assignment one

Ryan Blocker

CS464 | February 19th, 2024

All figures and calculations were done using
Python 3.11 in Jupyter Notebooks

problem 2-5

Graffiti Experiment (Mouse vs Trackpad)

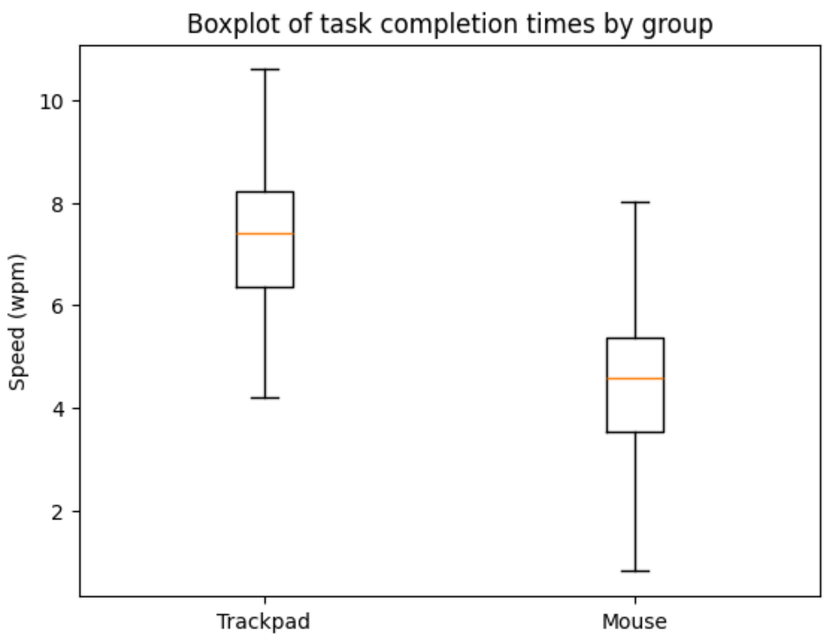
analyzing the data

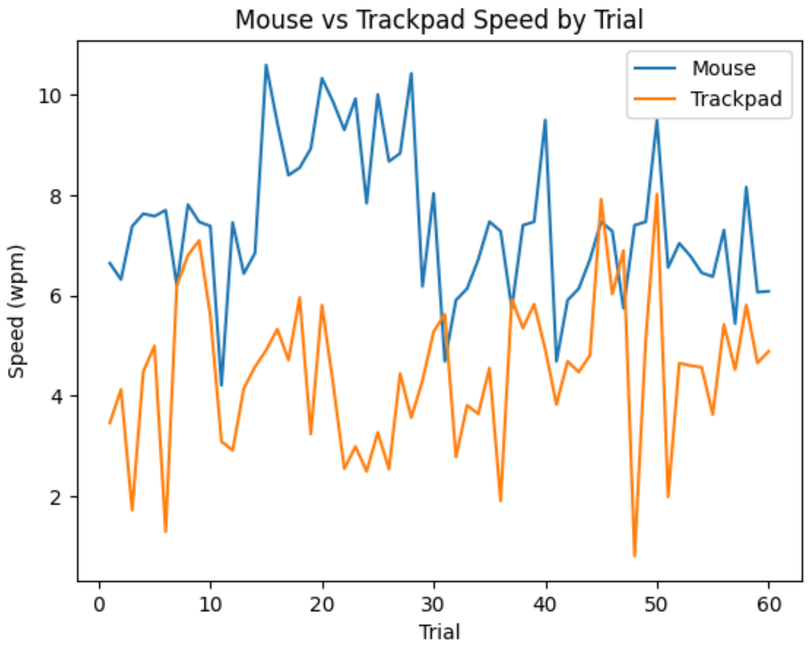
Mouse vs. Trackpad

- **Experiment Details:**
  - 12 Participants
  - 2 Groups (Trackpad and Mouse)
  - 10 Trials writing the alphabet
  - Speed (wpm), Error (%), and Keystrokes (KPMC) are recorded

analyzing the data

Words Per Minute (wpm)

