

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

Ans:

Dependent Variable: Response time of the user to identify color of the ink for a given list of printed words.

Independent Variable: Congruency/Incongruency condition: The word name or color of the ink will be same or different.

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

Now it's your chance to try out the Stroop task for yourself. Go to this link, which has a Java-based applet for performing the Stroop task. Record the times that you received on the task (you do not need to submit your times to the site.) Now, download this dataset which contains results from a number of participants in the task. Each row of the dataset contains the performance for one participant, with the first number their results on the congruent task and the second number their performance on the incongruent task.

Ans: Hypothesis for a given problem will be, incongruent printed words do not have an effect on the response time to tell the ink of the printed list of words. Alternate hypothesis for a given problem will be, incongruent printed words do have an effect on the response time to tell the ink of the printed list of words.

In a mathematical form,

H₀: $\mu_c = \mu_i$ (There is no difference in population mean of response time in congruent and incongruent scenario)

H_A: $\mu_c \neq \mu_i$ (There is a difference in population mean of response time in congruent and incongruent scenario)

μ_c = Population mean of response time for congruent list of words

μ_i = Population mean of response time for incongruent list of words

We have samples for the response time for a list of words in congruent and incongruent scenario. Sample size is less than 30. We don't have information about population mean for the congruent and incongruent scenarios. In this case t-test is best fit so we will use t-test to accept or reject the hypothesis. We will do a two-tailed t-test because we don't know the direction of the effect and how it is going to behave.

The shape of the sampling distribution for this type of problem is different from the normal distribution, especially when sample size is less than 30. This sampling distribution is given the special label of the "t-distribution". For practical purposes, the shape of the t-distribution is identical to the normal distribution when sample size is large. However, when sample sizes are small (below 30), the shape of the t-distribution is flatter than that of the normal distribution, and the t-distribution has greater area under the tails. The reason that the distribution is not normal is because the standard error is estimated using the sample standard deviation instead of the population standard deviation (because the population standard deviation is not known). This creates some uncertainty that is reflected in the t-distribution having greater area under the tails than the normal distribution, especially when the sample size is below 30

Reference: <https://simon.cs.vt.edu/SoSci/converted/T-Dist/activity.html>

Test Result:

Congruent words: 12.01 secs

Incongruent words: 30.36 secs

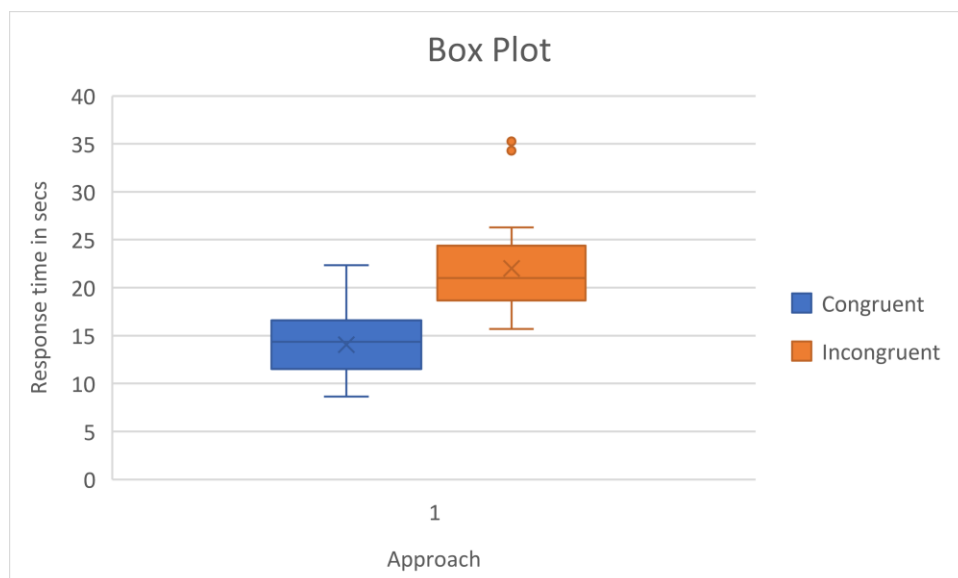
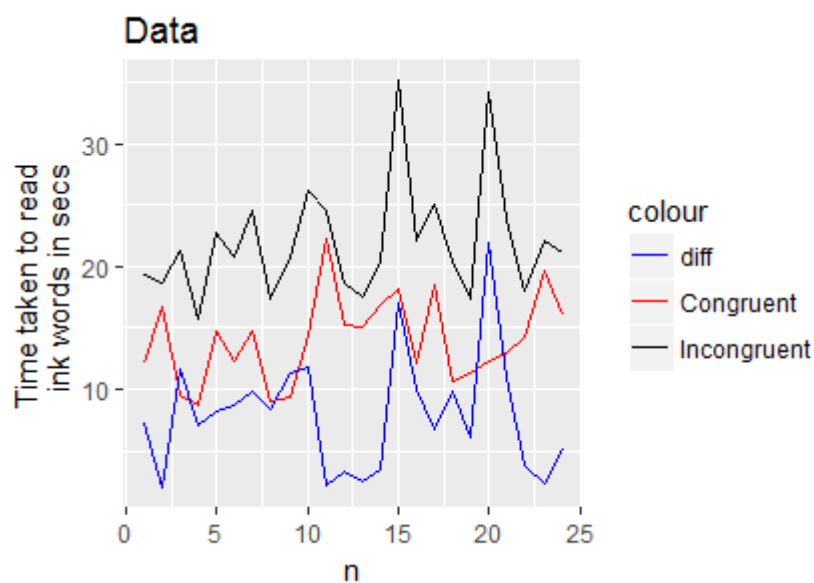
- Report some descriptive statistics regarding this dataset. Include at least one measure of central tendency and at least one measure of variability.

Ans:

column	mean	median	std_deviation	ss	n	df
Congruent	14.051125	14.3565	3.559358	291.3877	24	23
Incongruent	22.015917	21.0175	4.797057	529.2704	24	23
diff	7.964792	7.6665	4.864827	544.3304	24	23

- 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.

Ans:



Box plot and line chart clearly shows there is a significant difference in response time between congruent and incongruent scenario. Sample mean for the response time in

congruent and incongruent scenario is not equal so to reject the hypothesis, let's do a t-test and get the results.

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?

Ans:

standard error = 0.993

Alpha = 0.01

t = 8.020

t critical = 2.807

cohen's d = 1.637

Confidence Interval = (5.176, 10.751)

As t statistics is greater than t critical and $p < 0.01$, we can reject the null hypothesis. So, we can say that incongruent printed words do have an effect on the time it takes to tell the ink of the printed list of words. As t statistics is positive we can say it takes more time to tell the ink of the printed list of incongruent set of words. It does match my expectation.