

# STT 461 Project - Judging Bias in Figure Skating

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```
# Load the data set
skating <- read.csv("D:/MSU/SPRING 24/STT461/SkatingData_19-22_FIXED2.csv")
```

```
# Overview of variables
str(skating, list.len=ncol(skating))
```

```
## 'data.frame':    4954 obs. of  69 variables:
## $ segment       : chr  "sp" "sp" "sp" "sp" ...
## $ event_name     : chr  "World Championships" "World Championships" "World Championships" "World Championships" ...
## $ event_type     : chr  "CHAMP" "CHAMP" "CHAMP" "CHAMP" ...
## $ event_year     : int  2019 2019 2019 2019 2019 2019 2019 2019 2019 2019 ...
## $ event_country  : chr  "JPN" "JPN" "JPN" "JPN" ...
## $ discipline     : chr  "Mens" "Mens" "Mens" "Mens" ...
## $ tech_spec1_name: chr  "Evgeni MARTINOV" "Evgeni MARTINOV" "Evgeni MARTINOV" "Evgeni MARTINOV" ...
## $ tech_spec1_nat : chr  "UKR" "UKR" "UKR" "UKR" ...
## $ tech_spec2_name: chr  "Masako KAWAI" "Masako KAWAI" "Masako KAWAI" "Masako KAWAI" ...
## $ tech_spec2_nat : chr  "JPN" "JPN" "JPN" "JPN" ...
## $ tech_con_name  : chr  "Leena LAAKSONEN" "Leena LAAKSONEN" "Leena LAAKSONEN" "Leena LAAKSONEN" ...
## $ tech_con_nat   : chr  "FIN" "FIN" "FIN" "FIN" ...
## $ j1_name        : chr  "Miroslav MISUREC" "Miroslav MISUREC" "Miroslav MISUREC" "Miroslav MISUREC" ...
## $ j1_nat         : chr  "CZE" "CZE" "CZE" "CZE" ...
## $ j2_name        : chr  "Antica GRUBISIC" "Antica GRUBISIC" "Antica GRUBISIC" "Antica GRUBISIC" ...
## $ j2_nat         : chr  "CRO" "CRO" "CRO" "CRO" ...
## $ j3_name        : chr  "Albert ZAYDMAN" "Albert ZAYDMAN" "Albert ZAYDMAN" "Albert ZAYDMAN" ...
## $ j3_nat         : chr  "ISR" "ISR" "ISR" "ISR" ...
## $ j4_name        : chr  "Bettina MEIER" "Bettina MEIER" "Bettina MEIER" "Bettina MEIER" ...
## $ j4_nat         : chr  "SUI" "SUI" "SUI" "SUI" ...
## $ j5_name        : chr  "Ariadna MORONE" "Ariadna MORONE" "Ariadna MORONE" "Ariadna MORONE" ...
## $ j5_nat         : chr  "MEX" "MEX" "MEX" "MEX" ...
## $ j6_name        : chr  "Cynthia BENSON" "Cynthia BENSON" "Cynthia BENSON" "Cynthia BENSON" ...
## $ j6_nat         : chr  "CAN" "CAN" "CAN" "CAN" ...
## $ j7_name        : chr  "Anny HOU" "Anny HOU" "Anny HOU" "Anny HOU" ...
## $ j7_nat         : chr  "TPE" "TPE" "TPE" "TPE" ...
## $ j8_name        : chr  "Saioa SANCHO" "Saioa SANCHO" "Saioa SANCHO" "Saioa SANCHO" ...
## $ j8_nat         : chr  "ESP" "ESP" "ESP" "ESP" ...
## $ j9_name        : chr  "Philippe MERIGUET" "Philippe MERIGUET" "Philippe MERIGUET" "Philippe MERIGUET" ...
## $ j9_nat         : chr  "FRA" "FRA" "FRA" "FRA" ...
## $ skater         : chr  "Nathan CHEN" "Jason BROWN" "Yuzuru HANYU" "Vincent ZHOU" ...
## $ nationality    : chr  "USA" "USA" "JPN" "USA" ...
## $ start          : int  35 32 30 28 26 31 18 20 24 33 ...
## $ total          : num  107.4 96.8 94.9 94.2 93.4 ...
```

```
## $ j1_total      : num 105 96.2 95.4 93.6 91.4 ...
## $ j2_total      : num 110 92.3 94 90.8 94.8 ...
## $ j3_total      : num 108.5 92.8 95.2 94 95.2 ...
## $ j4_total      : num 102.6 99.6 93.9 92.3 87.2 ...
## $ j5_total      : num 102.6 96.5 95.4 88.7 91.4 ...
## $ j6_total      : num 107 95.9 94.8 96.7 94.1 ...
## $ j7_total      : num 108.3 100 95 96.5 98.1 ...
## $ j8_total      : num 110.1 100.3 96.2 96.2 97.2 ...
## $ j9_total      : num 109.9 95.5 94 93.2 89.5 ...
## $ level_sum     : int 16 16 16 16 16 15 16 16 15 16 ...
## $ j1_tes        : num 60 50.1 48.2 52.8 51.4 ...
## $ j2_tes        : num 62.7 50.1 49.8 52.8 54 ...
## $ j3_tes        : num 60.7 48.5 47.9 52 52.7 ...
## $ j4_tes        : num 58.1 51.8 48.2 50.3 49 ...
## $ j5_tes        : num 56.9 50.5 48.6 47.1 50.4 ...
## $ j6_tes        : num 61.5 50.9 48 54.2 53.3 ...
## $ j7_tes        : num 62.6 52.2 49.2 53.3 54.4 ...
## $ j8_tes        : num 62.9 52.1 48.2 54.7 54.7 ...
## $ j9_tes        : num 61.6 49 46.5 51.7 50.8 ...
## $ tes           : num 61 50.7 48.2 52.5 52.4 ...
## $ ss            : num 9.21 9.04 9.36 8.32 8.32 9.07 7.93 8.36 8.21 8.86 ...
## $ tr            : num 9.11 9.18 9.32 8.29 7.86 8.79 7.79 8.14 7.79 8.5 ...
## $ pe            : num 9.39 9.36 9.25 8.32 8.39 8.96 8.07 8.32 7.93 8.54 ...
## $ co            : num 9.32 9.25 9.39 8.39 8.18 9 8.11 8.36 8 8.57 ...
## $ in.           : num 9.39 9.32 9.39 8.36 8.21 9.07 8.25 8.39 7.96 8.61 ...
## $ j1_pcs        : num 45 46 47.2 40.8 40 ...
## $ j2_pcs        : num 47.2 42.2 44.2 38 40.8 ...
## $ j3_pcs        : num 47.8 44.2 47.2 42 42.5 ...
## $ j4_pcs        : num 44.5 47.8 45.8 42 38.2 ...
## $ j5_pcs        : num 45.8 46 46.8 41.5 41 ...
## $ j6_pcs        : num 45.5 45 46.8 42.5 40.8 ...
## $ j7_pcs        : num 45.8 47.8 45.8 43.2 43.8 ...
## $ j8_pcs        : num 47.2 48.2 48 41.5 42.5 ...
## $ j9_pcs        : num 48.2 46.5 47.5 41.5 38.8 ...
## $ pcs           : num 46.4 46.1 46.7 41.7 41 ...
```

```
library("dplyr")
```

```
##
## Attaching package: 'dplyr'

## The following objects are masked from 'package:stats':
##
##   filter, lag

## The following objects are masked from 'package:base':
##
##   intersect, setdiff, setequal, union
```

```
library("ggplot2")
```

```
# Check number of unique competitors per competition
```

```
competitor_count <- skating %>%
  filter(discipline == "Mens" | discipline == "Womens") %>%
  group_by(event_year, event_name, discipline) %>%
  distinct(skater) %>%
  summarise(n())
```

## 'summarise()' has grouped output by 'event\_year', 'event\_name'. You can  
## override using the '.groups' argument.

```
competitor_count
```

```
## # A tibble: 82 x 4
## # Groups:   event_year, event_name [41]
##   event_year event_name      discipline 'n()'
##   <int> <chr>          <chr>      <int>
## 1    2018 GP Helsinki      Mens         11
## 2    2018 GP Helsinki      Womens        11
## 3    2018 GP Intx de France Mens         11
## 4    2018 GP Intx de France Womens        12
## 5    2018 GP NHK Trophy     Mens         12
## 6    2018 GP NHK Trophy     Womens        12
## 7    2018 GP Rostelecom Cup Mens         12
## 8    2018 GP Rostelecom Cup Womens        10
## 9    2018 GP Skate America Mens         12
## 10   2018 GP Skate America Womens        11
## # i 72 more rows
```

```
# Check number of unique countries per competition
country_count <- skating %>%
  filter(discipline == "Mens" | discipline == "Womens") %>%
  group_by(event_year, event_name, discipline) %>%
  distinct(nationality) %>%
  summarise(n())
```

## 'summarise()' has grouped output by 'event\_year', 'event\_name'. You can  
## override using the '.groups' argument.

```
country_count
```

```
## # A tibble: 82 x 4
## # Groups:   event_year, event_name [41]
##   event_year event_name      discipline 'n()'
##   <int> <chr>          <chr>      <int>
## 1    2018 GP Helsinki      Mens         9
## 2    2018 GP Helsinki      Womens        6
## 3    2018 GP Intx de France Mens         8
## 4    2018 GP Intx de France Womens        6
## 5    2018 GP NHK Trophy     Mens         8
## 6    2018 GP NHK Trophy     Womens        6
## 7    2018 GP Rostelecom Cup Mens         9
## 8    2018 GP Rostelecom Cup Womens        6
```

```
## 9      2018 GP Skate America  Mens      9
## 10     2018 GP Skate America  Womens    6
## # i 72 more rows
```

How do judges score skaters from their own country compared to the other judges on the panel?

```
# Find entries where a judge shares the same nationality as the skater
# Filter out pairs and ice dance disciplines
shared_nat <- skating %>% filter(j1_nat == nationality | j2_nat == nationality
                                | j3_nat == nationality |
                                j4_nat == nationality |
                                j5_nat == nationality |
                                j6_nat == nationality |
                                j7_nat == nationality |
                                j8_nat == nationality |
                                j9_nat == nationality ) %>%
  filter(discipline == "Mens" | discipline == "Womens")

judge_nats <- shared_nat[c("j1_nat", "j2_nat", "j3_nat", "j4_nat", "j5_nat",
                           "j6_nat", "j7_nat", "j8_nat", "j9_nat", "j1_total",
                           "j2_total", "j3_total", "j4_total", "j5_total",
                           "j6_total", "j7_total", "j8_total", "j9_total",
                           "nationality")]

panel_scores <- shared_nat[c("j1_total", "j2_total", "j3_total", "j4_total",
                             "j5_total", "j6_total", "j7_total", "j8_total",
                             "j9_total")]
```

```
# Function to return the score of the 'home judge'
find_home <- function(row) {
  for (col in 1:9) {
    if (is.na(row[col])) {
      next
    }
    else {
      if (row[col] == row["nationality"]) {
        return(row[col + 9])
      }
    }
  }
}

home_judge <- apply(judge_nats, 1, find_home)
home_judge <- as.numeric(unlist(home_judge))

panel_scores["home"] = home_judge

# Function to calculate the mean of the remaining judges' scores (panel mean)
find_mean <- function(row) {
  panel_sum <- sum(row[1:9], na.rm = TRUE)
  n <- sum(is.na(row[1:9]))
  mean <- (panel_sum - row["home"])/(8-n)
}
```

```

panel_mean <- apply(panel_scores, 1, find_mean)

wilcox.test(home_judge, panel_mean, paired = TRUE, alternative = "greater")

##
## Wilcoxon signed rank test with continuity correction
##
## data: home_judge and panel_mean
## V = 1093783, p-value < 2.2e-16
## alternative hypothesis: true location shift is greater than 0

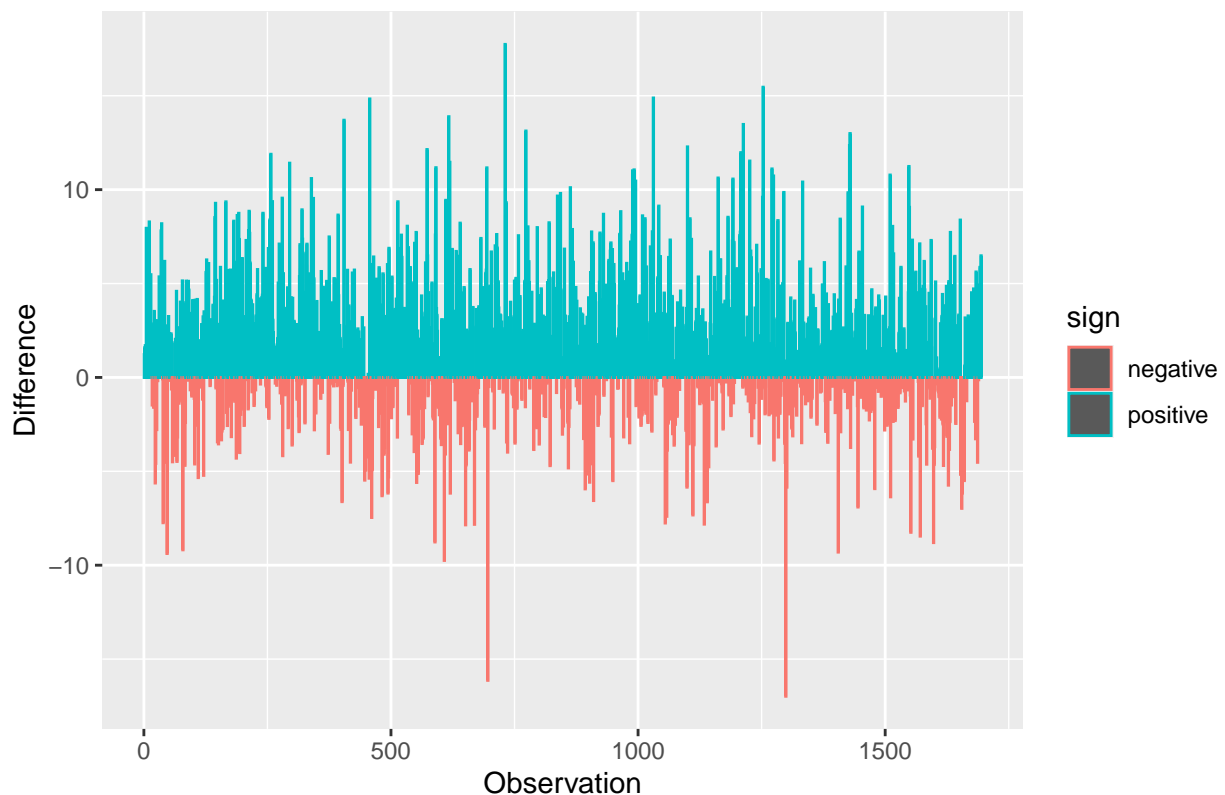
# Data frame for the differences between the home judge and mean of the others
diffs <- data.frame(diff = home_judge - panel_mean)
# solely for visualization purposes
diffs$index <- 1:nrow(diffs)
diffs$sign <- ifelse(diffs$diff > 0, "positive", "negative")

# mean difference for all singles observations
mean_diffs <- mean(diffs$diff, na.rm = TRUE)

# Overview of the differences for each observation
ggplot(diffs, aes(x= index, y=diff)) + geom_col(aes(color = sign)) +
  xlab("Observation") + ylab("Difference") +
  ggtitle("Home judge score vs. Panel score mean")

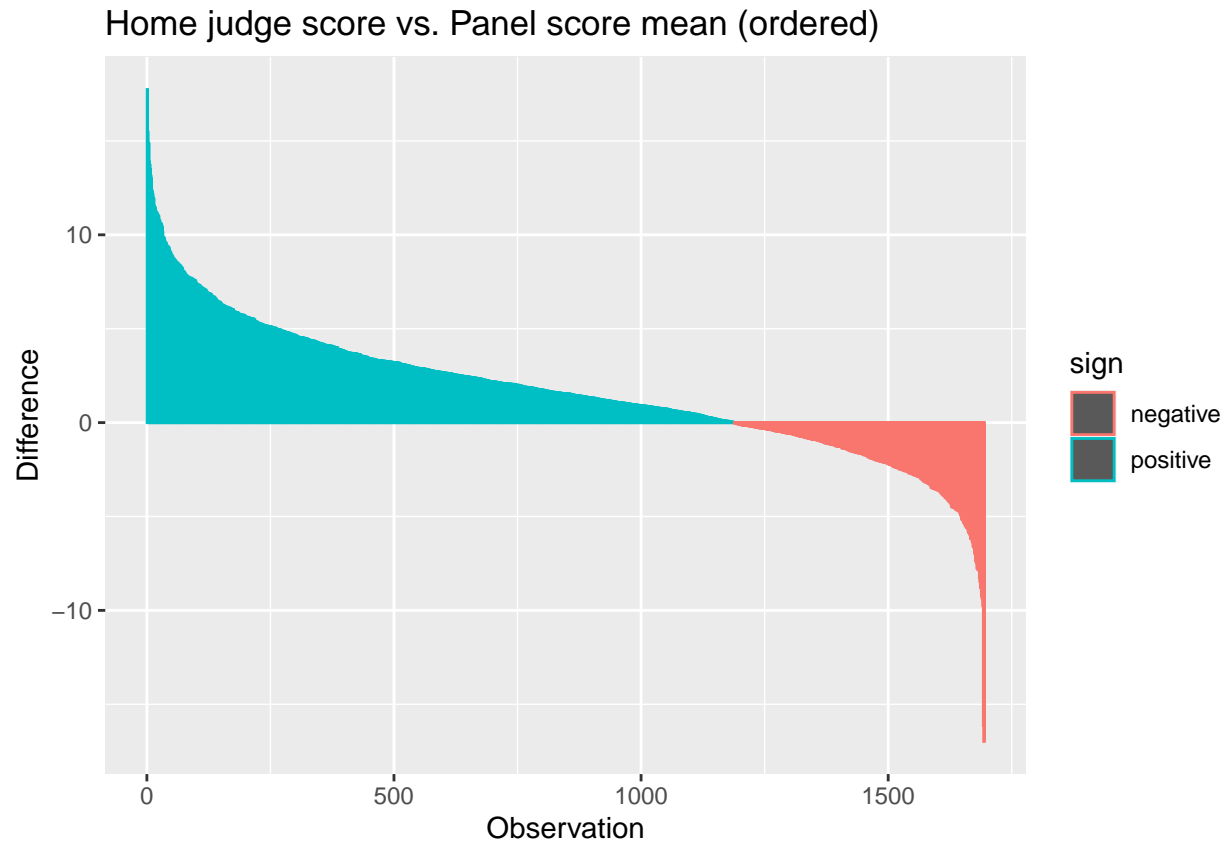
```

Home judge score vs. Panel score mean



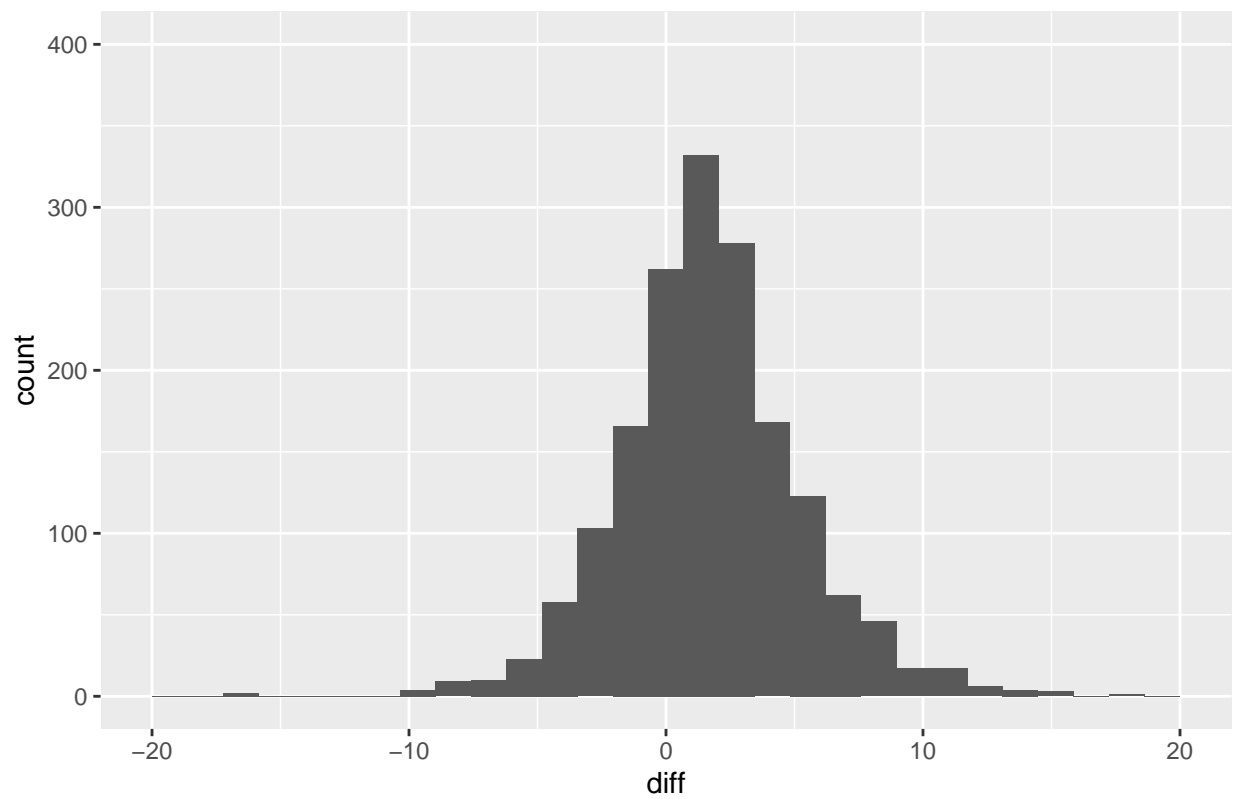
```
temp <- diffs %>% arrange(desc(diff))
temp$index <- 1:nrow(diffs)

temp %>% arrange(desc(diff)) %>% ggplot(., aes(x= index, y=diff)) +
  geom_col(aes(color = sign)) + xlab("Observation") + ylab("Difference") +
  ggtitle("Home judge score vs. Panel score mean (ordered)")
```



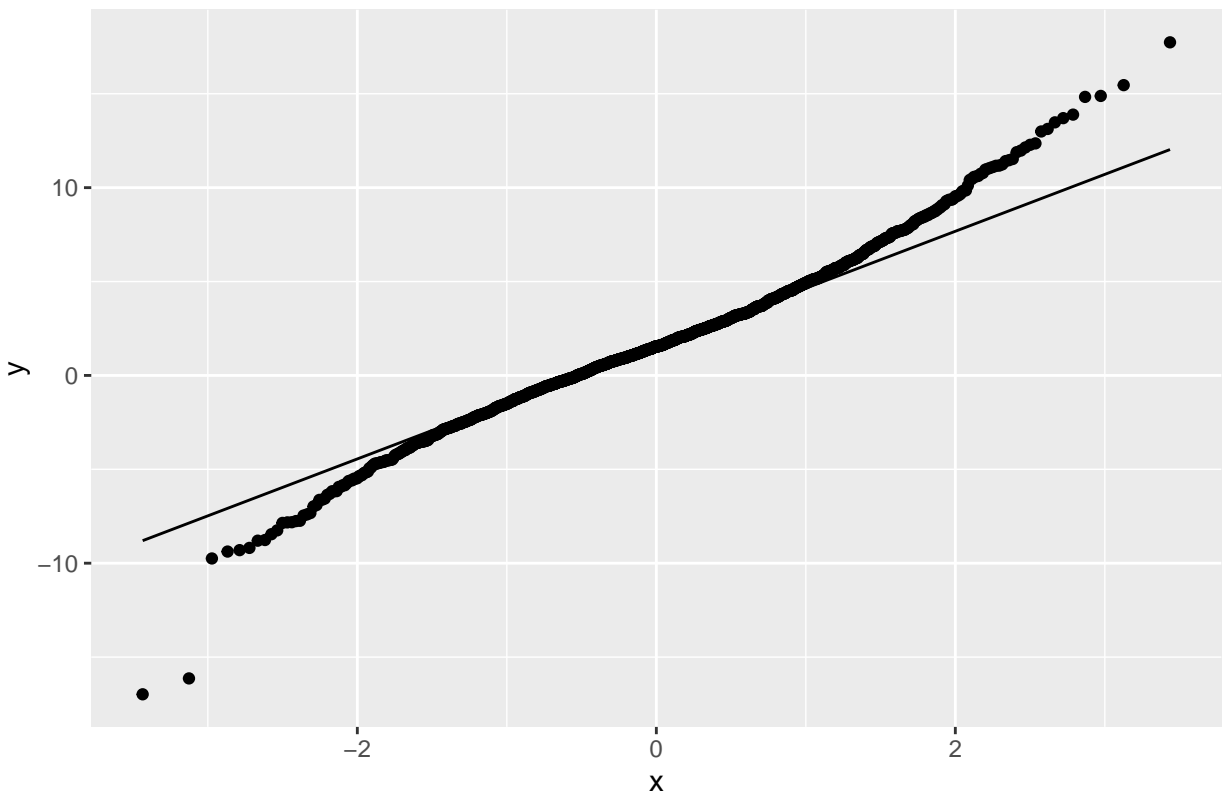
```
# Distribution of differences
ggplot(diffs, aes(x= diff)) + geom_histogram(bins = 30) +
  ggtitle("Distribution of differences from panel mean") +
  scale_x_continuous(limits = c(-20, 20)) +
  scale_y_continuous(limits = c(0, 400))
```

Distribution of differences from panel mean



```
# Checking normality of differences  
ggplot(diffs, aes(sample= diff)) + geom_qq() + geom_qq_line() +  
  labs(title = "QQ Plot Norm (diff from panel mean)")
```

QQ Plot Norm (diff from panel mean



```
# Paired permutation test
paired_perm <- function(diffs, n, mean, name, year, discipline, segment) {
  set.seed(1)
  diff <- replicate(10000, {
    # sample differences
    diffs_permuted <- sample(diffs$diff, size=n, replace = FALSE)
    # assign random positive or negative to each observation
    diffs_permuted <- sample(c(-1,1), size=n, replace=TRUE) * abs(diffs_permuted)
    # calculate the mean
    mean_permuted <- mean(diffs_permuted)
  })
  # Histogram of results
  h1 <- ggplot(data.frame(diff), aes(x = diff)) + geom_histogram(bins = 30)
  h1 <- h1 + geom_vline(xintercept = mean, col = 'red') +
    ggtitle(paste0("Permutation test ", discipline, " ", segment, " at ",
                    year, " ", name))

  # Determine which hypothesis to test
  if (mean > 0) {
    hypothesis <- "hA = true mean is greater than 0 (overscoring)"
    pval <- mean(diff > mean)
  } else if (mean <= 0) {
    hypothesis <- "hA = true mean is less than 0 (underscoring)"
    pval <- mean(diff <= mean)
  }
}
```



```

    return(list(h1, pval, hypothesis))
}

# Bootstrap for confidence intervals
boot <- function(diffs, n, name, year, discipline, segment) {
  set.seed(1)
  diff <- replicate(10000, {
    # sample differences
    diffs_permuted <- sample(diffs$diff, size=n, replace = TRUE)
    # calculate the mean
    mean_permuted <- mean(diffs_permuted, na.rm = TRUE)
  })
  conf_int <- quantile(diff, c(0.025, 0.975), names = FALSE)
  moe <- conf_int[2]-conf_int[1]
  # Histogram of results
  h1 <- ggplot(data.frame(diff), aes(x = diff)) + geom_histogram(bins = 30) +
    geom_vline(xintercept = conf_int, col = 'red') +
    ggtitle(paste0("Bootstrap Confidence Interval for ", discipline, " ",
                  segment, " at ", year, " ", name))

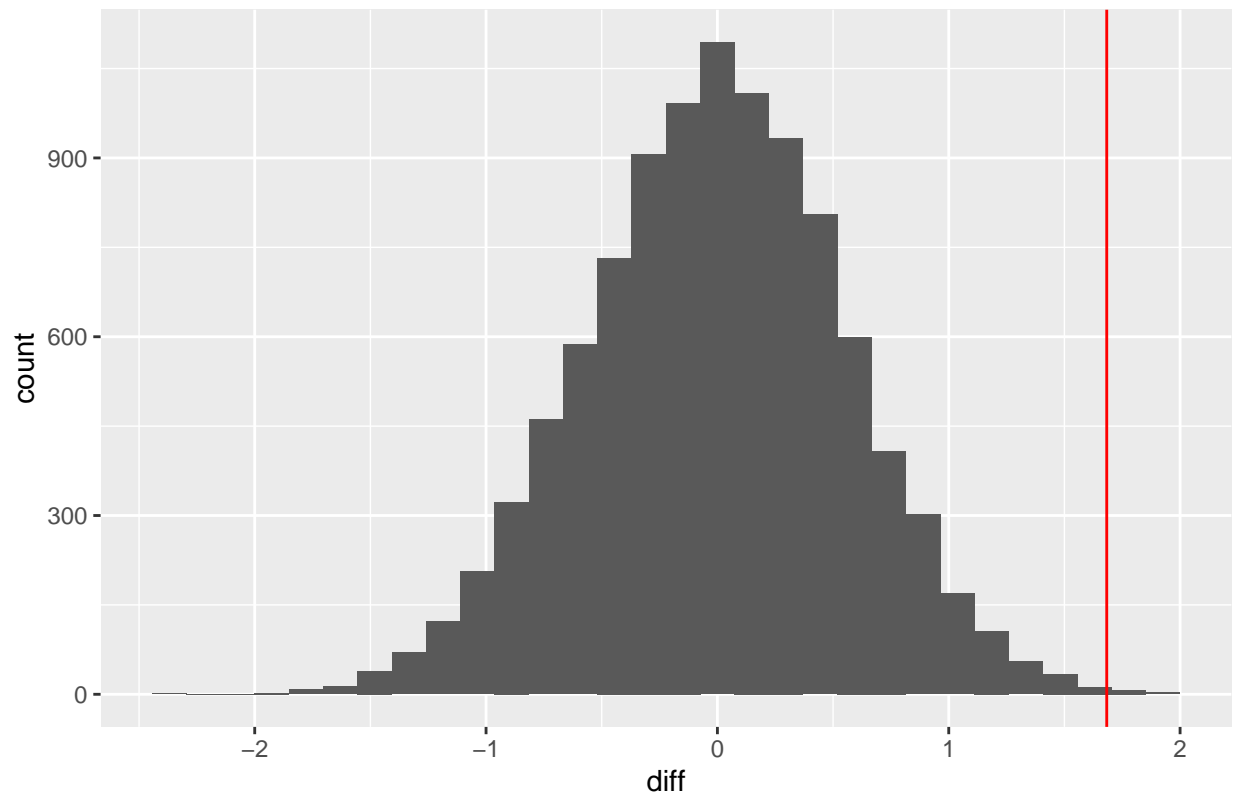
  return(list(h1, conf_int, moe))
}

# Apply functions to all singles data
paired_perm(diffs, 50, mean_diffs, "All competitions", "2019-2022", "diff from panel mean, all", "discipli

## [[1]]

```

Permutation test diff from panel mean, all disciplines at 2019–2022 All com

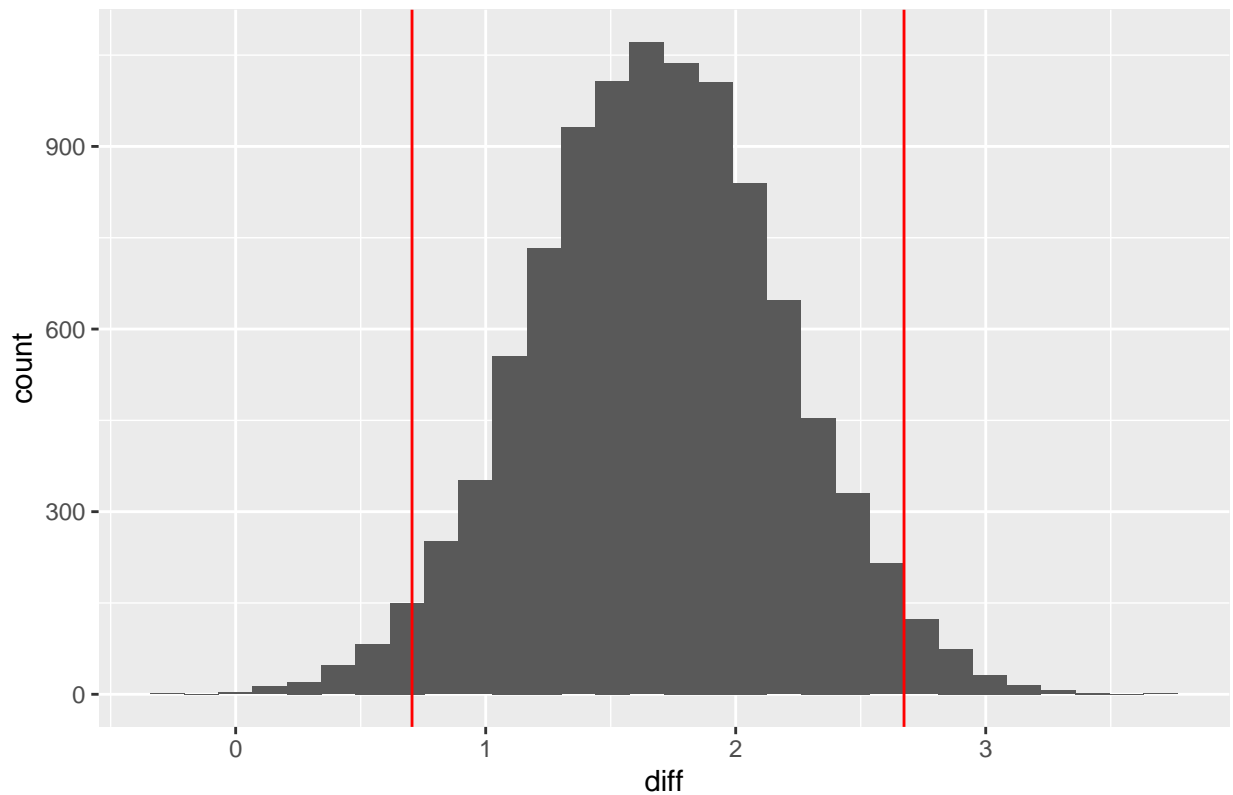


```
##
## [[2]]
## [1] 0.001
##
## [[3]]
## [1] "hA = true mean is greater than 0 (overscoring)"
```

```
boot(diffs, 50, "All competitions", "2019-2022", "diff from total, all", "disciplines")
```

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

# Bootstrap Confidence Interval for diff from total, all disciplines at 2019–202:



```
##
## [[2]]
## [1] 0.7053638 2.6731274
##
## [[3]]
## [1] 1.967764
```

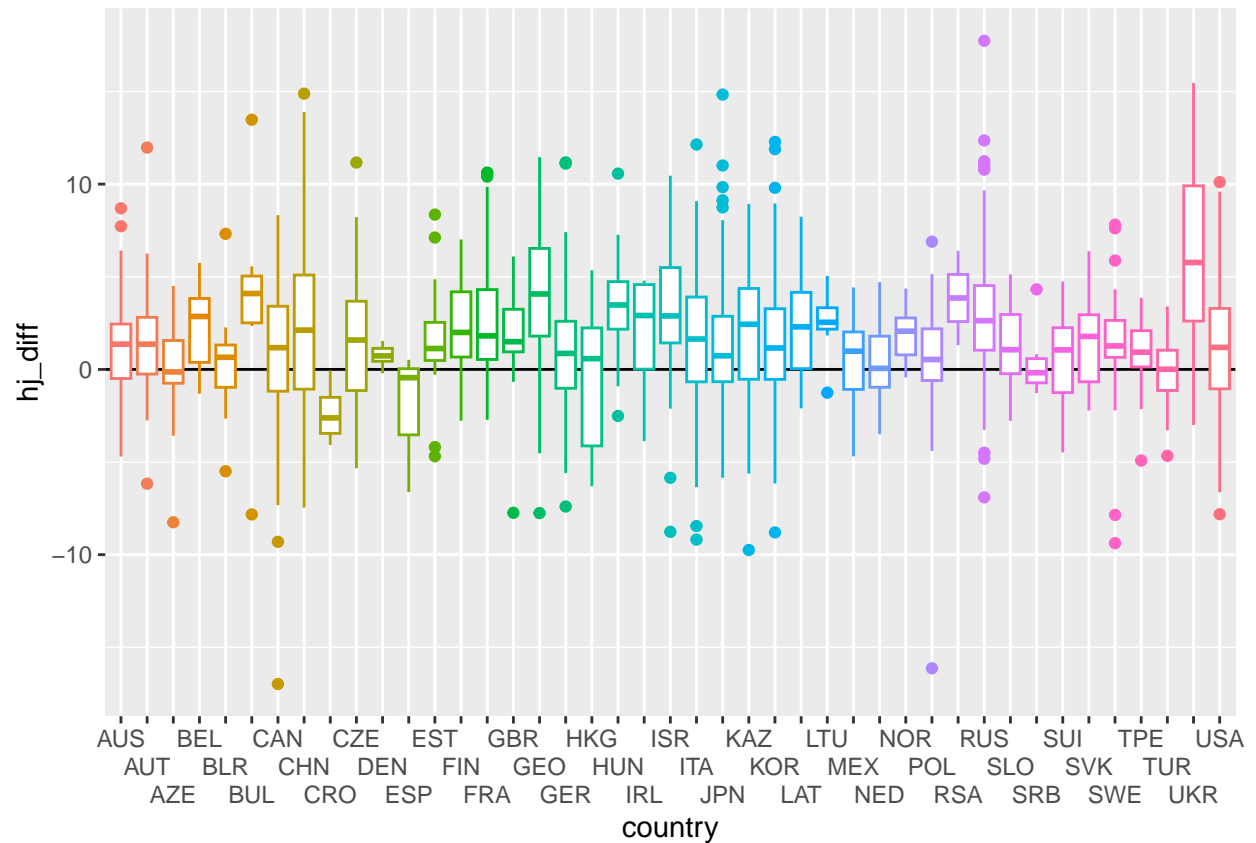
```
# Testing by country of judge (for all singles data)
scores <- data.frame(event = shared_nat$event_name, year = shared_nat$event_year,
  country = shared_nat$nationality, home = home_judge,
  away = panel_mean, hj_diff = home_judge - panel_mean,
  discipline = shared_nat$discipline,
  segment = shared_nat$segment)
head(scores)
```

```
##          event year country  home    away hj_diff discipline segment
## 1 World Championships 2019    FRA 88.86 87.64000 1.22000      Mens      sp
## 2 World Championships 2019    CZE 88.07 86.48500 1.58500      Mens      sp
## 3 World Championships 2019    CAN 84.28 82.58125 1.69875      Mens      sp
## 4 World Championships 2019    CAN 83.28 82.23125 1.04875      Mens      sp
## 5 World Championships 2019    ISR 88.72 80.77250 7.94750      Mens      sp
## 6 World Championships 2019    ISR 80.39 77.30375 3.08625      Mens      sp
```

```
# Group by country
by_country <- scores %>% group_by(country) %>%
  summarize(mean_diff = mean(hj_diff, na.rm = TRUE),
            st_dev = sd(hj_diff, na.rm = TRUE), n()) %>% arrange(desc(mean_diff))
by_country
```

```
## # A tibble: 43 x 4
##   country mean_diff st_dev `n()`
##   <chr>      <dbl>  <dbl> <int>
## 1 UKR         6.52    5.42    12
## 2 RSA         3.85    3.60     2
## 3 GEO         3.81    4.78    26
## 4 HUN         3.59    2.89    19
## 5 BUL         3.55    6.26     7
## 6 ISR         3.09    3.90    35
## 7 RUS         2.93    3.15   244
## 8 FRA         2.53    3.34    76
## 9 LTU         2.48    1.94     7
## 10 LAT        2.44    3.19    14
## # i 33 more rows
```

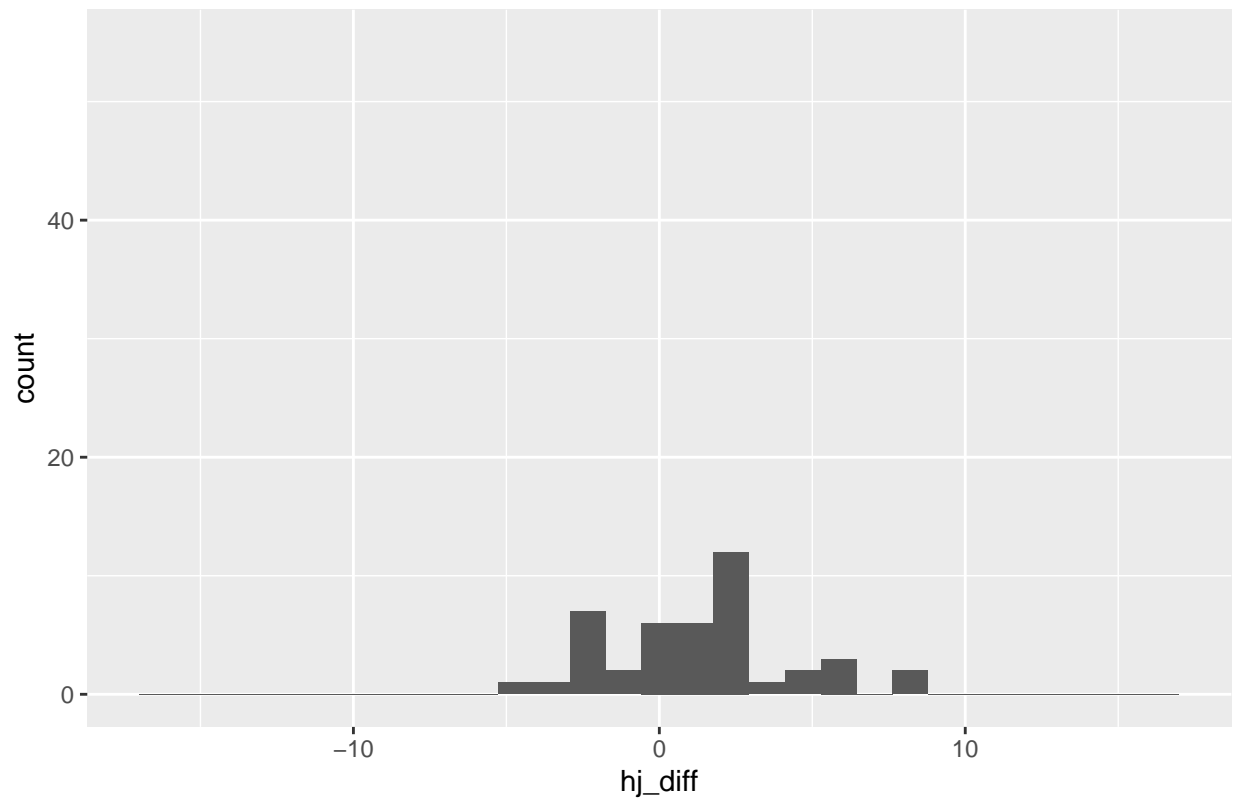
```
# Plot boxplots
ggplot(scores, aes(x= country, y= hj_diff)) +
  geom_hline(yintercept = 0, col = 'black') +
  geom_boxplot(aes(color = country), show.legend = FALSE) +
  scale_x_discrete(guide = guide_axis(n.dodge=3))
```



