Test a Perceptual Phenomenon Project by Uma Vishwanath

Questions For Investigation

1. What is our independent variable? What is our dependent variable?

A. Independent Variable: Word Condition (Congruent or Incongruent)
Dependent Variable: Response time in seconds

2. What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.

A. **Null hypotheses**: $H_0: \mu_c - \mu_{ic} = 0$
μ_c = Population mean for congruent words condition
μ_{ic}= Population mean for incongruent words condition
There is no significant different between population mean response time for congruent verses incongruent words condition.
Alternative hypotheses: $H_a: \mu_c - \mu_{ic} \neq 0$
There is significant difference between population mean response time for congruent verses incongruent words condition.

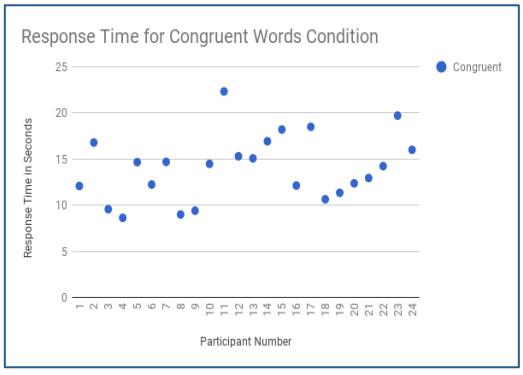
Z-test does not work here because we do not have population parameters μ *and* σ. This data set uses fewer subjects where sample size is 24. And each subject had gone through two conditions, which controls individual differences. The two samples sets given are dependent because when a subject goes through one condition, he gets experience of the condition and it has influence on the results of second condition. Our aim here is to find whether there is a significant difference in the response time when individuals are subjected to two different conditions and we are not concerned about in which direction there is a difference. So, the best test that can be performed under these circumstances is dependent two-tailed t-test with 95% confidence interval on paired samples.

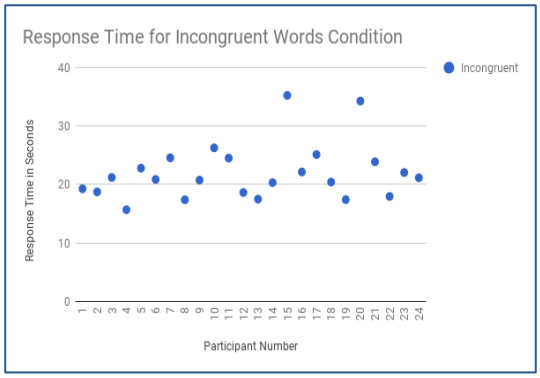
3. Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

A. μ_c (Population mean for congruent words condition) = 14.05
μ_{ic}(Population mean for incongruent words condition)= 22.02
S for congruent condition = 3.56
S for incongruent condition = 4.80
Point estimate $\mu_c - \mu_{ic}$ = -7.96
Sample standard deviation of the difference S = 4.86

4. Provide one or two visualizations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.

A.





The response time for congruent condition is ranging from 7-23sec and 13-35sec for incongruent condition. It is clear that average completion time for first test is much smaller than second. The second observation is that there are some outliers in incongruent test at 35sec.

5. Now, perform the statistical test and report your results. What is your confidence level and your critical statistic value? Do you reject the null hypothesis or fail to reject it? Come to a conclusion in terms of experiment task. Did the results match up with your expectation?

A. t-critical for two-tailed $\alpha = 0.05$ is $\pm$ 2.069
t-statistics: t(23) = -8.02, p < .01, two-tailed
Confidence interval on the mean difference, 95% CI = (-5.91, -10.02)
Effect size measures d = -1.64, r^2 = .74
t-critical for $\alpha = 0.05$

We reject the null from about results as t-statistics is much less than t-critical and the probability of getting this t- statistics is less than .01. It is clear that the type of test has causal effect on the time taken for a test. Participants will take around 5 to 10 seconds less time to complete congruent test. The results match my expectation as from own experience I took more time to complete incongruent words condition and all the participants took more time for the second condition.