Background Information

In a Stroop task, participants are presented with a list of words, with each word displayed in a color of ink. The participant's task is to say out loud the color of the ink in which the word is printed. The task has two conditions: a congruent words condition, and an incongruent words condition. In the congruent words condition, the words being displayed are color words whose names match the colors in which they are printed: for example RED, BLUE. In the incongruent words condition, the words displayed are color words whose names do not match the colors in which they are printed: for example PURPLE, ORANGE. In each case, we measure the time it takes to name the ink colors in equally-sized lists. Each participant will go through and record a time from each condition.
Questions For Investigation

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

The independent variable is whether the condition is a congruent words condition or an incongruent words condition;
The dependent variable is the time it takes to name the ink colors in equally-sized lists.

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

Null Hypotheses:

The time it takes to name the ink colors in the two conditions does not statistically differ at an alpha level of 0.05

$H_0 : \mu_1 = \mu_2$

Alternative Hypotheses:

The time it takes to name the ink colors in the two conditions does statistically differ at an alpha of .05

$H_A : \mu_1 \neq \mu_2$

Statistical Test : Dependent t-Test, justified as below:

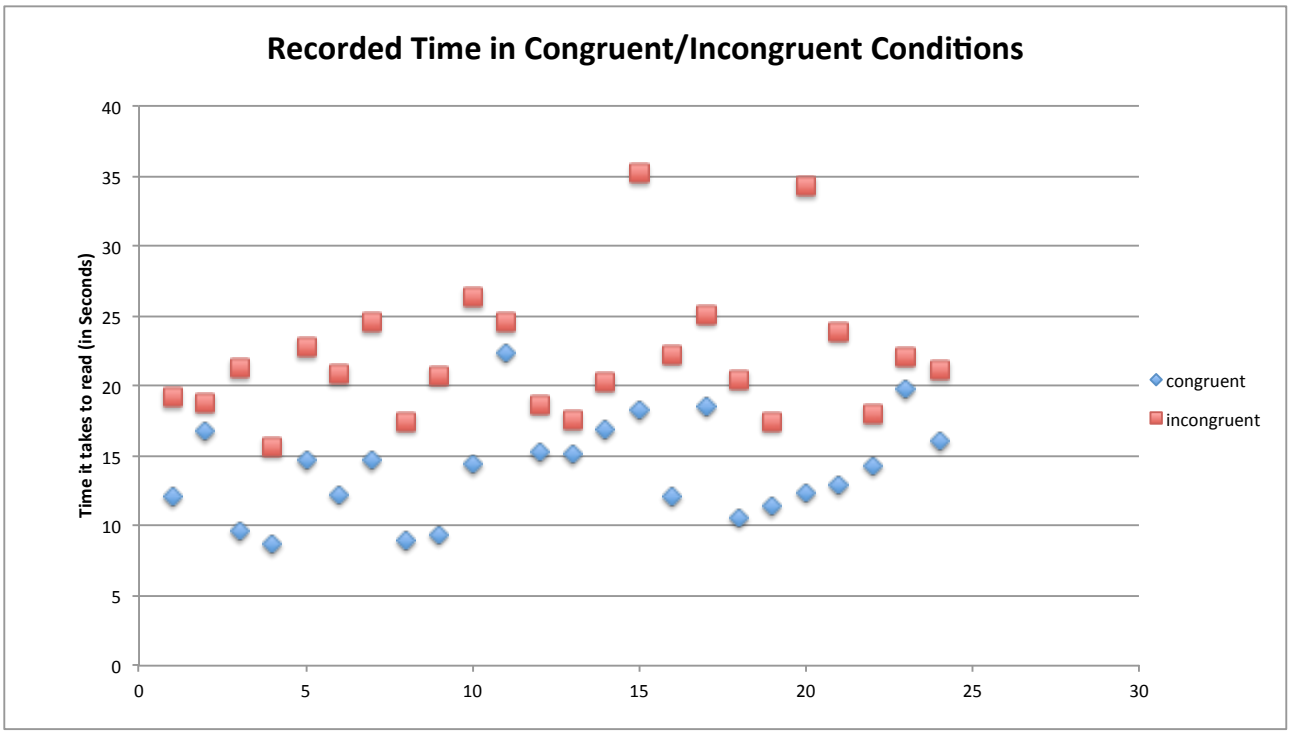
a. We cannot perform a Z-test as we don't know the population parameters μ and σ, we need to do a t-Test to find out if the difference is significant.

b. Dependent: according to the background information, there is only one sample that has been tested twice,each participant has two measurements.

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

	Congruent	Incongruent
Mean	14.051	22.016
Variance	12.669	23.012
Standard Deviation	3.559	4.797

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 scatter graph, we can see that all the 24 participants took more time to read in the incongruent condition.

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?

Confidence level α: 0.05
t-critical value: ± 2.069 (two-tailed)

t-statistic value: -8.021
The two-tailed P value is less than 0.0001
By conventional criteria, this difference is considered to be extremely statistically significant.

I do reject the null hypothesis.

The results did match up with my expectations.

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 think because we use different parts of the brain to process colors and writing; the words themselves have a strong influence over our ability to say the color. There are two theories that may explain the Stroop effect [3]:

a. Speed of Processing Theory: the interference occurs because words are read faster than colors are named.

b. Selective Attention Theory: the interference occurs because naming colors requires more attention than reading words.

Alternative or similar task:

I have found some research work on the “5 Digit test” which is similar to the Stroop task, in this test, five twos, which can be easily read as “two”, must be counted as a “five”. This test also allows us to measure at the same time the “processing speed” of the subjects and their ability to “direct” and “switch” their attentional control.

References:

[1] http://support.minitab.com/en-us/minitab/17/topic-library/basic-statistics-and-graphs/hypothesis-tests/basics/example-of-a-hypothesis-test/
[3] https://faculty.washington.edu/chudler/words.html
[4] https://en.wikipedia.org/wiki/Stroop_effect
[5] http://cognitivefun.net/test/2
[6] https://www.researchgate.net/publication/8554627_%275_Digit_test%27_A_multilinguistic_non-reading_alternative_to_the_Stroop_test