HCI – HW3

FITTS'S LAW EXPERIMENTATION

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Fitts's Law Description:

Fitts's law is a predictive model of human movement used in human-computer interaction. It describes how the distance from the source to the destination and the width of the target influence the index of difficulty(ID) of the task.

Different input modalities such as mouse, touch, mid-air, eye gaze, 3D tracker etc. can be used to conduct a Fitts's law experiment.

According to Shannon's formula for Fitts's law, the formula for **index of difficulty** is given by:

$ID = \log_2((A/W) + 1)$ [Units: 'bits']

Movement time – which is the time taken to move a pointer from the source to the destination point is calculated as follows:

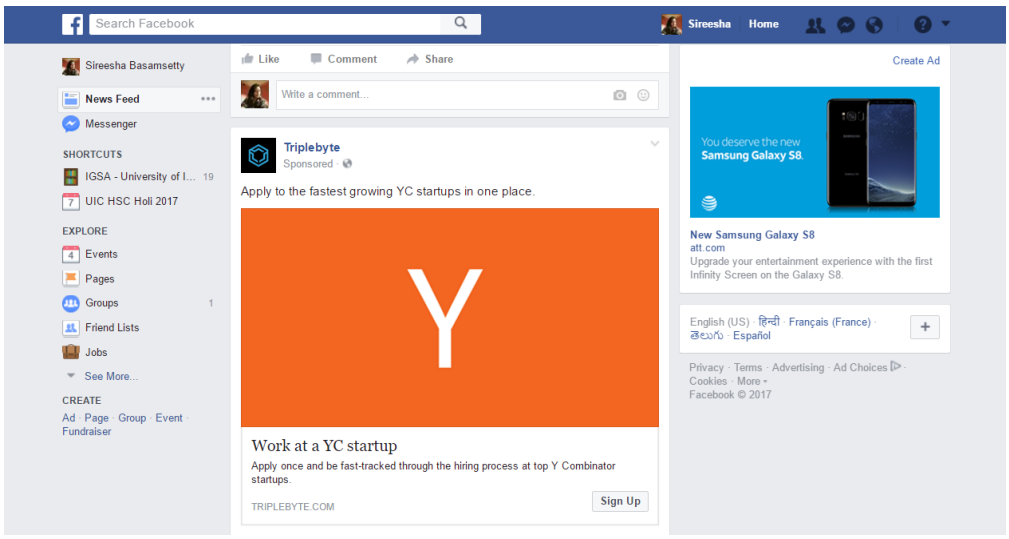
MT = a + b * ID or MT = b * ID

Depending on whether the line goes through the origin. b is the slope of the line.

Throughput – Combines speed and accuracy in one single measure. The formula is given by:

Throughput = (ID / MT) bits/s

Example for Fitts's Law:



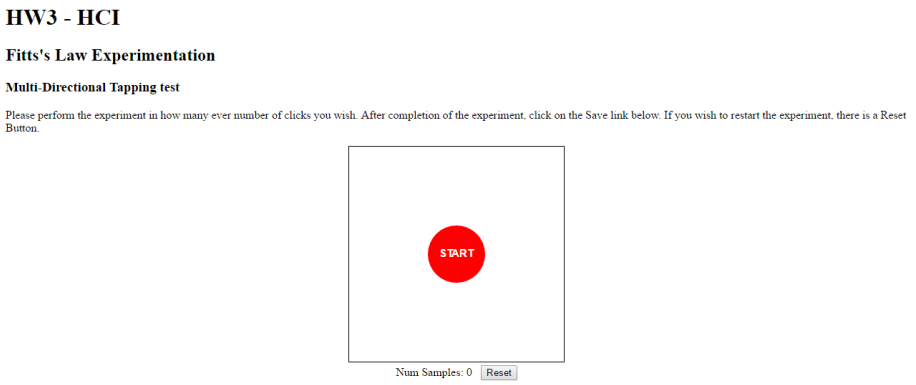
Consider the example of Facebook's website. Here, the mouse cursor and your attention is focused on the Facebook logo. You're then compelled to click a call to action, so you turn your focus to the button. The efficiency of this movement from one position to another is what Fitts's law aims to point.

