

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

The independent variable for this experiment is the congruency between words and colors presented to the participants. The dependent variable for this experiment is the time it takes for participants to read the words outloud.

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

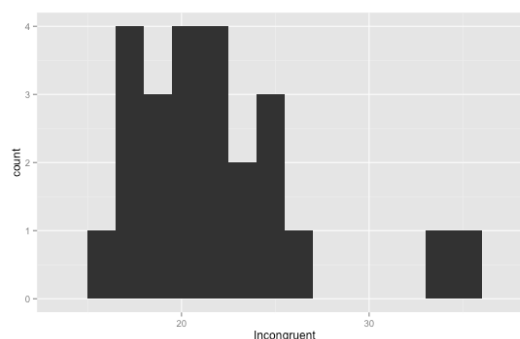
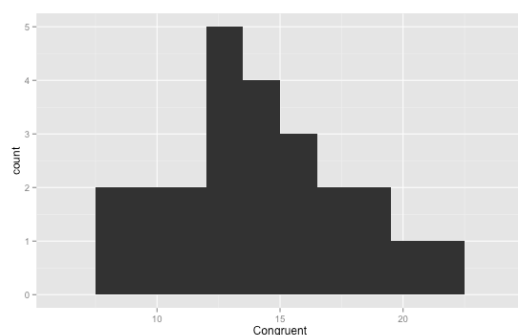
The hypothesis for this task is that participants will on average spend more time on non-congruent lists than congruent lists due to the stroop effect. In statistical term, the null hypothesis is that the differences between two groups are 0. The alternative hypothesis is that the difference between two groups are smaller than 0, indicating people spend more time during the Incongruent condition. Since we do not know the population mean and variance and the same participants are presented with both conditions, I recommend using matched-pair t-test to determine differences between means.

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

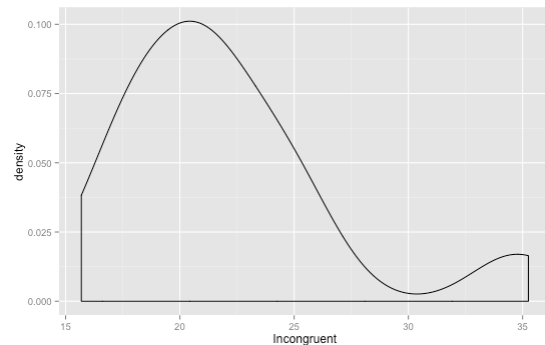
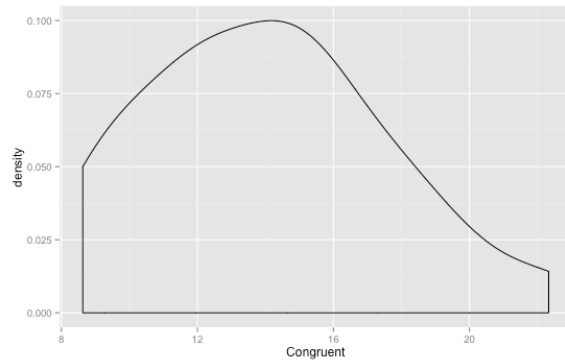
There are 24 trials in both datasets. For the congruent condition, the mean of the dataset is 14.05 seconds, the median is 14.36. The dataset range from 8.63 to 22.34, the variance is 12.67 with SD of 3.56. For the incongruent condition, the mean of the dataset is 22.02 with median of 21.02. The dataset range from 15.69 to 35.26, the variance is 23.01, the standard deviation is 4.80

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.

The comparisons of two distributions' frequency histograms are presented below. As we can see, time spent on incongruent seems to be longer than that of congruent condition. At the same time, there are few outliers in the incongruent group, which takes a lot more times than other participants in the same condition group.



Below display the density graph of both conditions. As we can see, both graphs skew slightly to the right. However, if we were to ignore the outliers for the incongruent dataset, both graphs seems to be reasonably normally distributed given there are only 24 data points for each graph.



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?

As explained above, I am going to perform a match-pair t-test on the dataset. The result output table is displayed below. As mentioned above, in this test, the null hypothesis is that the differences between two groups are 0. The alternative hypothesis is that the difference between two groups are smaller than 0, indicating people spend more time during the Incongruent condition. The t test return result of -8.021, $p < .05$, therefore we have rejected null hypothesis and concluded that people do spend significantly less time on congruent tasks compare with incongruent tasks. The result of this test have supported the existence of stroop effect.

14.051125	mean Congruent
22.015917	mean Incongruent
	mean difference (Congruent -
-7.964792	Incongruent)
4.864827	std. dev.
0.993029	std. error
24	n
23	df

-8.021	t
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2.05E-08	p-value (one-tailed, lower)
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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!

Because our brain processes visual cues and meanings in different areas and via different neural channels, disagreement between visual cues and meanings of words will cause more time for brain to think and decide which signal to go for. Same thing probably will happen is participants are prompted to say sweet when they smell sour and sour when they smell other smells.