Typing Speed vs. Keyboard Type

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1 Abstract

In fields such as data analytics or statistics, where typing speed is directly correlated to work productivity, employers and employees continuously try to find the best methods to improve typing speed, such as finding the right keyboard for them. This research project aims to determine what type of keyboard produces the best typing speed by creating an experiment comparing keyboards to typing speed. This experiment uses a Latin-Squares Block Design to better determine the relationship between typing speed, the operator, and the order at which the operator uses the keyboard and collects data. The results show that **insert results here**. In conclusion, **insert conclusion here**.

2 Introduction

The idea for this experiment was formulated from a need to find the best ways for Computational Modeling and Data Analytics (CMDA) students like us to be as productive as possible when working on their projects and assignments. In a career where typing speed directly leads to better performance at work, we wanted to find the best relationship between typing speed and the type of keyboard to use.

To best answer this question, we used three different types of keyboards to measure typing speed: dome-switch, scissor-switch and mechanical. Dome-switch keyboards use a rubber dome to register keyboard actions, are inexpensive and can commonly be found in offices. Scissor-switch keyboards are attached to the board itself and activate using a scissor-like mechanism to press into a rubber dome to register keyboard actions, and are commonly found on laptops. Mechanical keyboards are higher-end keyboards that are designed to register keyboard actions with as little movement as possible and without the use of a rubber dome. They're commonly found in both office and gaming setups.

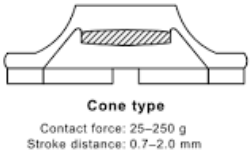


Figure 1: Dome switch

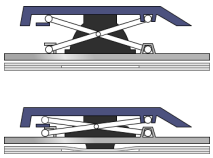


Figure 2: Scissor switch

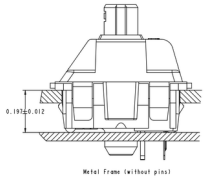


Figure 3: Mechanical switch

3 Experimental Design & Methods

To best compare the different keyboards, we set up a Latin-Squares Block Design with three replications for the most accurate results. Our treatment factor is the type of keyboard while our blocking factors are the users and the order at which keyboards we type with for optimal accuracy. Our response variable is the words per minute (WPM) the operator types at. Our sample size, in summary, is three replications of three operators using three keyboards each, totaling to 3^3 or 27 entries.

3.1 Statistical Model

The statistical model of a Latin-Squares Block Design is as follows:

$$y_{ijk} = \mu + \alpha_i + \tau_j + \beta_k + \epsilon_{ijk} \begin{cases} i = 0, \ldots, 3 \\ j = 0, \ldots, 3 \\ k = 0, \ldots, 3 \end{cases}$$

where i refers to the order at which the operator uses each keyboard, j refers to the keyboard type and k refers to the operator. As for the model itself, y_{ijk} is the observation in the i^{th} row and k^{th} column for the j^{th} treatment, μ is the population mean, α_i is the i^{th} row effect, τ_j is the j^{th} treatment effect and β_k is the k^{th} column effect. ϵ_{ijk} is the random error.

3.2 Assumptions

For our experimental design, we're assuming that our typing test uses random, lowercase letters with no numbers or symbols. We're assuming that each keyboard works perfectly fine and that every operator is an experienced typist majoring or working in a field that requires extensive keyboard use. We also assume that the three factors in the design do not interact with each other.

To make this experimental model as accurate as possible, we are assuming that these three assumptions are satisfied:

- Constant variance
- Independent samples
- Normal distribution

3.3 Hypothesis

We hypothesize that the keyboard type will be a significant effect on the operator's typing speed. Furthermore, we also believe that the operator themselves will also have a significant effect on the operator's typing speed. Additionally, we also do not expect the order to have a significant effect on the operator's typing speed.

3.4 Materials

Listed below are the keyboards we used for the experiment:

- Dome-switch: Logitech K270
- Scissor-switch: Surface Laptop 4 keyboard
- Mechanical: NovelKeys NK87 with Gateron Oil King linear switches

We used monkeytype.com to record our typing speed. For the experiment, we set the settings on **time** and let the typing test run for **60 seconds**. When we gathered our data, we used the help of a third friend to record data (aside from ourselves).