```
# Plot distributions for each country
charts <- scores %>% group_by(country) %>%
  group_map(.f = ~ ggplot(.x,aes(x= hj_diff)) + geom_histogram(bins = 30) +
    ggtitle(paste0("Distribution of differences for ", .y$country)) +
    scale_x_continuous(limits = c(-17, 17)) +
    scale_y_continuous(limits = c(0, 55)))
charts
```

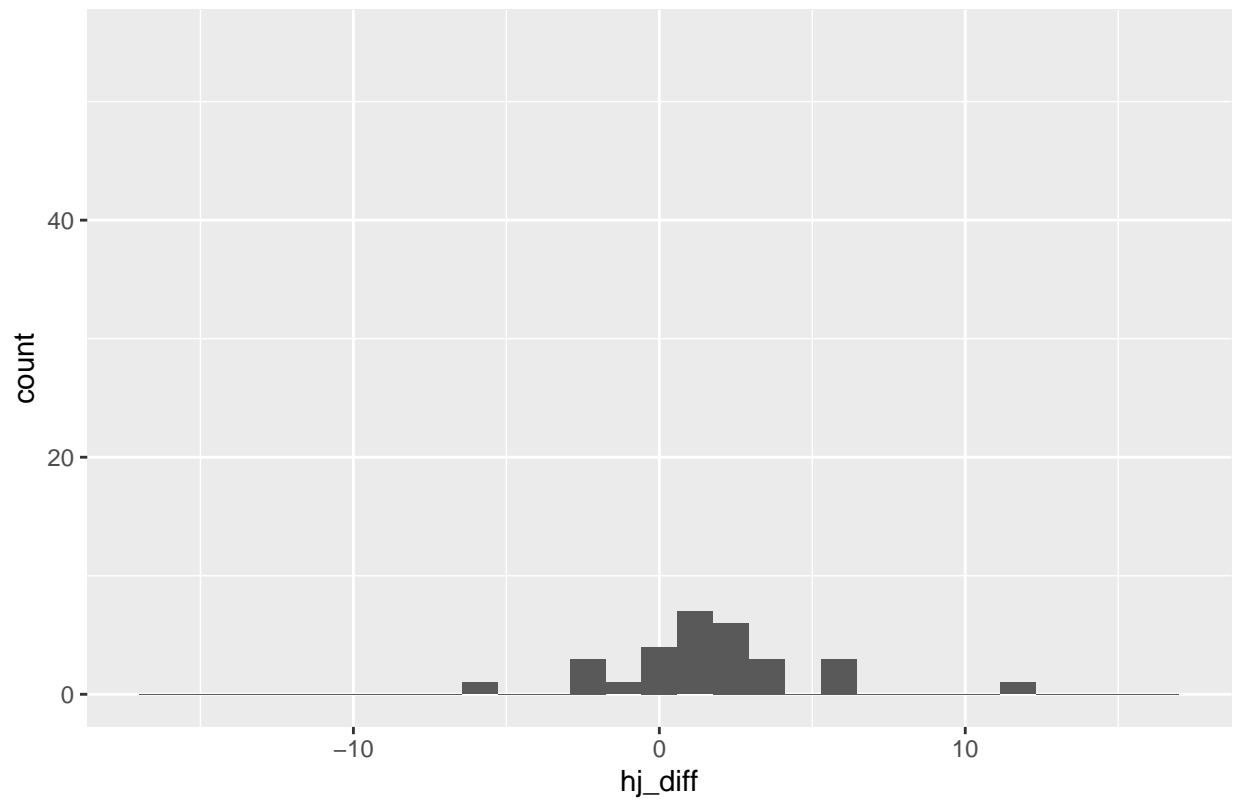
```
## [[1]]
```

Distribution of differences for AUS



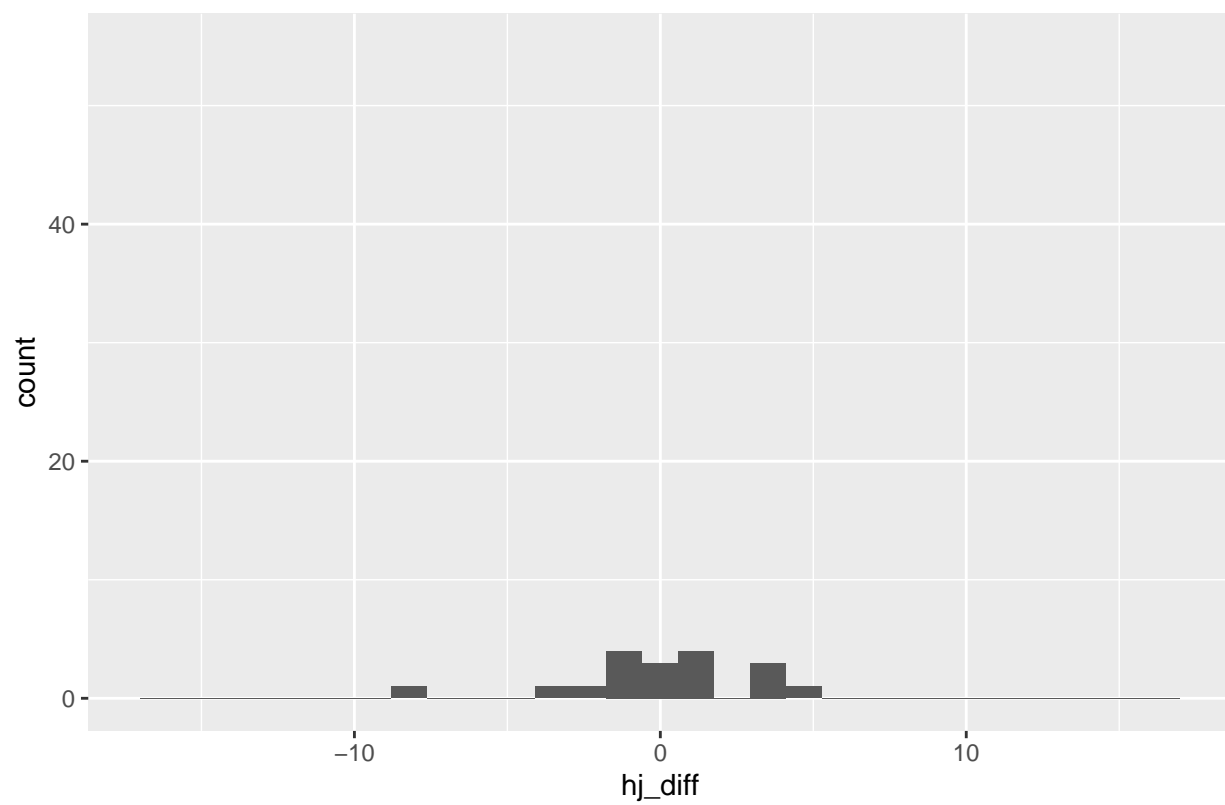
```
##  
## [[2]]
```

Distribution of differences for AUT



```
##  
## [[3]]
```

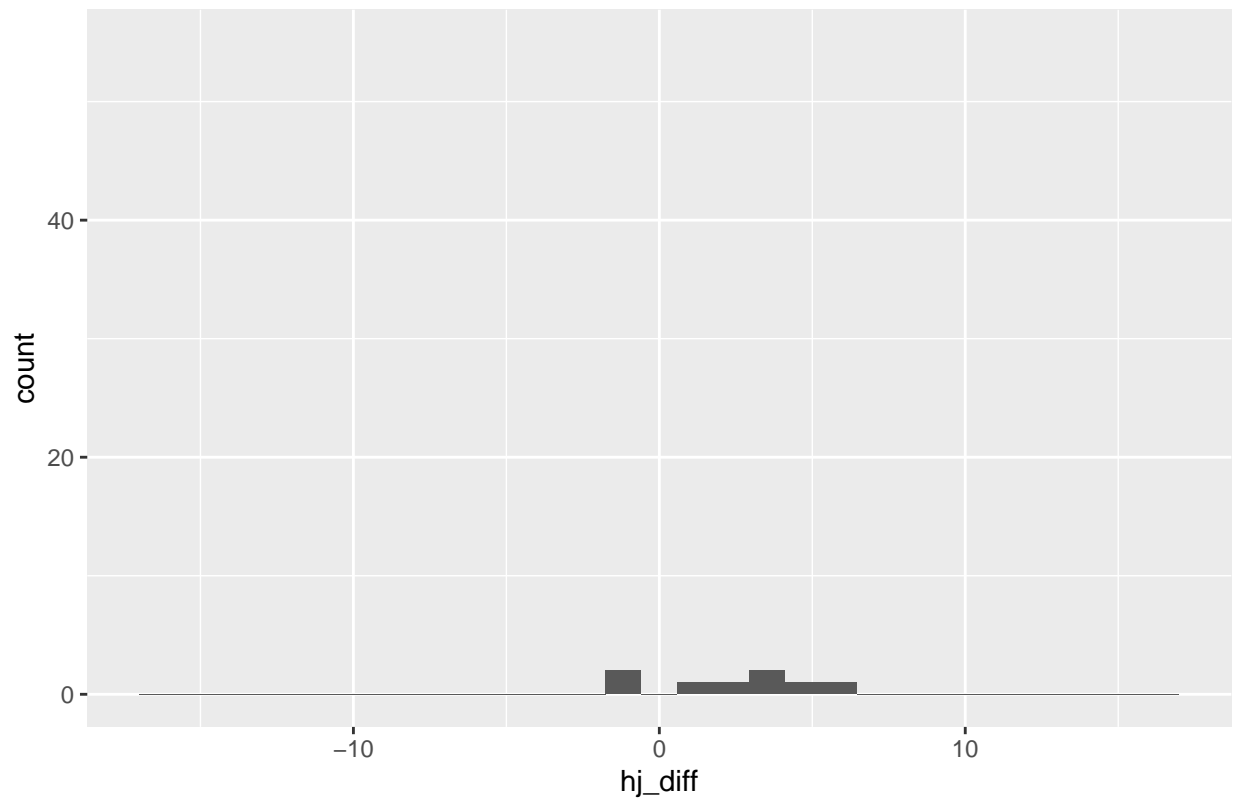
Distribution of differences for AZE



```
##  
## [[4]]
```

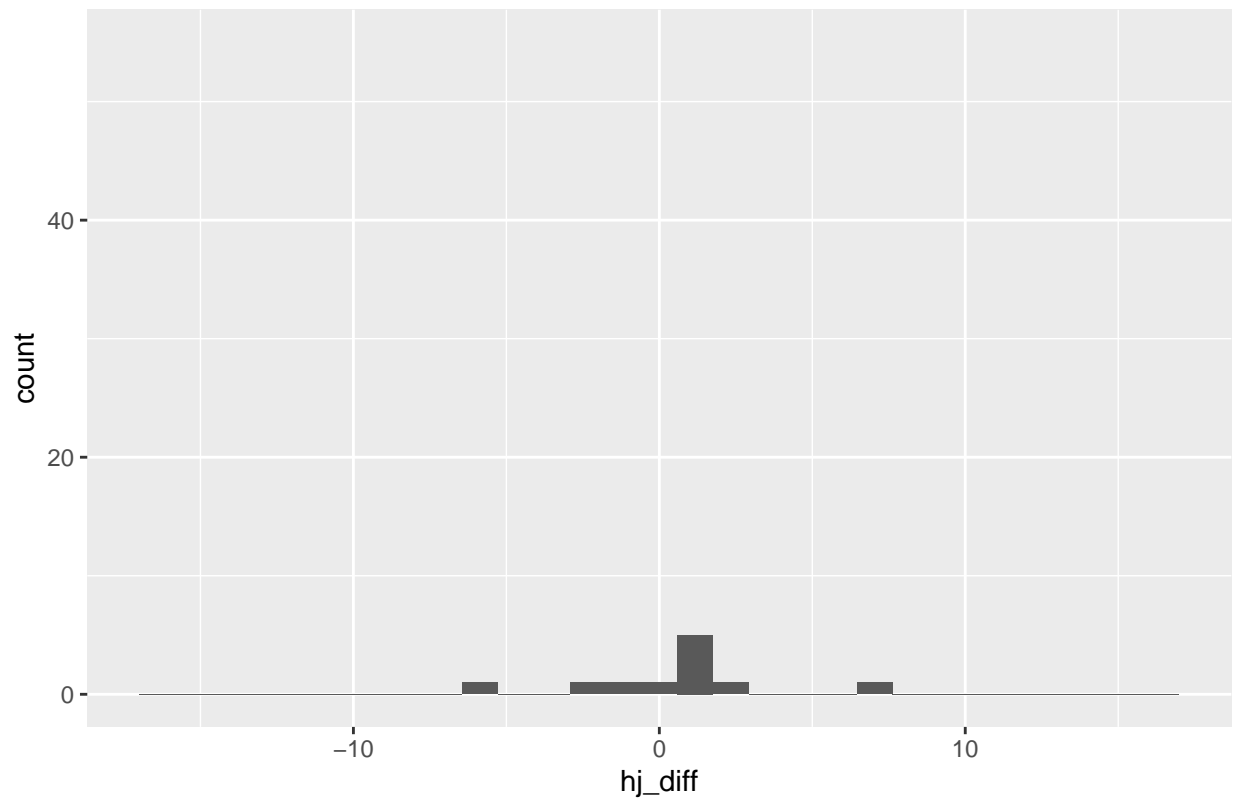


Distribution of differences for BEL



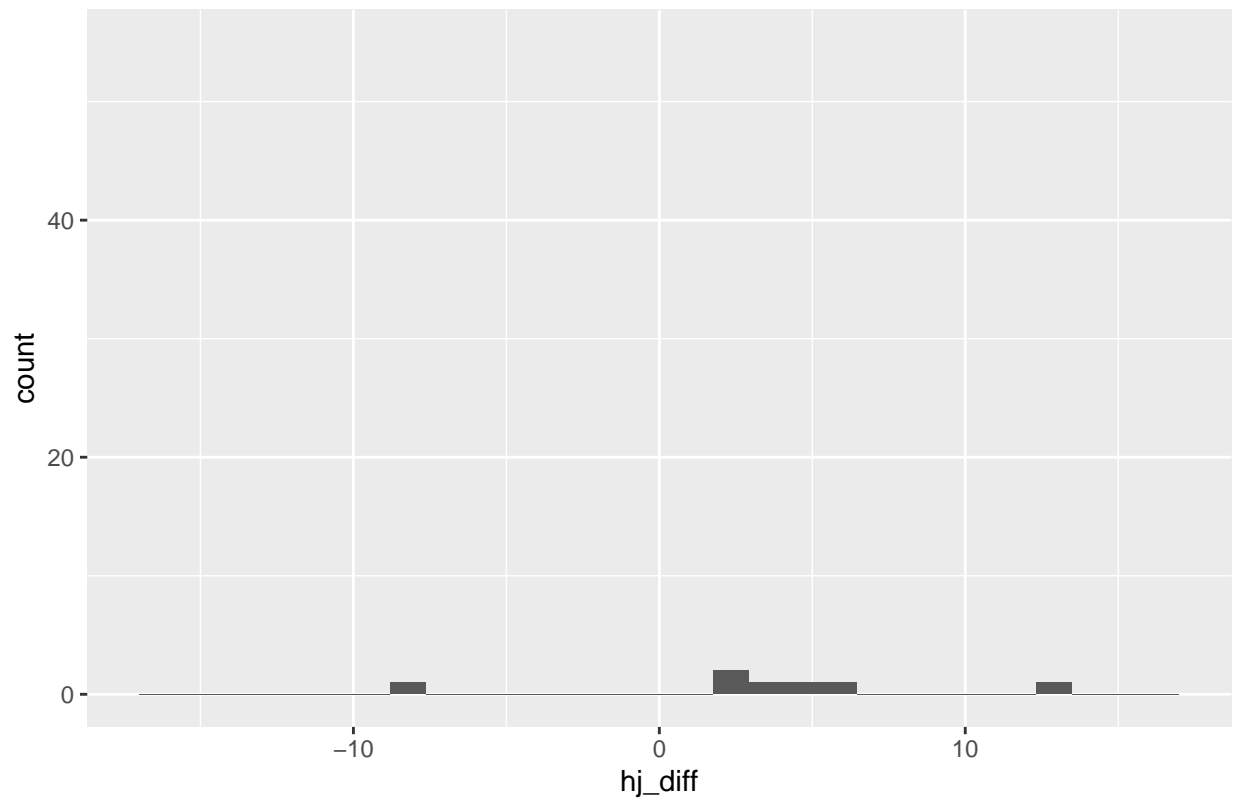
```
##  
## [[5]]
```

Distribution of differences for BLR

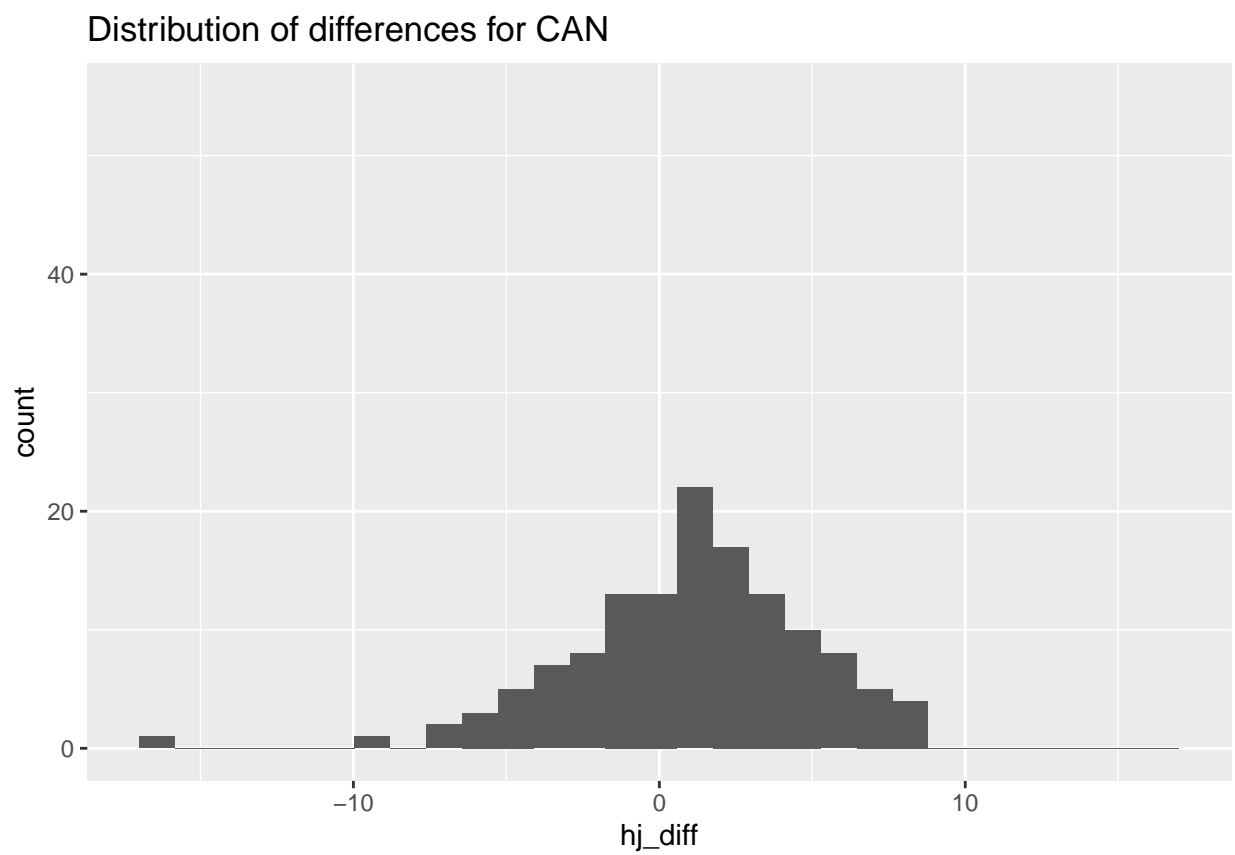


```
##  
## [[6]]
```

Distribution of differences for BUL

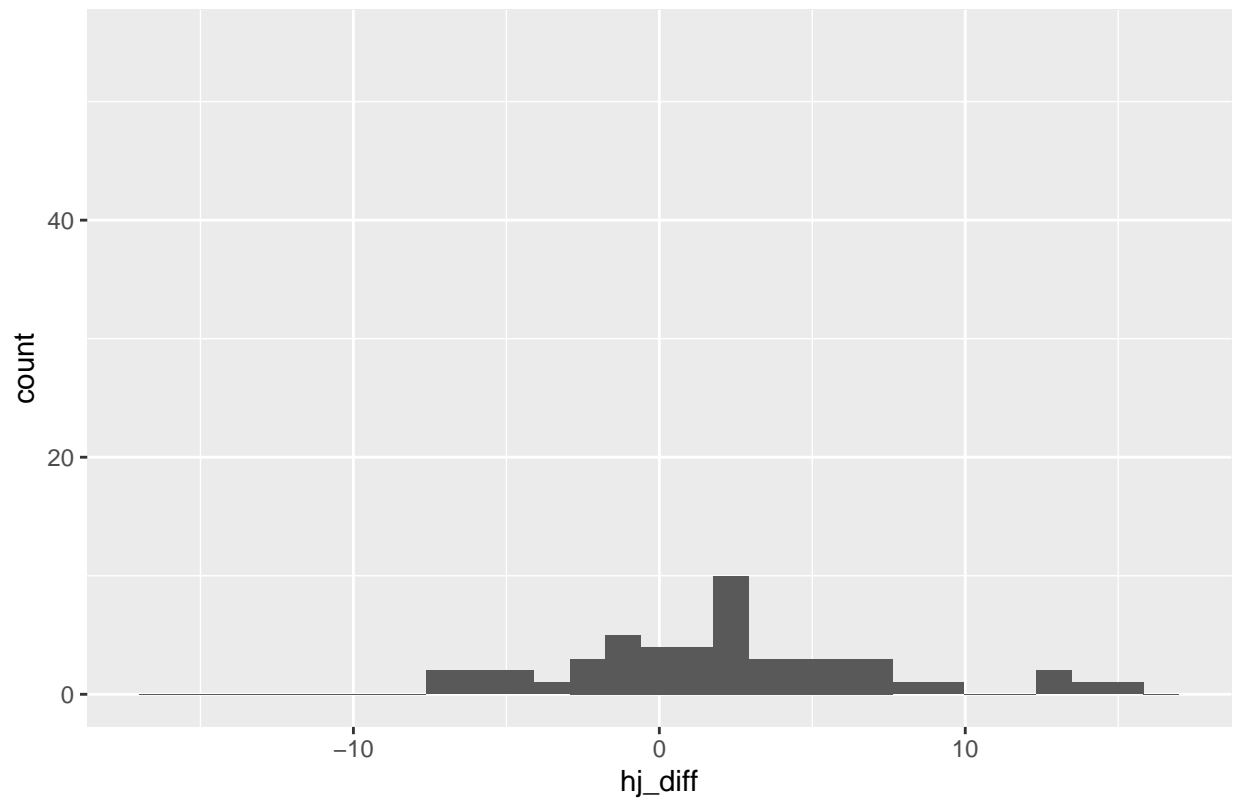


```
##  
## [[7]]
```



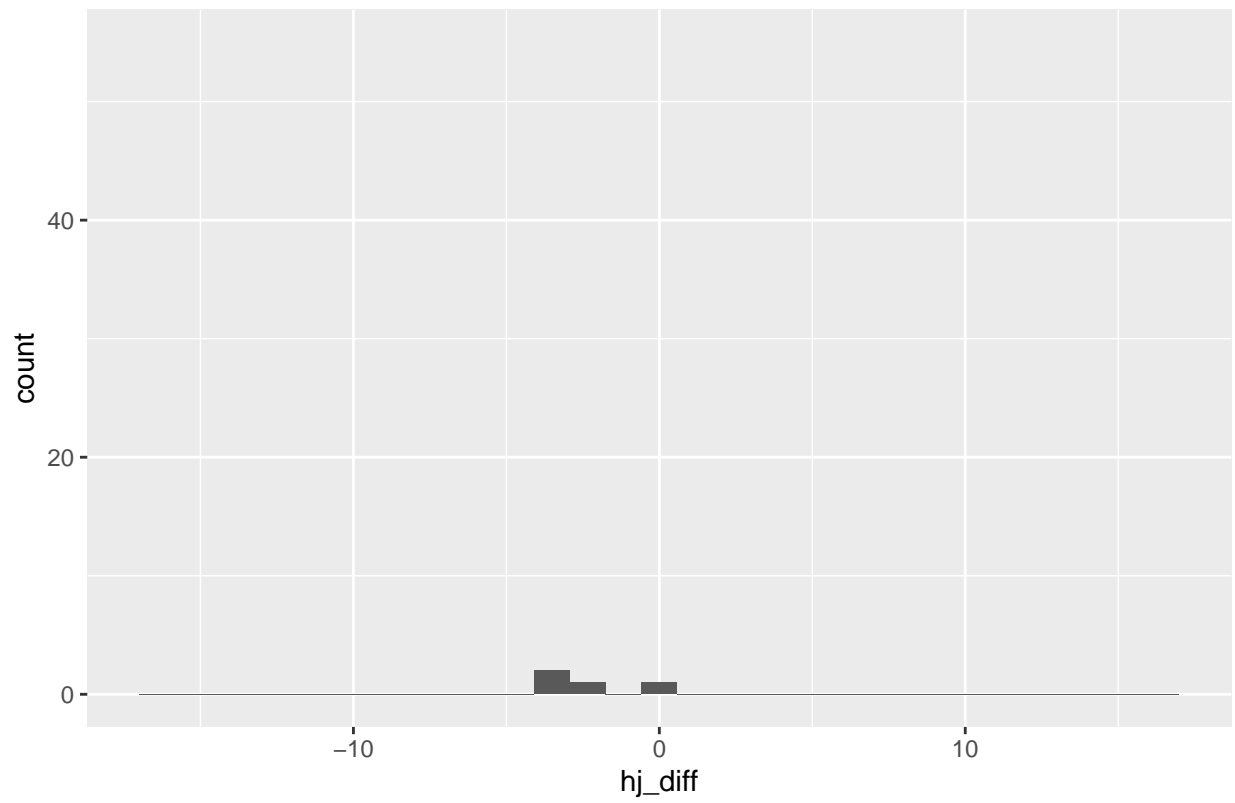
```
##  
## [[8]]
```

Distribution of differences for CHN



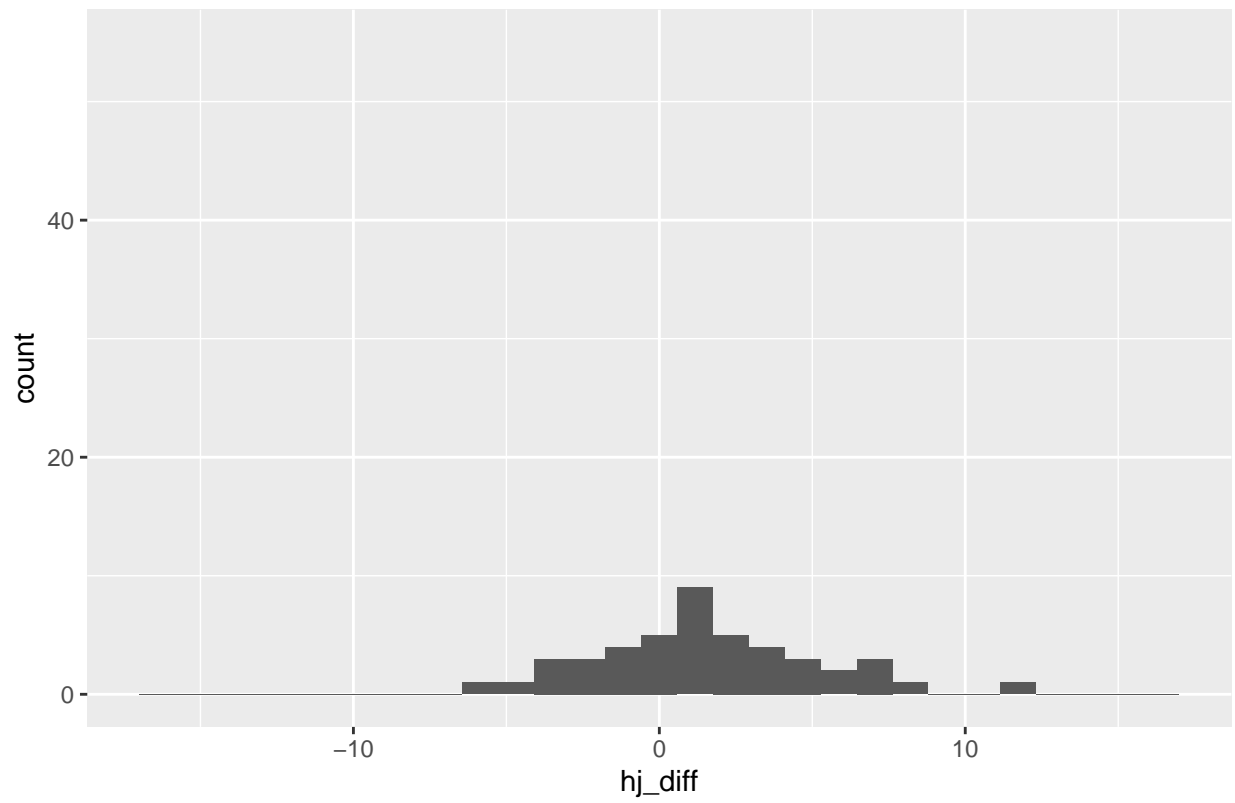
```
##  
## [[9]]
```

Distribution of differences for CRO

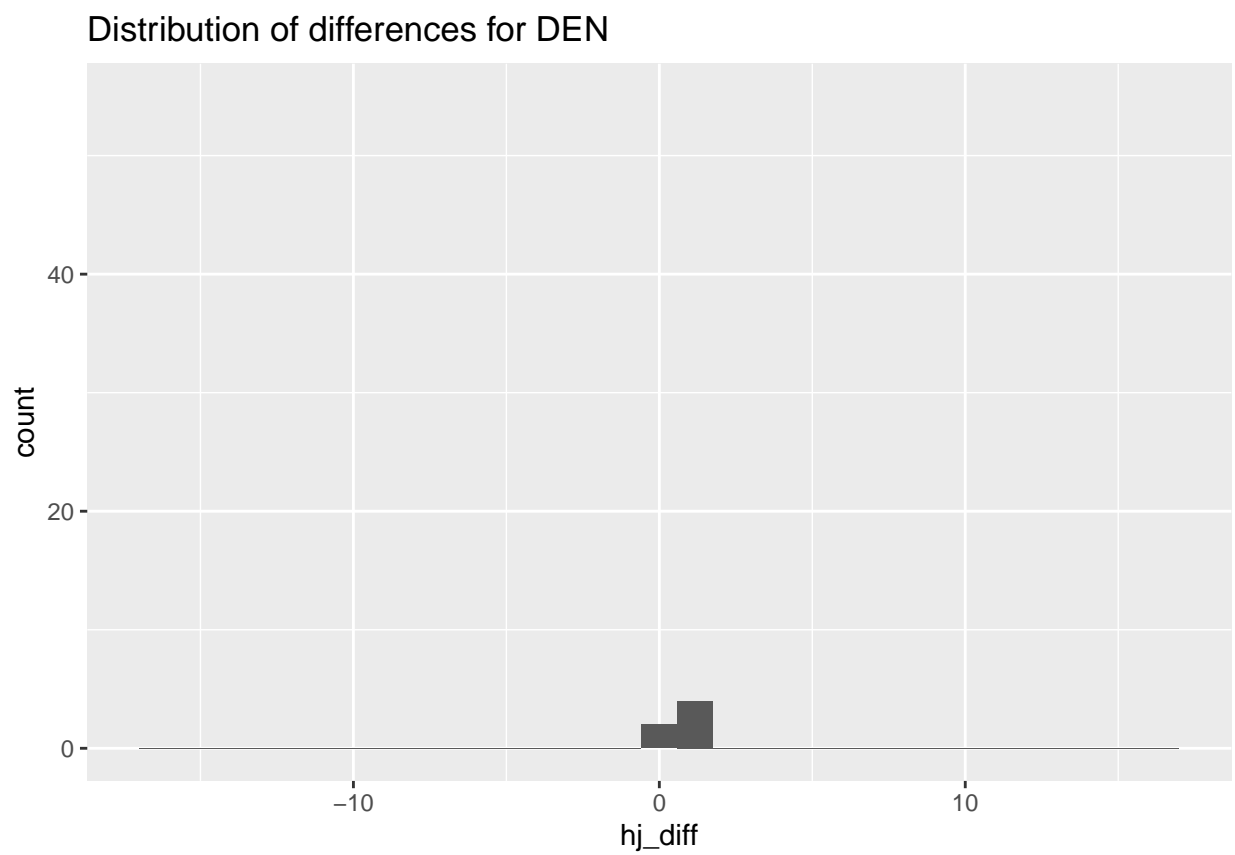


```
##  
## [[10]]
```

Distribution of differences for CZE



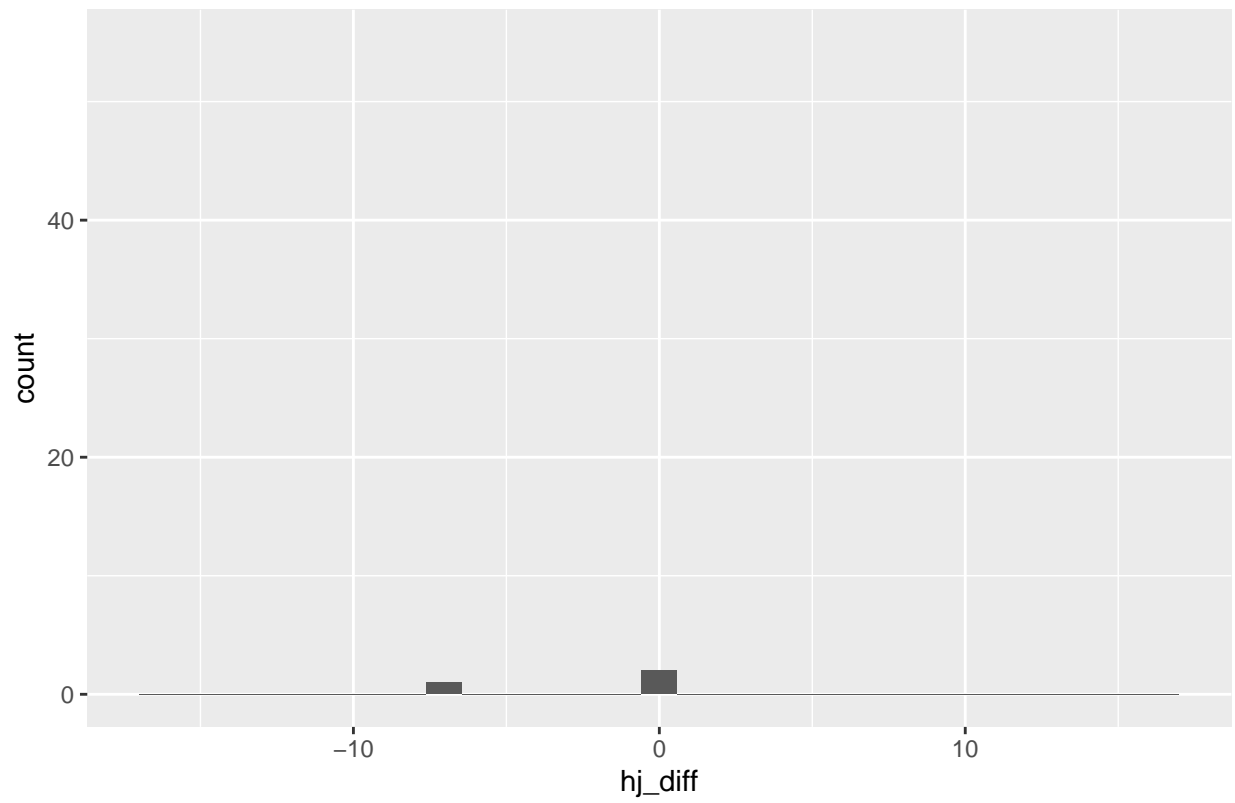
```
##  
## [[11]]
```



```
##  
## [[12]]
```

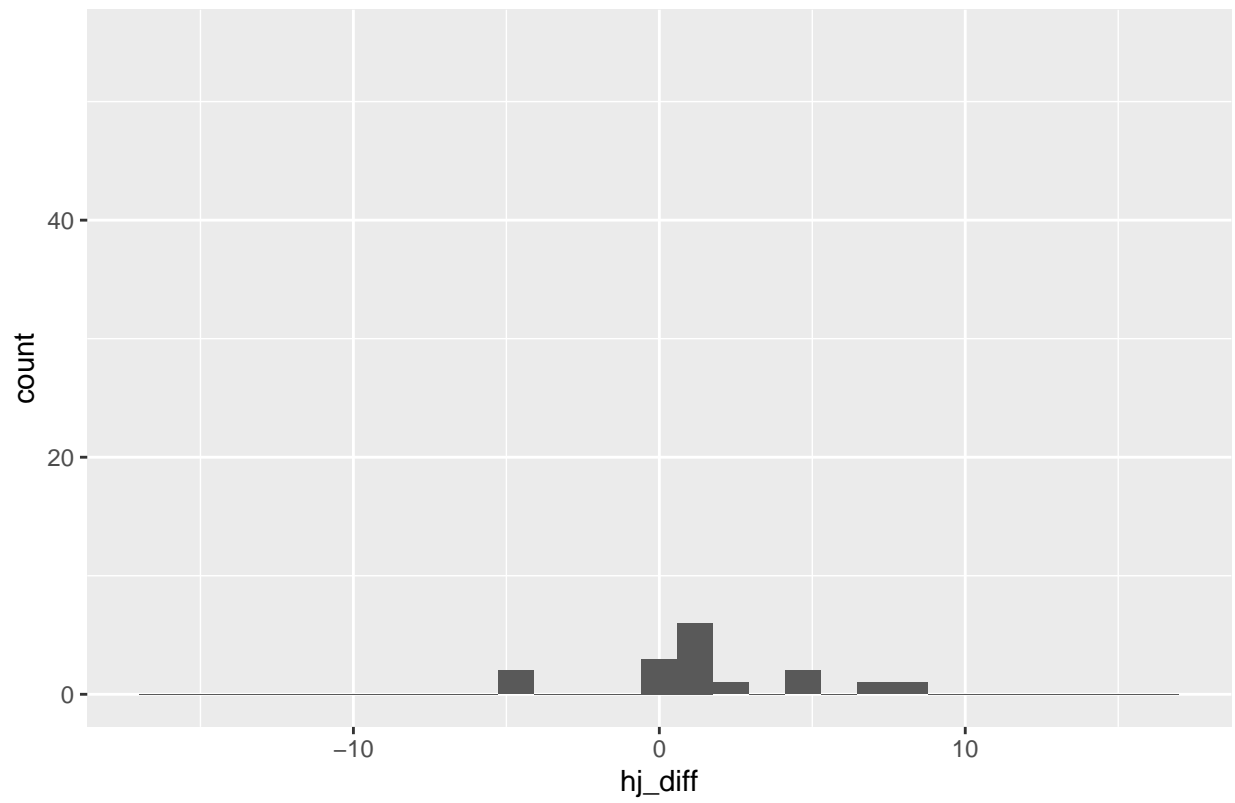


Distribution of differences for ESP



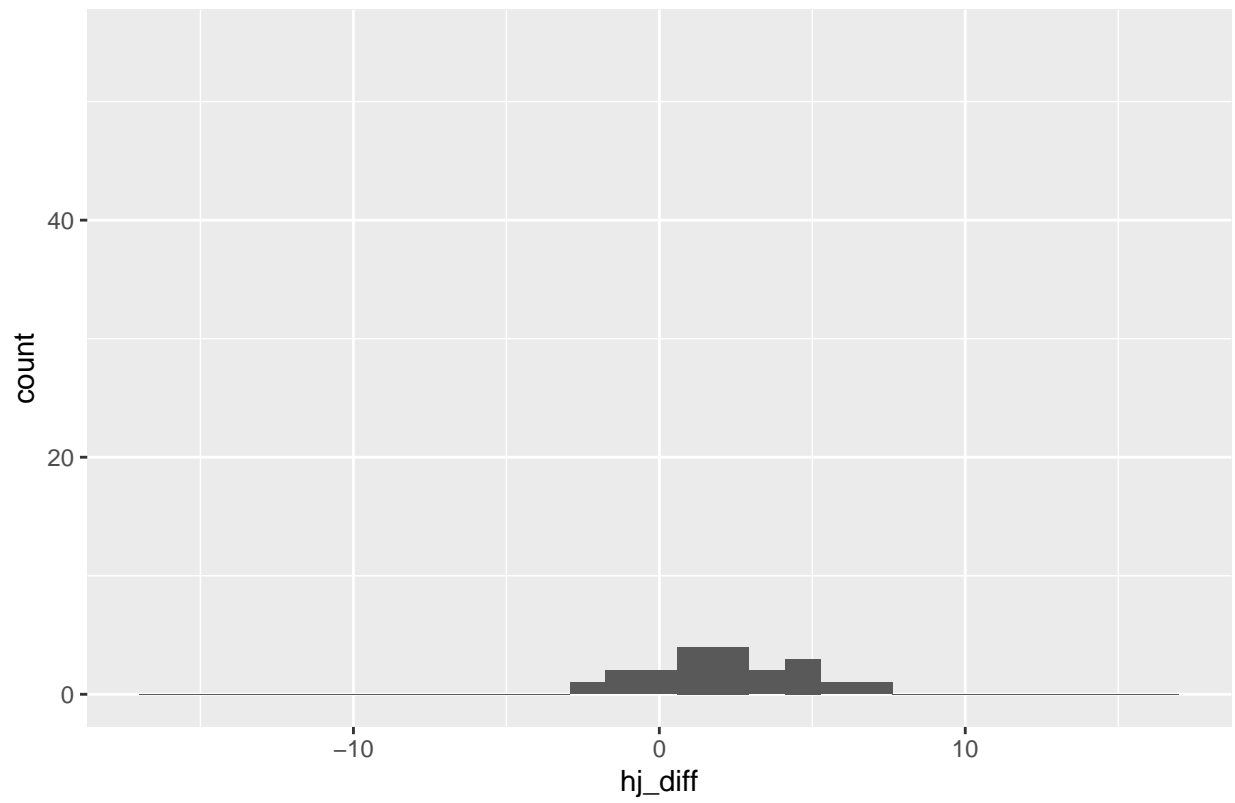
```
##  
## [[13]]
```

Distribution of differences for EST



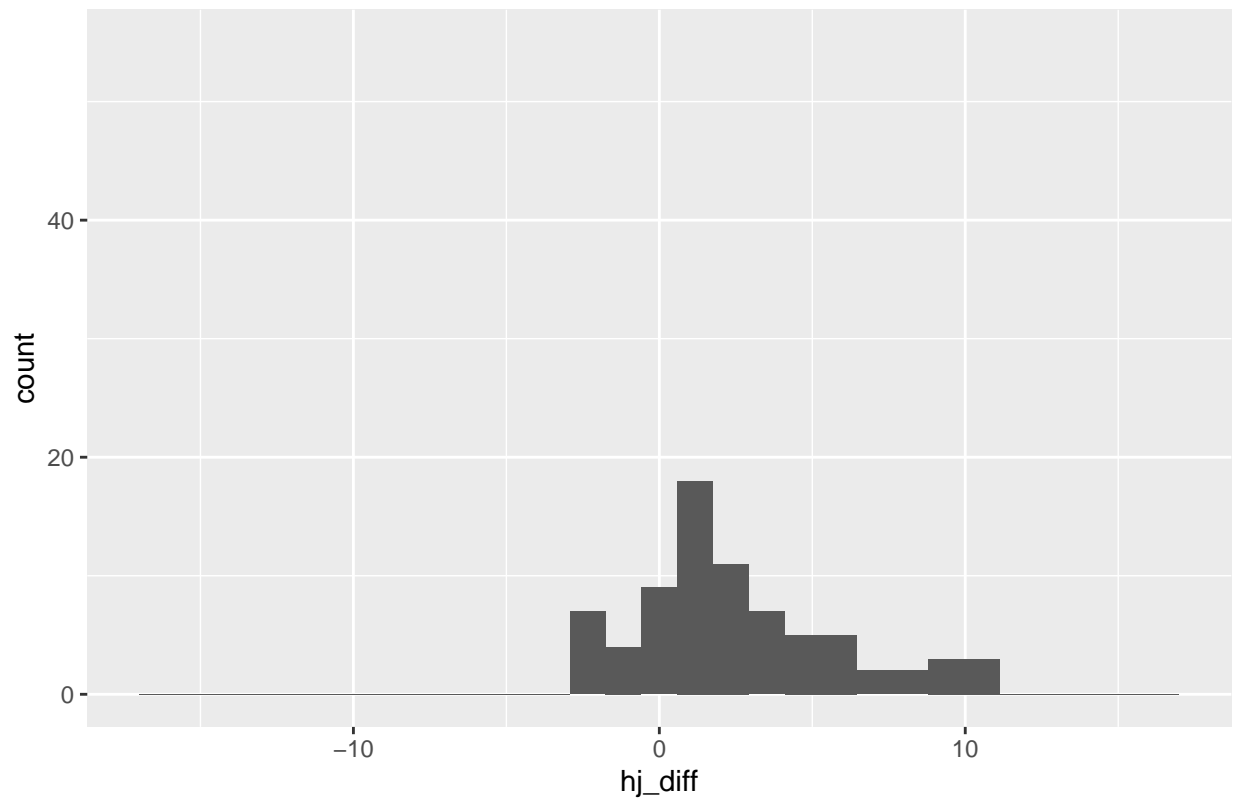
```
##  
## [[14]]
```

Distribution of differences for FIN



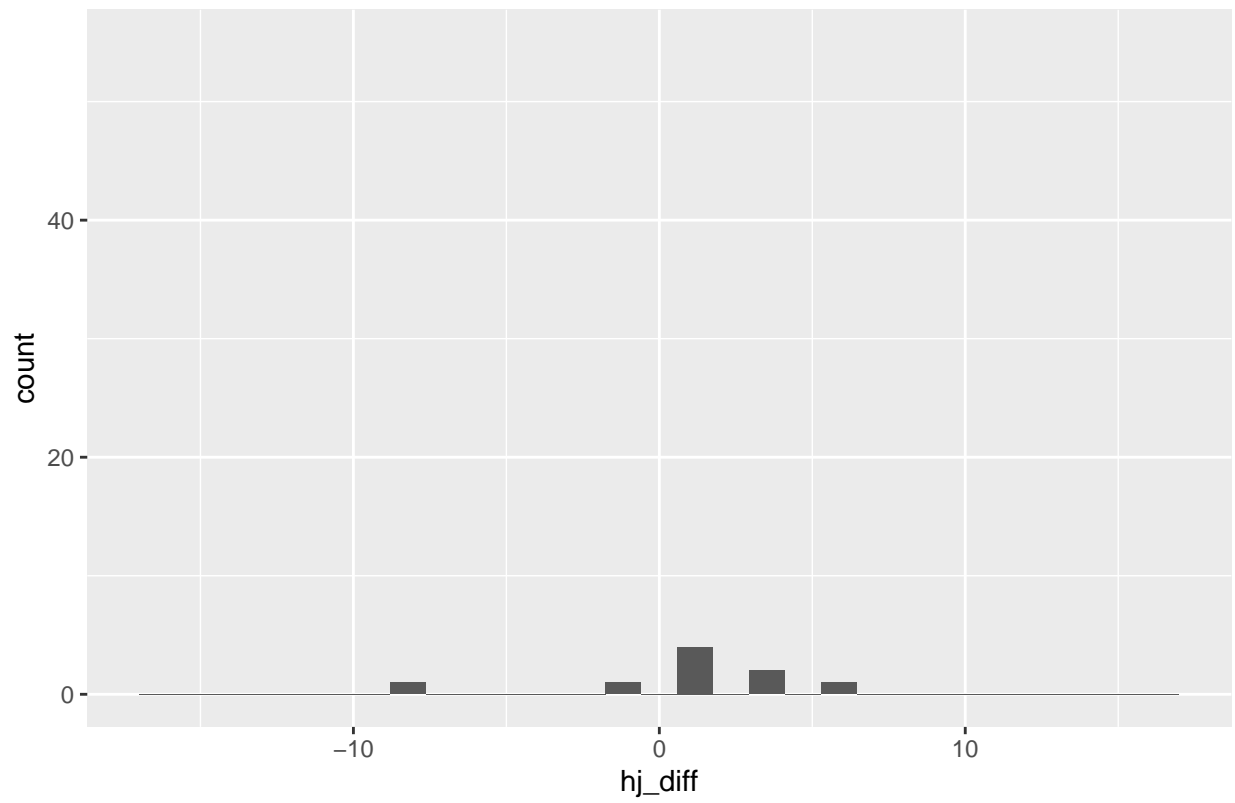
```
##  
## [[15]]
```

Distribution of differences for FRA



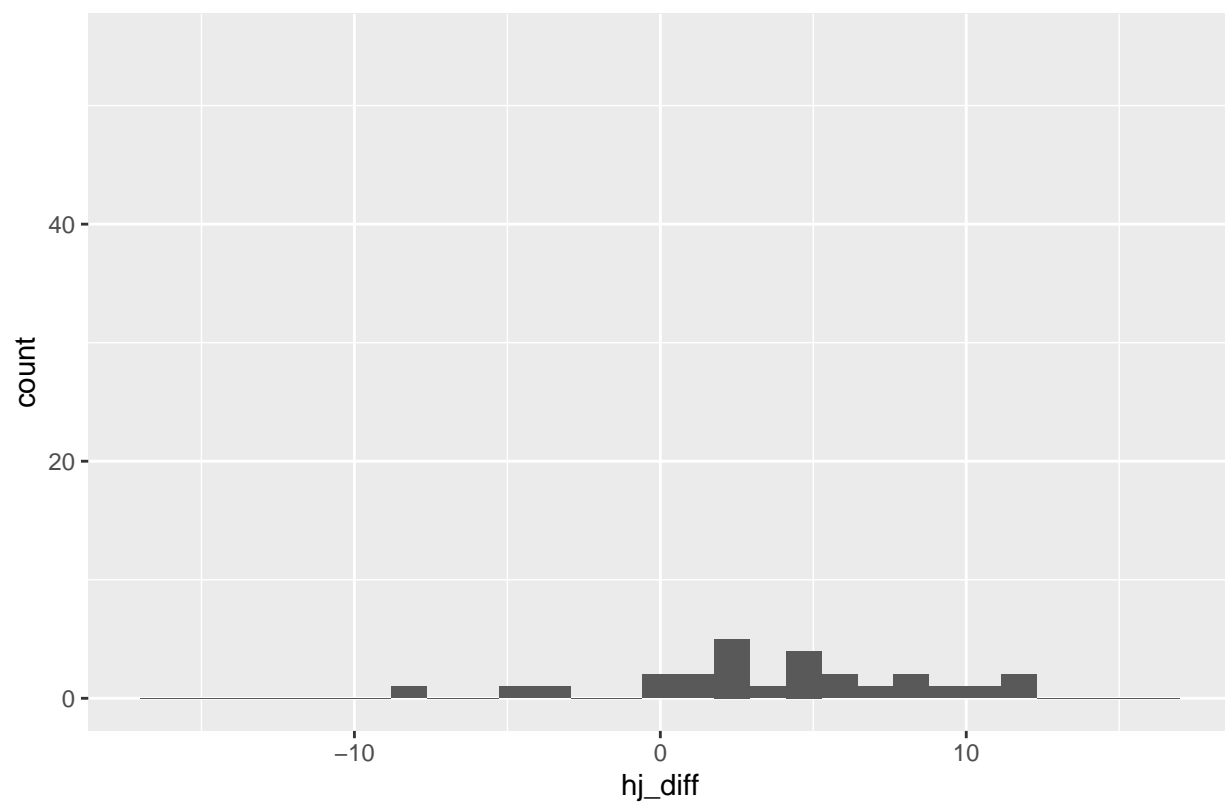
```
##  
## [[16]]
```

Distribution of differences for GBR



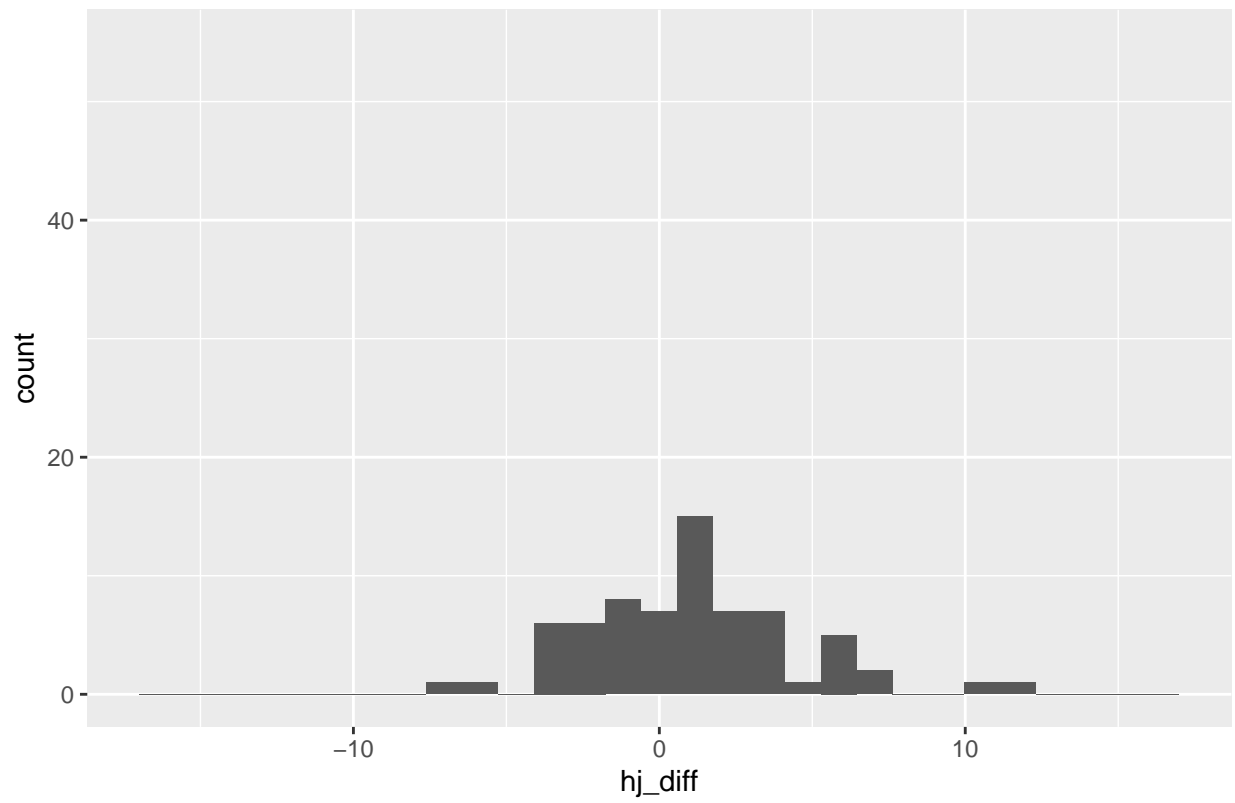
```
##  
## [[17]]
```

Distribution of differences for GEO



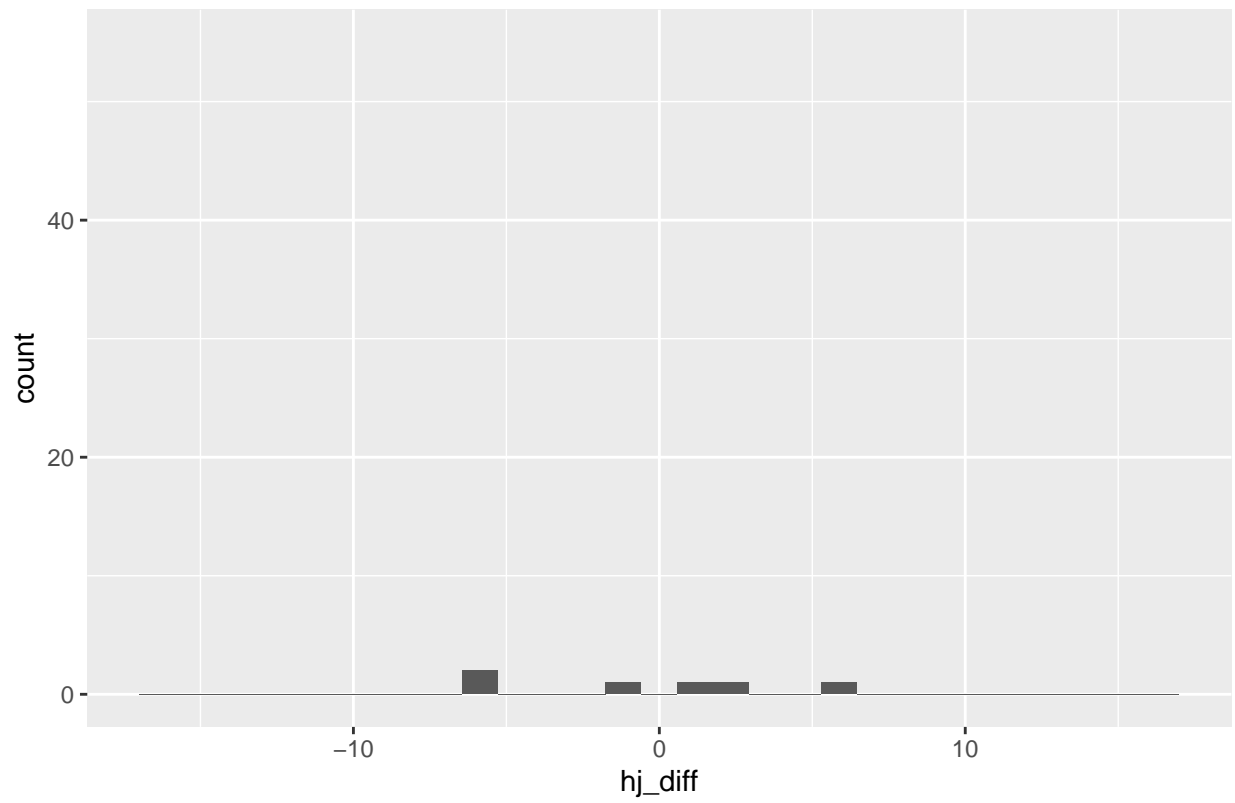
```
##  
## [[18]]
```

Distribution of differences for GER



