Statistics: The Science of Decisions Project Instructions

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.

Questions For Investigation

As a general note, be sure to keep a record of any resources that you use or refer to in the creation of your project. You will need to report your sources as part of the project submission.
1.
What is our independent variable? Which test was taken - congruent or incongruent.
What is our dependent variable? Time it takes to name the ink colors in the respective equal sized list.
2. 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 is that there will be no change between the time it takes the average person to take either type of test, congruent and incongruent. So in mathematical terms
H_0 (null hypothesis): $\mu = \mu_I$
H_a (alternative hypothesis): $\mu < \mu_I$

The alternative hypothesis is that it will take long for subjects to complete the incongruent test.

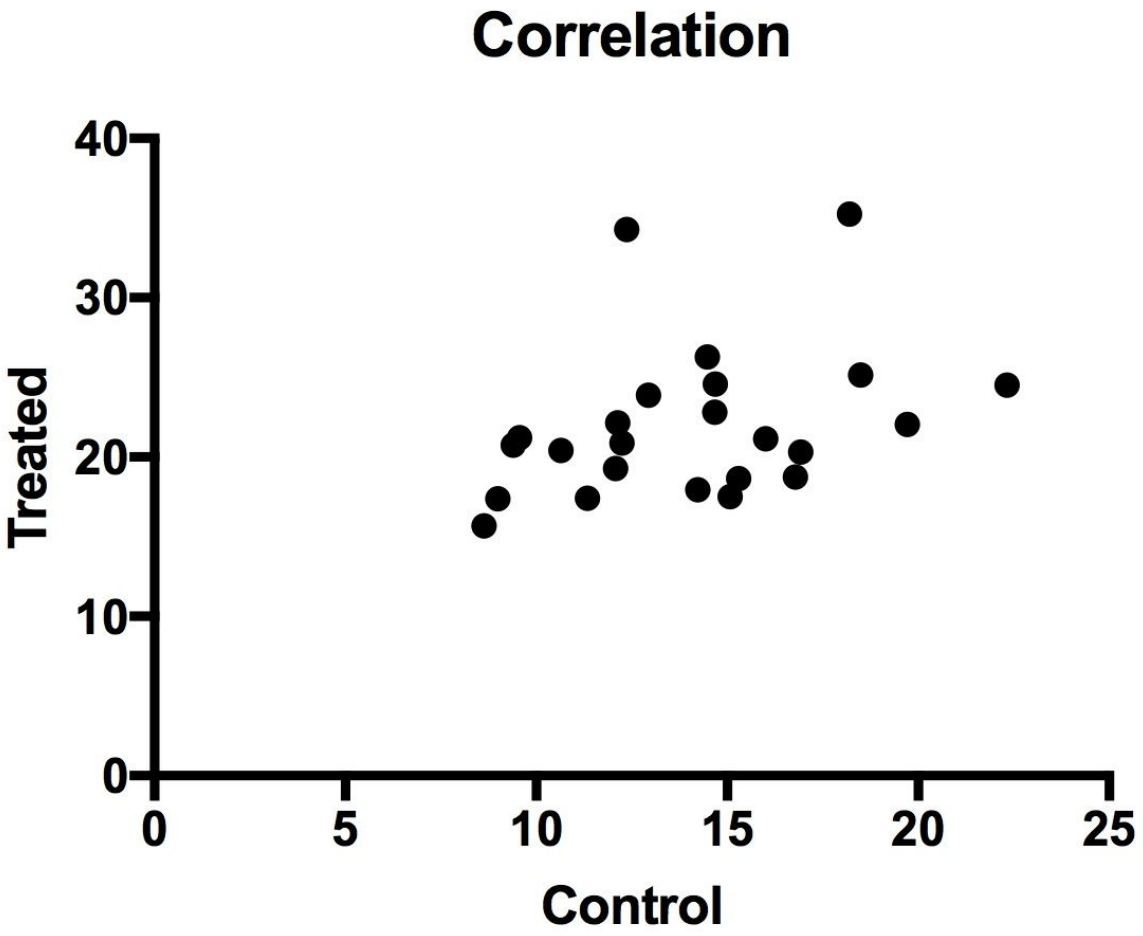
I will be conducting a one tailed paired t-test in the positive direction because I am expecting an increase time after the treatment and the samples are dependent - making them paired samples. I will be looking for t statistic values larger than the t critical value for a 95% confidence one tail test. I will be doing the same for the p-value. I will be looking at Cohen's d and r^2 values to determine how different the means are from each other in the case of Cohen's

d. And, in the case of r^2 how much of the difference in means is explained by the independent variable.

