Statistics: The Science of Decisions Project Instructions

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.

As a general note, be sure to keep a record of any resources that you use or refer to in the creation of your project. You will need to report your sources as part of the project submission.

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

Independent Variable is the one that we can change to radiate the behaviour to be observed

Here the independent variable is the **type of datasets**(*congruent or incongruent set of words*) we present to the subject

Dependent Variable is what we observe

Here it is ***Time taken to read the words*** *by each participant*

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

Research question:
      Do the Participant's response time to name the words differs in case of congruent and incongruent words ?

Null hypothesis - H$_0$

The Mean Response Time taken to name the words in case of congruent and Incongruent set has no difference

μ(congruent) = μ(Incongruent)

Alternate Hypothesis - H$_a$

The Mean Response time taken to name the words for congruent is different from mean response time taken to name the words of Incongruent set

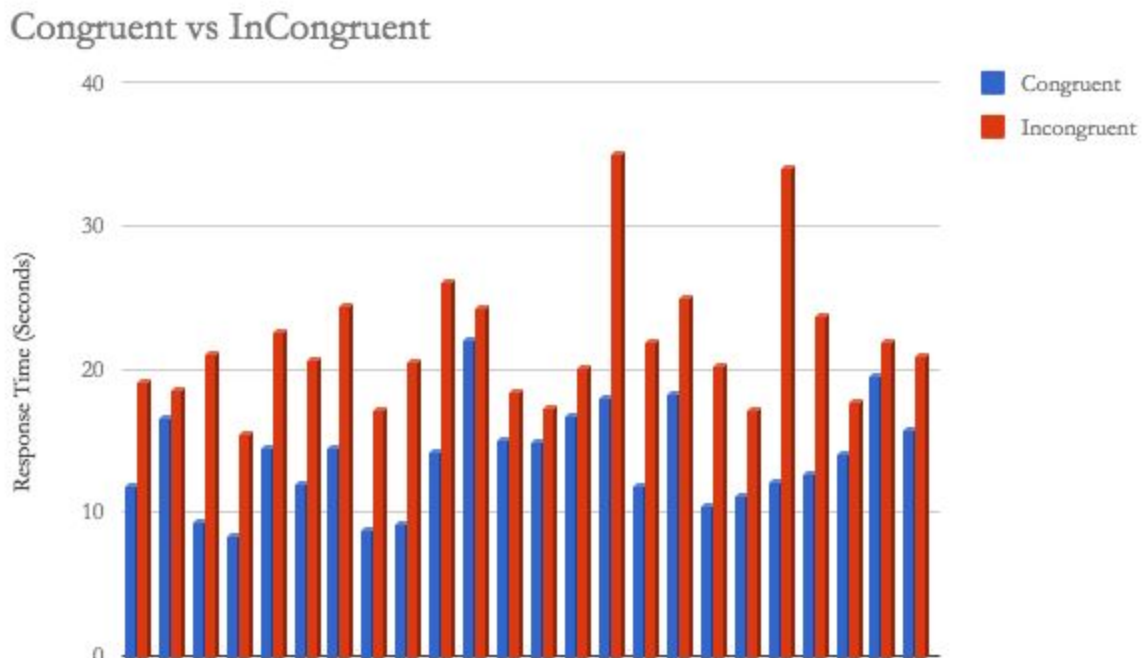*μ(congruent) != μ(Incongruent)*

 Two Tailed test

 t -test can be considered as paired samples with different conditions (one being congruent and other incongruent) and z-test is not applicable as we have no detailed information of Population parameters

Now it's your chance to try out the Stroop task for yourself. Go to this link, which has a Java-based applet for performing the Stroop task. Record the times that you received on the task (you do not need to submit your times to the site.) Now, download this dataset which contains results from a number of participants in the task. Each row of the dataset contains the performance for one participant, with the first number their results on the congruent task and the second number their performance on the incongruent task.

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

Mean(congruent)	14.05
Mean(Incongruent)	22.02
SD (Congruent)	3.56
SD (InCongruent)	4.80

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.

Congruent vs InCongruent

- The Time taken for Incongruent is higher than Congruent type
- The range for congruent is between 8 and 20 w.r.t range for incongruent is between ~20 and 35 which is approx 2 times higher than congruent

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?

n(Sample Size)	24

df	23
Alpha (95%)	0.05
t-critical	2.069

SD of paired samples difference is calculated here

T-statistic = mean(congruent) - mean (incongruent) / (SD of difference / sqrt(n))

= (14.05 - 22.02) / (4.86/sqrt(24))

= 7.96 /(4.86 / 4.90)

T-statistic = 8.04

Thus t-value(8.04) falls in critical region (> 2.069) and statistically significant .With that we can reject Null Hypothesis (**H₀**) in 95% confidence levels

R-Square is 0.74 or 74 % difference in sample size of 24 is due of stroop effect

Yes, It does match up to my my expectations that it takes time to read incongruent set of words

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 effect is due to one's brain ability of processing the color versus than vocabulary skills
An alternative test is Colored Number test which has similar capability effect