Test Perceptual Phenomenon

STROOP EFFECT

Background Information¶

In psychology, the Stroop effect is a demonstration of interference in the reaction time of a task.

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 each case, we measure the time it takes to name the ink colors in equally-sized lists. Each participant will go through and record a time from each condition.

Congruent Words Condition In the congruent words condition, the words being displayed are color words whose names match the colors in which they are printed as shown:

Incongruent Words Condition In the incongruent words condition, the words displayed are color words whose names do not match the colors in which they are printed as shown:

DESCRIPTIVE STATISTICAL ANALYSIS OF STROOP EFFECT¶

Question 1. What is our independent variable? What is our dependent variable?

Independent variable: The color congruency is the independent variable

Dependent variable: The time taken to recognize color congruency

Question 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 are

Null Hypothesis – There is no significant difference in the reaction time of the two tests

Alternative Hypothesis – There is a significant increase in the reaction time from congruent to incongruent

Assumptions Made:

H_o: $\mu_{congruent} = \mu_{incongruent}$

H_A: $\mu_{congruent} < \mu_{incongruent}$

for alpha level 0.05

Paired One Tailed t- test in positive direction

degree of freedom df = 23

where, μ is the population mean time of response of the condition used as subscript.

μ_c = Population Mean from which Congruent Words test sample is derived

μ_i = Population Mean from which Incongruent Words test sample is derived

Why I choose this Hypothesis?

When the name of a color is printed in a color which is not denoted by the name, 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.

Statistical Test Performed

Paired One Tailed t- test in positive direction

This test is suitable because we are not aware of population parameters from which the sample has been taken. m Here direction is specified that significant increase in response time so positive directional One tailed t- test is used. Paired as we have 2 dependent samples. However, the difference of the two means is a normal distribution. As the distribution of population data is skewed according to central limit theorem distribution of it sample mean is continuous distribution, even if the parent population is not normal, the differences will tend towards normality as sample size increases.

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	Incongruent
12.079	19.278
16.791	18.741
9.564	21.214
8.63	15.687
14.669	22.803
12.238	20.878
14.692	24.572
8.987	17.394
9.401	20.762
14.48	26.282
22.328	24.524
15.298	18.644
15.073	17.51
16.929	20.33
18.2	35.255
12.13	22.158
18.495	25.139
10.639	20.429
11.344	17.425
12.369	34.288
12.944	23.894
14.233	17.96
19.71	22.058
16.004	21.157

sample size = 24

Sample mean:

Congruent: 14.05 Incongruent: 22.02

Median:

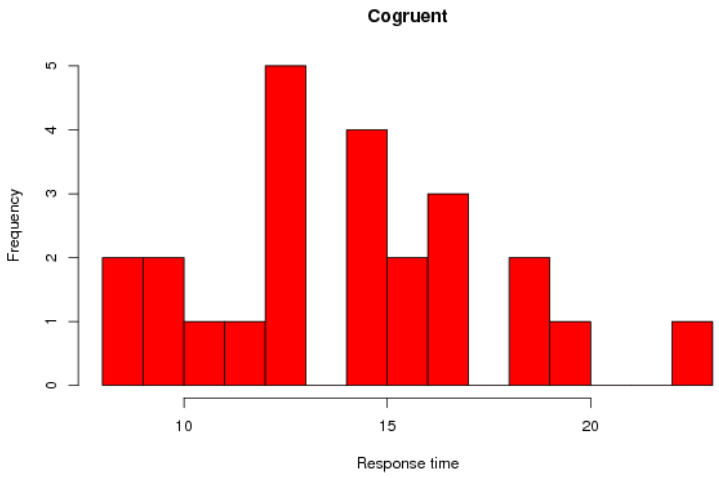
Congruent: 14.3565 Incongruent: 21.0175

standard. deviation:

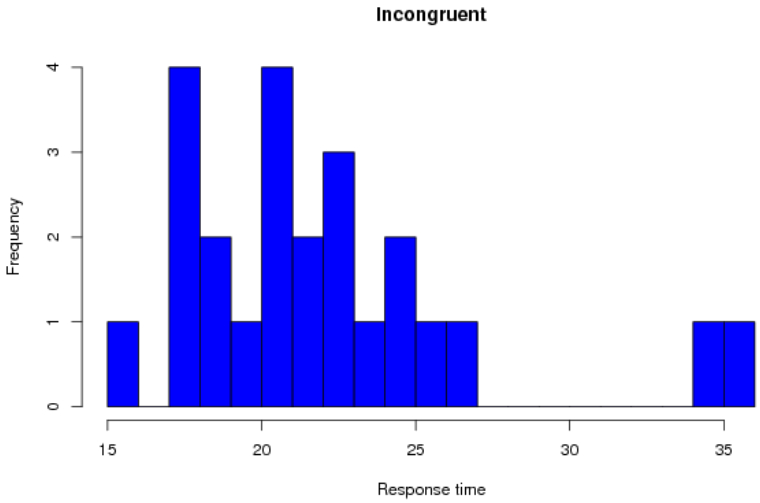
Congruent: 3.56 Incongruent: 4.80

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.

