

Stroop Effect

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

- *Independent variable is: The color of the ink word “whether it matched the word name or not”.*
- *Dependent variable is: Time consumed to name the ink word.*

2. What is an appropriate set of hypotheses for this task? What kind of statistical test do you expect to perform? Justify your choices.

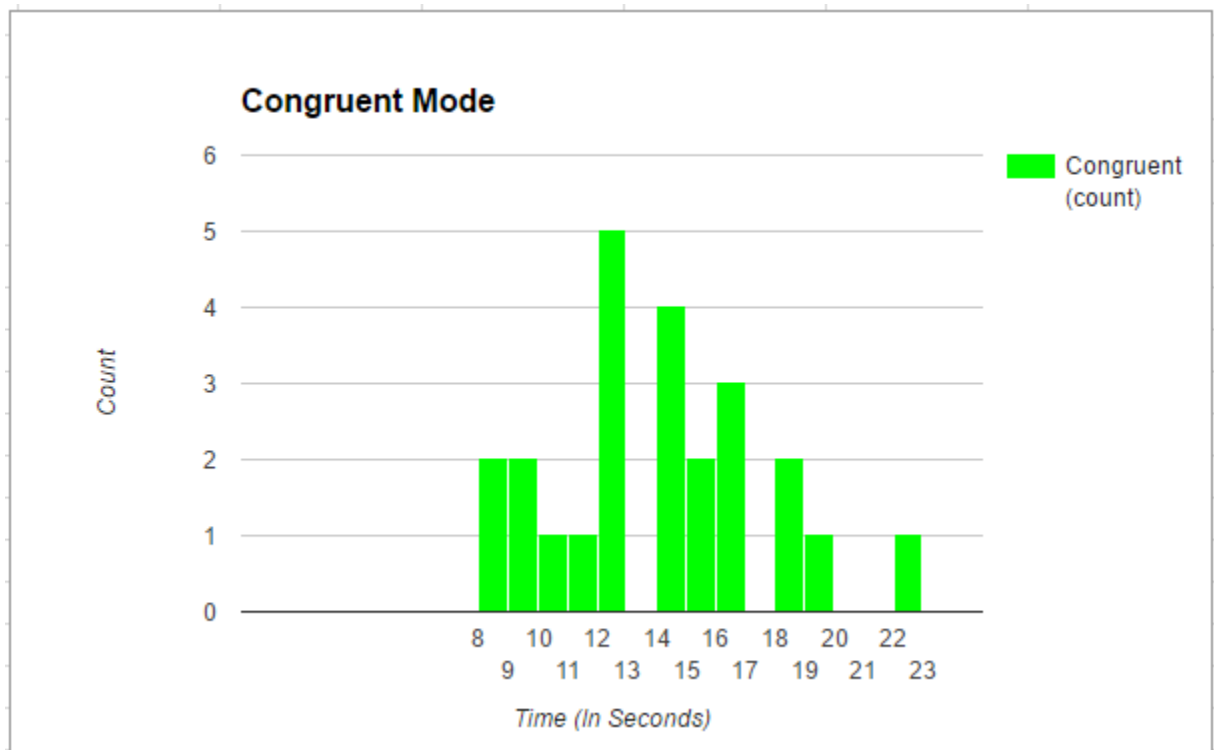
- *Regarding the hypotheses we will have:*
 - **H0 “Null Hypotheses”** *that the average time consumed by a person to name the ink word on the congruent mode **is equal to** the average time consumed by a person to name the ink word on the incongruent mode.*
 - **H1 “Alternative Hypotheses”** *that the average time consumed by a person to name the ink word on the Congruent mode **is not equal to /greater/ less than** the average time consumed by a person to name the ink word on the Incongruent mode*
- *I expect to perform a **two-tailed T-test** as I need to compare two samples and determine whether the average time in the congruent mode will be the same /less than or/ greater than the average time in the incongruent mode.*

