

P1 Test a Perceptual Phenomenon

1. Independent variable

List of congruent and incongruent ink colored words

Dependent variable

Time taken to name the ink color of words

2. The hypotheses for this task is as follows:

$$H_0: \mu_c - \mu_i = 0$$

$$H_1: \mu_c - \mu_i \neq 0$$

where

μ_c = mean time taken to name the correct ink color for congruent words

μ_i = mean time taken to name the correct ink color for incongruent words

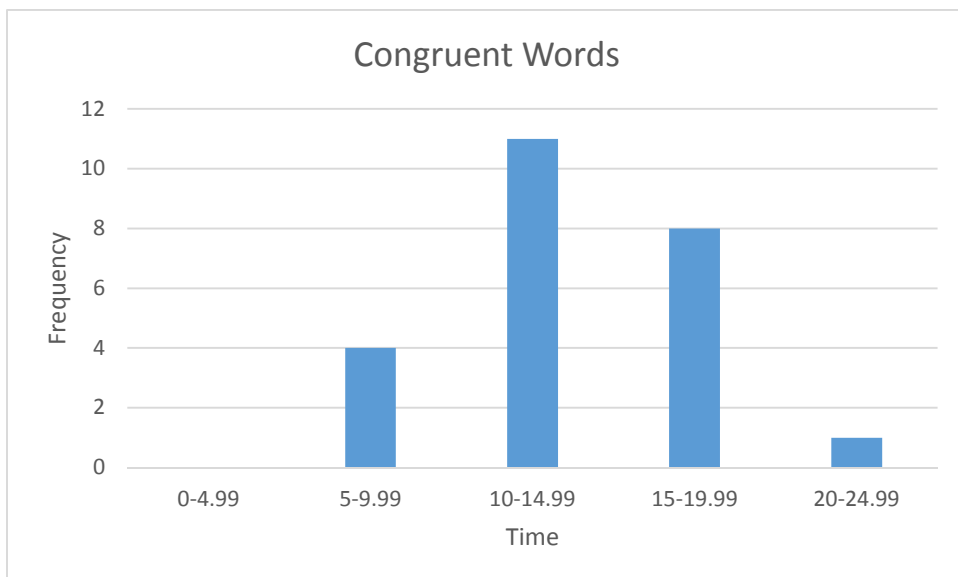
The statistical test performed is a dependent sample two tailed t-Test for the following reasons.

- The population parameters are not known, hence a z-test cannot be used.
- The test is carried out twice on the same sample or subject with two different conditions. First with the incongruent words and then with the incongruent words.
- The mean difference $\neq 0$, hence a two-tailed test is used.

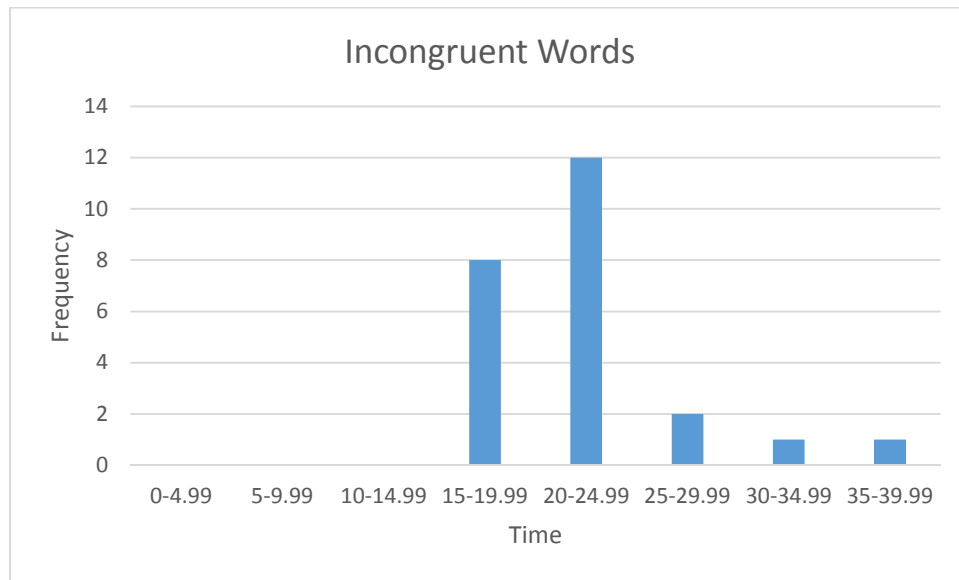
3.

	Congruent words	Incongruent words
Mean	14.051	22.016
Median	14.357	21.018
Variance	12.669	23.012
Standard Deviation	3.559	4.797

4.



This is a positive skewed distribution with 79.17% of the time taken falling between 10 and 19.99 seconds.



This is a positive skewed distribution with 83.33% of the time taken falling between 15 and 24.99 seconds.

The time taken to say the correct color increases with the incongruent words. It takes about 5 seconds longer.

5.

The mean difference $\mu_D = 22.016 - 14.051 = 7.965$
 $S_D = 4.865$

$$t\text{-statistic} = \frac{\mu_D}{\frac{S_D}{\sqrt{n}}} = \frac{7.965}{\frac{4.865}{\sqrt{24}}} = 8.021$$

At a 95% confidence level on the difference between the $\mu_c - \mu_i$ means or $\alpha = 0.05$ and a two tail test. t-critical value for tail probability of 0.025 and 23 degrees of freedom.

t-critical value = 2.069

Or $t(23) = 2.07$, p-value < 0.0001, two tailed test

The t-statistic is a lot greater than the t-critical value or statistically significant, hence we reject the null hypothesis H_0 .

The mean time to say an incongruent word on average is a lot greater than that to say a congruent word. Or the probability that the mean time to say an incongruent word correctly

does not differ significantly from the mean time to say a congruent word correctly is pretty much zero.

The confidence interval on the mean difference; 95% CI = (5.91, 10.02)

That is it takes between 5.910 and 10.019 seconds longer to say an incongruent word.

This results matches my expectations as it would take the brain a longer time to process the incongruent words.

6. One of the main reasons for the observed Stroop Effect is that it takes the brain longer to process colors than it does words. Hence there is some delay in saying the correct color for the incongruent words.¹

Another theory is the Automaticity model which states that reading is an automatic process and requires little effort. Naming colors by contrast is not automatic and requires more effort than reading words.²

A third theory is that the brain slows down when dealing with conflicting information. This is caused by interference due to competing functions in the brain.¹

If this can happen for colors then the same can be true for shapes and/or pictures if conflicting information is given.

A repeated measure experiment is designed with words of animals and the corresponding picture

The first measure will have the words of animals and corresponding pictures. E.g. the word bear and a picture of a bear.

The second measure would then have words of animals along with pictures of a different animals. E.g. the word bear and the picture of a lion.

The time taken to state the correct animal based on the picture in the second measure should increase from that of the first measure.

References

1. <http://www.wisegeek.org/what-is-the-stroop-effect.htm>
2. <http://www.rit.edu/cla/gssp400/sbackground.html>