

1. What is our independent variable? What is our dependent variable?
Independent Variable : List of words assigned with same colour or different colour i.e congruent and incongruent words condition.
Dependent Variable : Time taken to name the ink colours

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 Hypothesis: Population mean of time taken for reading congruent words is equal to the population mean of the time taken for incongruent words.

Let population mean score of the congruent test be μ_1 and mean score of the incongruent test be μ_2 .

$H_0: \mu_1 - \mu_2 = 0$.

Alternate Hypothesis: There is significant difference in population mean time taken to name ink colours between congruent and incongruent words condition.

$H_1: \mu_1 - \mu_2 \neq 0$.

Dependent samples t-tests will be the statistical test to be performed.

t-test is considered here because population parameters are not available and only sample statistics are present.

Since same person takes both congruent and incongruent words condition test. This is a kind of Pre-test and Post -test scenario where first subject has to take the congruent test and then the incongruent test.

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

Mean score of the congruent test, $\text{congruent}_{\text{mean}} = 14.05$

Mean score of the Incongruent test, $\text{incongruent}_{\text{mean}} = 22.02$

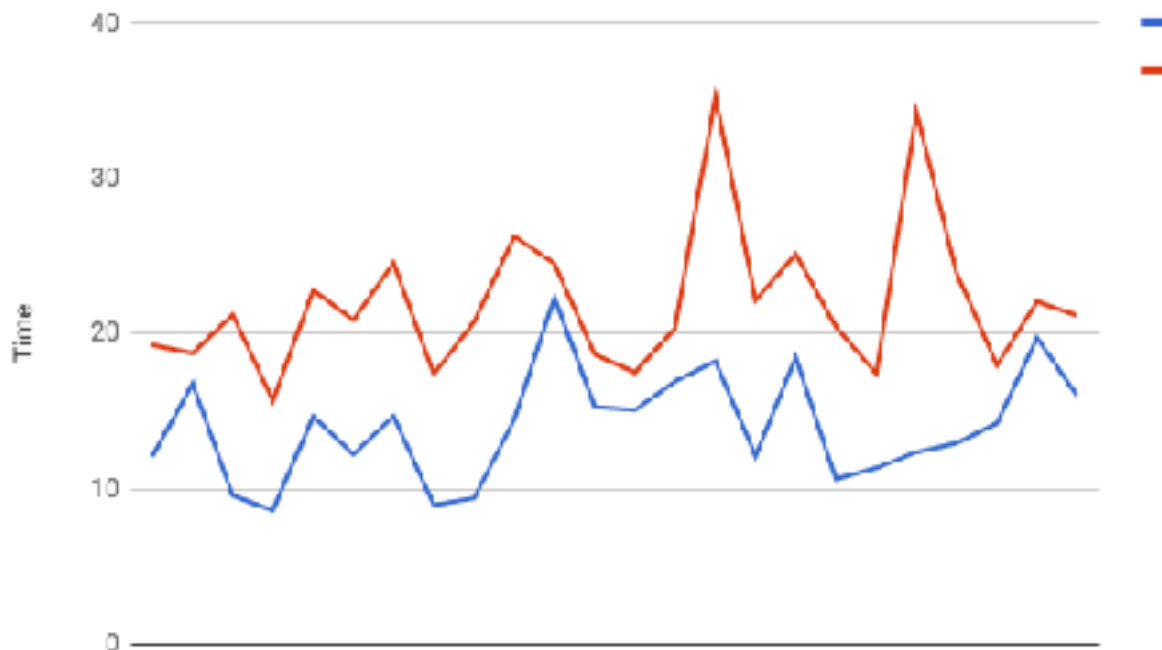
Point of estimate ($\text{congruent}_{\text{mean}} - \text{incongruent}_{\text{mean}}$) = -7.96

Standard deviation of differences, $s = 4.86$

Standard Error, $SE = 0.99$

4. Provide one or two visualisations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.

Congruent Vs Incongruent Scores



Above chart is line chart which shows the time taken by the users to name the ink colours in congruent and incongruent words condition. Blue line represents the time taken by different users for congruent words condition and red line represents the time taken by different users for incongruent words condition.

As we see the trend, red line is above blue line for all users which means all the users have taken more time to name ink colours in incongruent words condition when compared to congruent words 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?

$$t_{\text{statistic}} = -8.02$$

For 95% confidence interval,

$$t_{\text{critical}} = -2.069, +2.069$$

$$\text{confidence interval} = -10.02, -5.91$$

$$p \text{ value} = \text{less than } 0.0001$$

We are rejecting the null since $t_{\text{statistic}}$ is in the critical region for 95% confidence interval.

Conclusion:

This means that difference in time taken by the users to name the ink colours is considered to be extremely statically significant.

Expectation:

My alternate hypothesis was that time taken by users to name the ink colours for congruent and incongruent words will be significantly different which is statically proved above.

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!

As per the wikipedia article on stroop effect, brain processes words faster than colour and hence for congruent words, readers are able to respond faster when compared to incongruent words.

Alternative task like Emotional stroop effect where individual is given negative emotional words like "grief," "violence," and "pain" mixed in with more neutral words like "clock," "door," and "shoe". Just like in the original Stroop task, the words are coloured and the individual is supposed to name the colour. Research has revealed that individuals that are depressed are more likely to say the colour of a negative word slower than the colour of a neutral word.

References:

https://en.wikipedia.org/wiki/Stroop_effect