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

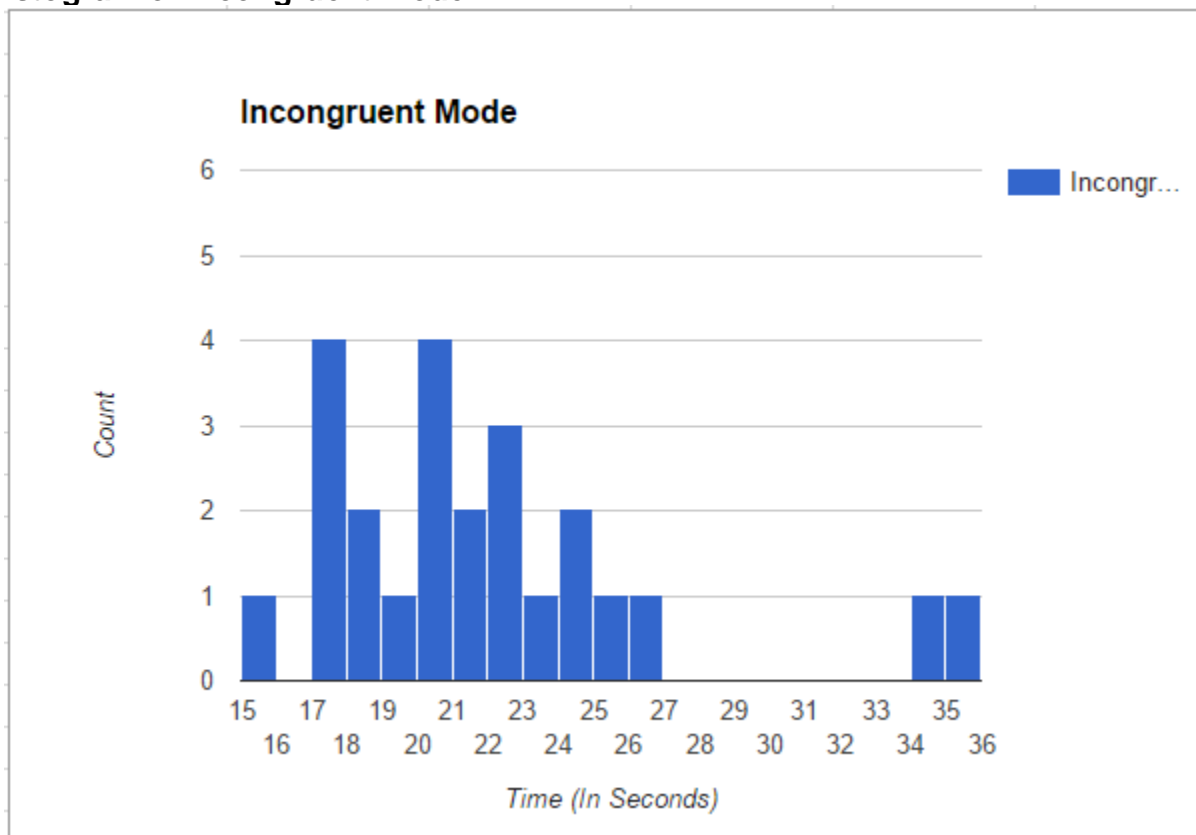
| Measurement | Congruent | Incongruent |
|----------------------------------|-----------|-------------|
| Mean | 14.05 | 22.02 |
| Mode | 13 | 21 |
| Median | 14.36 | 21.02 |
| Standard Deviation “Variability” | 3.6 | 4.8 |

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.