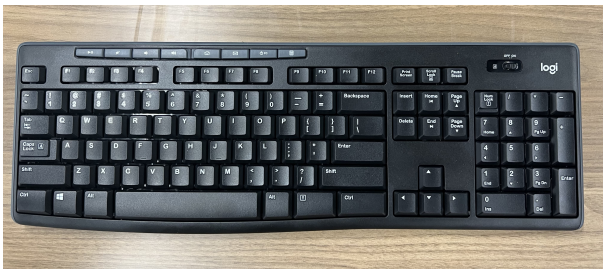


Figure 4: Logitech K270

Figure 5: NovelKeys NK87

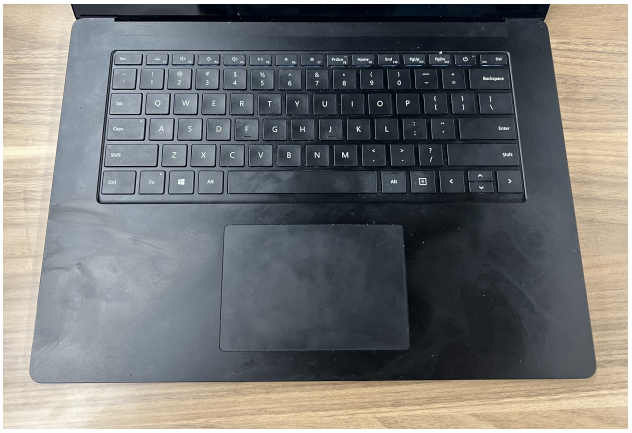


Figure 6: Surface Laptop 4

3.5 Procedure

After gathering our resources and setting the experiment up, we had our first operator complete the typing test starting with the dome-switch keyboard, then the scissor-switch keyboard and finally the mechanical keyboard. After recording the WPM for each keyboard, we then switched operators and conducted the same typing test under a different order: mechanical, dome-switch and finally scissor-switch. After recording the WPM again, we then switched operators one last time and swapped the order to scissor-switch, mechanical and finally dome-switch. Finally, we collected the WPM for each keyboard.

This process was repeated three times.

