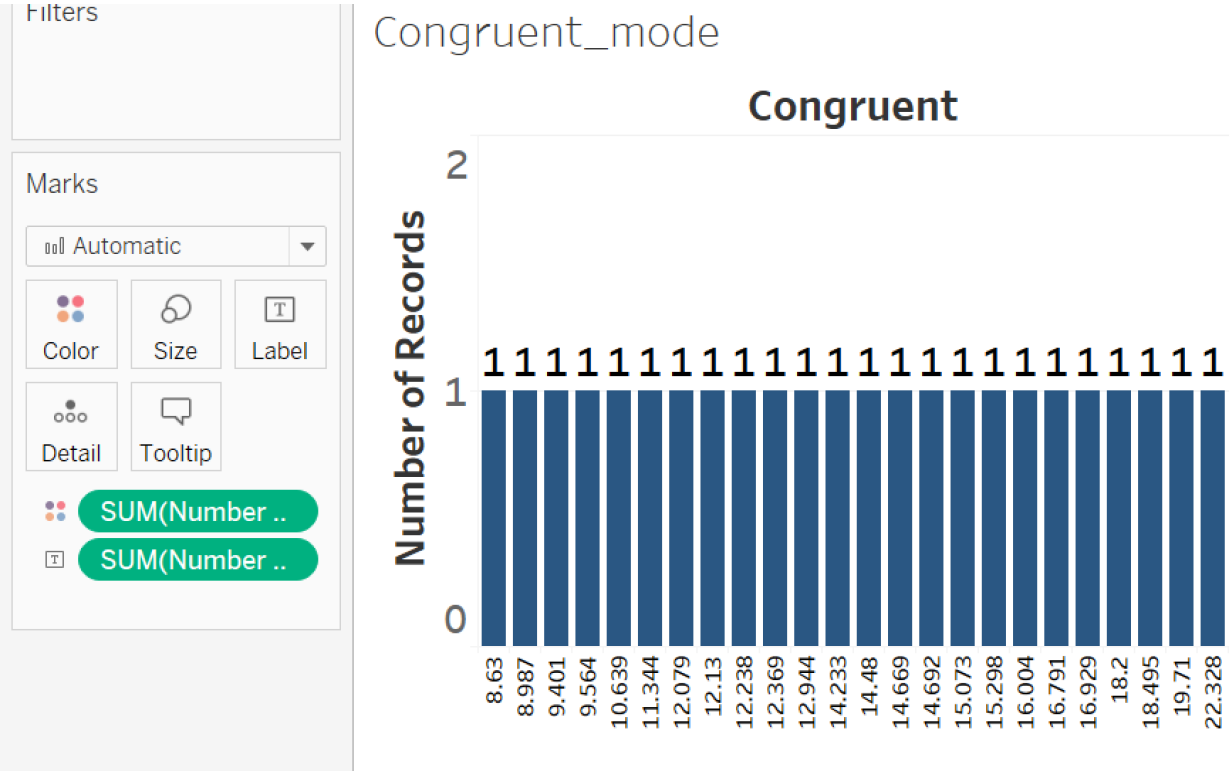
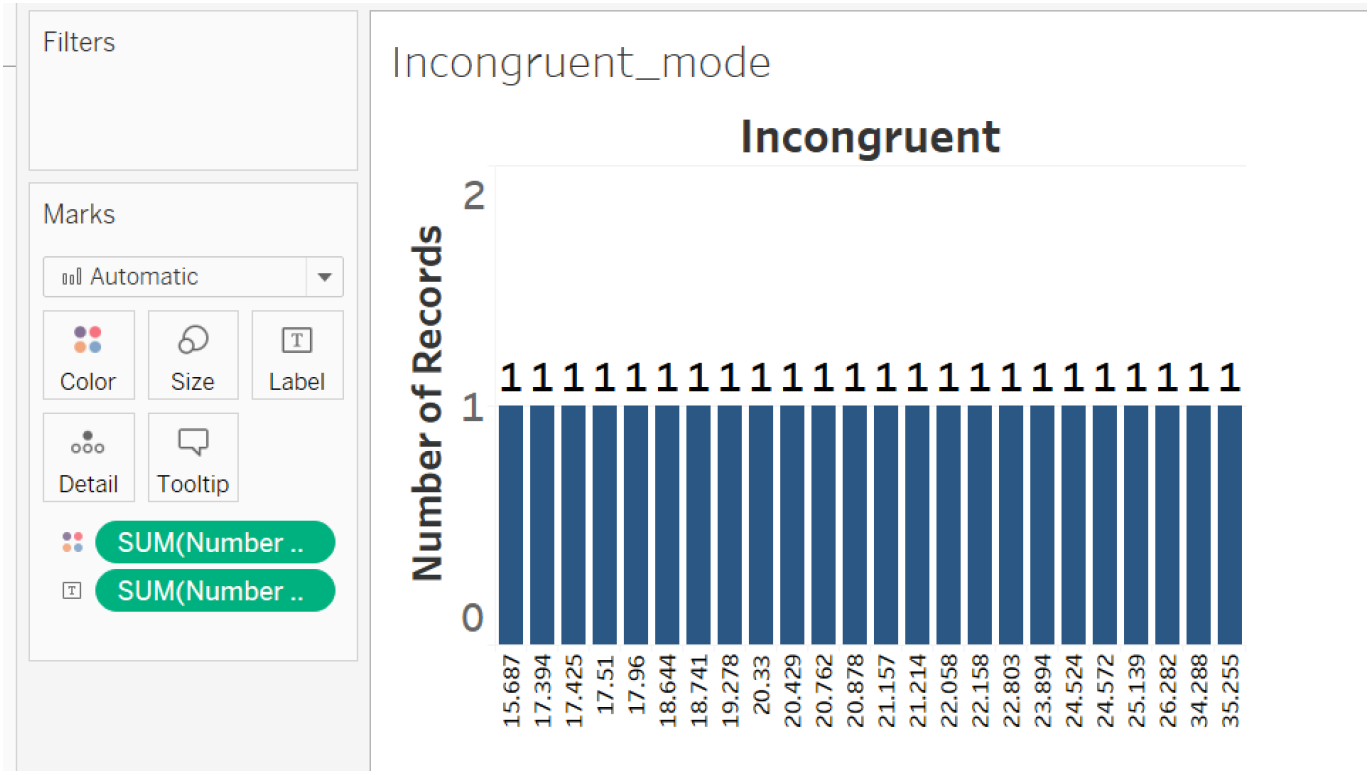
1) The variables are:
   a. The independent variable is the ink color of the words being displayed
   b. The Dependent Variable is the time it takes to name the ink colors of the words being displayed.
2) The set of hypotheses (where μc is the sample average (mean) time that it takes to say the ink color of the congruent words and μic is the sample mean time that it takes to say the ink color of the incongruent words) are:
   a. Null Hypothesis $H_o$: μic - μc = 0 (There is no difference in the time it takes to say the ink colors of both the words that are congruent with their ink color and the words that are incongruent with their ink color)
   b. Alternate Hypothesis $H_a$: μic - μc > 0 (The time it takes to say the ink colors of the words that are incongruent with their ink color will increase)
   c. I predict that it will be more difficult to say the ink colors when the words are not congruent with the ink color. In this case, the words will serve as a distraction since they will more likely read the words first because of the first condition test where the words were congruent with the ink color, thus, taking more time. Therefore, I will perform a one-tailed dependent t-test for paired sample in the positive direction given that the subjects take the test twice.
   d. Since we don't have the population parameters, the data entries are assumed to be the differences between two sets of entries which are not the original population entries. I assume that the dependent variable is continuous. I assume that the independent variable are matched pairs and that the distribution of the differences between the dependent paired entries when plotted should be approximately normally distributed.
3) See 4 below
4) These answers apply to question 3 and question 4.
   Since there is only one occurrence of every entry in the dataset, the set of data values have no mode as seen in the illustrations below (the x-axis is time in seconds).



