

## P1: Test a Perceptual Phenomenon

1. The Independent variable sometimes called an experimental or predictor variable is being manipulated in an experiment in order to observe the effect on a dependent variable. In this case there are two samples Congruent and Incongruent. The color of the ink is manipulated in these two ways to measure the time it takes participants to name the ink colors in equally-sized list., therefore the independent variable is the congruency condition which is whether or not the name of the color matches the ink it is written in.

Dependent variable sometimes referred to as the outcome variable in this experiment is the time it takes for participants to say the name of the ink color in equally-sized lists .

2. "The Stroop effect (sometimes called the Stroop test) is an outcome of our mental (attentional) vitality and flexibility. The effect is related to the ability of most people to read words more quickly and automatically than they can name colors. If a word is displayed in a color different from the color it actually names; for example, if the word green is written in blue ink then we have a hard time noticing the blue ink. In this instance, even when asked to name the color of the ink, we tend to say the name the word represents". cited from USING THE STROOP EFFECT TO TEST OUR CAPACITY TO DIRECT ATTENTION Raymond De Young Associate Professor of Environmental Psychology and Planning 2034 Dana Building, School of Natural Resources & Environment University of Michigan, 440 Church Street, Ann Arbor, MI, USA 48109 - See more at: <http://www.snre.umich.edu/eplab/demos/st0/stroopdesc.html#sthash.97P32gdp.dpuf> Since there is a marked difference between the times used to recognize colors in the two groups, the average times used namely the means of the individual groups will be compared to show this difference. The Null Hypothesis  $H_0$  will show that the real difference between the two mean is zero(or insignificant) i.e.  $H_0: \mu_c = \mu_i$  and the Alternate Hypothesis  $H_A$  will show that the difference between these means does not equal to zero(or is significant) i.e.  $H_A: \mu_c \neq \mu_i$  where  $\mu_c$  = sample mean for Congruent and  $\mu_i$  = sample mean for Incongruent. (The Null hypothesis is; changing the ink color has no effect on the time the participants take to read out the words and the Alternate Hypothesis is changing the ink color will reduce the time the participants will take to read out the words.)

The experiments aims to investigate if the sample means are different just by chance or because there population means which we do not know are different. We use a repeated measured design and a two-tailed t-test to statistically analyze this experiment because i) we do not know the population parameters, ii) the two groups are dependent and iii) the same conditions apply to both groups- same participants are used.

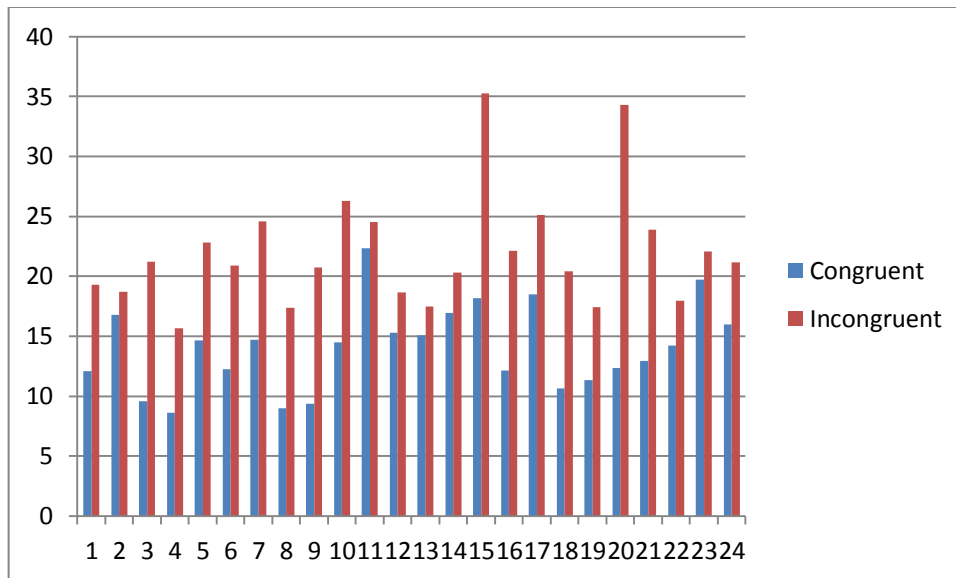
- 3.

Congruent	Incongruent	Difference(Con-Incon)
12.079	19.278	-7.199
16.791	18.741	-1.95
9.564	21.214	-11.65
8.63	15.687	-7.057
14.669	22.803	-8.134
12.238	20.878	-8.64
14.692	24.572	-9.88
8.987	17.394	-8.407
9.401	20.762	-11.361
14.48	26.282	-11.802
22.328	24.524	-2.196
15.298	18.644	-3.346
15.073	17.51	-2.437
16.929	20.33	-3.401
18.2	35.255	-17.055
12.13	22.158	-10.028
18.495	25.139	-6.644
10.639	20.429	-9.79
11.344	17.425	-6.081
12.369	34.288	-21.919
12.944	23.894	-10.95
14.233	17.96	-3.727
19.71	22.058	-2.348
16.004	21.157	-5.153
Average=14.051125	Average=22.01591667	Average=-7.964791667
Standard deviation =3.559357958	Standard deviation =4.797057122	Standard deviation= 4.86482691

$\mu_c = 14.05$ ,  $\mu_i = 22.02$

$Sd_c = 3.56$ ,  $Sd_i = 4.79$

4.



The chart shows the two groups have different median times showing the incongruent group has much longer times.

5.  $t_{\text{statistics}} = \mu_c - \mu_i / SE$

Difference in mean  $\mu_{\text{mean}} = \mu_c - \mu_i = 14.05 - 22.02 = -7.96$

$SE = S_{\text{diff}} / \sqrt{n} = 4.86 / \sqrt{24} = 0.99$

SE= standard Error, n = number of samples, S =sample standard deviation,  $S_{\text{dif}}$  = standard deviation of the difference of both groups

$df = 24 - 1 = 23$

$t_{\text{statistics}} = -7.96 / 0.99 = -8.02$

df= degree of freedom

$t_{\text{statistics}} = -8.02$  with p value of 4.103

using two tailed t-test for  $\alpha = 5\%$  or 0.05

$t_{\text{critical}}$  for  $\alpha = 0.025$  (one of the two tails) = -2.069 (ref t-table and p-value from Udacity link)

Margin of Error (ME) =  $t_{\text{critical}} * SE = 2.069 * 0.99 = 2.048$

Therefore confidence interval =  $\mu_{\text{mean}} \pm ME = -7.97 \pm 2.048 = -10.01, -5.91$

This test shows that 95% of the true difference between the averages of the two groups lies between -10.01 and -5.91

Since  $t_{\text{statistics}} > t_{\text{critical}}$  and the p value is less than 5% we reject the null hypothesis and Difference in mean  $\mu_{\text{mean}}$  is statistically significant meaning the Stroop effect holds and that is what I expected too.

6. The effects are caused by the fact that human brains have been conditioned or used to reading words rather than colors. The time delay could be explained as the brain trying to interpret the words and relate them to the color.