Test a Perceptual Phenomenon

DAND Project 1

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?
   Our independent variable is the test method (congruent and incongruent). Our dependent variable is the test subjects' reaction time.

2. What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.
   The null hypothesis should be that the mean reaction time for reacting to congruent words is longer than or equal to that of incongruent words. The alternative hypothesis should be that the mean reaction time for reacting to congruent words is shorter than that of incongruent words.

$$H_0: \mu_C \geq \mu_I$$

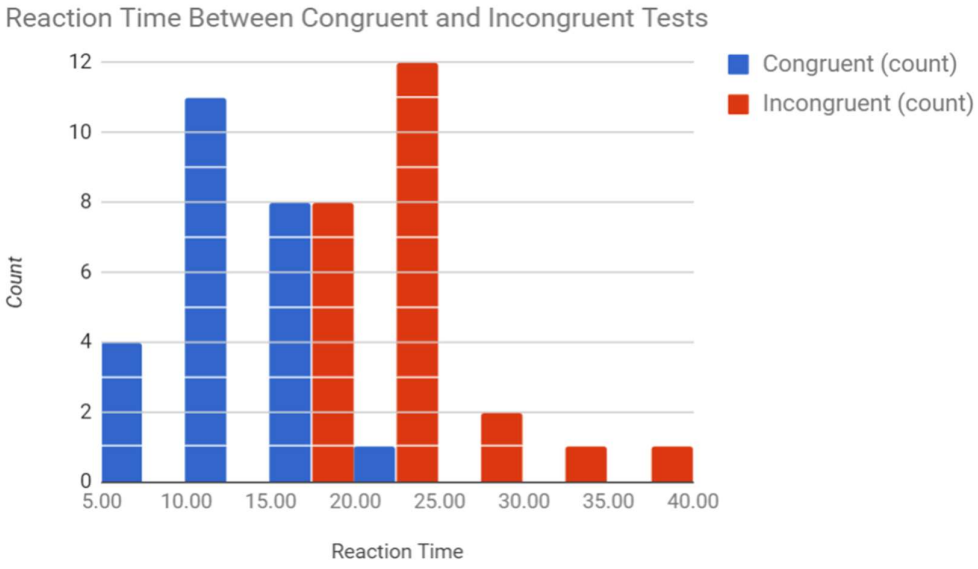
$$H_A: \mu_C < \mu_I$$

   Where μ is the population mean and subscript "C" and "I" are used to indicate congruent and incongruent words.
   Since σ is unknown and the sample size is smaller than 30, a t-test is appropriate. We are going to perform a one-tailed dependent samples t-test to compare the two samples and determine whether there is statistical evidence to support our assumptions.

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

	Congruent Test	Incongruent Test
Sample Size	24	24
Mean	14.051	22.016
Median	14.357	21.018
s^2	12.669	23.012
STDEV	3.559	4.797
STERR	0.726	0.979

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 graph, we can clearly see that the incongruent reaction time is leaning toward the right, meaning people generally take more time to react during incongruent tests.

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?

$$For\ \alpha\ =\ 0.01\ and\ df\ =\ 23\ in\ a\ one\ tailed\ t\ test, t_{critical}\ =\ 2.500^{[1]}$$

$$t = \frac{\bar{x}_I - \bar{x}_C}{S_D/\sqrt{n}} = 8.020$$

$$For\ t = 8.020, p\ <\ .0001, which\ means$$
$$the\ probability\ of\ obtaining\ said\ mean\ under\ H_o\ is\ less\ than\ 0.01\%$$
$$Conclusion: we\ have\ enough\ evidence\ to\ reject\ H_o,$$
$$The\ calculation\ results\ match\ our\ prediction.$$

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 automation of cognition is responsible for the effects observed. During incongruent tests, English speakers instinctively recognize the color and link the color to a word, and causes a confliction with the task he/she is supposed to perform. As a non-native speaker, I got very similar results in both tests, because I could not automatically form a link between the color and an English word.
   A similar experiment would be the Reverse Stroop Test.[2]

   References:
   [1] *T Table, https://s3.amazonaws.com/udacity-hosted-downloads/t-table.jpg*
   [2] *Durgin, Frank H. "The Reverse Stroop Effect." Psychonomic Bulletin & Review, vol. 3, no. 1, 2017, pp. 1–5., doi:10.13188/2471-4879.1000017.*