```
##  
## [[19]]
```

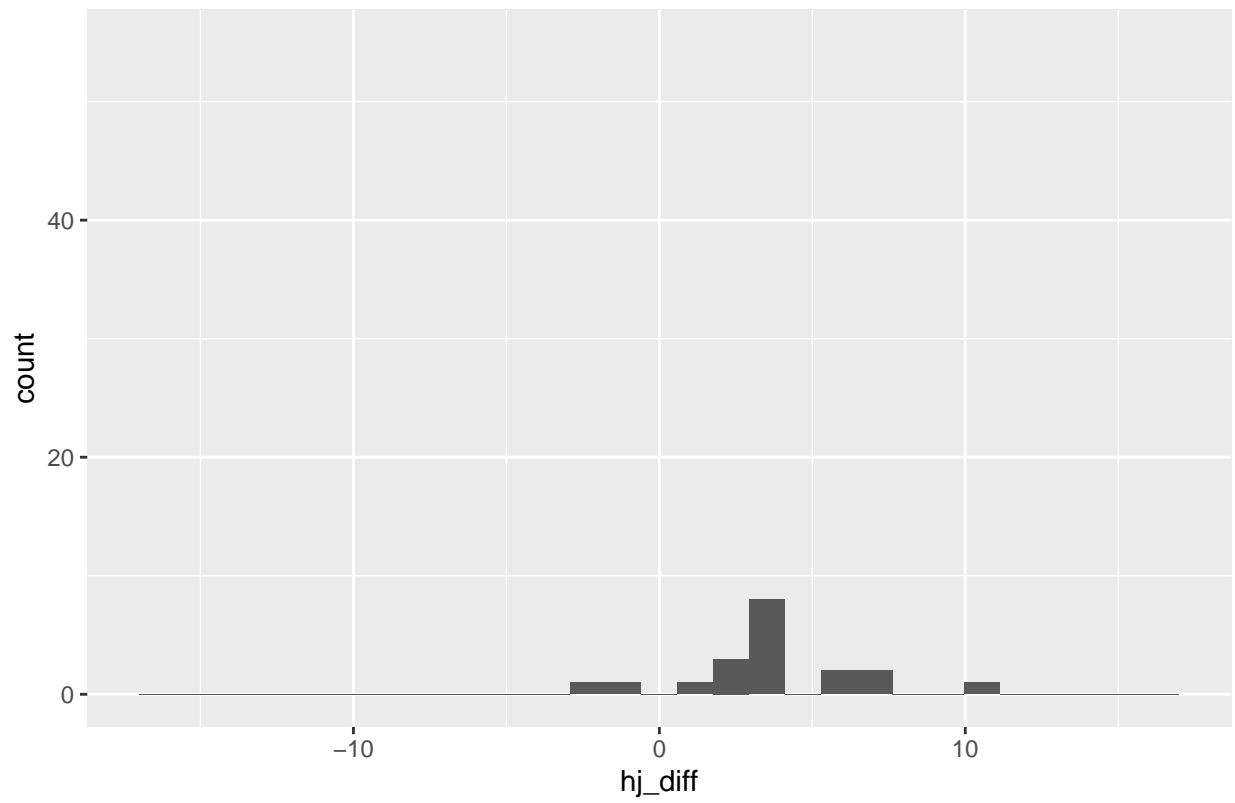
Distribution of differences for HKG



```
##  
## [[20]]
```

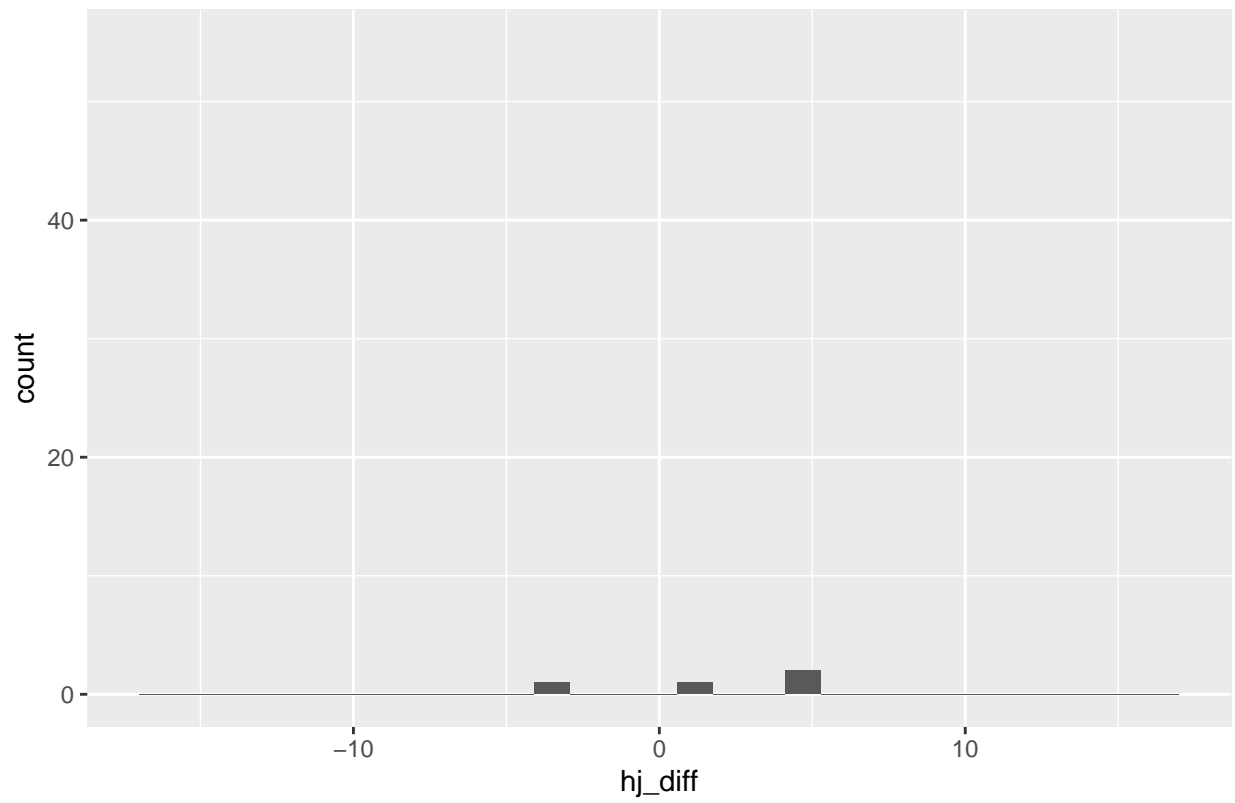


Distribution of differences for HUN



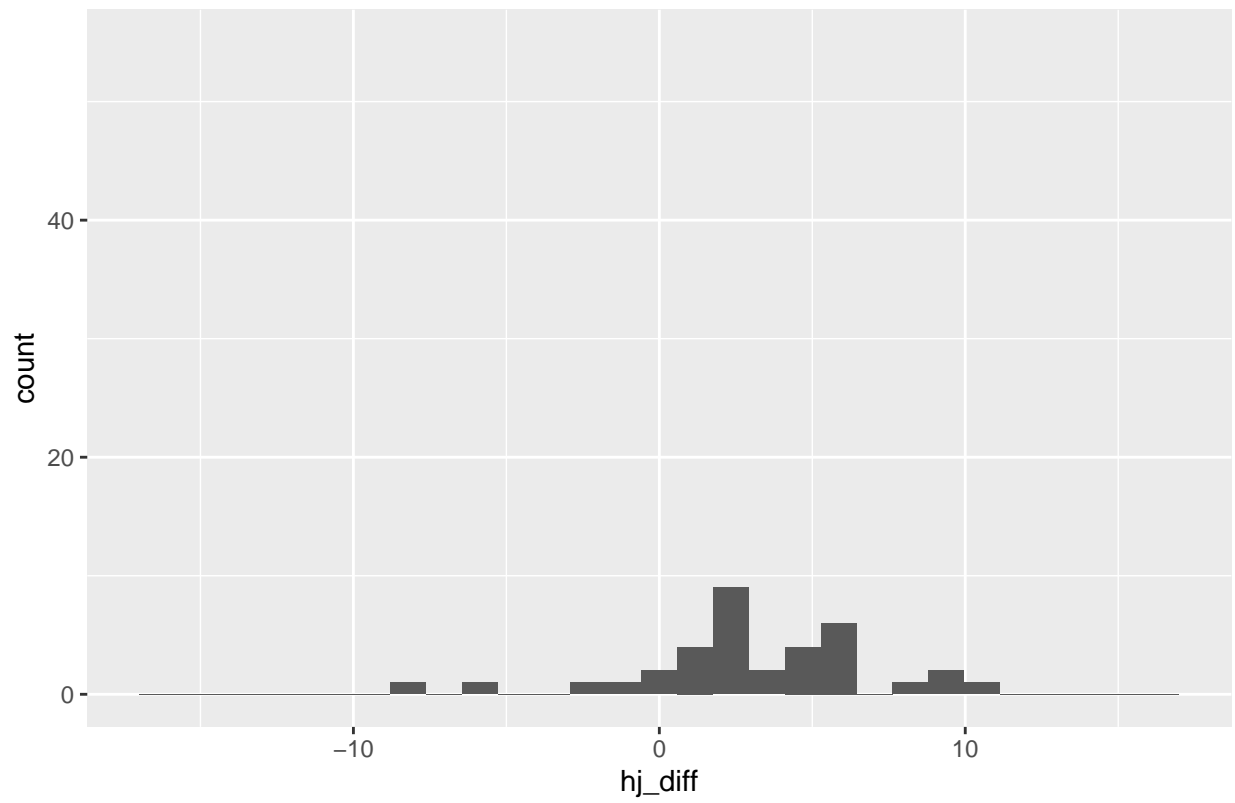
```
##  
## [[21]]
```

Distribution of differences for IRL



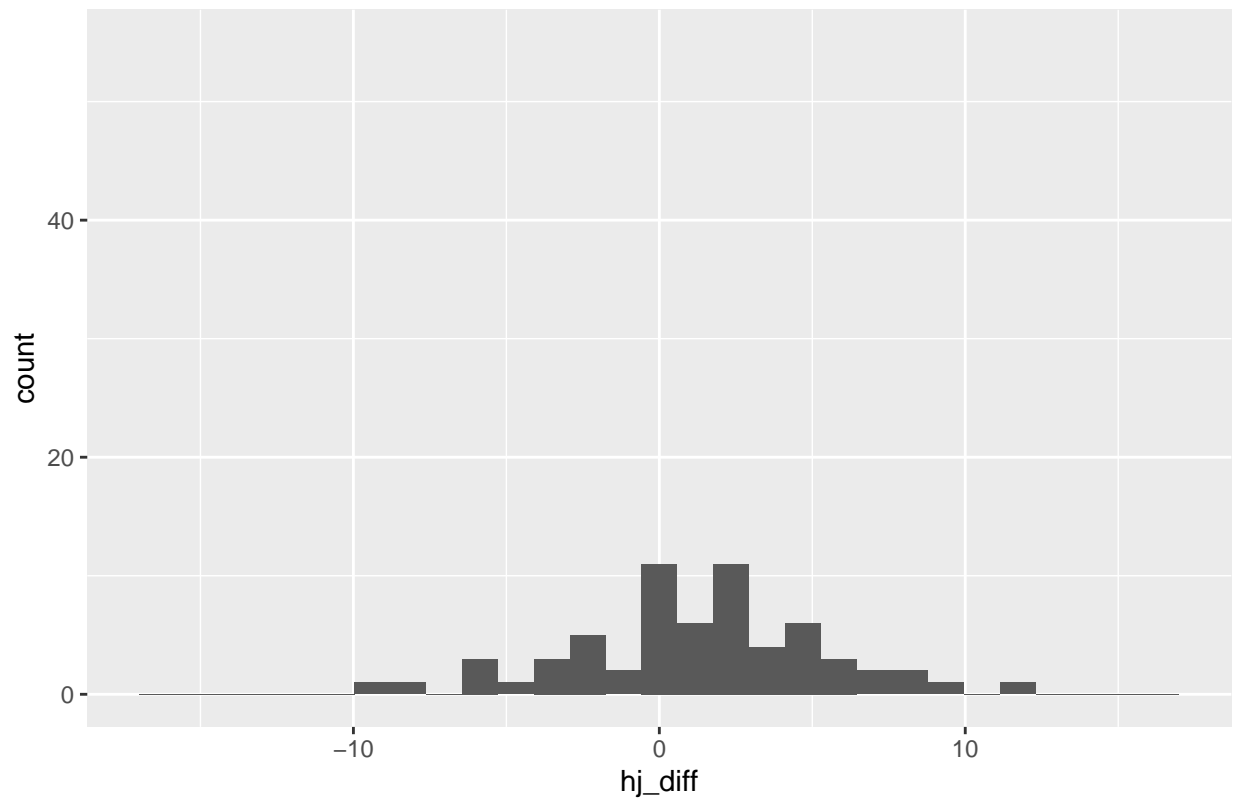
```
##  
## [[22]]
```

Distribution of differences for ISR



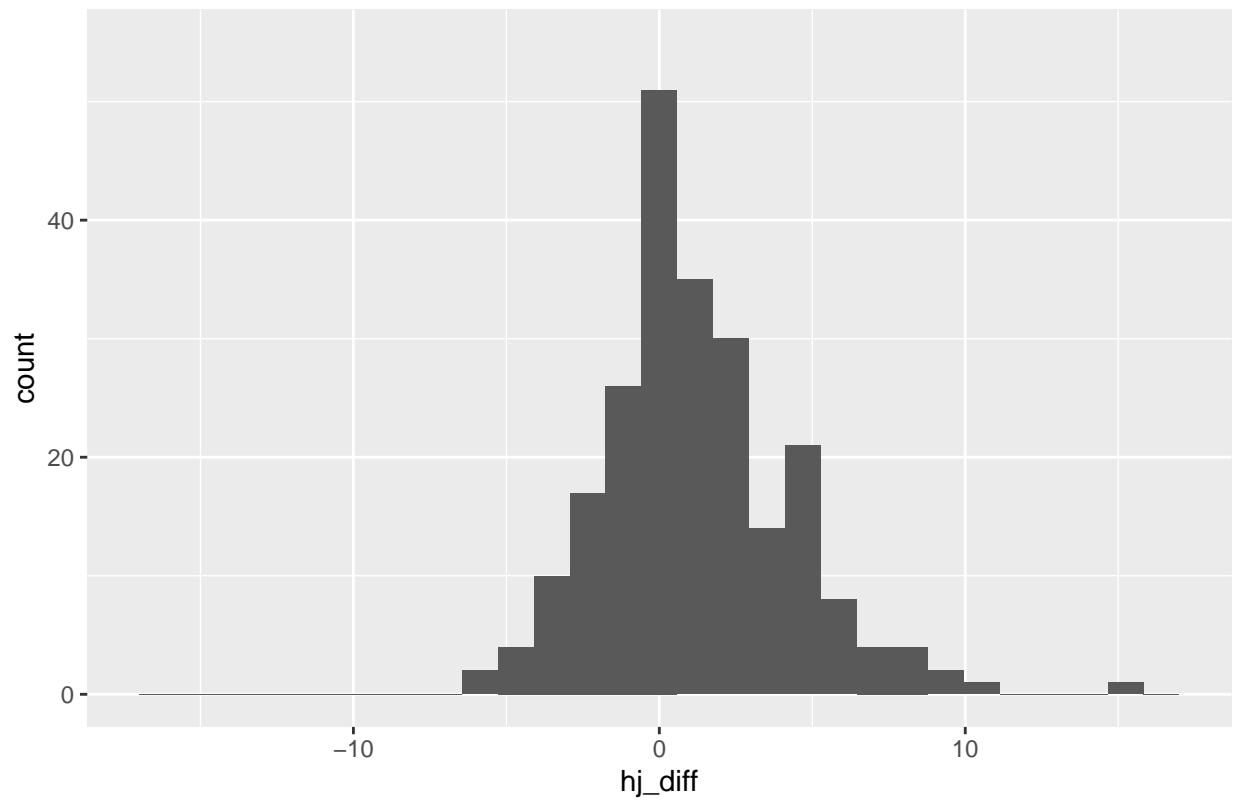
```
##  
## [[23]]
```

Distribution of differences for ITA



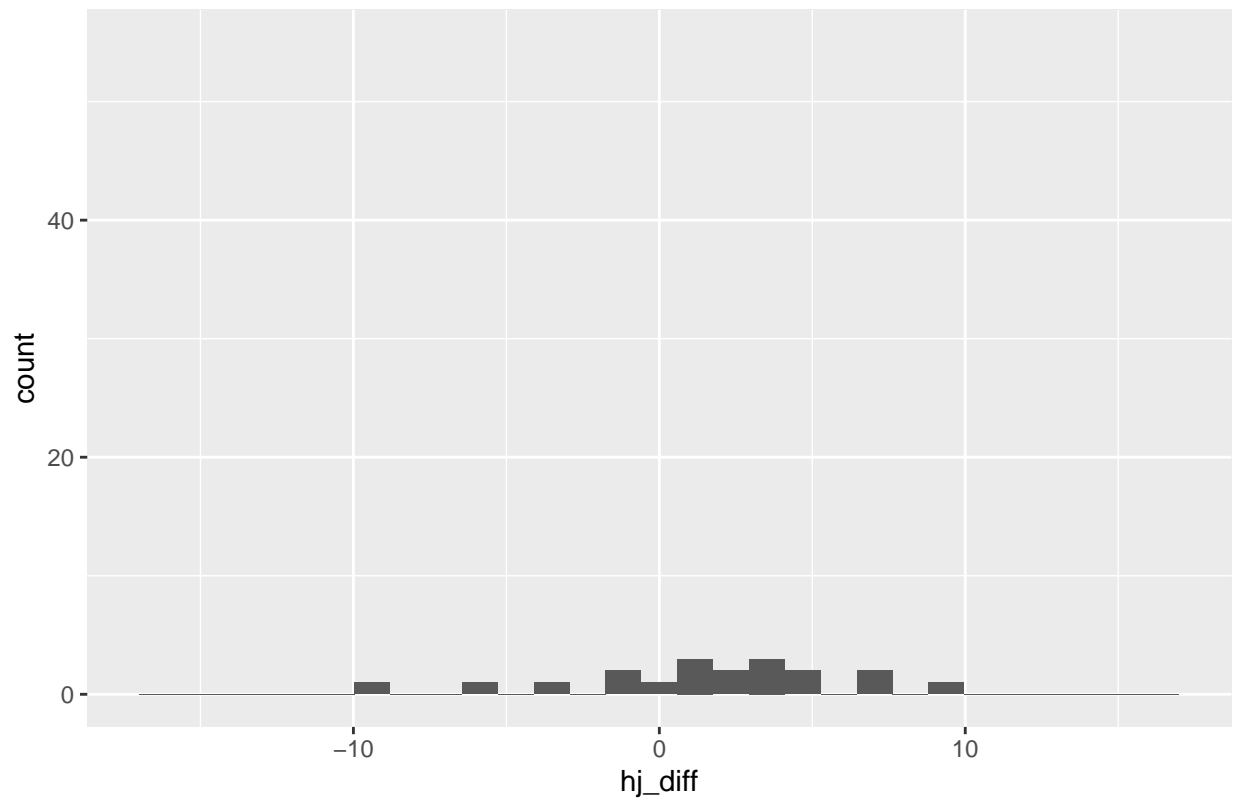
```
##  
## [[24]]
```

Distribution of differences for JPN



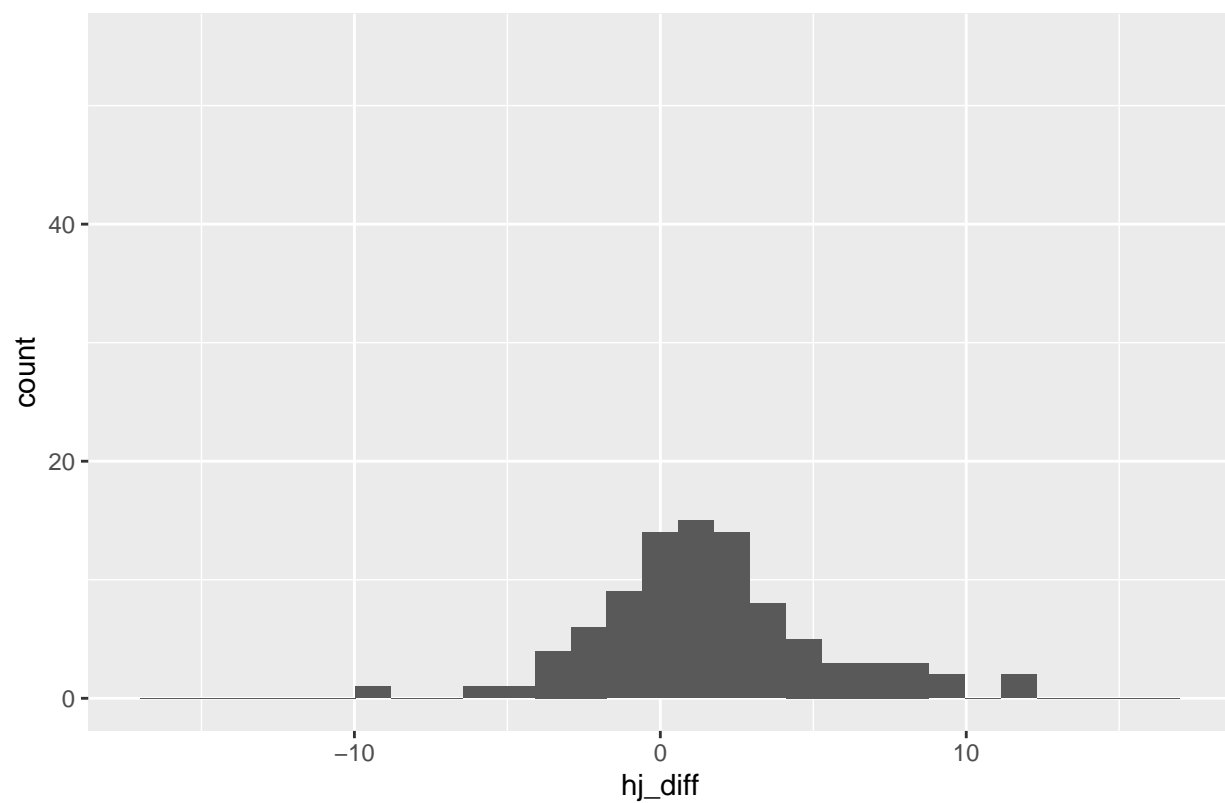
```
##  
## [[25]]
```

Distribution of differences for KAZ



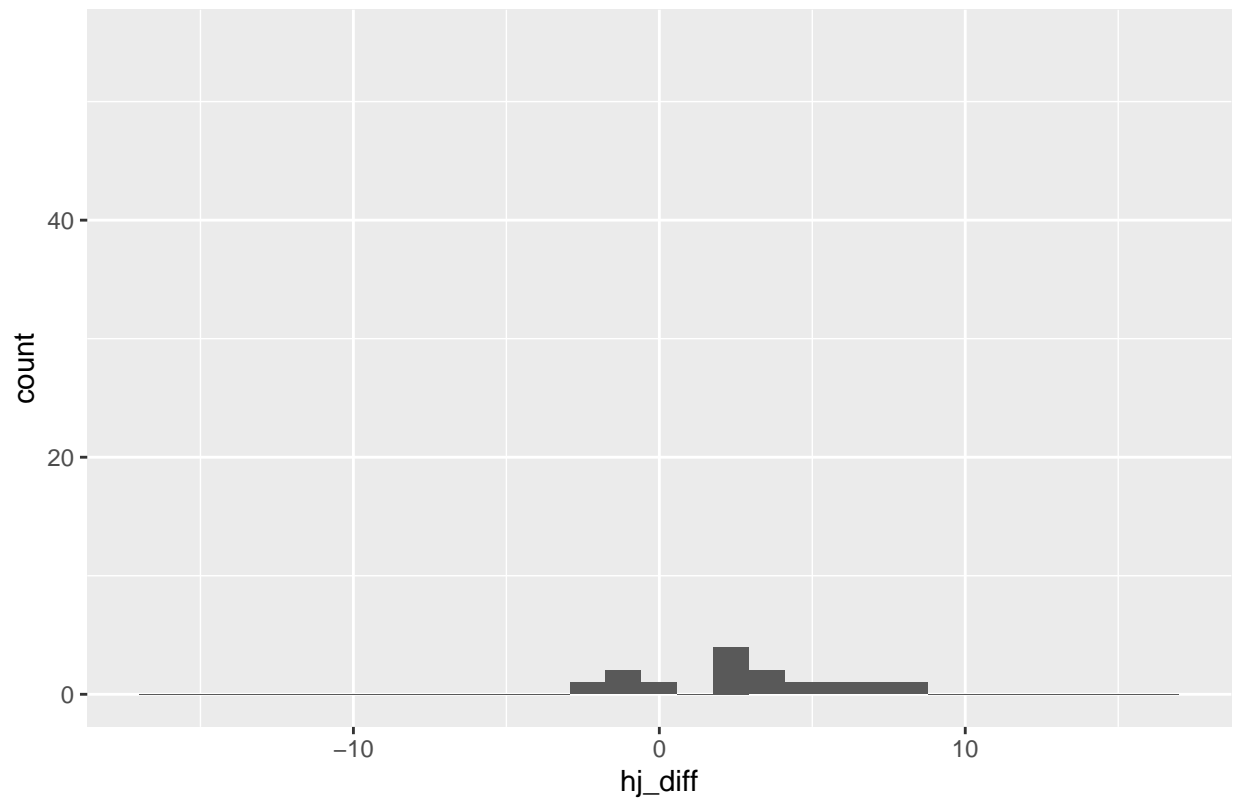
```
##  
## [[26]]
```

Distribution of differences for KOR



```
##  
## [[27]]
```

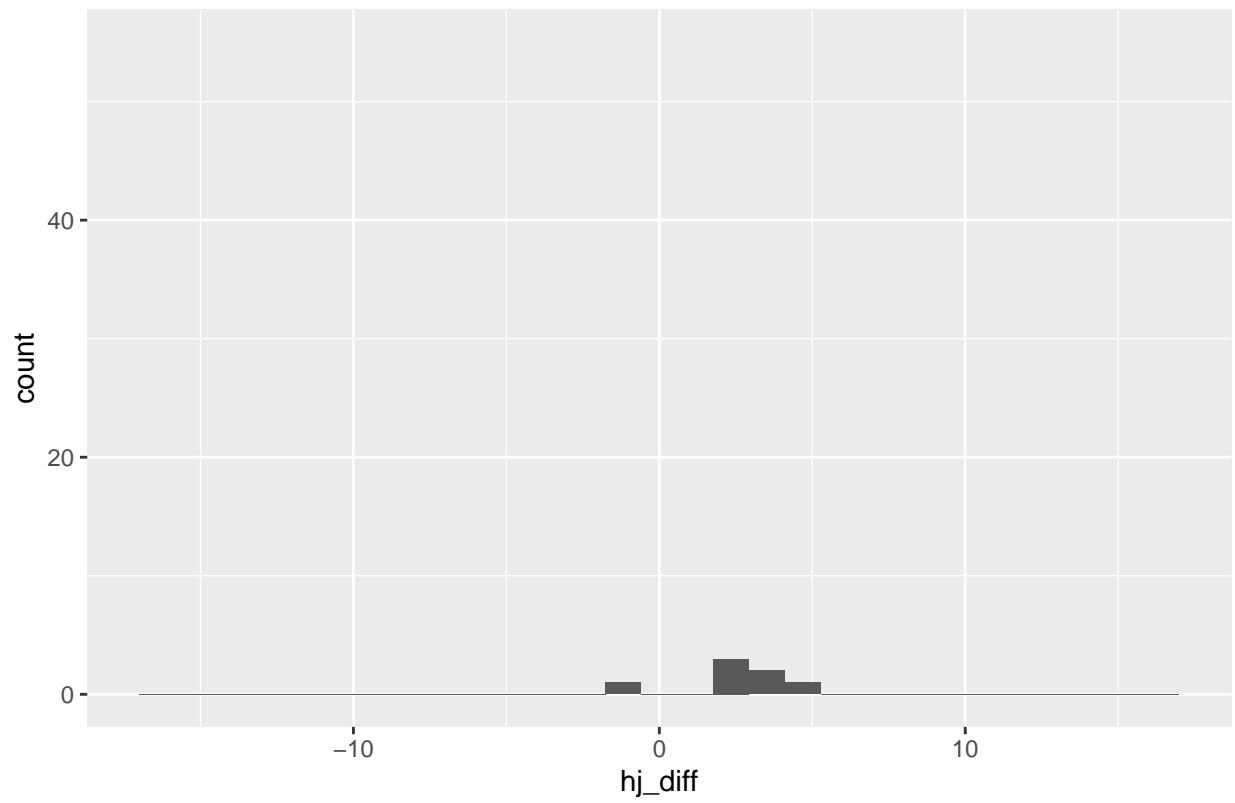
Distribution of differences for LAT



```
##  
## [[28]]
```

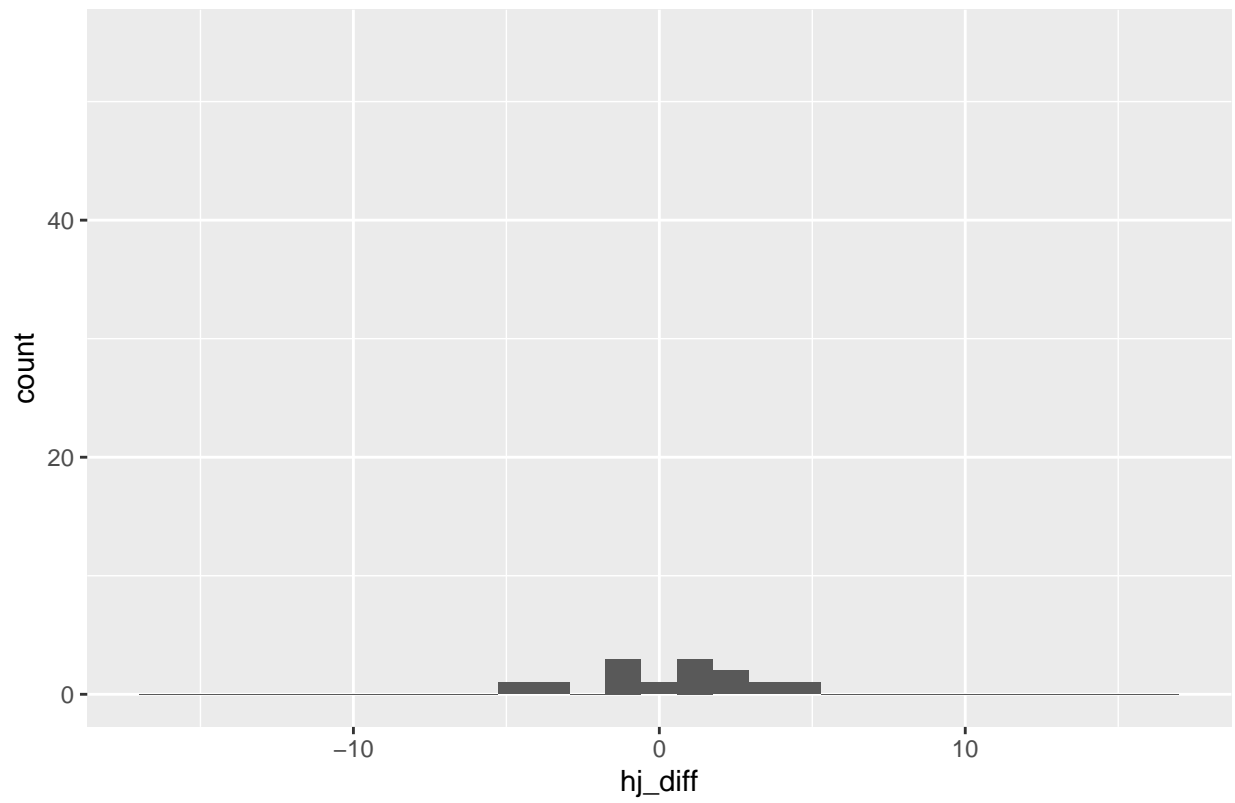


Distribution of differences for LTU

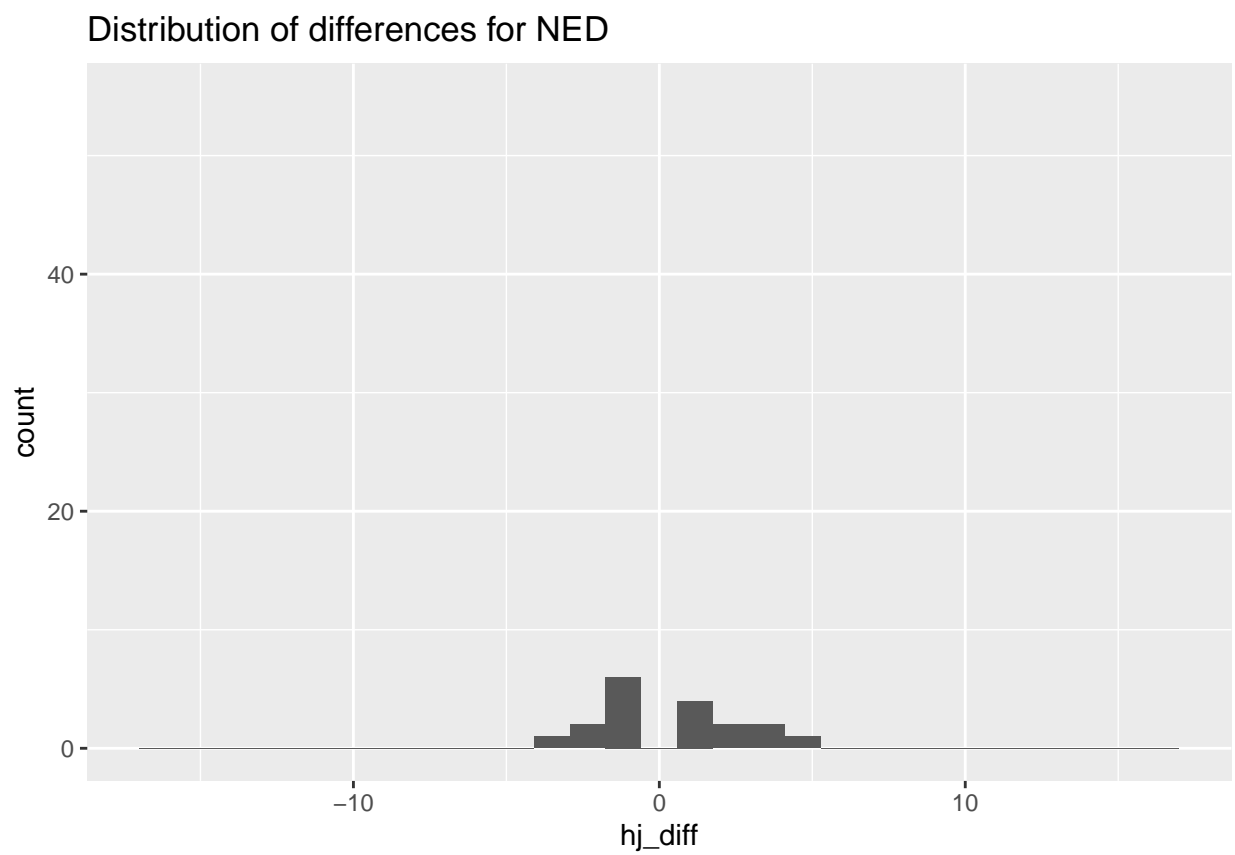


