P1: 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: What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform?

Null hypotheses: The average amount of time to complete incongruent word Set (μ_I) is not going to be significantly different than the average amount of time to complete congruent words set (μ_0) $\mu_0 = \mu_I$

Alternative hypotheses: The average amount of time to complete incongruent word Set (μ_I) is going to be significantly longer than the average amount of time to complete congruent words set (μ_0) $\mu_0 < \mu_I$

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:

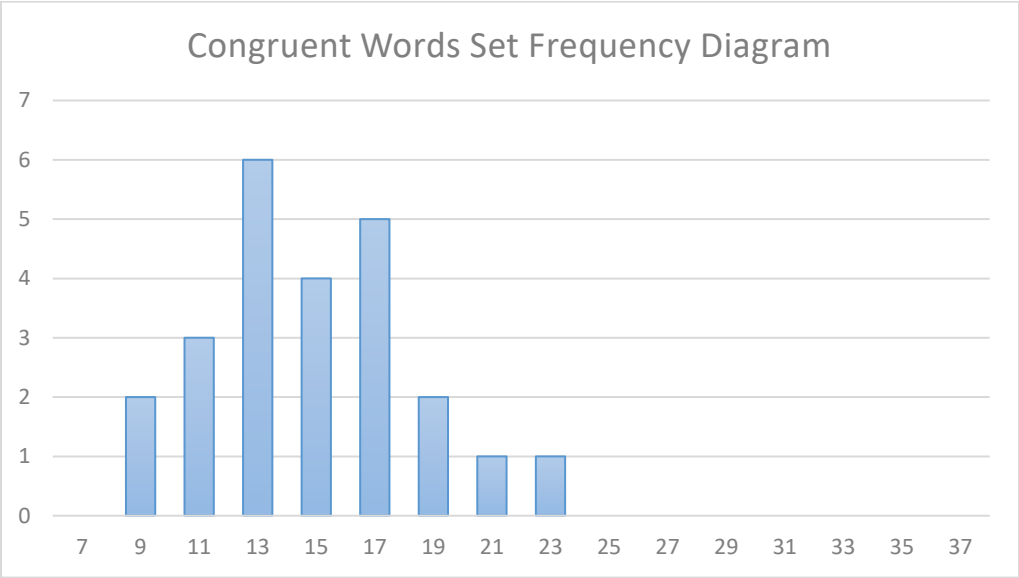
Min	8.63
Max	22.328
Average	14.05113
Standard Deviation	3.559358

Incongruent words set:

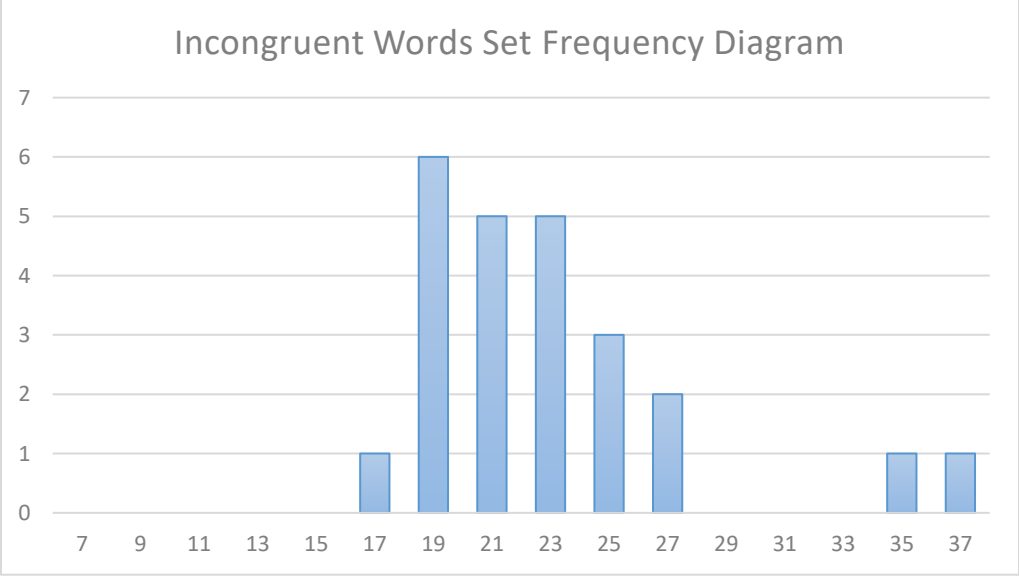
Min	15.687
Max	35.255
Average	22.01592
Standard Deviation	4.797057

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		R^2	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 R^2 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