

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: Number of words displayed,
Dependent Variable: time to name colors

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

Null Hypothesis: No significant increase in time with incongruent word test compared to congruent word test

Alternate Hypothesis: Significant increase in time with incongruent word test compared to congruent word test

I expect to use a 1-sided T-test to evaluate if the incongruent word test causes an increase in mean time to complete the test. Since there is increased cognitive complexity in the incongruent test, it is expected that this disparity between printed word and color will delay response time in study participants. This 1-sided test will help to evaluate if this complexity does increase the response time as expected.

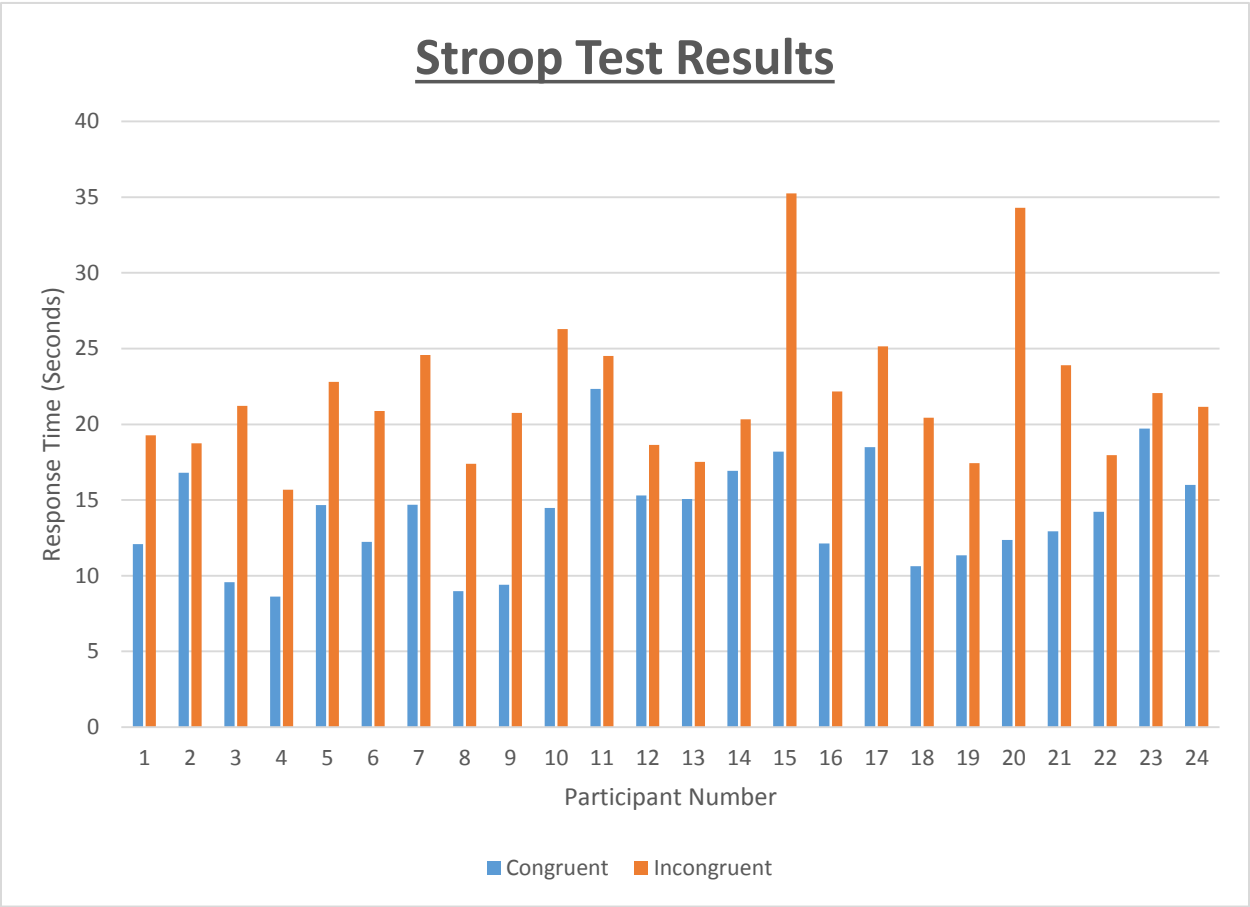
Now it's your chance to try out the Stroop task for yourself. Go to [this link](#), which has a Java-based applet for performing the Stroop task. Record the times that you received on the task (you do not need to submit your times to the site.) Now, download [this dataset](#) which contains results

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.

	Congruent	Incongruent
Mean	14.051	22.016
Sample Std Dev	3.559	4.797

- 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.



This graph illustrates the variance between the two test conditions by participant. Through this visualization it is easy to see that the incongruent test took longer for all participants though there is a variation in the amount of extra time required to complete the task.

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?

Mean of the Difference	7.965
Std Dev Difference	4.865
n	24
T Statistic	5.177
T-Critical Value	1.714
95% Confidence Interval	
alpha	0.05

I used a confidence interval of 95% with an alpha of 0.05 since this is a one-tailed test. After evaluating the data, I determined that we fail to reject the null hypothesis. The T Statistic is considerably higher than the T-Critical value which means the data supports the decision. The Incongruent Condition has an increase in mean that is statistically significant.

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!

There is a cognitive dissidence in stating the color of the word when it does not match the word itself (such as the word red written in blue font). This difference causes the brain to have a slowed reaction in trying to complete the task. There are many possible reasons for this effect and they are all based on our brains processing multiple pieces of information simultaneously. These different mental calculations essentially compete to try to be the first one to be processed.

A similar result might happen if you aligned pictures with disparate captions, such as a tree labelled car and a person had to say the label instead of the image. Or if a number or letter were printed in large font that was made up of smaller letters or numbers of a different type, such as a large 7 made up of lots of small 5's. Either of these would provide a visual disconnect between the image and the word we are to say.

Webpages used as resources in

<http://projectile.sv.cmu.edu/research/public/talks/t-test.htm>

<https://statistics.laerd.com/statistical-guides/measures-central-tendency-mean-mode-median.php>

http://onlinestatbook.com/2/summarizing_distributions/variability.html

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