

# Statistics: The Science of Decisions Project Instructions

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

Independent variable: words condition (congruent or incongruent)

Dependent variable: time it takes to name the ink 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: there's no difference between incongruent and congruent population means, that is,  $\mu_1 = \mu_2$  (set  $\mu_1$  as population mean under congruent condition;  $\mu_2$  as population mean performance under incongruent condition)

Alternative hypothesis: there's difference about population mean under two conditions, that is,  $\mu_1 \neq \mu_2$ .

I'm going to use dependent sample t-test because this experiment satisfies the test assumptions:

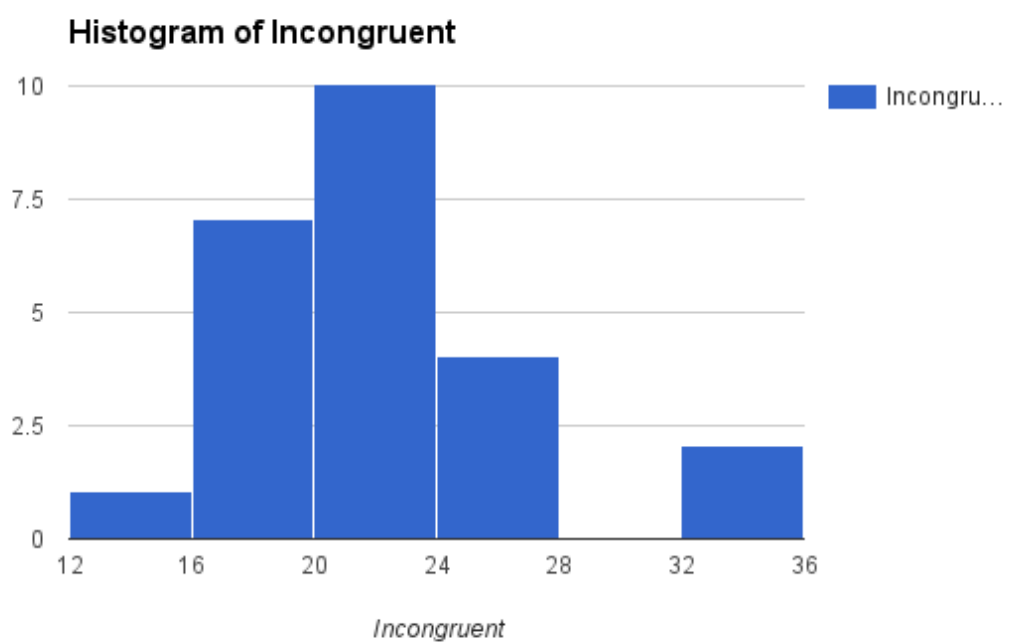
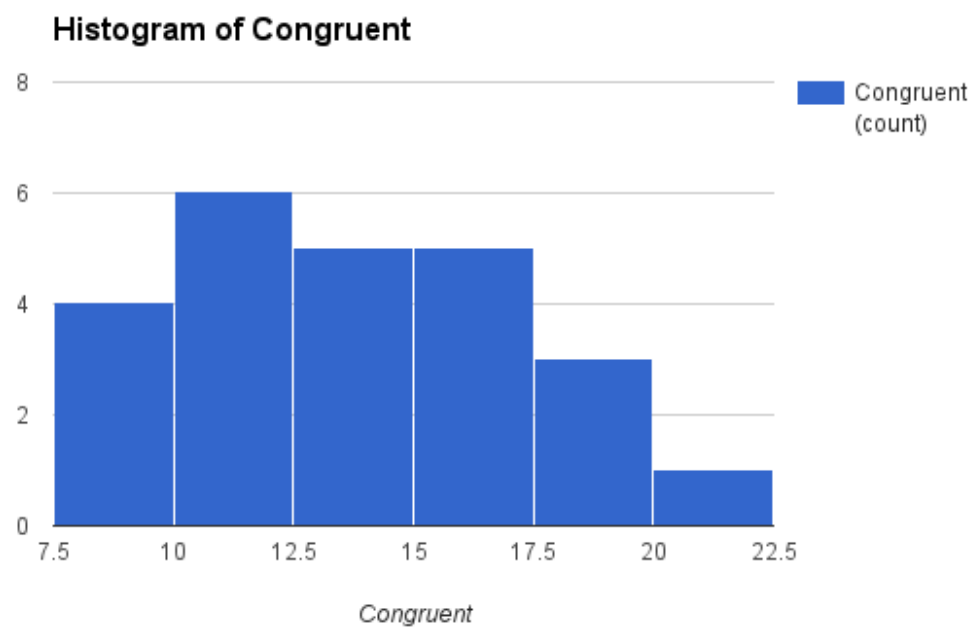
- Dependent variables,  $\mu$ , that is time it takes to name the in colors, are measured at interval or ratio level.
- Samples are randomly obtained from the population.
- It is a "two conditions" question and each participant did the test under two conditions separately, so the differences for each participant under two conditions are linked in the population through repeated measurement.
- Sample means are normally distributed in the population; the sample difference mean is normally distributed.

