

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?

independent variable: color of the word

dependent variable: Time to name the color of the word

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

Appropriate set of hypotheses: whether the color of the word match the meaning of the word will influence the time to name the color of the word.

μ_u : incongruent population means of time to name the color of the word

μ_m : congruent population means of time to name the color of the word

Null hypothesis : The unmatched will not cause longer time to name the color of the word.

$H_0 : \mu_u = \mu_m$

Alternative hypothesis : The unmatched may cause longer time to name the color of the word.

$H_a : \mu_u > \mu_m$

Statistical test: one -tail paired samples *t*-tests

Reason: The Alternative hypothesis the incongruent test statistic is greater than the congruent test statistic, a directional hypothesis.

1. less than 30 samples.
2. don't know the population's standard deviation.
3. assume that the distributions are Gaussian.

Justification: Same participants will first do the congruent task and then the incongruent task, record their time to name the color in both task.

Ref: https://en.wikipedia.org/wiki/Student%27s_t-test#Dependent_t-test_for_paired_samples

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.

Congruent : 11.0 Incongruent : 17.3

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

Congruent

Average : 14.05

Min:8.63

Max:22.3

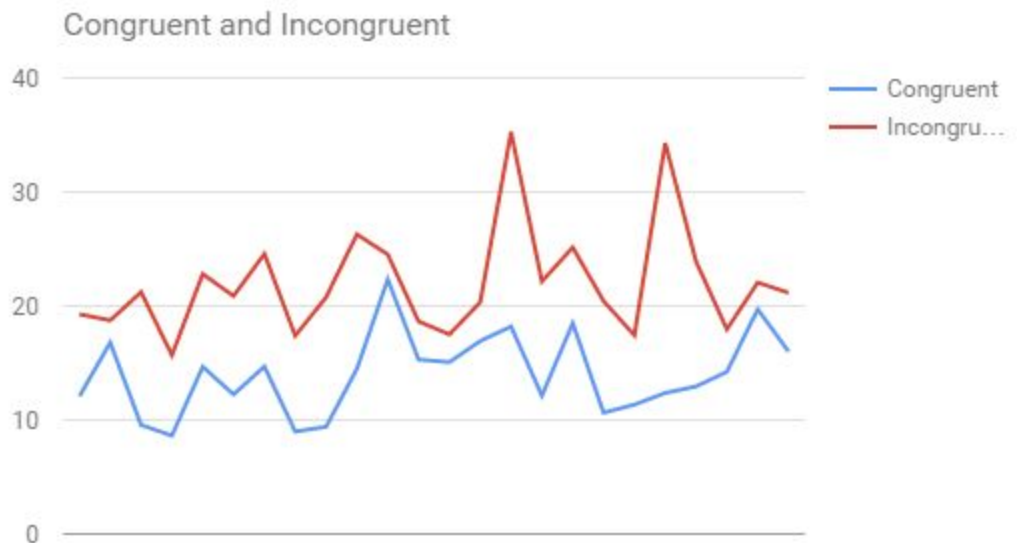
Incongruent:

Average : 22.02

Min:15.7

Max:35.3

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 biggest difference between “Incongruent” and “Congruent” is 21.9.

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?

μD : -7.9648

S: 4.86482691

df: 23
t-stat: -8.020706944
at α 0.05, t-critical: 1.714
P: 4.103E-08
95% CI: (-25.3527231, 9.42314)

Since p-value is lower than 0,05. We can Reject the null hypothesis.
It means that the unmatched of the word meaning and color did cause longer time to name the color of the word.
And the results match up with my expectations.

P.s. In the previous submission, I perform the [Stroop task](#), and report my own results, and make the statistical test based on that data.

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!

Reference:

https://en.wikipedia.org/wiki/Null_hypothesis

https://en.wikipedia.org/wiki/Confidence_interval