Stroop Task

What is a Stroop Task ?

A Stroop Task is a demonstration of interference in the reaction time of a task. It is widely used in clinical practice and investigation.

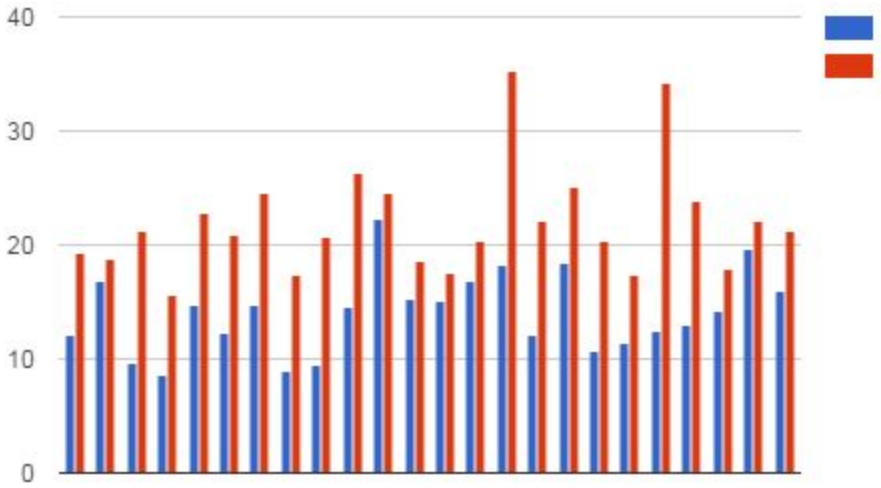
Participants are presented with a list of words, with each word displayed in a color of ink. The participant's task is to say the color of ink in which the word is printed. There are 2 sets of words. Each participant reads the 2 sets and the time for each set is noted.

The first set represents congruent word condition. The words are color words, whose names match the colors they are printed in. For example, RED, BLUE, GREEN.

The second set represents incongruent word condition. The words are color words, whose names do not match the colors they are printed in. For example, RED, BLUE, GREEN.

Statistics

A Dataset was collected containing results from 24 participants.

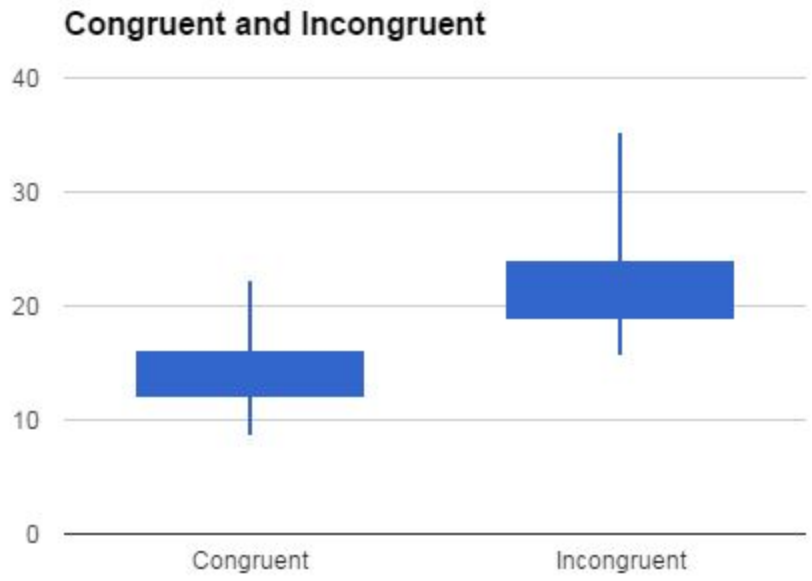


Blue bars : Congruent Word Condition
Red bars : Incongruent Word Condition

The 2 sets of words were our *independent variables* and the time taken to read all the words in each set were our *dependent variables*.

As clearly seen, each participant takes more time for the incongruent condition, than the congruent condition.
Comparing the sample median values : 14.36 for congruent condition, and 21.02 for incongruent condition, also gives the same result.
As does comparing the sample means values : 14.05 for congruent condition, and 22.02 for incongruent condition.

We found the standard deviation for the Congruent condition to be 3.56
whereas for the Incongruent condition to be 4.8.
So our Sample values are quite spread out.



These boxplots help us visualize the data, again showing that naming the color of the word takes longer when it doesn't match with the color meant by the word.

Results

The data in this repeated measures design was analyzed using statistical methods.
We conducted Dependent Samples t-test.
We chose to do a paired t-test since our sample size is 24 and we don't know the population standard deviation. We assume that the distributions are Gaussian.

If μ_c represents the population mean of Congruent condition times,
and μ_i represents the population mean of Incongruent condition times,
then our Null Hypothesis H_o is :
H_o : $\mu_c = \mu_i$

And our Alternative Hypothesis H_A is :
H_A : $\mu_c > \mu_i$ or
$\mu_c < \mu_i$ or
$\mu_c \neq \mu_i$

We chose a two-tailed test, assuming that Incongruent condition times can be greater than or less than the Congruent condition times.

If x_c is our sample mean of Congruent condition times,
and x_i is our sample mean of Incongruent condition times,
Our point estimate for x_c-x_i is -7.96.
Standard Deviation for the time differences is 4.87.
t_statistic = - 8.01
For significance alpha level of 5%,
t_critical = +/- 2.069

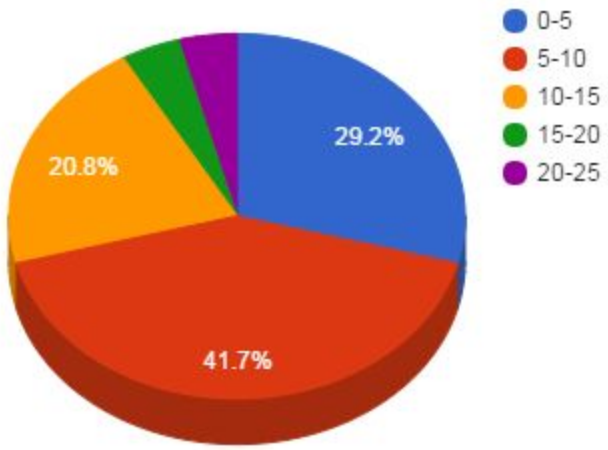
t_statistic is much lower than the t_critical value.
So we Reject the Null Hypothesis.

Our Effect size measure Cohen's d is -1.63.
The p-value < 0.0005

Our 95% Confidence Interval for the time differences is
(-10.02, -5.9)

So we can say that on average, participants will be slower by 10.02 to 5.9 time units for the Incongruent condition words than the Congruent condition words.

This is what we expected, because according to one of the many theories of explanation, the brain reads words faster than it recognizes colors !



Stroop Effect is based on the underlying notion that relevant and irrelevant information is processed in parallel, but they race to enter the single central processor during response selection.

Variations of Stroop Task are implemented for several reasons.
One of the variations is Numerical Stroop Effect, where participants are asked to choose a digit with higher value, among 2 digits. In the Congruent condition, higher value digits are larger in size than the other. For example, 5 : 3 , 1 : 6 , 4 : 7. In the Incongruent condition, higher value digits could be smaller in size than the other. For example, 4 : 7 , 2 : 8, 5: 9.

References

https://faculty.washington.edu/chudler/java/strvote.html

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

http://idahotc.com/Portals/0/docs/2012%20webinars/WAYPA-Session1-Stroop-Task-Handout.pdf

https://classroom.udacity.com

http://www.statisticshowto.com

http://support.minitab.com