Test a Perceptual Phenomenon

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

   In this case, the dependent variable is the time it takes to complete the Stroop task and the independent variable(s) are the congruent and incongruent conditions of how the words are displayed.

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

   μ_c = Population Average Time to Complete the Stroop Task with Congruent Conditions
   μ_I = Population Average Time to Complete the Stroop Task with Incongruent Conditions

   H_o: $\mu_c = \mu_I$
   H_a: $\mu_c <> \mu_I$

   Since the population parameters are unknown, I will be using the sample data in an attempt to estimate the parameters for the entire population. The null hypothesis is stating that the population average for the congruent test, if applied to everyone not just the sample, is equal to the population average for the incongruent test. The alternative hypothesis is stating that it will ***not*** be equal to each other.

   I will be performing a two-tailed dependent sample t-test to test my hypotheses. I've chosen this type of test for the following reasons:

   - I will be comparing two dependent samples of data in which the same subject sample is tested twice but under two different conditions.
   - The sample size is relatively small - less than 30.
   - I cannot predict the direction of the treatment effect and I only have samples to draw my conclusion from.

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

Stroop Dependent t-Test		
T_C - Congruguent Time	T_I - Incongrugent Time	$T_C - T_I$ (Difference)
12.079	19.278	-7.199
16.791	18.741	-1.95
9.564	21.214	-11.65
8.63	15.687	-7.057

14.669	22.803	-8.134
12.238	20.878	-8.64
14.692	24.572	-9.88
8.987	17.394	-8.407
9.401	20.762	-11.361
14.48	26.282	-11.802
22.328	24.524	-2.196
15.298	18.644	-3.346
15.073	17.51	-2.437
16.929	20.33	-3.401
18.2	35.255	-17.055
12.13	22.158	-10.028
18.495	25.139	-6.644
10.639	20.429	-9.79
11.344	17.425	-6.081
12.369	34.288	-21.919
12.944	23.894	-10.95
14.233	17.96	-3.727
19.71	22.058	-2.348
16.004	21.157	-5.153
Mean = 14.051125	**Mean = 22.01591667**	**Mean = -7.964791667**

n = 24

$\bar{x}_c$ = **14.051125**

$\bar{x}_i$ = **22.01591667**

Is there a significant difference? Let's see.

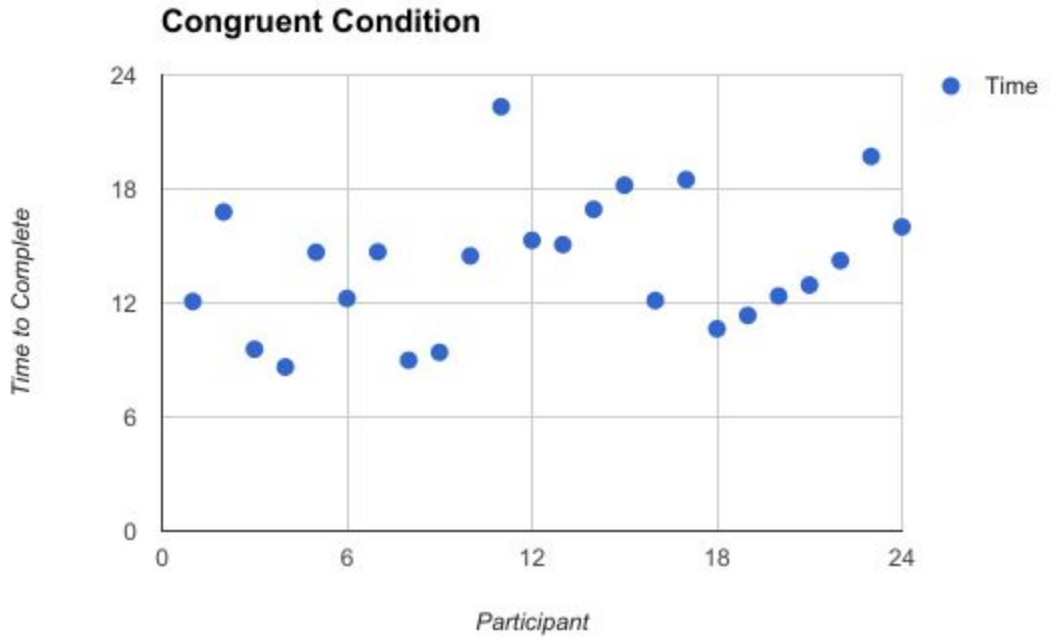
Point estimate: $\bar{x}_c - \bar{x}_i = -7.964791667$

