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

  Independent: The text and the colours of the text are independent variables ie. the type of Stroop task (congruent/incongruent).

  Dependent: The difference of time taken by the experiment to complete the Stroop task (in seconds)

  ie. the time taken by the reader to say the words.

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

         The null hypothesis always assumes no difference in the two population means ie. the population mean of congruent response time and that of the incongruent response time.

         The alternative hypothesis will be that there is a statistically significant difference in the population mean of the given dataset.

$$H0: \mu_{congruent} - \mu_{incongruent} = 0, \quad at \quad = 0.5$$

$$HA: \mu_{congruent} - \mu_{incongruent} \neq 0, \quad at \quad = 0.5$$

Steps to perform T-Statistic:

1 Calculate the difference of each value of the two population ie. incongruent and congruent data populations.

2 Then, Calculate the mean of the new population of the differences obtained.

3   Calculated the standard deviation of the new populations.

4   Identify the degree of freedom (df).

5   Calculate the SE of the new population.

6   Now we can use the value of the *new mean* obtained to conduct the t-test.

7   We used the above values to find the t-statistic and t-critical values.

8   We can also find the value of probability using t-statistic value and find the significance level.

I will perform a paired two paired t-test as the same participants were measured twice for two different conditions ie. incongruent or congruent. We are not concerned with the direction of the difference, the test will be two-tailed.

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

Here are some descriptive statistics for the dataset:

$$\bar{x}_{congruent} = 14.05 \ sec$$

$$S_{congruent} = 3.56 sec$$

$$\bar{x}_{incongruent} = 22.02 \ sec$$

$$S_{incongruent} = 4.80 \ sec$$

(values are rounded upto 2 decinal place)

Where x and S are the sample mean and sample standard deviation respectively.

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.
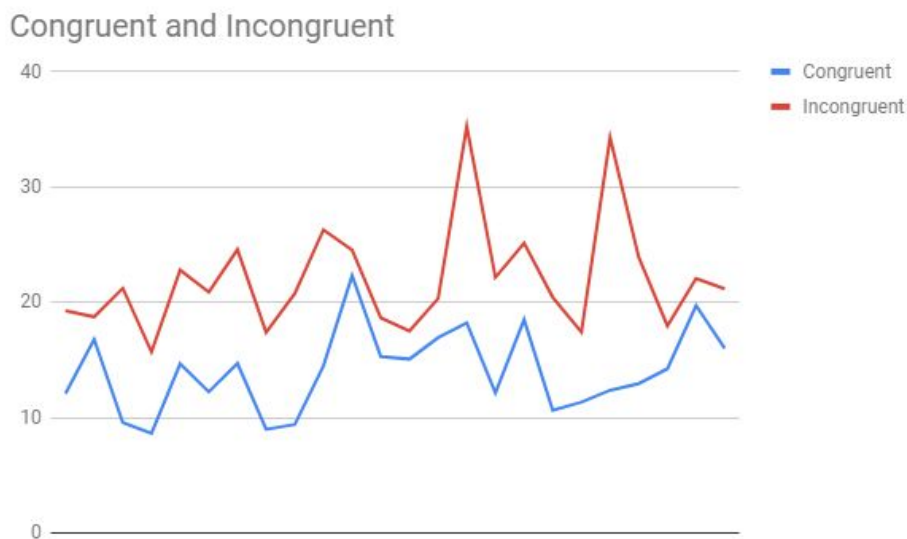

Fig 1: The above line chart shows that the time taken in incongruent task is more than than congruent task.

Congruent and Incongruent

Fig 2: The above area chart shows that the incongruent data covers more area than the congruent data.

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?

We have,

μ_D = -7.965 (Mean of differences)

SE_D = 0.993 (Standard Error)

n = 24

df = 23

In a two tailed t-test, we get:

α = 0.5 (95% confidence level)

t-critical = ± 2.069   (value is referred by t-table)

t-statistic = -8.021   (formula is t-statistic = difference between the means of two task/ SE_D)

p < 0.0001   (probability is calculated through www.graphpad.com/quickcals)

As the p-value is extremely small, the null hypothesis is rejected and it is highly unlikely that the difference in times occurs due to random chance.

So in contrast to null hypothesis the alternative hypothesis is accepted as it states that there is a difference in the time of incongruent and congruent task and come to the conclusion that there is a statistically

significant difference in average times for congruent/incongruent tasks.

This results matched up with my expectations as I was expecting the incongruent task to be harder and thus take up more time as was the case in my experience with the test with congruent and incongruent task.

6. 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 that the incongruent task takes a lot more time because our brain processes words much faster than colors and since the word reaches our brain first, our brain has to actively re-analyze the existing answer when it processes color information. This takes up a lot of time and we have to concentrate a lot to be not misled by the written word.

A test that can give similar result as a stroop test titled ARITHMETIC OPERATIONS. In the first experiment of the test we can give the responder with a maths equations with different arithmetic operations which has the same meaning of its sign so it gives the correct result , this task is a congruent task, but in the second experiment we will alter the meaning of the sign and give responder the same maths equations but with differing the sign with its operation as ("+" will operate as "*"), this will result into an incongruent task and may takes more time, to respond.