Statistics: The Science of Decisions Project Instructions

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

As a general note, be sure to keep a record of any resources that you use or refer to in the creation of your project. You will need to report your sources as part of the project submission.

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

**Answer:** 1) Independent variable is word-color match (congruent) and word-color mismatch (incongruent). 2) Dependent variable is reaction time.

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

**Now it’s your chance to try out the Stroop task for yourself. Go to**[**this link**](https://www.google.com/url?q=https://faculty.washington.edu/chudler/java/ready.html&sa=D&ust=1479085549714000&usg=AFQjCNEuPVZlLqgwWFFZt6MKzNgzAmVMcA)**, which has a Java-based applet for performing the Stroop task. Record the times that you received on the task (you do not need to submit your times to the site.) Now, download**[**this dataset**](https://www.google.com/url?q=https://drive.google.com/file/d/0B9Yf01UaIbUgQXpYb2NhZ29yX1U/view?usp%3Dsharing&sa=D&ust=1479085549714000&usg=AFQjCNGp92P2DP8DSbMGkdx9E4AswIV7JA)**which contains results from a number of participants in the task. Each row of the dataset contains the performance for one participant, with the first number their results on the congruent task and the second number their performance on the incongruent task.**

**Answer:**

a) Null and alternative hypotheses are clearly stated in words and mathematically. Symbols in the mathematical statement are defined. Testing hypothesis is does performance for participants different from congruent task (μc) vs incongruent task (μi). null hypothesis Ho: μc = μi performance are the same, alternative hypothesis Ha: μc ≠ μi (a two-tailed test) performance varies among tasks.

b) A statistical test is proposed which will distinguish the proposed hypotheses. Any assumptions made by the statistical test are addressed. Dependent t pair test are used in this study because same group of participants were used in the studies, sample size is less than 30, we don’t know the population statistics, and we have to assume that distributions are Gaussian. We are comparing the two set of task and see if there is or isn’t a significant difference between the two. Ho: μc = μi , μc-μi =μd=0; Ha: μc ≠ μi, μd ≠0.

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

# Answer: 1) Measure of Central Tendency: Mean, most representative value in the dataset. x̄=∑X/N, mean in congruent is 14.05, mean in incongruent is 22.02. 2) Measure of variability: Standard Deviation and Standard Error of the Mean. SD in congruent is 3.56, SD in incongruent is 4.80, SEM=SD/√N= ( √((x-x̄)^2/N) ) / √N, SE in congruent is 0.71, SE in incongruent is 0.96.

# Reference: <http://land-of-angels.com/py1/stroop.pdf>, page7 & page8.

**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.**

According to this plot, we can observed all of incongruent data are higher than congruent data. In another word, all of participants took longer to answer when they tested on the incongruent data set.

Attachment: Stroop\_Test.ipynb

**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?**

**Answer:** 1) If α=0.5, t-statistic=-8.0207, p-value<0.0001. 2) Because p-value less than 0.0001 means that they don`t statistically differ, I will reject null hypothesis which means there is a significant difference in the mean task completion times/ performance between two conditions, and the incongruent task requires long time to complete. 3) This result match up with my expectations. I took longer when I watched on the incongruent data set.

Attachment: <https://drive.google.com/open?id=1b-5YQAuyxzPsEgr996zx7WrZiYoZlYidHo4uKlXkLvk>

**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!**

**Answer:** N/A