

STROOP EFFECT

In psychology, the Stroop effect is a demonstration of interference in the reaction time of a task. When the name of a color (e.g., “blue”, “green”, or “red”) is printed in a color that is not denoted by the name (e.g., the word “red” printed in blue ink instead of red ink), 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.

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

Independent variable: Colour and congruency of Words

Dependent variable: Time taken to complete each test

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

Null Hypothesis and Alternative Hypothesis would be appropriate for this task.

Null Hypothesis (H₀): There is no significant difference in the population average amount of time to state the colors in a congruent or incongruent condition.

Alternative Hypothesis (H_A): The population average amount of time for incongruent condition will be different from congruent condition.

H₀: $\mu_1 = \mu_2$

H_A: $\mu_1 \neq \mu_2$

We will use one tail t-test because the Population mean and standard deviation is not known and data contains the paired sets of participants who have been tested repeatedly under different conditions.

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

```
data <- read.csv('stroopdata.csv')
str(data)

## 'data.frame':    24 obs. of  2 variables:
## $ Congruent : num  12.08 16.79 9.56 8.63 14.67 ...
## $ Incongruent: num  19.3 18.7 21.2 15.7 22.8 ...

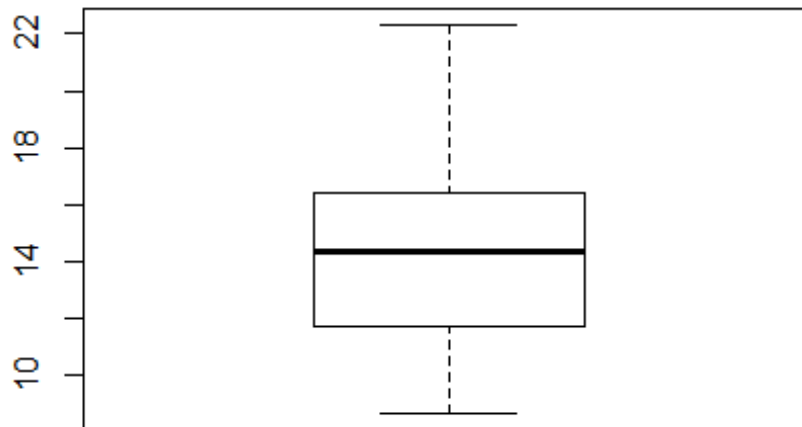
summary(data)

##      Congruent      Incongruent
## Min.   : 8.63    Min.   :15.69
## 1st Qu.:11.90    1st Qu.:18.72
## Median :14.36    Median :21.02
## Mean   :14.05    Mean   :22.02
```

```
## 3rd Qu.:16.20 3rd Qu.:24.05  
## Max. :22.33 Max. :35.26
```

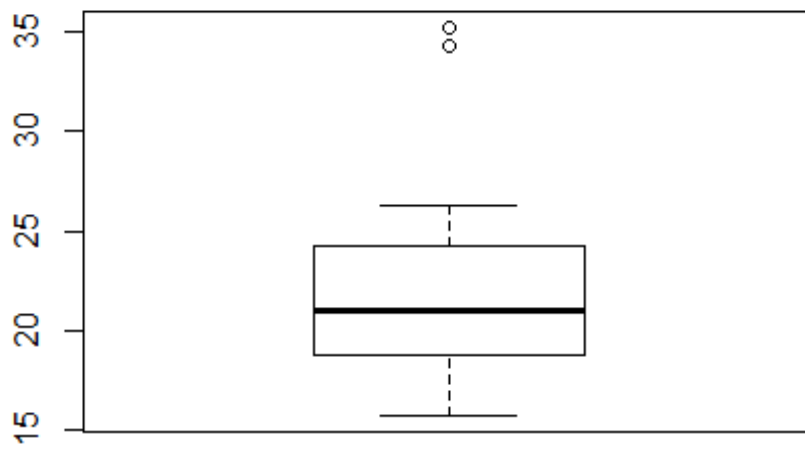
4. Provide one or two visualizations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.

```
boxplot(data$Congruent)
```