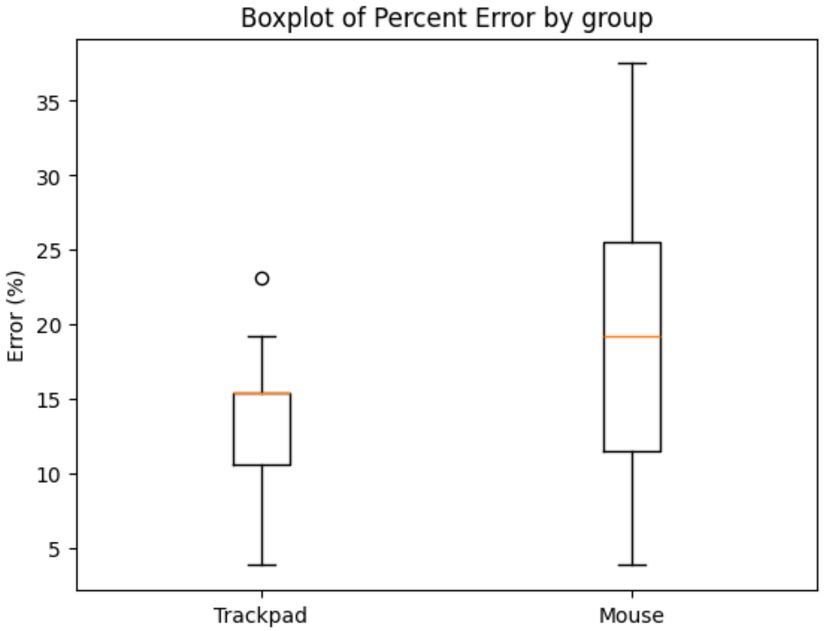


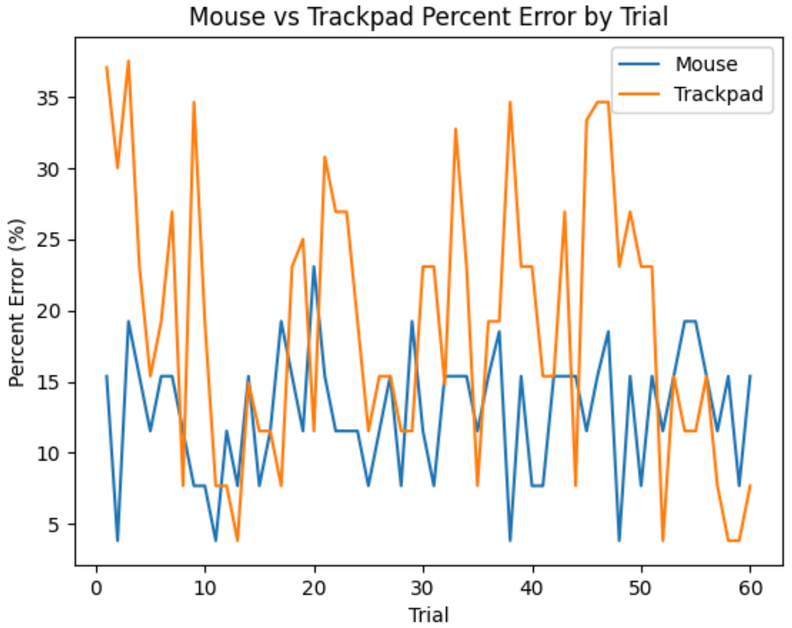


Based on the data on the left, it is evident that the trackpad input method was significantly **less efficient compared to the mouse.** On the right, we can observe that the speed per trial fluctuates significantly. **Based on this, we can conclude that the participants did not improve their writing speed as the trials progressed.**

analyzing the data

Percent Error (%)





Based on the data shown on the left, it is evident that the **trackpad input method was significantly more accurate compared to the mouse.** However, the average for both methods is relatively close. On the right, it is also apparent that the percent error fluctuated significantly. Nevertheless, the mouse consistently remained below a 25% threshold, whereas the trackpad reached as high as 35%. Based solely on this data, **I am uncertain whether we can reject the null hypothesis.**

analyzing the data

Reflection

- **Key Questions:**
  - What is the research question? Does input method change user performance in gestural input?
  - What are the independent variables (otherwise known as factors) of this experiment? Type of Input (Mouse or Trackpad)
  - What are the dependent variables of this experiment? Entry speed (wpm), Percent error (%), Keystrokes per character (KPMC)
  - Is there a control variable in this experiment? If so what is it or what are they? The control variable in this study is the number of phrases (10), the phrases file (alphabet.txt), and the gesture set.
  - Is there a random variable in this experiment? If so what is it or what are they? The random variable in the study is the participants themselves coming from different backgrounds (gender, age, education, physical abilities, etc)

