

Project 4 More Inference

Due Friday, February 24
Math 222

1. A 2001 study looked at whether students took longer to react while talking on a cell phone versus listening to music. In the study, 16 student volunteers played a game that simulated driving a car. Each volunteer drove two times, once with music and the other time while talking on the phone. The students were randomly assigned to whether they used the cell phone or listened to music first. In each situation, the reaction times (in milliseconds) were recorded to see how long it would take students to react to a simulated red light change.

The file `driving.csv` contains the data for each student.

- (a) Was this a randomized controlled experiment? What are the explanatory and response variables? Which variables, if any, have been controlled?
 - (b) Let X represent the number of students who take longer to respond when talking on a phone. What probability distribution can we use to model X ? What are appropriate null and alternative hypotheses for this situation?
 - (c) What is the actual value of the statistic X ? Is this value statistically significant? Explain in detail how you came to your conclusion and what it means.
 - (d) In part (a) and (b), we focused on the statistic X , and the test we carried out was an example of a **sign test**. We could also look at how large the differences are between the reaction times of students when they were using a phone versus when they were just listening to music. Analyze the data and decide if it is reasonable to make a t-distribution confidence interval for this difference. If it is reasonable, then compute a confidence interval for the difference with the `t.test()` function and report on your findings.
2. One episode of the TV show *Mythbusters* focused on whether yawning is actually contagious. During the episode, 50 subjects at a flea market were recruited to participate. Each subject was taken to a small room and told to wait for a few minutes. While the subjects waited, they were being filmed. In the episode, 34 of the subjects were escorted by an attendant who made a point of yawning on the way to the room (these 34 were the treatment group), the other 16 were escorted by an attendant who did not yawn (these 16 were the control group).

Of the 34 subjects in the treatment group, 10 yawned while they were being filmed. This compares with 4 out of the 16 subjects in the control group.

- (a) Organize the results in a two-way table with the explanatory variable at the top, and make a segmented bar graph to show if there are any differences between the two groups. (See the Dolphin Therapy example on my website for details on how to do this in R.)
- (b) Do a permutation test to see if the results we got could be due to random assignment alone. To do this, simulate how likely it would be to have 10 or more people yawn in the treatment group if 14 yawners were randomly assigned to the two groups. Were the results of the study significant? Explain.
- (c) As an alternative method, use the 2-sample test for proportions:

$$z = \frac{\hat{p}_1 - \hat{p}_2}{\sqrt{\hat{p}(1 - \hat{p})(\frac{1}{N_1} + \frac{1}{N_2})}}$$

to determine if the results of this study were significant. How do the p-values in part (c) and (d) compare? Which method do you think would be more reliable in this situation?

- (d) Is yawning contagious? What does the evidence above lead us to conclude?