1 Overview

In this assignment, you will be exploring throwing performance in augmented reality and conducting an experiment to compare between three conditions. We will find out together how well people throw in the physical world, whether that translates to augmented reality in a baseline condition and in one you customize, and whether they improve their throwing at the same rate.

This will give you a taste of making, running, analyzing the results for, and writing about a quantitative experiment. Before starting, read the 1-page Experience Prototyping section in a previous paper https://jeffhuang.com/papers/Portalble_UIST19.pdf to get a sense of the Portal-ble augmented reality system as a prototype from 2018.

2 Experiment Design

The three conditions you will be comparing will be a baseline physical throwing condition, a baseline virtual throwing condition, and a virtual throwing condition in which you can customize the projectile and target. For your custom condition, you may consider changing the projectile or target size, lighting, primative, color, weight, texture, distance, and angle. You will recruit two volunteer participants and each participant will perform all three conditions. Assign your two participants to one of these two formats:

Participant A: 20 trials throwing a physical projectile (physical baseline), 20 trials with the virtual projectile (virtual baseline), and 20 trials with your custom virtual condition.

Participant B: 20 trials throwing the virtual projectile (virtual baseline), 20 trials with a physical projectile (physical baseline), and 20 trials with your custom virtual condition.

2.1 Throwing Trials

For the baseline conditions at least, the participants should stand 2.5 meters away from the target and throw the projectile while keeping their hand in view of Portal-ble's phone camera. Portal-ble's will save the data for you in the virtual throwing conditions, but you will need to measure and save the data yourself for the physical baseline condition (using a measuring tape). Use the coordinate system where (0,0) is the center of the target, (-1,-1) is 1 cm to the left and 1 cm below the target, while (2,2) is 2 cm to the right and 2 cm above the target, etc.

These are the 3 key metrics:

1) the distribution of hits (the offset between the target and where the projectile hits)

2) the spread (x-axis and y-axis variance of where the projectile hits)

3) the rate of improvement in accuracy (distance to target) from trial to trial

2.2 Preparation

You will be responsible for recruiting two participants who have not used Portal-ble before as part of your study, and are over 18 years of age. Before you run your experiment, come up with a hypothesis about how your custom virtual condition will affect the results and prepare a consent form for them based on Brown's informed consent form https://www.brown.edu/research/sites/research/files/Standard%20Consent%20Template%20v08-26-19.docx for your two participants to sign.

There will be sessions allocated for you to run the experiment on the weekend (Feb 22–23), lasting 45 minutes (with 15 minutes between sessions for the devices to recharge) at https://docs.google.com/spreadsheets/d/1e3KnrWWXWHUgINfF7yFqU3jThjuBJeEdK47s5Rm6F7I/edit. If you are unable to come on the weekend, let Jeff know when you are available to check out the devices and to book a room (we will be using 102 CIT to have consistent lighting and access to a screen, so check the schedule first).

The Portal-ble setup instructions (similar to what Jing described in class) are here: https://docs.google.com/document/d/14sMQ7hBqTAplxYWaCZkdFqlckumozaEZYo-8YPH4pYs/edit

3 Deliverables

Run your experiment and submit your data by the midpoint so that you have a week to analyze the data and write your report. Your report will be judged like the methods and results section of a research paper. Be sure to include a description of what you did so that it is reproducible, what your hypothesis about your custom condition was and whether the results matched, then both descriptive and comparitive analysis of the 3 key metrics above for the 3 conditions.

Note that different metrics will require different types of comparisons, depending on whether they are within- or between- subjects, whether the metric is per trial or per condition. Also discuss whether the experimental design we have chosen is exposed to any of the three types of validity problems.

Finally, choose one of these analyses to include: 1) is there a difference (i.e. a bias) between the x-axis or the y-axis for different metrics, and why—explain in relation to the recent readings, 2) what is the trajectory of the virtual throw (i.e. time/speed vs distance), and describe it in relation to the recent readings.

Submit your report up to 4,000 words either as a pdf file to Canvas or on paper at the beginning of class on March 4.