problem 6-3

Gamer vs. Non-gamer

analyzing the data

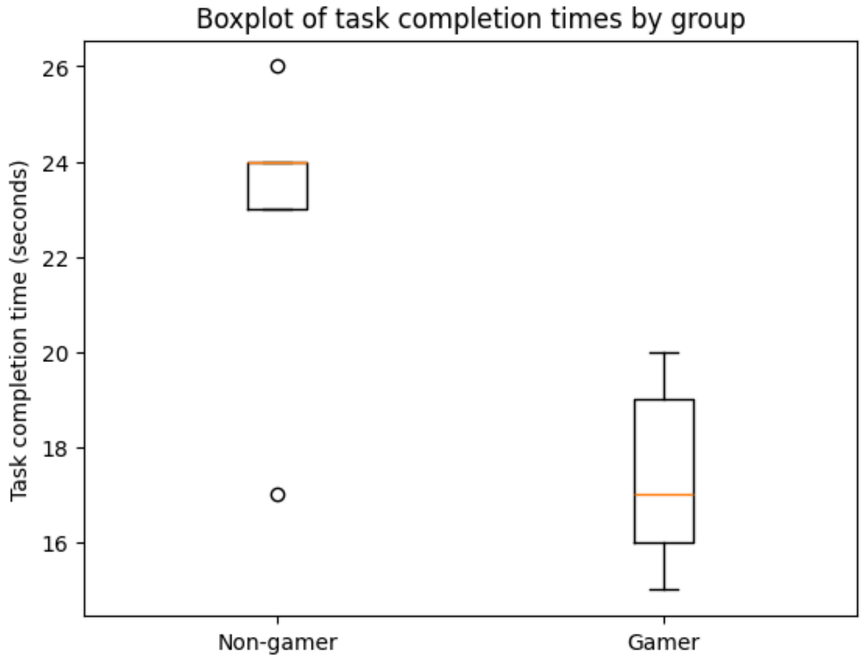
Gamer vs. Non-gamer

- **Experiment Details:**
  - 10 Participants
  - 2 Groups (Gamers and Non-gamers)
  - 5 Tasks
  - Time was recorded for participant to complete each task

analyzing the data

Boxplot

The box plot shows that **the median task completion time for non-gamers is higher than that of gamers**. It also shows that there is more variation in the task completion times of non-gamers than gamers, as the box and whiskers are wider for gamers.



analyzing the data

Two-Way ANOVA

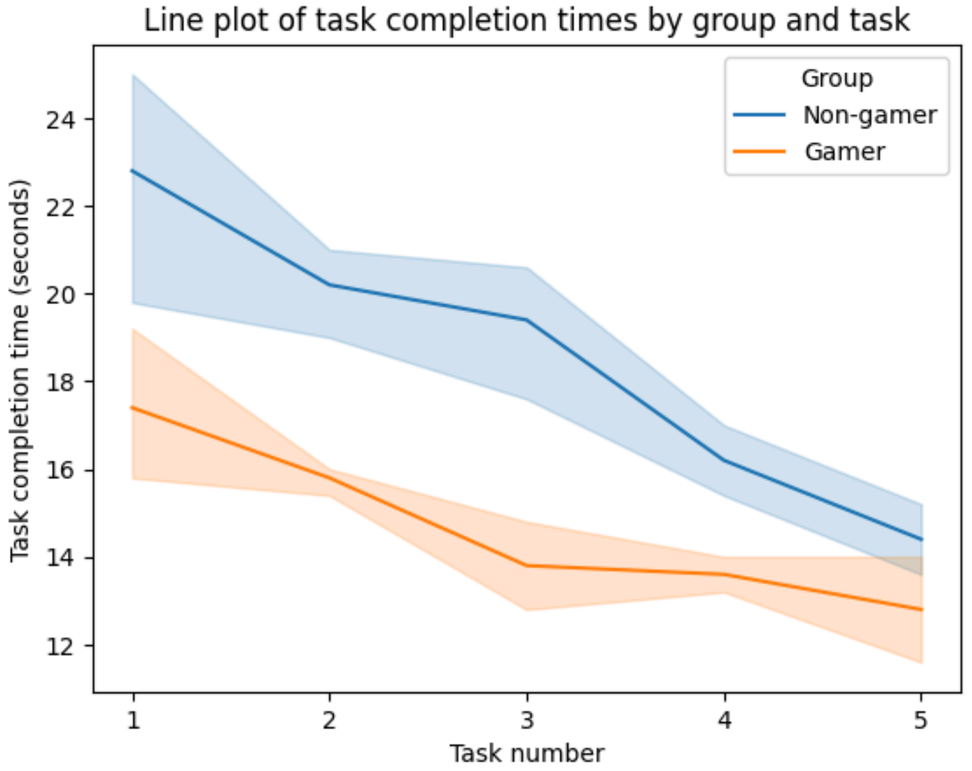
	sum_sq	df	F	PR(>F)
Task	260.92	4.0	22.570934	8.230032E-10
Group	192.08	1.0	66.463668	4.916444E-10
Task & Group	30.92	4.0	2.674740	**0.04559714**
Residual	115.60	40.0	NaN	NaN

This interaction term between Task and Group has 4 degrees of freedom. It also appears to have a significant effect on the dependent variable, The p-value is just below the threshold so **we can reject the null hypothesis and say that it is statistically significant.**

analyzing the data

Learning

The line plot shows that the mean task completion time for both groups decreases as the task number increases, which shows that **learning did occur over the five tasks** because the users got faster. The line plot also shows that the mean task completion time for non-gamers is higher than that of gamers for all tasks, which is consistent with the two-way ANOVA result. The **line plot does not show any clear pattern of interaction between the tasks** and the groups, as the lines are roughly parallel.