Fitts's Law Experiment for Aimed Movement:

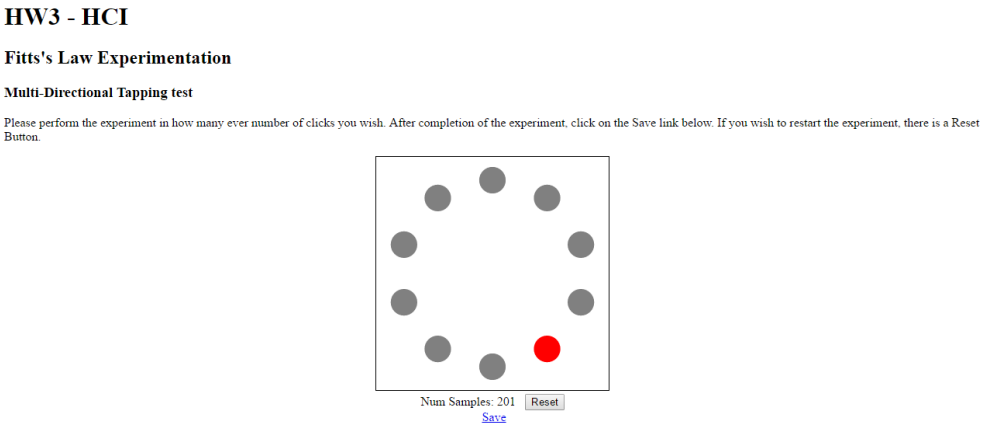
- The input modality I have chosen for my experiment is **MOUSE**.
- The Performance Test I am considering is the **Multi-Directional Tapping test**. Here, I will be considering my targets as circles.

Steps to conduct in experiment:

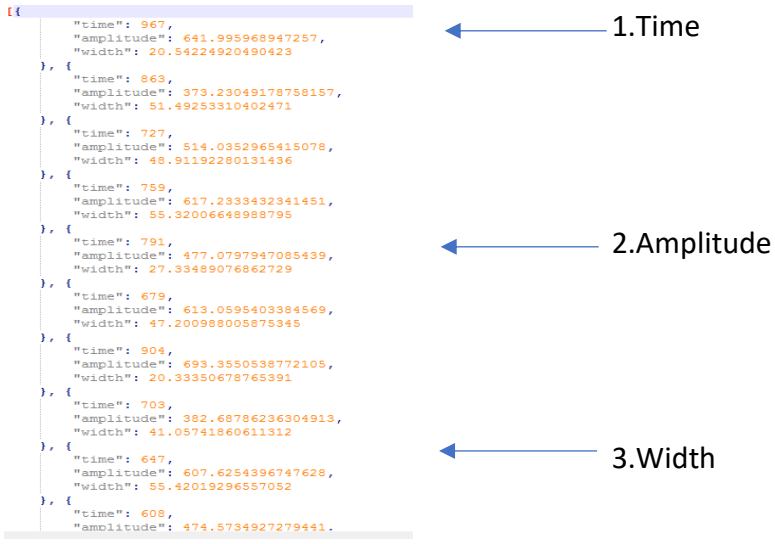
1. This is the window where the experiment will be conducted and data will be gathered based on the mouse clicks made by the user. (index.html)



2. The user will click on START.
3. This is how the visualization will look. User will start clicking on the red circles. After certain number of clicks, the target size and amplitude will change.



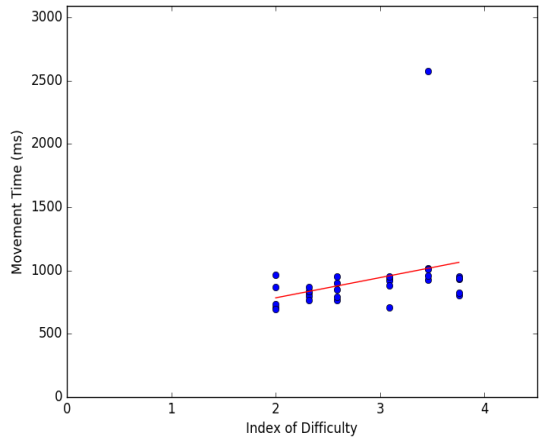
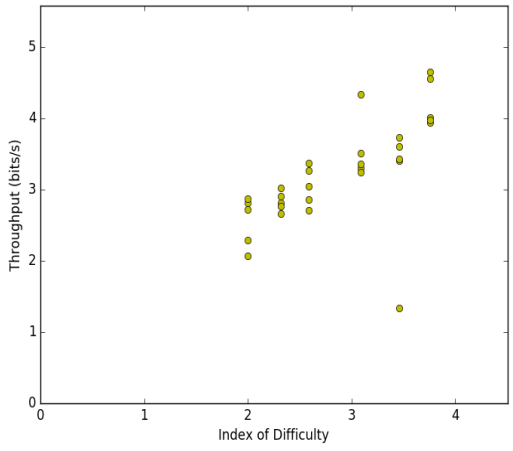
4. Target sizes considered – [20, 50] and distances considered - [150, 200, 250]
   6 combinations of these are considered.
5. The number of samples is incremented and displayed below showing how many clicks the user has performed. After he is done, everything in the square disappears and he can click on the save link below.
6. This saves a JSON file of data consisting of:



