

Answer Sheet:

What is our independent variable? What is our dependent variable?

Independent variable will be the colors of font(ink color) that are either the same as the colors of name or different from the colors of name.

Dependent variable will be the time for each participant to tell the font colors(ink color) for each condition.

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

First we denote the sample mean of congruent words condition is μ_1 and that of incongruent words condition is μ_2 . Similarly, the standard error will individually be denoted as SE1 and SE2. Variance for those two conditions are Var1 and Var2.

I will perform a two-sided paired student-t test to generate and verify the results.

Justify: The ideal goal of this experiment is to achieve and compare the population means of congruence words condition and incongruent words condition. To be exactly, we are more interested in whether the difference of conditions will lead to different average response times for the whole population. However, it is time-consuming and impractical to gather all data for the whole population and that is the reason why we chose those representative samples to analyze. Indeed, we are impossible to directly get the mean and standard deviations of population and Z-score test may not be a good choice.

Take another perspective, we are interested in comparing the means of those two conditions and t test will be more ideal than chi-squared test, which is substantively used for categorical variables.

Hence, we choose t-test rather than chi-squared and Z-score tests.

Null Hypothesis(H_0): There is no difference of reaction time between congruent and incongruent words conditions.(population means between congruent and incongruent words conditions will be the same)

Alternative Hypothesis(H_A): There is a difference of reaction time between congruent and incongruent words conditions.(population means between congruent and incongruent words conditions will not be the same)

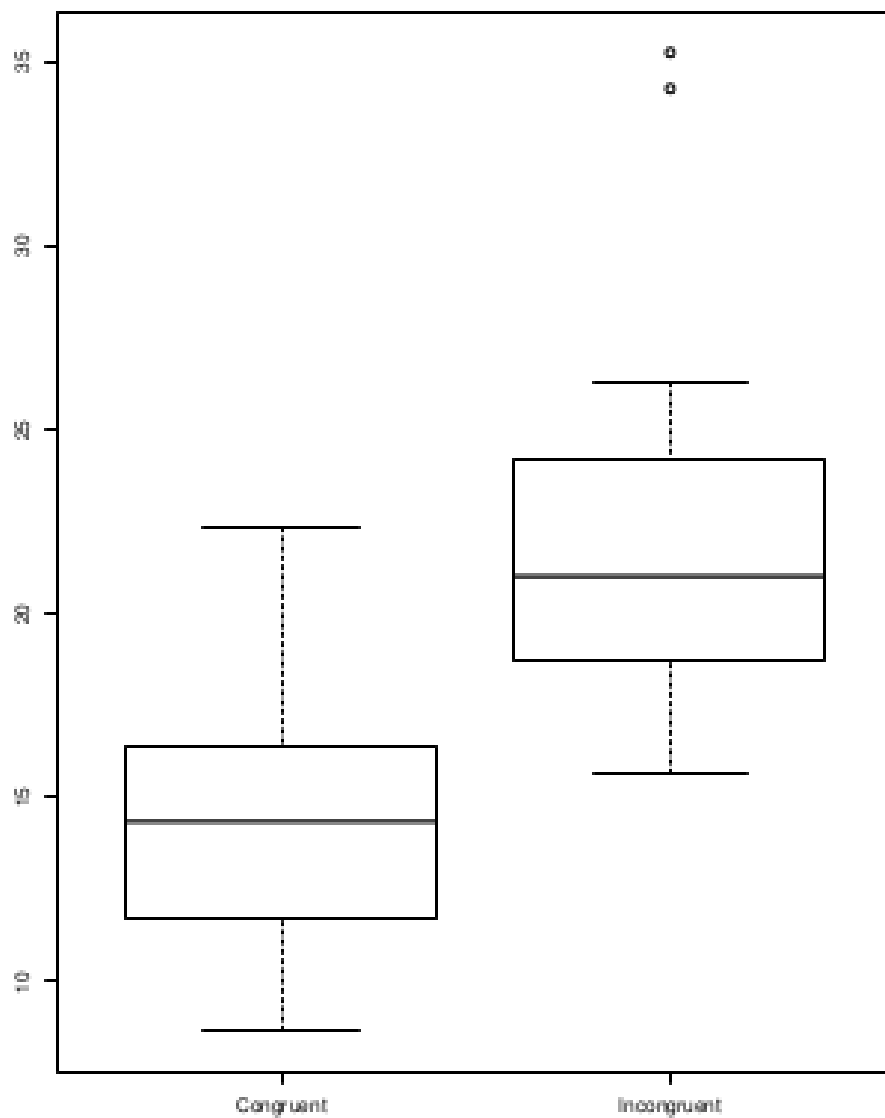
Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

Miu1-bar: 14.051125
miu2-bar: 22.0159166667

Var1 = 12.6690290707
Var2 = 23.0117570362
SE1 = 3.5593579576
SE2 = 4.7970571225

Median1 = 14.3565
Median2 = 21.0175

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.



By observation, the ranges and medians of two conditions vary significantly and that indicates that reaction time of incongruence group is much longer than that of congruence group.

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?

Assume we would like to find the 95% confidence interval and $\alpha = 0.05$.

Standard error of the difference between two samples = $4.8648269104/\sqrt{24} = 0.9930286348$

Since this is a two-tailed paired test and degree of freedom is 23, critical value will be +2.064 and -2.064.

t statistic is $(22.0159166667 - 14.051125) / 0.9930286348 = 8.0207069441$

Thus, t value falls in the critical region and the result is statistically significant.

We reject null hypothesis.

Now, we will compute the confidence interval:

$$\begin{aligned} \text{CI} &= (\bar{m}_1 - \bar{m}_2 - t\text{-value} * SE, \bar{m}_1 - \bar{m}_2 + t\text{-value} * SE) \\ &= (5.9151805645, 10.0144027688) \end{aligned}$$

Hence, we are 95 percent confidence that the true population mean will fall in the interval (5.9151805645, 10.0144027688)

Conclusion: This meet my expectation exactly. Individual attending the incongruence words test tends to make more mistakes and has a longer reaction time. Therefore, stroop effect presents.

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!

Potentially, I think that there are two main reasons causing stroop effect. The first theory is that people tend to read faster than to name the color. The second theory is that naming colors forces people to pay more attention than just reading words and those colors distract human minds to some extent.

Now I will give you a similar condition that leads to stroop effect.

I will let participants count the numbers of words on a blank paper. Similarly, there will be two conditions. For condition one, those words will be some verbs or some nouns that are totally irrelevant to numbers, such as dogs, cats, etc. But for condition 2, participants will have to read English words that represent numbers like two, three, eleven, etc. And then we also measure how long it takes for each individual to pronounce the correct number of counts. Hopefully we will find that people with condition 2 will have a longer reaction time than those with condition 1. This is due to stroop effect.

References:

Neuroscience For Kids: URL: <https://faculty.washington.edu/chudler/words.html>

Wikipedia - Stroop Effect: URL: https://en.wikipedia.org/wiki/Stroop_effect