

RED	GREEN	BLUE	YELLOW	PINK
ORANGE	BLUE	GREEN	BLUE	WHITE
GREEN	YELLOW	ORANGE	BLUE	WHITE
BROWN	RED	BLUE	YELLOW	GREEN
PINK	YELLOW	GREEN	BLUE	RED

RED	GREEN	BLUE	YELLOW	PINK
ORANGE	BLUE	GREEN	BLUE	WHITE
GREEN	YELLOW	ORANGE	BLUE	WHITE
BROWN	RED	BLUE	YELLOW	GREEN
PINK	YELLOW	GREEN	BLUE	RED

Stroop Effect Statistical Analysis

Trenton J. McKinney

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2 INTRODUCTION

The Stroop Effect was first published by John Ridley Stroop in 1929 and is a demonstration of cognitively induced reaction time interference. The effect is measured by presenting participants with a two condition task and comparing the time required to complete each condition. The conditions, congruent and incongruent words, present equally sized lists of matching word color pairs such as **RED** and **BLUE** and mismatched word color pairs such as **RED** and **BLUE** respectively, and records the reaction time for correctly stating ink color. An analysis of the reaction time is to demonstrate a statistically significant difference in the completion times of the two tasks. A successful rejection of the null hypothesis will provide evidence of cognitive interference. While the Stroop task is designed to demonstrate cognitive interference, it does not indicate which cognitive processes interfere to cause a difference in task completion times.

3 INVESTIGATION

3.1 VARIABLES

The independent variable is the task condition, Congruent and Incongruent word color pairs. The dependent variable is the time required to successfully complete each task condition.

3.2 HYPOTHESIS

The Stroop task is a method used to demonstrate differences in the completion time of a two condition task by a single subject. The sample is comprised of 24 subjects, each with a time measurement for the Congruent and Incongruent condition. A dependent two-tailed t-test will be used to determine the statistical significance of differences between paired samples during this investigation. A two-tailed test is being performed because the selected region of rejection for H_A is non-directional.

$H_0: \mu_{\text{congruent}} = \mu_{\text{incongruent}}$ Cognitive processes do not interfere
The population means of the congruent and incongruent condition are not different.
 $H_A: \mu_{\text{congruent}} \neq \mu_{\text{incongruent}}$ Cognitive processes do interfere
The population means of the congruent and incongruent condition are different.

3.3 DESCRIPTIVE STATISTICS

Measures of central tendency: Mean: $\mu_{\text{congruent}} = 14.05$, $\mu_{\text{incongruent}} = 22.02$, $\mu_{\text{difference}} = 7.96$

Measures of variability: Standard Deviation: $\sigma_{\text{congruent}} = 3.56$, $\sigma_{\text{incongruent}} = 4.80$, $S_{\text{difference}} = 4.86$

