

## TESTING A PERCEPTUAL PHENOMENON

### word set experiment

In a [Stroop effect](#), participants are presented with a list of words, with each word displayed in a color of ink. The participant's task is to read out the color of the ink in which the word is printed.

The two conditions of the experiment are:

1. Congruent words condition

2. Incongruent words condition.

1. In the congruent words condition, the words given in table 1 have colors corresponding to their names, for example RED, BLUE.

2. In the incongruent words condition, the color of the words do not correspond to their name in table 2, for example GREEN, YELLOW.

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

#### **1) What is our independent variable? What is our dependent variable?**

Independent variable is whether the font name and colour are similar or different. The dependent variable is the reaction time between the stimulus and the response. So the hypothesis is that Reaction time between stimulus and response will be longer when the font name and colour are different

#### **2) What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.**

Hypothesis: There is a difference between the time used to recognize colors under congruent words condition and incongruent words condition, namely, the Stroop Effect is in existence. One hypothesis we can use is: there is a difference between the time used to recognize colors under congruent words condition and incongruent words condition, namely, the Stroop Effect is in existence.

We are referring to the population means of congruence words group and incongruence words group. The average times for the respective groups to recognize the colors are recorded. By comparing these means directly, we'll be able to tell whether there is a difference between the two groups' color recognition times. It is not possible to experiment with the whole world, so experiments are taken with respect to samples. In this case, the observation is the difference between the two groups' times. With this new data, we can construct new statistics such as means and standard errors.

We can use a two-sided paired student T-test to verify. This is because of three reasons. One, we need to address the uncertainty in sample standard error resulted from the unknown population standard deviation;

two, we are comparing the means of two groups that are dependent; three, the same subject is involved under both conditions.

Below is the hypothesis to test:

H0:  $\mu_{\text{diff}} = 0$  (The real difference between group population means is zero)

HA:  $\mu_{\text{diff}} \neq 0$  (The real difference between group population means is not zero)

### Characteristics:

Interval or ratio scale of measurement (approximately interval)

Random sampling from a defined population

Samples or sets of data used to produce the difference scores are linked in the population through repeated measurement, natural association, or matching

Scores are normally distributed in the population; difference scores are normally distributed

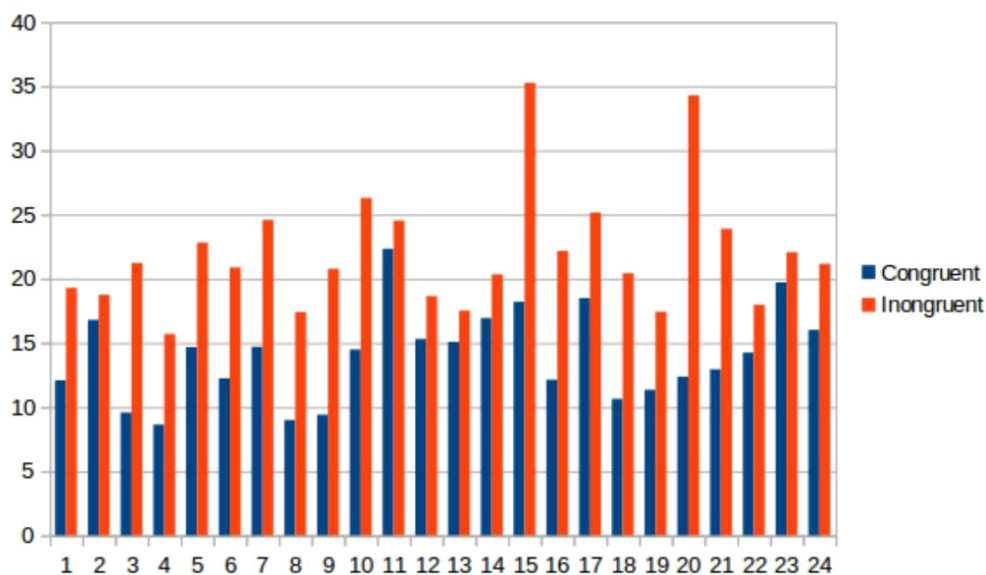
**3) Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.**

