

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

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

The independent variables are the congruent and incongruent words because they are the conditions the researchers used as inputs. The dependent variable is time because it is changing and different for every person.

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_0 : There is no difference in completion time between population means of incongruent and congruent conditions ($\mu_c = \mu_i$).

H_1 : There is a difference in completion time between population means of incongruent and congruent conditions ($\mu_c \neq \mu_i$).

I would expect to perform a two-tailed paired t-test because the sample size is less than 30 and the samples are dependent. This will tell me if the results of the paired observations are statistically significant.

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.

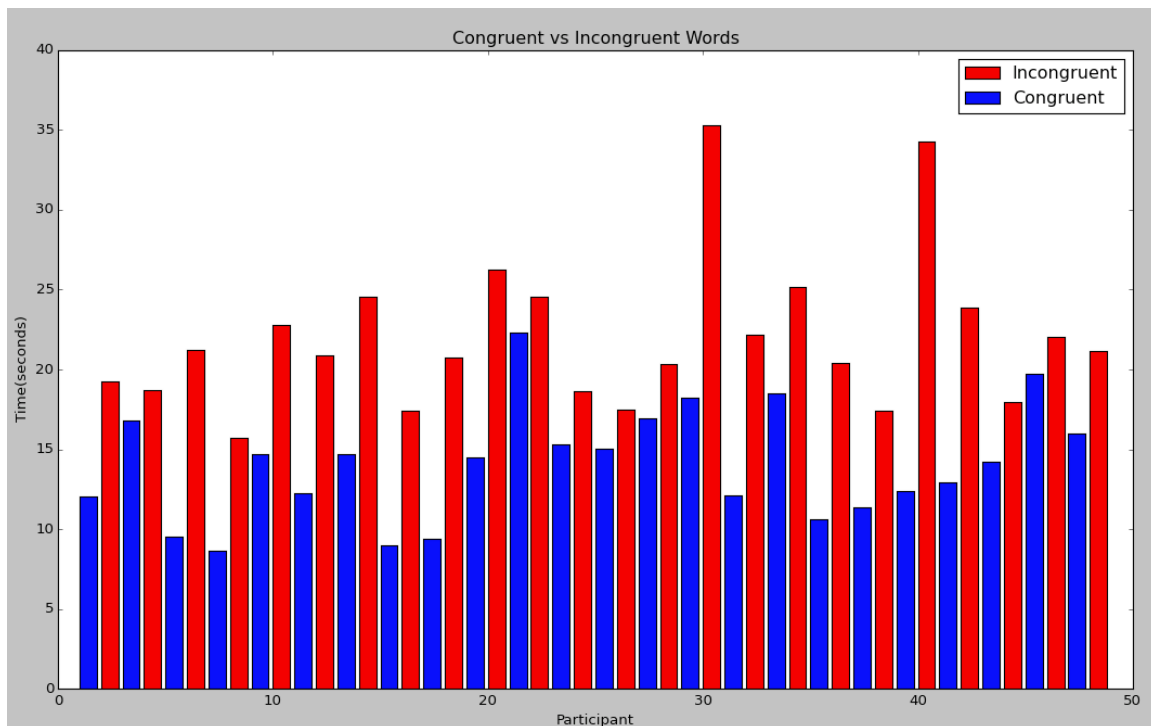
My values for the Stroop task for congruent: 12.928 seconds and incongruent: 29.652 seconds.

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	14.05	22.02
Median	14.36	21.02
Standard Deviation	3.56	4.80
Standard Error	0.99	0.99

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.

Observing the plot below it can be determined that incongruent words take a longer time to say out loud compared to congruent ones because every participant took a longer time. It can also be seen on individual lines that just because a participant took the longest time on one, does not mean they took the longest time on the other. For example, participants 14 and 19 had the highest peaks for incongruent but they did not have the highest peaks for congruent words.



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?

$$t = (\mu_1 - \mu_2) / (s / \sqrt{n})$$

STD of population = 4.86
 $14.05 - 22.02 / (4.86 / \sqrt{24})$

T-Statistic = +8.03
P-Value < 0.0001 (for 23 DF)
T-Critical = +2.807
Confidence level = 99%.

I reject the null hypothesis because the T-Statistic is less than the critical value of -2.807 (the rejection area) with a 99% confidence. I would accept there is a difference in the sample means and population means, which is not due to chance. The results matched up with my expectations that the populations are different. If the sample size was larger we could test if the values were significant for larger populations. We might have the participant read the words rather than the colors and see if that has the same effect.

Sources

<http://www.csun.edu/~amarenco/Fcs%20682/When%20to%20use%20what%20test.pdf>

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