

## Project 1: Test a Perceptual Phenomenon

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

The independent variable are the conditions – whether the words are congruent words or incongruent words.

The dependent variable is the amount of 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.

$\mu_C$  is the population mean of the amount of time it takes to name the ink color of congruent words.

$\mu_I$  is the population mean of the amount of time it takes to name the ink color of incongruent words.

$$H_0: \mu_C - \mu_I = 0$$

$$H_a: \mu_C - \mu_I \neq 0$$

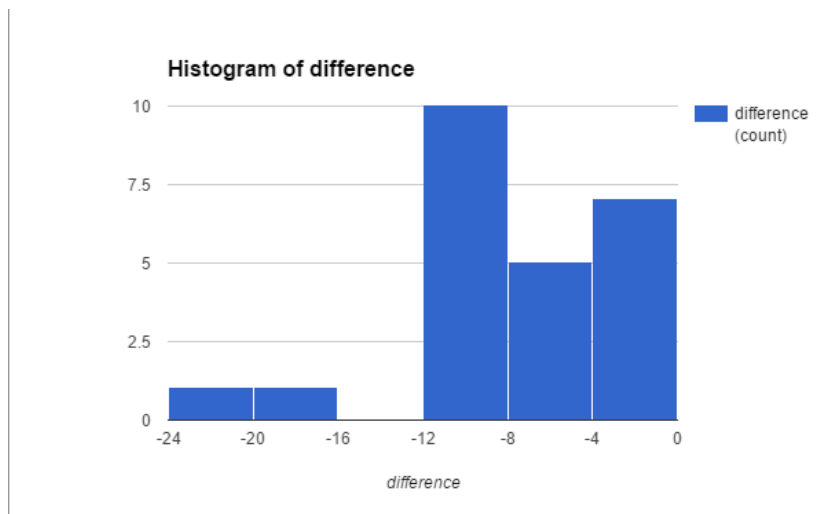
In other words, the null hypothesis is that there is no difference between the population means of the amount of time it takes to name the ink color of congruent words and incongruent words; any difference in the sample observations is due to chance. The alternative hypothesis is that there is a difference between the two population means.

Since we have within-subject design with two conditions, and we do not know the population mean and standard deviation, I expect to perform **dependent t-test for paired samples**.

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

After calculating the difference in timing between Congruent and Incongruent conditions, the mean of the difference is -7.96479, and the standard deviation is 4.864827.

### 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.



The most obvious thing to note is that all differences are negative. However, the distribution is not normal.

**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?

Mean Difference = -7.96479, SD = 4.864827, n = 24

t statistic =  $-7.96479 / (4.864827 / \sqrt{24}) = -8.021$

Let's set the alpha level to 0.05, so  $t^*(23) = 2.069$  and  $-2.069$

Since -8.021 is smaller than -2.069, our  $t^*$  value, and the two-tailed P value is less than 0.0001, we can reject the null hypothesis.

We can conclude that it takes less time to name the ink colors when words match the colors they are printed in, than words that don't match the colors they are printed in.

Yes, the results match my expectation.

**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!

I think the following is responsible: when words themselves aren't playing tricks on the brain, and not tricking it into expecting a certain color, it takes less time to process and say the name of the ink color. To generalize, maybe the part of our brain that is in charge of recognition (of color) is also in charge of reading comprehension.

Here's another task that I can think of: let people try to identify the names of 25 twins wearing certain jackets. And then, ask the same participants to name the same 25 twins when they switched their jackets.