```
##  
## [[29]]
```

Distribution of differences for MEX

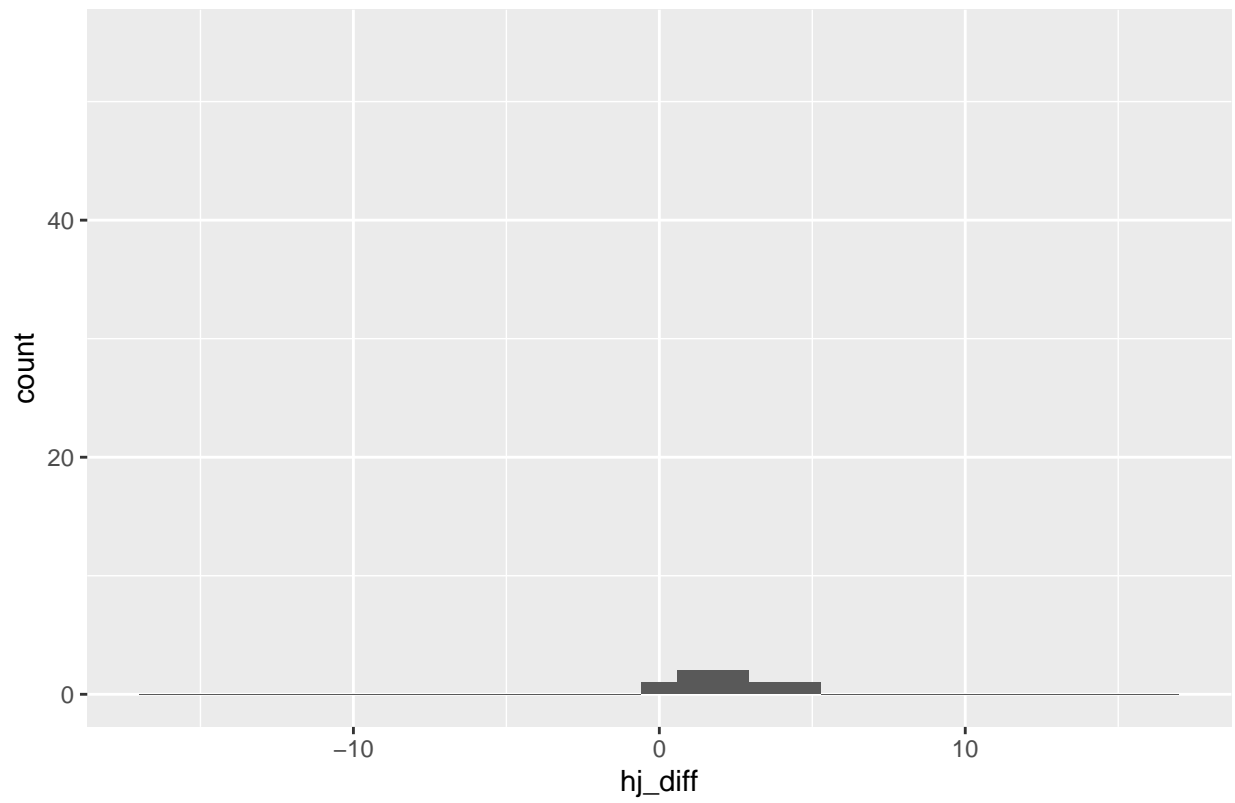


```
##  
## [[30]]
```



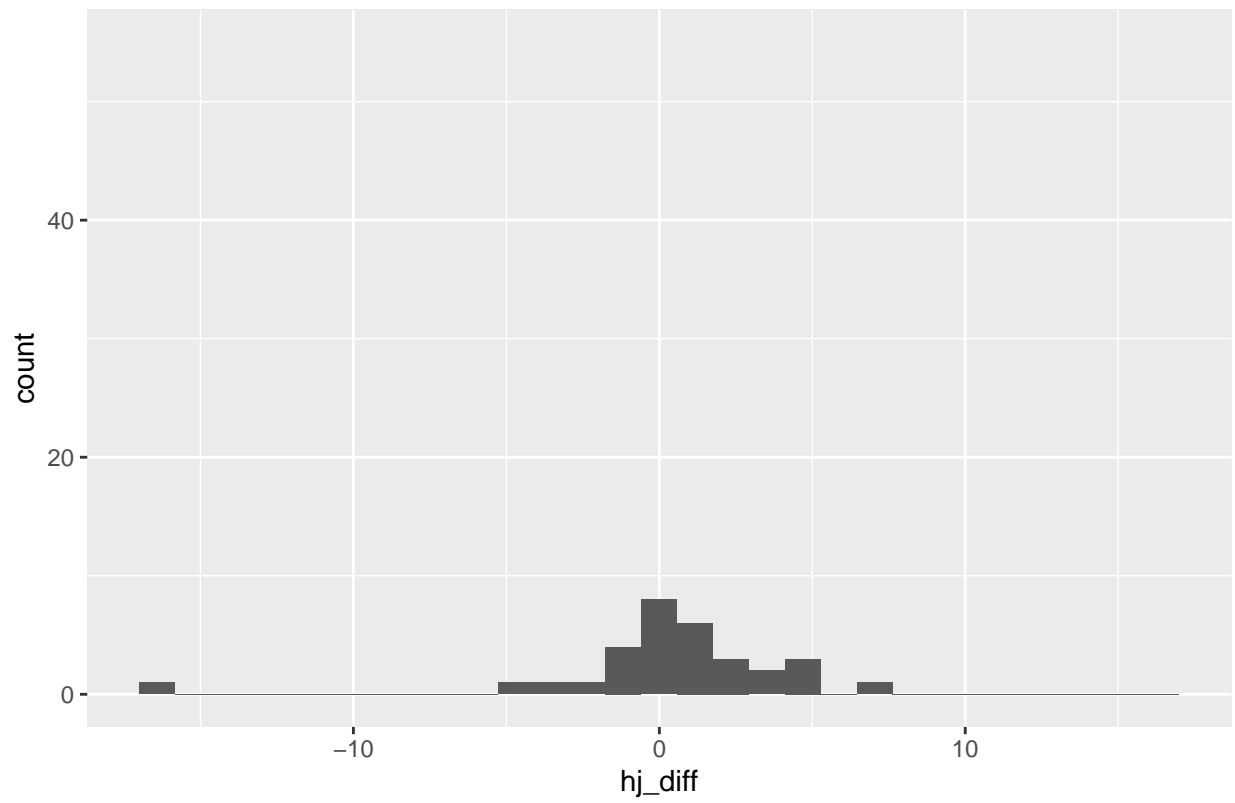
```
##  
## [[31]]
```

Distribution of differences for NOR



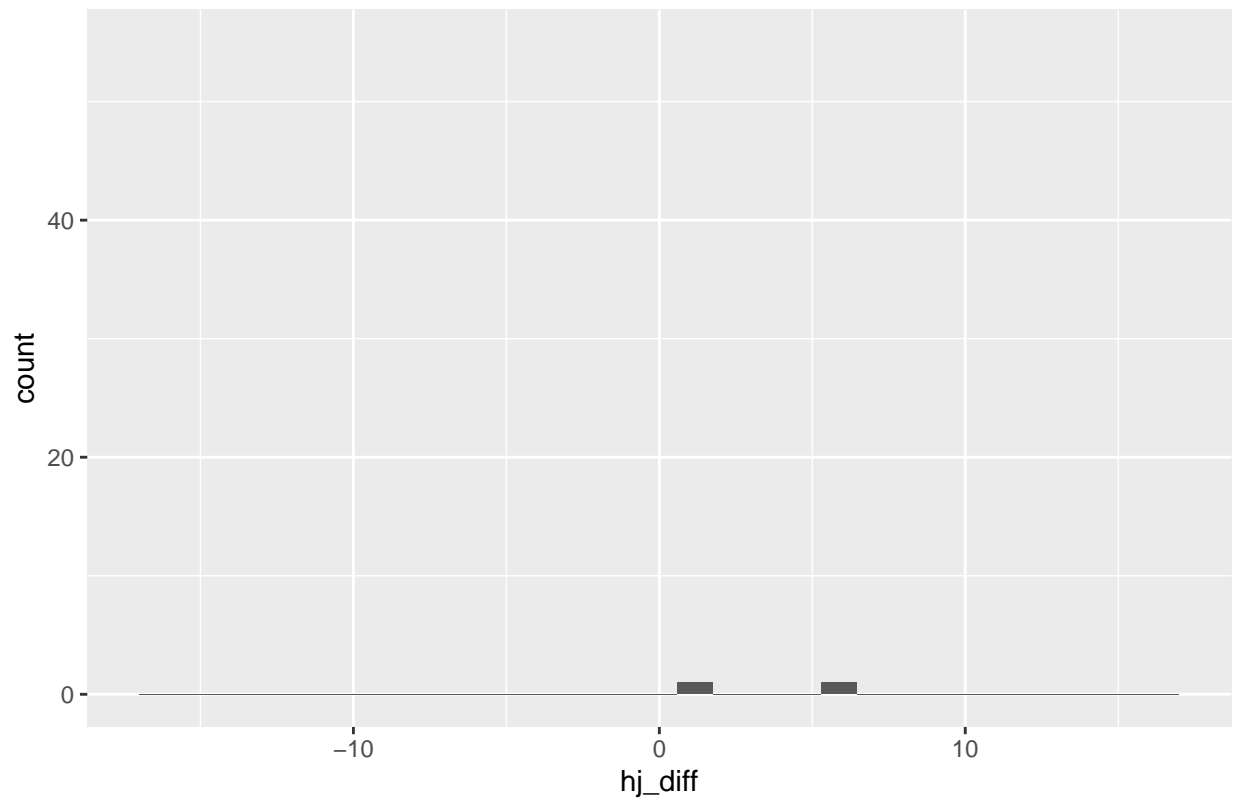
```
##  
## [[32]]
```

Distribution of differences for POL



```
##  
## [[33]]
```

Distribution of differences for RSA

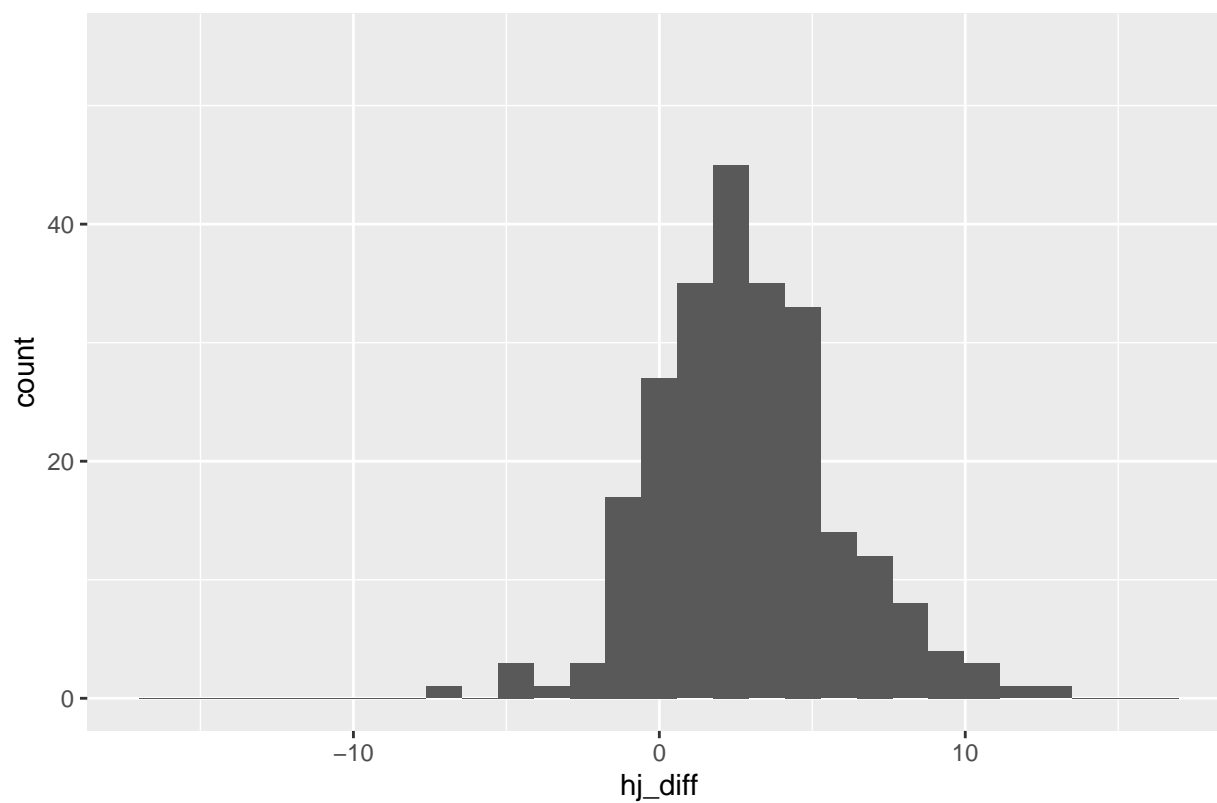


```
##
```

```
## [[34]]
```

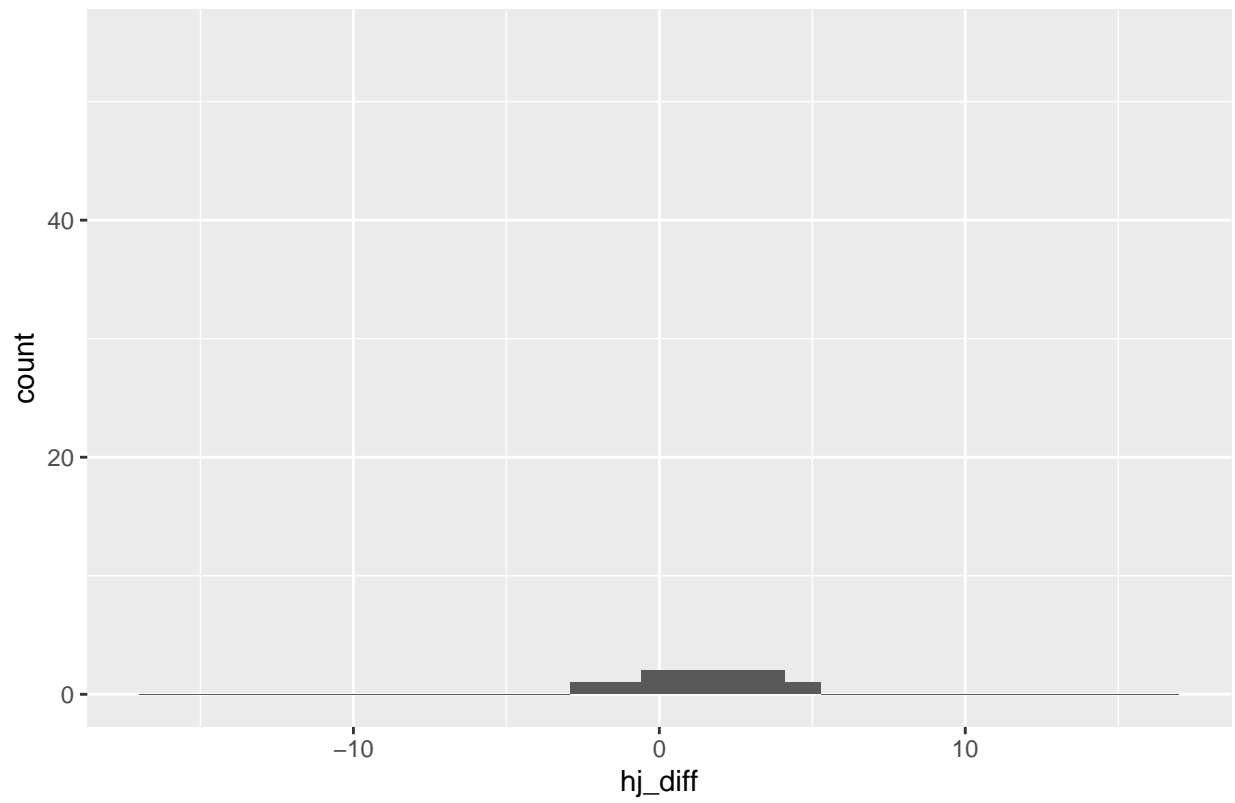
```
## Warning: Removed 1 rows containing non-finite values ('stat_bin()').
```

Distribution of differences for RUS



```
##  
## [[35]]
```

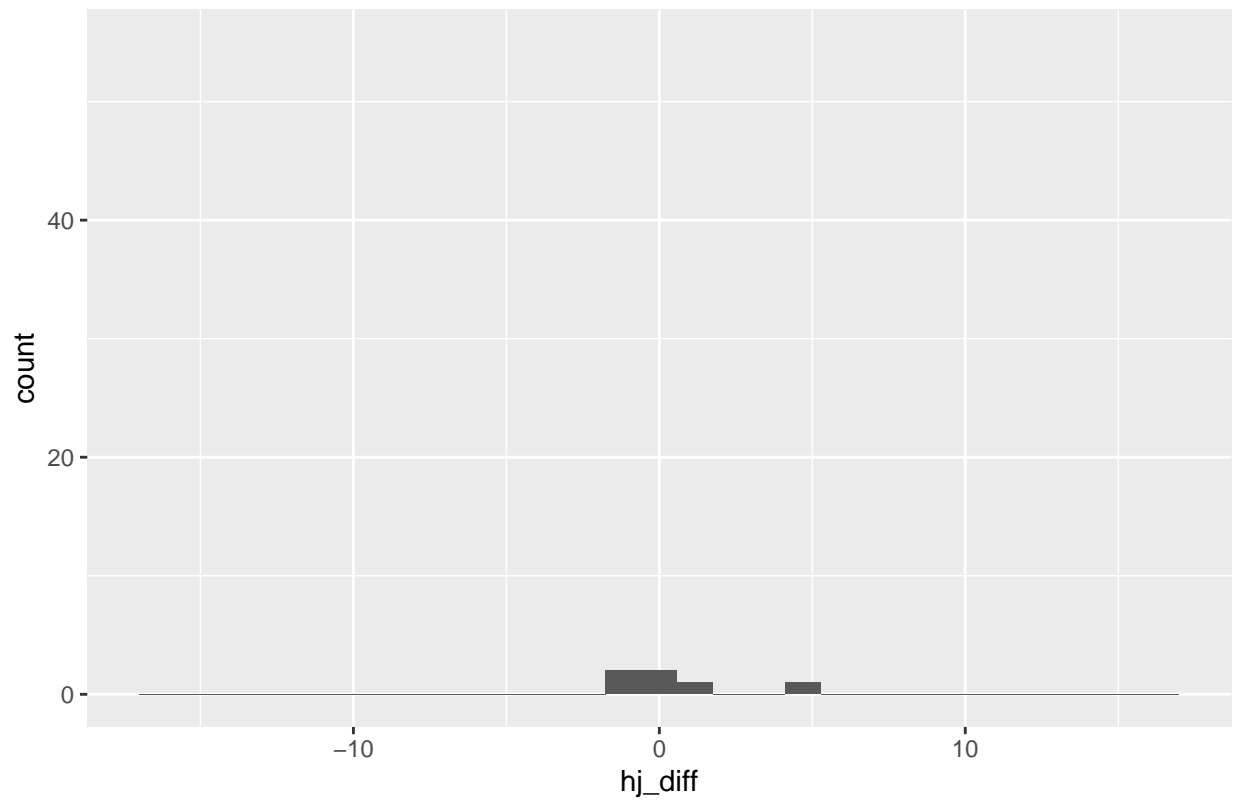
Distribution of differences for SLO



```
##  
## [[36]]
```

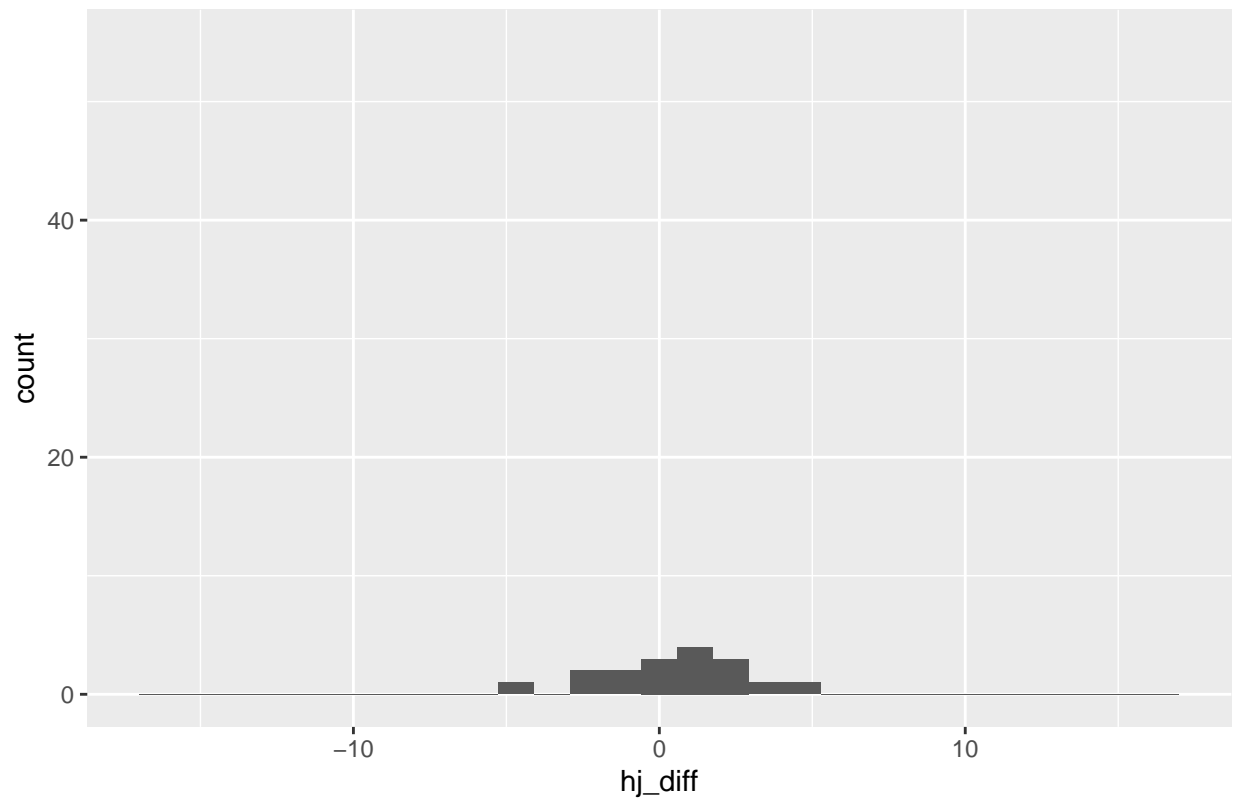


Distribution of differences for SRB



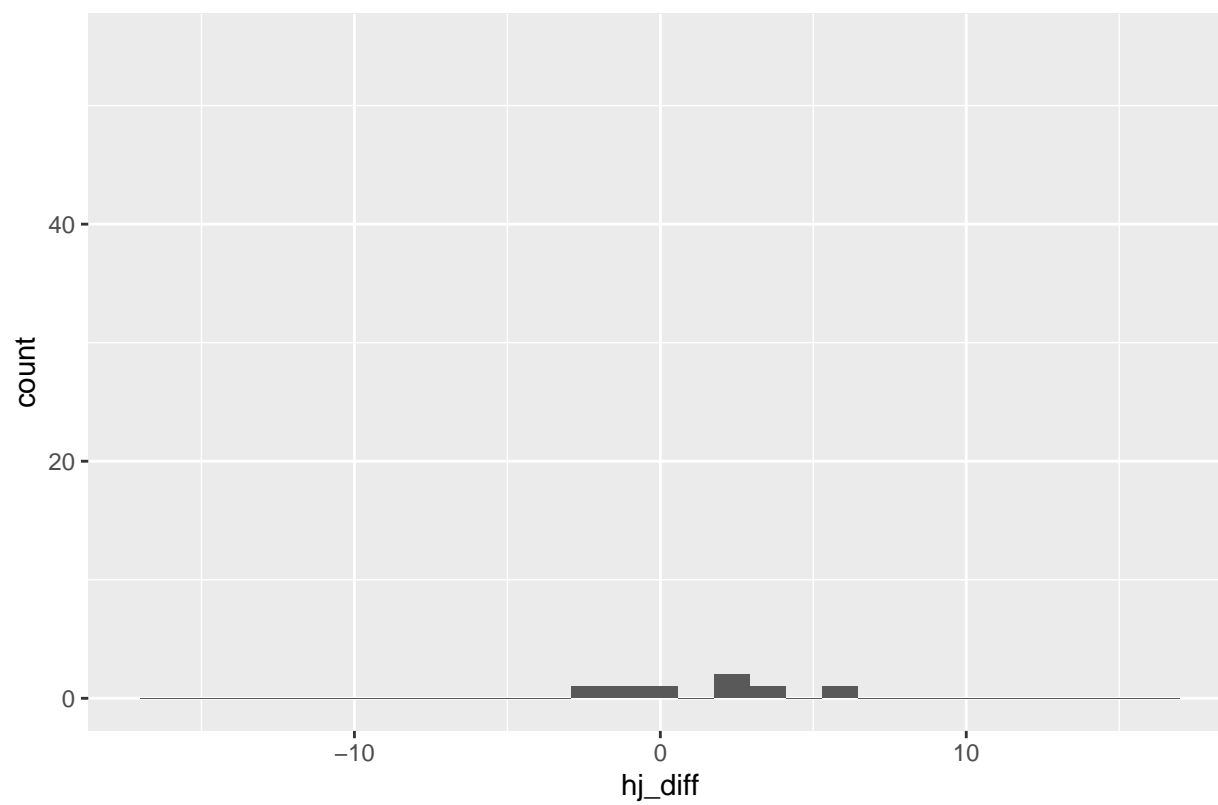
```
##  
## [[37]]
```

Distribution of differences for SUI



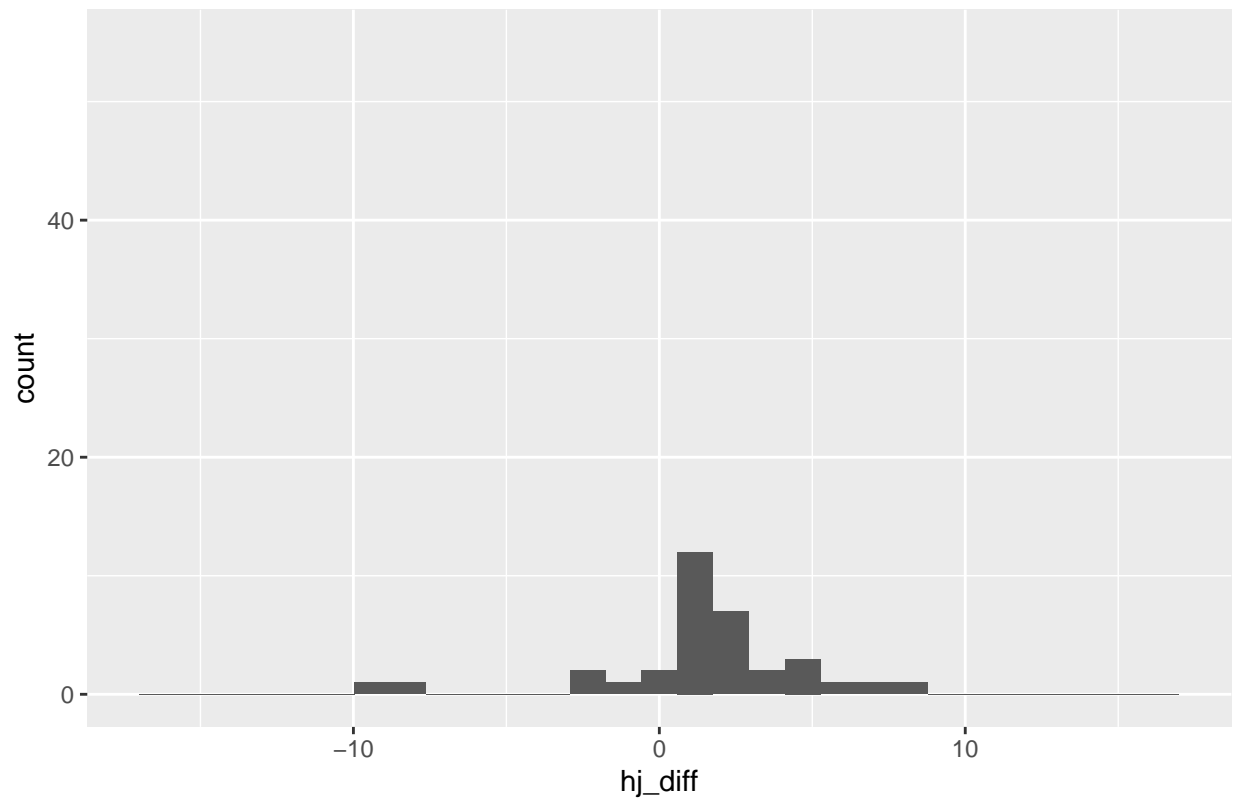
```
##  
## [[38]]
```

Distribution of differences for SVK



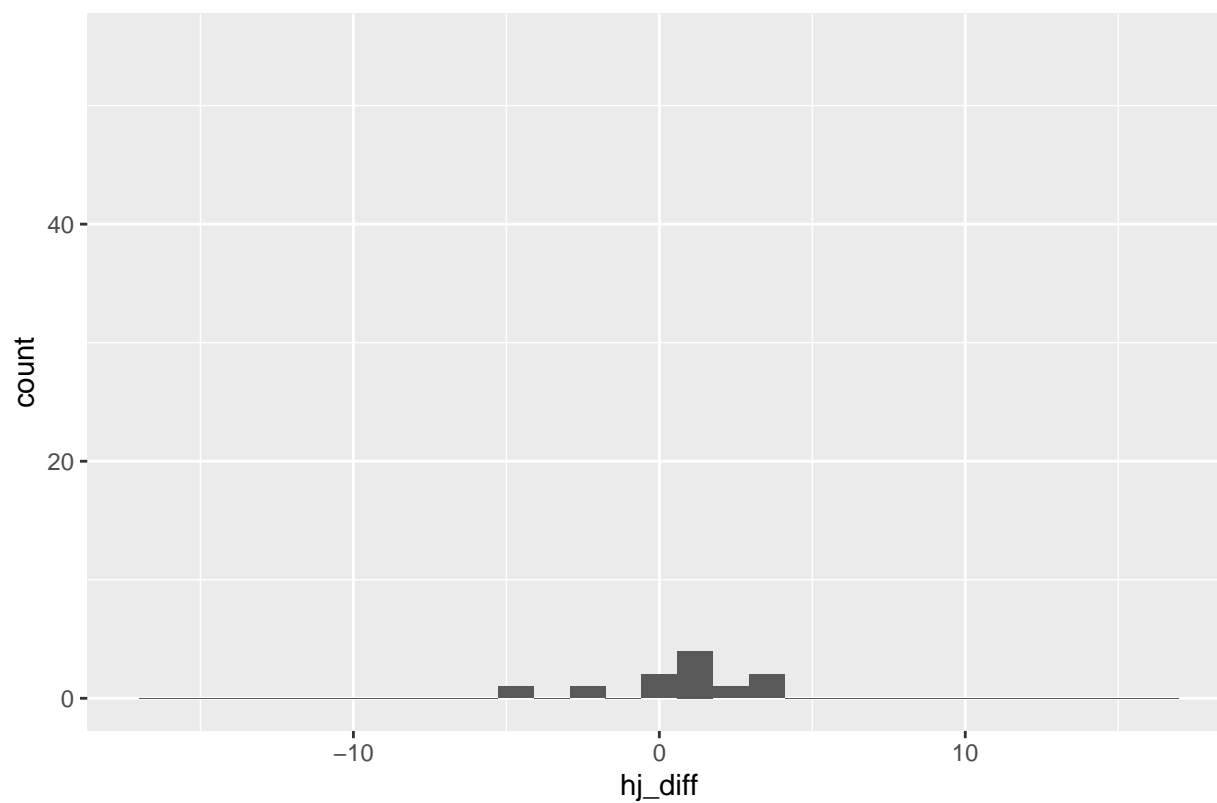
```
##  
## [[39]]
```

Distribution of differences for SWE



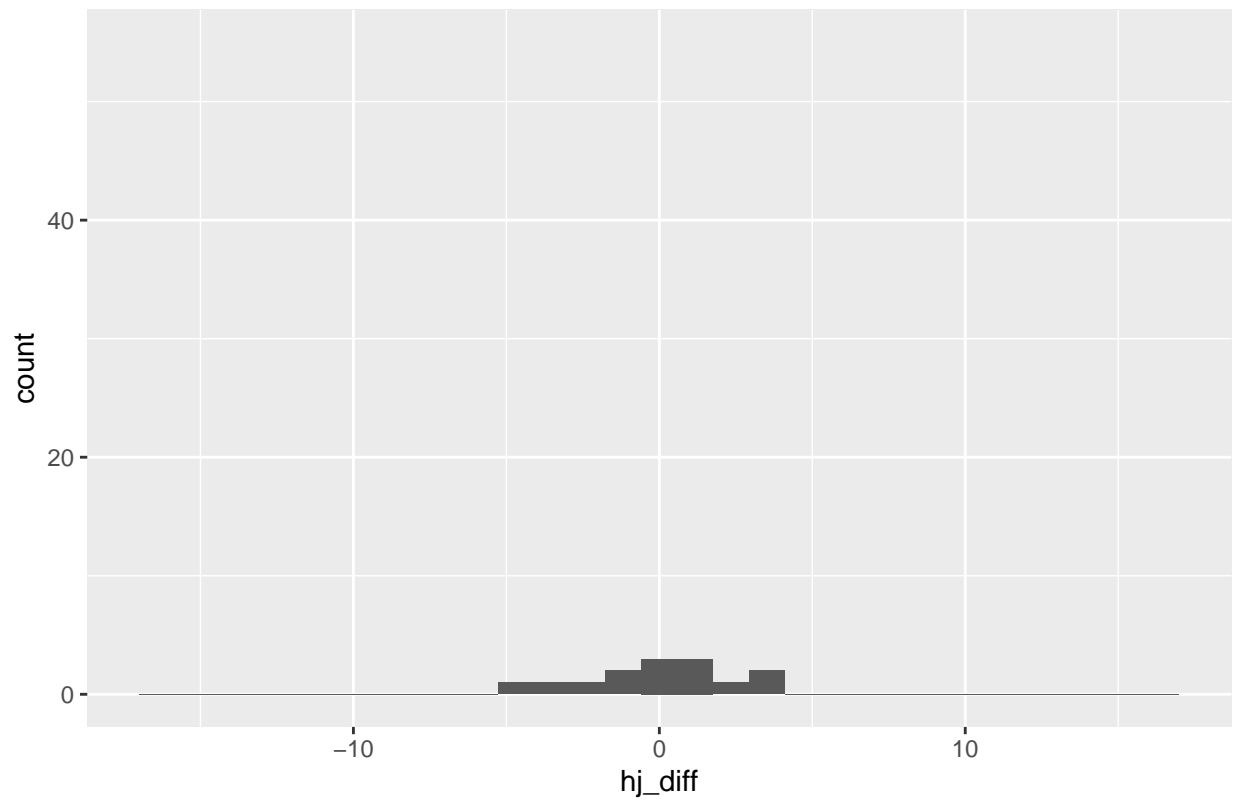
```
##  
## [[40]]
```

Distribution of differences for TPE

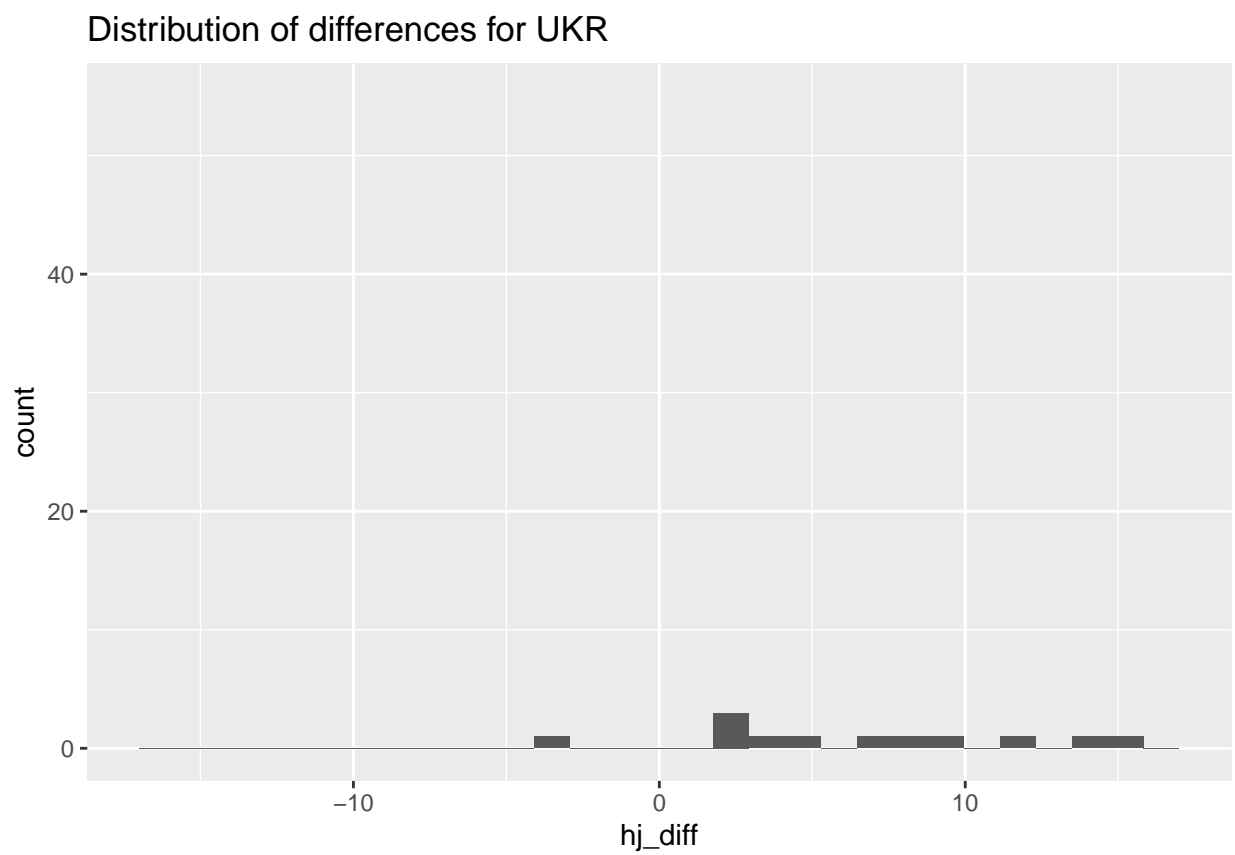


```
##  
## [[41]]
```

Distribution of differences for TUR

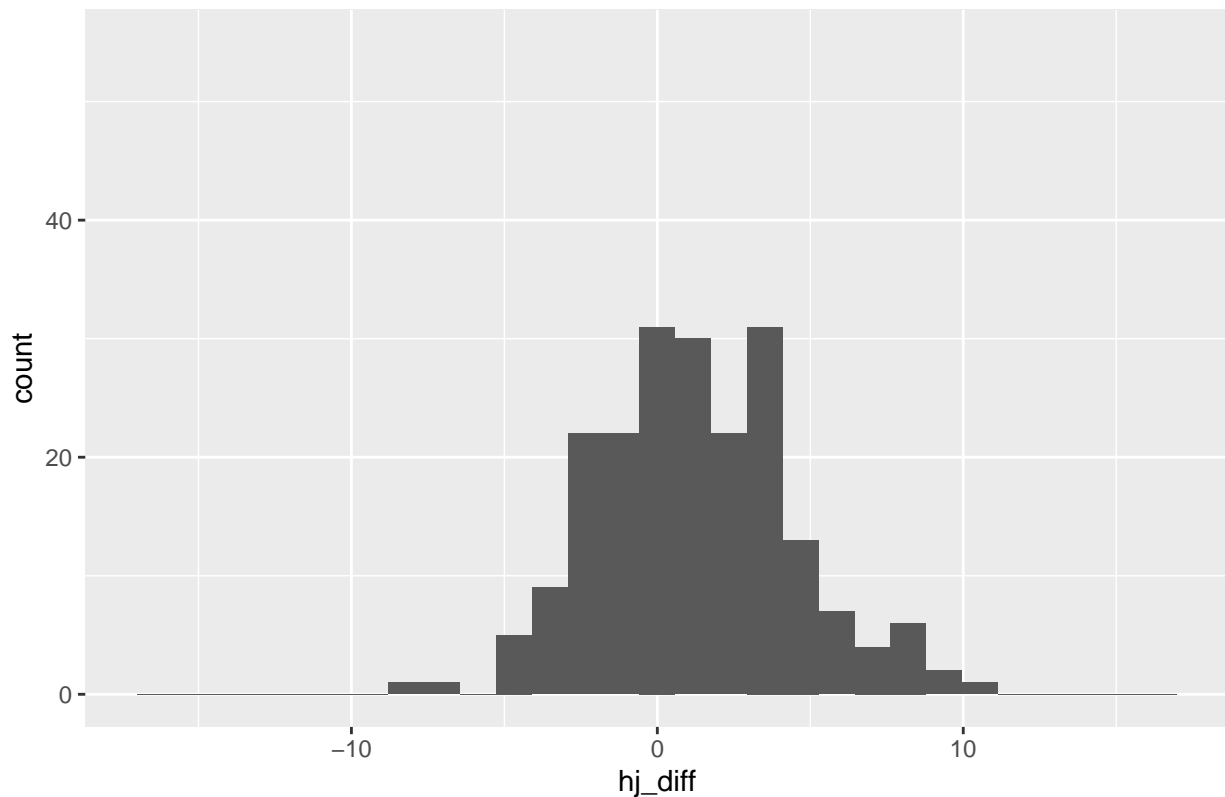


```
##  
## [[42]]
```



```
##  
## [[43]]
```

Distribution of differences for USA



```
# Exploring outliers for Russia
russia <- scores %>% filter(country == "RUS")
russia[russia$hj_diff %in% boxplot.stats(russia$hj_diff)$out,] %>% arrange(desc(hj_diff))
```

```
##           event year country  home  away  hj_diff discipline
## 1   Golden Spin of Zagreb 2019    RUS 171.73 153.9917 17.73833      Mens
## 2   GP Gran Premio d'Italia 2021    RUS 157.11 144.7538 12.35625      Mens
## 3   European Championships 2022    RUS 197.58 186.3413 11.23875      Mens
## 4         GP NHK Trophy 2019    RUS 154.00 142.9425 11.05750      Mens
## 5         GP NHK Trophy 2019    RUS 159.99 149.0300 10.96000      Mens
## 6         GP Rostelecom Cup 2021    RUS 189.72 178.9387 10.78125      Mens
## 7   World Championships 2021    RUS 148.50 152.9988 -4.49875    Womens
## 8   European Championships 2019    RUS 137.01 141.5250 -4.51500    Womens
## 9         GP Intx de France 2019    RUS  59.09  63.9125 -4.82250      Mens
## 10  GP Gran Premio d'Italia 2021    RUS 148.42 155.3250 -6.90500    Womens
## segment
## 1      fp
## 2      fp
## 3      fp
## 4      fp
## 5      fp
## 6      fp
## 7      fp
## 8      fp
## 9      sp
## 10     fp
```



```
# Exploring outliers for all singles data
```

```
scores[scores$hj_diff %in% boxplot.stats(scores$hj_diff)$out,] %>% arrange(desc(hj_diff))
```

##	event	year	country	home	away	hj_diff	discipline
## 1	Golden Spin of Zagreb	2019	RUS	171.73	153.99167	17.738333	Mens
## 2	Warsaw Cup	2021	UKR	140.26	124.80000	15.460000	Mens
## 3	Grand Prix Final	2019	CHN	174.65	159.76625	14.883750	Mens
## 4	Four Continents	2019	JPN	145.82	130.98750	14.832500	Mens
## 5	Lombardia Trophy	2019	CHN	178.73	164.84167	13.888333	Mens
## 6	European Championships	2019	UKR	123.91	110.20875	13.701250	Mens
## 7	Nebelhorn Trophy	2021	BUL	113.68	100.20286	13.477143	Mens
## 8	GP Skate America	2019	CHN	162.46	149.33375	13.126250	Mens
## 9	GP Gran Premio d'Italia	2021	CHN	156.27	143.27875	12.991250	Mens
## 10	GP Gran Premio d'Italia	2021	RUS	157.11	144.75375	12.356250	Mens
## 11	Four Continents	2020	KOR	186.48	174.19875	12.281250	Mens
## 12	Golden Spin of Zagreb	2018	ITA	93.48	81.34000	12.140000	Mens
## 13	Nebelhorn Trophy	2021	AUT	140.36	128.38571	11.974286	Mens
## 14	GP NHK Trophy	2018	KOR	132.76	120.87250	11.887500	Mens
## 15	Nebelhorn Trophy	2021	UKR	126.49	114.96250	11.527500	Womens
## 16	Lombardia Trophy	2019	GEO	156.66	145.19667	11.463333	Mens
## 17	GP Rostelecom Cup	2018	GEO	168.83	157.41625	11.413750	Mens
## 18	European Championships	2022	RUS	197.58	186.34125	11.238750	Mens
## 19	Golden Spin of Zagreb	2018	GER	124.58	113.40667	11.173333	Mens
## 20	Warsaw Cup	2019	CZE	106.34	95.17500	11.165000	Mens
## 21	Warsaw Cup	2021	GER	133.77	122.66333	11.106667	Womens
## 22	GP NHK Trophy	2019	RUS	154.00	142.94250	11.057500	Mens
## 23	GP NHK Trophy	2019	JPN	160.92	149.91375	11.006250	Mens
## 24	GP NHK Trophy	2019	RUS	159.99	149.03000	10.960000	Mens
## 25	GP Rostelecom Cup	2021	RUS	189.72	178.93875	10.781250	Mens
## 26	Warsaw Cup	2021	GEO	102.34	91.60667	10.733333	Womens
## 27	Lombardia Trophy	2021	FRA	136.16	125.53667	10.623333	Mens
## 28	GP Intx de France	2018	FRA	159.93	149.33500	10.595000	Mens
## 29	Lombardia Trophy	2021	HUN	74.70	64.13167	10.568333	Womens
## 30	GP NHK Trophy	2019	ISR	145.01	134.55000	10.460000	Mens
## 31	GP Skate America	2021	FRA	159.26	148.85000	10.410000	Mens
## 32	GP Intx de France	2019	USA	167.65	157.54125	10.108750	Mens
## 33	Golden Spin of Zagreb	2021	FRA	167.34	157.48500	9.855000	Mens
## 34	GP Gran Premio d'Italia	2021	JPN	169.60	159.76000	9.840000	Mens
## 35	GP Skate Canada	2019	KOR	124.82	115.01750	9.802500	Womens
## 36	European Championships	2019	ESP	173.84	180.45875	-6.618750	Mens
## 37	Four Continents	2020	USA	119.52	126.14857	-6.628571	Womens
## 38	GP Gran Premio d'Italia	2021	RUS	148.42	155.32500	-6.905000	Womens
## 39	Olympic Winter Games	2022	CHN	174.06	181.03625	-6.976250	Mens
## 40	Four Continents	2020	CAN	128.06	135.38875	-7.328750	Mens
## 41	European Championships	2020	GER	143.09	150.49000	-7.400000	Mens
## 42	Four Continents	2019	CHN	104.82	112.28250	-7.462500	Mens
## 43	World Championships	2021	GBR	54.51	62.25125	-7.741250	Mens
## 44	European Championships	2020	GEO	156.55	164.30625	-7.756250	Mens
## 45	Four Continents	2020	USA	139.83	147.64714	-7.817143	Womens
## 46	Nebelhorn Trophy	2019	BUL	109.80	117.62667	-7.826667	Womens
## 47	Nebelhorn Trophy	2019	SWE	124.22	132.07500	-7.855000	Mens
## 48	European Championships	2022	AZE	153.81	162.06125	-8.251250	Mens
## 49	European Championships	2022	ITA	103.59	112.04500	-8.455000	Womens

## 50	Golden Spin of Zagreb 2018	ISR	111.55	120.31500	-8.765000	Mens
## 51	Four Continents 2022	KOR	136.25	145.05000	-8.800000	Mens
## 52	World Championships 2022	ITA	161.11	170.29500	-9.185000	Mens
## 53	GP Skate Canada 2021	CAN	116.17	125.47500	-9.305000	Womens
## 54	World Championships 2021	SWE	108.23	117.61000	-9.380000	Mens
## 55	Golden Spin of Zagreb 2018	KAZ	69.09	78.83833	-9.748333	Womens
## 56	Warsaw Cup 2019	POL	60.76	76.89500	-16.135000	Mens
## 57	Golden Spin of Zagreb 2021	CAN	122.21	139.19167	-16.981667	Mens
##	segment					
## 1	fp					
## 2	fp					
## 3	fp					
## 4	fp					
## 5	fp					
## 6	fp					
## 7	fp					
## 8	fp					
## 9	fp					
## 10	fp					
## 11	fp					
## 12	sp					
## 13	fp					
## 14	fp					
## 15	fp					
## 16	fp					
## 17	fp					
## 18	fp					
## 19	fp					
## 20	fp					
## 21	fp					
## 22	fp					
## 23	fp					
## 24	fp					
## 25	fp					
## 26	fp					
## 27	fp					
## 28	fp					
## 29	fp					
## 30	fp					
## 31	fp					
## 32	fp					
## 33	fp					
## 34	fp					
## 35	fp					
## 36	fp					
## 37	fp					
## 38	fp					
## 39	fp					
## 40	fp					
## 41	fp					
## 42	fp					
## 43	sp					
## 44	fp					
## 45	fp					