The final answers are rounded up to 2 decimal places

The Median is the average of the 12th and 13th entries. Median = (14.233 + 14.48)/2 = 14.36




The Median is the average of the 12th and 13th entries. Median = (20.878 + 21.157)/2 = 21.02

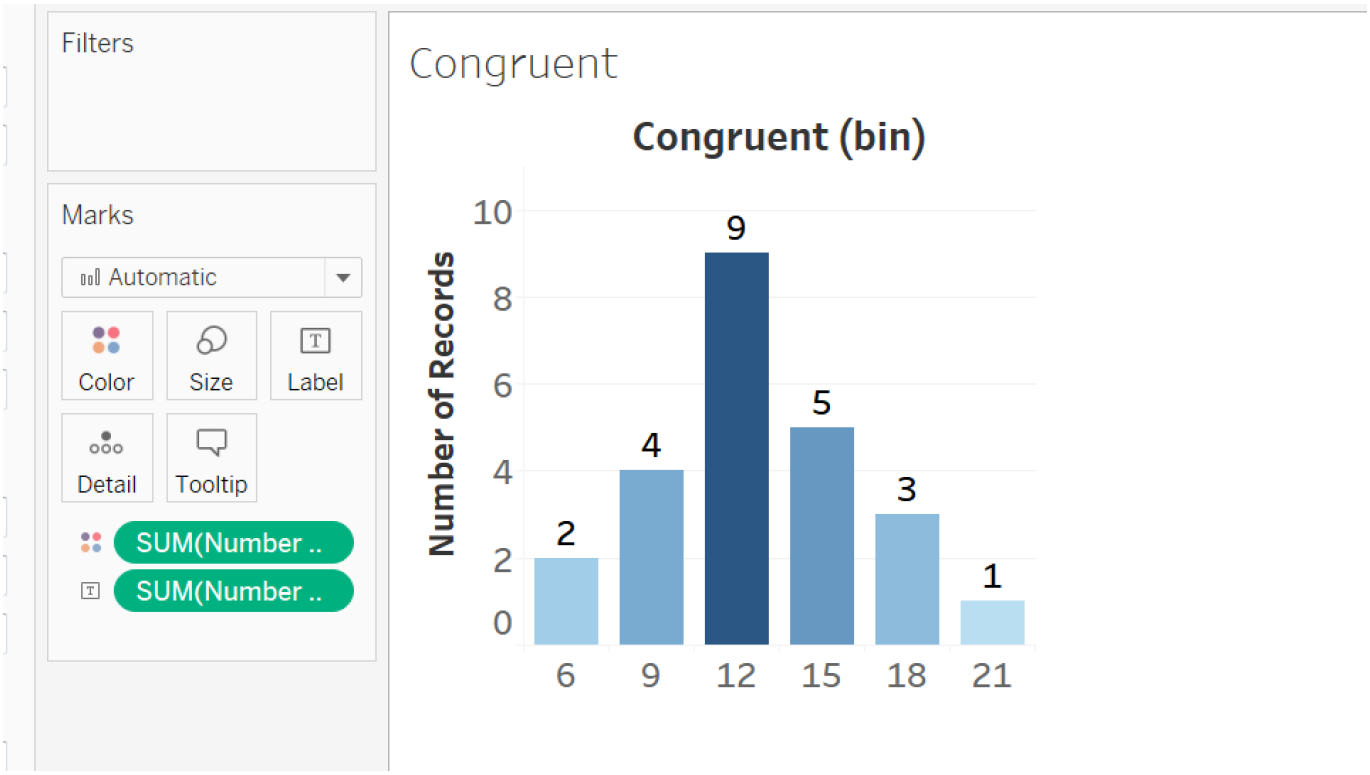
Measures of Variance

The interquartile range IQR = Q3 – Q1. Q1 is the mean of the 6th and 7th (25 percentile) enteris. Q3 is the mean of the 18th and 19th (75 percentile) enteris.

