Test A Perceptual Phenomenon (of Stroop Effect[1])

by Jay

Note: Please see that the references are included in footnotes.

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

Dependent variable: Time required to complete test in seconds (i.e. reading speed)
Independent variable: Words conditions

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: Incongruent words does not affect reading speed.
Alternate Hypothesis: Incongruent words affects reading speed.
Statistical test: Dependent Sample two-tailed t-test is used here.

Dependent sample is chosen since in the experiment both conditions were done to the same participants.

The reason for choosing two-tailed over one-tailed is so we don't discount the possibility of participants for some reasons read faster on incongruent words condition.

Another reason is that with two tailed test t-criticals would be higher, which means the mean of dependent samples must be farther away to reject the null hypothesis, in other words we exercise more scepticism towards our experiment.[2]

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

Measures of central tendency:

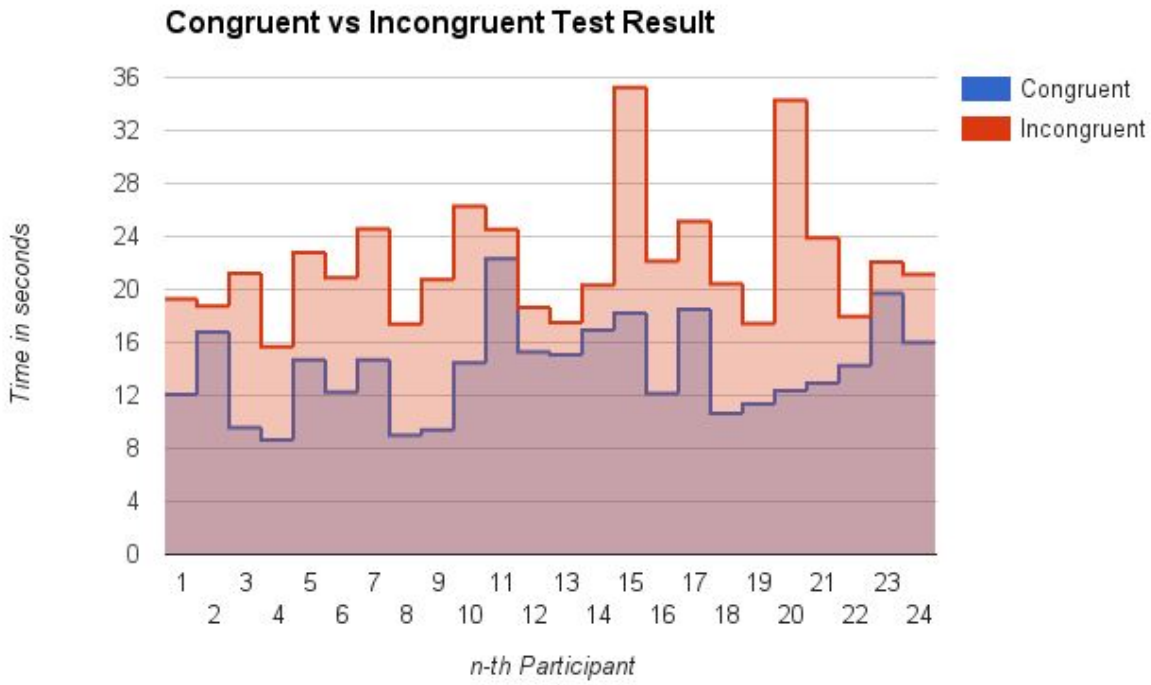
congruent condition sample mean: 14.051	incongruent condition sample mean: 22.016
congruent condition sample median: 14.357	congruent condition sample median: 21.018

[1] https://en.wikipedia.org/wiki/Stroop_effect
[2] Please see http://www.psychstat.missouristate.edu/introbook/sbk25m.htm for another reasoning why two-tailed test is better.

Measures of variability:

congruent cond. variance: 12.669	incongruent cond. variance: 23.012
congruent cond. standard dev.: 3.559	incongruent cond. standard dev.: 4.797
differences (D) standard dev: 4.865	standard error: 0.993

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.



From the above chart, we see that time required to finish the test in incongruent mode are consistently more than in congruent mode. The time required to complete the test ranges from a little above 8 seconds to around 22 seconds for congruent mode and 16 seconds to about 35 seconds for incongruent mode.

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:	0.05
t-statistic:	8.021
t-critical values:	-2.042 and 2.042
point estimate:	7.965
confidence intervals:	5.937 and 9.993

Based on the above statistical test, where t-statistic is far above the positive t-critical value, we can conclude that the mean of time required to finish the test in incongruent mode is **significantly higher** than in congruent mode, hence we can **reject the null hypothesis**. This means, as I expected, that incongruence between colors and words impacts our perception.

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!

The effects are probably caused by our brain automatically creating images when we read words. I.e. I don't think the effects would happen if the words are written in, say, chinese.

As for an alternative task, I couldn't find any at the moment, but an extension of this test could be by providing warped texts instead, to see if by making the text harder to read we can reduce the time difference between congruent and incongruent mode.