

Statistics :The science of decision

Stroop Effect:

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.

Question:

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

dependent: Response Time in seconds

independent: Word Condition (Congruent or Incongruent)

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

H_0 - Null Hypothesis: ($\mu_i - \mu_c = 0$) There is no significant difference in the population average response time in viewing the congruent(c) words vs viewing the incongruent(i) words.

H_a - Alternative Hypothesis: ($\mu_i - \mu_c \neq 0$) There is a significant difference, positive or negative, in the population average response times.

The Dependent Samples t-Test is the appropriate statistical test as the same subjects are assigned two different conditions. The different conditions are dependent because, in theory, by doing the first test you have some practice doing it and you might have an unfair advantage due to this learning effect in doing the similar type of test second. In addition, we don't have any population parameters provided (so a z-test would not be appropriate here).

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

a. Central tendency:

For congruent

X_c =mean of sample data of congruent

$X_c=14.051125$

For incongruent

X_i =mean of sample data of incongruent

$X_i=22.01591667$

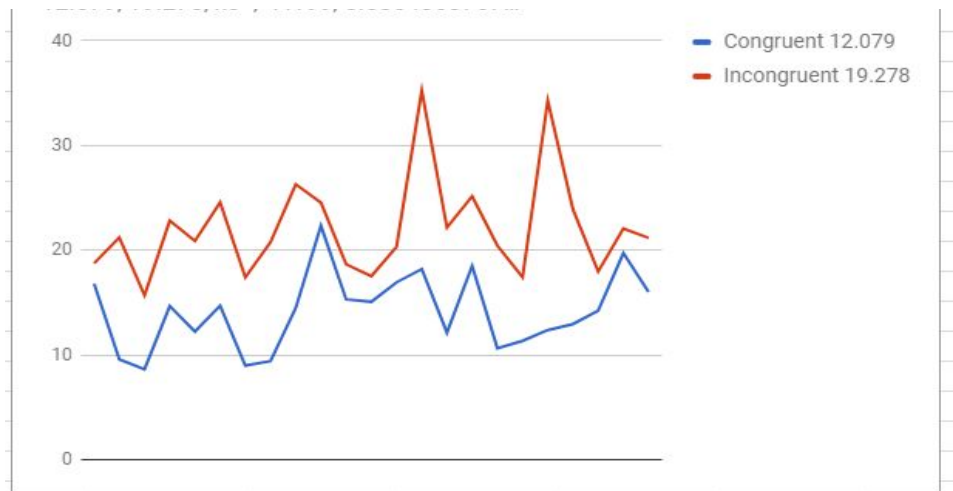
B.variability measure:

Standard deviation of each difference

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Congruent	Incongruent		difference	mean of difference squared deviation	sum of squared deviation/n-1							
2	12.079	19.278	$x_c=$	-7.199	-7.964791667	0.5864368767	23.66654087						
3	16.791	18.741	14.051125	-1.95		36.17771879							
4	9.564	21.214		-11.65		13.58076046							
5	8.63	15.687	$x_i=$	-7.057		0.8240857101	4.86482691						
6	14.669	22.803	22.01591667	-8.134		0.02863146007							
7	12.238	20.878		-8.64		0.4559062934							
8	14.692	24.572		-9.88		3.66802296							
9	8.987	17.394		-8.407		0.1955482101							
10	9.401	20.762		-11.361		11.53423104							
11	14.48	26.282		-11.802		14.72416779							
12	22.328	24.524		-2.196		33.27895729							
13	15.298	18.644		-3.346		21.33323646							
14	15.073	17.51		-2.437		30.55648071							
15	16.929	20.33		-3.401		20.82819438							
16	18.2	35.255		-17.055		82.63188754							
17	12.13	22.158		-10.028		4.256828627							
18	18.495	25.139		-6.644		1.744490627							
19	10.639	20.429		-9.79		3.33138546							
20	11.344	17.425		-6.081		3.548671043							
21	12.369	34.288		-21.919		194.7199302							

Hence standard deviation=4.86482691

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.



Observed:

The congruent data value is always less than corresponding to incongruent data value.

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?

$$X_c = 14.051125$$

$$X_i = 22.01591667$$

$$S = 4.86482691$$

$$t = (X_c - X_i) / (S / \sqrt{n})$$

$$t = (14.051125 - 22.01591667) / (4.86482691 / \sqrt{24})$$

$$t = -8.020706944$$

t-statistic= -8.020706944

t-critical=+2.069 or +2.069

Hence, t-statistic < t-critical

Conclusion:

We reject the Null Hypothesis which states that there is no significant differences between the population average completion time for the two different conditions (Congruent & Incongruent).

Inclusive document:

[spreadsheet](#)