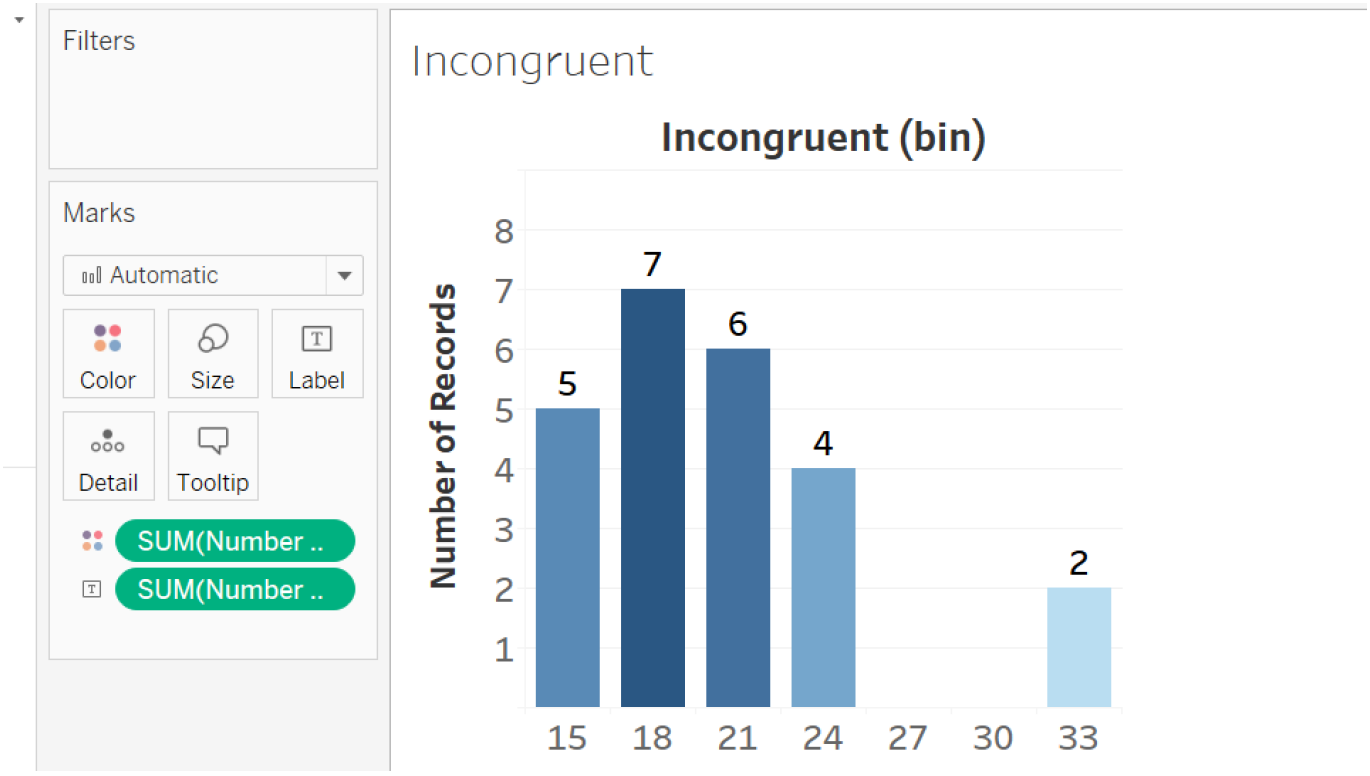
For the ink color that is congruent with the words
IQRc = 16.3975 - 11.7115 = 4.69. This distribution has a range (Max -Min) of 13.70 seconds

For the ink color that is incongruent with the words
IQRic = 24.209 – 18.6925 = 5.52. his distribution has a range (Max – Min) of 19.57 seconds

I decided to group the time it took to say the ink color for both the ink color that was congruent with its word and the ink color that was incongruent with its word into groups or bins of 3 seconds. For the congruent data sample, this resulted to a normal distribution with a mode corresponding to the bin size of 12-14 seconds as shown in the histogram below.




For the incongruent data sample, this resulted to a right-skewed distribution with a mode corresponding to the bin size of 18-20 seconds and what appears to be an outlier corresponding to the bin size 33 - 32 as shown in the histogram below.




The mean of the ink color with congruent words $\bar{x}c$ = 14.05
The mean of the ink color with congruent words $\bar{x}ic$ = 22.02

