1P1: Test a Perceptual Phenomenon

# Introduction

In psychology, the Stroop effect is a demonstration of interference in the reaction time of a task. When the name of a color (e.g., "blue", "green", or "red") is printed in a color that is not denoted by the name (e.g., the word "red" printed in blue ink instead of red ink), naming the color of the word takes longer and is more prone to errors than when the color of the ink matches the name of the color. (Stroop Effect, n.d.)

# Question 1: Identify variables in the experiment

Dependent: Total time it takes to say out loud the color of the ink in which the word is printed

Independent: The way colors are presented to participants. A congruent words condition, and an incongruent words condition.

# Question 2: What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform?

Null hypothesis: There is no statistically significant relation between the type of presentation of the words (congruent or incongruent) and the average amount of time it takes to read the words µ0 = µI

Alternative hypothesis: The average amount of time to complete incongruent word Set (µI) is going to be significantly longer than the average amount of time to complete congruent words set (µ0) µ0 < µI

Since the sample size is 25 (<30), Student's t-test should be performed to determine if the two samples that we have are coming from two different population or not.

For the sake of this document, 95% confidence interval will be used. This is a Pre-test post-test, dependent-samples t-test and based on the alternative hypothesis, a one-tailed test in positive direction.

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

Congruent words set:

|  |  |
| --- | --- |
| Min | 8.63 |
| Max | 22.328 |
| Average | 14.05113 |
| Standard Deviation | 3.559358 |

Incongruent words set:

|  |  |
| --- | --- |
| Min | 15.687 |
| Max | 35.255 |
| Average | 22.01592 |
| Standard Deviation | 4.797057 |

# Question 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 words set frequency diagram:

Incongruent words set frequency diagram:

By looking at the diagrams, it is evident that majority of people completed the congruent words set between 11 and 19 seconds, and the incongruent words set between 17 and 25 seconds. So, we can guess that presenting the list of words in incongruent matter would probably increase the time it takes to complete the task of saying the colors.

# Question 5: 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?

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Congruent | Incongruent | Difference |  | Congruent Mean | 14.051125 |
| 12.079 | 19.278 | 7.199 |  | Incongruent Mean | 22.01591667 |
| 16.791 | 18.741 | 1.95 |  |  |  |
| 9.564 | 21.214 | 11.65 |  | Difference Mean | 7.964791667 |
| 8.63 | 15.687 | 7.057 |  | SD of Differences | 4.86482691 |
| 14.669 | 22.803 | 8.134 |  | Standard Error of the Mean | 0.993028635 |
| 12.238 | 20.878 | 8.64 |  | T-Critical value | 1.714 |
| 14.692 | 24.572 | 9.88 |  | T-Statistic | 8.020706944 |
| 8.987 | 17.394 | 8.407 |  | Statistically Significant | Yes |
| 9.401 | 20.762 | 11.361 |  | Reject the Null | Yes |
| 14.48 | 26.282 | 11.802 |  | P-Value | < .00001 |
| 22.328 | 24.524 | 2.196 |  |  |  |
| 15.298 | 18.644 | 3.346 |  | Margin of Error | 1.70205108 |
| 15.073 | 17.51 | 2.437 |  | Confidence interval (lower) | 6.262740587 |
| 16.929 | 20.33 | 3.401 |  | Confidence interval (upper) | 9.666842747 |
| 18.2 | 35.255 | 17.055 |  |  |  |
| 12.13 | 22.158 | 10.028 |  | Cohen's d | 1.637219949 |
| 18.495 | 25.139 | 6.644 |  | R2 | 0.736636416 |
| 10.639 | 20.429 | 9.79 |  |  |  |
| 11.344 | 17.425 | 6.081 |  |  |  |
| 12.369 | 34.288 | 21.919 |  |  |  |
| 12.944 | 23.894 | 10.95 |  |  |  |
| 14.233 | 17.96 | 3.727 |  |  |  |
| 19.71 | 22.058 | 2.348 |  |  |  |
| 16.004 | 21.157 | 5.153 |  |  |  |

As it’s shown in the calculations, t-statistic is in critical region and therefore the result is statistically significant. Hence, we reject the null hypothesis.

We can say that saying out loud the incongruent words set takes significantly longer time than congruent words set.

Based on R2 value, 73.6% of the difference is due to incongruent words.

# References

*Stroop Effect*. (n.d.). Retrieved from Wikipedia: https://en.wikipedia.org/wiki/Stroop\_effect