

In this assignment you will explore Fitts' Law, a fundamental and widely used mathematical model in HCI, while conducting your own eye tracking study. Eye tracking is a common user study technique, and you will have a chance to try a professional eye tracker: the Tobii Pro X3-120. The readings we have done in class describe Fitts' Law principles and will help you measure the effect two conditions on pointing interactions, while examining the eye-gaze activity of participants. This is probably the most challenging assignment, so you ought to start early. The success of the study depends on many details; read this document several times until you feel comfortable carrying out the study.

For this assignment, you will find 3 participants and arrange an 1-hour session with them in CIT 472 (the actual eye-tracking experiment will take about 5 minutes per condition). You can get the key for 472 from Dawn in CIT 470 (or at the reception if Dawn is not around). Mark **four** 1-hour slots on [THIS Doodle](#) to book the room: 1 for you to run through the study, and 3 for participants. Make sure your participants have not participated in any other classmate's study. Before your study, prepare a study protocol and an informed consent document. At the beginning of the study, and ask them to sign the consent form and fill out [this demographics questionnaire](#).

Follow the [step-by-step instructions HERE](#) to run the study.

Fitts' Law Study

You will have two conditions in your study: the baseline one and one that you design yourself. The condition you design can be anything you think might affect pointing performance: listening to music during the study, or using a faster mouse, etc.

For each condition, you will go through the same layout. The circles will be arranged in a circle, and they will have varying amplitudes and widths. Note the following parameters: 3 amplitudes (256, 384, 512), 3 widths (24, 64, 96), and 10 trials per combination of amplitude and width.

The combinations of width and amplitude will be picked randomly by the webpage (note that in total you will have $3 \times 3 \times 10 = 90$ trials per participant per condition). Once a participant has gone through all combinations of amplitudes and widths, you will be prompted to create and download the log data file. Don't forget, otherwise you will have to repeat the study again. Do this after each condition, and you will have 2 cursor log files for each participant. All of them will be found in the Downloads folder. The eye-tracker log files will be in WebgazerPlusPlus/logs. Don't forget to get copies of all of them at the end of the study and remove them from the Downloads folder and the WebgazerPlusPlus/logs folder.

Analysis

By 1pm on April 17 (midpoint), you should have already performed a test-run by yourself, and you should have run the study with at least one participant, uploaded their data to [this Google](#)

[Drive folder](#), and have scheduled the remaining two participants. We recommend using python and/or Excel, but however you do the analysis is fine.

The `cursor_log_file.txt` file that will be created includes the timestamp of moving and clicking activity of the cursor, along with the success/failure information. You will use these log files for your analysis. Follow the procedures recommended by Soukoroff and MacKenzie. Use the Shannon’s formulation of Fitts’ Law to calculate the MT , ID , W_e , a (intercept), b (slope), and error rates. Fit a linear regression to your data in order to create the classic regression plot of ID vs MT for each of your two conditions.

You can use Excel’s Trendline to do the plot and compute the best-fit regression/correlation. Were the regression plots what you expected? Does Fitts’ Law “work”? Compare the throughputs (according to the formulation specified in Soukoreff and MackKenzie) between the two conditions. Also include some descriptive results: plot distance from target vs time for one or two representative trials, what were the percentages of error and average times for each condition?

The eye-tracking log file contains the predictions of eye-gaze coordinates made by the eye tracker. As it says in [the step-by-step guide](#), you should use [this script](#) to combine the cursor and eye-tracking log files into one readable file per participant per condition.

In order to compare the study results between the two conditions, perform whatever you believe is the appropriate statistical analysis. This will help you determine how the participant’s gaze and cursor movements were affected by the condition you designed.

Finally, do at least one creative analysis on the data from the two conditions. Choose from the following, or come up with your own: What is the bias between your eye and the target? Does the eye gaze follow Fitts’ Law the way the cursor does? How does user pointing relate to eye-gaze (e.g. to they look first and then point, or look at different places they could point to and choose where to aim)? Does Fitts’ Law fit the data best or does a two-part model (like Welford’s law) or a power law fit better? Basically, try to discover something new and interesting!

Final Words

Once you have completed this assignment, you will understand Fitts’ Law and eye tracking better than even many HCI researchers. Keep a journal (lab notes) of your work as you go. Describe everything you did, and what you found. **Deliverables:** (1) send via email a final short report that includes your journal notes, study protocol, plots, and any other files you generated; (2) upload the combined log files you have gathered for each participant and condition (a total of 6 files per each of you). Contact Nedi for help this assignment, but don’t wait until the last few days because both she and Jeff will be traveling between April 20 and April 27.

The assignment grade will be based on correctly running the user study and avoiding pitfalls (5 points), performing a reasonable analysis of the Fitts’ Law study data (6 points), trying a creative analysis of the final data (5 points), quality of the report and conclusions (2 points), and midpoint progress (2 points).