A: What is our independent variable? What is our dependent variable?

The independent variable is two conditions, one is congruent condition and another one is incongruent condition. The dependent variable is the time to recognize the word measured by the scientist.

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

The null hypothesis (H_0*) for this task is that the population mean (*μ_C*) of reaction time in congruent condition is equal to the population mean (*μ_I*) of reaction time in incongruent condition. The alternative hypothesis (*H_1*) states that the population mean (*μ_C*) of reaction time in congruent condition is different than the population mean (*μ_I*) of reaction time in incongruent condition.*

H_0: $\mu_C = \mu_I$

H_1: $\mu_C \neq \mu_I$

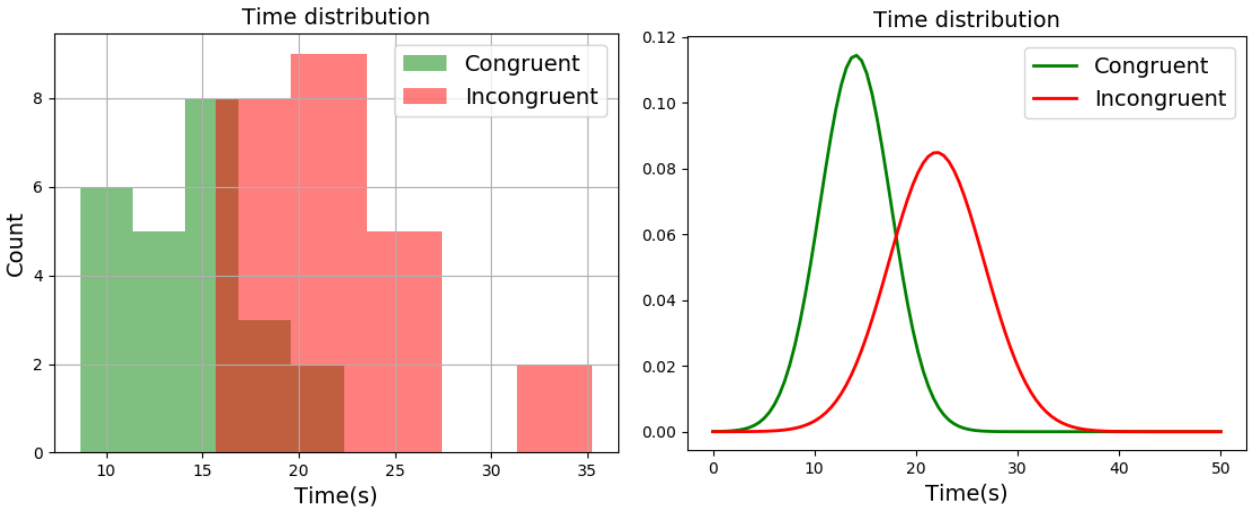
It should be T test. The first, the sample size is 24, which is less than 30. Besides that, there has an unknown population standard deviation. We also need to assume the distribution is close to Gaussian, without skewed distribution.

I am choosing a paired t-test (dependent samples t-*tests), which involves one group of people which has been tested twice.*

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

The mean data for congruent and incongruent condition is 14.05 and 22.02, respectively. So the average time for congruent group is less than incongruent group. Besides that, the std deviation for congruent and incongruent condition is 3.56 and 4.80, respectively, which means the variability for incongruent group is large than the congruent group.

D: 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.



From the graph, it is clearly demonstrated that the mean and std deviation for congruent and incongruent group.

E: 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 confidence level is 95%. Since there has 24 data points, which mean the degree of freedom is 23. Thus the t-critical value is ± 2.069. Since the value (±8.02) I got is much high than t-critical value, so I reject the null hypothesis. The conclusion is that the population mean (μC) of reaction time in congruent condition is different than the population mean (μI) of reaction time in incongruent condition.

F: 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!

The reason is that the color match with the word would help human recognize the work more quickly. Another reason would be the sequence. We can assume that the participant take part in the congruent task and incongruent task in a sequence. In this way, the participant status change after the first task, which would influence the second task result and cause such error in the final result. The way to fix this problem is to choose two groups of people, while one group perform the congruent task and another group perform the congruent task. In this way, the final result would be more reliable. Because the participants is independent, which will not have any side effect on the final results.