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?

Independent variable: 一致文字条件下的data，因为其不受影响；

Dependent variable: 不一致文字条件下的data，这一情况下是指参与者回答问题使用的时间，其会因一些因素而改变。

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

**适当假设集：**

设一致文字条件下总体的所使用的平均时间为μ1, 不一致条件下总体的所使用的平均时间为μ2

**建立假设** (alpha = 0.05):

*H0*: μ1 - μ2 = 0

*Ha*: μ1 - μ2 ≠ 0

零假设：不一致文字条件下所使用的平均时间与一致条件下所使用的平均时间不具备alpha为0.05的统计学差异

备择假设：不一致文字条件下所使用的平均时间与一致条件下所使用的平均时间具备alpha为0.05的统计学差异

**统计测试**：Inferences About the Difference Between Two Population Means: Matched Samples

**理由：**因为平均值差异可能是预期变异，我们需要通过T-检验发现其差异的显著性。我会做一个非独立配对样本的均值T-检验 (dependent paired, two-sample for mean T-Test)

* Dependent: I chose dependent because there is only one sample that has been tested twice
* Paired: I chose paired because our participants were measured at two time points (so each individual has two measurements).

Now it’s your chance to try out the Stroop task for yourself. Go to this link, 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 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.

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

The mean, median of the Congruent: 14.051125, 14.3565

The mean, median of the Incongruent: 22.0159167, 21.0175

The variance of the Congruent: 12.66902907

The variance of the Incongruent: 23.011757

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.

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?

置信水平α = 0.05

关键统计值：

t = -8.020706944

t-critical = 2.069

p-value (2-tail) = 4.10300058571119\*10-8

因为p值小于α，所以拒绝零假设

结论：不一致文字条件下所使用的平均时间与一致条件下所使用的平均时间具备alpha为0.05的统计学差异

此结果与我预期的一致，因为在不一致文字条件下，我自己也会犯更多错误，会导致所花时间更长；而在一致文字条件下，只需读出文字本身即可，类似于条件反射，所用时间较短。

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!

原因：一致文字条件下，大脑的思考类似于条件反射，思考、反应的时间更短；

非一致文字条件下，大脑要同时处理颜色与文字，时间更长。

类似任务：左手写字。

Reference：<https://en.wikipedia.org/wiki/Stroop_effect>

Textbook: Modern Business Statistics with Microsoft Excel 5th David