

## Statistics: The Science of Decisions, Stroop Task

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In this problem, the independent variables are a congruent words condition, and an incongruent words condition. And the dependent variable is the time it takes to name the ink colors in two equally-sized lists.

Null hypothesis for this task is “there is no differences between the time to name the ink colors under conditions of congruent words and incongruent words.” The alternative hypothesis is “there is significant differences between the time to name the ink colors under conditions of congruent words and incongruent words.”

$$H_0: \mu_0 - \mu_1 = 0$$
$$H_a: \mu_0 - \mu_1 \neq 0$$

Where  $\mu_0$  is the average time under the condition of congruent words and  $\mu_1$  is the average time under the condition of incongruent words.

The two samples given are dependent under two conditions. Since we don't know the mean and standard deviation of population, I will use t-test to estimate.

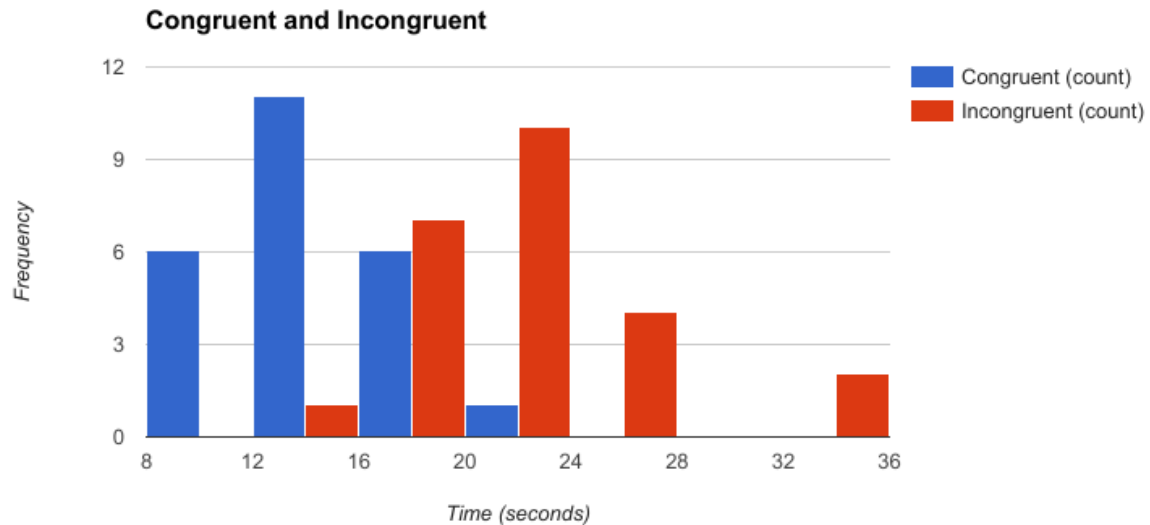
These two data set both have 24 rows and the table below is the brief statistics:

	Difference
Mean	-7.964791667
Standard deviation	4.86482691

In these two dataset we can find the following table for the central tendency and variability.

	Congruent	Incongruent
Mean	14.051125	22.01591667
Median	14.3565	21.0175
Q1	11.89525	18.71675
Q3	16.20075	24.0515
lower whisker	5.437	10.714625
Upper whisker	22.659	32.053625
Minimum	8.63	15.687
Maximum	22.328	35.255

We can find that both the mean and median of Incongruent task are larger than the ones of congruent task while the range of incongruent task is larger than the one of congruent task.



From the distribution of two tasks, we can see these two distributions are positively skewed and the mode of congruent task is between 12 and 16 seconds while the mode of incongruent task is between 20 and 24 seconds.

I will set the  $\alpha$  to be 0.05 and since this is the two-tailed test, the t critical value is  $\pm 2.064$  with the degree of freedom of 23.

$$t_{statistic} = \frac{-7.964}{4.864/\sqrt{24}} = -8.021$$

Since t is in the critical region and the p-value is less than .05, we will reject the null and conclude that the time of incongruent task is significant different from the time of congruent task.

The Cohen's d is

$$Cohen's\ d = \frac{-7.964}{4.864} = -1.637$$

The 95% confidence interval is  $(-7.96 - 2.064 * \frac{4.864}{\sqrt{24}}, -7.96 + 2.064 * \frac{4.864}{\sqrt{24}})$ , which is  $(-10.014, -5.915)$ . The difference of time between congruent task and incongruent task is between  $(-10.014, -5.915)$  with 95% of confidence.

We can find the time of congruent task is smaller than the time of incongruent task, since our brain has two parts taking care of texts and colors separately.

Here is another similar task I found from Archimedes-lab. This experiment will add the shapes, not just colors and texts.

