

Test a Perceptual Phenomenon

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.

Raw Data in seconds for each test:

	Congruent	Incongruent
0	12.079	19.278
1	16.791	18.741
2	9.564	21.214
3	8.63	15.687
4	14.669	22.803
5	12.238	20.878
6	14.692	24.572
7	8.987	17.394
8	9.401	20.762
9	14.48	26.282
10	22.328	24.524
11	15.298	18.644
12	15.073	17.51
13	16.929	20.33
14	18.2	35.255
15	12.13	22.158
16	18.495	25.139
17	10.639	20.429
18	11.344	17.425
19	12.369	34.288
20	12.944	23.894

What is the independent variable? What is the dependent variable?

Independent variable - the two conditions - congruent words, and incongruent words.

Dependent variable - reaction time in each of the two conditions. What is an appropriate

What is an appropriate set of hypotheses for this task? Specify your null and alternative hypotheses, and clearly define any notation used. Justify your choices.

Hypotheses:

Null hypotheses, H_0 - the reaction time of the congruent words condition is greater than or equal to the incongruent words

condition: $\mu_{congruent} \geq \mu_{incongruent}$

Alternate hypotheses, H_A - the reaction time of the congruent words condition is less than the incongruent words condition: $\mu_{congruent} < \mu_{incongruent}$

Where: $\mu_{congruent}$ - Mean of congruent reaction times in

seconds, $\mu_{incongruent}$ - Mean of incongruent reaction times in seconds

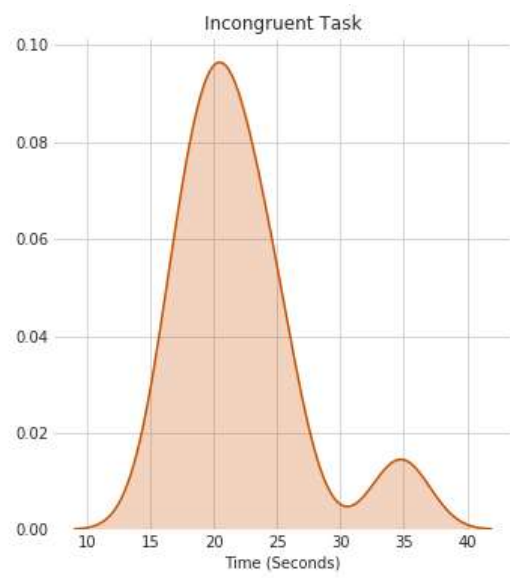
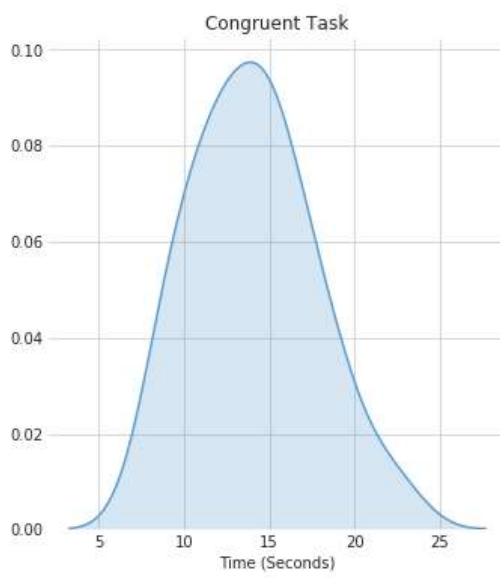
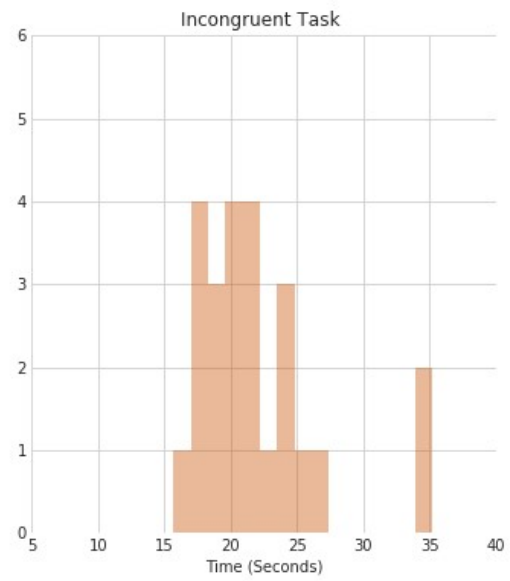
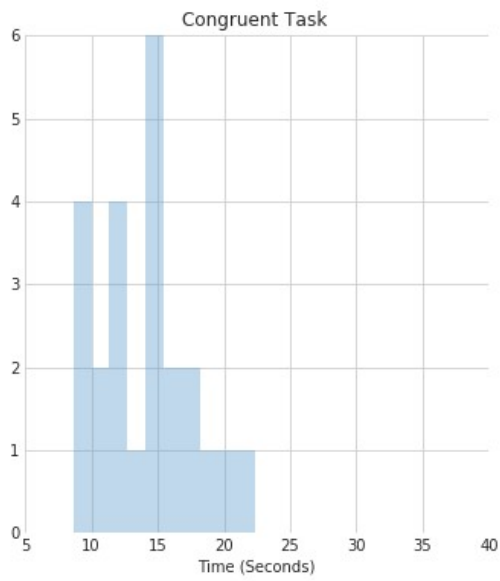
To determine if list congruity has any effect on reaction time the Recommended statistical test are dependent samples t-test, one-tailed and negative. it suffices to test hypothesis #2. It is a broader statement that makes no assumptions as to which mean is greater. Since we do not have information on population parameters, a **dependent samples t-test** will be appropriate to test the alternative hypothesis against the null. By examining how the sample means differ from each other, we will be able to make a determination about how the population means differ. The samples are *dependent* because each participant is timed twice: once with the congruent list and once with the incongruent list.