4 Observations & Results

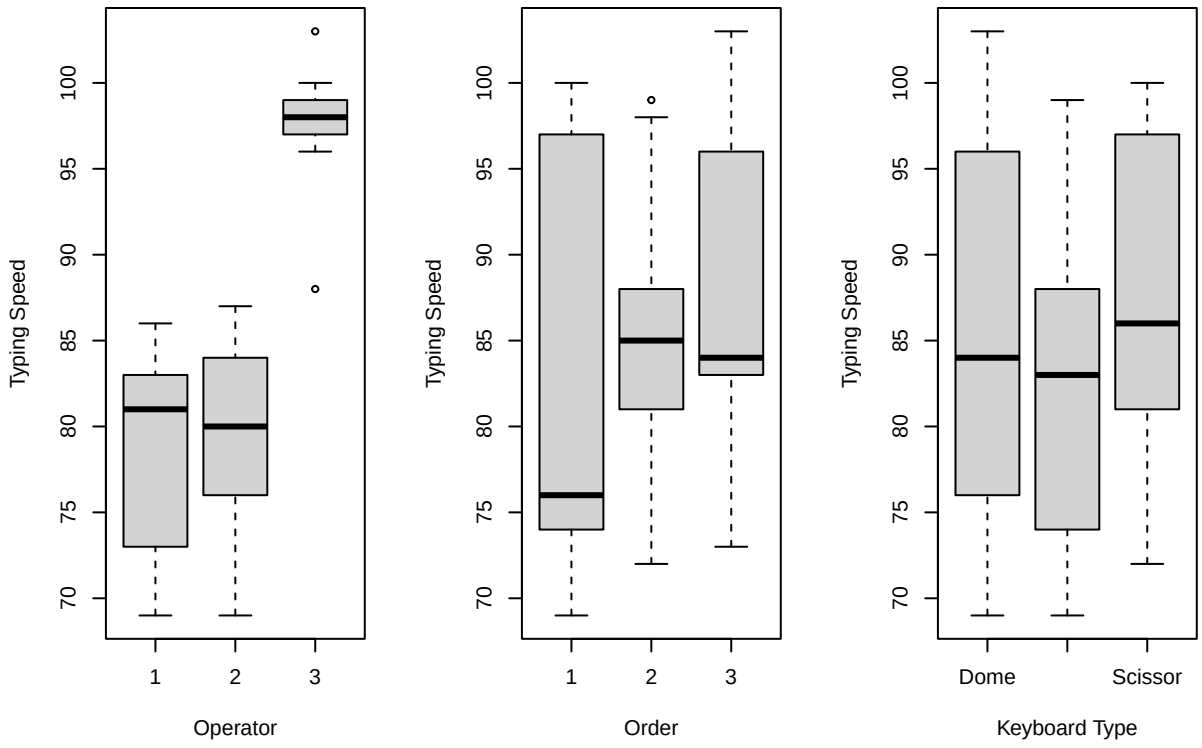
4.1 Observations

Once we collected our data, this was what our Latin-Squares Block Design looked like after all three replications:

After collecting our observations, we wanted to see the different treatment and blocking factors' effects with our response vairable, the operator's WPM. We did so by creating three side-by-side boxplots showing the difference between the operator, the order, the type of keyboard, and the typing speed.

Testing Order	Operator:		
	1	2	3
1	A = 69,75,84	C = 76,74,69	B = 97,97,100
2	B = 81,86,72	A = 83,85,76	C = 99,98,88
3	C = 73,83,83	B = 84,80,87	A = 98,103,96

A = Dome B = Scissor C = Mechanical



This is the numerical summary of our typing speed:

Minimum	1^{st} Quartile	Median	3^{rd} Quartile	Maximum
69	76	85.94	96.50	103

4.2 Checking Assumptions

We must check to see if our model assumptions are satisfied before we report our results.

4.2.1 Constant Vairance

We checked for constant variance by using a residual vs. fitted values plot to see if there are any trends in the data. Furthermore, we used Levene's Test to confirm that our data has constant variance. After viewing the plot and test (Appendix A), we confirmed that our data's variance is constant.

4.2.2 Normal Distribution

To test whether our data is normally distributed, we created a Q-Q plot and used the Shapiro-Wilk test to determine whether our data is normally distributed. Based on the plot and test (Appendix B), we confirmed that our data is normally distributed.

4.2.3 Independent Samples

To test whether our data is normally distributed, we created a residuals vs. order plot and used the Durbin-Watson test to determine whether our data is normally distributed. Based on the plot and test (Appendix C), we confirmed that our data is normally distributed.

4.3 Results

Now that our assumptions have been satisfied, we can view our results in an ANOVA table and confirm which treatments are significant and which are not.

Table 2: ANOVA Table

	Df	Sum Sq	Mean Sq	F value	Pr(>F)
Operator	2	2,044.741	1,022.370	40.105	0.00000
Order	2	118.741	59.370	2.329	0.123
Keyboard Type	2	95.630	47.815	1.876	0.179
Residuals	20	509.852	25.493		

Based on the ANOVA Table above, the operator is the only significant effect on an operator's typing speed. The type of keyboard and the keyboard order have no significant effect on the typing speed whatsoever.

