreal has crashed and displayed some nonsense projection on the Vive
- Safety Feature
    - On the Holodeck, you can project the Vive's head mounted camera above the controller visuals to see where you are in the room
    - This occasionally crashed the Vive controller on us
- Netting
    - The projection of the camera boundaries around the room

2. User Guide

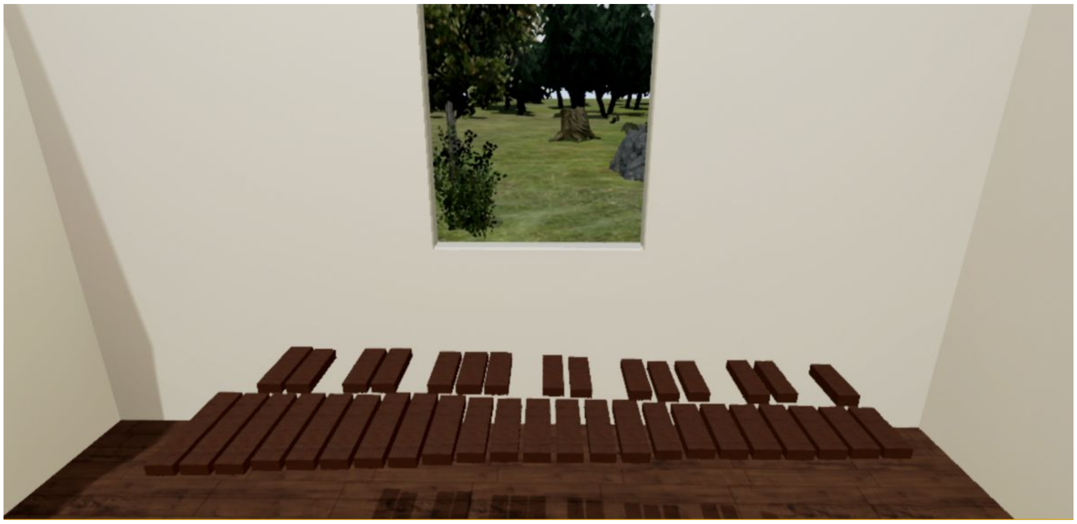
1. Setup the HTC Vive as per the installation instructions provided by HTC, making sure that the play area is safe and free from obstacles
2. To play with the marimba, first launch the marimba application
   a. See Section I.3 for more details
3. After the application is running, securely put on the wrist straps that come with the Vive controllers
4. While letting the controllers dangle, put on the HTC Vive headset
5. There are two ways to listen to the marimba:
   a. Connect headphones to the audio port on the Vive and put them on after putting on the headset. This is recommended for the most immersive experience.
   b. Use desktop speakers
6. To play the marimba, simply walk over to the marimba and hit it with the virtual mallets
7. To stop, take off the Vive and kill the game process

3. Screenshots

Isometric View of the Marimba Room



Marimba Model



III. Looking Forward

1. Future Improvements

We initially wanted to create a “garage band” assortment of instruments in a VR environment. After working with the HTC Vive for a few months now, we can safely say the technology is not to a point where that is practical. We believe that VR, as it stands right now, is limited to percussion instruments. Although the HTC controllers are arguably the best such devices on the market right now, they are not precise enough to handle the fine motor skills required accurately create virtual string instrument experience, such as a guitar. On top of that, the controllers do not provide any sensible faculties to mimic finger movements required for a piano or a trumpet.

That being said, we believe there is room to invent new instruments that can only work in VR. During our development process, we encountered a bug where you could play the marimba by phasing the virtual mallet up and down through the note blocks. Obviously this is not possible in the physical world but it does raise the question if it would make sense to invent a synthetic instrument that could use the lack of physical limitations to its advantage.

2. Next Steps

We are looking into publishing this project as free demo software on Steam. We are also considering ways we could support this project past our involvement in the Virtual Reality course.

IV. Legal

1. Building from this Project

We have licensed this software under the MIT License. On top of that we, the authors, would like to ask that if you use our code in other projects, that you inform us upon doing so and give credit where credit is due. This is mostly for our own curiosity if anyone has found this work to be useful in their endeavors.

2. Special Thanks

We would like to thank Professor Joe Geigel and Zane Draper for helping us with this project. Without their assistance, the project would not have been possible.