

Project I

Test a Perceptual Phenomenon

Statistics: The Science of Decisions

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

Answer:

Independent Variable: **Congruency** i.e. whether the word is congruent (matches with the colour) or incongruent (doesn't match with the colour)

Dependent Variable: **Time** it takes to name the 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.

Answer:

Taking

Population mean for Congruent Test as (μ_1),

Population mean for Incongruent Test as (μ_2).

The null hypothesis is that there is no significant difference between each person's congruent (μ_1) and incongruent (μ_2) tests.

Mathematically,

$$\mu = \mu_2 - \mu_1$$

$$\text{Null H: } \mu = 0$$

The alternative hypothesis is that the difference between the tests will be significant for every person.

Mathematically,

$$\text{Alt. H: } \mu \neq 0$$

Results of Personal Tests:

Congruent = 13.588 s

Incongruent = 13.908 s

I expect to perform "Dependent T-Test for Paired Samples".

A dependent t-test is an example of a "within-subjects" or "repeated-measures" statistical test. This indicates that the same subjects are tested more than once. Thus, in the dependent t-test, "related groups" indicates that the same subjects are present in both groups.

Resource: <https://statistics.laerd.com/statistical-guides/dependent-t-test-statistical-guide.php>

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

Answer:

Descriptive Statistics:-

Central Tendency -

Statistic	Congruent	Incongruent	All
Mean	14.05113	22.01592	18.03352
Median	21.0175	14.05113	17.735

Variability -

Statistic	Congruent	Incongruent	All
Variance	12.66903	23.01176	33.65772
Standard Deviation	3.559358	4.797057	5.801528

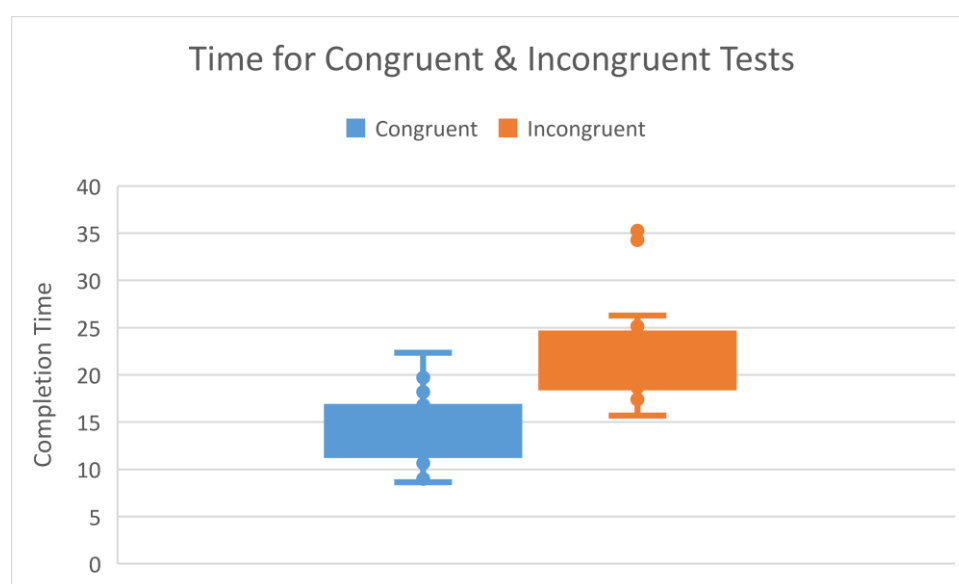
Resources:

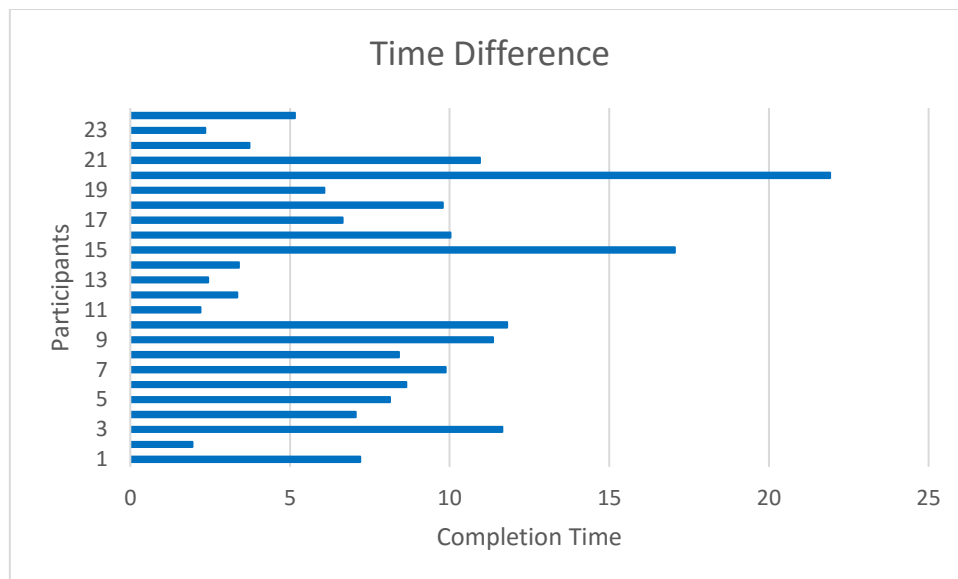
stattrek.com/descriptive-statistics/variability.aspx?tutorial=ap

https://en.wikipedia.org/wiki/Central_tendency

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.

Answer:





As can be clearly seen, the time for completion of Incongruent test is always greater than that of Congruent test in the given set. The boxplot shows the distribution and the outliers.

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?

Answer:

Paired t-test result:

$t(23) = -8.0207$

p-value: 0.00000004103

Confidence Level: 95%

Since the p-value is less than 0.05 (p-critical value), we reject the null hypothesis. Thus, the time difference between the incongruent & congruent tests are significant.

The results match up to 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!

Answer:

It is possible that the brain takes lesser time to recognise colour as compared to reading text. This time difference results in Stroop effect.

Alternatives with similar effect:

→ Singing a song's lyrics in another song's tune would take more time than the original.

→ Naming acquaintances, when they have their names written on a paper and stuck to their forehead. This might take more time than usually naming them as the brain will again start processing the text instead of instinctively naming them.

→ Numerical Stroop effect:

A digit can be presented as big or small (e.g., **5** vs. 5), irrespective of its numerical value. Comparing digits in incongruent trials (e.g., **3** 5) is slower than comparing digits in congruent trials (e.g., **5** 3) and the difference in reaction time is termed the numerical Stroop effect.

Resource: https://en.wikipedia.org/wiki/Stroop_effect#Numerical
