

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

An independent variable is the variable that is changed or controlled in a scientific experiment

to test the effects on the dependent

variable. A dependent variable is the variable being tested and measured in a scientific experiment. Dependent variable is also known as

outcome variable.

Independent variable: Color Congruency and,

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

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

Every hypothesis test contains a set of two opposing statements, or hypotheses, about a population parameter. The first hypothesis is called

the null hypothesis, denoted by  $H_0$ . The hypothesis that the estimate is based solely on chance is called the null hypothesis. Thus, the null

hypothesis is true if the observed data (in the sample) do not differ from what would be expected on the basis of chance alone.

The complement of the null hypothesis is called the alternative hypothesis. The alternative hypothesis is the statement you want to be able

to conclude is true. Alternate hypothesis is abbreviated as  $H_a$ .

$H_0: \mu = \mu_{H_0} = 0.05$  .

$\mu$  is the population mean

Alternate hypothesis is the opposite of null hypothesis

The population parameter is not equal to the claimed value

$H_a: \mu \neq \mu_{H_0} \neq 0.05$

The population parameter is greater than the claimed value

$H_a: \mu > \mu_{H_0}$

The population parameter is less than the claimed value

$H_a: \mu < \mu_{H_0}$

For this task a set of hypotheses is:

$H_0$ : There is no difference in population means of response time under incongruent and congruent conditions (  $H_0: \mu_C = \mu_I$  ),

$H_a$ : Population mean of the response time under incongruent condition will be significantly larger than the response time under congruent

condition (  $H_a: \mu_C < \mu_I$  )

For this task we have to calculate the mean, standard deviation, variance, p-value and t-test value.

Here the sample size is less than 30.

Population standard deviation is unknown.

In z test the conversion is based on our knowledge about the population's standard deviation and mean. A z-score tells us how many standard

deviations from the mean our result is. We can use our knowledge of normal distributions (like the 68.95 and 99.7 rule) or the z-table to

determine what percentage of the population will fall below or above our result.

But in case of T-test we have to assume that the distributions are normal.

Based on the way the experiment is being conducted the test is a dependent. The assumptions of the t-test for dependent means focus on

sampling, research design, measurement, and distribution. The t-test for dependent means is considered typically "robust" for violations

of normal distribution.

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

mean of congruent task = 14.051125  
mean of Incongruent task = 22.01591667  
Variance of congruent task = 4887.793435  
Variance of Incongruent task = 11797.9394  
Standard Deviation of congruent task = 3.559357958  
Standard Deviation of Incongruent task = 4.797057122

Ques-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.

#### Observation about congruent and Incongruent data plots

We can see that the results on the congruent task data approaches to normal distribution and same as in Incongruent task data.

From box-plots we can see most of the data points lies between lower quartile and upper quartile in congruent task. Same as in Incongruent task.

Ques-5. What is your confidence level and your critical statistic value?

#### CONFIDENCE LEVEL

A confidence level refers to the percentage of all possible samples that can be expected to include the true population parameter.

Confidence interval for congruent data at 95% confidence level:

for low is 12.5481

for high is 15.5541

Confidence interval for Incongruent data at 95% confidence level:

for low is: 19.99029

for high is 24.04153624

#### CRITICAL STATISTIC VALUE

The critical value is a factor used to compute the margin of error, as shown in the equations below.

Margin of error = Critical value x Standard deviation of the statistic

When the sampling distribution of the statistic is normal or nearly normal, the critical value can be expressed as a t score or as a z score. To find the critical value, follow these steps.

Compute alpha ( $\alpha$ ):  $\alpha = 1 - (\text{confidence level} / 100)$

Find the critical probability ( $p^*$ ):  $p^* = 1 - \alpha/2$

To express the critical value as a t statistic, follow these steps.

Find the degrees of freedom (df). Often, df is equal to the sample size minus one.

The critical t statistic ( $t^*$ ) is the t statistic having degrees of freedom equal to df

and a cumulative probability equal to the critical probability ( $p^*$ ).

From t-test table: For congruent task

dof = 24-1

= 23

At dof 23 and  $p^* = 0.9172294497$

T-test value is 0.20 for one tail.

Critical static value at 0.20 = 0.7118715916

From t-test table: For Incongruent task

dof = 24-1

= 23

At dof 23 and  $p^* = 0.8747923188$

T-test value is 0.20 for one tail.

Critical static value at 0.20 = 0.9594114244

Ques- Do you reject the null hypothesis or fail to reject it?

At  $T=8.020706944$  and dof=23, The two-tailed P value is less than 0.0001

P-value is smaller than the significance value so we reject the null hypothesis.

## CONCLUSION

I conclude by putting everything together. A 95% confidence interval for the congruent data mean is 14.051125 and

standard deviation is 3.559357958. For the Incongruent data mean is 22.01591667 and standard deviation is 4.797057122.

Alternatively we could state this confidence interval as 12.54813 to 15.55411 for congruent data and confidence interval

as 19.9902971 to 24.041535 for Incongruent data.

For congruent data critical statistic value is 0.1655411005.

And for Incongruent data critical statistic value is 0.2504153624.

Finally the result match with my expectation.