

# 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.

### Questions For Investigation

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 : Condition and Dependent Variable : Time taken

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 : mean of Congruent data in population is same as mean of Incongruent data in population or the difference between the two means is equal to 0 in population

$$H_o : \mu_c = \mu_i \text{ or } H_o : \mu_c - \mu_i = 0$$

Alternative Hypothesis : mean of Congruent data in population is not same as mean of Incongruent data in population or the difference between the two means is not equal to 0 in population

$$H_a : \mu_c \neq \mu_i \text{ or } H_a : \mu_c - \mu_i \neq 0$$

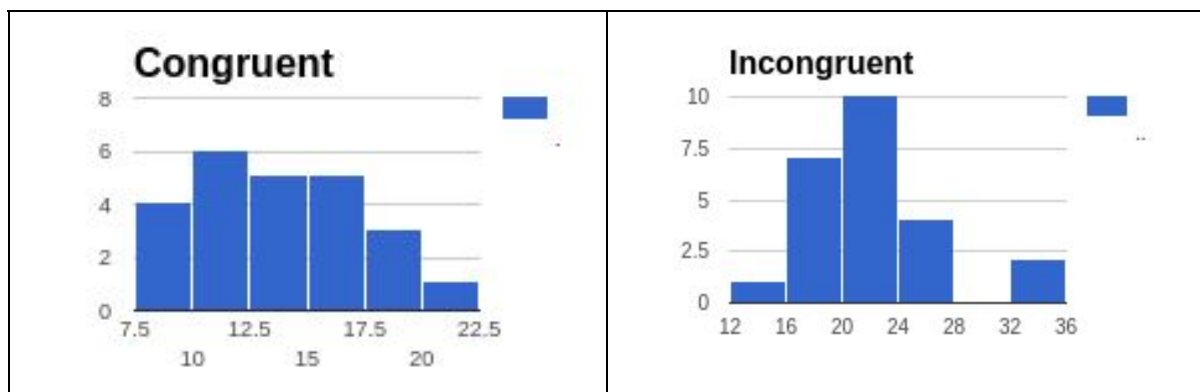
2 tailed paired t-test is the best suitable here for statistical analysis since t-test enable us to see the differences between samples from different populations. Also we don't know the population parameters or there is no information provided regarding population.

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.

Test 1:	Test 2:
$\bar{x}_1 = 14.051125$	$\bar{x}_2 = 22.01591667$
$SD_1 = 3.559357958$	$SD_2 = 4.797057122$
Median = 15.1855	Median = 18.077

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.



The histogram of samples of congruent is positively skewed and that of incongruent is normally distributed. Mode of congruent data samples is between 10-12.5 and Mode of incongruent data samples is between 20-24

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?

Test 1:	Test 2:
$\bar{x}_1 = 14.051125$ $SD_1 = 3.559357958$ $Median = 15.1855$	$\bar{x}_2 = 22.01591667$ $SD_2 = 4.797057122$ $Median = 18.077$

$$\bar{d} = -7.964791667, s_d = 4.86482691$$

$$t = \frac{(-7.964791667)}{\frac{4.86482691}{\sqrt{24}}} \text{ with } d.f = 23$$

*t value = -8.020706944 and since it is two tailed test and at  $\alpha = 0.05$  ( 95% Confidence Level )*

*t-critical =  $\pm 2.069$*

*Since  $|t\text{-value}| > |t\text{-critical}|$  so we reject the null hypothesis and accept the alternative hypothesis.*

The two-tailed P value is less than 0.0001

By conventional criteria, this difference is considered to be extremely statistically significant.

*Yes, the result match up with my expectations.*