P1: Test a Perceptual Phenomenon

Author: Olena Gull-Kormachova
Date: 03-09-2017

Background Information

In a Stroop task, participants are presented with a list of words, with each word displayed in a colour of ink. The participant's task is to say out loud the *colour 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 colour words whose names match the colours in which they are printed: for example, RED, BLUE. In the *incongruent words* condition, the words displayed are colour words whose names do not match the colours in which they are printed: for example, PURPLE, ORANGE. In each case, we measure the time it takes to name the ink colours in equally-sized lists. Each participant will go through and record a time from each condition.

Questions for Investigation

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

Independent variable: congruent and incongruent words condition
Dependent variable: the time it takes to name the ink colours

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

Since the variance of the population is unknown, the sample size is small (<30), and participants are requested to perform a task under two different conditions, I aim to perform one-tailed dependent samples t-test which is chosen when two different treatments are applied to the same subjects.

An appropriate set of hypotheses for this task is:
$$H_0: \mu_C \geq \mu_I$$
$$H_a: \mu_C < \mu_I$$

Where: H_0 is a null hypothesis,
H_a is an alternative hypothesis,
μ_C is a population mean time for colour recognition for congruent words,
μ_I is a population mean time for colour recognition for incongruent words.

In this set of hypotheses, the null hypothesis states that the population mean time for colour recognition for congruent words is equal to or greater than the population mean time for colour recognition for incongruent words. The alternative hypothesis is that the congruent words population mean is less than the incongruent words population mean.

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	Difference C-I
n	24	24	24
mean	14,051	22,016	-7,965
median	14,357	21,018	-7,667
Variance	12,669	23,012	23,667
StdDev	3,559	4,797	4,865
SE	0,727	0,979	0,993