7. Copy this “data.json” file into the same directory as the report.py file.
8. Run the report.py file. Experiment has been conducted using Python.
9. For line fitting: used least squares polynomial fit.
10. Results:

Plots:

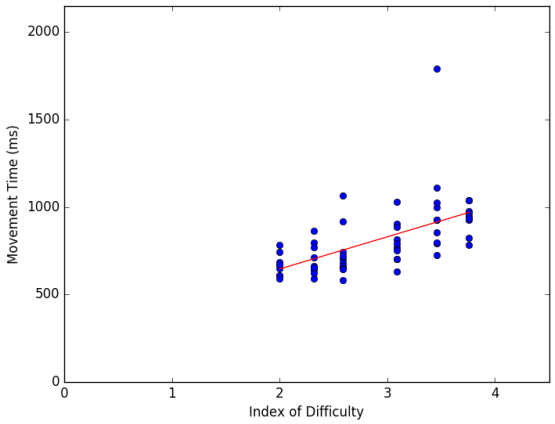
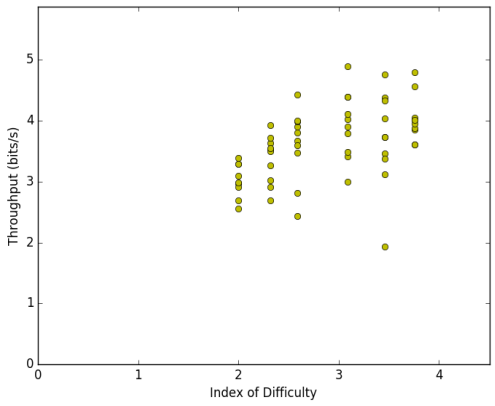
Trials for Participant #1: (For 5 clicks per combination of Width and Amplitude) (Total 30 samples)

1. Movement time over Index of Difficulty	2.Throughput over Index of Difficulty
	

Regression Coefficients obtained:

Regression coefficients: A=0.1597636496250646, B=0.464613277830934

Trials for Participant #2: (For 10 clicks per combination of Width and Amplitude) (Total 60 samples)

1. Movement time over Index of Difficulty	2.Throughput over Index of Difficulty
	

Regression Coefficients obtained:

Regression coefficients: A=0.18384515343792554, B=0.2783614921956743

Analysis of Data collected:

Device Assessment Questionnaire:

1. The force required for actuation was:				
		X		
TOO LOW				**TOO HIGH**
2. Smoothness during operation was:				
			X	
VERY ROUGH				**VERY SMOOTH**
3. The mental effort required for operation was:				
	X			
TOO LOW				**TOO HIGH**
4. The physical effort required for operation was:				
		X		
TOO LOW				**TOO HIGH**
5. Accurate pointing was:				
		X		

EASY				**DIFFICULT**
6. Operation speed was:				
		X		
TOO FAST				**TOO SLOW**
7. Finger fatigue:				
			X	
NONE				**VERY HIGH**
8. Wrist fatigue:				
			X	
NONE				**VERY HIGH**
9. Arm fatigue:				
		X		
NONE				**VERY HIGH**
10. Shoulder fatigue:				
	X			
NONE				**VERY HIGH**
11. Neck fatigue:				
	X			
NONE				**VERY HIGH**
12. General comfort:				
			X	
VERY UNCOMFORTABLE				**VERY COMFORTABLE**
13. Overall, the input device was				
			X	
VERY DIFFICULT TO USE				**VERY EASY TO USE**

Conclusion:

1. The larger the target sizes, the easier it is to select it.
2. The closer the targets are placed, the easier it is to select them in less amount of time.
3. Of the targets are small and distant, the fatigue level and overall comfort of the user is compromised.

References:

1. https://en.wikipedia.org/wiki/Fitts%27s_law
2. https://www.interaction-design.org/literature/book/the-glossary-of-human-computer-interaction/fitts-s-law
3. https://webdesign.tutsplus.com/articles/applying-fitts-law-to-mobile-interface-design--webdesign-6919
4. http://scipy-cookbook.readthedocs.io/items/LinearRegression.html

Source Code link to GitHub Repository:

https://github.com/sireesha1231/HCI-HW3

1. index.html – For visualization and experimentation
2. report.py – For performing regression and displaying output plots