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

Here the independent variable is whether the word name and font color are same or different. (Same color and word, different color and word). The dependent variable is the average reaction time to name the word's color.

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: The mean time to recognize congruent words is equal to or greater than the mean time to recognize incongruent words.

Alternate Hypothesis: The mean time to recognize congruent words is less than the mean time to recognize incongruent words.

$H_0$: $\mu C \geq \mu I$

$H_A$: $\mu C < \mu I$

Where $\mu$ is a population mean, the subscript "C" represents the congruent words condition, and the subscript "I" represents the incongruent words condition.

As we choose to prove that there is enough evidence to reject the null hypothesis, t-test is used as the population variance is not known and the size of the sample is less than 30 (24 here) so we assume the data is normally distributed.

So, we choose a one tailed t-test.

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

| Statistic | Congruent | Incongruent | Difference (C-I) |
|---|---|---|---|
| n | 24 | 24 | |
| x̄ | 14.05 | 22.02 | -7.96 |
| Median | 14.36 | 21.02 | -7.67 |
| Variance | 12.67 | 23.01 | 23.67 |
| Standard Deviation | 3.56 | 4.80 | 4.86 |
| Standard Error | 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.**



Congruent v Incongruent
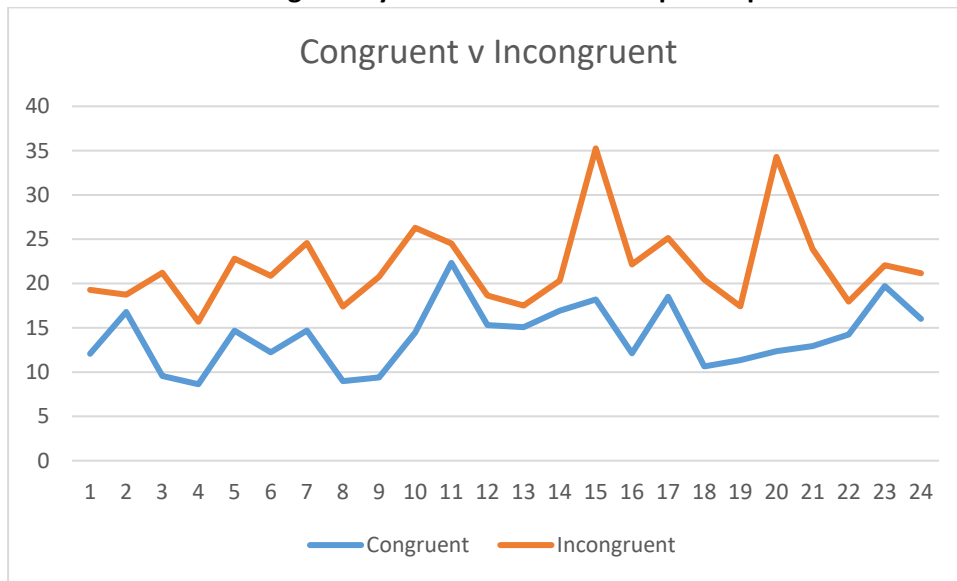
Observing this we can say that all participants took longer to answer when tested on the incongruent data set. The range of incongruent words in 12 seconds to 36 seconds whereas congruent words in 8 seconds to 24 seconds, so there is a noticeable difference in the time taken to recognise incongruent words.
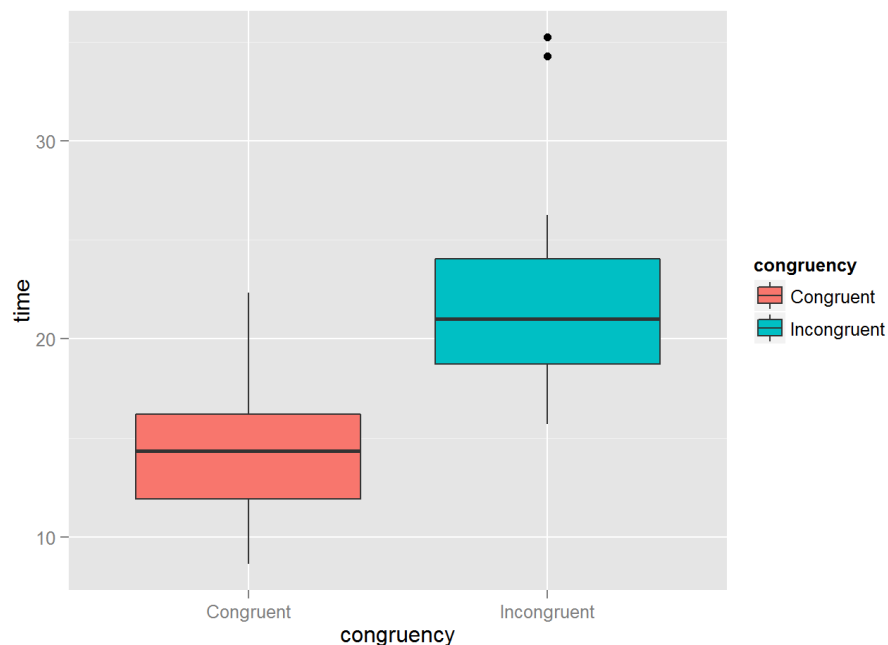


The box plot shows the difference in median time between the two conditions. Here we see the incongruent words take much longer time.

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?**

At 95% confidence interval α=0.05

μ Difference: -7.9648

Standard Deviation difference = 4.86

Degrees of freedom df= 23

t statistical value  t=−8.02

t critical value =  -2.069; 2.0689

p value = 0.00084536582 (2.52 e-08)

95% Confidence Interval: (-25.3527231, 9.42314)

As the p value is less than 0.05 we reject our null hypothesis, so we conclude that we ware 95% confident that it takes longer time to read incongruent words than congruent words. Yes, the results matched up my expectations, I spent much more time under incongruent words.

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 the brain naturally concentrates on the word than color when observing a coloured word. To observe color we have to concentrate and verify the word also here and this takes time, so it takes longer time to recognize incongruent words.

**Sources**
- **Numerical_Stroop_effect wiki**
- **t-table.pdf**