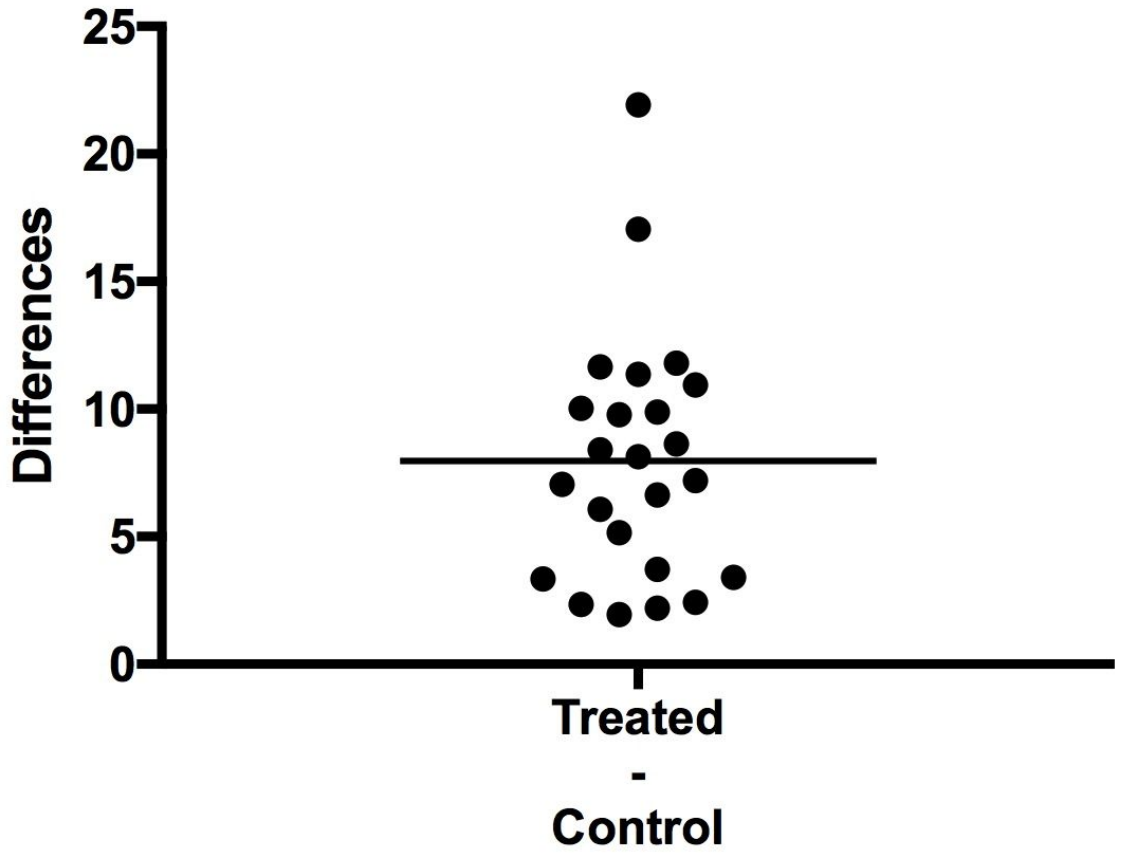
3. Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

	Control	Treated	Treated - Control
Number of values	24	24	24
Minimum	8.63	15.69	1.95
25% Percentile	11.53	18.67	3.483
Median	14.36	21.02	7.667
75% Percentile	16.59	24.37	10.72
Maximum	22.33	35.26	21.92
Mean	14.05	22.02	7.965
Std. Deviation	3.559	4.797	4.865
Std. Error of Mean	0.7266	0.9792	0.993
Lower 95% CI	12.55	19.99	5.911
Upper 95% CI	15.55	24.04	10.02

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.



The graph above shows the correlation between the congruent and incongruent reading times.



The graph above shows the normalized distribution of all mean differences. We see the line in the middle which represents the fact that most differences lie above the mean with a few much higher than the mean. This shows how the treated (ie incongruent tests) affected the average time of reading the list - (ie it made it longer and put more mean differences high on the y axis).

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?

Test result

Table Analyzed	Paired t test data
Column B	Treated
vs.	vs.
Column A	Control

Paired t test	
P value	<0.0001
P value summary	****
Significantly different (P < 0.05)?	Yes
One- or two-tailed P value?	One-tailed
t, df	t=8.021 df=23
Number of pairs	24
How big is the difference?	
Mean of differences	7.965
SD of differences	4.865
SEM of differences	0.993
95% confidence interval	5.911 to 10.02
R squared (partial eta squared)	0.7366
How effective was the pairing?	
Correlation coefficient (r)	0.3518
P value (one tailed)	0.0459
Was the pairing significantly effective?	Yes

This tells us that the mean of the treated group fell inside the critical area of for a 1 tailed P value less than .05. Additionally, we see from the R^2 that 73.66% of the change seen between tests was a result of the independent variable (ie which test). Additionally, the t statistic was much higher than the t- critical score.

For the t-critical test, the value was 1.714 for the one tail, and the t statistic for the data was 8.021 so it was far into the critical reason showing the the change in the test type from congruent to incongruent increased the time it took to complete reading the list to the confidence of at least 95%.

Cohen's d for this data is 1.64 which show that there is a high correlation between the two data set's means.

Based on the above explained tests, we reject the null hypothesis. In plain words, taking the incongruent test caused the average person in the sample to take longer reading the list.

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!

It probably has to do with the amount of information your brain has to processes at once. So, you are sorting two lists at once when you do the incongruent test. You could ask someone to read you a list of simple equations like 2+3 = , 3+1 =, 2+2= ect then ask them to go down the list again but this time to just tell you the totals. I think this test would measure other factors so you would want to control for that for instance, you could measure their ability to do simple equations and control for that once you ask them to do this test.