5 Conclusion

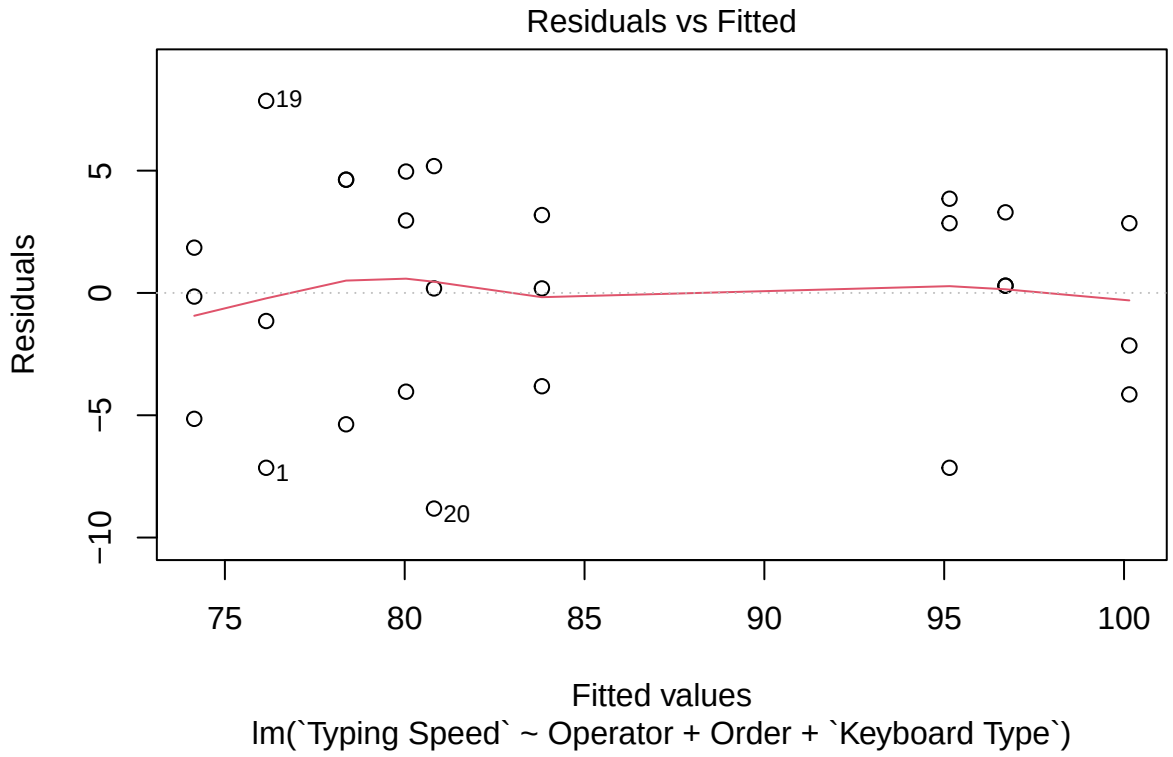
Our experiment asserts that the only significant effect on typing speed is the person at the keyboard. None of the keyboard types showed any significant change in typing speed, as did the order in which the tests were conducted. This is contrary to our initial hypothesis that keyboard type would have an effect on typing speed. It is worth noting that this experiment only utilized three different operators to conduct the tests with. Improvements to this design would want to allow for a greater amount of typists to record their typing speed across the keyboards. Ultimately, our experiment asserts that anyone looking to increase their typing speed should not worry too much about the keyboards they use, but rather they should seek to improve their speed through consistent practice.

6 References

Hlavac, Marek (2022). stargazer: Well-Formatted Regression and Summary Statistics Tables. R package version 5.2.3. https://cran.r-project.org/package=stargazer