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

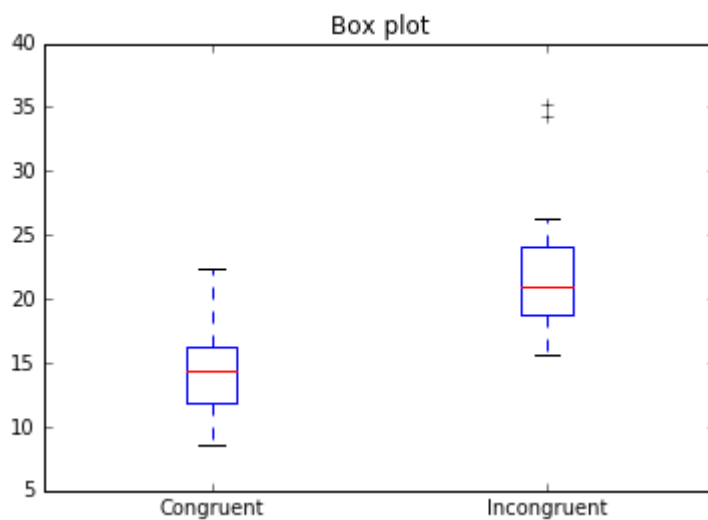
|             | Sample mean | Sample standard deviation |
|-------------|-------------|---------------------------|
| congruent   | 14.051125   | 3.559357958               |
| incongruent | 22.01591667 | 4.797057122               |

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.

Under congruent condition, most of participants (23 of 24) can finish the test under 20s; while only eight participants takes no more than 20s under incongruent condition.



### Further improvement: Box Plot



(graph comes from advisor's review)

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?

**The mean difference** = sample mean under congruent condition – sample mean under incongruent condition = -7.964791667

Use google spreadsheet to calculate **the standard deviation**  $Sd = 4.86482691$

So, **standard error**  $SE = Sd/\sqrt{n} = 4.86482691/\sqrt{24} = 0.9930286347$

**t-statistics** = the mean difference/ $SE = -8.02070694508$

assume **a-level** = .05

**df** =  $24 - 1 = 23$

it is a two-tailed test

**t critical value** =  $\pm 2.069$

so, 95% **CI** =  $(-7.964791667 \pm 2.069 * 0.9930286347) = (-10.0193679122, -5.91021542181)$

Use GraphPad we can get the two-tailed **P value** is less than 0.0001

this difference is considered to be **extremely statistically significant**.

So, reject to null which matches up my expectation.

Conclusion in terms of the experiment task: people's recognition ability will be affected by Stroop Effect. Under the incongruent condition, people would take more time to finish the task.