

Stroop Effect – Test a Perceptual Phenomenon

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

Q1. What is our independent variable? What is our dependent variable?

Independent variable is the type of Words Condition – Congruent or Incongruent.

Dependent variable is the Time taken by the participant to name the ink color.

Q2. What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.

Ho – Null Hypothesis : There is **no significant difference** in time, for the population, to state the colors of the words in a congruent or incongruent condition
i.e. $(\mu_c - \mu_i = 0)$.

Ha – Alternative Hypothesis : There is a statistically significant difference in time, for the population, to state the colors of words in a congruent or incongruent condition i.e. $(\mu_c - \mu_i \neq 0)$

$(\mu_i$ – Mean of Incongruent Dataset, μ_c – Mean of Congruent Dataset)

A two-tailed Dependent Samples t-Test is appropriate for this Study because -

1) Population Parameters are not provided. Hence we cannot do a z-test.

2) The Same Participants are given two different treatments. Hence a Dependent Samples t-Test.

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.

Q3. Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

Congruent Dataset :-

Mean = 14.051125

Variance = 12.66902907

Standard Deviation = 3.559357958

Incongruent Dataset :-

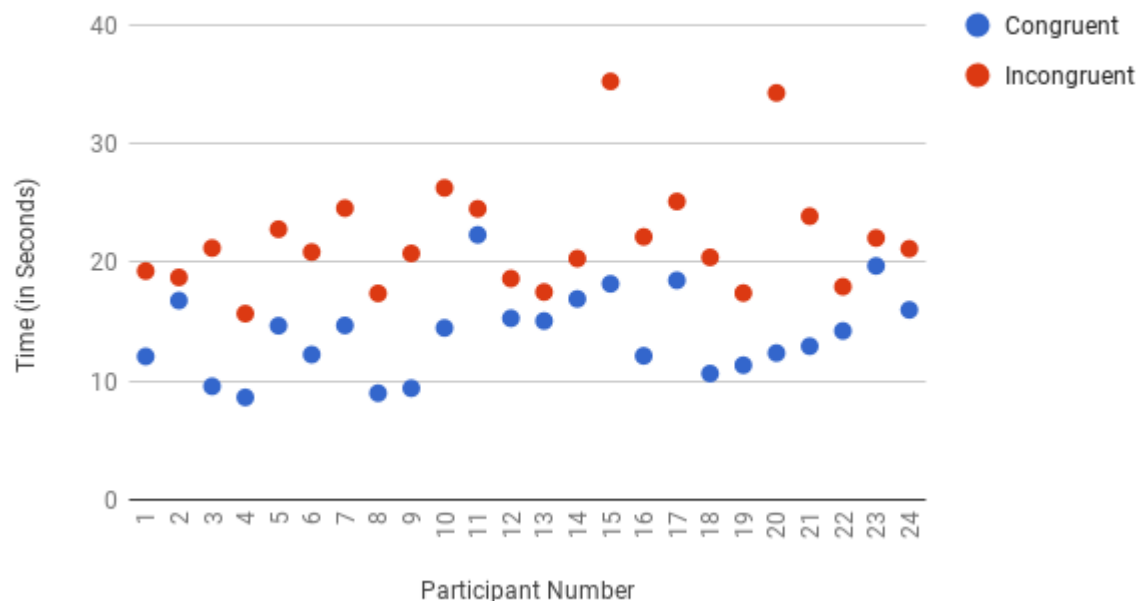
Mean = 22.01591667

Variance = 23.01175704

Standard Deviation = 4.797057122

Q4. 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.

Response Time Scatter Plot



It is Observed from this Scatter Plot that time taken by each participant is more for Incongruent Treatment than for Congruent Treatment.

Q5. 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?

Mean of Differences (μ_D) = -7.964791667

Standard Deviation (S) = 4.86482691

Degrees of Freedom (dF) = 23

Alpha Level (α) = 0.05

t-Statistic = -8.020706944

p = Less than 0.0001

t-Critical (t_c) = -2.069, +2.069

95% Confidence Interval = (-10.019367912, -5.910215422)

Since $p < 0.05$, we **Reject** the Null Hypothesis. It can be seen that the Response Time is more in case of Incongruent Condition than Congruent Condition. This means that there is a significant difference in the average response time of participants in the two Tests. Yes the results match up to my expectations.