

Project 1 Stroop Effect

Summary

A dataset containing experimental test results of the Stroop Effect was analysed. In psychology, the Stroop effect is a demonstration of interference in the reaction time of a task. By using statistics conclusions were drawn and commented on the test results.

Introduction

In a Stroop task, participants are presented with a list of words, with each word displayed in a color of ink. The participant's task is to say out loud the *color of the ink* in which the word is printed. The task has two conditions: a congruent words condition, and an incongruent words condition. In the *congruent words* condition, the words being displayed are color words whose names match the colors in. In the *incongruent words* condition, the words displayed are color words whose names do not match the colors in which they are printed.

Method

In each case, the time was measured it takes to name the ink colors in equally-sized lists. Each participant went through and recorded a time from each condition congruent and incongruent. The test results were recorded and made available to the author of this report for analysis.

This is a Dependent t-test for paired samples. It is a repeated measures design and measures the time taken to of two types of coloured words namely congruent (c) and Incongruent (i) The dataset consists of $n = 24$ entries. A t-score method is used as there are less than a sample size of 30 and the population standard deviation is unknown

The independent variable is an equal size lists of colour words.

The dependent variable is the the time in seconds (taken to name the colour words)

The null hypothesis is that there is no difference in time taken between congruent and incongruent words conditions. The alternative hypothesis is that there is a difference in time taken to name the words in the congruent and incongruent word lists.

Null Hypotheses $H_0: \mu_c = \mu_i$ The congruent population mean μ_c is equal to incongruent population mean μ_i

Alternative $H_A: \mu_c \neq \mu_i$ The congruent population mean is not equal to incongruent population mean

This is a two tailed test as we consider the alternative hypothesis can have time greater or less than the null hypothesis.

Analysis of data

The test results of congruent are summarized in Figure 1 below. The plot shows a histogram, and density plot of the test results. The mean value of the results was 14.05, with a standard deviation of 3.56. The first, second and third quartile is 12.67, 11.90 and 16.20 respectively. The IQR is 4.31. The test results of incongruent are summarized in Figure 2 below. The plot shows a histogram and density plot of the test results. The mean value of

the results was 22.02, with a standard deviation of 4.80. The first, second and third quartile are 18.72, 21.02 and 24.01 respectively. The IQR is 5.33

