Project 1: Test a perceptual phenomenon

1. **What are the independent and dependent variables?**

The independent variable is the condition the subjects are given (either congruent or incongruent). The dependent variable is the time taken to name the ink colors in the list.

2. **What is an appropriate set of hypotheses for the task? What kind of statistical test will be performed?**

Null hypothesis: There will be no significant difference between the mean response time for all members of the population between the two conditions.

$H_0 : \mu_i = \mu_c$

Alternative hypothesis: There will be a significant difference between the mean scores of the population for the two conditions.

$H_A : \mu_c \neq \mu_i$

This can be measured using a dependent t-test for paired samples. We are measuring the subjects twice--two conditions--thus this test is appropriate.[1]

The dependent t-test is a small sample test ($n < 30$), and our sample size is appropriate.[2] Additionally, are are only slightly worried about normal distributions of the samples, as this test is decently robust against departures from normal. The histograms in step 4 indicate the distribution of both is approximately normal. The two-tailed test is most appropriate because we are looking for *any* difference in the response times, and not in a specific direction.

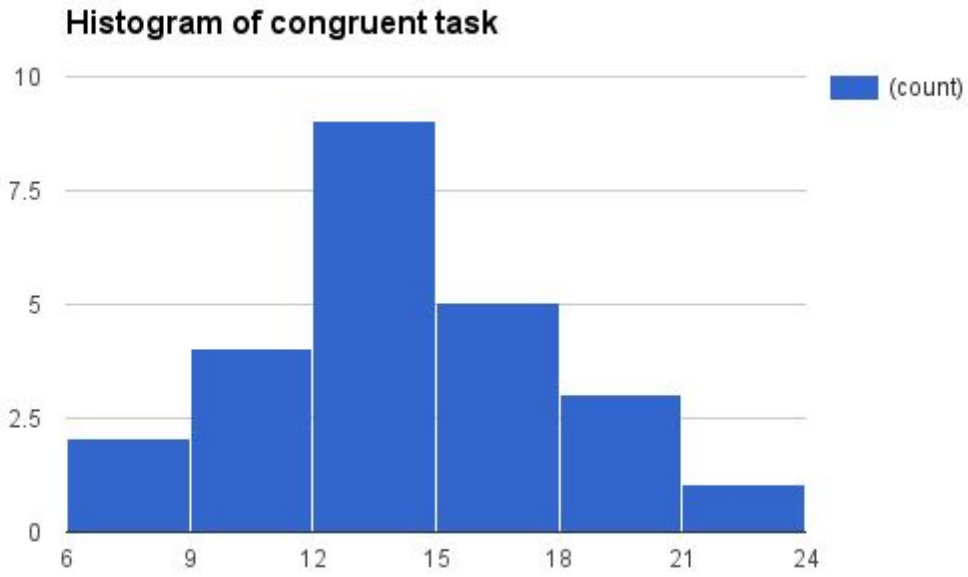
3. **Descriptive statistics for data**

	Congruent	Incongruent
Mean	14.051125	22.01591667
Median	14.3565	21.0175
Sample Standard Deviation	3.559357958	4.797057122

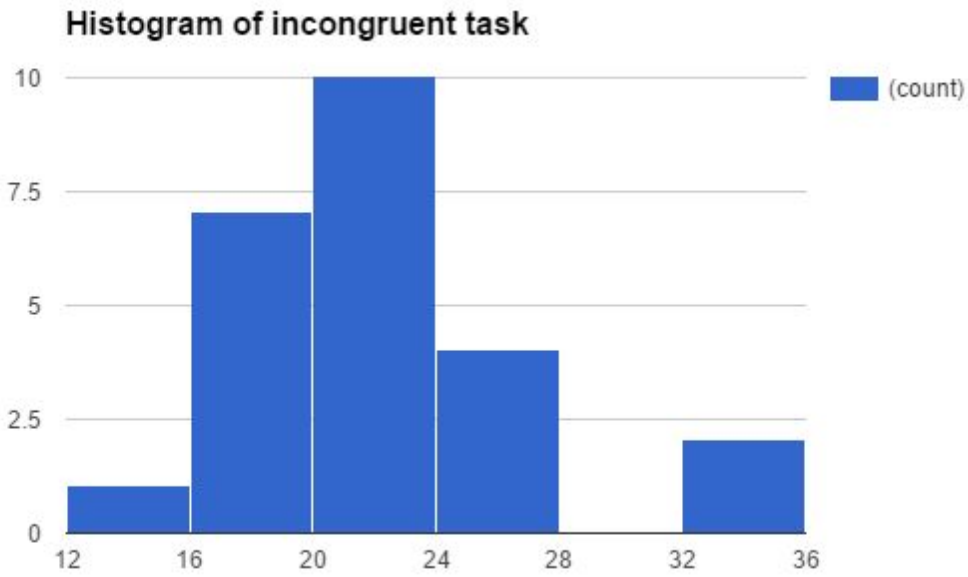
[1] https://explorable.com/dependent-t-test-for-paired-samples

[2] ibid.

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 histogram gives us basic information about the distribution of the sample. Its bin size is 3. We can see its shape is approximately normal, with a slightly higher than normal count around the mean of 14.05.



The histogram of the incongruent task differs greatly from the congruent task. Although the bin sizes are wider (four seconds, instead of 2.5) and there are fewer bins, the bin from 28-32 seconds has 0

results. In a different sample, this would likely be different, and the sample would appear more normal. The empty bin is a warning that we must account for sample errors and must approximate the means of all possible samples of the population this represents by using confidence intervals.

5. **Perform the statistical test and report results. What is confidence level and critical statistic value? Reject or fail the reject null hypothesis? Conclude. Did results match expectations?**

We performed this experiment, based on confidence level $\alpha < 0.1$, the athlete's alpha. (If there is a possibility it will improve performance, it's worth trying, even though 1 in 10 calculations might be due to chance). With 23 degrees of freedom, we approximate the t-critical value at 1.714.

With order maintained in the data, $t(23) = -8.021$, $p < 0.0005$. Thus we reject the null hypothesis and conclude there is a difference between the mean scores.

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!**

Stroop suggested there is a cognitive interference that occurs when all the expected details about reading words and matching them to their color occurs ("Stroop Effect"). Similar cognitive dissonance may occur when reading words that are similarly spelled, but unknown to the reader (substitutes the one she knows for the real word). This also may occur in spelling when one is used to mispronouncing a word and then learns how it is spelled, e.g. says "griev*i*ous" or "veheme*nen*ce" when "grievous" and "vehemence" are the correct words.

Additionally, we could refer to the low-hanging conclusions of others, but that seems too simplistic and their work is cited in the article we have previously cited.

Works cited

"Stroop Effect." https://en.wikipedia.org/wiki/Stroop_effect. Visited 15 July 2016.