# Overview

Hello wonderful people who are helping complete this study! There are a few aspects of our system that still need some last few tweaks before the study can officially be run. First, let’s give you an overview of the entire system and then we will highlight the work that still needs to be done.

# Redirected Walking is defined as manipulating the mapping between real and virtual motions to allow users of virtual reality to explore large virtual spaces using limited physical spaces. An open problem with redirected walking is finding a level of manipulation that is high enough to minimize the necessary physical space but small enough to avoid simulator sickness by remaining imperceptible. Previous research has found general guidelines for perception thresholds, but these guidelines are ineffective due to the wide variance of thresholds between users and advances in head mounted displays. Therefore, our objective is to create a process that will quickly and accurately calibrate the perception threshold for individual users.

# To accomplish this, users will be placed in a virtual room where they will turn to look at a painting. As they turn, a scaling of virtual rotation relative to the real world will be applied. The level of scaling is called Rotation Gain. Two mathematical methods typically used to find the perceptibility thresholds for hearing sounds will be used to assess each user’s perceptibility threshold for Rotation Gain. The two methods, an adaptive staircase method and the “Best PEST” will be compared for efficiency.

# Results of this study will refine current redirected walking techniques, help create more immersive experiences in virtual reality for training, games, and other applications as well as help diminish the physical restrictions with current certain environments.

Our system is comprised of one (large) Unity file. In this file, the two most important folders are the *Scenes* folder and the *Scripts* folder. In the *Scenes* folder there are three different unity scenes for the different levels of our project. One for the training stage, one for the main testing stage, and one for the verification stage. Each of these scenes uses a few of the scripts from the *Scripts* folder. While every one of the scripts is well documented with comments in the code, we will give you an overview here.

In each of the training scenes, the main script is called *Training Sequence* and is attached to the Reticule game object. It requires ten inputs from you. The first is the *Player* which is simply the head of the camera within the Redirected User game object. The second is the Painting game object while the third is the Feet game object which helps initialize the user’s position. The fourth is the Arrow game object and the fifth is the room which contains all of the objects that build our room. The sixth - ninth are the various voiceovers used for training and the last is the audio we use for the selection sound. This script handles all the button presses and plays the audio at the appropriate times. It simulates the testing environment that the users will be placed in next.

The *Redirected Walking Scene* is the main testing environment and uses a few of the scripts within the *Scripts* folder. On the Reticule game object, we have the *Button Manager* script. This one handles all the button presses, the initialization of the threshold estimation methods, writing data to files, and resetting the room to call the next gain level. The inputs on this script include a dropdown menu with the two estimation techniques, the *Rotation Tests* script that is used on the Redirected User game object, and the same Player, Arrow, and Room variables from the training sequence. This scene also uses the *Rotation Tests* script which handles all of the calculations to algorithmically choose the next gain to test. This is where you can add a unique user ID that will we label all of the data with. The last script that this scene uses is called *Laser Pointer* and has an instance attached to each of the Controller game objects. This script handles the Reticule game object and make sure it appears on the wall where your controller points.

Lastly, we have the *Verification Scene*. This scene is a representation of a typical VR environment that the user will move around in. While they move around, gains at the calculated threshold levels will be applied at various times throughout the experience and the user will be rating their comfort level on scale of 1-100 so we can determine whether or not the thresholds that we calculated previously were accurate. The script will record this information automatically. The work of applying the gains and recording the comfortability rating will be done in the script called *Rating* applied on the Camera Head game object within the Redirected User game object.

# To Do Still

Here are some of the things that still need some work before the study can be implemented.

1. Re-record voiceovers for training sequence if necessary.
2. Third voiceover is not triggering properly in Training Scene.
3. Need to integrate verification stage training into Training Scene.
4. Figure out how to transfer the final calculated rotation values into the verification stage.
5. Fix the verification stage script so that the specified rotation gains are applied within a certain radius of the given targets.
6. Make the algorithm record comfortability rating when entering radius of target.

Please contact us with any questions and/or concerns! Feel free to edit the code as much as you wish.

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