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.**

Bar Chart of Reaction Times
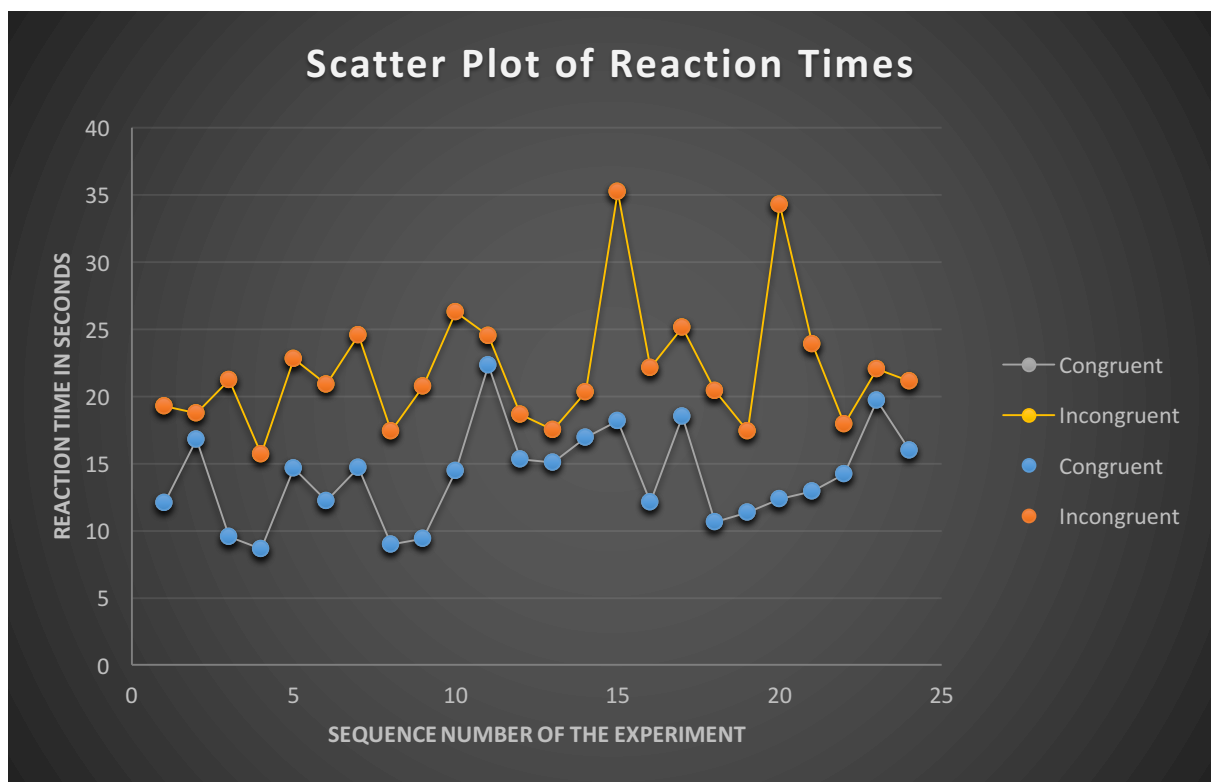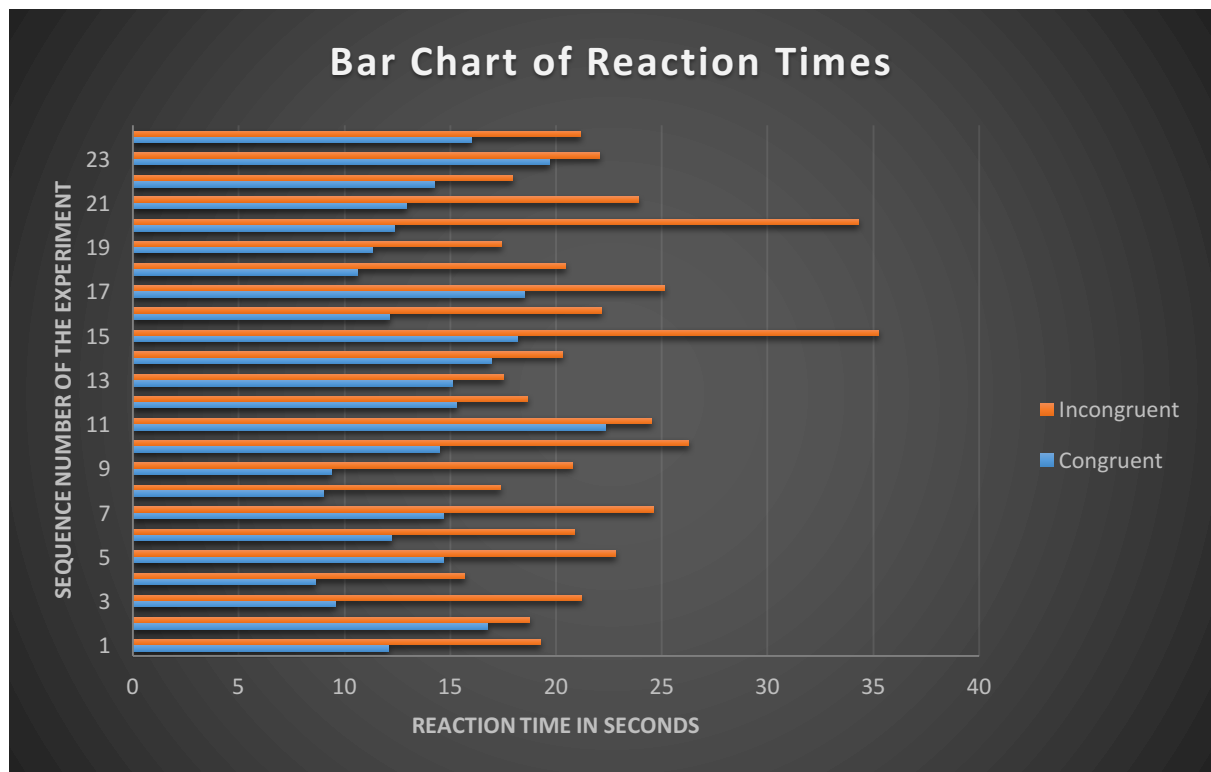
From both visualizations above we can clearly see that reaction time to answer incongruent test is longer than congruent. This is consistent with the descriptive statistics which we calculated before.

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?**

α = 0,05
df = 23
t_{crit} = -1,714
t = -8,02

With 95% confidence interval and 23 degrees of freedom, the critical statistic value for a one-tailed test is -1,714. My calculated t-statistic for the difference in means in colour recognition time of the congruent and incongruent tasks is -8,02 and it falls in the critical region; therefore, I can reject the null hypothesis in favour of the alternative hypothesis.

I can conclude that there is sufficient evidence at the α = 0,05 level of significance to support the statement that the participants reaction time for the colour recognition under incongruent words condition is significantly longer than of the congruent words condition.

The results match up with my expectations because my own results in seconds for incongruent part of the test were higher than for the congruent.

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!**

Normally, people tend to focus more on reading a word rather than on recognizing a colour when they see a coloured word. However, if we defocus our vision and concentrate only on colours, we will force our brain to recognise colours faster.
Similar task could be seeing picture of people with different faces expressions (sad, happy, angry) and reading those expressions under the picture. I believe that incongruent task would take more time to recognise correct face expression.

Background Information

- [One tailed test or two in Hypothesis testing. How to decide](#)
- [Numerical Stroop effect](#)
- [Dependent t-test for paired samples](#)
- [Hypothesis test](#)