HWA 3

1) I have choses to do this analysis using python and numpy. The reason for this choice is fairly simple. I have done some daytrading before where I used python in combination with numpy to do some technical analysis. Here are my results:

Group 1 (Using Mouse)

- Sample Mean: 403.47 milliseconds
- Sample Variance: 114.60 *ms*^2
- Standard Deviation: 10.71 milliseconds
- Five Number Summary:
    - Minimum: 380 milliseconds
    - 1st Quartile (25%): 395 milliseconds
    - Median (50%): 405 milliseconds
    - 3rd Quartile (75%): 410 milliseconds
    - Maximum: 420 milliseconds

Group 2 (Using Joystick)

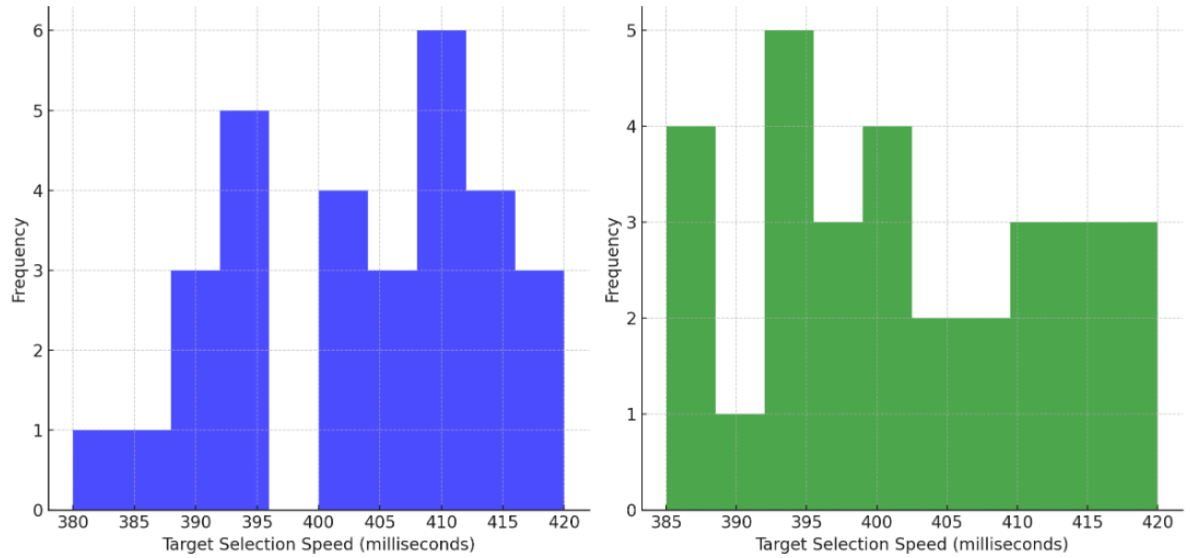
- Sample Mean: 401.93 milliseconds
- Sample Variance: 119.44 *ms*^2
- Standard Deviation: 10.93 milliseconds
- Five Number Summary:
    - Minimum: 385 milliseconds
    - 1st Quartile (25%): 395 milliseconds
    - Median (50%): 401 milliseconds
    - 3rd Quartile (75%): 410 milliseconds
    - Maximum: 420 milliseconds

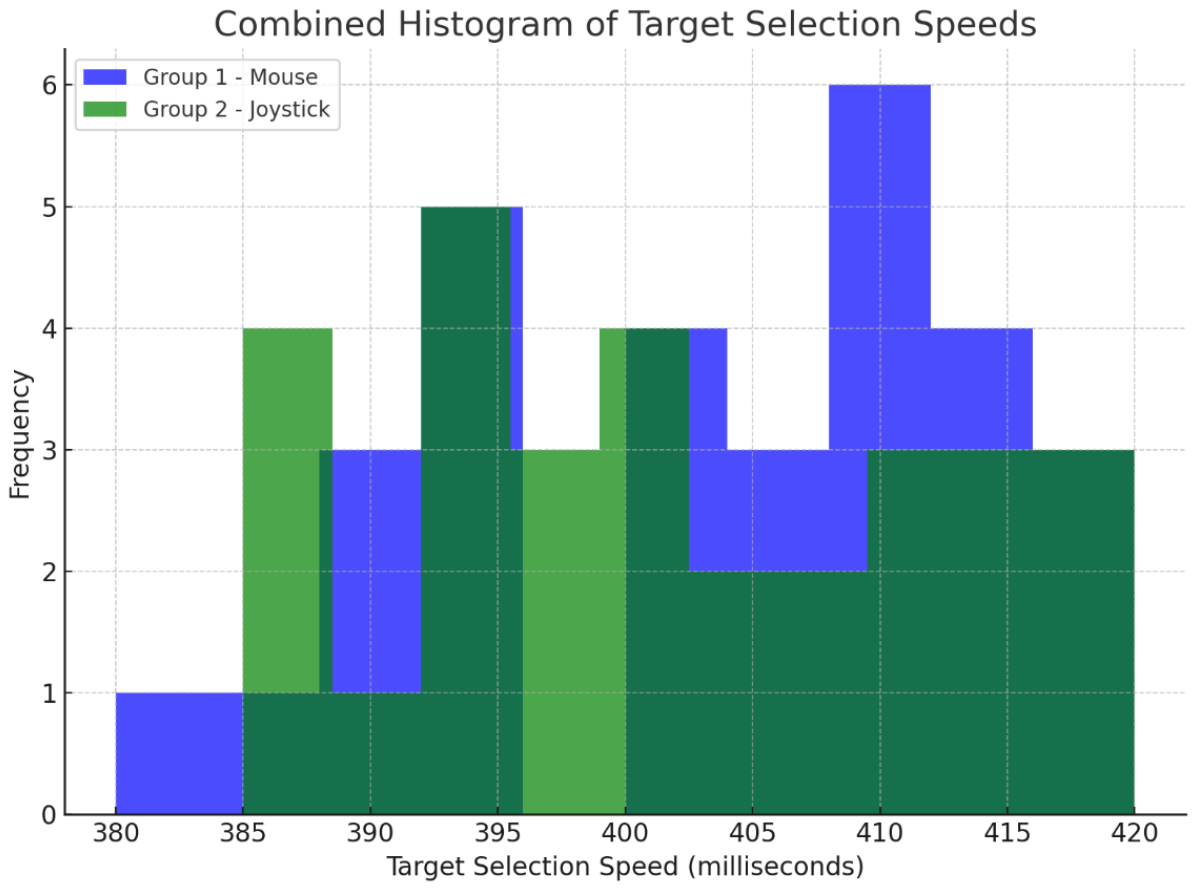
***** Code for these results can be found in the same zip file.

