

Report of the Stroop Test Analysis

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

The **independent variable** is the **kind of test performed on the participant** i.e. congruent or incongruent. The **dependent variable** is the **time taken to complete each test**.

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

The **null hypothesis** (H_0) : There is no significant difference between the response times for the congruent and incongruent task

$$\mu_{congruent} = \mu_{incongruent}$$

The **alternate hypothesis** : There is a difference between the response times for congruent and incongruent tasks (in no specific direction)

$$\mu_{congruent} \neq \mu_{incongruent}$$

The **two-tailed t-test** was performed on the data to reach a statistical decision. Reason: The sample size is **quite small** (< 30) and the standard deviation of the population as a whole is not known to us. Thus, we perform a **t-test** instead of a Z-test

There is only one categorical variable. The experiment is performed on two related groups i.e. the same set of subjects as the same person appeared for the congruent as well as incongruent task. Our hypotheses is poised to **determine a relation between the means** of the two groups. Thus, we conduct a **dependent t-test**.

Moreover, we are not concerned with **direction** of the difference. Thus, it is a **two-tailed t-test**.

3) Descriptive Statistics regarding the test

Means:

Congruent: 14.051125

Incongruent: 22.015917

Median:

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Congruent: 14.3565

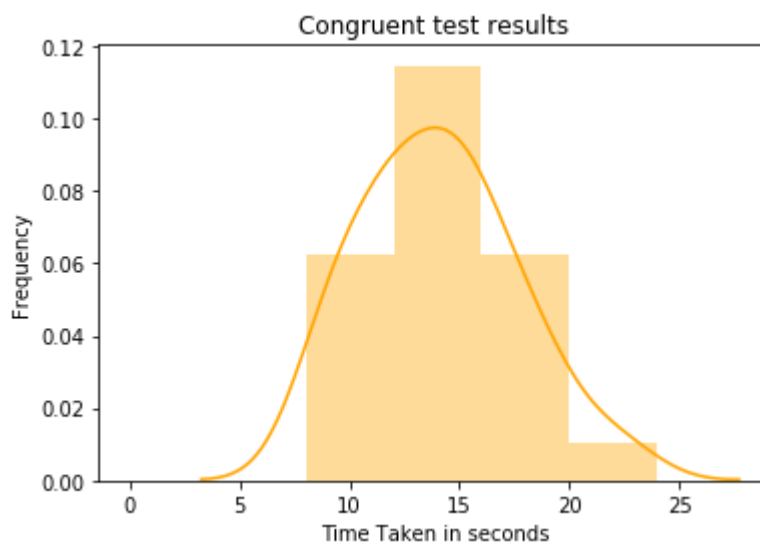
Incongruent: 21.0175

Standard deviation:

Congruent 3.559358

Incongruent 4.797057

4) Data visualizations



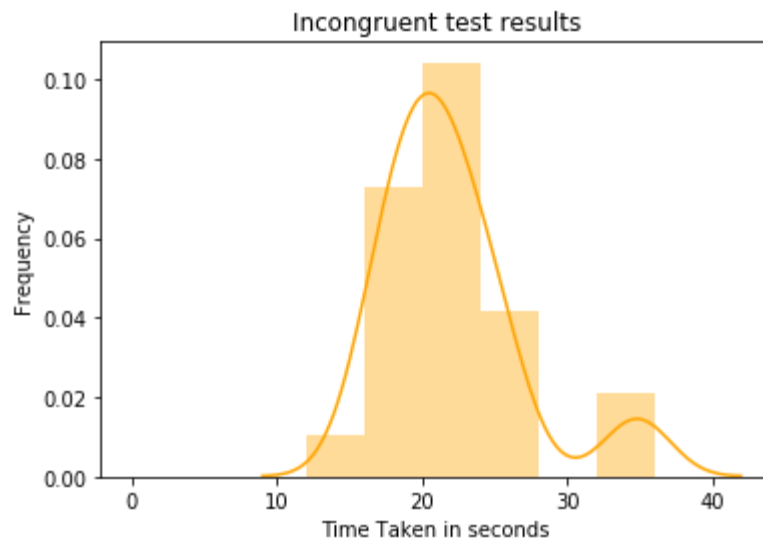
Observations:

Time taken ranges between **7 and 24 seconds**

Majority of the candidates took **12-16 seconds** to complete the congruent images test