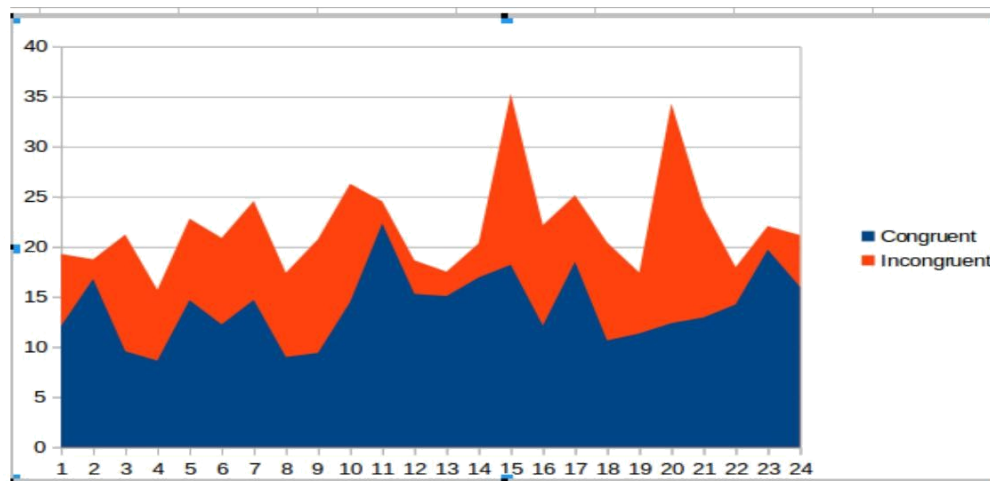
### Measure of Central tendency

Statistic	Congruent	Incongruent	Difference
N	24	24	24
$\bar{X}$	14.05	22.02	-7.96
Median	14.36	21.02	-7.67
SD <sup>2</sup>	12.67	23.01	23.67
SD	3.56	4.80	4.86
SE	0.73	0.98	0.99

**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.**

### VISUALIZATION OF DATA SETS





5) The above Two visualization is The Data analysis of Congruent and Incongruent data, with data in x-axis and frequency in y-axis shows that the Corresponding values of stroop effect data

Now, perform the statistical test and report your results. 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 expectation

#### Statistical Test

One Tailed t-test for 99% (  $\alpha$  )=

0.01 Degree Of Freedom = 23

Critical statistics(  $t_{crit}$  )=

-2.50 T - statistics (t) = -8.02

P-value = < .0001

Since the p-value is less than 0.0001, we reject the null hypothesis and conclude that the difference between congruence and incongruence group time difference is statistically significant, namely, the stroop effect is present. This is in line with my expectation. Based on the confidence intervals, we're 95% confident that the true difference between the congruence and incongruence group average times is between -10.0 and -5.9

6) What do you think is responsible for the effects observed? Can you think of an alternative or similar task that would result in a similar effect? Some research about the problem will be helpful for thinking about these two questions!

#### Conclusion and Decision

I think this effect is caused by the distraction resulted from the presence of the words and particularly, the wrongly labelled words. Since humans are so sensitive to words that there is already a "conditioned reflex" established. Therefore, whenever a word is present, eyes and brain will automatically capture and decipher them, which leads to a delay and a interference with the color recognition. As per Wikipedia, "Warped words" is a similar situation. A similar experiment involving hard to read words can be used to test the effect.

Thus from the above Statistical test we can conclude that Null Hypothesis ( $H_0$ ) should be rejected, Since the T-Statistics lies in the Critical region and Alternate Hypothesis( $H_a$ ) is Accepted.

#### Reference:

[Google sheets](#)

[Microsoft Excel](#)

[Wikipedia: Numerical Stroop effect](#)

[https://www.google.co.in/url?](https://www.google.co.in/url?sa=t&rct=j&q=&esrc=s&source=web&cd=2&cad=rja&uact=8&ved=0ahUKEwiB8r3h2qHWAhUKPI8KHxulAocQFggvMAE&url=https%3A%2F%2Fhelp.libreoffice.org%2FCommon%2FInserting_Charts&usg=AFQjCNE7cbwNY8ZT1bC1gia9qpXt3k-qVQ)

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**[Stroop effect – Wikipedia](#)**

**[Investopedia: Hypotheses Testing](#)**