The statistical results for each group provide insight into the target selection speeds of children using different interfaces. The mean indicates the average speed, with Group 1 averaging around 403.47 milliseconds and Group 2 at 401.93 milliseconds. The standard deviation, approximately 10.70 ms for Group 1 and 10.93 ms for Group 2, shows the typical deviation from the mean, reflecting the consistency of the children's performance. Variance gives an idea of the overall spread of the data, which is moderate in both groups. The five-number summary, including minimum, first quartile, median, third quartile, and maximum, outlines the data's distribution, revealing that most children's target selection times fall within a similar range for both interfaces. These statistics collectively provide a detailed understanding of the children's performance with each interface in terms of average speed, consistency, and overall spread.

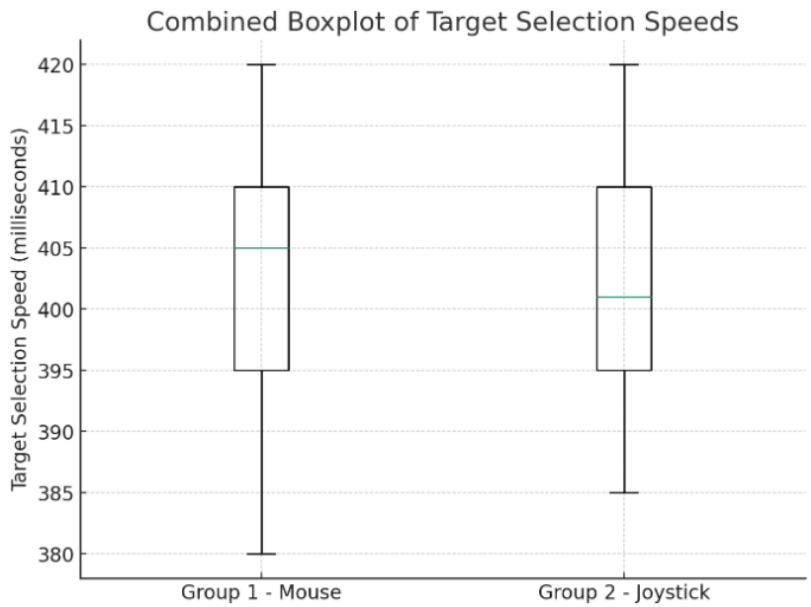
2) For Group 1, the mean (403.47 ms) being slightly lower than the median (405 ms) suggests a distribution that is somewhat skewed to the left, while for Group 2, the mean (401.93 ms) being very close to the median (401 ms) indicates a more symmetric distribution of target selection times.

3)


Frequency
Target Selection Speed (milliseconds)
Frequency
Target Selection Speed (milliseconds)


Combined Histogram of Target Selection Speeds
Group 1 - Mouse
Group 2 - Joystick
Frequency
Target Selection Speed (milliseconds)

4)



The combined boxplot above displays the data distributions for both Group 1 (using a mouse) and Group 2 (using a joystick) side by side.

From the boxplots, we can evaluate and discuss the dispersion comparison:

> **Median**: The line inside each box indicates the median. Both groups have medians close to each other, suggesting similar central tendencies.
> **Interquartile Range (IQR)**: The length of each box represents the IQR, which is the range between the first and third quartiles. It appears that both groups have a similar IQR, indicating comparable dispersion in the middle 50% of the data.
> **Whiskers**: The "whiskers" extend from the boxes to show the range of the data. Both groups have similar ranges, but the slight differences in the lengths of the whiskers indicate minor variations in the spread of the data.
> **Outliers**: There are no apparent outliers in either group, suggesting that most of the data falls within a reasonable range of the median.