The data is **normally distributed**

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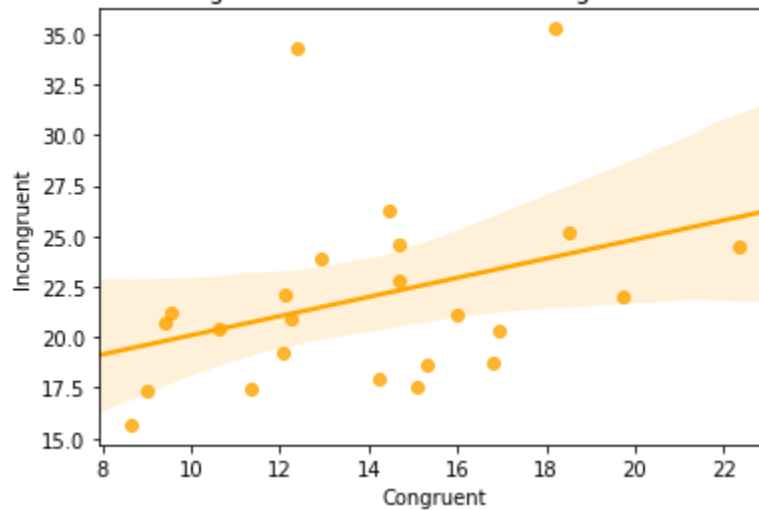
Observations:

The time taken ranges from **12 to 36 seconds**

Majority candidates took **20-24 seconds** to complete the test on incongruent images

The data **shows some positive skewness** but mean is pretty close to the bar with the highest frequency. So, it can be considered **normally distributed to some extent**

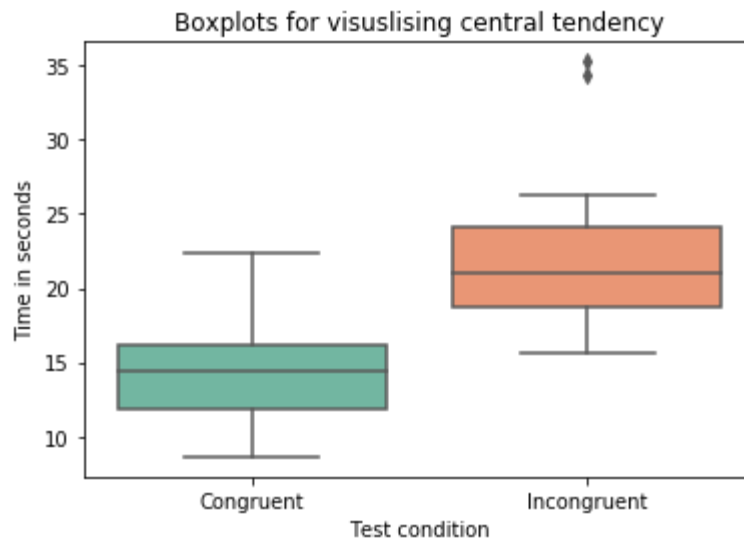
Scatter Plot for visualizing the correlation between Congruent and Incongruent timings



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Observations:

There exists a net upward trend but the positive correlation is **very weak**. There are a number of subjects in the sample that have had deviation from the trend. Thus, by and large there is no such correlation and subjects with low congruent times may or may not have low incongruent times



Observations:

There are **no outliers** in the congruent data.

There are **outliers** in the incongruent data.

The mean of the incongruent data is **more** than that of the congruent data

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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?

degree of freedom = 23

t-value = -10.962468918867696

confidence level = 99% based on the t-table. This implies that the risk of rejecting the null hypothesis when it is true is very low (i.e. less than 1% chance of a type 1 error)

p-value = less than 0.001

This value is extremely statistically significant

We reject the null hypothesis

This implies that there is a significant difference between the mean time taken to complete the congruent task and the mean time taken to complete the incongruent task. The negative t-value suggests that the time taken to do the congruent task is usually lesser than the time taken to do the incongruent task

The decision does match my expectation because the incongruent task requires greater focus and thus more time. When I took the Stroop task, I too took approx 4-5 s more on the incongruent task.

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!

Ans. Since recognizing colors is not an "automatic process" there is hesitancy to respond; whereas, the brain automatically understands the meaning of words as a result of habitual reading. This idea is based on the premise that automatic reading

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does not need controlled attention, but still uses enough attentional resources to reduce the amount of attention accessible for color information processing

A similar task can be giving the participant a list of simple words like

Happy, sit, ugly and so on. The task would be read out the opposite of the word (antonym) instead of the word itself.

For example, happy will be read as sad, sit as stand and so on.

This test is also based on the theory that the brain is not accustomed to automatically responding to the opposite of the word and thus uses more attention and cognitive ability like the color recognition based Stroop task

Additional resources: https://en.wikipedia.org/wiki/Stroop_effect