Testing a perceptual phenomenon

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Background information

In a Stroop task, participants are presented with a list of words, with each word displayed in a color of ink. The participant's task is to say out loud the *color 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 color words whose names match the colors in which they are printed: for example RED, BLUE. In the *incongruent words* condition, the words displayed are color words whose names do not match the colors in which they are printed: for example PURPLE, ORANGE. In each case, we measure the time it takes to name the ink colors 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?

Congruency of the words will be the ***independent variable***. *Any word can appear in any colour.*

*The **response time** of the participant will the **dependent variable.***

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

HYPOTHESES:

μ1 = mean response time of congruent test

μ2 = mean response time of incongruent test

Null hypothesis (H_0): μ1 - μ2 ≥ 0

*In null hypothesis, the response time of **incongruent test** is considered **equal or lesser** than response time of **congruent test**.*

Alternative hypothesis (H_A): μ1 - μ2 < 0

*In alternative hypothesis, the response time of **incongruent test** is considered **more** than that of **congruent test**.*

STATISTICAL TEST TO BE PERFORMED:

A ***paired t-test*** *will be suitable due to following reasons:*

- *Both the tests are conducted on same set of people, thus it's **dependant.***
- *Response time are measured twice. .*
- *Alternative hypotheses is lower tailed.*
- *Standard deviation is unknown.*
- *Sample size is less than **30.***
- *The variables are normally distributed.*

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

The following are some statistical data obtained by using functions in Google sheets.

Statistic	Congruent	Incongruent
Count (n)	24	24
Mean ($\bar{X}$)	14.051125	22.01591667
Median (M)	14.3565	21.0175
Standard Dev (s)	3.559357958	4.797057122
Variance (s^2)	12.66902907	23.01175704

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.

RESPONSE TIME - CONGRUENT VS. INCONGRUENT TEST
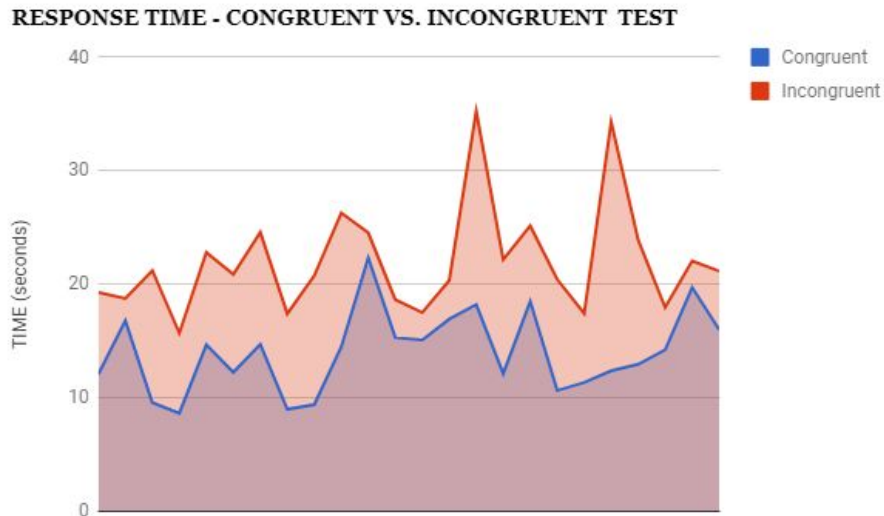
The plot shows an area graph of response time of both congruent and incongruent tests.

We can see from the above visualization that Incongruent tests take longer time.

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?

The following data were obtained when a paired t-test was conducted over the given data.

Confidence level = 99 %

α = .01

t-Test: Paired Two Sample for Means

Statistic	Congruent test	Incongruent test
Mean	14.051125	22.01591667
Variance	12.66902907	23.01175704
Observations	24	24
Pearson Correlation	0.351819527	
Hypothesized Mean Difference	0	
df	23	
t Stat	-8.020706944	
P(T<=t) one-tail	2.0515E-08	
t Critical one-tail	2.499866736	
P(T<=t) two-tail	4.103E-08	
t Critical two-tail	2.807335678	

- *The **negligible P value** of the one tail test straight away shows that **NULL HYPOTHESES** must be **REJECTED.***
- *The t - statistic value arrives to be **-8.0207** which is not in range of the **t - critical value.** This too leads to rejection of **NULL HYPOTHESES.***
- ***ALTERNATIVE HYPOTHESES SUCCEEDS***

*Thus from the above results, we conclude that **incongruent tests** will take more time when compared to **congruent tests.** The reason is that it takes time to analyse both colour and the word.*

The results did match with what I expect out of common intuition.

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!

- *The reason for the above result is that it we need observe both the color and the word carefully which takes more time when compared to observing the colors only.*
- *We can use the Stroop effect as tool to evaluate performance of human beings.The same analyses can be carried for proving the **importance of sleep** by conducting the test over candidates with good sleep and over candidates with sleep deprivation. Any similar tests can also be carried out apart from Stroop effect.*
- *We can analyse performance of energy drinks over athletes with same tests.*

REFERENCES :
1. *Wikipedia - Stroop effect*
2. *http://blog.minitab.com/blog/michelle-paret/alphas-p-values-confidence-intervals-oh-my*
3. *https://www.youtube.com/watch?v=wy8GVt7Ityk*
4. *http://www.statisticssolutions.com/manova-analysis-paired-sample-t-test/*
5. *https://www.youtube.com/watch?v=pTmLQvMM-1M&t=302s*