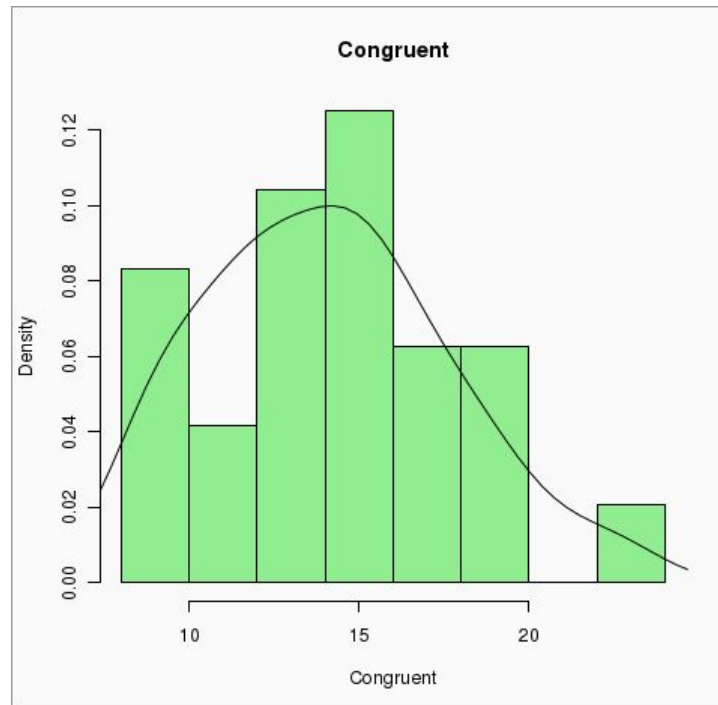


Figure 1 Distribution plot of Congruent test results

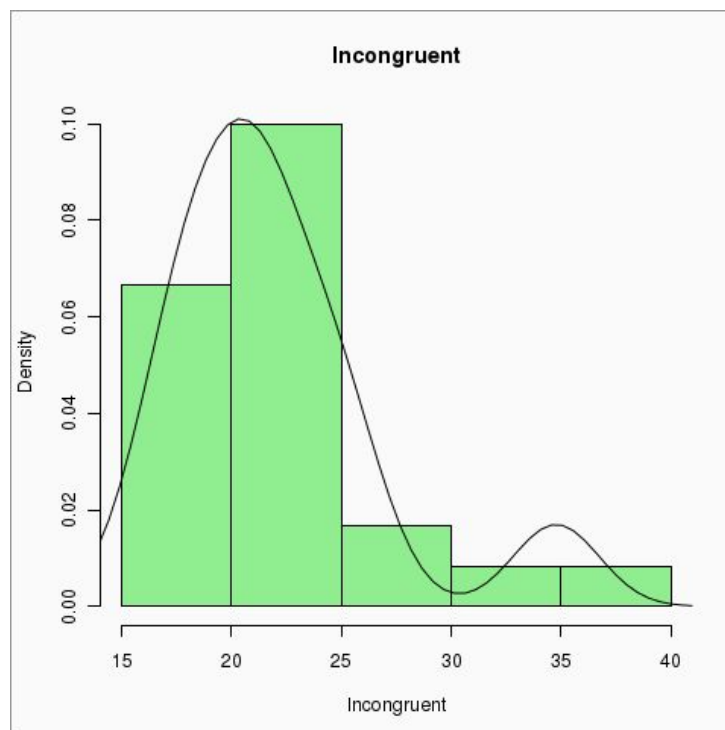


Figure 2 Distribution plot of incongruent test results

Comparing the results we can see that incongruent has a longer mean value indicating that the time taken on average for this test was considerably longer than congruent. These mean results indicate that the alternative hypotheses may be the correct choice. Figure 1 is more normally distributed than Figure 2, Figure 2 has a definite right skew, suggesting something other than random is occurring on the incongruent experimental tests.

Analysis

The mean value of the congruent result is $\bar{x}_c=14.05$, incongruent result is $\bar{x}_i=22.02$. The point estimate is $\bar{x}_c - \bar{x}_i = -7.97$. From the dataset the Sample deviation of differences (S) is 4.86. Assuming a critical value of $\alpha=0.05$. The t statistic value (t_{stat}) is:

$$t_{stat} = \frac{\mu_c - \mu_i}{s / \sqrt{n}} = -7.97 / (4.86 / \sqrt{24}) = -8.03$$

We use a two tailed test as the test results may be lower or higher than the null hypothesis. With an alpha level (α) of 0.05, and degrees of freedom = n-1 (23) from the t-table we obtain a t_{crit} value of ± 2.069 .

As the t_{stat} value is outside of the critical regions we reject the null.

Conclusions

The null hypothesis is rejected. The participants took significantly longer to carry out the incongruent task compared to the congruent. The format of the ink words on the incongruent test has a causal effect on the time taken to carry out the task. This was the expected result

Discussion

The most common theory for the Stroop Effect is Automaticity. This suggests that recognising colours is not an automatic process and there is hesitancy to respond whereas the brain automatically understands the meaning of words as a result of habitual reading. This may be a reason for the difference in results between congruent and incongruent. An extension of the test may be to warp the words used, so the words may be more difficult to read slowing down the brain's reaction and processing time.

References:

https://en.wikipedia.org/wiki/Stroop_effect
<https://faculty.washington.edu/chudler/java/ready.html>
<http://www.snre.umich.edu/eplab/demos/st0/stroopdesc.html>
<http://www.math.unt.edu/~tam/SelfTests/StroopEffects.html>