

Project 1: Test of Perceptual Phenomenon

Background information

In a Stroop task, participants are presented with a list of words, with each word displayed in a color of ink. The participant's task is to say out loud the color of the ink in which the word is printed. The task has two conditions: a congruent words condition, and an incongruent words condition. In the congruent words condition, the words being displayed are color words whose names match the colors in which they are printed. In the incongruent words condition, the words displayed are color words whose names do not match the colors in which they are printed. In each case, we measure the time it takes to name the ink colors in equally-sized lists. Each participant will go through and record a time from each condition.

Data Set: [VIEW](#) (With solution)

Questions for investigation

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

Dependent variable: Time it takes to name the ink colors in equally-sized lists.

Independent variable: The congruency condition - whether the name of the color matches with the ink color.

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

Hypothesis test

H₀: Time to name colors is the same for congruent and incongruent tasks. ($\mu_c = \mu_i$)

H_A: Time to name colors is *not* the same for congruent and incongruent tasks. ($\mu_c \neq \mu_i$)

We have 2 dependent samples of data, we can predict just by looking from the data that congruent list has less time as compared to incongruent list, but we cannot say it for

sure, so we decide to take non-directional **Two-sided T-test** to understand if there is a significant difference in congruent and incongruent data.

Note: We use t-test instead of z-test because we don't have population parameter but have sample data.

3. Report some descriptive statistics regarding this dataset.

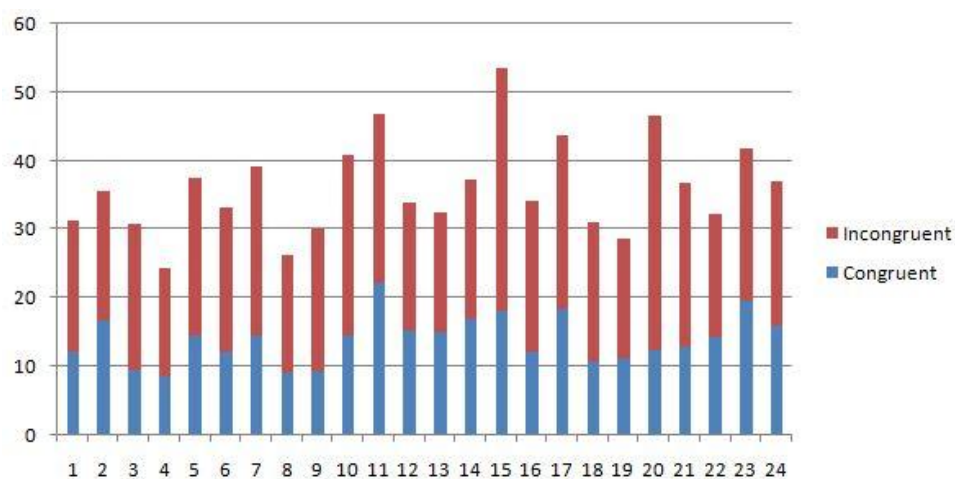
Congruent

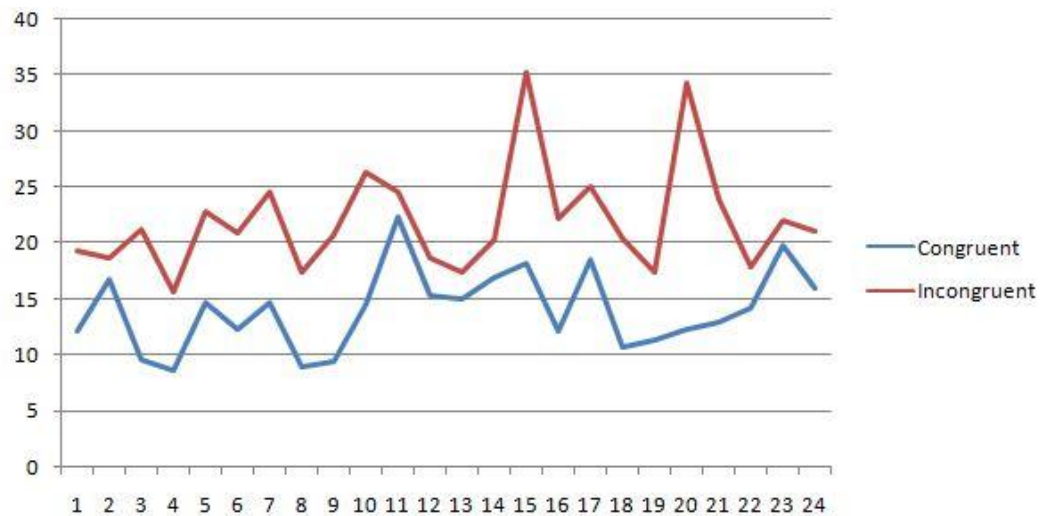
Mean: 14.051125
Median: 14.3565
Variance: 12.66902907
SD: 3.559357958

Incongruent

Mean: 22.01591667
Median: 21.0175
Variance: 23.01175704
SD: 4.797057122

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.





From the following visualization diagram, we can clearly see that congruent data is less than incongruent data. Hence we confirm our previous observation. But is it significant and not just by chance. We need to perform the T-test to get the further information.

5. 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?

μD : -7.964791667
 S: 4.86482691
 Degree of freedom (df): 23
 t-statistics: -8.020706944
 $\alpha = 0.05$
 t-critical: -2.06865761 and 2.06865761
 P: 4.103E-08
 95% CI: (-10.01902791 to -5.910555424)

Null hypothesis rejected. At $\alpha 0.05$, our 95% interval is between -2.069 to 2.069, we clearly see that our t-statistics value is not in between t-critical values. Hence we can reject the null. And state, Time to name colors is *not* the same for congruent and incongruent tasks. The two-tailed P value is less than 0.0001, By conventional criteria, this difference is considered to be extremely statistically significant.

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?

Our brain first focuses on the how we read the text, instead of focusing on the color of the text. As reading color dominates the visual appearance of text, hence it takes more time to concentrate on the task.

Numerical/Physical size Stroop tasks, where numerical values and physical size are the factors that contribute to congruency/incongruency, results in a similar effect. It takes longer to recognize the number and physical size (two separate tasks) of small numbers that have a large physical size and large numbers that have a small physical size.

References:

1. [Stroop Effect - Wikipedia](#)
2. [P-Value Calculator](#)