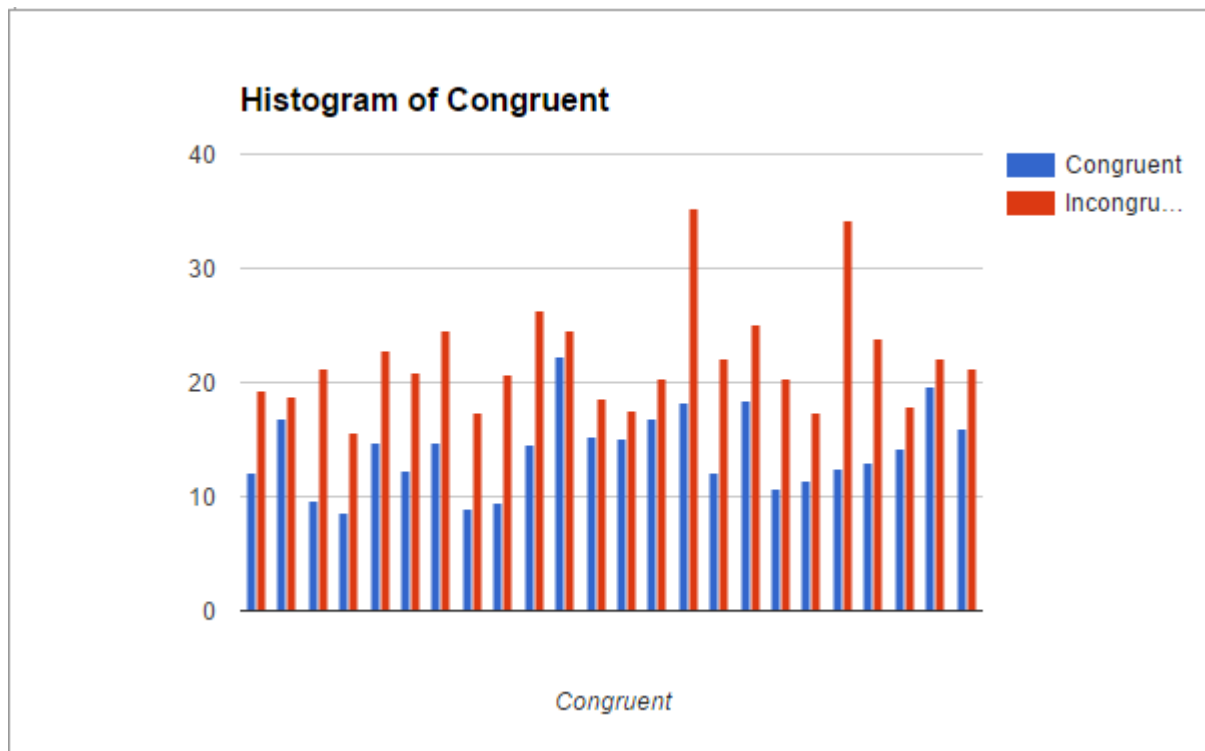
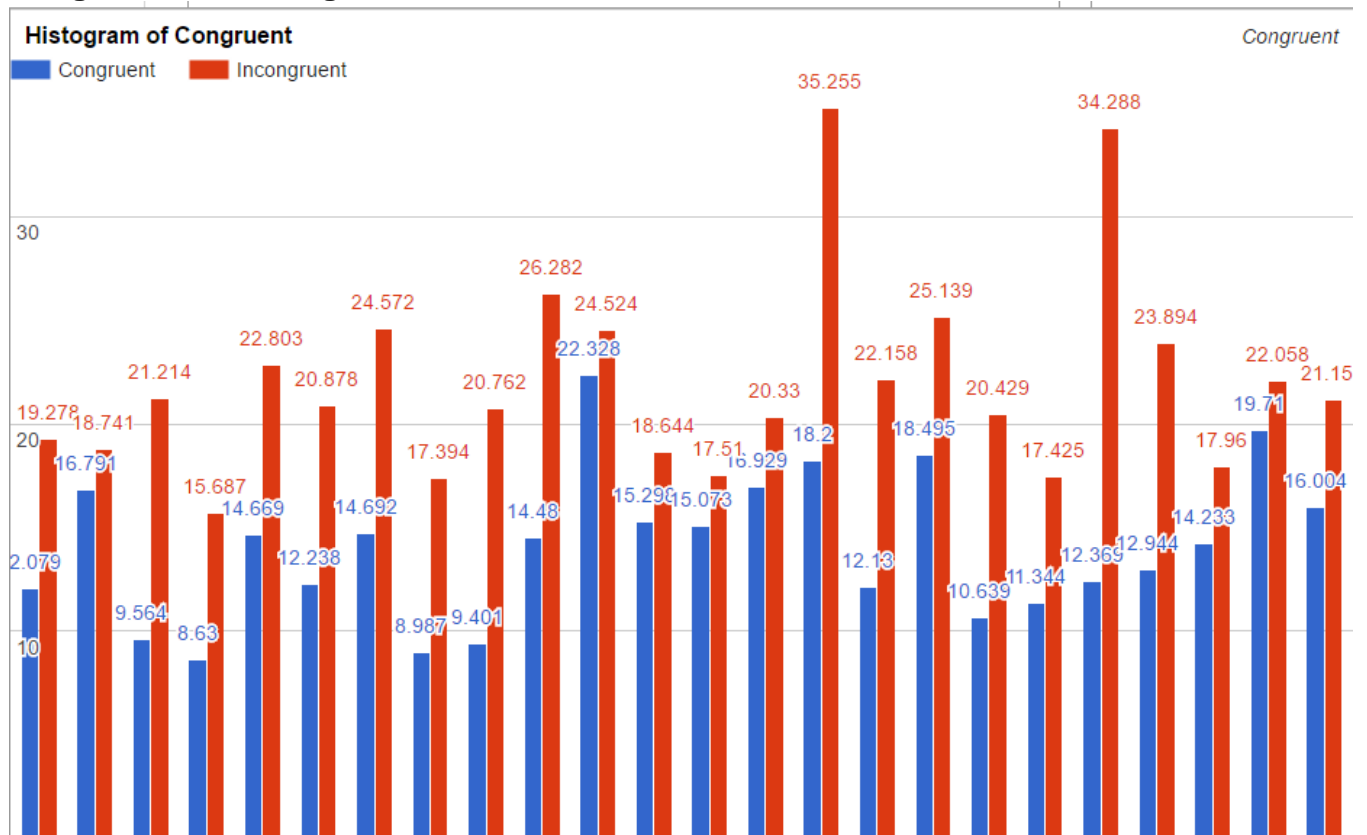
- **Histogram of Incongruent mode**



- **Histogram of Incongruent mode**



- Congruent Vs. Incongruent mode



- **My Observations:**

- All the central tendency variables are tending to be less in the congruent mode than the incongruent mode, **however**, the variability, is near in both modes.
- We can easily observe that people tends to take more time in the incongruent mode than they took in the congruent 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?