```
## 46      fp
## 47      fp
## 48      fp
## 49      fp
## 50      fp
## 51      fp
## 52      fp
## 53      fp
## 54      fp
## 55      fp
## 56      fp
## 57      fp
```

```
# Testing by event (for all singles data)
by_event <- scores %>% group_by(event, year) %>%
  summarize(mean_diff = mean(hj_diff, na.rm = TRUE),
            st_dev = sd(hj_diff, na.rm = TRUE), n()) %>% arrange(desc(mean_diff))
```

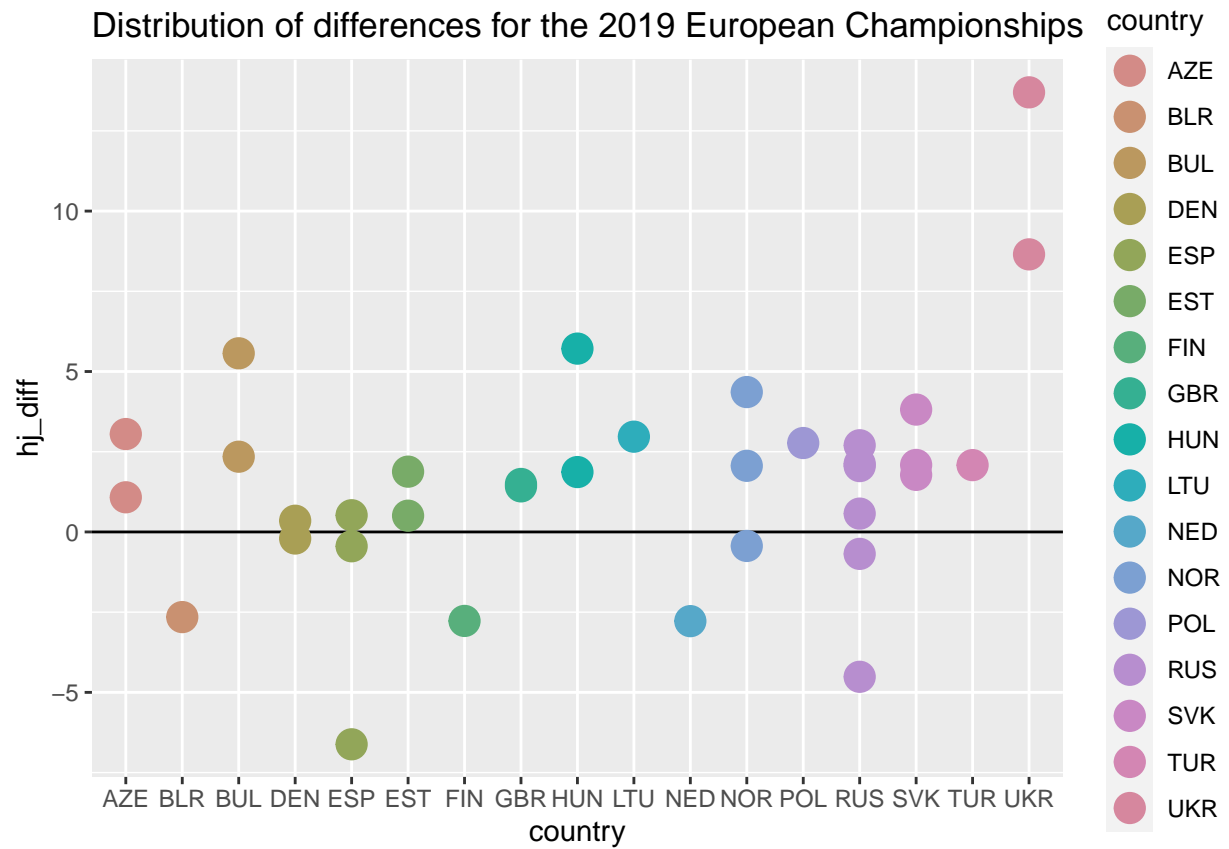
```
## 'summarise()' has grouped output by 'event'. You can override using the
## '.groups' argument.
```

```
by_event
```

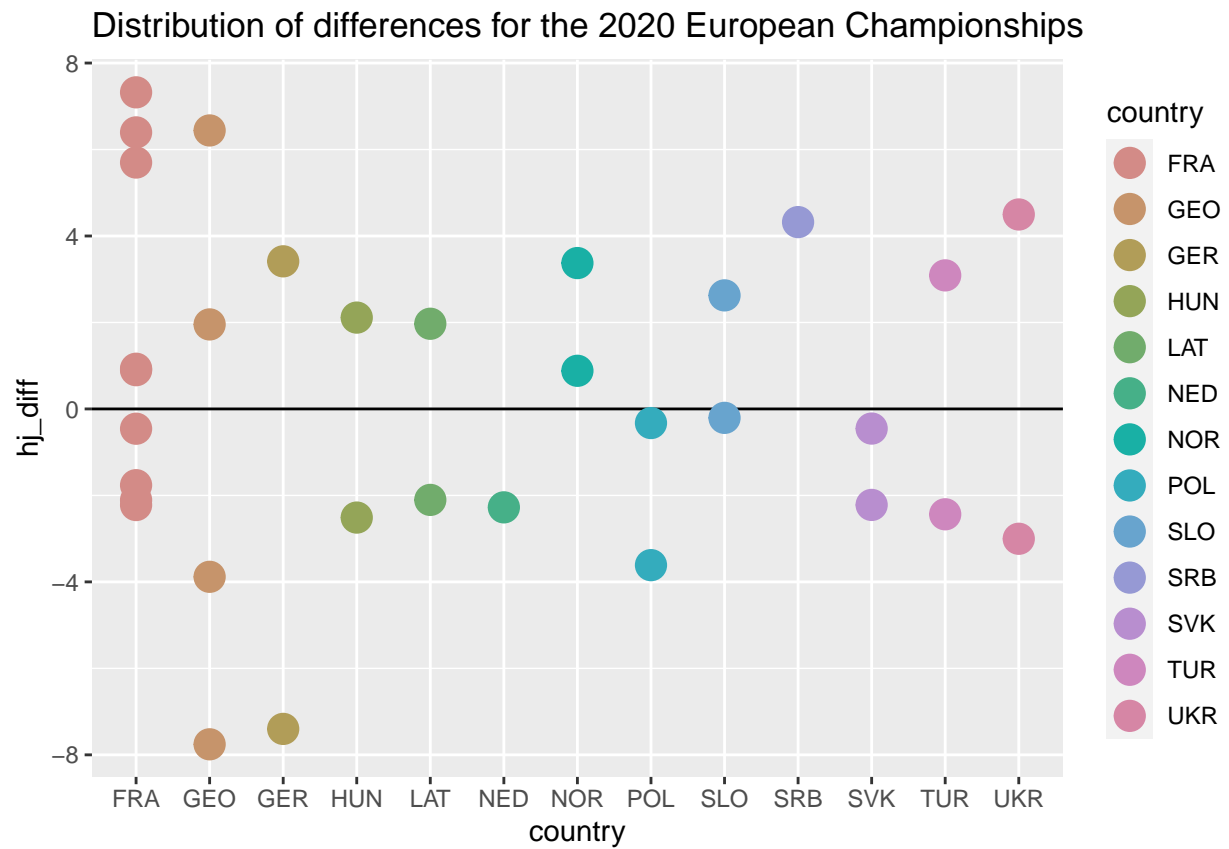
```
## # A tibble: 41 x 5
## # Groups:   event [18]
##   event          year mean_diff st_dev 'n()'
##   <chr>         <int>     <dbl>  <dbl> <int>
## 1 GP NHK Trophy    2019      3.57   3.94   48
## 2 Lombardia Trophy 2019      3.27   4.44   30
## 3 Grand Prix Final  2019      3.19   3.73   24
## 4 GP NHK Trophy    2018      2.95   3.46   46
## 5 Olympic Team Event 2022      2.81   3.20   11
## 6 Lombardia Trophy  2018      2.77   2.82   40
## 7 Nebelhorn Trophy  2021      2.68   3.92   40
## 8 Lombardia Trophy  2021      2.63   3.11   45
## 9 GP Rostelecom Cup  2019      2.60   3.15   40
## 10 GP Intx de France 2018      2.48   2.88   43
## # i 31 more rows
```

```
charts <- scores %>% group_by(event, year) %>% group_map(.f = ~ ggplot(.x,
  aes(x= country, y= hj_diff)) + geom_hline(yintercept = 0, col = 'black') +
  geom_point(aes(color = country), size= 5) +
  ggtitle(paste0("Distribution of differences for the ",
    .y$year, " ", .y$event))) + scale_color_hue(c = 50))
charts
```

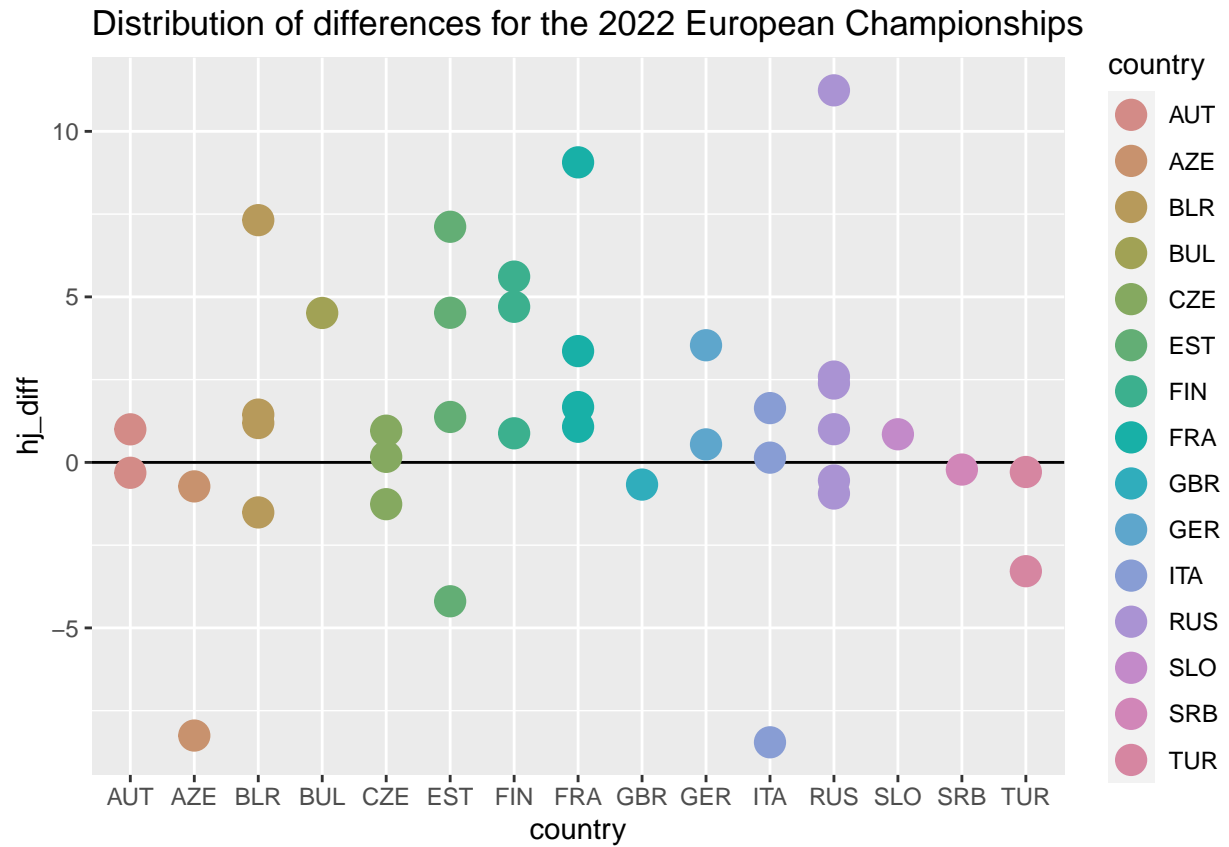
```
## [[1]]
```



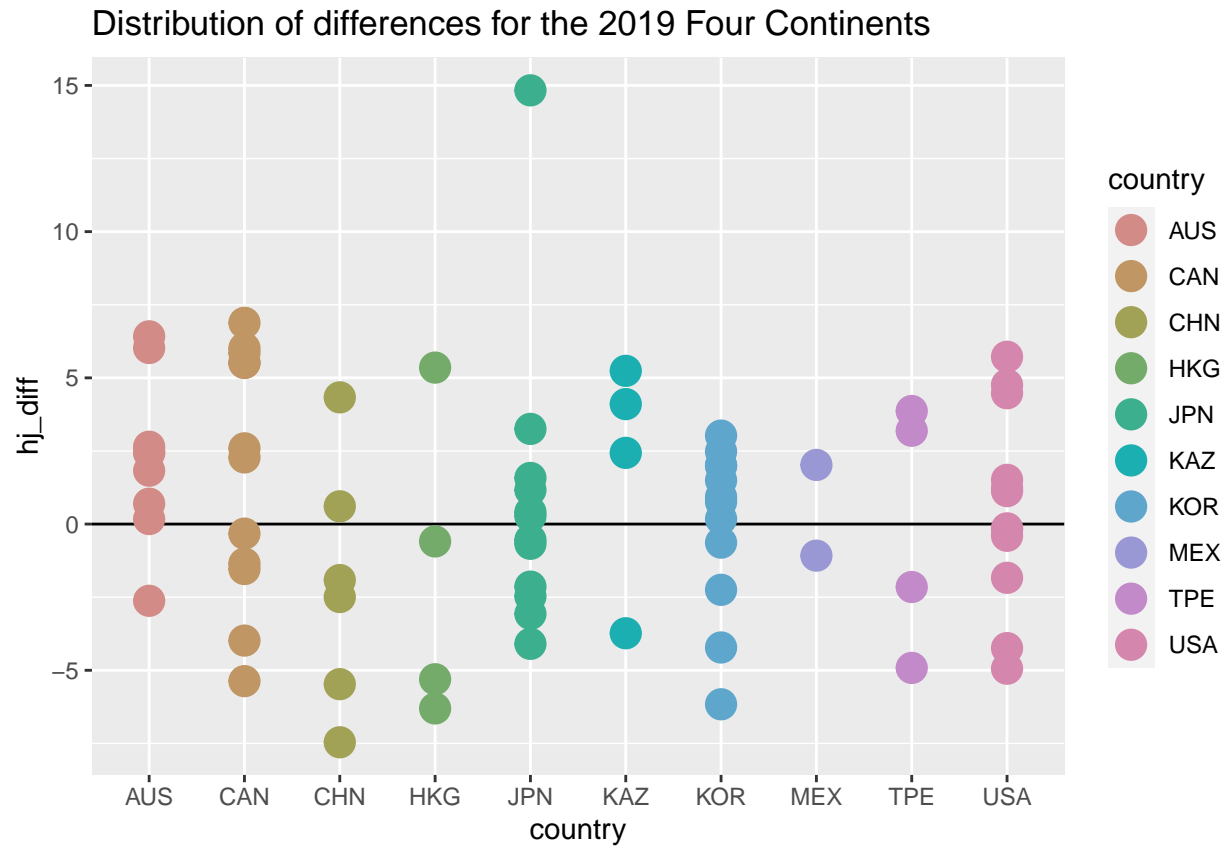
```
##
## [[2]]
```



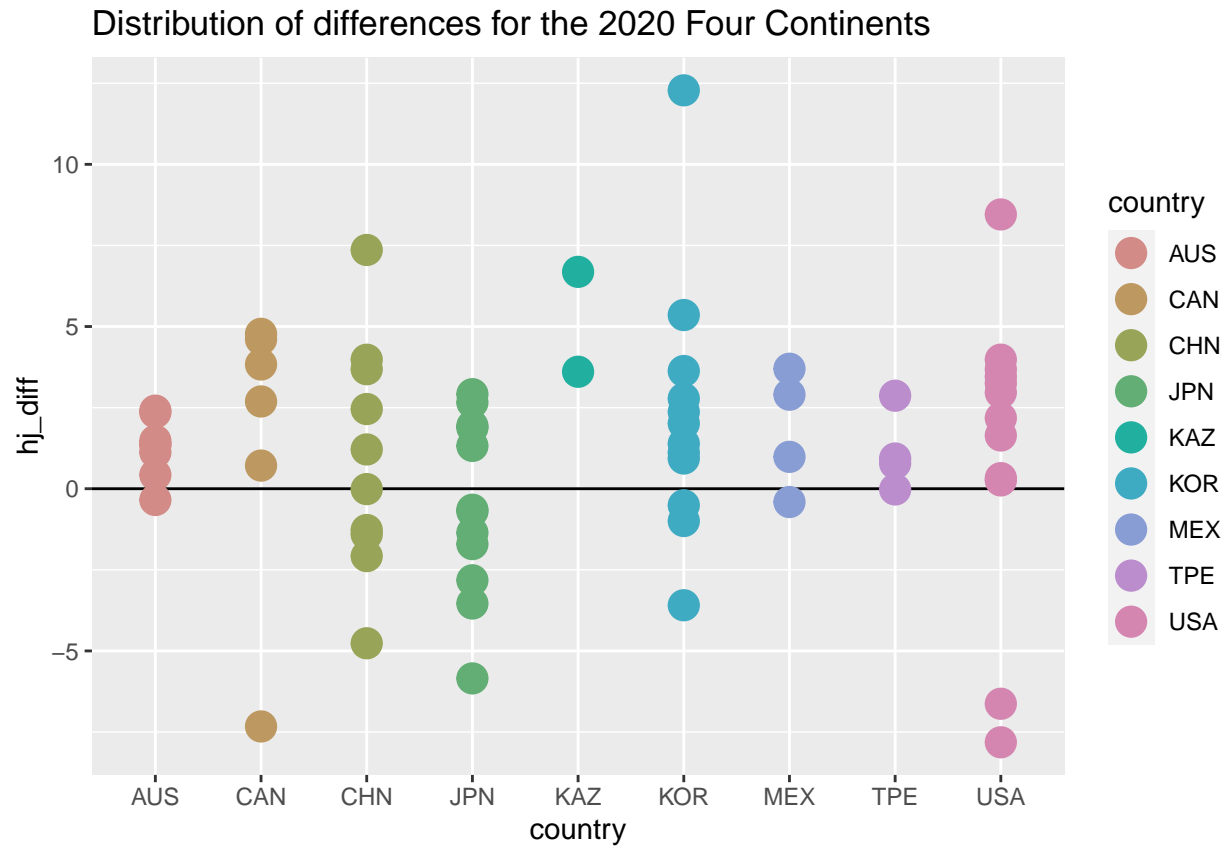
```
##  
## [[3]]
```



```
##
## [[4]]
```

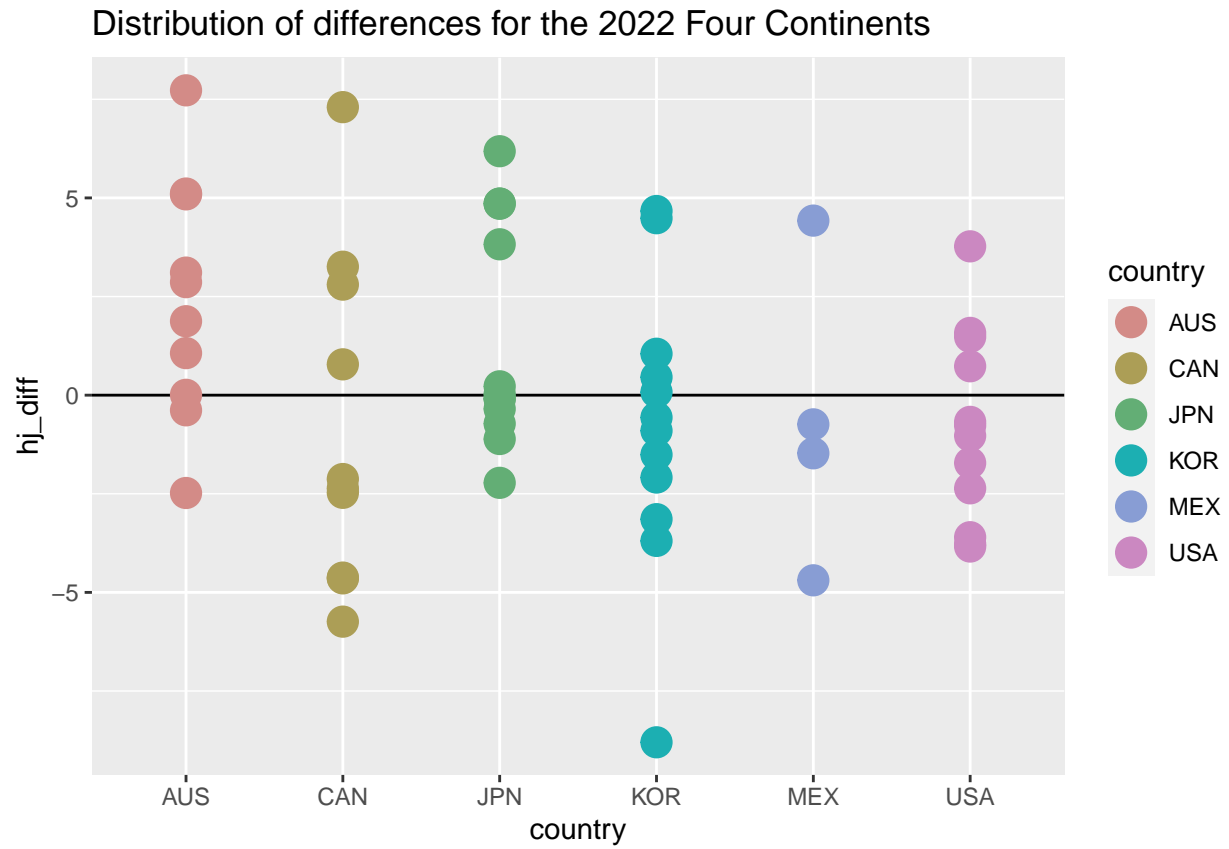


```
##
## [[5]]
```

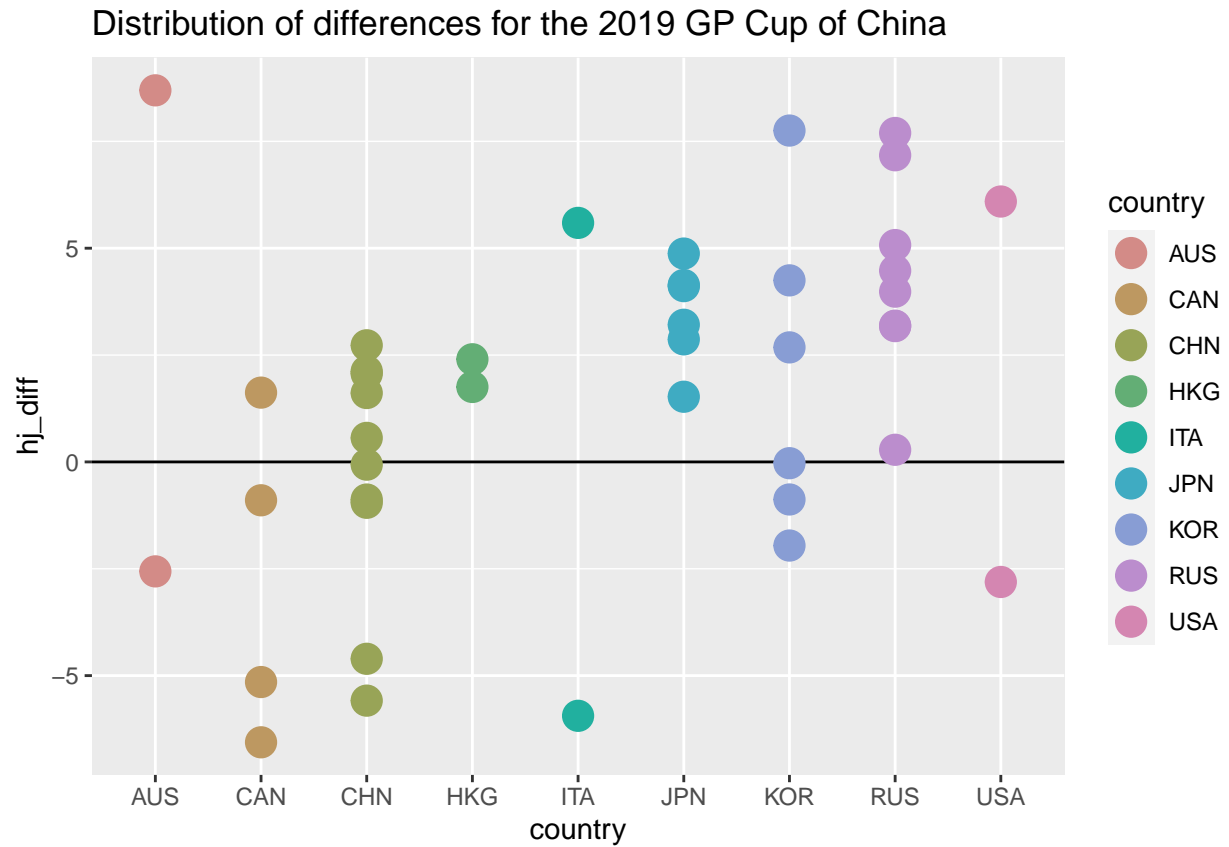


```
##
## [[6]]
```



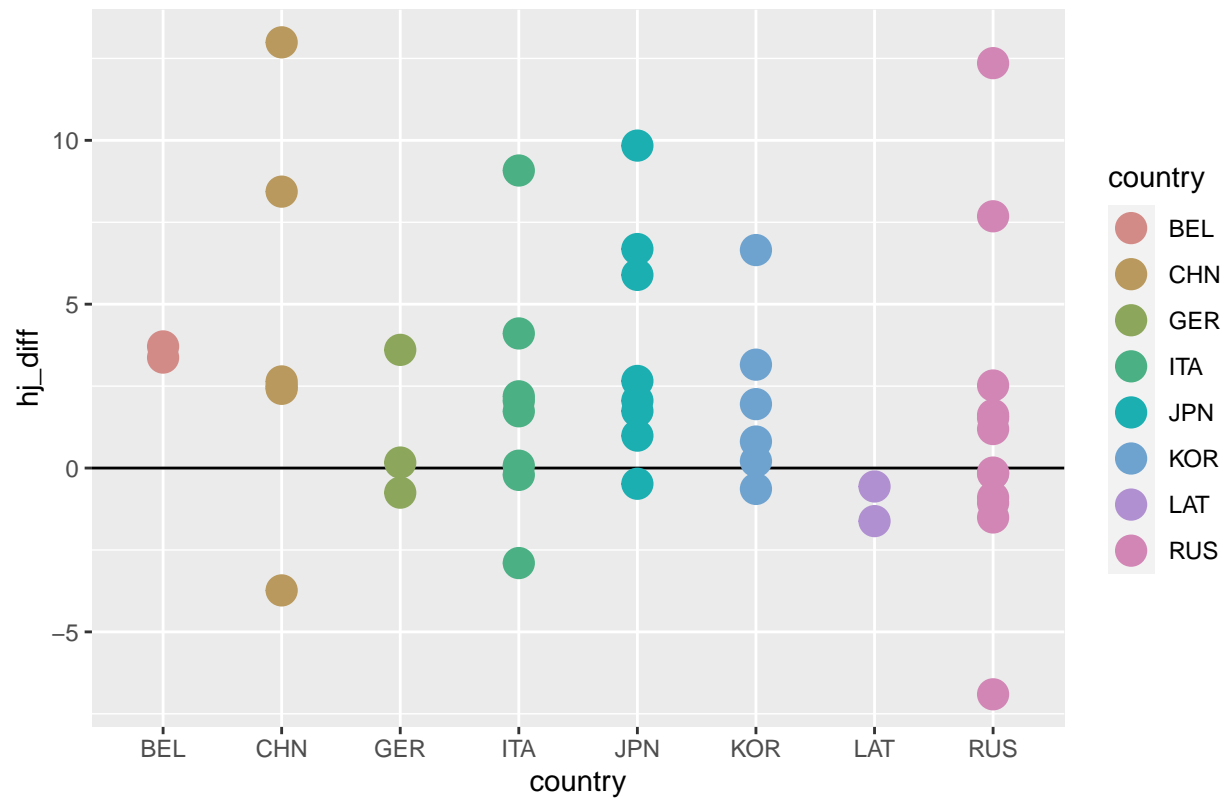


```
##  
## [[7]]
```

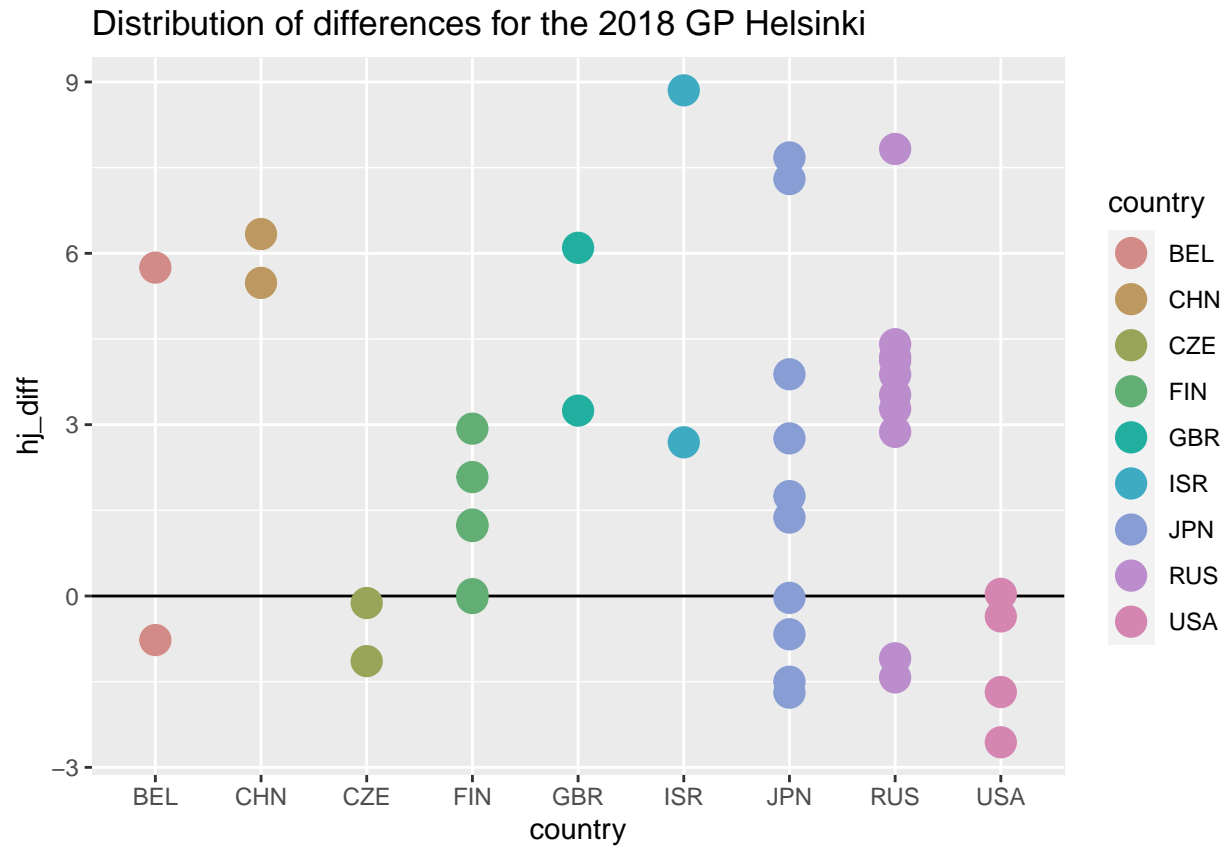


```
##
## [[8]]
```

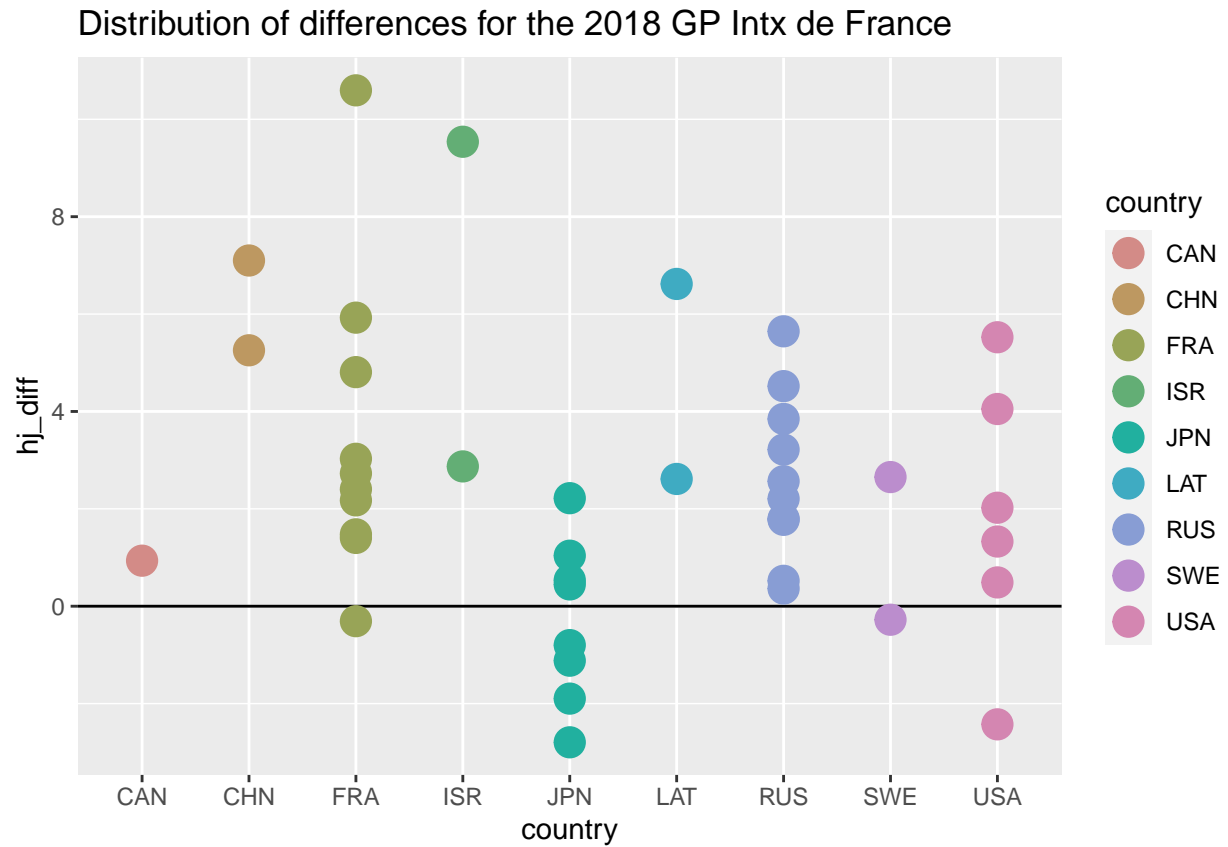
Distribution of differences for the 2021 GP Gran Premio d'Italia



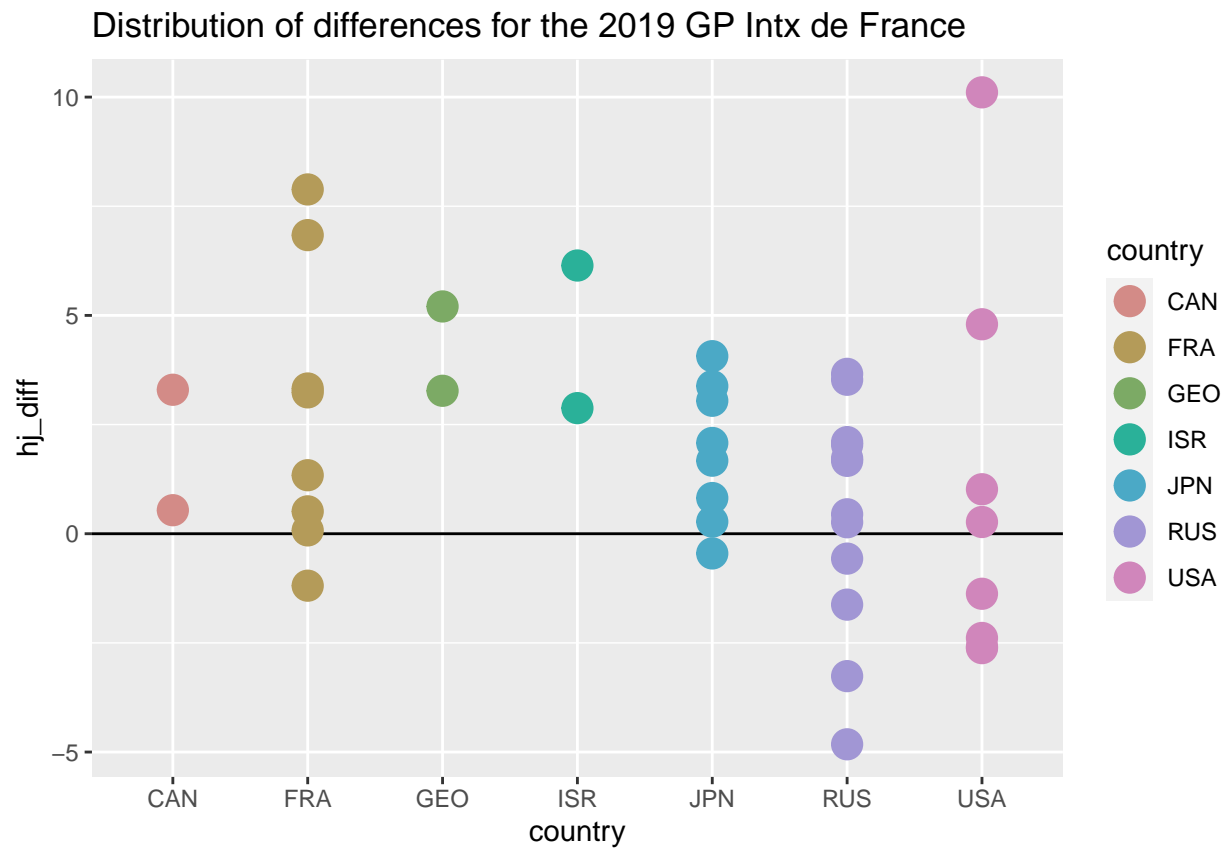
```
##
## [[9]]
```



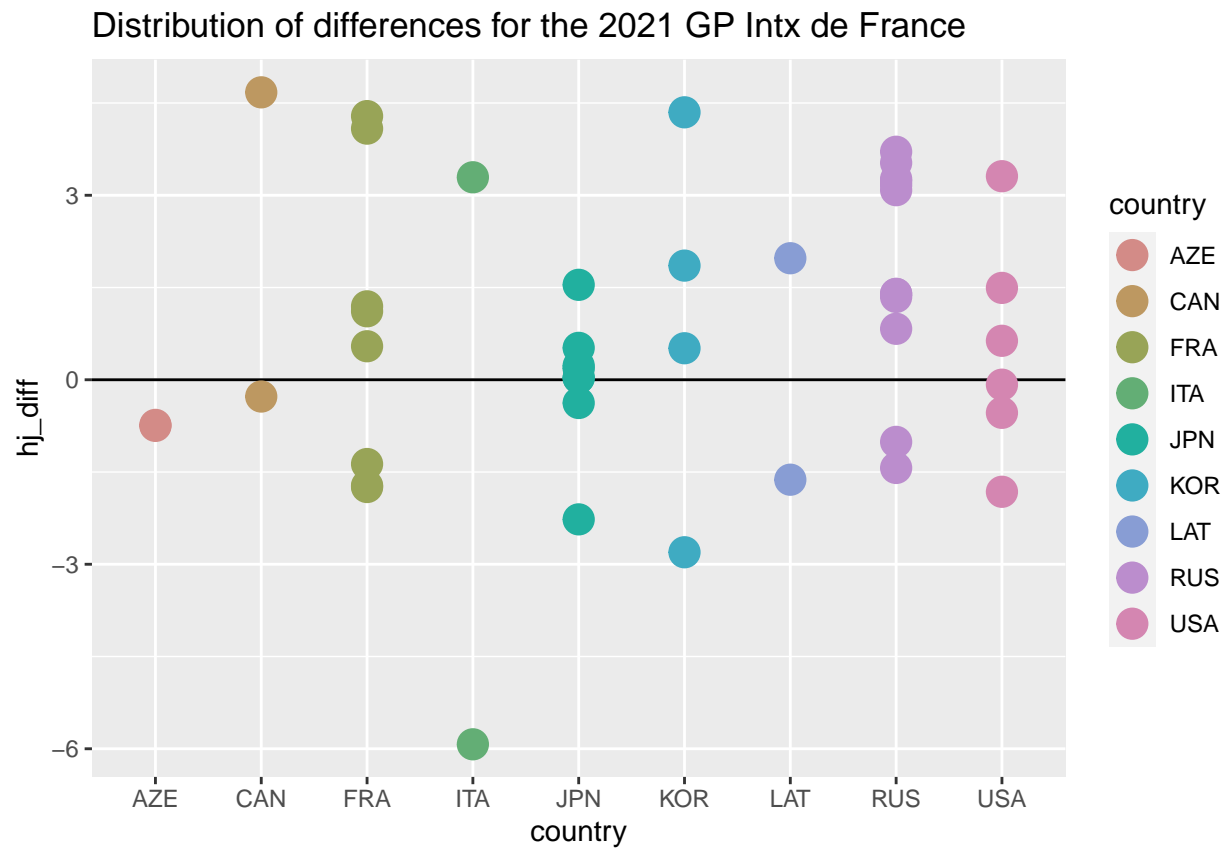
```
##  
## [[10]]
```



