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? What is our dependent variable?

     -Our independent variable is the words condition (colour of the ink). Our dependant variable is the time it takes to name the ink colours in the equally 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.

     -H(null) : the mean difference (μ_D) <= 0.
H(alt) : the mean difference (μ_D) > 0
Where : $x_d = x_i - x_c$
I expect to perform a one tailed t-test in the positive direction.
The justification for the choices is I and hypothesizing that the application of the condition will cause the mean time to increase and not decrease.

Now it's your chance to try out the Stroop task for yourself. Go to this link, which has a Java-based applet for performing the Stroop task. Record the times that you received on

the task (you do not need to submit your times to the site.) Now, download [this dataset](#) which contains results from a number of participants in the task. Each row of the dataset contains the performance for one participant, with the first number their results on the congruent task and the second number their performance on the incongruent task.

3. Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.
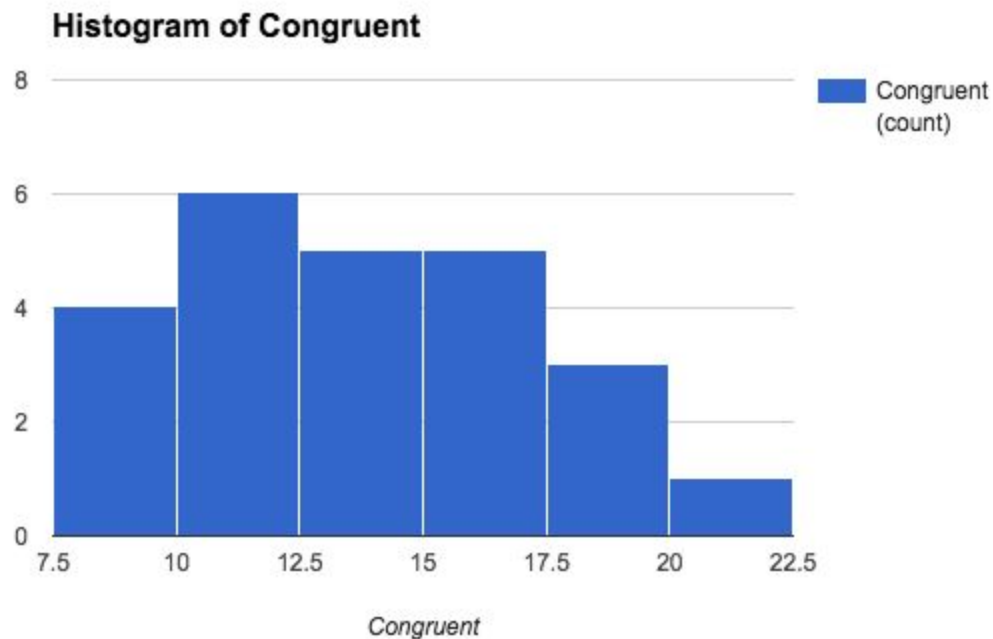
- c = congruent, i = incongruent, d = differences
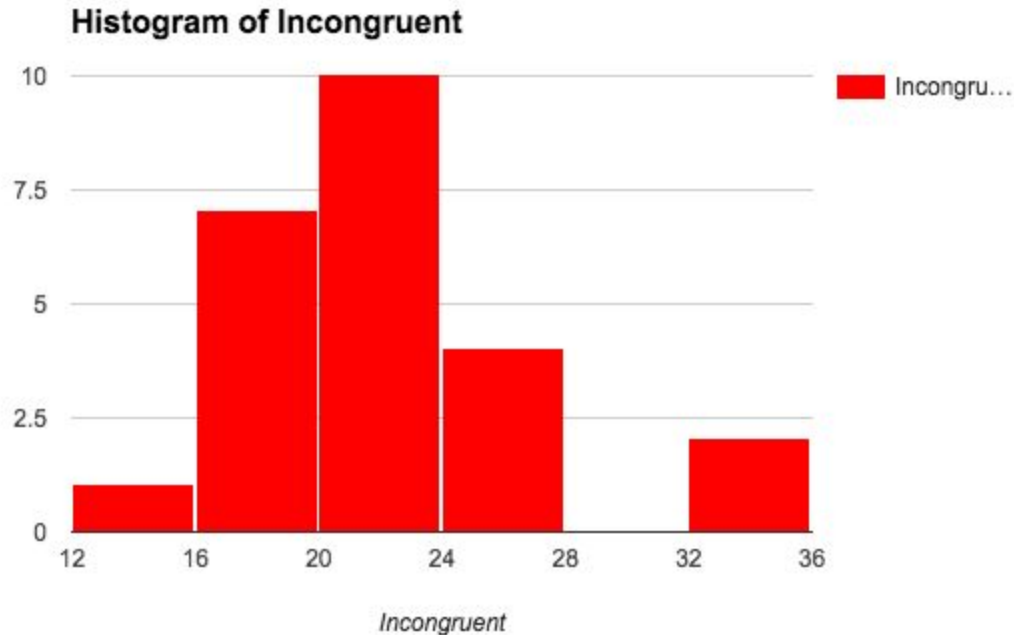- $\overline{x_c} = 14.05$, $n_c = 24$, $S_c = 3.56$
- $\overline{x_i} = 22.02$, $n_i = 24$, $S_i = 4.8$
- $\overline{x_d} = 7.96$, $n_d = 24$, $S_d = 4.86$

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.

Histogram of Congruent

-One observation from the plot of the congruent data is it appears to be normally distributed.

Histogram of Incongruent

Incongruent

-One observation from the plot of the incongruent data is it appears to be normally distributed.

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?

- $\alpha = .05$, $t_{critical} = 1.714$
- $t = (22.02 - 14.05)/(4.86/\sqrt{24}) = 8.03$

- Because our t value is greater than our critical value and subsequently $p < \alpha$, we reject the null hypothesis. The conclusion here is that the application of the treatment has caused the mean time to go up. This matches my expectations given the theory behind and my results of the stroop test.

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!

-Given some research, my understanding is that the effects observed are due to how the brain process different types of information. I think a similar task that could have a similar effect is having a bunch of random colour names in a group written in different coloured fonts. A

subject could then count the number of occurrences of the matching word or matching ink colour. (Source: https://en.wikipedia.org/wiki/Stroop_effect)