

UDACITY - P1 - STROOP TASK

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

- a. Independent Variable - type of word / color pairing condition
 - i. congruent (same name / color) or
 - ii. incongruent (different name / color)
- b. Dependent Variable - response time, measured in time it takes to name the ink colors in equally-sized lists of words with name / color pairing

2. What is an appropriate set of hypotheses for this task?

The data set contains sample response time measurements for two different types of tasks performed by a participant. Each participant takes a congruent test and an incongruent test. We want to find out if, in general, the response times of the sample slow down under incongruent test relative to the congruent test. I will use the results from the sample to draw conclusions about the impact on response times in general on the population (all people).

First I'll define the difference between the two sample response times

$$\begin{aligned}x_1 &= \text{response time of congruent task} \\x_2 &= \text{response time of incongruent task} \\d &= x_1 - x_2 = \text{difference in response time}\end{aligned}$$

Null Hypothesis: (there will be no difference in the response times between the two tasks) ->
 $H_0: \mu_d \geq 0$ or $\mu_1 - \mu_2 \geq 0$ (where μ is the population mean)

Alternative Hypothesis: (there will be a significant increase in response times between the two tasks) -> $H_a: \mu_d < 0$ or $\mu_1 - \mu_2 < 0$

This is a one-sided test. If the difference between the sample means is a large negative result, then the null hypothesis will be rejected.

a. What kind of statistical test do you expect to perform? Justify your choices.

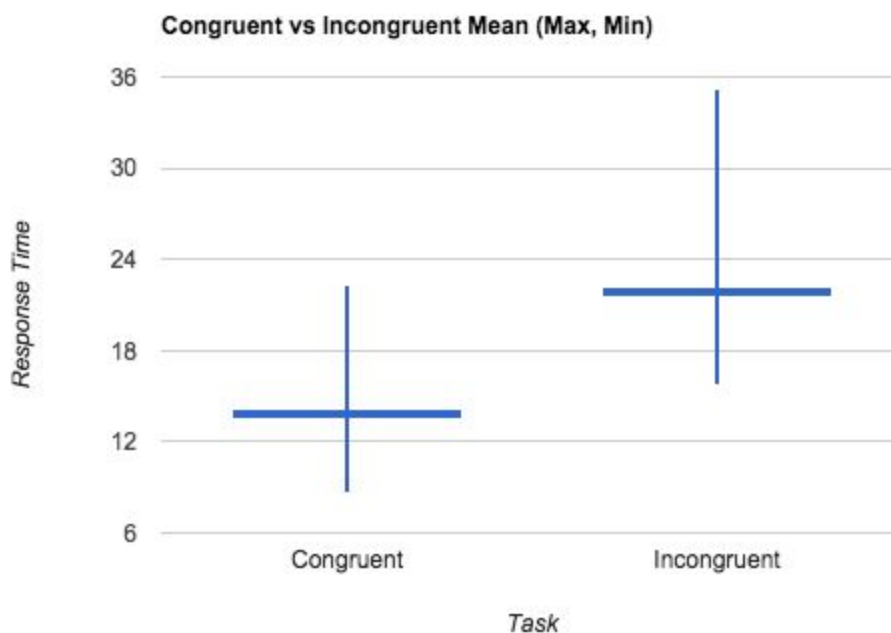
Because our sample size of $n = 24$ is less than ($<$) 30 we have to use a t-distribution.

I will use a paired means t-test. A paired t-test is used to compare the difference between two population means where the observations in one sample can be paired with observations in the other sample. In the Stroop Task we are comparing response times from the two different task conditions on the same participants. This type of test is also referred to as a repeated measures t-test

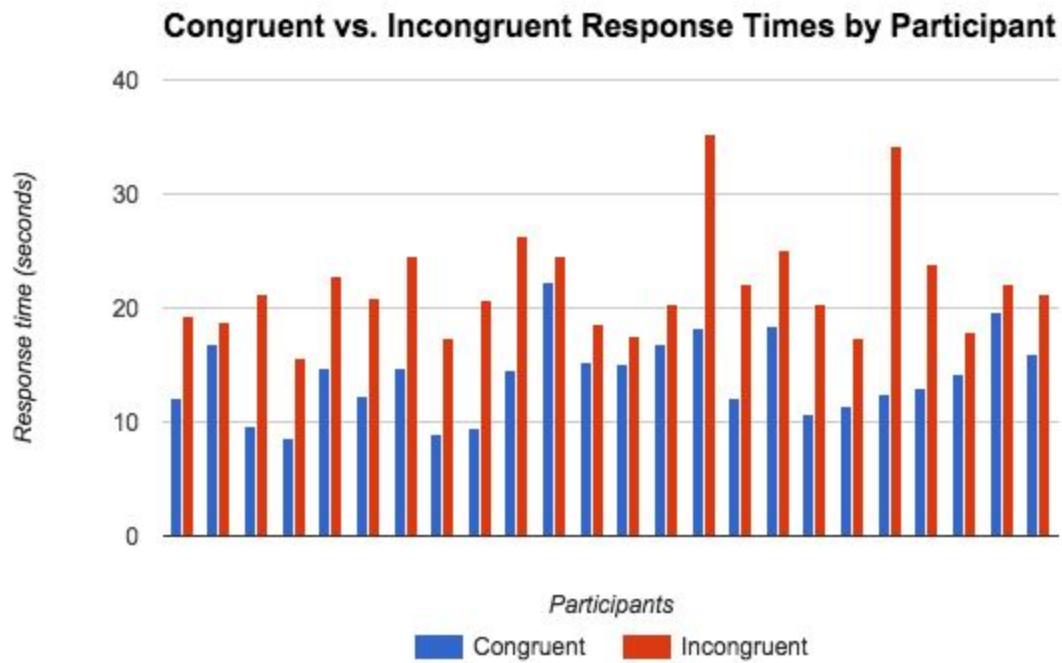
3. Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