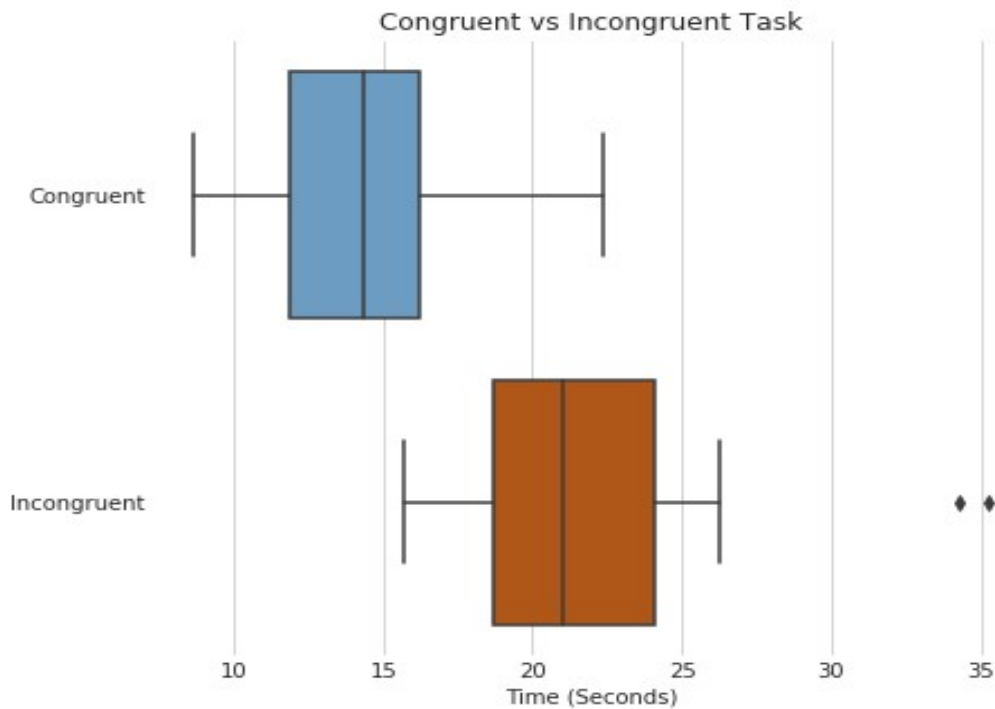
After doing the test myself on the [interactive Stroop Effect website](#), it took me congruent = 13.287 secs, incongruent = 27.269 secs. I expect to reject the null hypothesis and come to the conclusion that it takes significantly longer to identify colors where the text does not match the ink. But I am a sample size of one, so we will need to examine a larger sample to establish this.

Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability. The name of the data file is 'stroopdata.csv'.

- Mean -
 - Congruent = 14.05 secs
 - Incongruent = 22.02 secs
- Standard deviation -
 - Congruent = 3.56 secs
 - Incongruent = 4.80 secs
- Median -
 - Congruent = 14.36 secs
 - Incongruent = 21.02 secs

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.





Observations:

1. Distribution of congruent and incongruent times are dense around the median and less spread out.
2. It is easily noticeable that the incongruent times are considerably higher than congruent times.

Now, perform the statistical test and report your results. What is your confidence level or Type I error associated with your test? What is your conclusion regarding the hypotheses you set up? Did the results match up with your expectations? Hint: Think about what is being measured on each individual, and what statistic best captures how an individual reacts in each environment.

4.8648269103590556

$s_{c-i}=4.86$ sc-i=4.86 secs

-7.96479166667 0.993028634778 Ttest_relResult(statistic=-8.020706944109957, pvalue=4.1030005857111781e-08)

$\bar{x}_c - \bar{x}_i = -7.96$ $\bar{x}_c - \bar{x}_i = -7.96$ secs

S.E. = 0.99 secs

$t_{stat} = -8.021$ $t_{stat} = -8.021$

P-value = 0.00000004

$t(23) = -8.021$, $p = .00$, one-tailed

$\alpha = 0.01$ $\alpha = 0.01$ i.e. confidence level = 99%

$t_{critical} = -2.500$ $t_{critical} = -2.500$

Decision: Reject H_0 i.e. Reject - "the reaction time of the congruent words condition is greater than or equal to the incongruent words condition"

This means, that the reaction time of the congruent words condition is significantly less than the incongruent words condition.

Conclusion

We see that the average time of sample under congruent conditions is different from the average time of sample under incongruent conditions. My confidence level is .001(0.1%), and since the degree of freedom is $n - 1$ which is 23, my critical statistic value is ± 3.768 . Also, I reject the null hypothesis. Finally, as I expected when I saw the boxplot, the results from t-test match up with my expectations.

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!

I think the reason of the Stroop effect is because in the incongruent word condition the words distract the attention. According to Wikipedia, the Simon effect is similar to the Stroop effect. The Simon effect refers to the finding that reactions are faster and accurate when stimulus occurs in the same relative location.

Resources:

Udacity Forums

Udacity nanodegree videos

<http://www.graphpad.com/quickcalcs/>

http://www.ats.ucla.edu/stat/mult_pkg/faq/general/tail_tests.htm

<http://www.statstutor.ac.uk/resources/uploaded/paired-t-test.pdf>

<https://www.ltconline.net/greenl/courses/201/descstat/mean.htm>