

Hypothesis Testing via Simulation

The Data

```
library(tidyverse)
d <- tibble(favor = rep(c("yes", "no"), c(50, 25)))
d
```

```
## # A tibble: 75 x 1
##   favor
##   <chr>
## 1 yes
## 2 yes
## 3 yes
## 4 yes
## 5 yes
## 6 yes
## 7 yes
## 8 yes
## 9 yes
## 10 yes
## # ... with 65 more rows
```

The Observed Statistic

```
d %>%  
  summarize(prop_yes = mean(favor == "yes"))
```

```
## # A tibble: 1 x 1  
##   prop_yes  
##   <dbl>  
## 1      0.667
```

```
library(infer)  
d %>%  
  specify(response = favor, success = "yes") %>%  
  calculate(stat = "prop")
```

```
## # A tibble: 1 x 1  
##   stat  
##   <dbl>  
## 1 0.667
```

The Observed Statistic, cont.

```
p_hat <- d %>%  
  specify(response = favor, success = "yes") %>%  
  calculate(stat = "prop") %>%  
  pull()
```

```
p_hat
```

```
## [1] 0.67
```

The Hypotheses

Let p be the true proportion of Americans who favor same-sex marriage.

$$H_0 : p = 0.5$$

$$H_A : p \neq 0.5$$

```
d %>%  
  specify(response = favor, success = "yes") %>%  
  hypothesize(null = "point", p = .5)
```

```
## Response: favor (factor)  
## Null Hypothesis: point  
## # A tibble: 75 x 1  
##   favor  
##   <fct>  
## 1 yes  
## 2 yes
```

The Simulation

```
d %>%  
  specify(response = favor, success = "yes") %>%  
  hypothesize(null = "point", p = .5) %>%  
  generate(reps = 10000, type = "simulate")
```

```
## Response: favor (factor)  
## Null Hypothesis: point  
## # A tibble: 750,000 x 2  
## # Groups:   replicate [10,000]  
##      favor replicate  
##      <fct> <fct>  
## 1 yes      1  
## 2 yes      1  
## 3 yes      1  
## 4 yes      1  
## 5 yes      1  
## 6 yes      1  
## 7 yes      1  
## 8 yes      1
```

The Null Distribution of Statistics

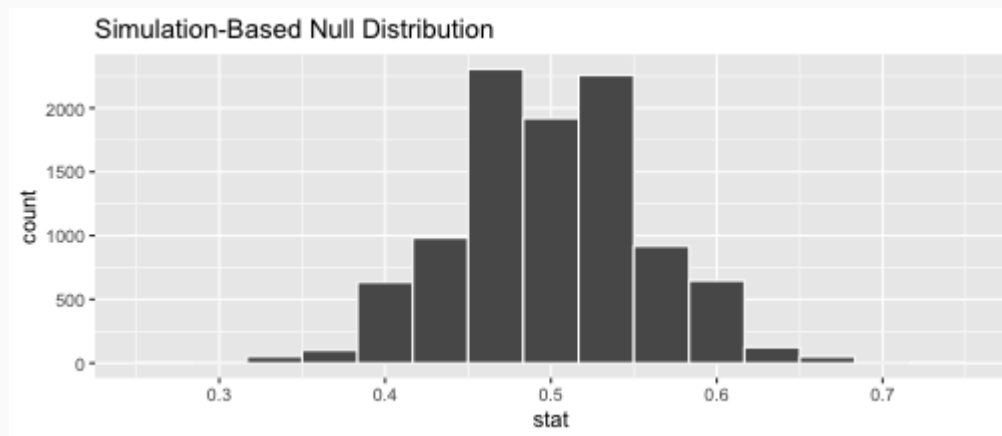
```
d %>%  
  specify(response = favor, success = "yes") %>%  
  hypothesize(null = "point", p = .5) %>%  
  generate(reps = 10000, type = "simulate") %>%  
  calculate(stat = "prop")
```

```
## # A tibble: 10,000 x 2  
##   replicate stat  
##   <fct>      <dbl>  
## 1 1          0.547  
## 2 2          0.547  
## 3 3          0.587  
## 4 4          0.507  
## 5 5          0.413  
## 6 6          0.493  
## 7 7          0.52  
## 8 8          0.413  
## 9 9          0.44  
## 10 10         0.547
```

Visualizing the Null

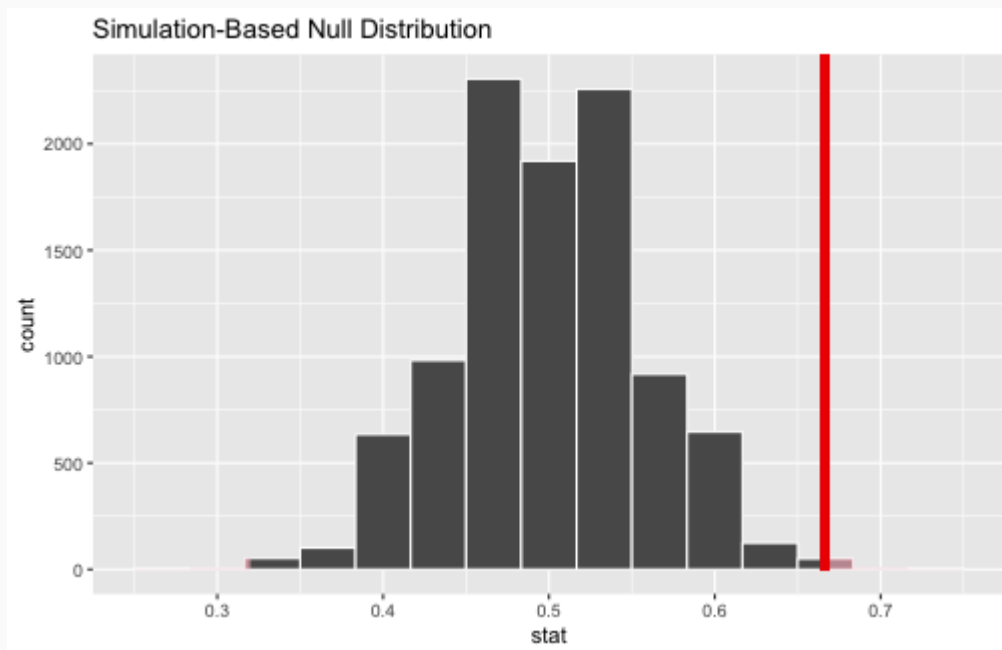
```
null <- d %>%  
  specify(response = favor, success = "yes") %>%  
  hypothesize(null = "point", p = .5) %>%  
  generate(reps = 10000, type = "simulate") %>%  
  calculate(stat = "prop")
```

```
null %>%  
  visualize()
```



`visualize()` is a `ggplot`

```
null %>%  
  visualize() +  
  shade_p_value(obs_stat = p_hat,  
                direction = "both")
```



Computing a p-value

```
null %>%  
  get_p_value(obs_stat = p_hat,  
              direction = "both")
```

```
## # A tibble: 1 x 1  
##   p_value  
##   <dbl>  
## 1 0.00580
```