

Project: Test a Perceptual Phenomenon

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

The independent variable is the *condition of the test* (congruent or incongruent), and the dependent variable is the *measure of time* it takes a participant to name the ink colors.

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

An appropriate set of hypothesis for this task would be:

1. The condition of the test has no statistically significant effect on the time.

H_0 (null hypothesis) : $\mu_c = \mu_i$

(μ_c is equal to μ_i)

2. The condition of the test does have a statistically significant effect on the time.

H_a (alternative hypothesis) : $\mu_c \neq \mu_i$

(μ_c is not equal to μ_i)

Based on the dataset, this is a **repeated measures design**, where each participant gets both treatments. I will do a **dependent t-test for paired samples**, with an alpha level of 0.05 ($\alpha=0.05$) to find out which hypothesis is correct.

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

Summary statistics from stroopdata.csv:

| Congruent | . Incongruent |
|---------------|---------------|
| Min. : 8.63 | Min. :15.69 |
| 1st Qu.:11.90 | 1st Qu.:18.72 |
| Median :14.36 | Median :21.02 |
| Mean :14.05 | Mean :22.02 |

3rd Qu.:16.20 3rd Qu.:24.05

Max. :22.33 Max. :35.26

Of particular interest:

Congruent Mean: 14.051125

Incongruent Mean: 22.01591667

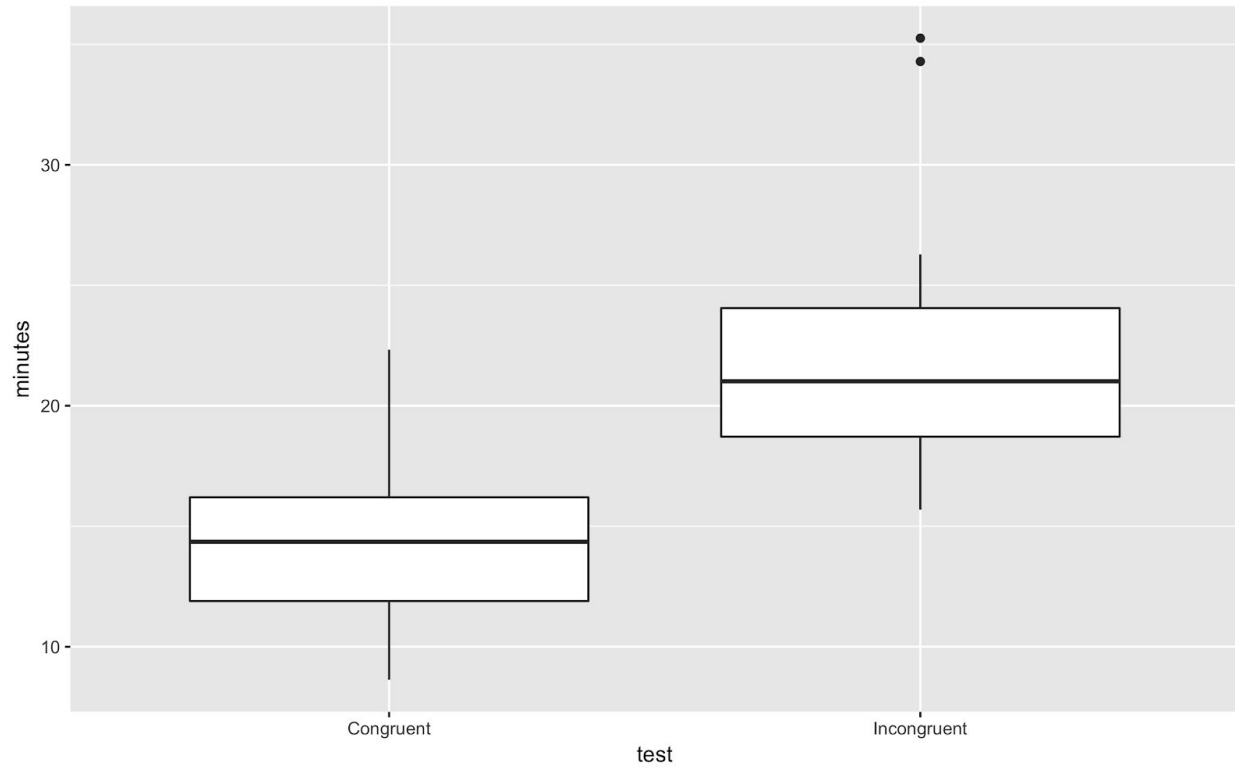
Point estimate: -7.964791667

S (Standard Deviation of Differences): 4.76239803

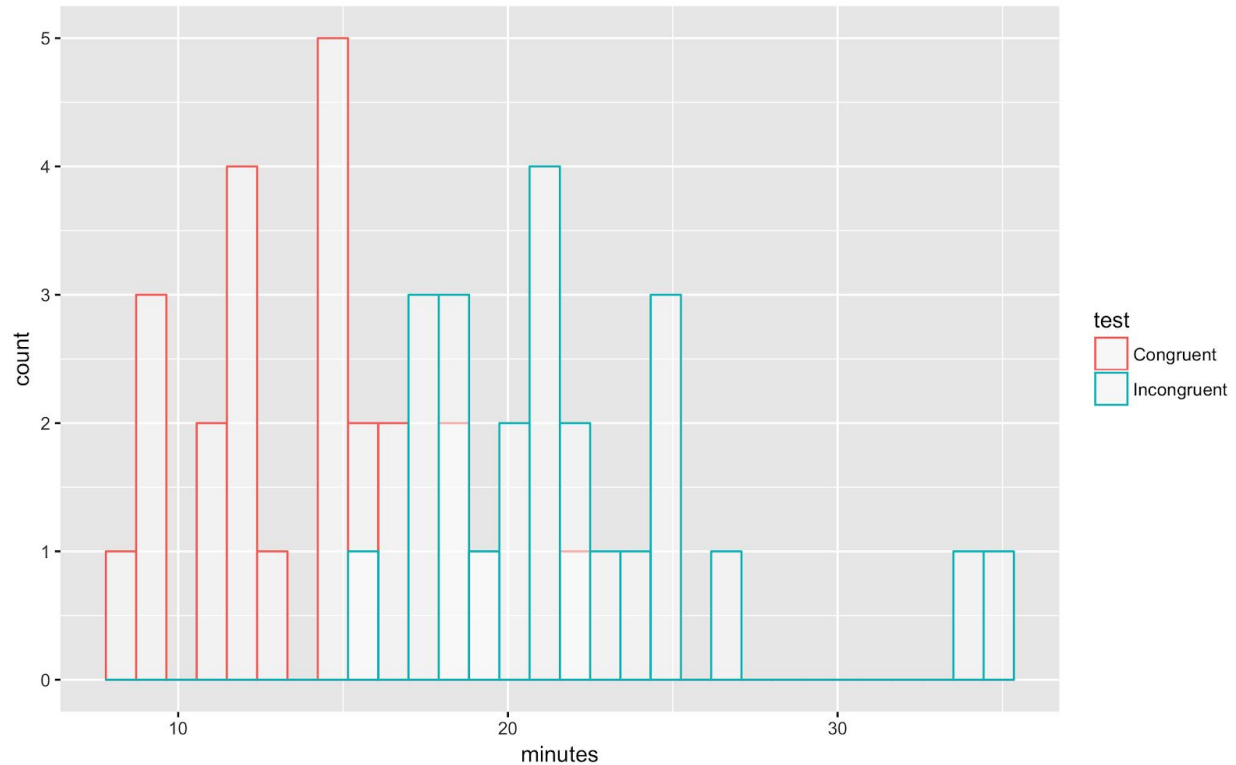
Congruent Range: 13.7

Incongruent Range: 19.57

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.



This boxplot graph shows that incongruent test times are longer than congruent test times, and the median test time is significantly longer in the incongruent tests than it is in the congruent tests.



This histogram reaffirms the findings of the boxplot--that the distribution of test times is longer for the incongruent dataset than it is for the congruent dataset.

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 the experiment task. Did the results match up with your expectations?