```
##
## [[11]]
```

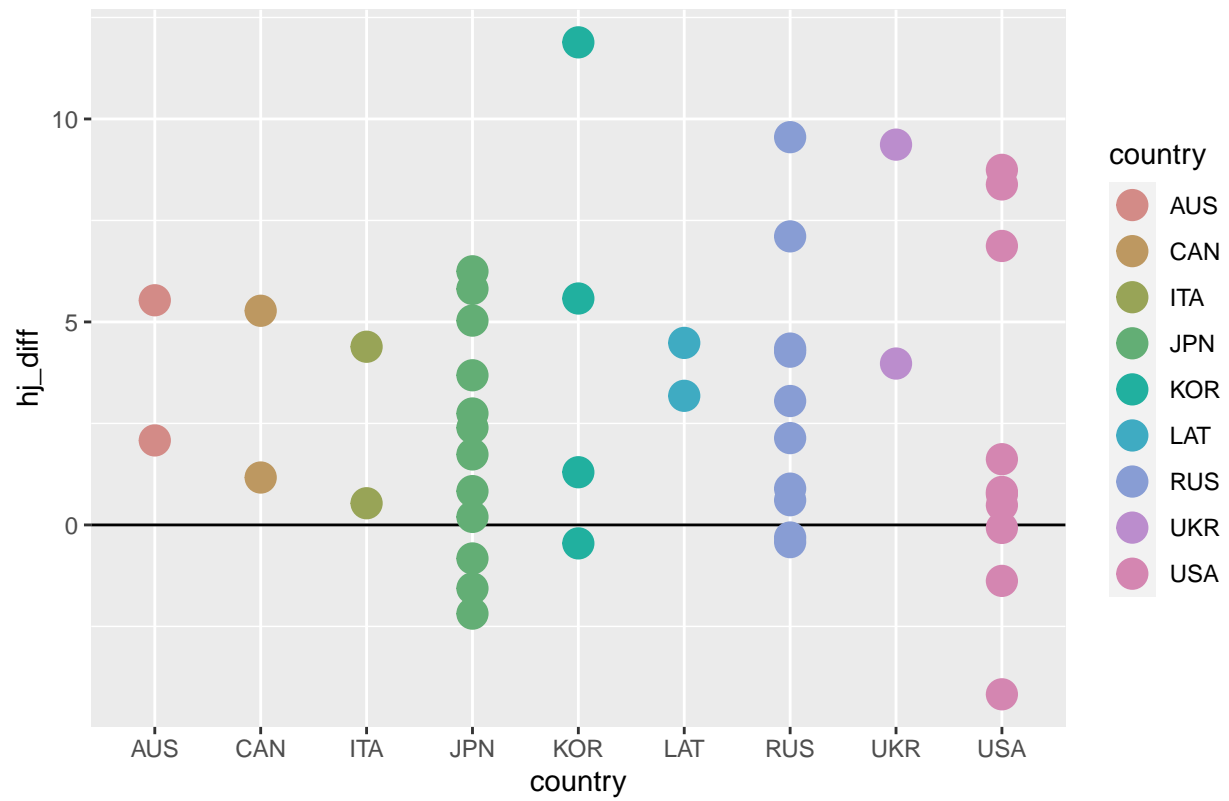


```
##  
## [[12]]
```



```
##  
## [[13]]
```

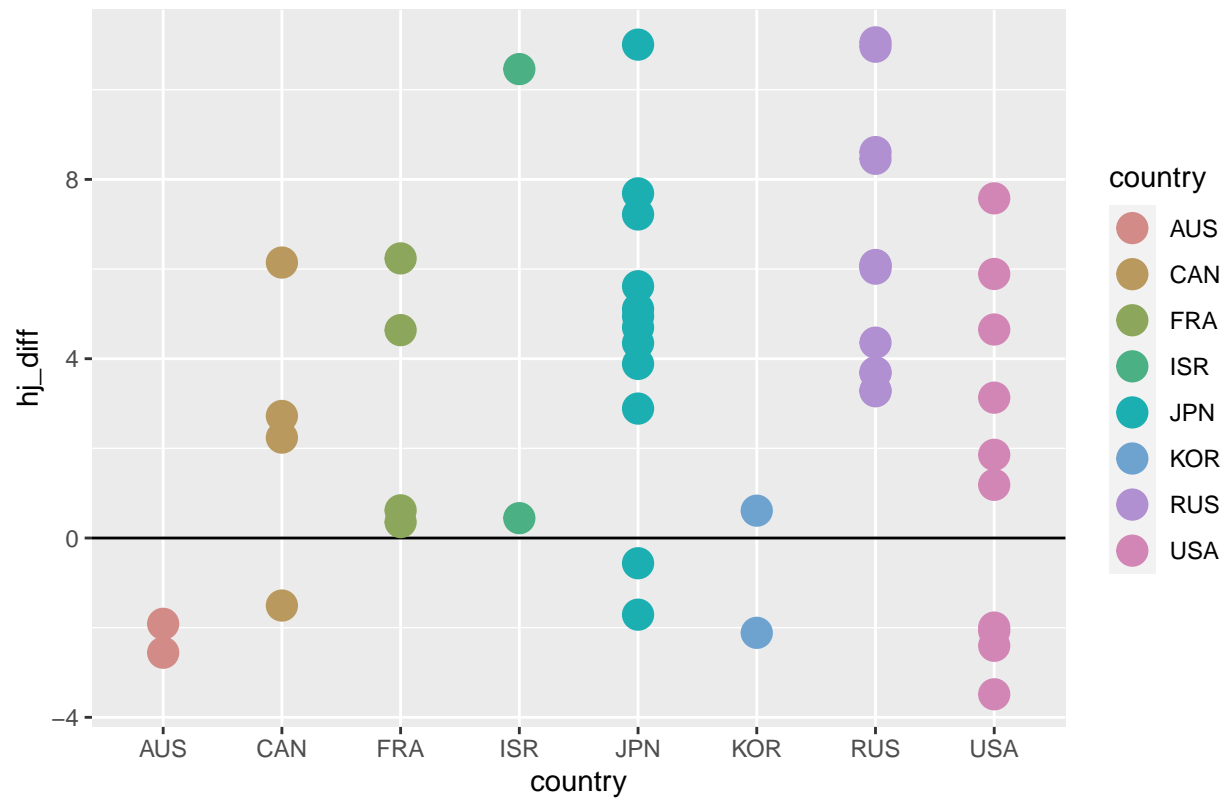
Distribution of differences for the 2018 GP NHK Trophy



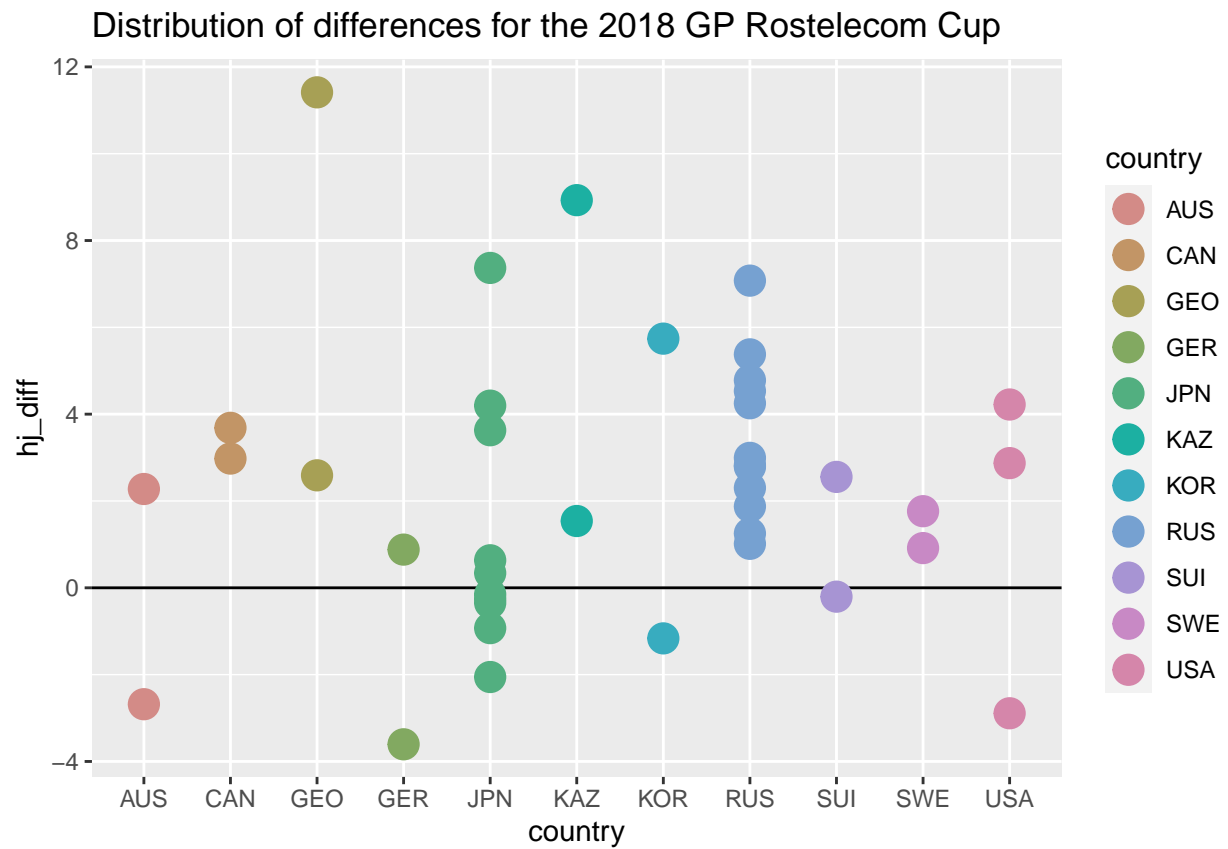
```
##
## [[14]]
```



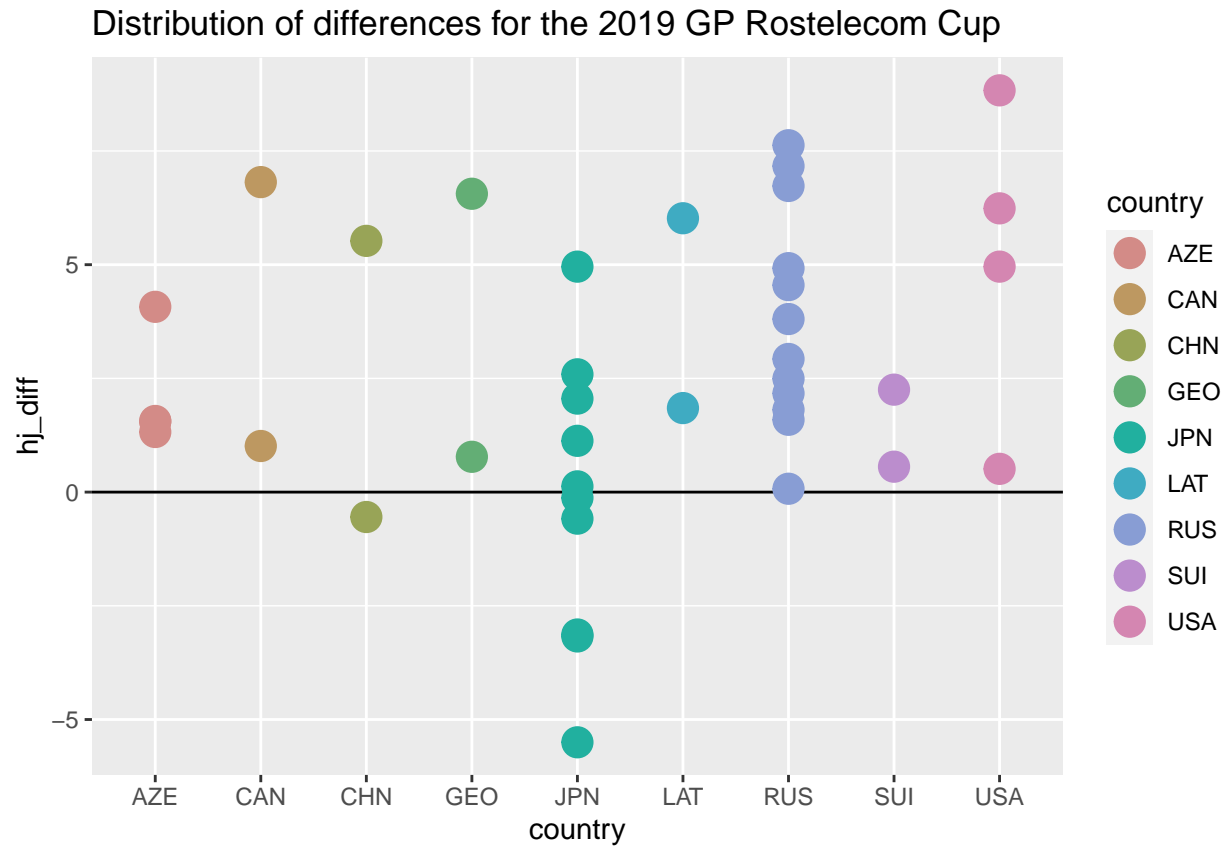
Distribution of differences for the 2019 GP NHK Trophy



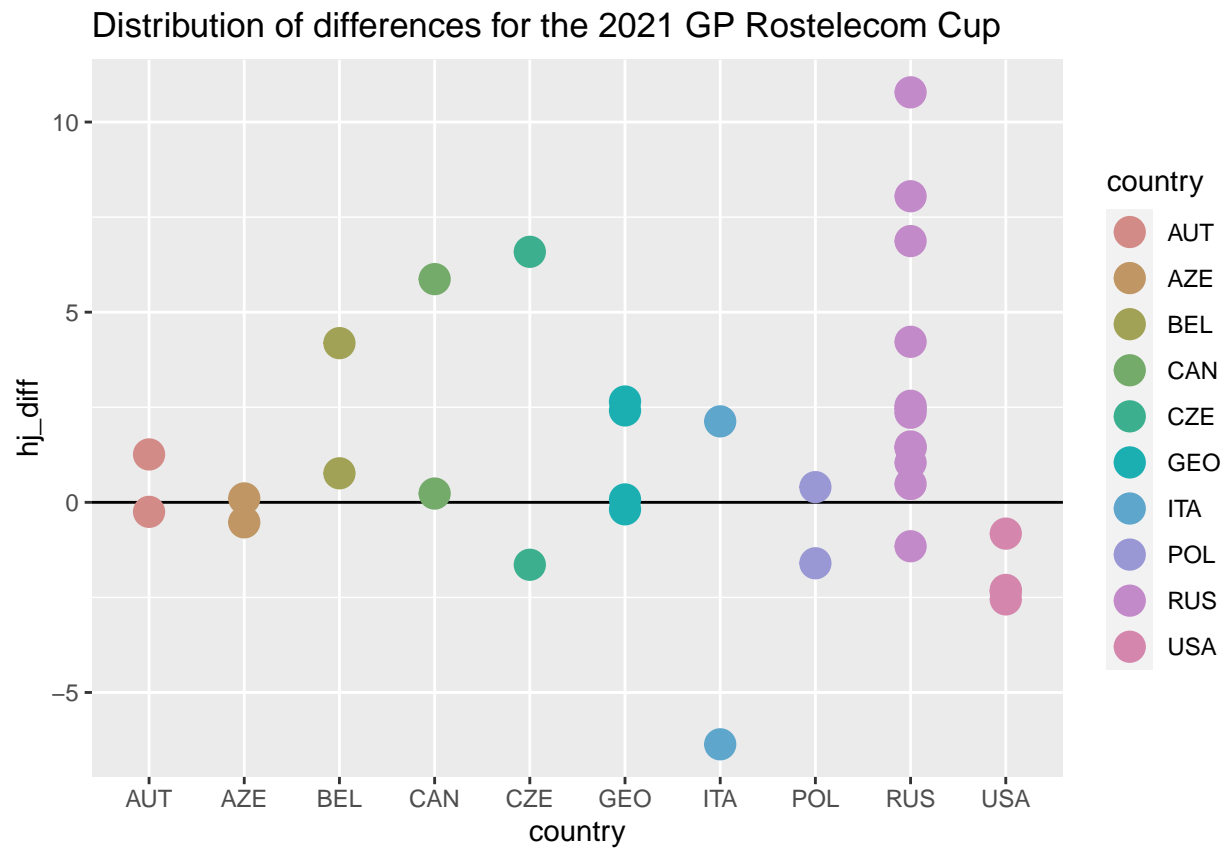
```
##
## [[15]]
```



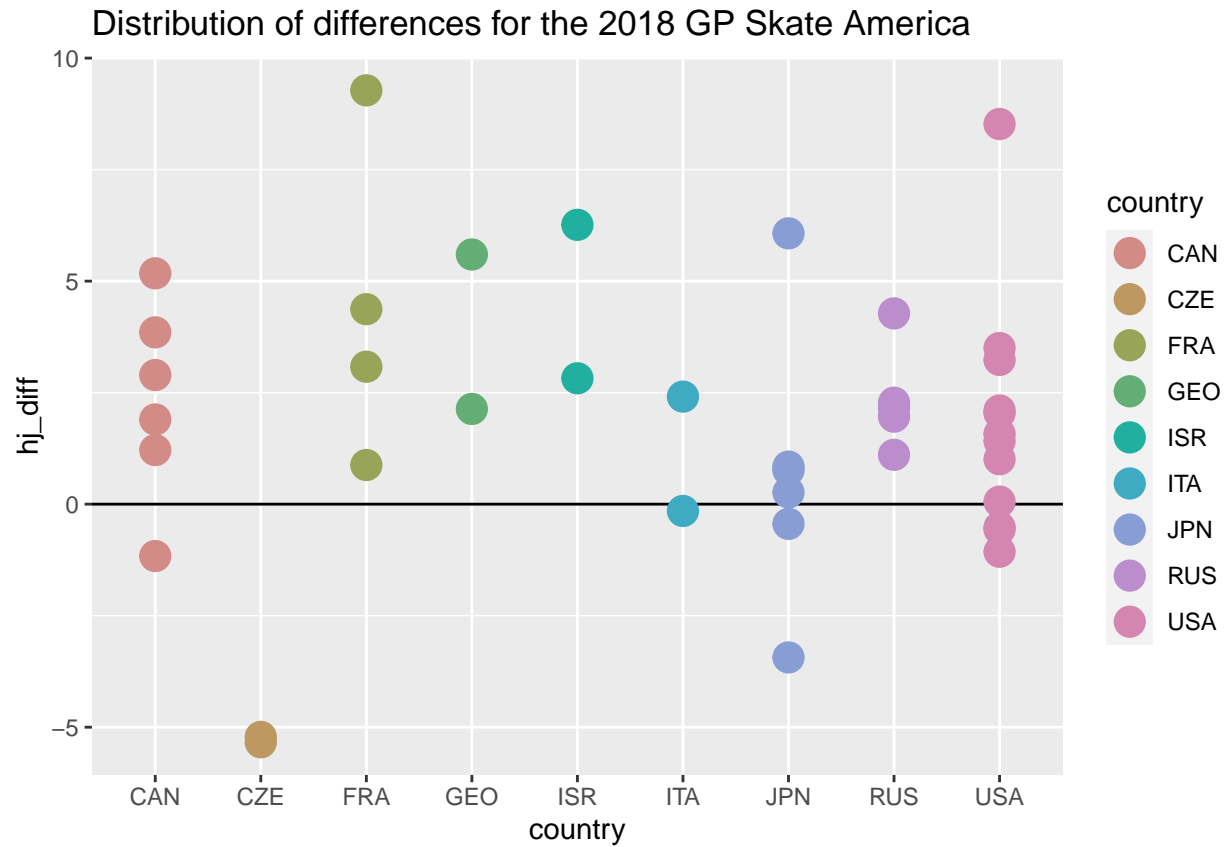
```
##  
## [[16]]
```



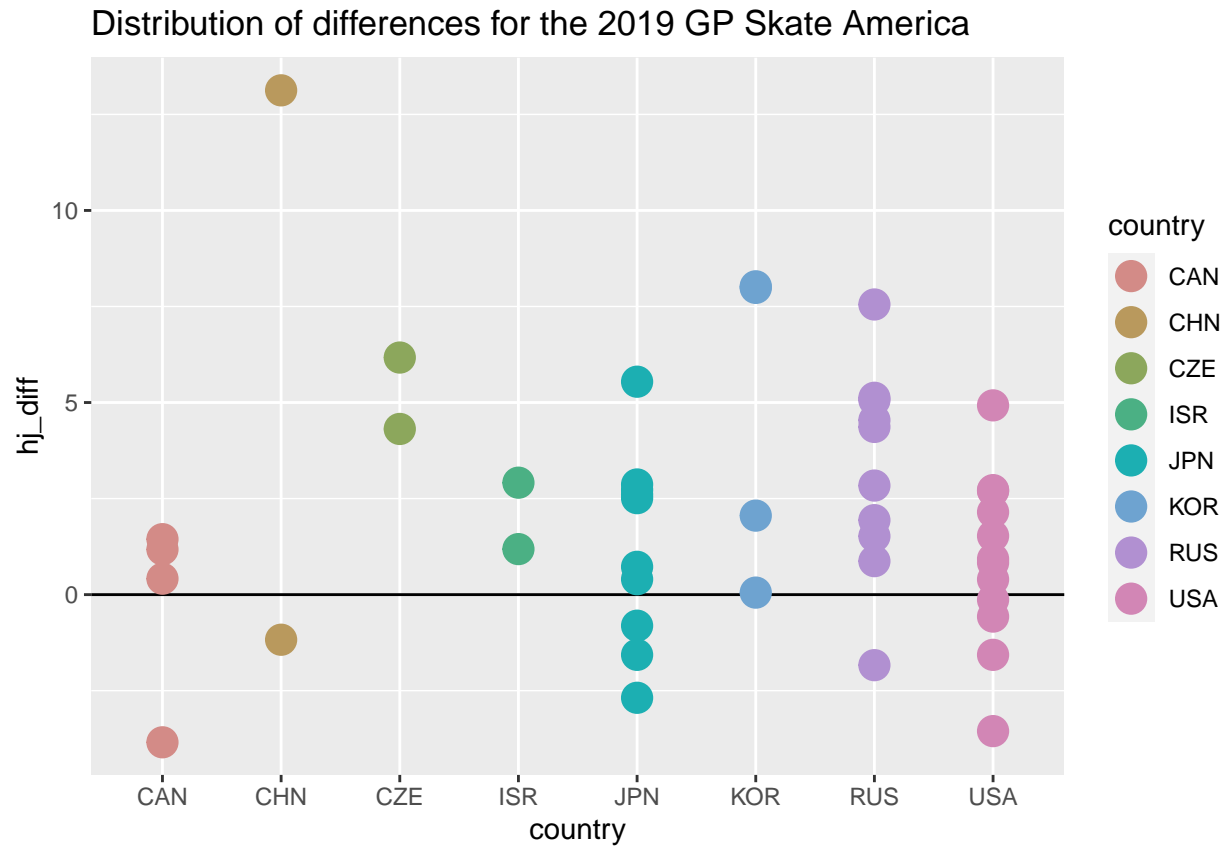
```
##  
## [[17]]
```



```
##
## [[18]]
```

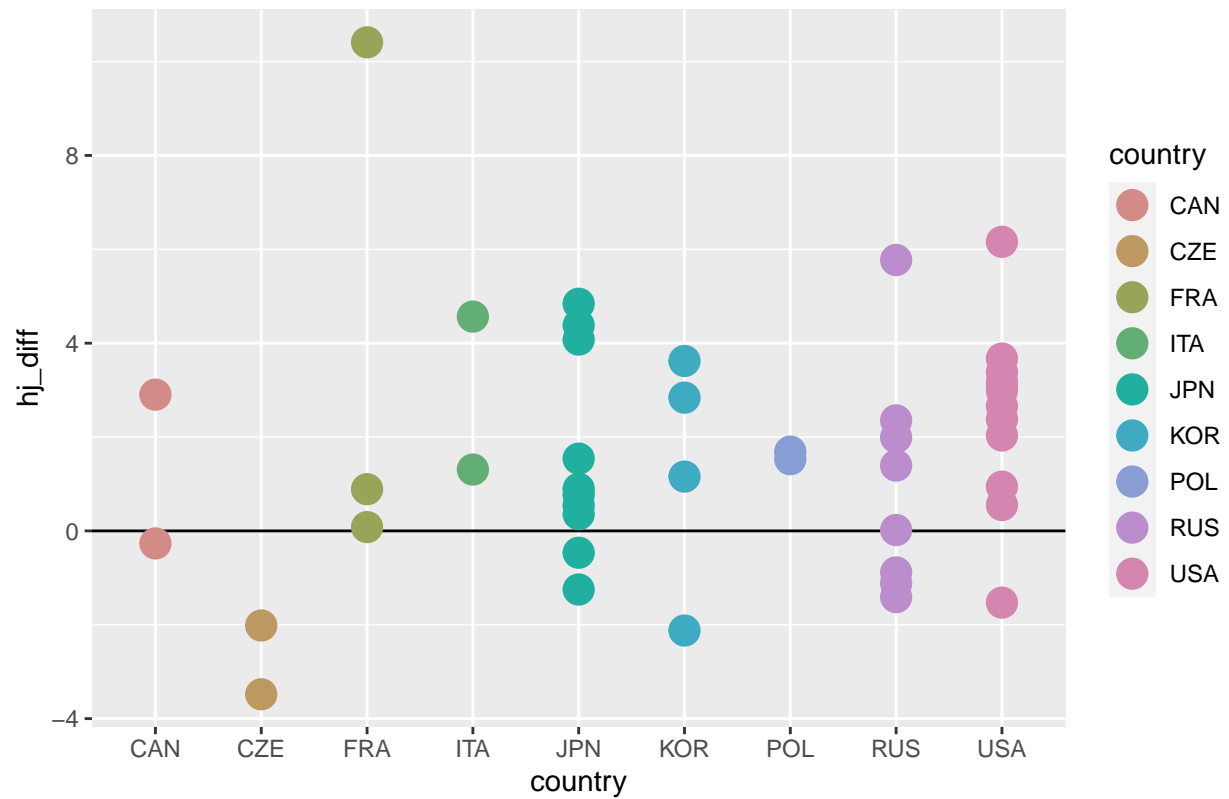


```
##  
## [[19]]
```

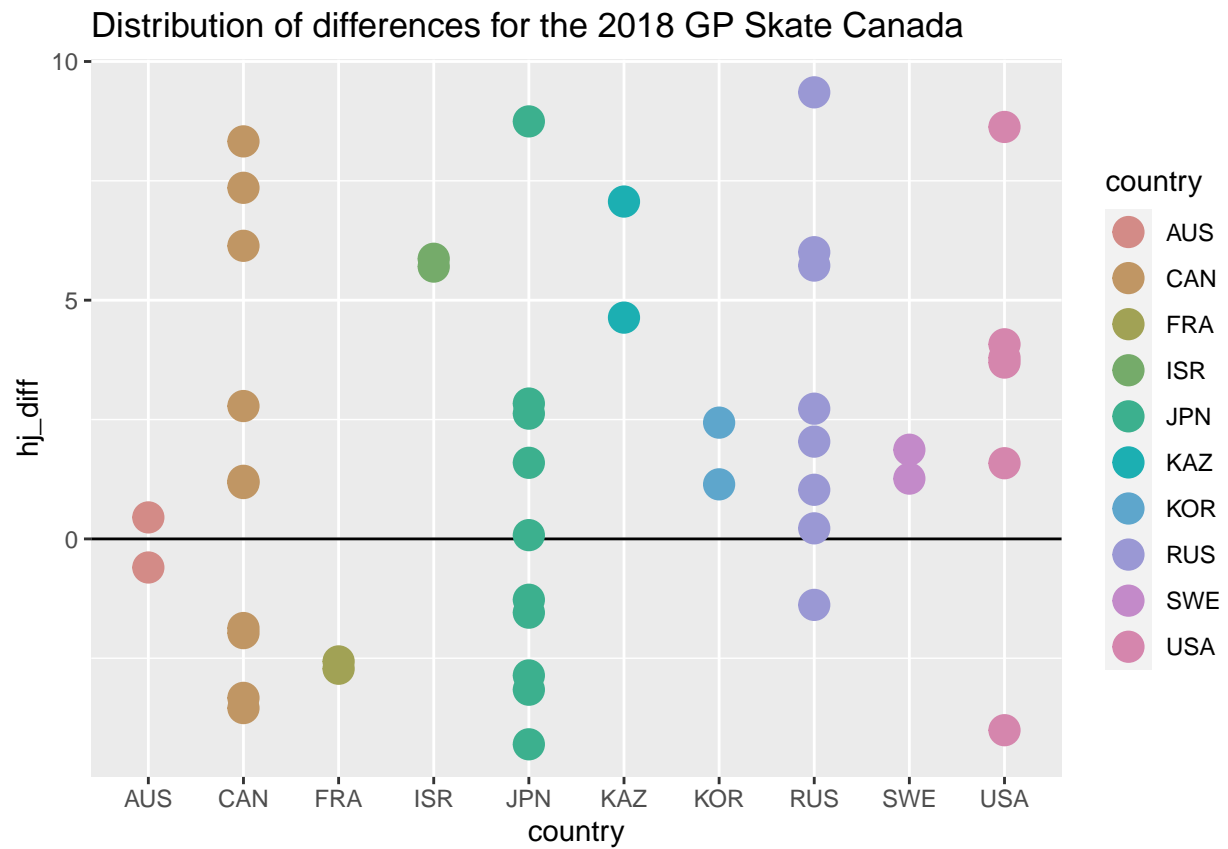


```
##  
## [[20]]
```

Distribution of differences for the 2021 GP Skate America

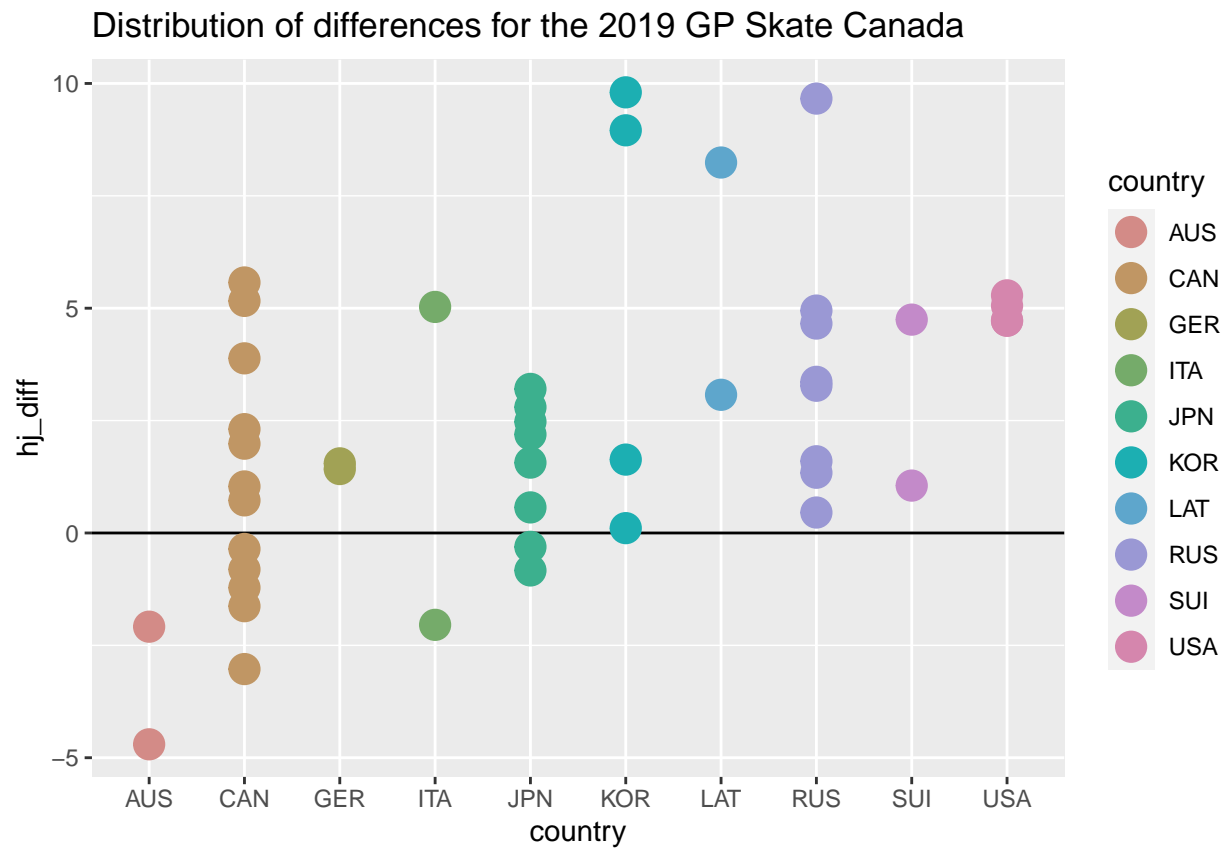


```
##
## [[21]]
```

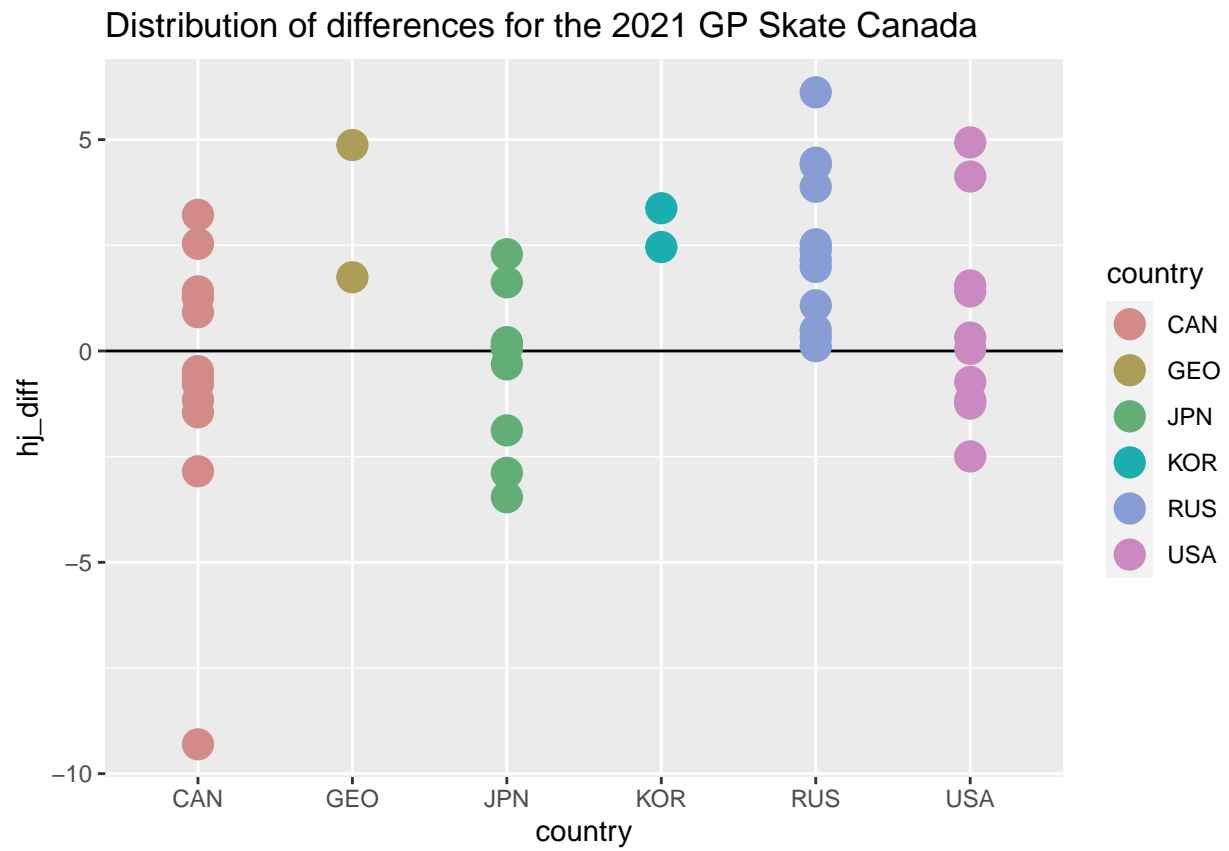


```
##
## [[22]]
```



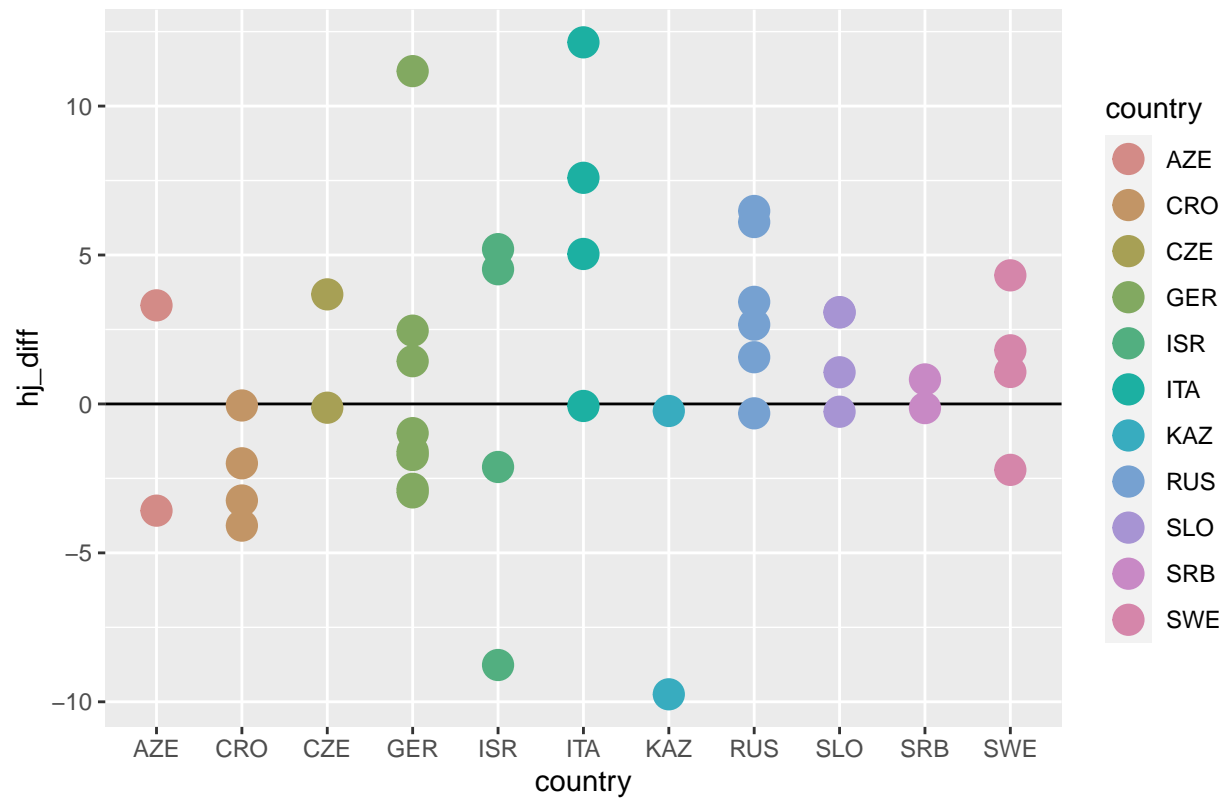


```
##  
## [[23]]
```

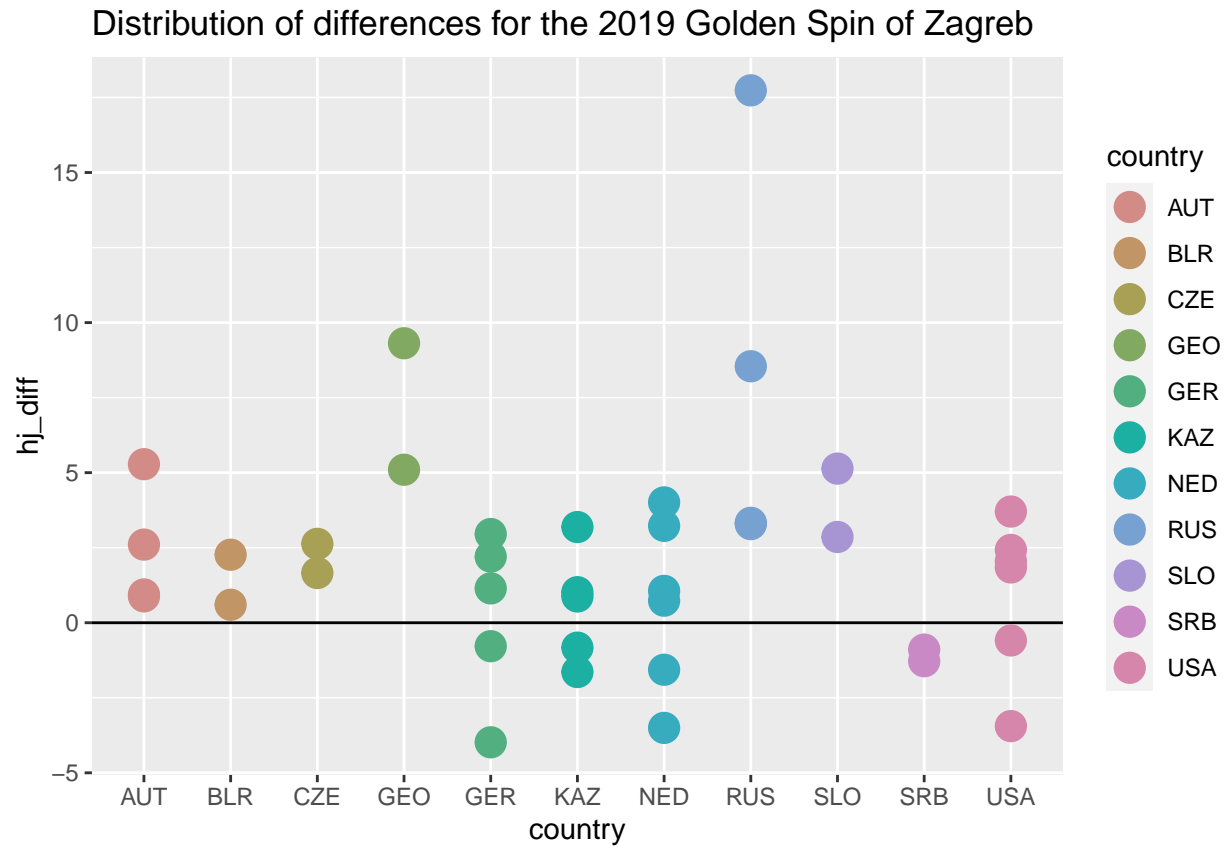


```
##  
## [[24]]
```

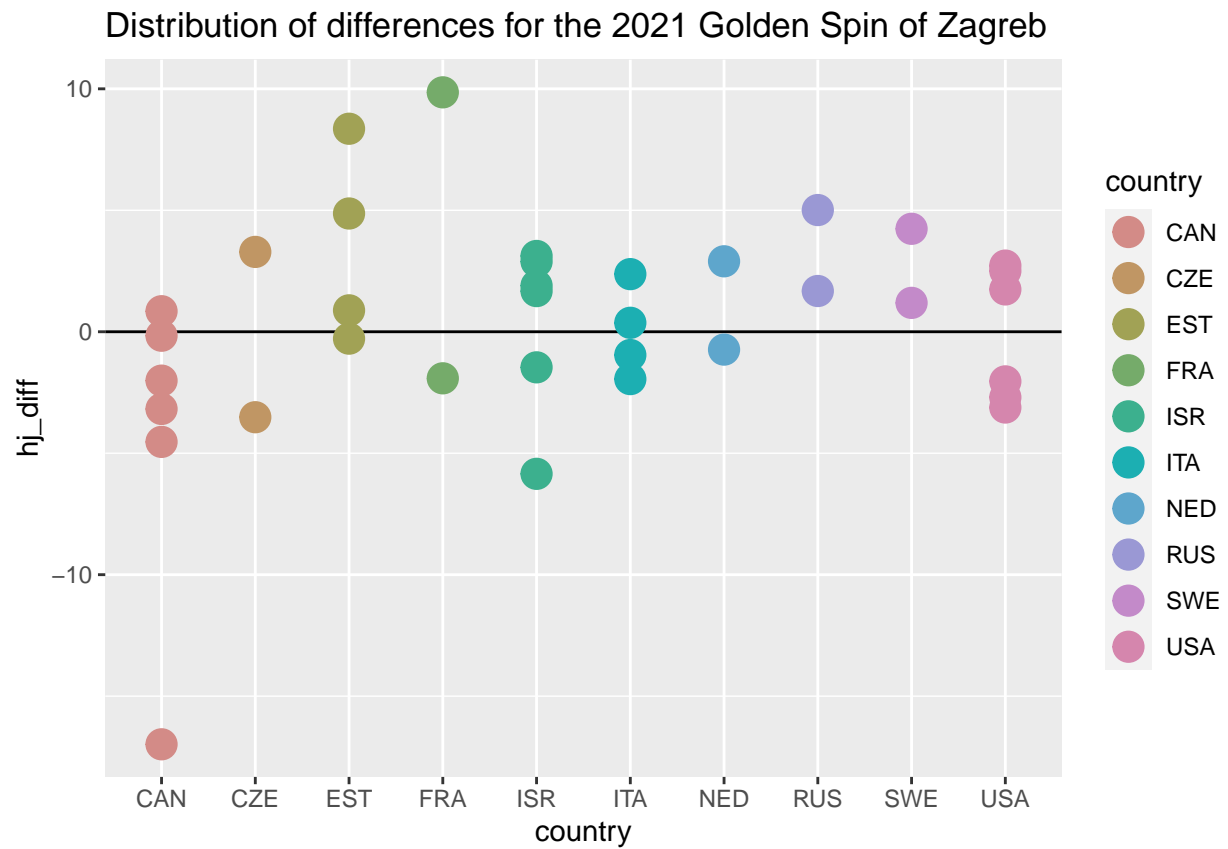
Distribution of differences for the 2018 Golden Spin of Zagreb



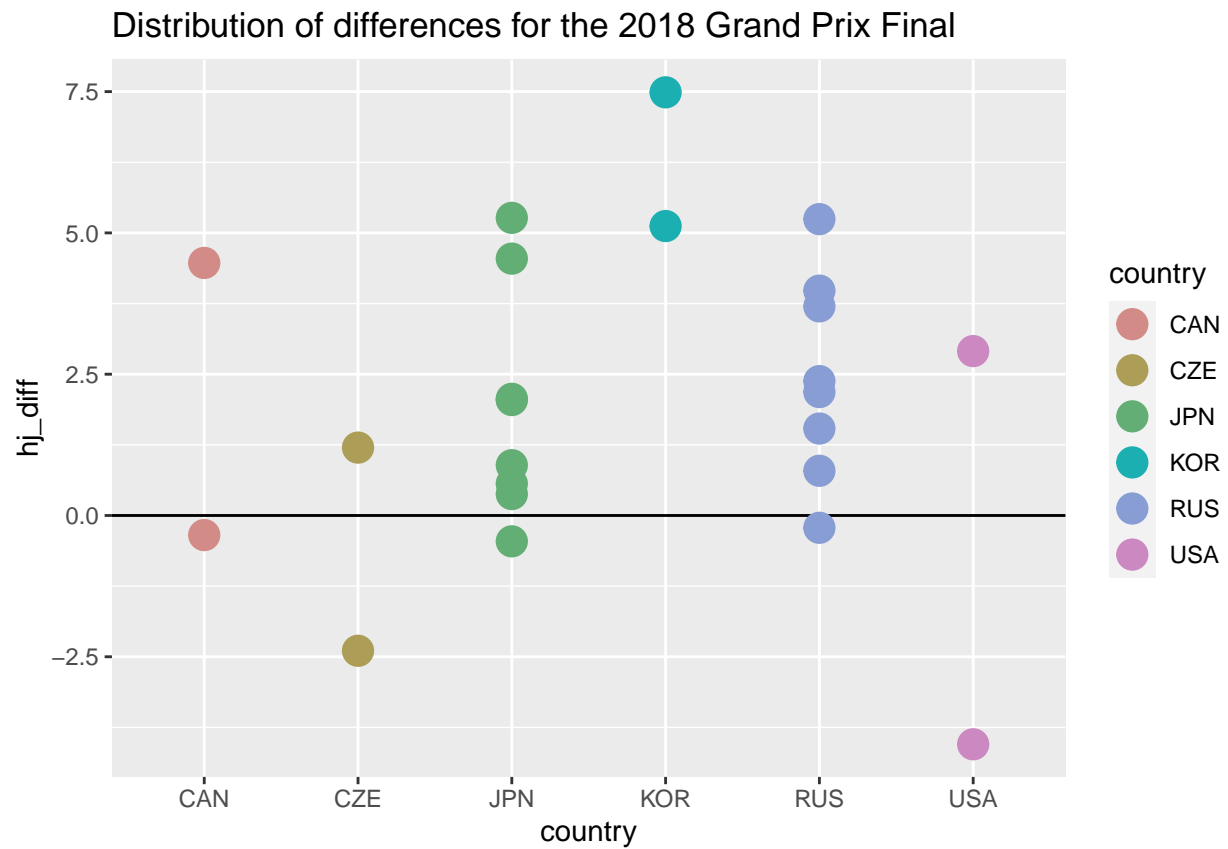
```
##
## [[25]]
```



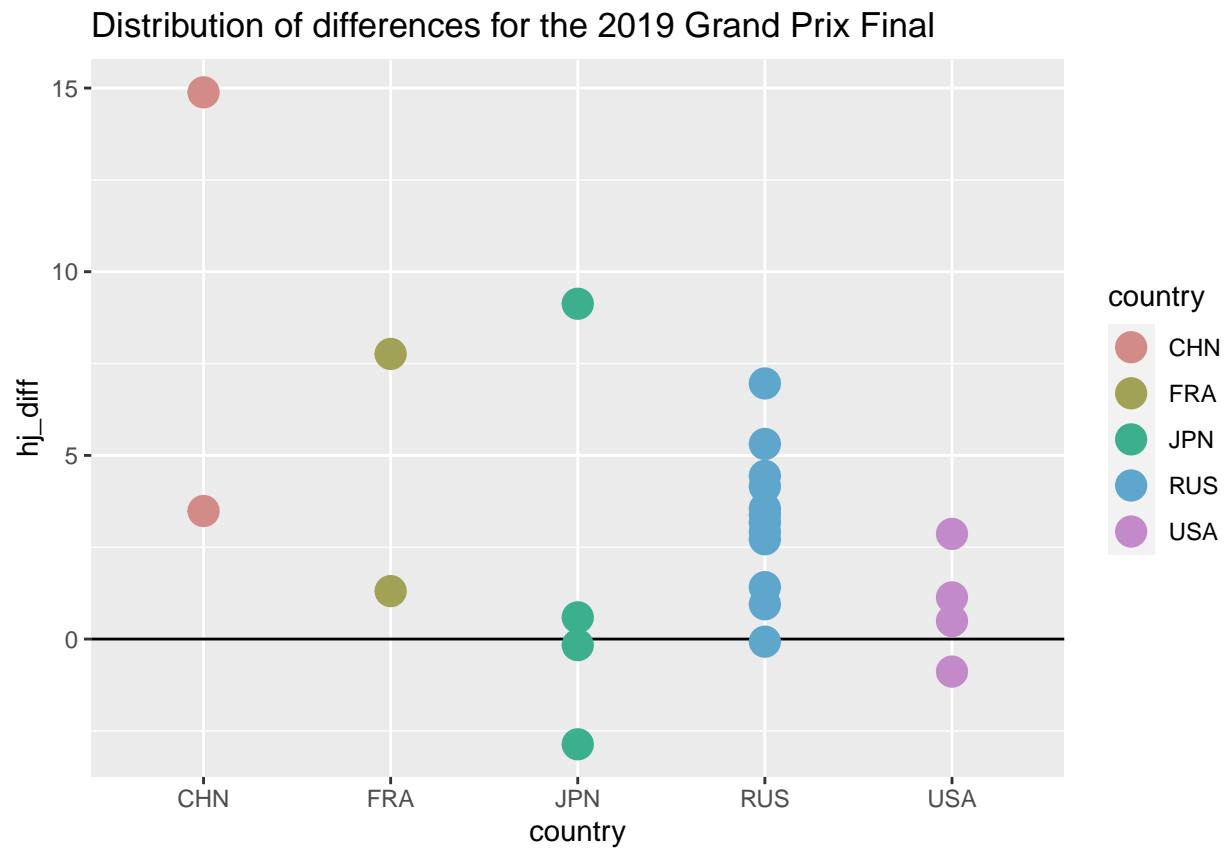
```
##
## [[26]]
```