Overall, the boxplots indicate that the dispersion of target selection speeds is quite similar between the two groups, with both exhibiting comparable ranges and consistency in their data distributions.

5)

Skewness and Kurtosis Analysis

Group 1 (Mouse)

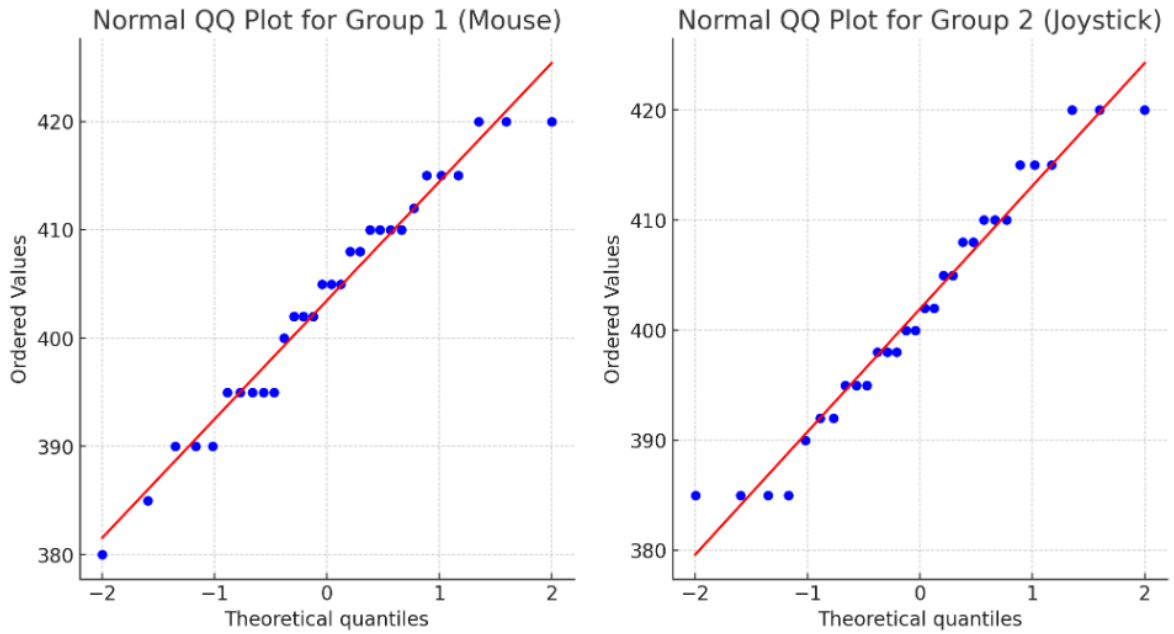
- Skewness: -0.273 (Standard Error: 0.447)
- Kurtosis: 2.267 (Standard Error: 0.894)

Group 2 (Joystick)

- Skewness: 0.059 (Standard Error: 0.447)
- Kurtosis: 1.998 (Standard Error: 0.894)

Interpretation

- Skewness: Close to zero for both groups, indicating a fairly symmetric distribution around the mean. Group 1 shows a slight left skew.
- Kurtosis: Values close to 3 for both groups, indicating a distribution similar to a normal distribution in terms of peak and tails.



Normal QQ Plots Analysis

- Group 1 (Mouse): The QQ plot shows some deviations from the straight line, especially in the tails, indicating some deviation from normality.
- Group 2 (Joystick): The QQ plot also shows slight deviations from the straight line, suggesting minor departures from normality.

6) The 99% confidence interval for the standard deviation of Group 1 (children using a mouse) is calculated to be approximately 7.97 milliseconds to 15.92 milliseconds.

Interpretation:

This interval indicates that we can be 99% confident that the true standard deviation of the target selection speed for Group 1 lies between 7.97 ms and 15.92 ms. In other words, there's a 99% probability that the range from 7.97 ms to 15.92 ms encompasses the actual standard deviation of target selection speeds for children using a mouse. This relatively wide interval reflects the variability in target selection speeds within this group.

7) The P-value that I found using the ttest_1samp from scipy.stats was 1.172101093238827e-21. If we test this claim at a significance level of 5% we need to reject the hypothesis that the mean speed of the joystick manufacturer is 350ms. The P-value found provides strong evidence against the producer's claims. (See code for calculations).

8) The P-value that I found using the chi2 from scipy.stats was 0.9677953524682695 for the test that the variance of the target selection speed is less than or equal to 200 ms². We do not reject this because of the P-value being greater than the significance level. Therefore we can say that the test provides insufficient evidence to support the claim that the variance of the target selection speed with a mouse among children aged 7 to 9 is greater than 200 ms². Therefore, based on the given data, we cannot conclude that the variance exceeds 200 ms².