

# Project: Test a perceptual phenomenon- Stroop Effect

## 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.

---

## Question 1: Identify variables in the experiment

### Independent Variable:

To read all the words displayed which are color words and whose names do not match the colors in which they are printed.

### Dependent Variable:

It is the time taken to name the ink colors in equally-sized list as in the congruent words list.

---

## Question 2a: Establish hypotheses

### Null Hypothesis $H_0$ :

The average time taken to read the set of congruent words and the set of incongruent words are the same.

Mathematically it can be written as:

$$H_0 : \mu_c = \mu_i$$

Or,  $H_0 : \mu_c - \mu_i = 0$

### Alternate Hypothesis $H_a$ :

The average time taken to read the set of congruent words and the set of incongruent words are different. And according to stroop effect as time taken will be more to read the incongruent words.

Mathematically it can be written as:

$$H_a : \mu_c < \mu_i$$

Where,  $\mu_c$  - Mean of time taken to read the congruent words list.  
 $\mu_i$  - Mean of time taken to read the incongruent words list.

### Question 2b: Establish a statistical test

For analysing the given independent samples, I will be using t-test because of the absence of population parameters.

Assumptions:

1. Take the  $\alpha$ -level as .05 or 5%.
  2. Assumed it is a one-tailed test.
- 

### Question 3: Report descriptive statistics

#### **Variables used:**

$n_c$  – sample size of the congruent words list.

$n_i$  – sample size of the incongruent words list.

$\bar{x}_c$  – Sample average of the time taken to read the congruent words list.

$\bar{x}_i$  – sample average of the time taken to read the incongruent words list.

$S_c$  – Standard deviation of the time taken to read the congruent words list.

$S_i$  - Standard deviation of the time taken to read the incongruent words list.

