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Stroop Effect Analysis

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

The independent variable is the word condition. The dependent variable is the 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: $H_0: \mu_1 = \mu_2$

There is no difference in the mean times to read the ink colors for both the congruent and incongruent word conditions.

Alt Hypothesis: $H_a: \mu_1 \neq \mu_2$

There is significant difference in the mean times to read the ink colors for both the congruent and incongruent word conditions.

μ_1 represents the mean time to read the ink colors for the congruent word condition population.

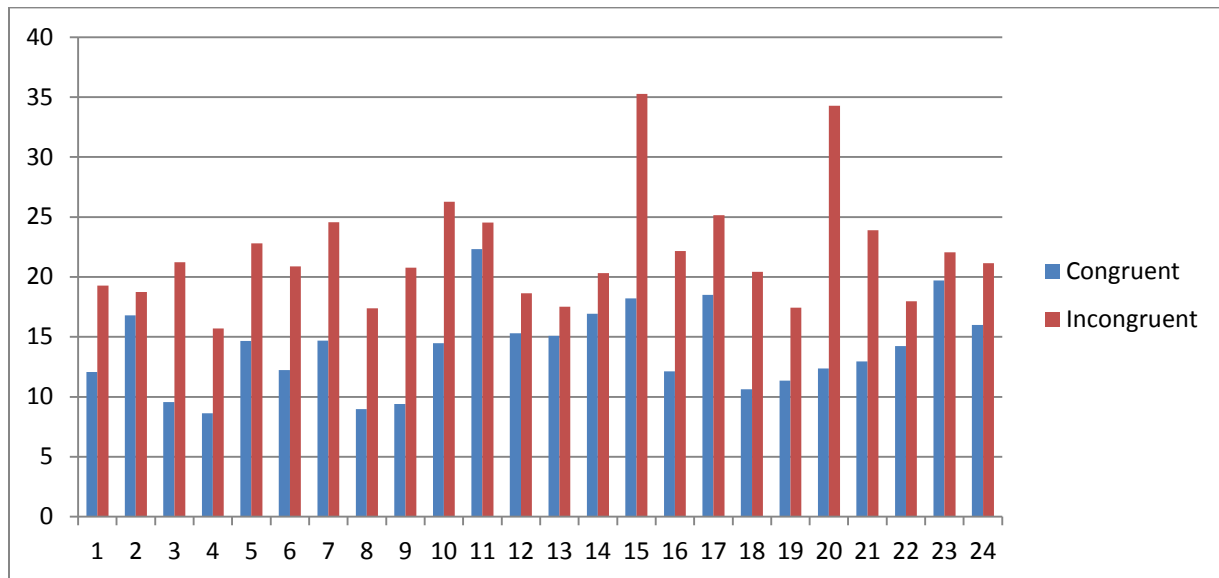
μ_2 represents the mean time to read the ink colors for the incongruent word condition population.

Since we are working with 2 small samples ($n < 30$) and we do not know the population standard deviations, I expect to perform a dependent two-tailed t-test on this research. Each participant performed the two word conditions and the measurements are coupled. We assume the population data to be approximately 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.

	Congruent	Incongruent	
Mean	14.05	22.02	
Standard deviation	3.56	4.80	
n (sample size)	24	24	

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.



We can see from the chart that the incongruent word condition seems to have caused interference and slower times to read the ink colors versus the congruent word condition. We want to know if the difference in the means is statistically significant.

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?

Using alpha = 0.05	
df = degrees of freedom	23
t-critical	+/-2.07
t statistic	-8.02
r ²	.74
95% confidence interval	(-10.02, -5.91)

I calculated a t statistic of -8.02 which falls in the alpha = 0.05 critical range of +/-2.07 so therefore, we reject the null hypothesis that the means of the word conditions are equal. The means of the word conditions are statistically significant. Seventy-four (74) percent of the variability in the time to name the ink colors is due to the different word conditions. The 95% CI of (-10.02, -5.91) shows we are 95% confident that the difference in the means falls in this range. In other words, the incongruent word condition times are slower since the range is negative.

This is what I expected since when I did the Stroop task, I read the ink colors in 15.68 seconds for the congruent word condition versus 22.80 for the incongruent word condition.

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 believe the interference has caused the slower times in reading the ink colors.
From a very young age, we are conditioned to learn basic things like numbers, letters and colors.
I believe since this is ingrained in our minds and possibly into our subconscious, any difference (interference) causes us to hesitate in our thinking.

One task that might result in a similar result would be the following:
Most people had to memorize the multiplication tables when they were kids and that's why for the most part, we are able to do simple multiplication.
Suppose there was a test to read two columns of math problems.

congruent

$$2 \times 2 = 4$$

$$5 \times 8 = 40$$

$$7 \times 9 = 63$$

incongruent

$$1 \times 3 = 5$$

$$8 \times 8 = 54$$

$$9 \times 8 = 62$$

There might be delay in the reading the multiplication problems that are incorrect versus correct.

Resources used:

I read the wikipedia page on the Stroop Effect to get a better idea of the background of this study.
https://en.wikipedia.org/wiki/Stroop_effect