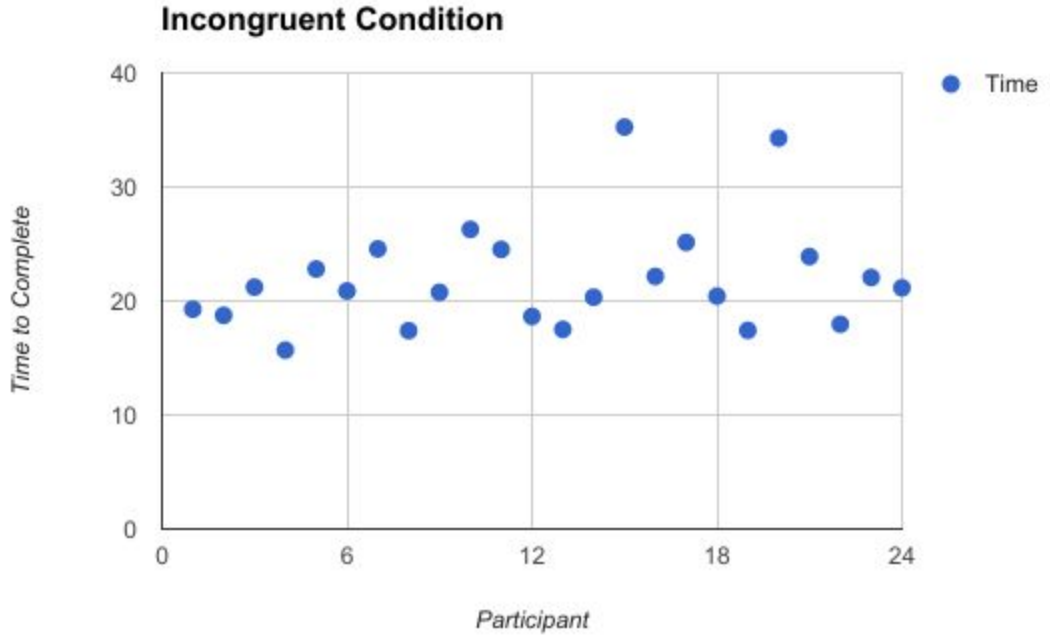
Sample Standard Deviation of the Differences = S = 4.86482691

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.

   From the two visualizations, I notice the Incongruent scatter plot has a more condensed, linear form compared to the Congruent scatter plot.

(Continue below for scatter plots…)





5. 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?

$$t = \mu_c - \mu \,/\, (S/\sqrt{n})$$
$$t = -7.964 \,/\, (4.864/\sqrt{24})$$
$$t = -8.044$$

$$\alpha = 0.05$$
$$\text{t-critical values} = -2.069 \ \& \ 2.069$$

I would reject the null because the t-statistic falls past the critical value and into the critical region. Since our test was based on an experimental design, we can make causal statements such as, the incongruent test had a causal effect on the time it took participants to complete.

Confidence Interval Level: -7.964 +- 2.064 (4.864/4.899) = (-10.0135 , -5.9145)

I can conclude that on average, participants will take between 10 to 6 seconds longer to complete the incongruent test compared to the congruent test. The results actually did match up with my expectations because I have had prior experience with taking a test similar to the Stroop test.

Sources: My Google Sheets