$$n_c = 24$$

$$n_i = 24$$

**Measure of centrality:** Mean of the two given samples.

$$\bar{x}_c = 14.05 \text{ seconds}$$

$$\bar{x}_i = 22.02 \text{ seconds}$$

**Measure of variability:** Standard deviation of the two given samples.

$$S_c = 3.56$$

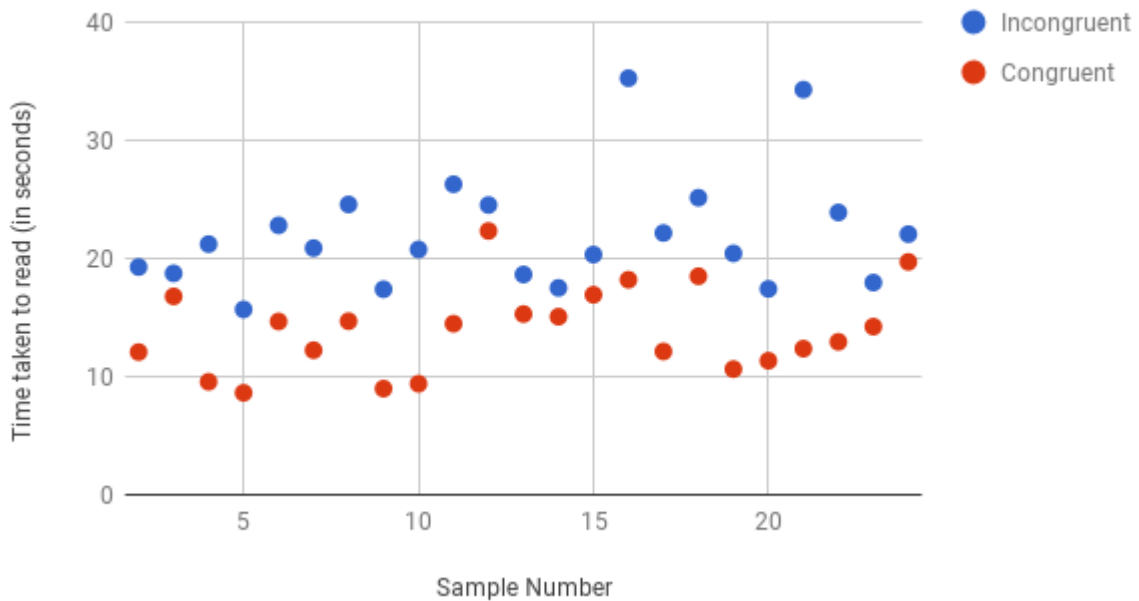
$$S_i = 4.79$$

---

### Question 4: Plot the data

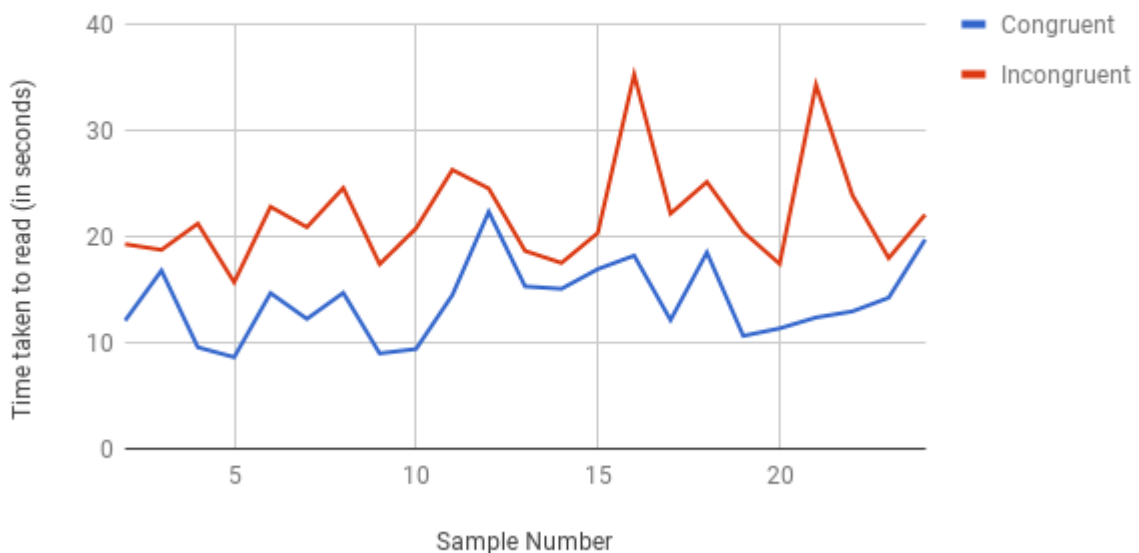
To visualize the given sample and to draw comparisons I have used scatterplot and a line graph.

Scatterplot of time taken for congruent and incongruent list



The above figure shows the scatterplot of the sample values of time taken to read the congruent and incongruent words list. It can be observed that majority of points belonging to the incongruent lists have more taken as compared to that of the congruent words list.

Line chart of time taken to read Congruent and Incongruent word list



The above figure shows the line chart of the sample values of time taken to read the congruent and incongruent words list. It can be observed that majority of points belonging to the incongruent lists have more taken as compared to that of the congruent words list.

### Question 5: Perform the statistical test and interpret your results

From above:

$$n_c = n_i = 24$$

$$\bar{x}_c = 14.05 \text{ seconds}$$

$$\bar{x}_i = 22.02 \text{ seconds}$$

$$S_c = 3.56$$

$$S_i = 4.79$$

$$\begin{aligned} \text{Degrees of freedom } df &= n_c + n_i - 2 \\ &= 24 + 24 - 2 \\ &= 46. \end{aligned}$$

$$\text{Standard error } SE = \sqrt{\left[ \frac{S_c^2 + S_i^2}{n_c} \right]} = \sqrt{\left[ \frac{3.56^2 + 4.79^2}{24} \right]} = 1.22 \text{ seconds}$$

$$t\text{-statistic} = \frac{x_i - x_c}{SE} = \frac{22.02 - 14.05}{1.22} = 6.63$$

As it is a one-tailed test and taking  $\alpha = .05$  and  $df = 46$ .

$$t\text{-critical} = 1.684$$

As t-statistic is greater than the t-critical value so the decision is to reject the null which means that due to stroop effect/ treatment the time taken to read increases.

The p-value is less than 0.00001.

And the result is statistically significant.

---

### Question 6: Digging deeper and extending the investigation

The Stroop Effect is the interference in mind due to two conflicting pieces of information the word and the color of the word which causes that causes an overlap in cognition. It is also helpful in studying the reaction time of a person. So if an experiment is performed based on the above effect the reaction time of a found to be more. Many variations can be performed to this test.