- I'm going to use two-tailed T-test to compare the **μ "incongruent" Vs the μ "Congruent"** in order to check whether changing the ink word color than its name has an effect or not, we will have the following:
 - **H0 "Null Hypotheses"** that the average time consumed by the person to name the ink word on the congruent mode **is equal to** the average time consumed by the person to name the ink word on the incongruent mode. (**μ "Congruent" = μ "incongruent"**)
 - **H1 "Alternative Hypotheses"** that the average time consumed by the person to name the ink word on the Congruent mode **is not equal to /greater/ less than** the average time consumed by the person to name the ink word on the Incongruent mode, **μ "incongruent" \neq μ "Congruent" / μ "incongruent" $>$ μ "Congruent" or/ μ "incongruent" $<$ μ "Congruent"**
 - Since we have sample of "**n=24**", so the **degrees of freedom will= n-1=23**.
 - And since we are using two-tailed test so we will have t-critical value of "0.025" on both sides.
 - **Using n=23, and t-critic value= 0.025, so the t-probability is +/- 2.069.**
 - so, the t-critical value should be less than +/-

$$t = \frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$$

- We will use the T-test Formula where:
 - \bar{x}_1 = Mean incongruent mode set
 - \bar{x}_2 = Mean Congruent mode set
 - S_1 = Standard deviation of incongruent mode set
 - S_2 = Standard deviation of congruent mode set
 - n_1 = Total number of values in incongruent mode set
 - n_2 = Total number of values in Congruent mode set
 - So, our T-Critical value will be = **-6.5 "detailed calculations below"**
- So, it's very obvious that the t value we got is so far away than the t-critical value "-2.069", so, we will **reject the H0 "Null Hypotheses"** that the average time consumed by the person to name the ink word on the congruent mode **is equal to** the average time consumed by the person to name the ink word on the incongruent mode.

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 effect observed is because of people are more practiced at word reading than naming colors, there is less interference with word reading than there is with naming colors.

- *Interference occurs when you look at one of the words, you see both its color and its meaning. These two different bits of information begin to confuse the brain, which then causes a conflict, forcing you to make a choice; Our experiences and stored memories has taught us that word meaning is more important than the color a word is written in; Interference occurs when you try to pay attention only to the color. The interference that happens suggests that you are not always in control of what you can pay attention to.*
- *We can approach the same effect of the Stroop effect but applying it on numbers, so that:*
 - *The Congruent mode will be that the displayed number name is the same as the count of number words. “e.g. (one) or (Two Two)”*
 - *The Incongruent mode will be that the displayed number name will be different than the count of number words “e.g. (Three Three) or “Four”.*
 - *There is also a common experiment called the “Reversed Stroop Effect”*

Calculation of T-Value:

| A | B | C | D | E |
|-----------|-------------|---|--------------------|-----------------------|
| Congruent | Incongruent | | Congruent avergae= | Incongruent avergae= |
| 12.079 | 19.278 | | 14.051125 | 22.01591667 |
| 16.791 | 18.741 | | Congruent SE= | Incongruent SE= |
| 9.564 | 21.214 | | 3.559357958 | 4.797057122 |
| 8.63 | 15.687 | | Congruent Median= | Incongruent Median= |
| 14.669 | 22.803 | | 14.3565 | 21.0175 |
| 12.238 | 20.878 | | Cong_SE^2= | Incong_SE^2= |
| 14.692 | 24.572 | | 12.66902907 | 23.01175704 |
| 8.987 | 17.394 | | Cong_SE^2/n-cong= | Incong_SE^2/n-incong= |
| 9.401 | 20.762 | | 0.5278762113 | 0.9588232098 |
| 14.48 | 26.282 | | SE-addition= | |
| 22.328 | 24.524 | | 1.486699421 | |
| 15.298 | 18.644 | | Sqrt_SE-addition= | |
| 15.073 | 17.51 | | 1.219302842 | |
| 16.929 | 20.33 | | Means-Diff= | |
| 18.2 | 35.255 | | 7.964791667 | |
| 12.13 | 22.158 | | T Value= | |
| 18.495 | 25.139 | | 6.532250554 | |
| 10.639 | 20.429 | | | |
| 11.344 | 17.425 | | | |
| 12.369 | 34.288 | | | |
| 12.944 | 23.894 | | | |
| 14.233 | 17.96 | | | |
| 19.71 | 22.058 | | | |
| 16.004 | 21.157 | | | |
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