

# STROOP TASK ANALYSIS

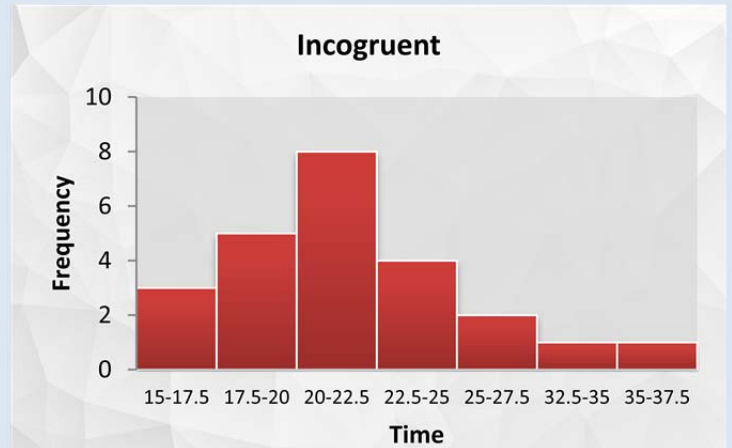
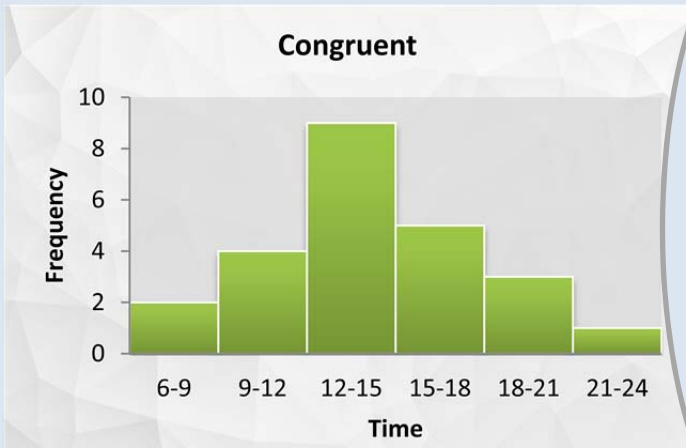
## Introduction

In a Stroop experiment, a participant is required to accomplish two tasks. In the first task, congruent, the participant is presented with a list of names of colors written in ink's color that matches the word's meaning. In the second task, incongruent, the participant is presented with another list of names of colors but written in ink's color that does not match the word's meaning. In each task, the time is recorded. In this project, I am going to see if the time required to complete the incongruent task is significantly larger than the time required to complete the congruent task.

## Descriptive Statistics

Congruent		Incongruent	
Mean	14.05	Mean	22.02
Median	14.36	Median	21.02
Mode	Bin 12-15	Mode	Bin 20-22.5
Minimum	8.63	Minimum	15.69
1 <sup>st</sup> Qtr	11.90	1 <sup>st</sup> Qtr	18.72
Median	14.36	Median	21.02
3 <sup>rd</sup> Qtr	16.20	3 <sup>rd</sup> Qtr	24.05
Maximum	22.33	Maximum	35.26
Standard Deviation	3.56	Standard Deviation	4.80
IQR	4.31	IQR	5.33
Lower Limit	5.44	Lower Limit	10.71
Upper Limit	22.66	Upper Limit	32.05

## Histograms



## Boxplots



## Summary

- In the congruent task, we notice that the mean of 14.05 and the median of 14.36 are about the same since the variable is almost normally distributed. However, in the incongruent task, the mean of 22.02 is slightly larger than the median of 21.02 since the distribution is slightly skewed to the right.
- By comparing the values to the upper and the lower limits, we don't seem to have outliers in the congruent task. However, in the incongruent task, we have two possible outliers, i.e., 34.29 and 35.26, which are larger than the upper limit of 32.05. However, other sophisticated methods might be required to test for outliers.

