# Background

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.

## Word set used in congruent task (Word Set#1) and incongruent task (Word Set#2) are depicted below:





# Problem

# Problem Description

In this project, investigation of a classic phenomenon from experimental psychology called the [Stroop Effect](https://en.wikipedia.org/wiki/Stroop_effect) is carried out. Following tasks are performed during the course of the project.

* 1. Study and Learn about the experiment
  2. Perform [Stroop Effect](https://en.wikipedia.org/wiki/Stroop_effect) experimental and record results
  3. Create a hypothesis regarding the outcome of the task
  4. Look at some data collected from others who have performed the same task and will compute some statistics describing the results.
  5. Interpret recorded results in terms of hypotheses created earlier

# Data Collection

## Data collection steps are listed below:

## Navigate to [Interactive Stroop Effect Experiment](https://faculty.washington.edu/chudler/java/ready.html) (which has a Java-based applet for performing the Stroop task) and follow the instructions to perform Stroop task.

## Recorded the time duration observed on the Stroop task for both congruent words condition, and an incongruent words.

## Downloaded the [dataset](https://drive.google.com/file/d/0B9Yf01UaIbUgQXpYb2NhZ29yX1U/view),which contains results from a number of participants who participated earlier in the stroop 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.

# Solution Approach

# Identify variables in the experiment

Independent variable: words Set Type (either congruent or incongruent words)

Dependent variable: Time takes for reader to name the ink colors

Note: Number of words in congruent or incongruent list is fixed. Same subject is exposed to two conditions

# Establish hypotheses

**null hypothesis**: H0: μC ≥ μI

Mean time for color recognition for congruent words Set is greater than or equals to mean time for incongruent words Set.

**Alternative hypothesis**: HA: μC < μI

Congruent words Set mean is less than incongruent words Set mean.

Wherein,

μ : sample mean

μC : mean of congruent words Set

μI: mean of incongruent words Set

# Establish a statistical test

The available data is sample data and population parameter such as standard deviation is not available and total samples are < 30, hence t-test is suitable here.

Based on the Null hypothesis 1-tailored test is suitable.

So overall, statistical test to be carried 1-tailed t-test

Since same subject is exposed to two conditions, t-test is of type for dependent samples, "same subjects" or "repeated-measures" statistical tests.

# Report descriptive statistics

Calculated Descriptive statistics are depicted below table for measure of centrality (Mean, Median, and Mode) and one measure of variability (Range, IQR, SD).

|  |  |  |  |
| --- | --- | --- | --- |
| **Sample Statistics** | **Congruent** | **Incongruent** | **Diff (Cong-InCong)** |
| **n** | 24 | 24 |  |
| **Sum** | 337.227 | 528.382 | -191.155 |
| **Mean(x̄)** | 14.051125 | 22.01591667 | -7.964791667 |
| **Median** | 14.3565 | 21.0175 | -6.661 |
| **Mode** | 14.3565 | 21.0175 | -6.661 |
| **Range** | 13.698 | 19.568 | -5.87 |
| **IQR** | 4.686 | 5.5165 | -0.8305 |
| **Variance(s2)** | 12.669029 | 23.01175704 | -10.34272797 |
| **s** | 3.559358 | 4.797057122 | -1.237699165 |
| **SE** | 0.7265509 | 0.979195185 | -0.252644284 |
| Degree of freedom | 23 | 23 |  |

# Plot the data

Comparative plot of data for both samples is depicted below:

# Perform the statistical test and interpreting results

Statistical test has been performed at 95% confident level and results are depicted in below table, tests includes test statistic, p-value.

|  |  |  |
| --- | --- | --- |
| **degree of freedom** | 23 |  |
| **Alpha** | 0.05 | 95% |
| **t Critical** | 1.714 |  |
| **Mean of X D** | -7.9647917 |  |
| ***SXD*** | 4.8648269 |  |
| **t Statistical** | -8.0207069 |  |

The test results are interpreted in terms of the experimental task performed. Since **t Statistical** not falls within criticalregion, NULL Hypothesis (H0: μC ≥ μI) is rejected. Hence At the 99% confidence level (α = .01), time taken to read congruent words Set is less than incongruent words Set.

# Digging deeper and extending the investigation

Detecting words and reading is easier for brain when compared with color of the words.

# References

1. <https://en.wikipedia.org/wiki/Stroop_effect>
2. <https://faculty.washington.edu/chudler/java/ready.html>
3. <https://docs.google.com/document/d/1-OkpZLjG_kX9J6LIQ5IltsqMzVWjh36QpnP2RYpVdPU/pub?embedded=True>
4. <http://www2.le.ac.uk/offices/ld/resources/numerical-data/variability>
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6. <http://www.sjsu.edu/faculty/gerstman/StatPrimer/t-table.pdf>
7. <http://www.mathportal.org/calculators/statistics-calculator/t-test-calculator.php>