On average, it took longer for people to say the ink color of the words when the words were incongruent with the ink color than when the words are congruent with the ink color.
Sample Standard Deviation of the ink color with congruent words Sc = 3.56
Sample Standard Deviation of the ink color with incongruent words Sic = 4.80
Sample Standard Deviation of the differences of incongruent and congruent S-D = 4.87

| | A | B | C | D | E |
|---|---|---|---|---|---|
| 1 | **Congruent (c)** | **Incongruent (ic)** | **Difference (D)** | **$\bar{x}D$ =** | **7.964791667** |
| 2 | 12.079 | 19.278 | 7.199 | | |
| 3 | 16.791 | 18.741 | 1.95 | **$\bar{x}c$ =** | **14.051125** |
| 4 | 9.564 | 21.214 | 11.65 | | |
| 5 | 8.63 | 15.687 | 7.057 | **$\bar{x}ic$ =** | **22.01591667** |
| 6 | 14.669 | 22.803 | 8.134 | | |
| 7 | 12.238 | 20.878 | 8.64 | **Sc =** | **3.559357958** |
| 8 | 14.692 | 24.572 | 9.88 | | |
| 9 | 8.987 | 17.394 | 8.407 | **Sic =** | **4.797057122** |
| 10 | 9.401 | 20.762 | 11.361 | | |
| 11 | 14.48 | 26.282 | 11.802 | **S-D =** | **4.86482691** |
| 12 | 22.328 | 24.524 | 2.196 | | |
| 13 | 15.298 | 18.644 | 3.346 | | |
| 14 | 15.073 | 17.51 | 2.437 | | |
| 15 | 16.929 | 20.33 | 3.401 | | |
| 16 | 18.2 | 35.255 | 17.055 | | |
| 17 | 12.13 | 22.158 | 10.028 | | |
| 18 | 18.495 | 25.139 | 6.644 | | |
| 19 | 10.639 | 20.429 | 9.79 | | |
| 20 | 11.344 | 17.425 | 6.081 | | |
| 21 | 12.369 | 34.288 | 21.919 | | |
| 22 | 12.944 | 23.894 | 10.95 | | |
| 23 | 14.233 | 17.96 | 3.727 | | |
| 24 | 19.71 | 22.058 | 2.348 | | |
| 25 | 16.004 | 21.157 | 5.153 | | |
| 26 | | | | | |
| 27 | | | | | |

0

5) Sample size n = 24
The mean of the ink color with congruent words $\bar{x}c$ = 14.05
The mean of the ink color with congruent words $\bar{x}ic$ = 22.02
The mean of the difference $\bar{x}D$ = 7.97
Sample Standard Deviation for congruent words Sc = 3.56
Sample Standard Deviation for incongruent words Sic = 4.80
Sample Standard Deviation of the differences S-D = 4.87

Standard error of mean = $(S\text{-}D/\sqrt{n})$ = 0.99
t-statistics = $(\bar{x}D)/(S\text{-}D/\sqrt{n})$
t-statistics = 7.97 / 0.99 = 8.05
t-critical at alpha level of .05 one-tailed in the positive direction with 23 degrees of freedom = 1.714
Confidence level is 0.05
Margin of error = t-critical * $(S\text{-}D/\sqrt{n})$ = 1.714 * 0.99 = 1.70
Confidence interval of the mean difference CI = $\bar{x}D$ +/- t-critical * $(S\text{-}D/\sqrt{n})$ = (6.27, 9.67)
Cohen's d = $\bar{x}D$ / S-D = 7.97 / 4.87 = 1.64
$r^2 = t^2 / (t^2 + df) = 8.05^2 / (8.05^2 + 23) = 0.74$

The t-statistics is greater than the t-critical in the positive direction at an alpha level of .05. This means that the probability of getting the mean of incongruent ink color is less than 5% and that something must have caused it. There is a statistically significant increase in the average time it takes to say the ink color of the word that are incongruent with their ink color. This result match up with my expectation and as a result, I reject the null.

## Results Section

### Descriptive Statistics:

| | | |
|---|---|---|
| Median(c) = 14.36 | IQRic = 5.52 | Sic = 4.80 |
| Median (ic) = 21.02 | $\overline{xc}$ = 14.05 | S-D = 4.87 |
| Range(c) = 13.70 | $\overline{xic}$ = 22.02 | n = 24 |
| Range(ic) = 19.57 | $\overline{xD}$ = 7.97 | |
| IQRc = 4.69 | Sc = 3.56 | |

### Inferential Statistics:

Paired Sample t-test
$t(23) = 8.05$, $p = .05$, one-tailed in the positive direction
Confidence interval on the mean difference; 95% CI = (-0.38, 16.32)

### Effect size measures

$d = 1.67$
$r^2 = .74$