3.4 VISUALIZATIONS

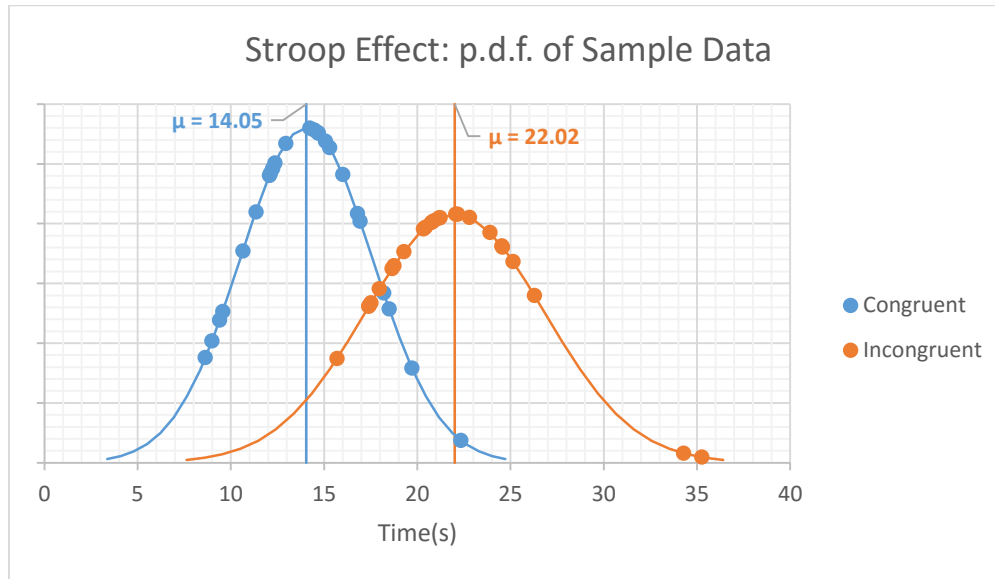


Figure 1: p.d.f. of Stroop Effect Sample Data

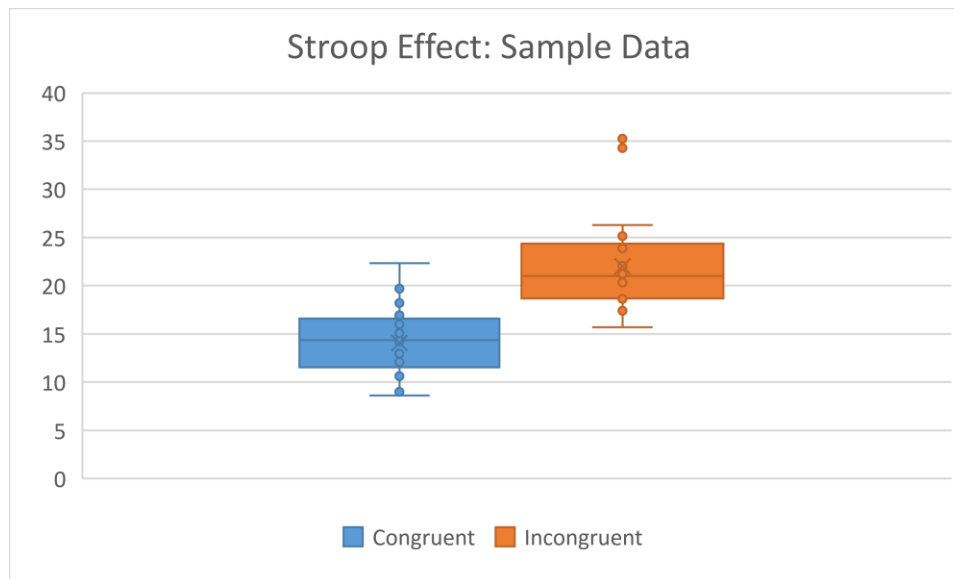


Figure 2: Box & Whisker of Stroop Effect Sample Data

Figure 1 depicts the probability distribution function (p.d.f.) of the sample data on a normal curve and Figure 2 shows most of the data between the 1st and 3rd quartile (with the exception of two outliers in the Incongruent data).

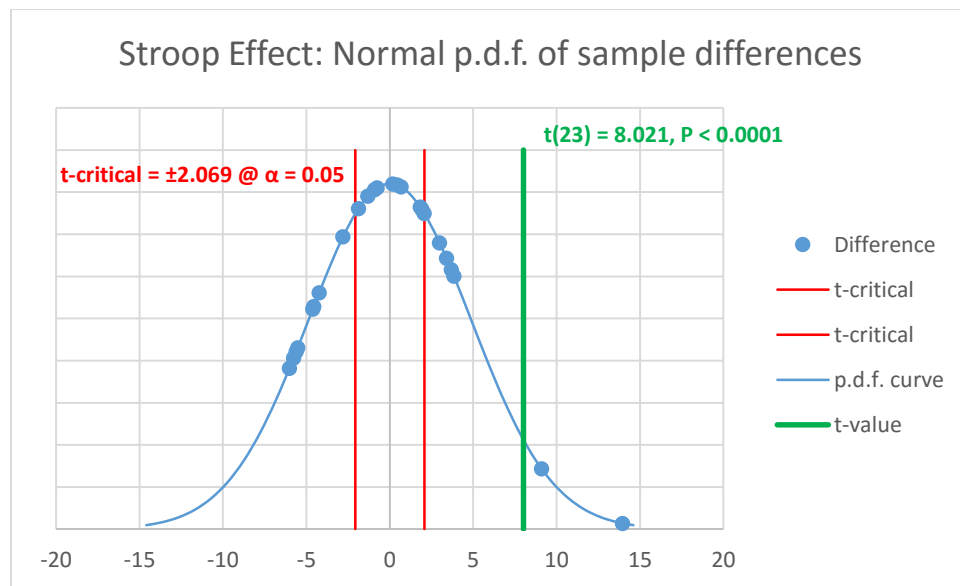


Figure 3: Normal p.d.f. of Stroop Effect Sample Differences

Figure 3 is a normal p.d.f. of the sample differences with t-critical at ± 2.069 for $\alpha = 0.05/2 = 0.025$ and $P < 0.0001$ for $t(23) = 8.021$. The t-value demonstrates the statistical significance of the sample data condition completion time differences.

3.5 RESULTS

3.5.1 Cohen's d

$d = 1.64$; the difference between the two sample means is > 1.5 standard deviations

3.5.2 Coefficient of determination

$r^2 = 0.74$

3.5.3 P Value & t-value

$t(23) = 8.021$, $P < 0.0001$

3.5.4 Confidence Interval (CI)

95% CI = (5.91, 10.02)

3.6 CONCLUSION

For a two-tailed t-test with $df = 23$ and $\alpha = 0.05/2$, $t\text{-critical} = 2.069$. $t(23) = 8.021 \gg t\text{-critical}$. The statistical tests indicate a statistically significant increase in the amount of time required to complete the Incongruent colors test compared to the Congruent colors test and 74% of the effect can be attributed to cognitive interference. Based upon the analysis, this sample data supports a rejection of the null hypothesis.

4 RESOURCES

1. [Statistics: The Science of Decisions Project Instructions](#)
2. [Statistics: The Science of Decisions Project Rubric](#)
3. [Interactive Stroop Effect Experiment](#)
4. [Stroop Effect - Neuroscience for Kids](#)
5. [Central Tendency](#)
6. [Measure of Variability](#)
7. [GraphPad QuickCalcs](#)
8. [Confidence Level](#)
9. [What is Hypothesis Testing](#)