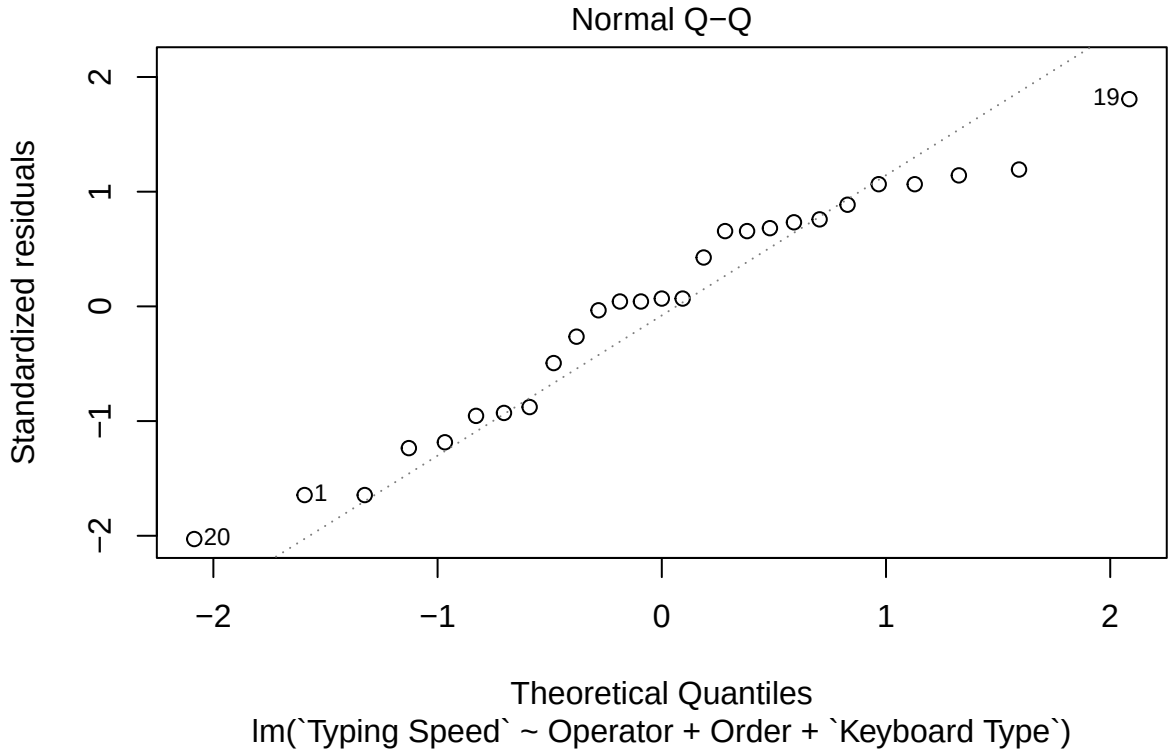
7 Appendix

7.0.1 Appendix A



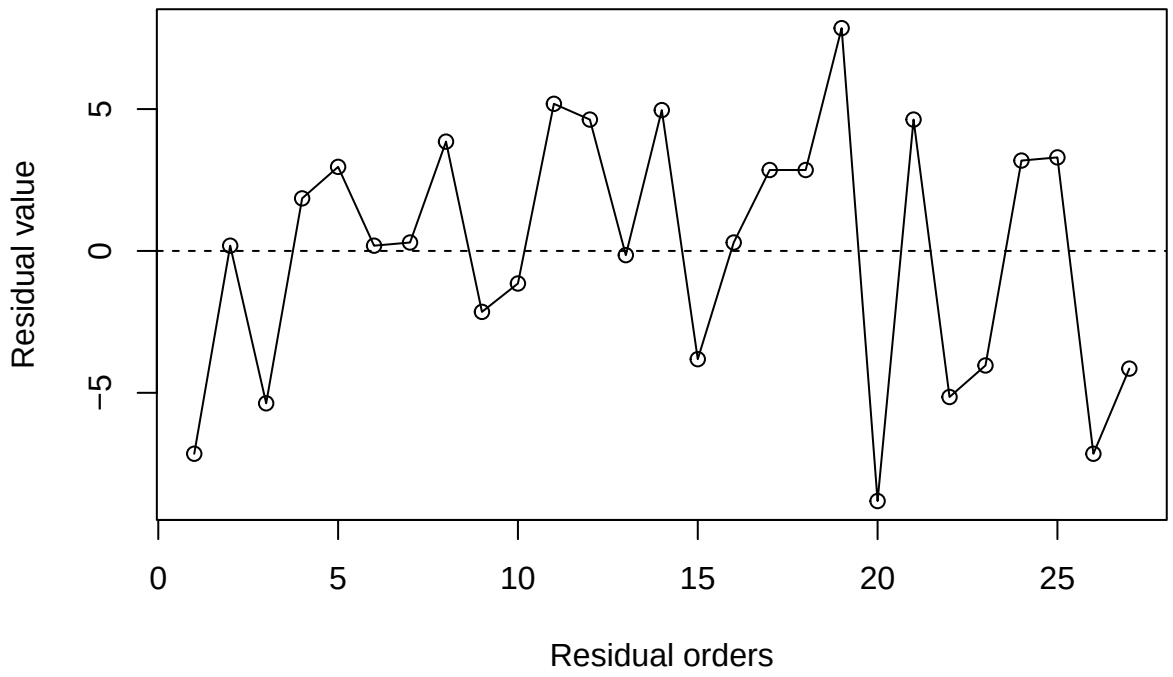

```
## Levene's Test for Homogeneity of Variance (center = median)
##       Df F value Pr(>F)
## group  2  0.4887 0.6194
##       24
```

7.0.2 Appendix B




```
##
##  Shapiro-Wilk normality test
##
## data:  myfit$residuals
## W = 0.95418, p-value = 0.2703
```

7.0.3 Appendix C




```
##  lag Autocorrelation D-W Statistic p-value
##    1      -0.1809235       2.22788   0.654
##  Alternative hypothesis: rho != 0
```