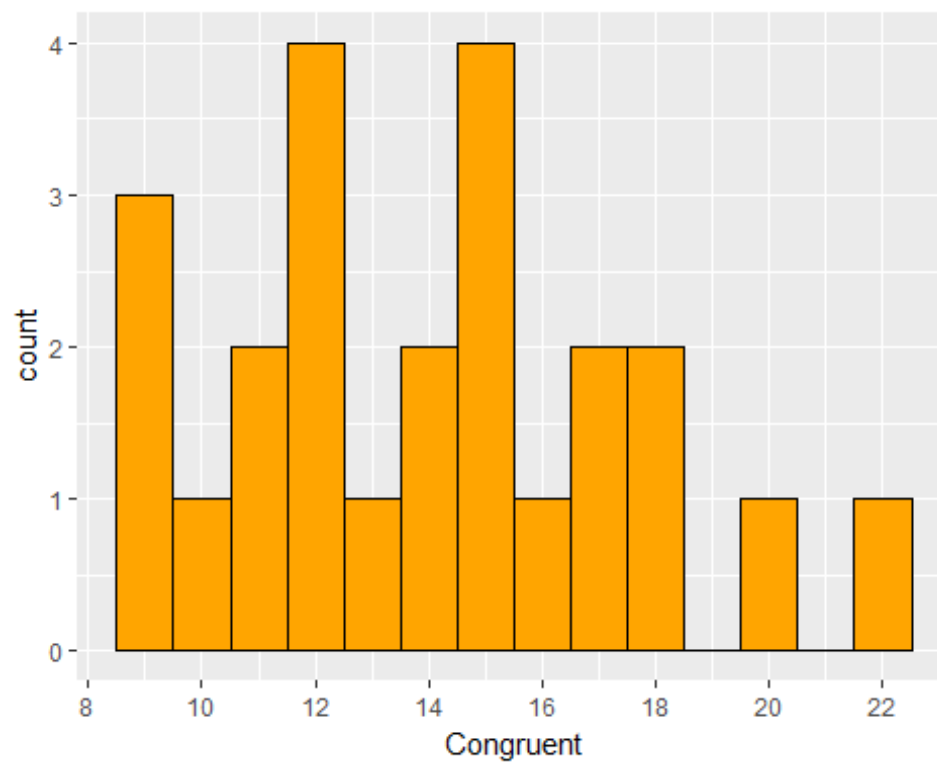


```
boxplot(data$Incongruent)
```

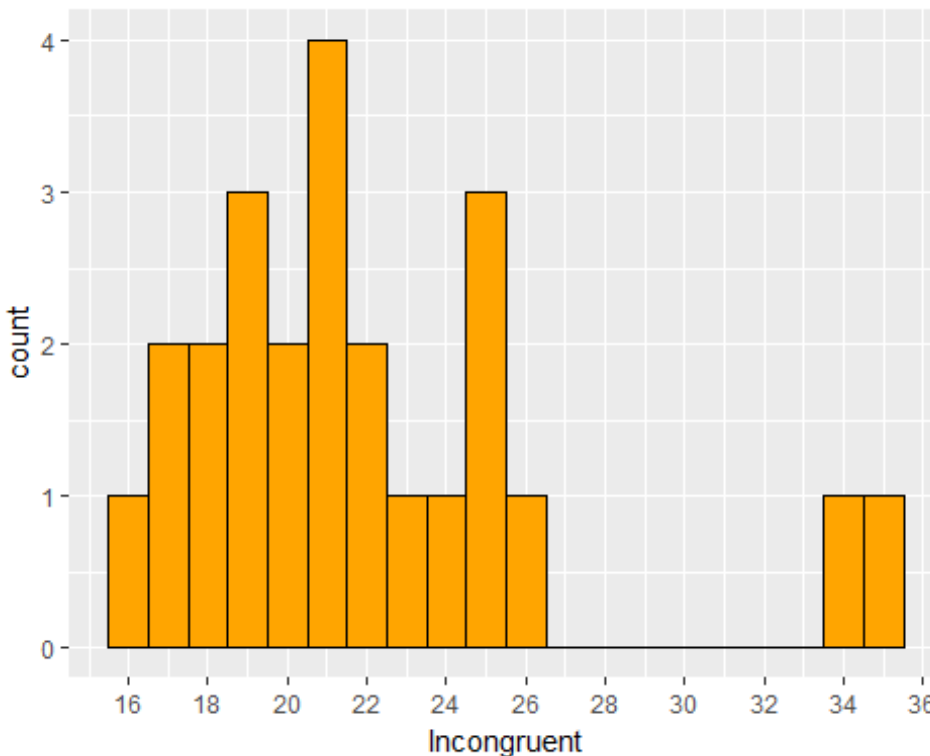
```
library(ggplot2)
```



```
ggplot(aes(x = Congruent), data = data)+  
  geom_histogram(color = I('black'), fill = I('orange'), binwidth = 1)+  
  scale_x_continuous(breaks = seq(8,24,2))
```



```
ggplot(aes(x = Incongruent), data = data)+
  geom_histogram(color = I('black'), fill = I('orange'), binwidth = 1)+
  scale_x_continuous(breaks = seq(14,36,2))
```



In Boxplot of Incongruent, We can see that there are couple of outliers which is effecting the skewness.

In the histogram, the graph of Congruent seems bimodal and Incongruent looks Postively skewed.

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? Come to a conclusion in terms of the experiment task. Did the results match up with your expectations?

The mean difference is 7.97

standard deviation (S) is 4.86

Standard Error = $s/\sqrt{n} = 4.86/\sqrt{24} = 0.99$

t-statistic = mean difference/Standard Error = $7.97/0.99 = 8.04$

Degree of freedom = $n - 1 = 24 - 1 = 23$

t-critical value at alpha level of 0.05 with degree of freedom 23 is 1.71.

As the t-statistic value which is 8.04 is far greater than the critical value 1.71, we can reject the null hypothesis.

We can conclude that time taken to complete the incongruent task is significantly greater than completing the congruent.

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

I think that as in the first test, the users have to only focus on the one thing either the colour or name. They know that both colour and name would be same, so they can quickly rectify from either the name or colour. But in the second test they have been used to this kind of easy detection that it gets a bit difficult task for them to recognize from the discrepancy between the name and colour.

For the alternative task, we could ask first the users to listen to the words with no noise and write them down. Second time, same the words would be played in different order with other sounds and noises. This would produce the same effect as in this the user first had to focus only on one thing and the other time they have to tackle different type of sounds or noises to rectify the words and jot it down.