# Inferential Statistics

## Statistical Test and Hypothesis Statement

Intuitively, I believe that the time required to complete the incongruent task should be greater than the time required to complete the congruent task. In the congruent task, where the color matches the word, the brain needs less time to read the word, i.e., the matched color supports the process of reading the word. However, in the incongruent task, the brain identifies the color first, but since the word does not match the color, it will require extra time to come back and read the word, leading to more time to accomplish the task. Based on that, my hypothesis will be as follows:

**H<sub>0</sub>:** There is no difference in population means of response time under incongruent and congruent conditions

**H<sub>a</sub>:** Population mean of the response time under incongruent condition will be significantly larger than the response time under congruent condition

$$H_0: \mu_c = \mu_i$$

$$H_a: \mu_c < \mu_i$$

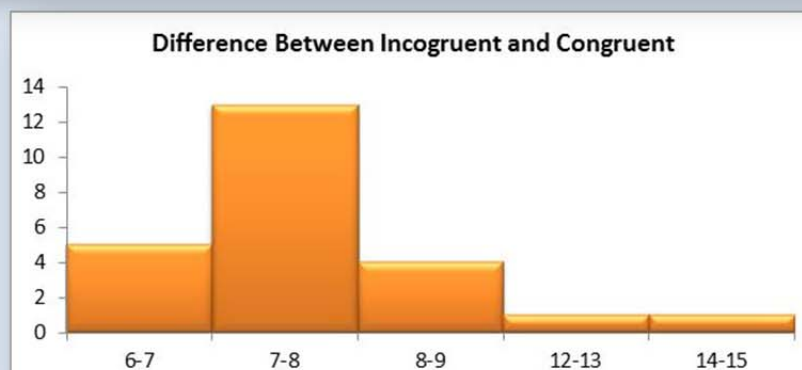
Where  $\mu_i$  is the hypothesized incongruent mean and  $\mu_c$  is the hypothesized congruent mean.

Since the time required to accomplish each task changes based on the type of task, the dependent variable is the time, and the treatment or the independent variable is the type of task whether congruent or incongruent.

Since we have paired or dependent samples, and our alternative hypothesis is testing whether the time required to complete the incongruent task is significantly larger than the time required to complete the congruent, I am going to use one-tailed, dependent t-test with  $\alpha=.05$  or confidence level=95%.

Before conducting the t-test, I believe that the assumptions for the paired t-test have been met as follows:

- 1- The dependent variable (time required to complete the task) is continuous.
- 2- Each participant was selected randomly from a defined population.
- 3- Each set (congruent, and incongruent) is linked to the population through repeated measurement.
- 4- The difference between the incongruent and congruent variables is normally distributed. Although the distribution is skewed to the right, this might be due to the small sample size.





## Calculations

Congruent (xi)	Incongruent (yi)	Difference (di)
8.63	15.69	7.06
8.987	17.39	8.41
9.401	17.43	8.02
9.564	17.51	7.95
10.639	17.96	7.32
11.344	18.64	7.30
12.079	18.74	6.66
12.13	19.28	7.15
12.238	20.33	8.09
12.369	20.43	8.06
12.944	20.76	7.82
14.233	20.88	6.65
14.48	21.16	6.68
14.669	21.21	6.55
14.692	22.06	7.37
15.073	22.16	7.09
15.298	22.80	7.51
16.004	23.89	7.89
16.791	24.52	7.73
16.929	24.57	7.64
18.2	25.14	6.94
18.495	26.28	7.79
19.71	34.29	14.58
22.328	35.26	12.93

Mean of the Difference	= 7.964792
Standard Deviation of the Difference	= 1.87264
Standard Error of the Mean Difference	= 0.382251
t stat	= 20.83655
DF	= 23
t critical	= 1.71387
p-value	= 9.88E-17

## Conclusion

After conducting the test, my results are as follows:

$$t(23)=20.84, \quad p=9.88E-17, \quad t_{critical}=1.71$$

Since  $t(23)=20.84$  while  $t_{critical}=1.71$ , and p-value is almost zero while  $\alpha=.05$ , it is clear that difference is not due to a chance. Therefore, we have a strong evidence to reject the null hypothesis and conclude that the time increase is due to the type of the treatment, which is the incongruent task.