

P1:Test a Perceptual Phenomenon

Stroop test

In psychology, the Stroop effect is a demonstration of interference in the reaction time of a task. The task has two conditions: a congruent words condition, and an incongruent words condition. In each case the time it takes to name the ink colors in equally-sized lists is measured. Each participant will go through and record a time from each condition.

*In the congruent words condition, the words being displayed are color words whose names match the colors in which they are printed.

*In the incongruent words condition, the words displayed are color words whose names do not match the colors in which they are printed.

Here, the number of participants=24

Stroop Effect

YELLOW BLUE ORANGE
BLACK RED GREEN
PURPLE YELLOW RED
ORANGE GREEN BLUE
BLUE RED PURPLE
YELLOW RED GREEN

1.What is your independent variable? What is your dependent variable?

The dependent variable is the time required by participants to read the written color names of the words or the reaction time in seconds

The independent variable is whether the font name and the color name are same or 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.

Hypotheses:

H_0 : There is no significant difference between the population parameters of the congruent and incongruent conditions

H_A : There is significant difference between the population parameters of the congruent and incongruent conditions

Let μ_c be the population mean under congruent condition

Let μ_{ic} be the population mean under incongruent condition

Then,

$H_0: \mu_c - \mu_{ic} = 0$ (Null hypothesis)

$H_A: \mu_c \neq \mu_{ic}$ (Alternative hypothesis)

Statistical test used: Two-tailed test for dependent samples

This test is used because of the following reasons:

- The samples are dependent
- Since we do not know μ and σ , we cannot use z-test
- Here, we are not interested in knowing the direction of the treatment effect i.e., whether the reaction times of each condition is either greater than or less than the other. We only want to know if there is a significant difference under both conditions. So we can use a two-tailed test

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

Descriptive statistics for congruent condition

| Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
|------|---------|--------|-------|---------|-------|
| 8.63 | 11.90 | 14.36 | 14.05 | 16.20 | 22.33 |

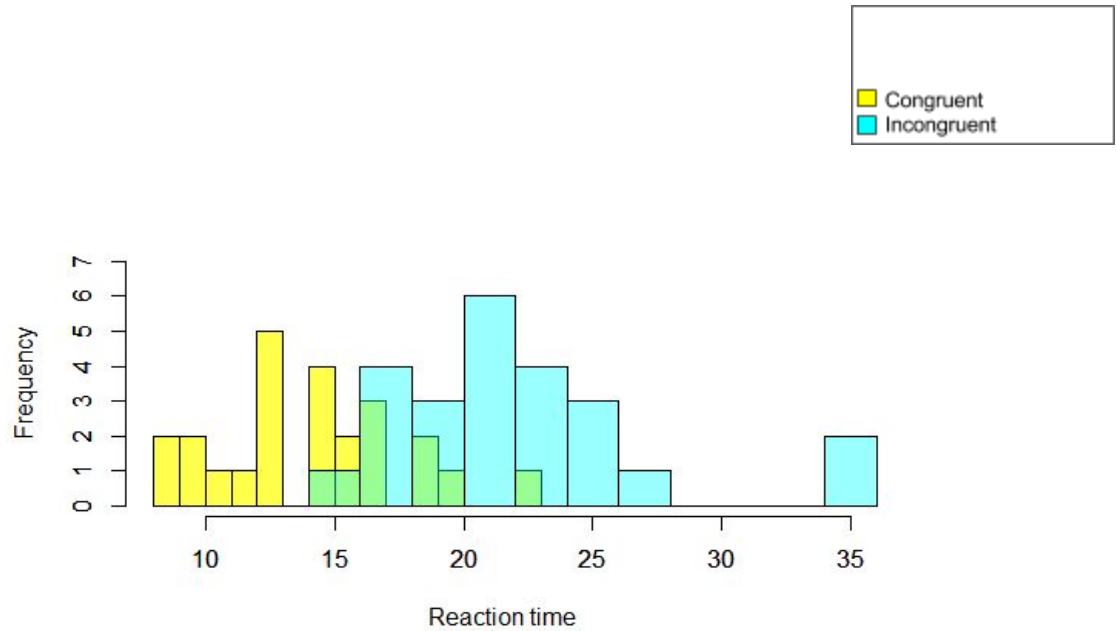
Standard deviation=3.559

Descriptive statistics for incongruent condition

| Min. | 1st Qu. | Median | Mean | 3rd Qu. | Max. |
|-------|---------|--------|-------|---------|-------|
| 15.69 | 18.72 | 21.02 | 22.02 | 24.05 | 35.26 |

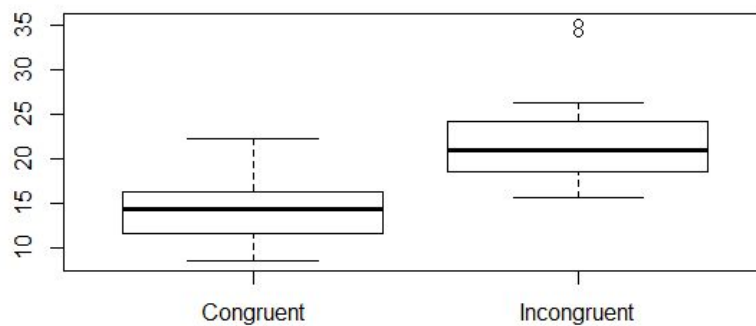
Standard deviation=4.797

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.



Observation:

- The reaction time of most participants under congruent word condition is between 13-15 s
- The reaction time of majority of participants under incongruent words condition is between 20-25s



Observation

- The median reaction times under congruent condition is significantly lower than under incongruent condition

5. Statistical test and results

Using t-test function in R, the following results are obtained for $\alpha=0.05$:

$t(23)=-8.0207$

p-value = .00000004103, two-tailed

Confidence interval on mean difference; 95% CI = (-10.019028, -5.910555)

Results

Since $t\text{-statistic}=8.027 > t\text{-critical}=2.069$, there is enough evidence to reject the null hypothesis. Therefore, there is a significant difference in the response times under congruent and incongruent conditions.

Reflection

The results matched up to my expectations since I myself took the test and found out that the reaction time is greater under incongruent words condition and also the visualisations strengthened my intuition.