Congruent	Incongruent	
24	24	n
14.051	22.016	mean
14.357	21.018	median
23	23	df
291.388	529.270	SS
12.141	22.053	variance
3.559	4.797	stev - samp
0.711	0.959	std error

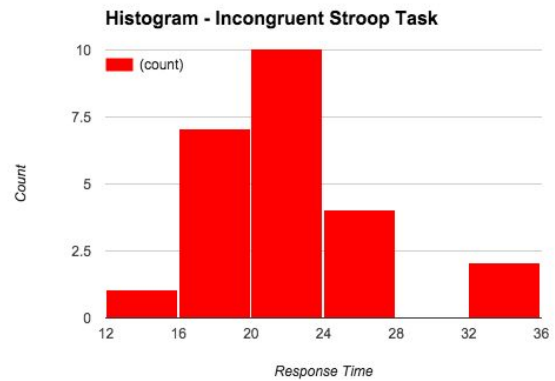
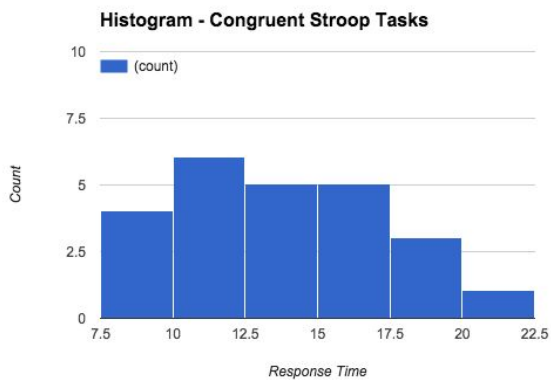
4. Provide one or two visualizations that show the distribution of the sample data. Write one or two sentences noting what you observe about the plot or plots.
- a. Below is a candlestick chart that compares Mean, Max & Min for the Congruent vs Incongruent samples. You'll observe that congruent test results in faster response times vs the incongruent test. In addition the the congruent test has a tighter distribution than the incongruent test.



Another way to see the response times is to view them grouped by participant (below). You'll observe that for all of the participants in the sample the response time for the congruent task (blue) is faster than the incongruent task (red).



- b. Below are sextile histograms for the two tests. We observe the congruent test is more evenly distributed than the incongruent test which has a higher concentration of response times in the second and third sextiles.



5. Now, perform the statistical test and report your results.

- a. What is your confidence level and your critical statistic value?
 - i. confidence level 95% or $\alpha = 0.05$, t-critical = - 1.714
 - ii. t-statistic = -8.021, df = 23, $p < 0.001$
- b. Do you reject the null hypothesis or fail to reject it?
 - i. reject the null
- c. Come to a conclusion in terms of the experiment task.
 - i. The sample mean difference in response time for a congruent task vs. an incongruent task is extremely statistically significant. In general, we can conclude that the population of people will take a significantly longer time to process the mix match of name / color in the incongruent task vs. the congruent task.
- d. Did the results match up with your expectations?
 - i. Yes. The candlestick chart and the set the expectation that the incongruent task response times would be slower than the congruent task

6. Optional:

- a. What do you think is responsible for the effects observed?
 - i. People recognize words as symbols first. Layering on a different color on a named color word and asking a person to respond to the color instead of the name slows them down.
- b. Can you think of an alternative or similar task that would result in a similar effect?
 - i. Number in place of color. Dog dog would be Two -> One one one would be Three
<https://faculty.washington.edu/chudler/java/readyn.html>

Resources (some included above):

<http://www.graphpad.com/quickcalcs/pValue1/>

<http://www.kon.org/urc/v11/rusch.html>

<http://www.biostathandbook.com/testchoice.html>

<http://stattrek.com/hypothesis-test/paired-means.aspx?Tutorial=AP>

http://www.unt.edu/rss/class/Jon/ISSS_SC/Module008/issm_m8_introttests/node3.html