```
##  
## [[27]]
```

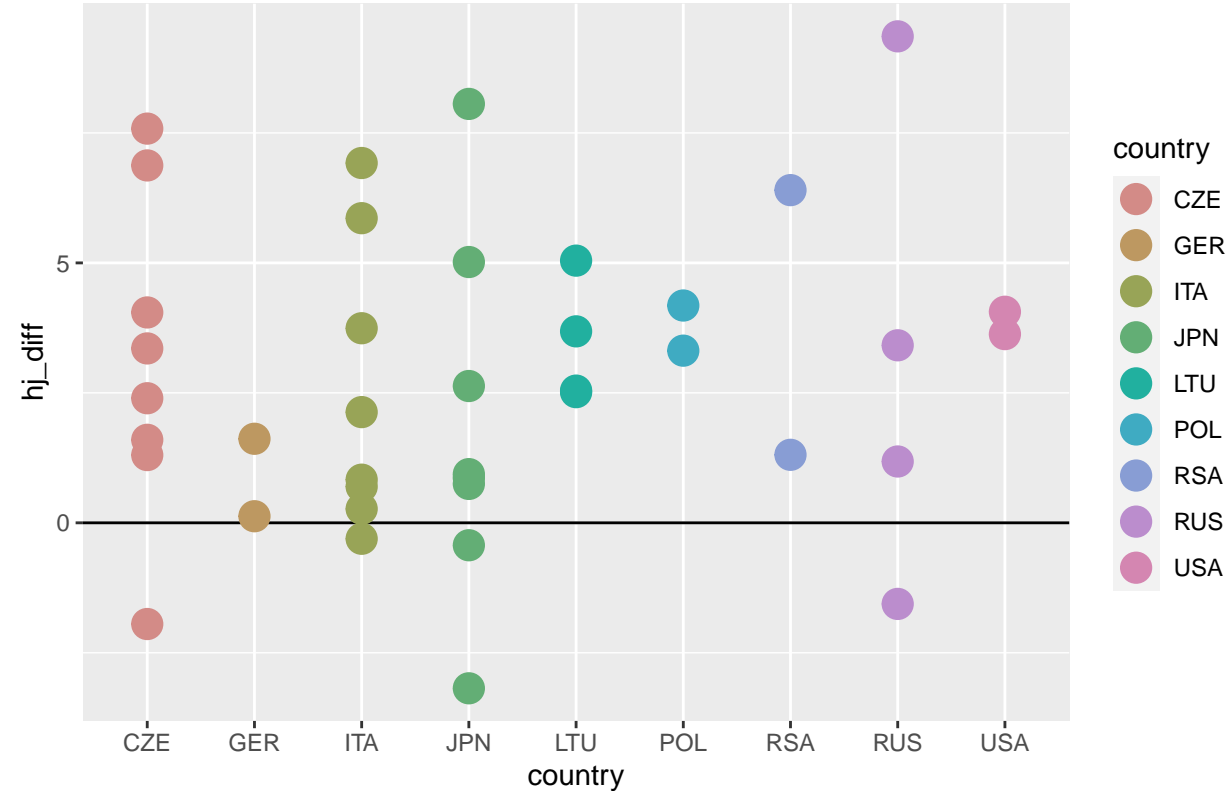


```
##  
## [[28]]
```



```
##  
## [[29]]
```

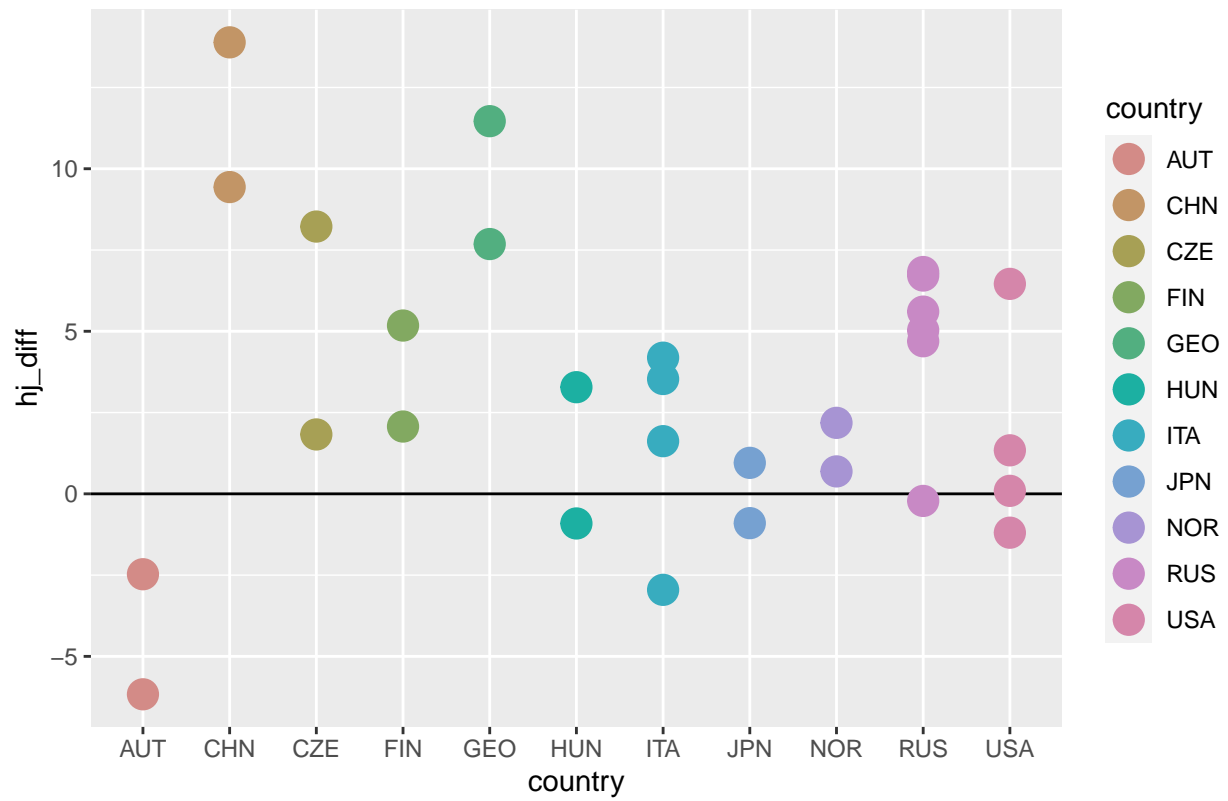
Distribution of differences for the 2018 Lombardia Trophy



```
##  
## [[30]]
```

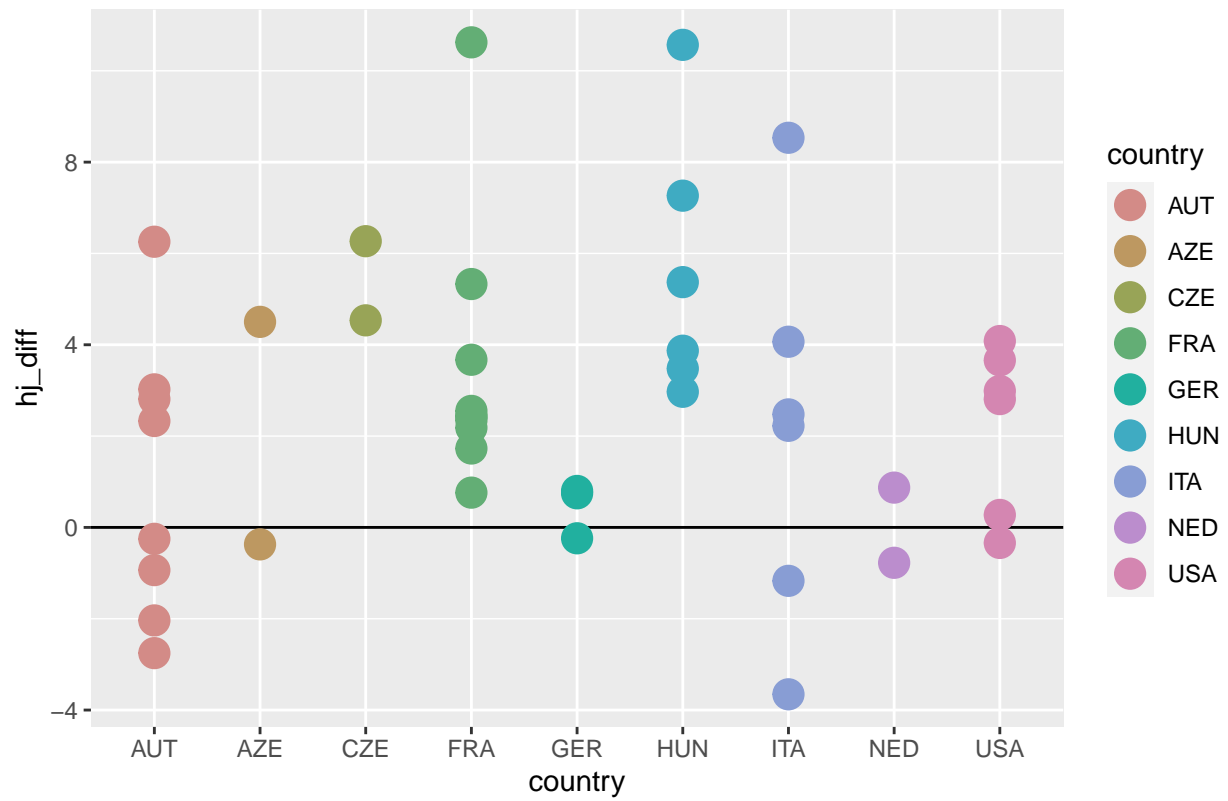


Distribution of differences for the 2019 Lombardia Trophy



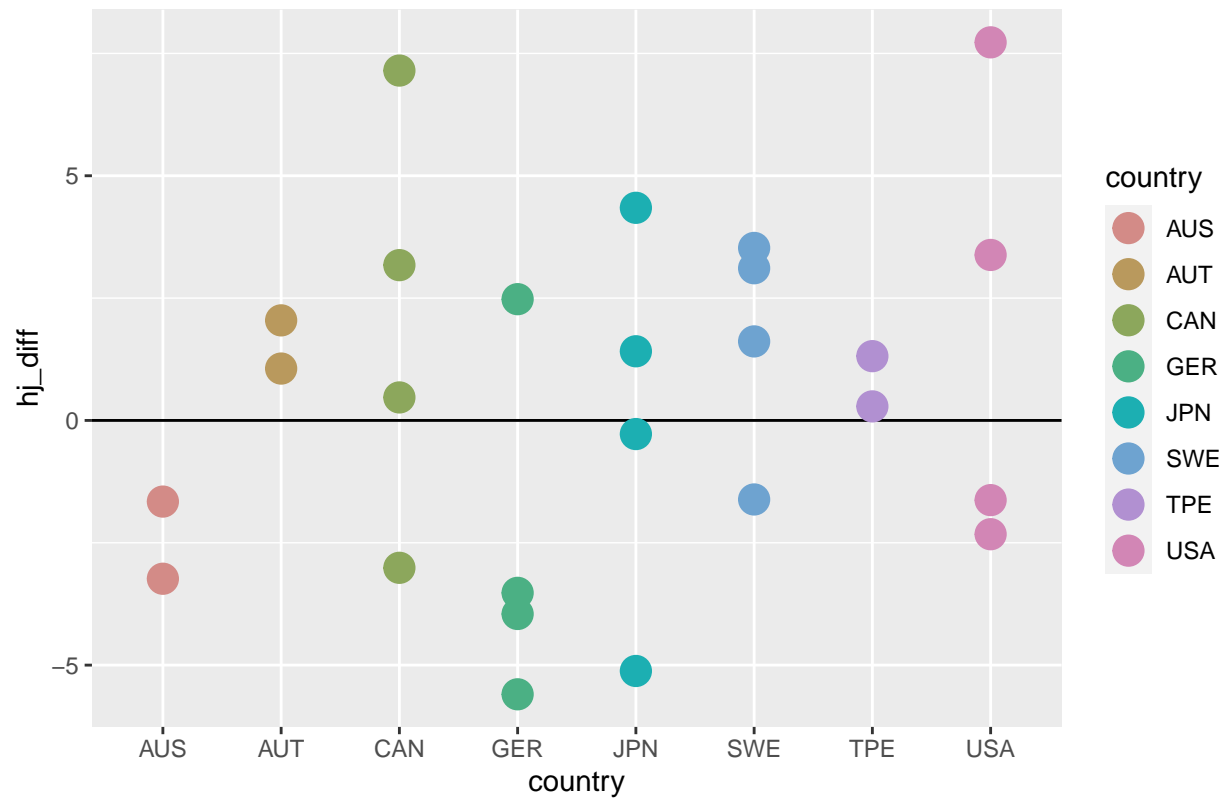
```
##
## [[31]]
```

Distribution of differences for the 2021 Lombardia Trophy



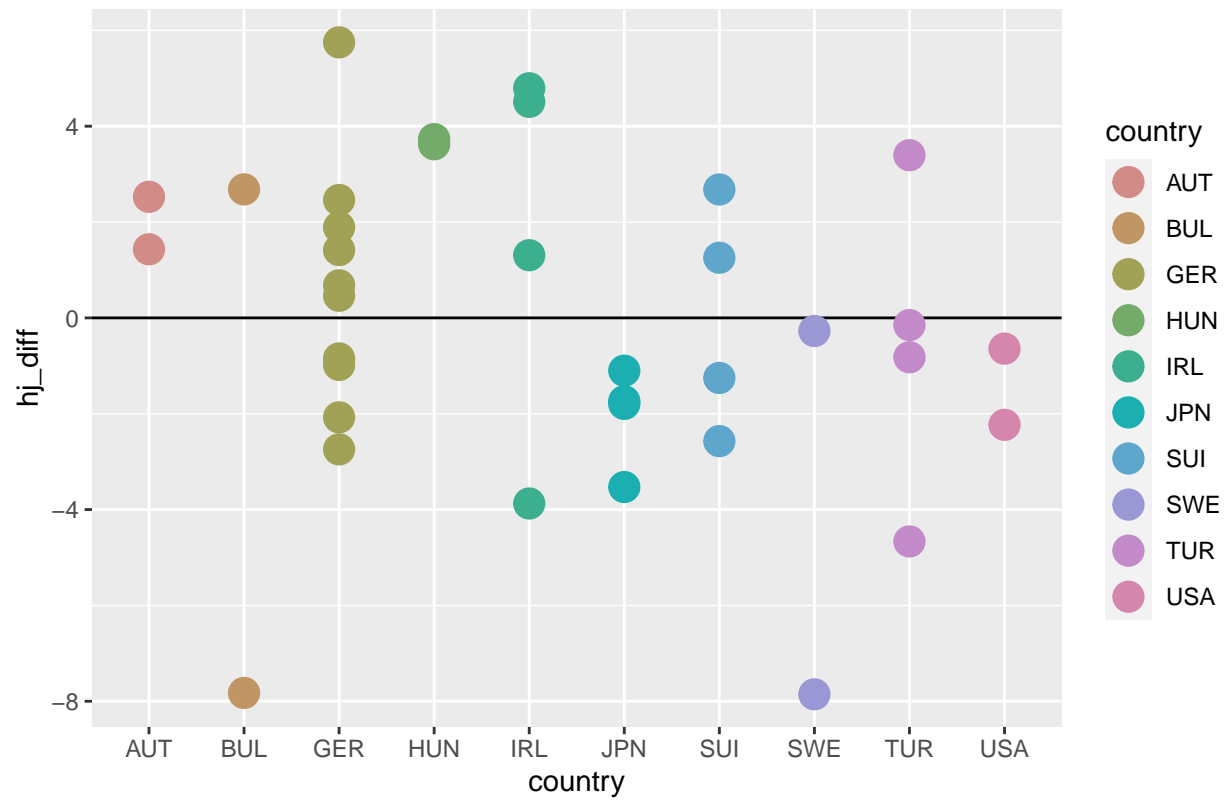
```
##
## [[32]]
```

Distribution of differences for the 2018 Nebelhorn Trophy

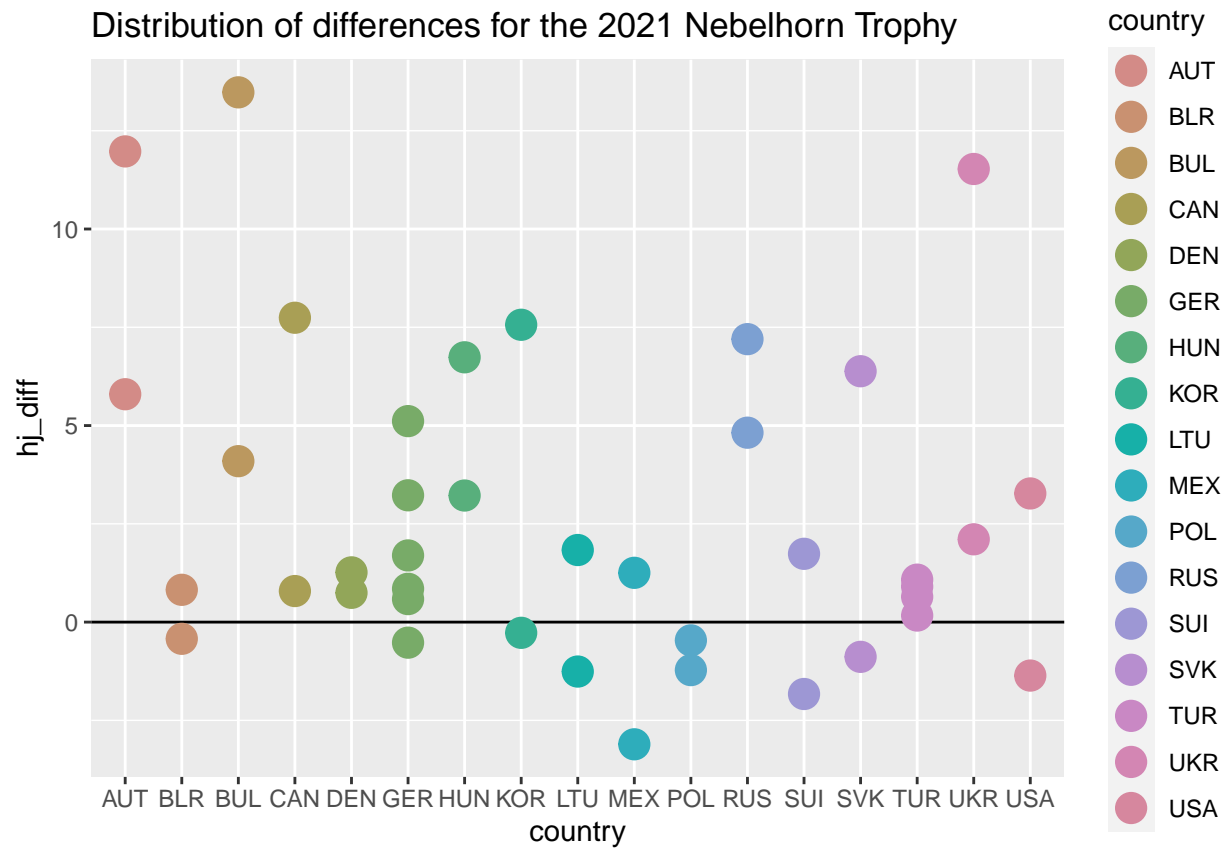


```
##
## [[33]]
```

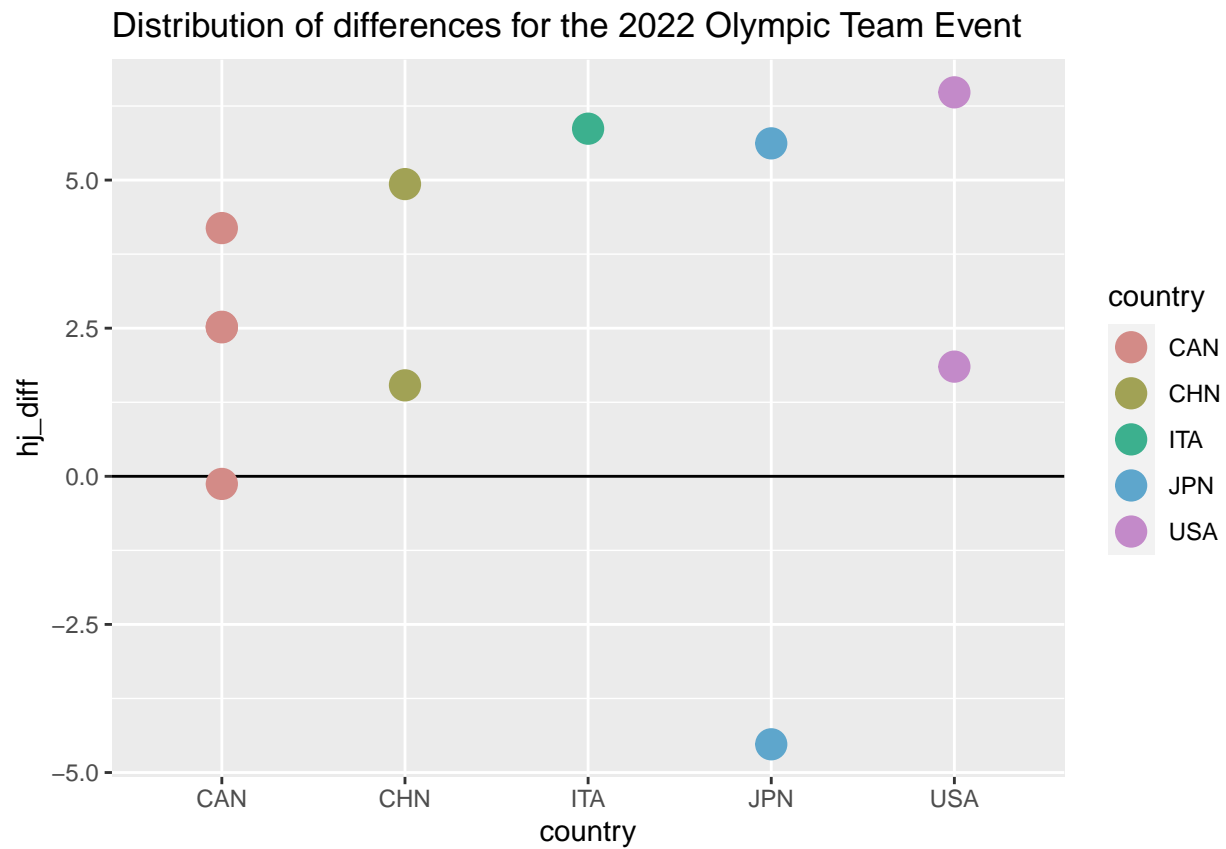
Distribution of differences for the 2019 Nebelhorn Trophy



```
##
## [[34]]
```

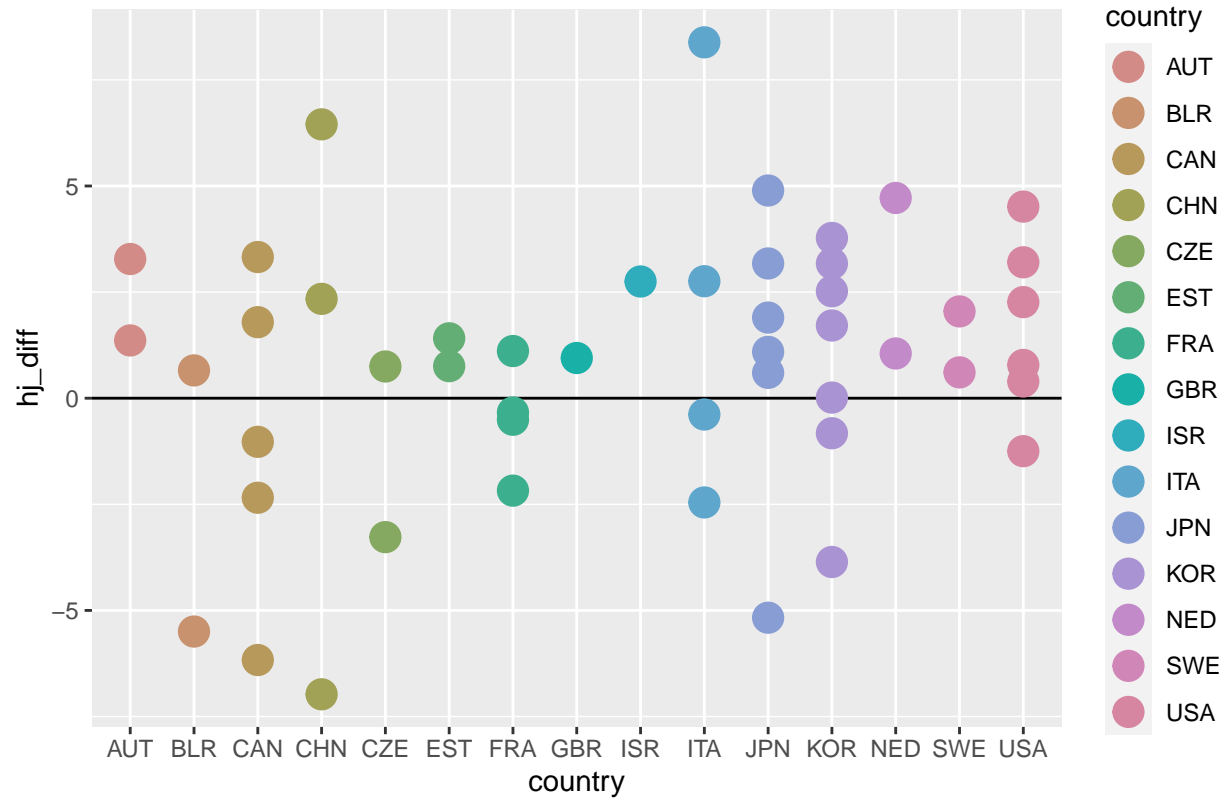


```
##
## [[35]]
```

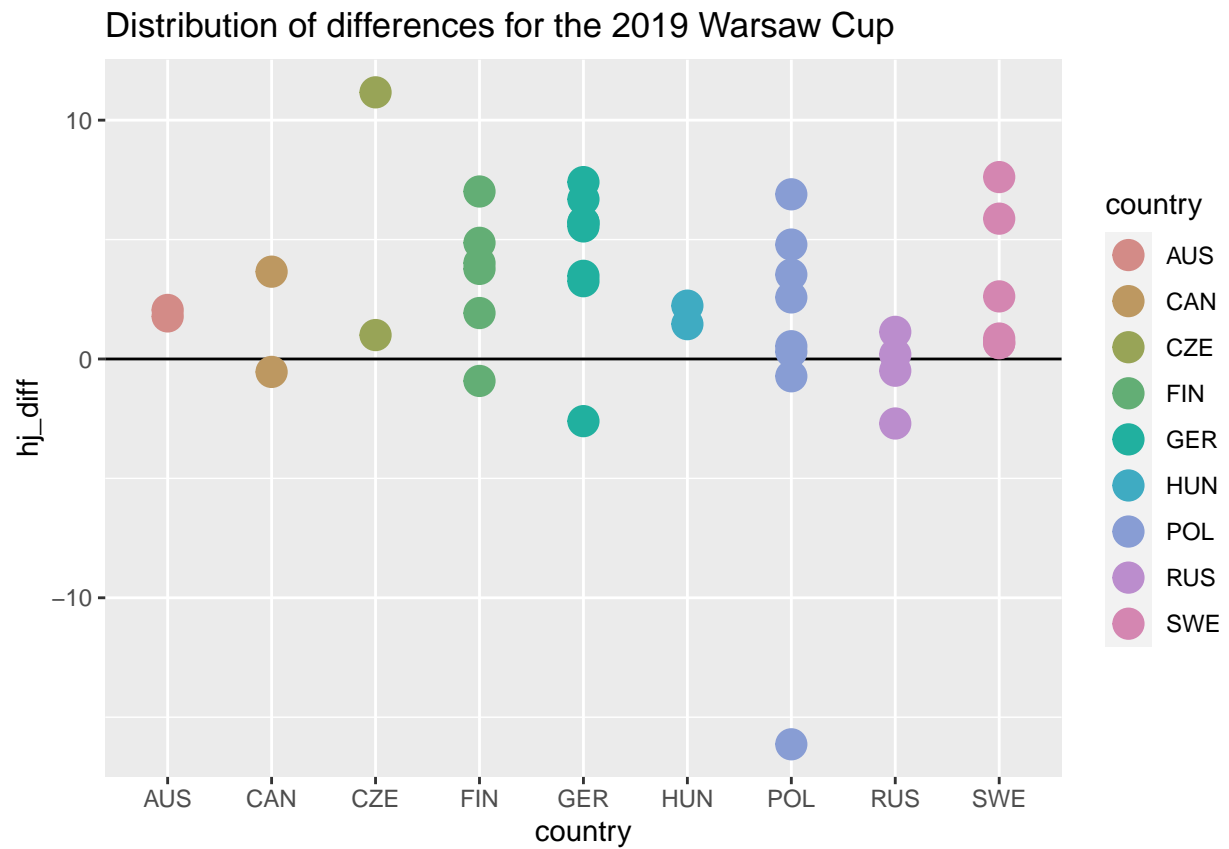


```
##  
## [[36]]
```

Distribution of differences for the 2022 Olympic Winter Games

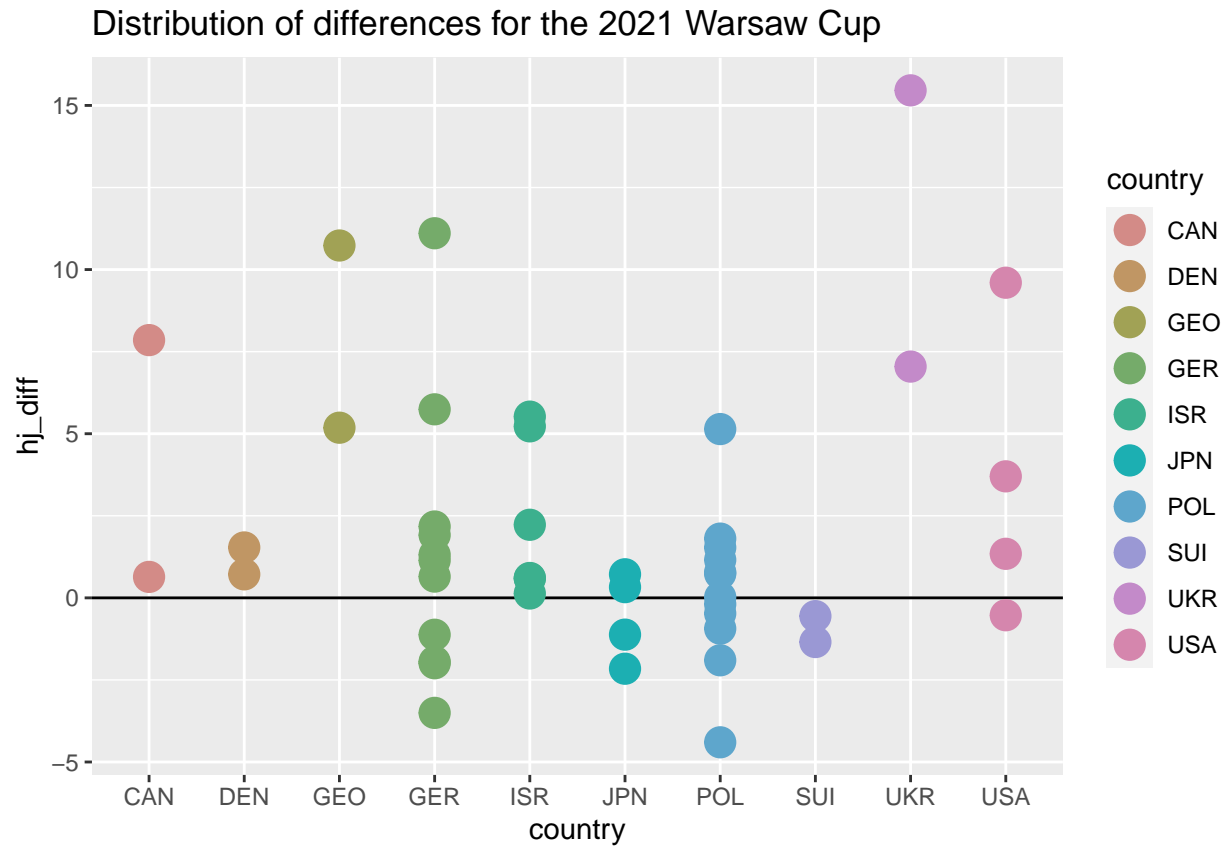


```
##
## [[37]]
```

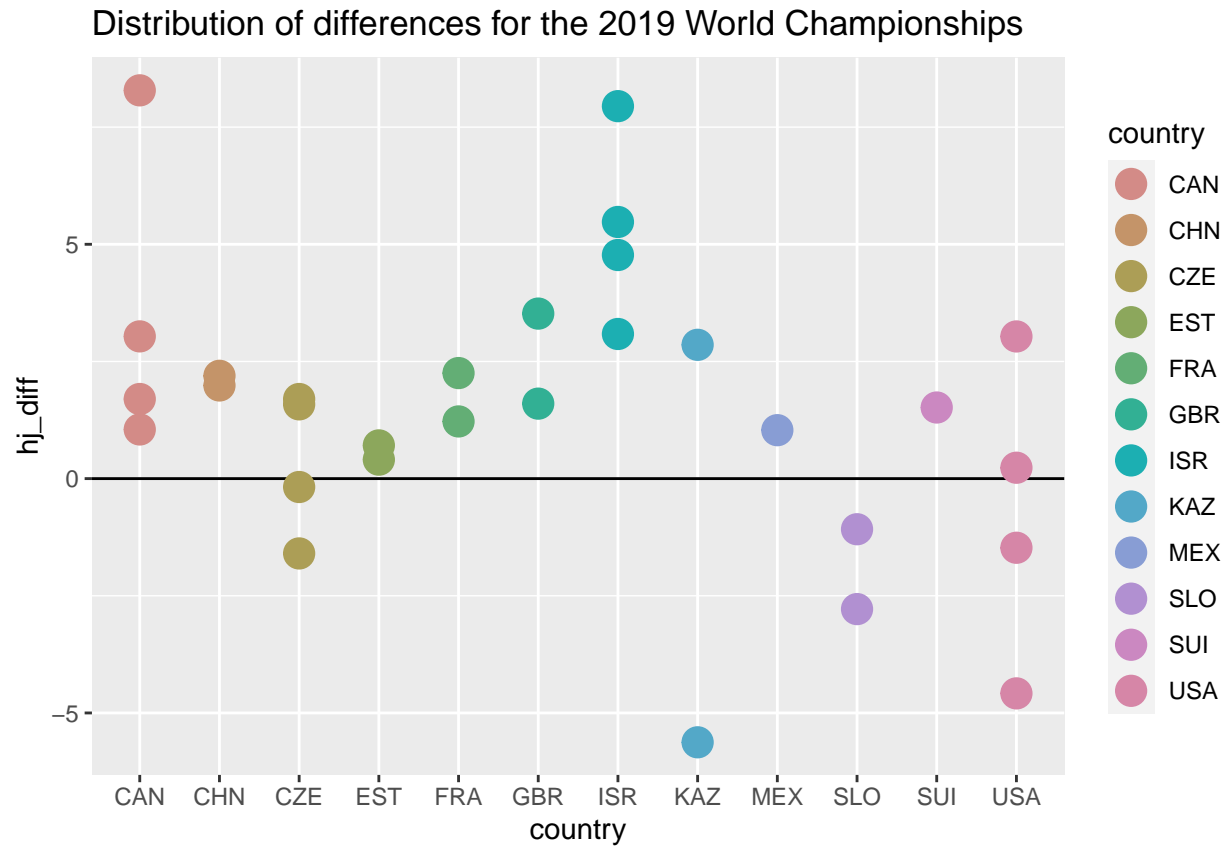


```
##  
## [[38]]
```



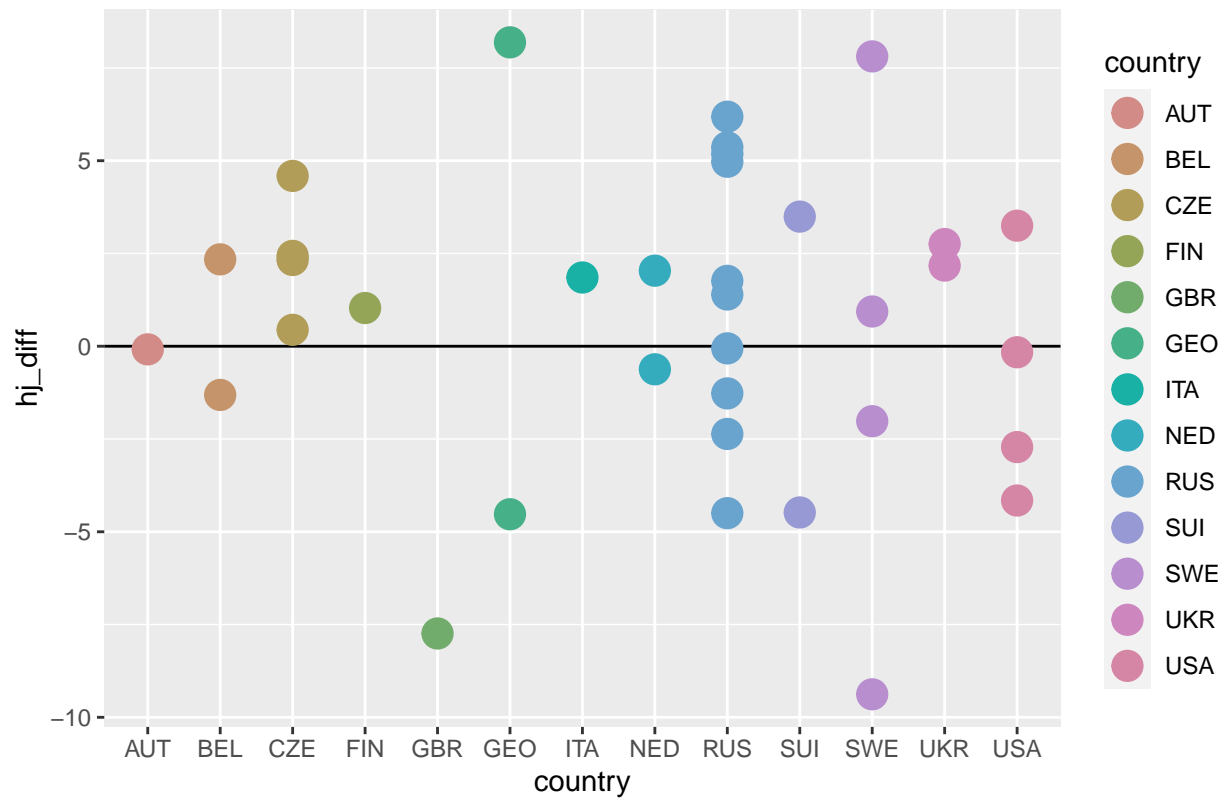


```
##  
## [[39]]
```



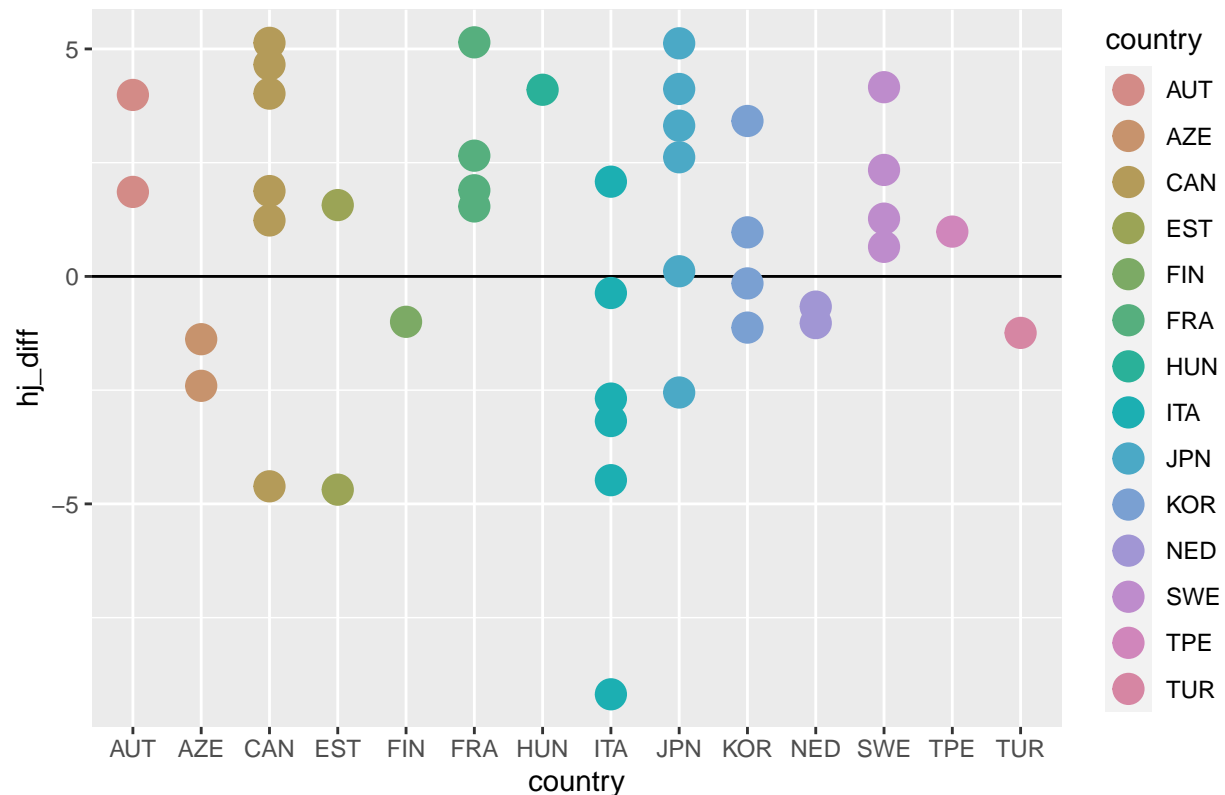
```
##  
## [[40]]
```

Distribution of differences for the 2021 World Championships



```
##
## [[41]]
```

## Distribution of differences for the 2022 World Championships



*# Functions to get home and away scores for each judge on the panel of an event*

*# Non-paired permutation test function*

```
new_perm <- function(home, away) {
  n <- length(home)
  all <- c(home, away)
  mean <- mean(home) - mean(away)
  diff <- replicate(10000, {

    # Randomly sample n scores
    home_perm <- sample(all, size = n, replace = FALSE)
    # Remaining unsampled go into other list
    away_perm <- setdiff(all, home_perm)

    mean_diff <- mean(home_perm) - mean(away_perm)
  })