Histogram for Congruent Condition

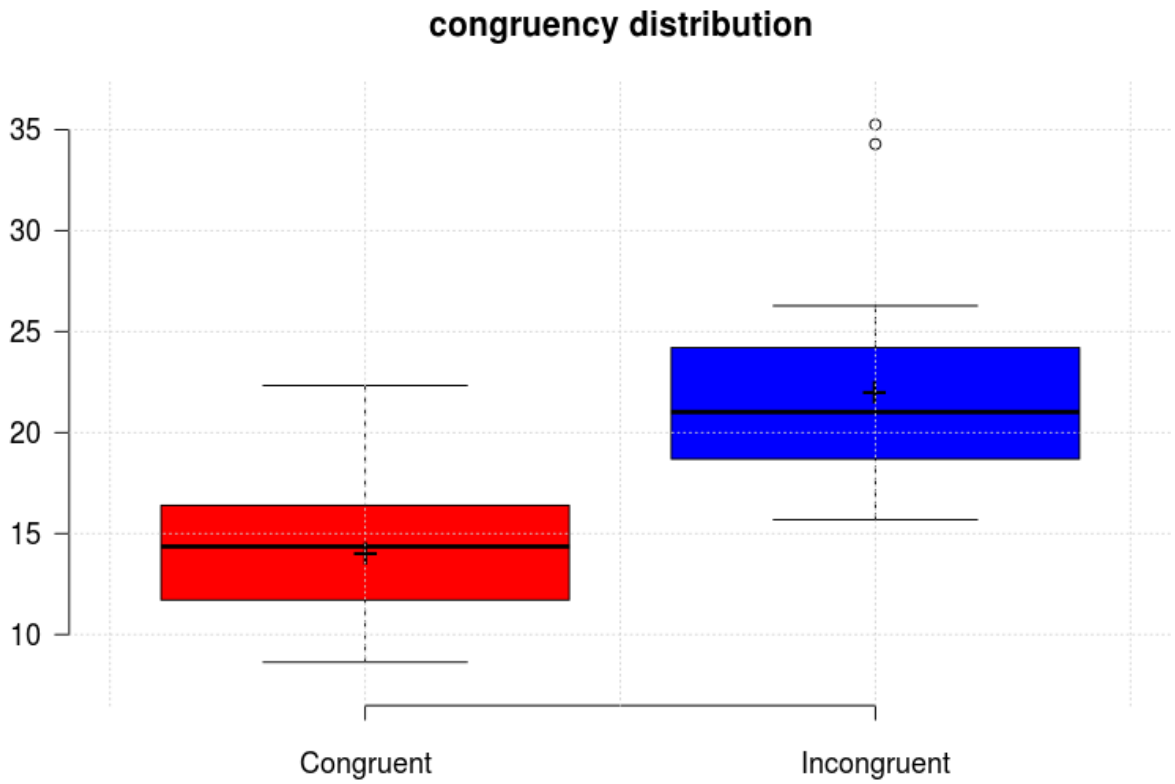


Histogram for Incongruent Condition



***As seen in above histograms, sample is somewhat distributed positively skewed. Therefore, median is better for measuring central tendency. There is long range difference in times of incongruent condition. As distribution is skewed we can't apply z-test so we will apply t-test.**

Box plot Distribution



Boxplot shows that the two conditions have significant difference in median times, and the two also have different ranges - with the Incongruent words group presenting much longer times, but congruent have much longer range of times. Moreover, as box is not in the middle of whiskers that shows that data is skewed

Question .5 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? Conclude in terms of the experiment task. Did the results match up with your expectations?

t = D/SE D = difference of mean = μ_i-μ_c = 22.02-14.05 = 7.97

SD diff of mean = $\sqrt{(\Sigma(x_i\text{-}y_i\text{-}D)^2/n\text{-}1)}$ = 4.86

SE = Standard Error = S.D of diff of mean/$\sqrt{n}$

= SD/$\sqrt{n}$ = 4.86/$\sqrt{24}$ = 0.99

n = sample size = 24

df = degree of freedom = 23

alpha level = 0.05

confidence level 95%

confidence interval (6.27, 9.66)

t-critical value = 1.714 : t-statistics = 8.05 approx : t statistics > t critical

***Therefore, we reject null hypothesis in favor of alternative hypothesis the value of p is < 0.0001. The result is significant at p < 0.05**

Conclusion

Results match my expectations

Question 6. Optional: 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!

It depends on our Brain functioning and speed how our brain process information. For some people they can observe things fast, so they can identify congruency in Stroop effect. When I did Stroop test my time of response is less than 4 secs in both conditions It also depends on the efficiency of field of view over data processed by the brain. Emotions and their respective emojis can result in similar effect.

References:

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