problem 6-4

Flick vs. Drag Touch Gesture

analyzing the data

Gamer vs. Non-gamer

- **Experiment Details:**
  - 12 Participants
  - 2 Groups (divided by number of hands used)
  - Trials consisted of drag-only experiences and drag+flick experiences
  - Time was recorded for participant to complete task

analyzing the data

Two-Way ANOVA

	sum_sq	df	F	PR(>F)
Group	4.083333	1.0	1.195122	0.280839
Method	36.416667	3.0	3.552846	0.022663
Group:Method	12.750000	3.0	1.243902	0.306578
Residual	136.666667	40.0	NaN	NaN

Based on the ANOVA table, the F-value of the group effect is 0.01, which is much smaller than the critical F-value of 4.35. This means that we **cannot reject the null hypothesis that there is no effect of hand use on the task completion time.** The F-value of the method effect is 18.77, which is much greater than the critical F-value. In other words, the **task completion time differs significantly between drag-only and drag+flick users**.

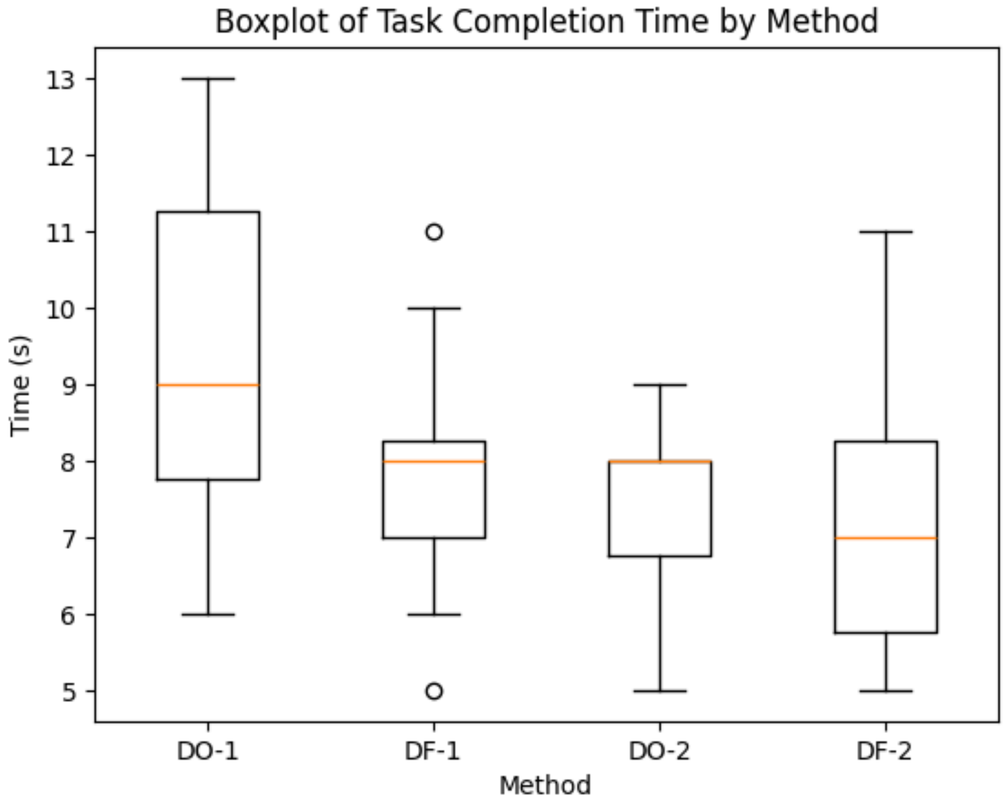
The F-value of the interaction effect is 0.01, which is much smaller than the critical F-value. This means that we cannot reject the null hypothesis that there is **no interaction effect of number of hands and interaction method on the task completion time**. The effect of interaction method on the task completion time does not depend on the hand use.

analyzing the data

Boxplot

The drag+flick methods have lower task completion times than the drag-only methods, regardless of the hand use. This confirms the ANOVA result that the **interaction method has a significant effect on the task completion time**. Second, we can see that the drag-only methods have more variation in the task completion time than the drag+flick methods, as indicated by the presence of outliers.

This suggests that the **drag-only methods are less consistent and more prone to errors than the drag+flick** methods. Third, we can see that the **number of hands use does not have a clear effect on the task completion time**, as the boxes for left and right are roughly similar in size and position.



Thank you!

CS464 | February 19th, 2024

All figures and calculations were done using
Python 3.11 in Jupyter Notebooks