# P6Project: Test a Perceptual Phenomenon

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Questions: https://docs.google.com/document/d/1-OkpZLjG_kX9J6LIQ5IltsqMzVWjh36QpnP2RYpVdPU/pub?embedded=True

Dataset: https://drive.google.com/file/d/0B9Yf01UaIbUgQXpYb2NhZ29yX1U/view

1. Our Independent variable and dependent variable
   In this case, our independent variable is the two conditions of words: congruent or incongruent. Our dependent variable is the time it takes for participants to name the ink colors of words on a list.

2. Appropriate hypotheses and statistical test of this task
   We call the time to name the ink colors on congruent words list as $x_i$ and one to name ink colors on incongruent words list of the same person as $y_i$.
   Appropriate null hypothesis is that there is no difference in time to name ink colors of congruent words list and incongruent words list. On the other hand, alternative hypothesis is that it takes shorter time to name ink colors of incongruent words list than congruent words list. We can write down as follows in mathematical way.
   - Null hypotheses: $x_i = y_i$
   - Alternative hypotheses: $x_i < y_i$

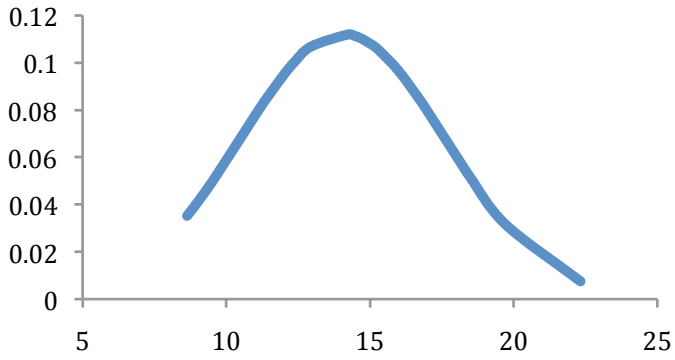
   Appropriate test is one-sided t-test for following reasons.
   - We expect that congruent words list takes shorter time to name its colors.
   - We only have sample data, not knowing $\mu$ and $\sigma$, which is used for z-test.

   Assumptions made for the t-test are
   - The scale of measurement applied to this data collection is continuous scale, "time".
   - The data is collected from randomly selected people from total population.
   - As showed in my answer to question 4, the sample data is normally distributed.
   - The sample size, 24, is reasonably large enough to draw bell-shaped distribution curve.

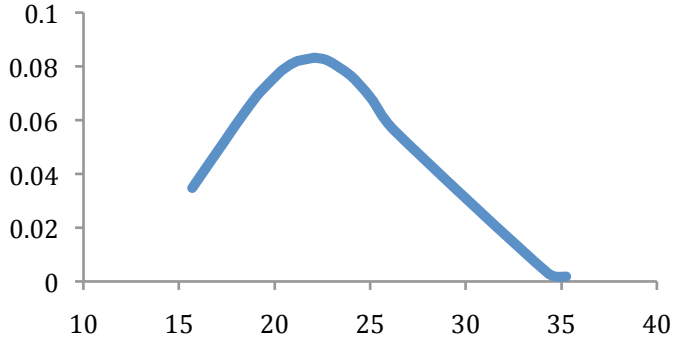
3. Descriptive statistics
   Calculating from the dataset, sample mean and sample standard distribution from each group are
   - $\bar{x}_A = 14.05$
   - $s_A = 3.56$
   - $\bar{y}_B = 22.02$
   - $s_B = 4.8$

   *A* stands for sample data of congruent words and *B* stands for sample data of incongruent words.

4. Visualization of the distribution of the sample data
   The sampling distribution of congruent words data is normal distribution as showed below.




The sample data of incongruent words is normally distributed as well.




5. One-tailed t-test
   Calculate $d_i = y_i - x_i$ for each sample data.

| | Congruent | Incongruent | di |
|---|---|---|---|
| 1 | 12.079 | 19.278 | 7.199 |
| 2 | 16.791 | 18.741 | 1.95 |
| 3 | 9.564 | 21.214 | 11.65 |
| 4 | 8.63 | 15.687 | 7.057 |
| 5 | 14.669 | 22.803 | 8.134 |
| 6 | 12.238 | 20.878 | 8.64 |
| 7 | 14.692 | 24.572 | 9.88 |
| 8 | 8.987 | 17.394 | 8.407 |
| 9 | 9.401 | 20.762 | 11.361 |
| 10 | 14.48 | 26.282 | 11.802 |
| 11 | 22.328 | 24.524 | 2.196 |
| 12 | 15.298 | 18.644 | 3.346 |
| 13 | 15.073 | 17.51 | 2.437 |
| 14 | 16.929 | 20.33 | 3.401 |
| 15 | 18.2 | 35.255 | 17.055 |
| 16 | 12.13 | 22.158 | 10.028 |
| 17 | 18.495 | 25.139 | 6.644 |
| 18 | 10.639 | 20.429 | 9.79 |
| 19 | 11.344 | 17.425 | 6.081 |
| 20 | 12.369 | 34.288 | 21.919 |
| 21 | 12.944 | 23.894 | 10.95 |
| 22 | 14.233 | 17.96 | 3.727 |
| 23 | 19.71 | 22.058 | 2.348 |
| 24 | 16.004 | 21.157 | 5.153 |
| mean | 14.05 | 22.02 | 7.96 |
| sd | 3.56 | 4.8 | 4.86 |

Mean difference đ is

$đ = \bar{y}_B - \bar{x}_A = 7.96$

Standard deviation of the difference is

$s_d = 4.86$

Since the sample size is n = 24, degree of freedom is

Df = 24 – 1 = 23

Standard error of mean can be calculated from the number of samples and sample standard deviations.

$SE(đ) = s_d / \sqrt{n} = 0.99$

Using the SEM value, we can calculate t-statics.

T-statistics = đ / SE(đ) = 8.03

When α level is 0.05, t-critical value is 1.676.

t (46) = 1.676, p = 0.05, one-tailed

Since t-statistics > t (46), we reject the null hypothesis. p <0.05.

In conclusion, in a Stroop effect experiment, the time it takes to name ink color of congruent word and one of incongruent word are different. As we expected, it takes more time to name ink color of words on incongruent words list.

Reference

https://www.investopedia.com/ask/answers/073115/what-assumptions-are-made-when-conducting-ttest.asp