Background Information

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 the congruent words condition, the words being displayed are color words whose names match the colors in which they are printed: for example RED, BLUE. In the incongruent words condition, the words displayed are color words whose names do not match the colors in which they are printed: for example PURPLE, ORANGE. 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.

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

Independent variable: the type of the word, incongruent or congruent

Dependent variable: the time it takes to name the ink colors

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

In this test, we use sample data to predict population parameters. The two sample data can be used to predict the average response time. We use d to represent the different between pairs of data, then $\bar{d}$ = mean of these differences.

Average of congruent : a_c Average of incongruent : a_i Mean of difference: $a_c - a_i = \bar{d}$

$H_0 : \bar{d} = 0$

$H_1: \bar{d} < 0$

I plan to use paired two sample t-test to analyze the data (one tailed test). I choose this statistical test because we have two related group in this experiment, one is the people read congruent, the other one is the same people read incongruent word. And also assume the data is normal distribution. The sample size 24 is less than 30. I choose to do one-tailed test because the reasonable hypotheses is incongruent will increase the time.

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
Mean	14.051125	22.01591667
Standard Error	0.726550901	0.979195185
Median	14.3565	21.0175
Standard Deviation	3.559357958	4.797057122
Sample Variance	12.66902907	23.01175704
Range	13.698	19.568
Minimum	8.63	15.687
Maximum	22.328	35.255
Sum	337.227	528.382

Count	24	24
Confidence Level (95.0%)	1.50298505	2.025619571

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 Distribution

Incongruent Distribution
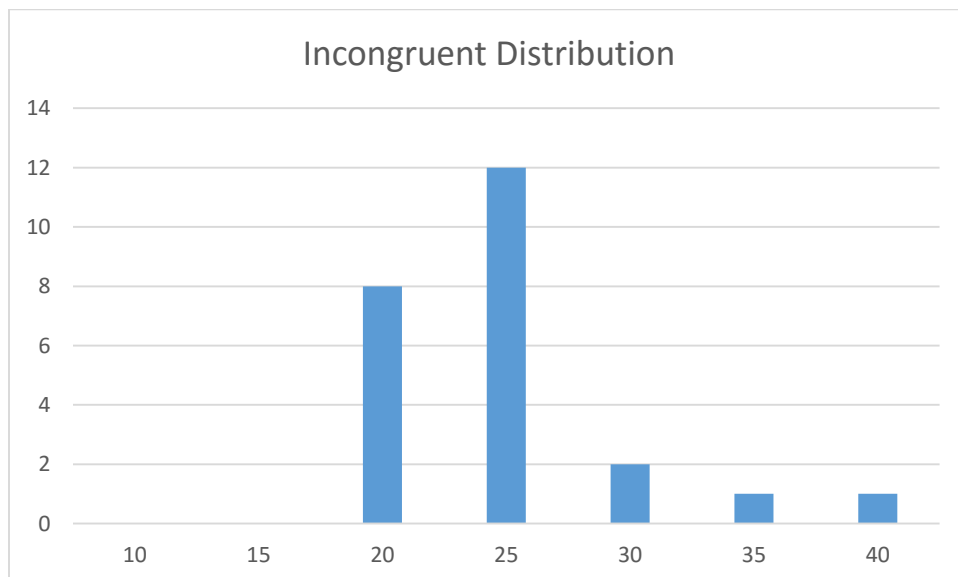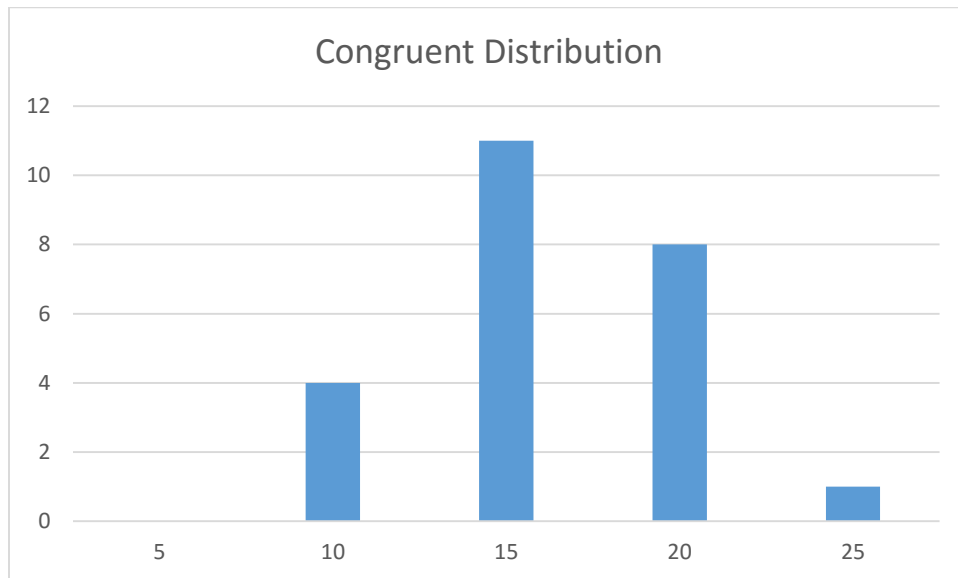
The two datasets distribution is non-symmetric. The congruent has a peak at 15 and incongruent at 25. There is also a cluster from 30-40 for the incongruent.

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?

My confidence level is 0.05. Based on the below table, we reject the null and can conclude that the incongruent will increase the time for people to read ink color. It match my exception.

All the statistical value is in the below table.   (One tailed test)

t-Test: Paired Two Sample for Means		
	Congruent	*Incongruent*
Mean	14.051125	22.01591667
Variance	12.66902907	23.01175704
Observations	24	24
Pearson Correlation	0.942168514	
Hypothesized Mean Difference	0	
df	23	
t Stat	**wrong-20.864**	
P(T<=t) one-tail	9.87841E-17	
t Critical one-tail	1.713871528	

The new answer for t -stat is -8.22. Here is the step :[mean(congruent)-mean(incongruent)]/standard deviation(congruent-incongruent)/squre_root(24) =-7.97/(4.76/4.9)=-8.22

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

Probably because the incongruent made people more confuse and need more time to response. I think made the word smaller may cause a smaller effect.