My expectations are that I will reject the null hypothesis. My confidence level for this statistical test is 95% ($\alpha=0.05$). Based on my calculations, my t-Statistic is -8.02. The t-Critical values for this test are ± 2.064 . Given these results, I **reject** the null hypothesis, that the “condition of the test has no statistically significant effect on the time”.

t-Statistic:
-8.020631367

t-Critical Values for 2 tailed test 0.05:
+/- 2.064

P Value Results

t=-8.02 DF=24

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

6. Optional: What do you think is responsible for the effects observed? Can you think of an alternative or similar task that would result in a similar effect? Some research about the problem will be helpful for thinking about these two questions!

I had never heard of the Stroop test before, and did a little research on its history. According to the website www.psytoolkit.org, the test in which the color of the ink differs from the word itself (incongruent) is more difficult and takes longer than the test in which the color of the ink matches the word because, "In Stroop's words, there is "interference" between the color of the ink and the word meaning. This interference occurs no matter how hard you try, which means that it is uncontrollable with the best conscious effort. It implies that at least part of our information processing occurs automatically." (<https://www.psytoolkit.org/lessons/stroop.html>) They write that the Stroop effect is an example of "selective attention", which is paying attention to certain stimuli while ignoring others.

A similar phenomena may be observed if one were to take a test that required one to say the name of a shape that is printed over a picture of a shape. In the first test, participant must say the printed word when the printed word and the shape are identical (for example the word "square"

printed on top of a square shape), and in the second test the participant must say the printed word when the printed word and the shape are different (for example the word “square” printed on top of a triangle shape).