

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: lists of congruent and incongruent words (words printed in colors)

Dependent variable: the time it takes to name the colors on each list.

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

μ_1 symbolizes the mean time to read list of congruent words of all people (population)

μ_2 symbolizes the mean time to read list of incongruent words of all people (population)

- Null hypothesis (H_0): in the population, it takes all people equal or less time to read list of incongruent words than to read list of congruent words ($\mu_2 - \mu_1 \leq 0$)
- Alternative hypothesis (H_a): In the population, it takes people more time to read list of incongruent words than to read list of congruent words. ($\mu_2 - \mu_1 > 0$)

One-tail dependent t-test for paired sample in the positive direction

Justify:

- Use t-test instead of z-test because we don't know population standard deviation and sample size is smaller than 30
- Dependent t-test for paired sample because there is within-subject design using 1 set of subjects in 2 conditions.
- One-tail to show the positive direction, indicating the increase in time taken to read list of incongruent words in comparison with that to read list of congruent words

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

List of congruent words (List 1):

Mean: $x_1 = 14.05$

Standard deviation: $s_1 = 3.56$

Median: 14.3565

Range: 13.698

List of incongruent words (list 2):

Mean: $x_2 = 22.02$

Standard deviation: $s_2 = 4.80$

Median: 21.0175

Range: 19.568

Difference between time to read each list:

Mean (difference): 7.965

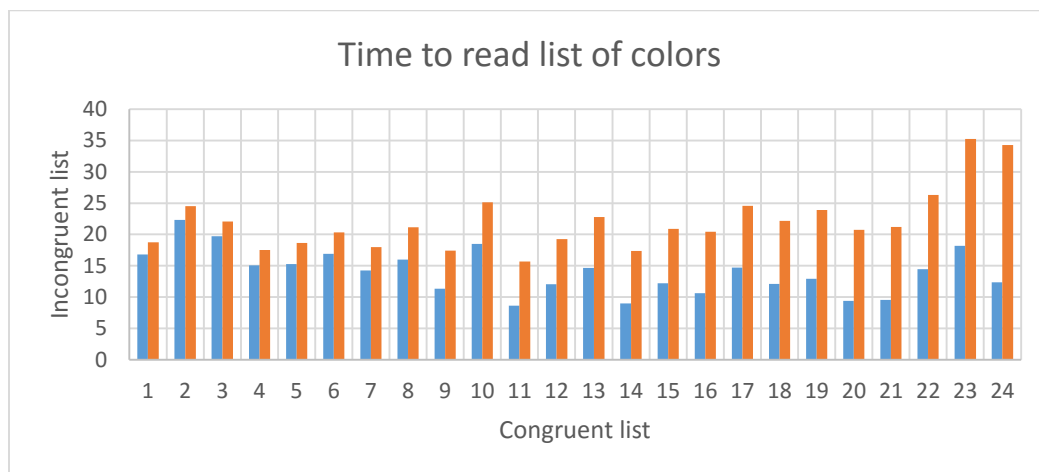
Max, min (difference): (1.95, 21.919)

Range (difference): 19.969

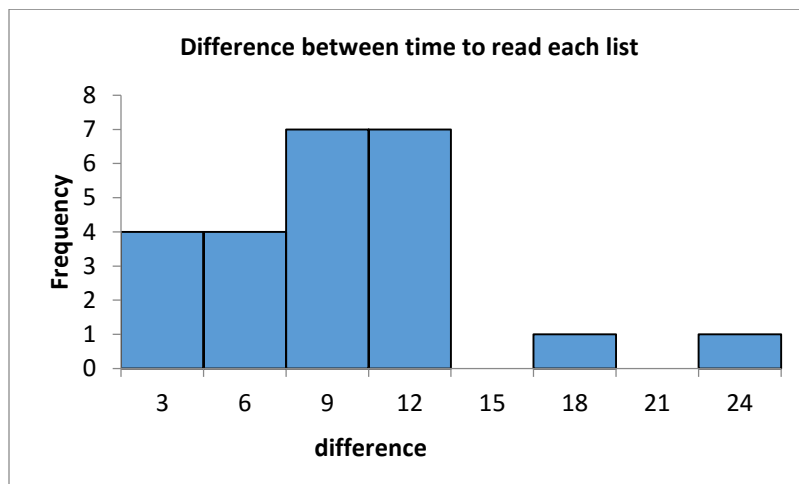
$Q3 = 11.635$; $Q1 = 4.295$

Interquartile range (IQR) = 7.34

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.



To each in 24 participants in the test, it takes more time to read the incongruent list than time to read the congruent list.



More than half of the participants take from 4 to 12 seconds more to read the 2nd list than to read the 1st list.

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?

Standard (difference): $s_D = 4.87$

Standard error (difference): $SE = s_D/\sqrt{n} = 0.99$

t-statistic = (difference between means)/(standard error) = 8.02071

t-critical (df = 23) = 1.714, $\alpha=0.05$, one-tail

Confidence level = 95%, significance level = 5%

t-statistic > t-critical => reject the null hypothesis.

Conclusion:

It takes people more time to read the second list than to read the first list.

Research matches up with expectation.

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!

People takes more time to the name of colors than to read the words. With the 1st list, participants simply read the words. With the 2nd list, participants need more time to recall the name of each color and to pay more attention without being distracted by the word.

Similar tasks: compare the difference between time to read list of flower names printed in word; and name list of flowers' pictures.

REFERENCE:

Udacity courses: Intro to descriptive statistics and inferential statistics

Statistics for management and economics 9th edition – Gerard Keller

T-Score vs. Z-Score: What's the Difference? - <http://www.statisticshowto.com/when-to-use-a-t-score-vs-z-score/>