Assignment 2

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1 BRIEF SUMMARY

In this assignment, we aimed to analyze the efficiency of two input devices (Mouse and Touchpad) using Fitts' Law. Our goal was to determine which input device offers better performance in terms of speed and accuracy when selecting targets of varying sizes and distances. We hypothesize that the Mouse will demonstrate superior efficiency compared to the Touchpad due to its greater precision and faster movement capabilities, particularly in selecting smaller targets or targets placed at greater distances. Specifically, we expect that the Mouse will result in **shorter completion times** (i.e., higher speed) and **fewer errors** (i.e., higher accuracy) compared to the Touchpad. These hypotheses are based on the assumption that the Mouse provides a more direct and controlled method of interaction, while the Touchpad's multi-touch gestures may introduce variability in movement accuracy and speed.

2 DIVISION OF WORK

- **Danqi**: Implemented the user selection of targets and wrote the report.
- **Du Pyo**: Implemented the notification UI, the changing of the distance and width of the circles as the game proceeds, and the R code that converts the csv file into grouped data, and the excel spreadsheet that contains the graph based on the grouped data.
- **Karel**: Initialized the project structure, segmented tasks with clear deliverables under GitHub Issues, implemented the capability to render n circles, Implemented Logging, and reviewed Pull Requests.

Rubric:

- **User selects 9 targets in a circular arrangement** (2.5 marks): Danqi, Karel
- **3 distance (a.k.a. Amplitude) conditions** (1.5 marks): Du Pyo
- **3 target sizes (a.k.a. width) conditions** (1.5 marks): Du Pyo
- **Log, Analyse Data and Report** (4.5 marks): Danqi, Du Pyo, Karel

Width	Amplitude	Technique	average_in	fitts_id
0.2	1	Mouse	0.680259	2.584963
0.2	1	TouchPad	0.995444	2.584963
0.2	2	Mouse	0.710667	3.459432
0.2	2	TouchPad	0.983667	3.459432
0.2	3	Mouse	0.744148	4
0.2	3	TouchPad	0.937037	4
0.4	1	Mouse	0.468963	1.807355
0.4	1	TouchPad	0.701704	1.807355
0.4	2	Mouse	0.505704	2.584963
0.4	2	TouchPad	0.706926	2.584963
0.4	3	Mouse	0.553222	3.087463
0.4	3	TouchPad	0.741519	3.087463
0.6	1	Mouse	0.452704	1.415037
0.6	1	TouchPad	0.599407	1.415037
0.6	2	Mouse	0.472963	2.115477
0.6	2	TouchPad	0.684	2.115477
0.6	3	Mouse	0.523519	2.584963
0.6	3	TouchPad	0.666037	2.584963

Fig. 1. Data collected from participants performing Fitt's Law Experiment
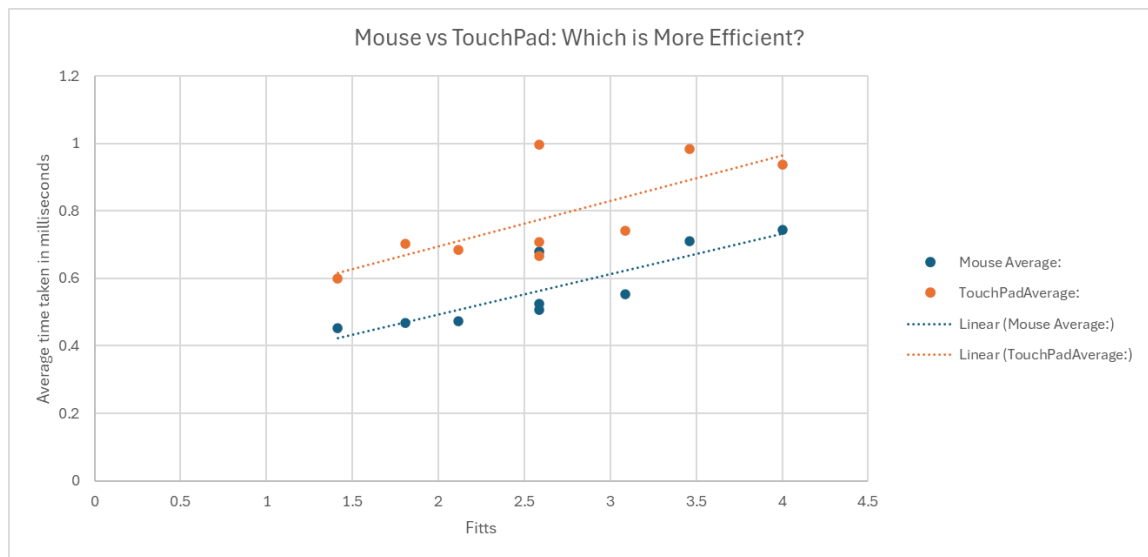

Fig. 2. Comparison of input device performance using Fitts' Law. The data shows that the Mouse outperforms the Touchpad in performance, with significantly shorter completion times.

3   RESULTS

The results are summarized in the table and graph above. Fig. 1 shows the average time taken for each combination of distance and size, while Fig. 2 plots the average time against the Fitts ID for both input devices (Mouse vs. Touchpad).

Based on our analysis using Fitts' Law, the results indicate that the Mouse is significantly more accurate and efficient than the Touchpad. Specifically, participants demonstrated faster target selection times and achieved greater accuracy with the Mouse across varying target sizes and distances. The Mouse consistently produced lower error rates and shorter completion times compared to the Touchpad, validating our hypothesis that the Mouse provides better performance in terms of both speed and precision.

4   CHALLENGES AND RESOLUTIONS

This time, we encountered more challenges compared to Assignment 1. However, we successfully resolved all of them.

Danqi faced the challenge of learning to create a new branch, push her work, and merge it to the main branch using her GitHub account. This process was entirely new to her. With Karel's assistance, she successfully overcame this challenge.

Du Pyo found it challenging to use his R knowledge to gather and group data in the desired manner. Fortunately, the professor allowed the usage of ChatGPT, which significantly helped him with this task. Initially, creating spreadsheets seemed daunting, but the process was smooth thanks to the zoom video tutorial provided by the professor. Writing the code to change the distance and width of the circles was the most challenging task to Du Pyo. He ended up being in charge of choosing which data structure to use for the combinations, and he still not sure if he made the correct decision. Adjusting the circles to change their distance and width according to the created data structure was more difficult than he anticipated. Nevertheless it worked.