Another Randomization Test Example

Mythbusters

Is Yawning Contagious?

Mythbusters is on the case

An experiment conducted by the *MythBusters*, a science entertainment TV program on the Discovery Channel, tested if a person can be subconsciously influenced into yawning if another person near them yawns (Season 3, Episode 28). 50 people were randomly assigned to two groups: 34 to a group where a person near them yawned (seeded) and 16 to a group where there wasn't a person yawning near them (control). (See also Exercise 2.6.) We wish to determine if their experiment provided, as claimed on the show, significant evidence that yawning is contagious.

First Questions to Ask:

1. What is the research question?
2. What type of study is this?
3. What are the response and explanatory variables?
4. What type of variable is each of the above?

EDA

The Data

Below are the results of the experiment:

	Yawn	No Yawn	Total
Control	4	12	16
Seeded	10	24	34
Total	14	36	50

To analyse in R, load the necessary packages and the data set with one row per subject, which is stored as `yawns.csv` in our **Class > Data** folder.

```r
library(openintro)
library(mosaic)
library(dplyr)
library(ggplot2)
library(infer)

yawns <- read.csv("~/Stats 212 summer20/Class/Data/yawns.csv")
```

Check and organize/summarize

Go ahead and explore the data a little. What are the variable names? Can you see the first few cases to check the data? Can you create a table called `yawn_table` that shows the counts from the table above?

Feel free to check the `DolphinRandomization.Rmd` file for helpful code.

Visualize

Use the table from the last section to plot the relationship using the `mosaicplot()` function.

The Hypothesis Test

State the Null and Alternative

Think about the research question. How would you formulate that into a null and alternative hypothesis using words? How could you write it out using symbols like we did for the Dolphin experiment?

Pay careful attention to how you phrase the research question. It has implications to how you will write your alternative hypothesis.

The Evidence

First create a table of row proportions (so the rows add up to 1.0) called `yawn_props`. Then find the proportion of subjects who yawned in each group, and calculate the observed difference in proportions, you can call this `obs.diffinprop`.

Unusual?

Do you think this observed difference in the proportion of people who yawned would be unusual if yawns really weren't contagious (null true)?

How could you simulate the null model using playing cards?

How many cards would you need to simulate the null model for this experiment?[1]

    a) 50

    b) 30

    c) 52

    d) 1000

How many cards would represent the 'yawners'?[2]

    a) 36

    b) 34

    c) 14

    d) 16

Null Model

Create the null model for the difference in proportion of yawners. Use 1000 simulations. The code below should help:

```
null_distn <- _____ %>%
  specify( _____ ~ _____, success = "_____") %>%
  hypothesize(null = "_____") %>%
  generate(reps = _____, type = "permute") %>%
  calculate(stat = "_____", order = c("_____", "_____"))
```

If your code is correct, you won't see anything. Check `DolphinRandomization.Rmd` for help (just remember we are using a different dataset and variables with different names).

Calculate P-values

Report both a one-sided and a two-sided p-value for testing if there's a significant difference between the seeded group and the control group.

The One tailed test

Visualize the null model and where our observation is. And then calculate the actual value. Consider carefully which direct to use for the one tailed test.

```
null_distn %>%
  visualize(method = "_____") +
  shade_p_value(_____, direction = "_____")

null_distn %>%
  get_p_value(obs_stat = _____, direction = "_____")
```

---

[1] a
[2] c

3

The Two tailed test

Alter the code above for a two-tailed test.

Conclusion in Context

Myth Busted?

At the end of the episode, Jamie (the mustached one) claims it is plausible that yawning is contagious. Do you agree? Can the MythBusters claim that there is "significant" evidence that yawning is contagious? Defend your answer.

How might you have improved the design of this experiment to test the effect of yawning seeds?

Check

You can check your R code and answers in the `Mythbusters_key.Rmd` file in the **Class > Ch 2 Dolphins and Yawning examples** folder.