  # Determine which hypothesis to test
  if (mean > 0) {
    hypothesis <- "hA = true mean is greater than 0 (overscoring)"
    pval <- mean(diff > mean)
  } else if (mean <= 0) {
    hypothesis <- "hA = true mean is less than 0 (underscoring)"
    pval <- mean(diff <= mean)
  }

  return(list("Permutation test", pval))
}
```

```

}

# Get the home and away scores for a judge
analyze_judge <- function(segment, judge_num){

  #Gets the difference from the total score (not panel mean)
  bool = segment[,judge_num] == segment[,20]
  home <- segment[,judge_num+9][bool] - segment[,19][bool]
  away <- segment[,judge_num+9][!bool] - segment[,19][!bool]

  return(list(paste0("j_",judge_num), home, away))
}

# Run tests on a judge's scores
test_list <- function(judge_scores){

  home <- judge_scores[[2]]
  away <- judge_scores[[3]]

  if (length(home) != 0){
    if (mean(home)-mean(away) > 0){
      wilcox <- wilcox.test(home, away, alternative = "greater")
    }
    else {
      wilcox <- wilcox.test(home, away, alternative = "less")
    }
    perm <- new_perm(home, away)
  }
  else {
    wilcox <- "No home scores to test"
    perm <- "No home scores to test"
  }

  return(list(judge_scores[[1]], wilcox, perm, c("diff in means", mean(home) -
                                                mean(away))))
}

# Run tests for each judge on the panel
get_results <- function(segment){

  segment <- segment[c("j1_nat", "j2_nat", "j3_nat", "j4_nat", "j5_nat", "j6_nat",
                      "j7_nat", "j8_nat", "j9_nat", "j1_total", "j2_total", "j3_total", "j4_total", "j5_total", "j6_total", "j7_total", "j8_total", "j9_total", "j10_total")]

  results <- list()

  for (judge in 1:9) {
    results[[judge]] <- analyze_judge(segment, judge)
  }

  return(list("Individual Judge Analysis", lapply(results, test_list)))
}

```

```

# Functions to analyze home judge bias by event and segment

run_test <- function(segment) {
  shared_nat <- segment %>% filter(j1_nat == nationality | j2_nat == nationality
                                | j3_nat == nationality |
                                j4_nat == nationality |
                                j5_nat == nationality |
                                j6_nat == nationality |
                                j7_nat == nationality |
                                j8_nat == nationality |
                                j9_nat == nationality )

  n_obs <- nrow(shared_nat)

  judge_nats <- shared_nat[c("j1_nat", "j2_nat", "j3_nat", "j4_nat", "j5_nat",
                             "j6_nat", "j7_nat", "j8_nat", "j9_nat", "j1_total",
                             "j2_total", "j3_total", "j4_total", "j5_total",
                             "j6_total", "j7_total", "j8_total", "j9_total",
                             "nationality")]

  panel_scores <- shared_nat[c("j1_total", "j2_total", "j3_total", "j4_total",
                               "j5_total", "j6_total", "j7_total", "j8_total",
                               "j9_total")]

  home_judge <- apply(judge_nats, 1, find_home)
  home_judge <- as.numeric(unlist(home_judge))

  panel_scores["home"] = home_judge

  panel_mean <- apply(panel_scores, 1, find_mean)

  # Data frame for the differences between the home judge and mean of the others
  diffs <- data.frame(diff = home_judge - panel_mean)
  # solely for visualization purposes
  diffs$index <- 1:nrow(diffs)
  diffs$sign <- ifelse(diffs$diff > 0, "positive", "negative")

  # mean difference for all singles observations
  mean_diffs <- mean(diffs$diff, na.rm = TRUE)

  st_dev <- sd(diffs$diff, na.rm = TRUE)

  # Decide which hypothesis to use for wilcoxon test
  if (mean_diffs > 0) {
    w_test <- wilcox.test(home_judge, panel_mean, paired = TRUE, alternative = "greater")
  } else if (mean_diffs <= 0) {
    w_test <- wilcox.test(home_judge, panel_mean, paired = TRUE, alternative = "less")
  }

  # Paired Permutation test
  perm_test <- paired_perm(diffs, n_obs, mean_diffs, segment$event_name[1],
                           segment$event_year[1], paste0("from panel mean, ",
                                                           segment$discipline[1]), segment$segment[1])

```

```

# Confidence interval for true mean difference
confidence <- boot(diffs, n_obs, segment$event_name[1], segment$event_year[1],
  paste0("from total, ", segment$discipline[1]),
  segment$segment[1])

# Histogram with each observed difference
h1 <- ggplot(diffs, aes(x= index, y=diff)) + geom_col(aes(fill = sign)) +
  xlab("Observation") + ylab("Difference") +
  ggtitle(paste0("HJ score vs. Panel Mean for ", segment$discipline[1], " ",
    segment$segment[1], " at ", segment$event_year[1], " ",
    segment$event_name[1])) +
  scale_x_continuous(breaks = seq(0, max(diffs$index), 1))

output <- list(c(segment$discipline[1], segment$segment[1], "# of Obs.",
  n_obs, "Standard Deviation of Observations", st_dev), w_test,
  c("Permutation Test p-value", perm_test),
  c("Bootstrap Confidence Interval",
    confidence[c(1,2)], "MOE", as.numeric(confidence[3])/2),
  h1, get_results(segment))

return(output)
}

```

```

analyze_event <- function(name, year) {

  # Filter for specific event only
  event <- skating %>%
    filter(event_year == year & event_name == name)

  # Filter for distinct skater/judge country matches
  filtered <- event %>% filter(j1_nat == nationality | j2_nat == nationality
    | j3_nat == nationality |
    j4_nat == nationality |
    j5_nat == nationality |
    j6_nat == nationality |
    j7_nat == nationality |
    j8_nat == nationality |
    j9_nat == nationality ) %>%

  distinct(skater, .keep_all = TRUE)

  nats <- as.data.frame(table(filtered$nationality)) %>%
    rename(Nationality = Var1)

  # Histogram for frequencies of home judge occurrences on the panel
  h1 <- ggplot(nats, aes(x = Nationality, y = Freq)) +
    geom_bar(stat = "identity", aes(fill = Nationality)) +
    scale_y_continuous(breaks = seq(0, max(nats$Freq), 2)) +
    scale_fill_hue(c = 50) + theme(legend.position="none") +
    ggtitle(paste0("Home Judge Occurrences for ", year, " ", name))

  # Separate into the four segments
  mens_sp <- event %>%
    filter(discipline == "Mens", segment == "sp")

```

```
womens_sp <- event %>%
  filter(discipline == "Womens", segment == "sp")
mens_fp <- event %>%
  filter(discipline == "Mens", segment == "fp")
womens_fp <- event %>%
  filter(discipline == "Womens", segment == "fp")

segments <- list(mens_sp,womens_sp,mens_fp,womens_fp)

return(list(paste0("Results for ", year, " ", name),
  lapply(segments, run_test), h1))
}
```

```
results <- analyze_event("GP NHK Trophy", "2019")
```

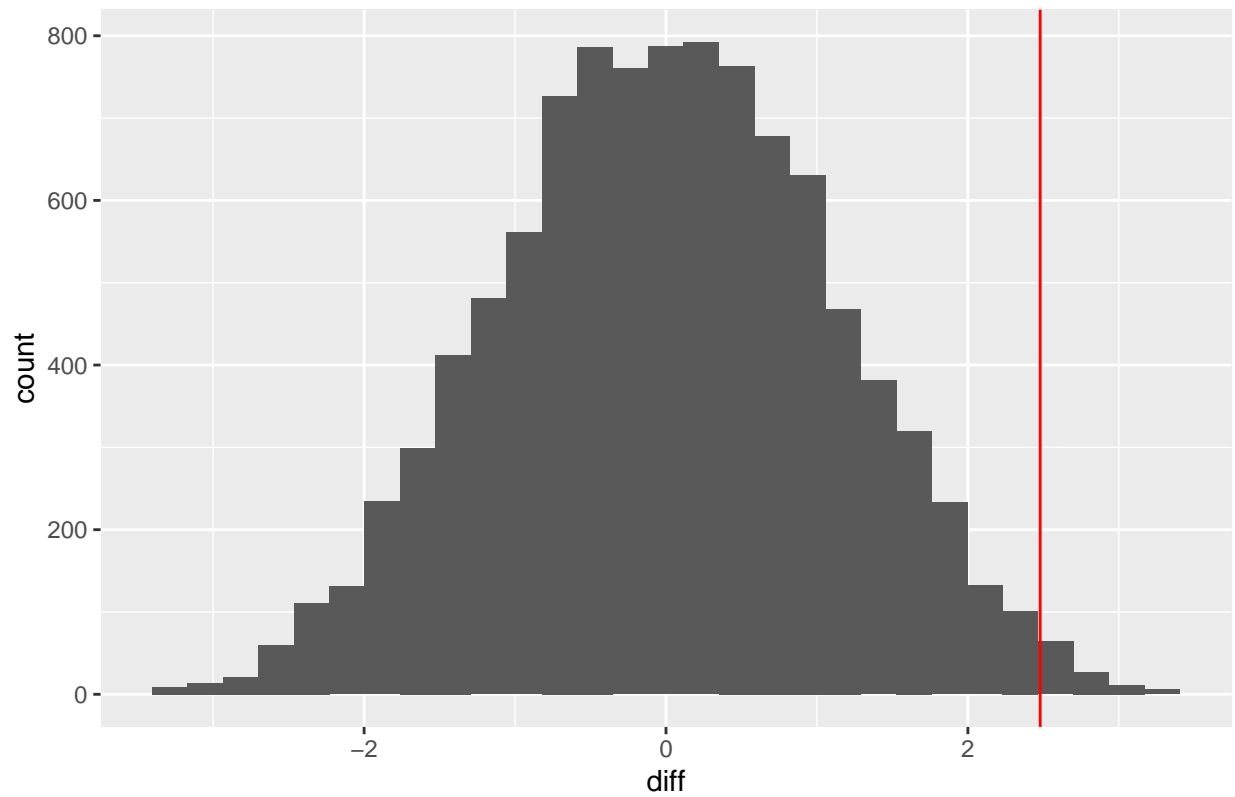
```
## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties
```

```
results
```

```
## [[1]]
## [1] "Results for 2019 GP NHK Trophy"
##
## [[2]]
## [[2]][[1]]
## [[2]][[1]][[1]]
## [1] "Mens" "sp"
## [3] "# of Obs." "12"
## [5] "Standard Deviation of Observations" "3.08513135279767"
##
## [[2]][[1]][[2]]
##
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 69, p-value = 0.008057
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[3]]
## [[2]][[1]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[1]][[3]][[2]]
```

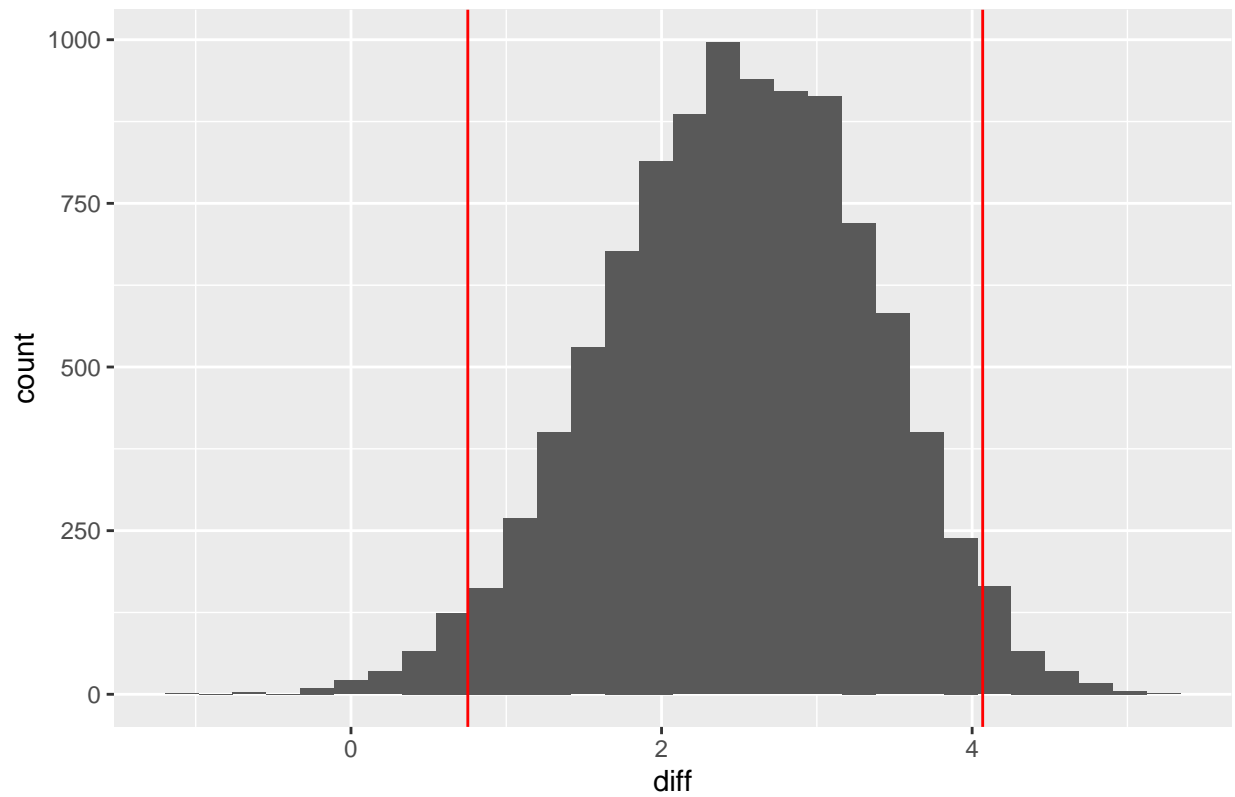


# Permutation test from panel mean, Mens sp at 2019 GP NHK Trophy



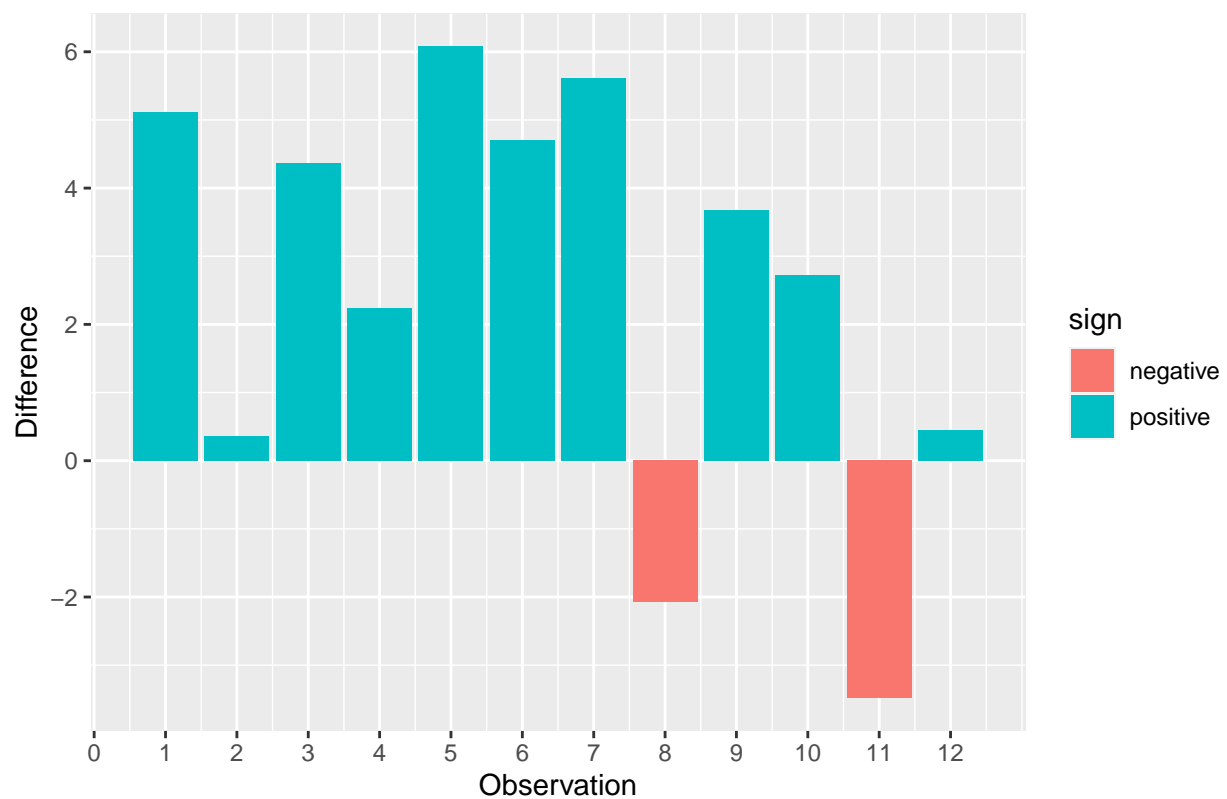
```
##
## [[2]][[1]][[3]][[3]]
## [1] 0.0102
##
## [[2]][[1]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[1]][[4]]
## [[2]][[1]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[1]][[4]][[2]]
```

# Bootstrap Confidence Interval for from total, Mens sp at 2019 GP NHK Tro



```
##
## [[2]] [[1]] [[4]] [[3]]
## [1] 0.7522891 4.0679896
##
## [[2]] [[1]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[1]] [[4]] [[5]]
## [1] 1.65785
##
##
## [[2]] [[1]] [[5]]
```

HJ score vs. Panel Mean for Mens sp at 2019 GP NHK Trophy



```
##
## [[2]][[1]][[6]]
## [[2]][[1]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[1]][[6]][[2]]
## [[2]][[1]][[6]][[2]][[1]]
## [[2]][[1]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[1]][[6]][[2]][[1]][[2]]
## [1] "No home scores to test"
##
## [[2]][[1]][[6]][[2]][[1]][[3]]
## [1] "No home scores to test"
##
## [[2]][[1]][[6]][[2]][[1]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[1]][[6]][[2]][[2]]
## [[2]][[1]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[1]][[6]][[2]][[2]][[2]]
##
```

```

## Wilcoxon rank sum exact test
##
## data: home and away
## W = 6, p-value = 0.5833
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[1]][[6]][[2]][[2]][[3]]
## [[2]][[1]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.587
##
##
## [[2]][[1]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "-0.2099999999999998"
##
##
## [[2]][[1]][[6]][[2]][[3]]
## [[2]][[1]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[1]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 19, p-value = 0.1864
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[3]][[3]]
## [[2]][[1]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.1917
##
##
## [[2]][[1]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "1.242222222222222"
##
##
## [[2]][[1]][[6]][[2]][[4]]
## [[2]][[1]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[1]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 5, p-value = 0.1818

```

```

## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[1]][[6]][[2]][[4]][[3]]
## [[2]][[1]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.1944
##
##
## [[2]][[1]][[6]][[2]][[4]][[4]]
## [1] "diff in means"      "-1.62000000000001"
##
##
## [[2]][[1]][[6]][[2]][[5]]
## [[2]][[1]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[1]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 20, p-value = 0.01515
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[5]][[3]]
## [[2]][[1]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[5]][[3]][[2]]
## [1] 0
##
##
## [[2]][[1]][[6]][[2]][[5]][[4]]
## [1] "diff in means" "3.099"
##
##
## [[2]][[1]][[6]][[2]][[6]]
## [[2]][[1]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[1]][[6]][[2]][[6]][[2]]
## [1] "No home scores to test"
##
## [[2]][[1]][[6]][[2]][[6]][[3]]
## [1] "No home scores to test"
##
## [[2]][[1]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "NaN"
##
##

```

```

## [[2]][[1]][[6]][[2]][[7]]
## [[2]][[1]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[1]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 27, p-value = 0.004545
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[7]][[3]]
## [[2]][[1]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[7]][[3]][[2]]
## [1] 0
##
##
## [[2]][[1]][[6]][[2]][[7]][[4]]
## [1] "diff in means" "3.38"
##
##
## [[2]][[1]][[6]][[2]][[8]]
## [[2]][[1]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[1]][[6]][[2]][[8]][[2]]
## [1] "No home scores to test"
##
## [[2]][[1]][[6]][[2]][[8]][[3]]
## [1] "No home scores to test"
##
## [[2]][[1]][[6]][[2]][[8]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[1]][[6]][[2]][[9]]
## [[2]][[1]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[1]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 8, p-value = 0.3333
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[9]][[3]]
## [[2]][[1]][[6]][[2]][[9]][[3]][[1]]

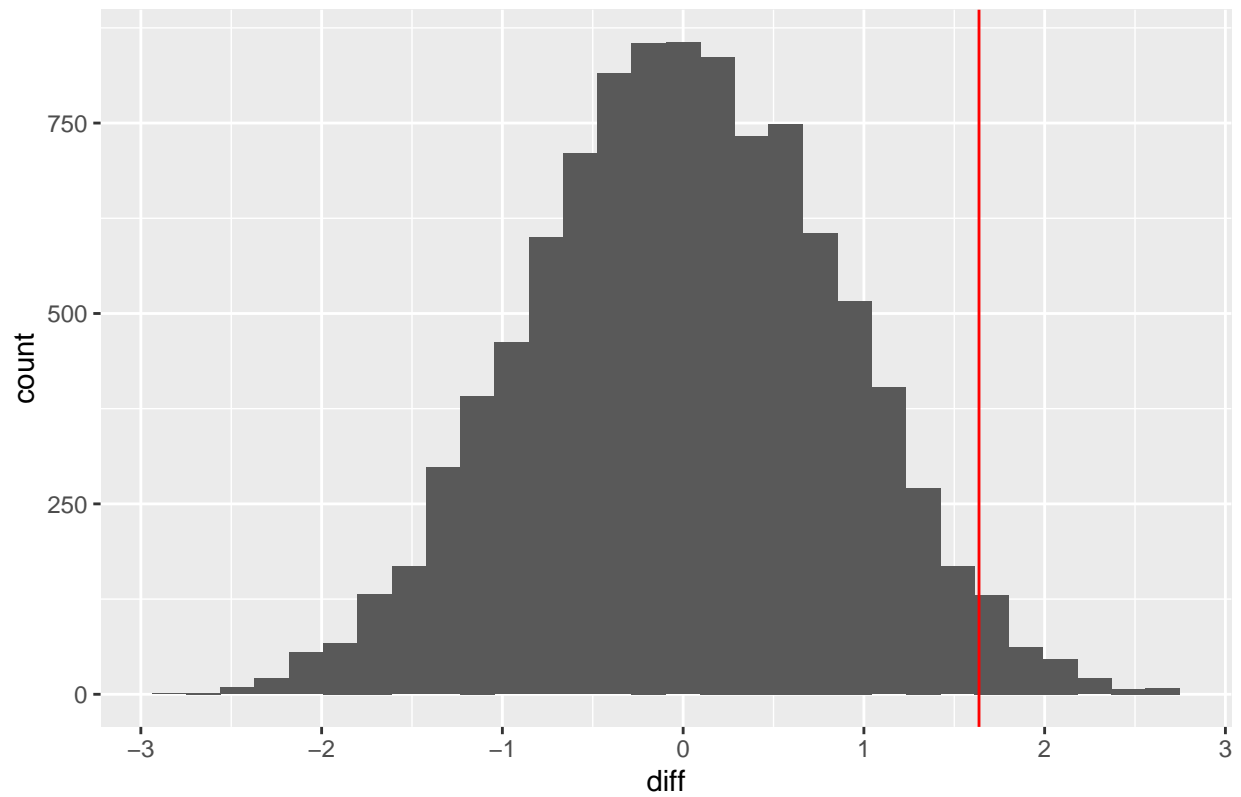
```

```

## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.2521
##
##
## [[2]][[1]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "1.79818181818182"
##
##
##
##
## [[2]][[2]]
## [[2]][[2]][[1]]
## [1] "Womens"                "sp"
## [3] "# of Obs."              "12"
## [5] "Standard Deviation of Observations" "2.55790771987754"
##
## [[2]][[2]][[2]]
##
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 66, p-value = 0.01709
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[3]]
## [[2]][[2]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[2]][[3]][[2]]

```

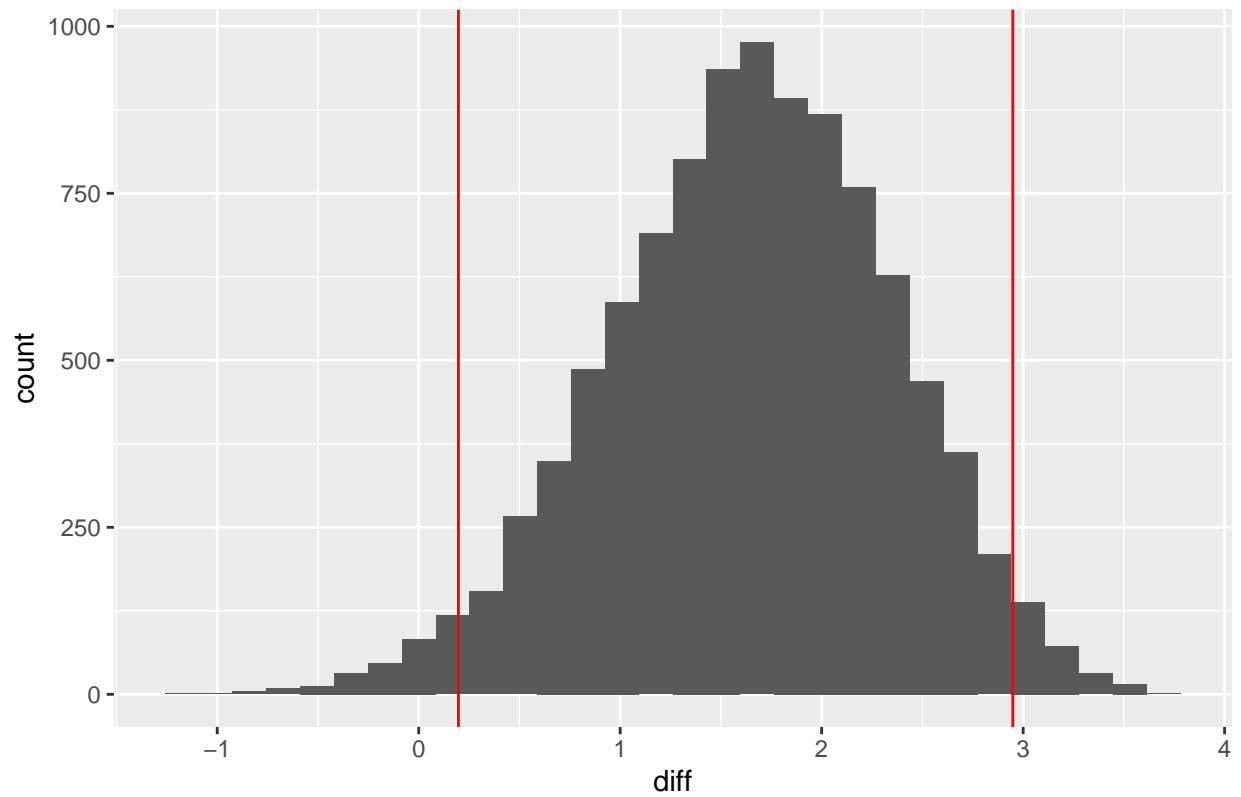
# Permutation test from panel mean, Womens sp at 2019 GP NHK Trophy



```
##
## [[2]][[2]][[3]][[3]]
## [1] 0.0257
##
## [[2]][[2]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[2]][[4]]
## [[2]][[2]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[2]][[4]][[2]]
```

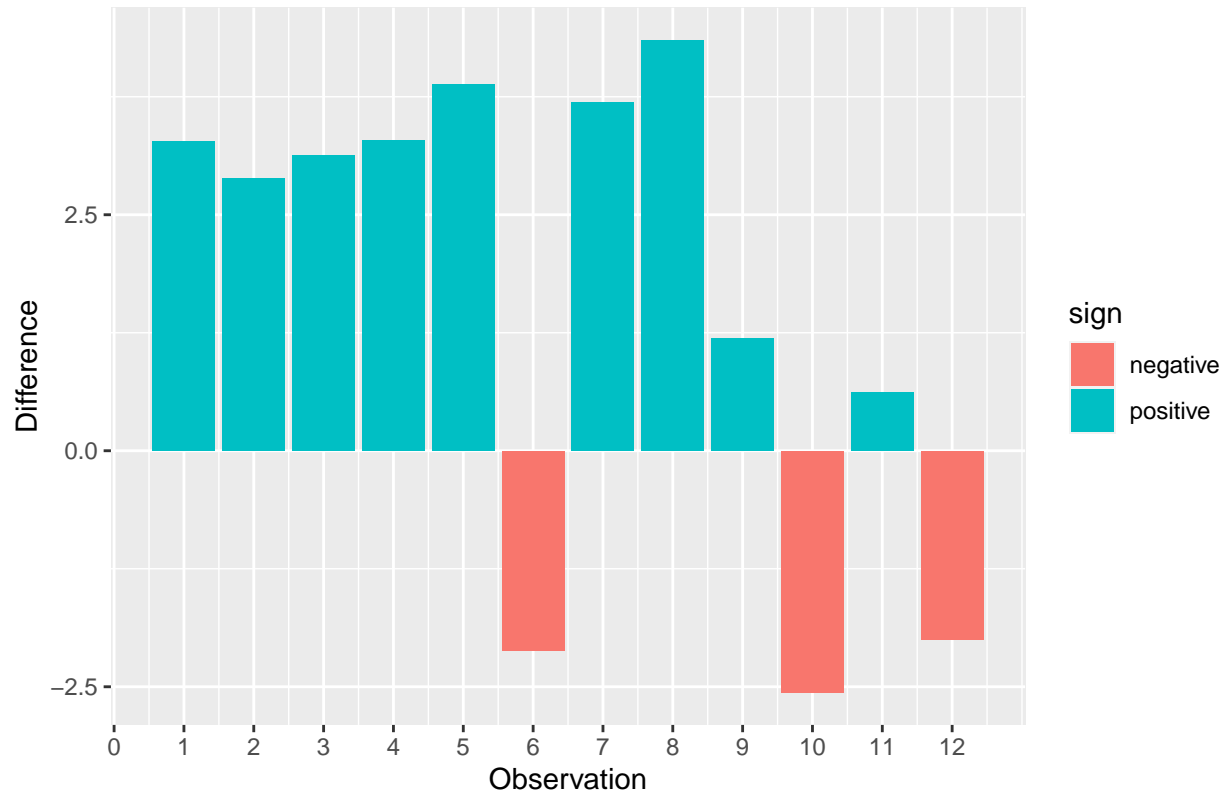


# Bootstrap Confidence Interval for from total, Womens sp at 2019 GP NHK



```
##
## [[2]] [[2]] [[4]] [[3]]
## [1] 0.1970547 2.9488568
##
## [[2]] [[2]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[2]] [[4]] [[5]]
## [1] 1.375901
##
##
## [[2]] [[2]] [[5]]
```

HJ score vs. Panel Mean for Womens sp at 2019 GP NHK Trophy



```
##
## [[2]][[2]][[6]]
## [[2]][[2]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[2]][[6]][[2]]
## [[2]][[2]][[6]][[2]][[1]]
## [[2]][[2]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[2]][[6]][[2]][[1]][[2]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[1]][[3]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[1]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[2]][[6]][[2]][[2]]
## [[2]][[2]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[2]][[6]][[2]][[2]][[2]]
##
```

```

## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 23, p-value = 0.05
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[2]][[3]]
## [[2]][[2]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.0602
##
##
## [[2]][[2]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "1.69222222222222"
##
##
## [[2]][[2]][[6]][[2]][[3]]
## [[2]][[2]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[2]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 4, p-value = 0.4167
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[2]][[6]][[2]][[3]][[3]]
## [[2]][[2]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.4184
##
##
## [[2]][[2]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "-0.667272727272726"
##
##
## [[2]][[2]][[6]][[2]][[4]]
## [[2]][[2]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[2]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 17, p-value = 0.3

```

```

## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[4]][[3]]
## [[2]][[2]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.3064
##
##
## [[2]][[2]][[6]][[2]][[4]][[4]]
## [1] "diff in means"      "0.8666666666666669"
##
##
## [[2]][[2]][[6]][[2]][[5]]
## [[2]][[2]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[2]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 27, p-value = 0.004545
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[5]][[3]]
## [[2]][[2]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[5]][[3]][[2]]
## [1] 0
##
##
## [[2]][[2]][[6]][[2]][[5]][[4]]
## [1] "diff in means"      "2.832222222222222"
##
##
## [[2]][[2]][[6]][[2]][[6]]
## [[2]][[2]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[2]][[6]][[2]][[6]][[2]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[6]][[3]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "NaN"
##
##

```

```

## [[2]][[2]][[6]][[2]][[7]]
## [[2]][[2]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[2]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 10, p-value = 0.1667
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[7]][[3]]
## [[2]][[2]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.0898
##
##
## [[2]][[2]][[6]][[2]][[7]][[4]]
## [1] "diff in means" "2.22181818181818"
##
##
## [[2]][[2]][[6]][[2]][[8]]
## [[2]][[2]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[2]][[6]][[2]][[8]][[2]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[8]][[3]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[8]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[2]][[6]][[2]][[9]]
## [[2]][[2]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[2]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 1, p-value = 0.1667
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[2]][[6]][[2]][[9]][[3]]
## [[2]][[2]][[6]][[2]][[9]][[3]][[1]]

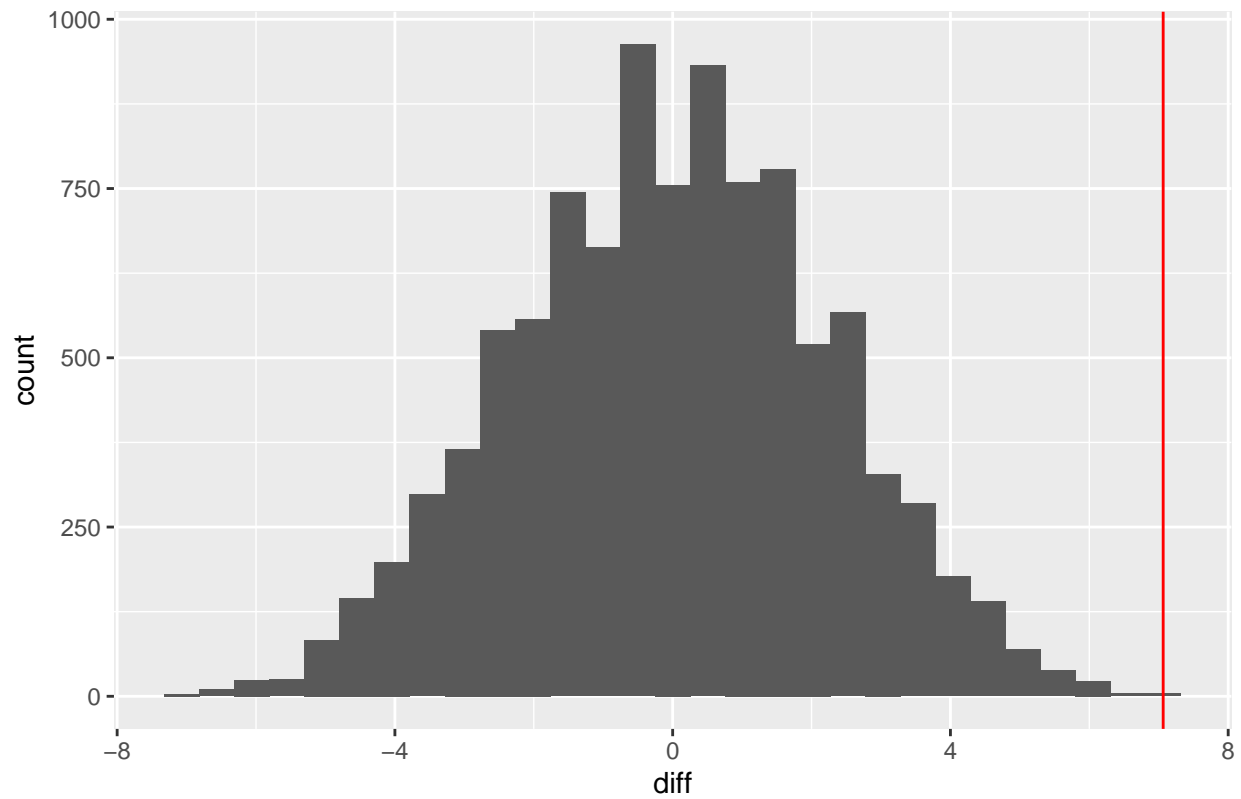
```

```

## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.1696
##
##
## [[2]][[2]][[6]][[2]][[9]][[4]]
## [1] "diff in means" "-1.18"
##
##
##
##
## [[2]][[3]]
## [[2]][[3]][[1]]
## [1] "Mens" "fp"
## [3] "# of Obs." "12"
## [5] "Standard Deviation of Observations" "3.62916953910403"
##
## [[2]][[3]][[2]]
##
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 77, p-value = 0.0004883
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[3]]
## [[2]][[3]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[3]][[3]][[2]]

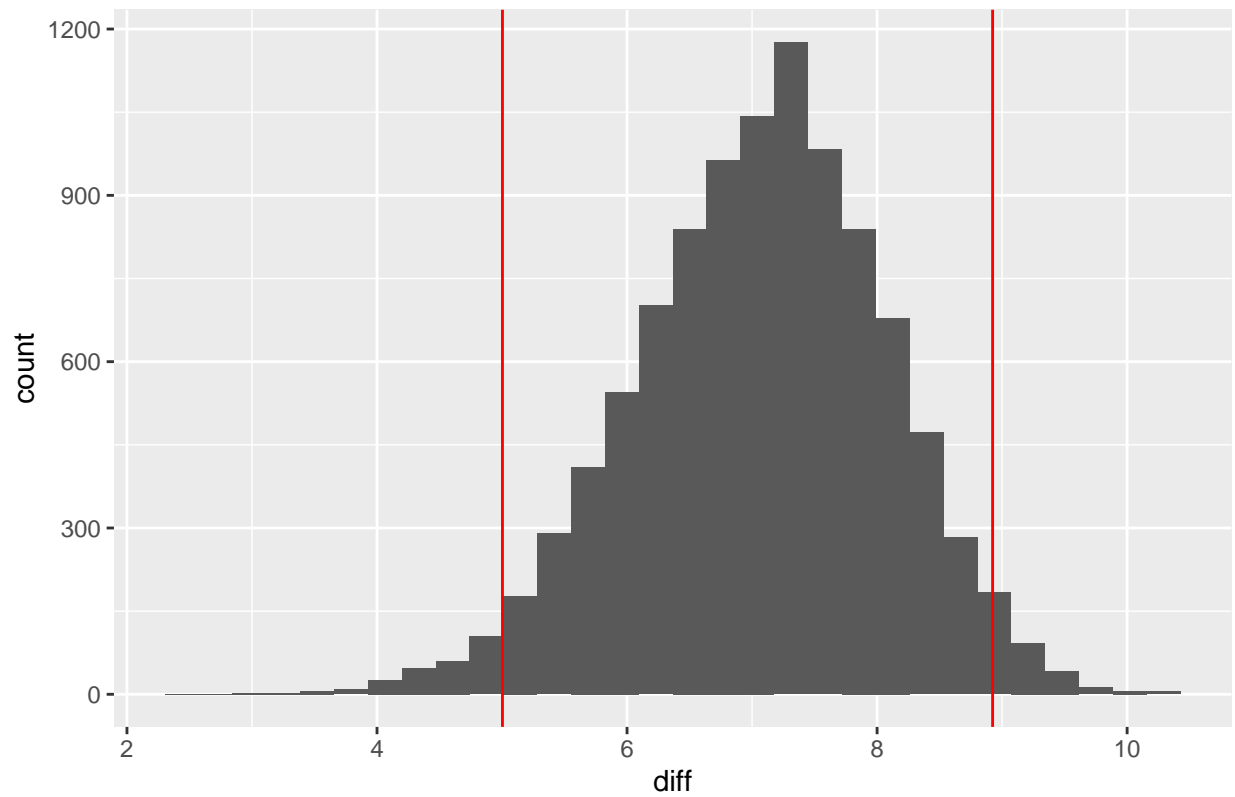
```

Permutation test from panel mean, Mens fp at 2019 GP NHK Trophy



```
##
## [[2]][[3]][[3]][[3]]
## [1] 3e-04
##
## [[2]][[3]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[3]][[4]]
## [[2]][[3]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[3]][[4]][[2]]
```

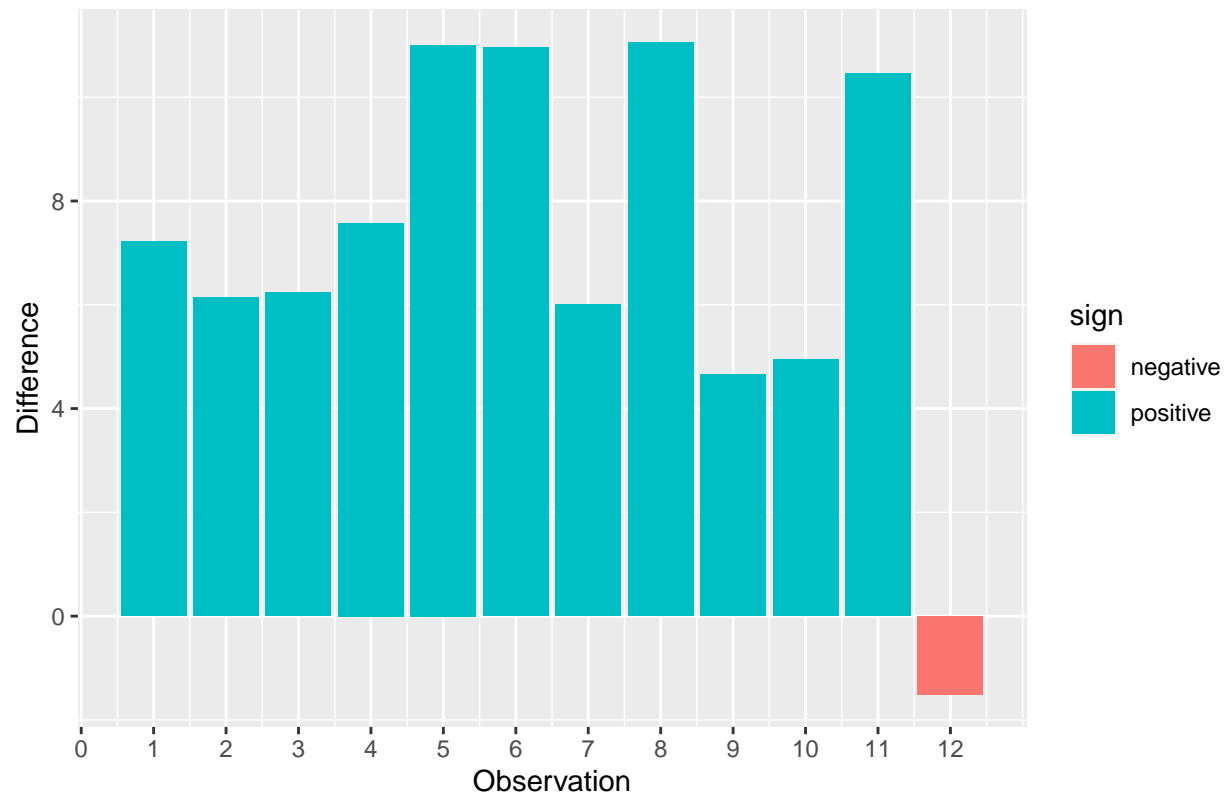
Bootstrap Confidence Interval for from total, Mens fp at 2019 GP NHK Troj



```
##
## [[2]] [[3]] [[4]] [[3]]
## [1] 5.003477 8.924010
##
## [[2]] [[3]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[3]] [[4]] [[5]]
## [1] 1.960267
##
##
## [[2]] [[3]] [[5]]
```



HJ score vs. Panel Mean for Mens fp at 2019 GP NHK Trophy



```
##
## [[2]][[3]][[6]]
## [[2]][[3]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[3]][[6]][[2]]
## [[2]][[3]][[6]][[2]][[1]]
## [[2]][[3]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[3]][[6]][[2]][[1]][[2]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[1]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[1]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[3]][[6]][[2]][[2]]
## [[2]][[3]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[3]][[6]][[2]][[2]][[2]]
##
```

```

## Wilcoxon rank sum exact test
##
## data: home and away
## W = 11, p-value = 0.08333
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[2]][[3]]
## [[2]][[3]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[2]][[3]][[2]]
## [1] 0
##
##
## [[2]][[3]][[6]][[2]][[2]][[4]]
## [1] "diff in means" "7.059090909090909"
##
##
## [[2]][[3]][[6]][[2]][[3]]
## [[2]][[3]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[3]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 21, p-value = 0.1045
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[3]][[3]]
## [[2]][[3]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.1031
##
##
## [[2]][[3]][[6]][[2]][[3]][[4]]
## [1] "diff in means" "3.625555555555556"
##
##
## [[2]][[3]][[6]][[2]][[4]]
## [[2]][[3]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[3]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 18, p-value = 0.06061

```

```

## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[4]][[3]]
## [[2]][[3]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.0774
##
##
## [[2]][[3]][[6]][[2]][[4]][[4]]
## [1] "diff in means" "7.069"
##
##
## [[2]][[3]][[6]][[2]][[5]]
## [[2]][[3]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[3]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 15, p-value = 0.1818
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[5]][[3]]
## [[2]][[3]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.132
##
##
## [[2]][[3]][[6]][[2]][[5]][[4]]
## [1] "diff in means" "4.399"
##
##
## [[2]][[3]][[6]][[2]][[6]]
## [[2]][[3]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[3]][[6]][[2]][[6]][[2]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[6]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "NaN"
##
##

```

```

## [[2]][[3]][[6]][[2]][[7]]
## [[2]][[3]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[3]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 27, p-value = 0.004545
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[7]][[3]]
## [[2]][[3]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[7]][[3]][[2]]
## [1] 0
##
##
## [[2]][[3]][[6]][[2]][[7]][[4]]
## [1] "diff in means" "6.87888888888889"
##
##
## [[2]][[3]][[6]][[2]][[8]]
## [[2]][[3]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[3]][[6]][[2]][[8]][[2]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[8]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[8]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[3]][[6]][[2]][[9]]
## [[2]][[3]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[3]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 11, p-value = 0.08333
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[9]][[3]]
## [[2]][[3]][[6]][[2]][[9]][[3]][[1]]

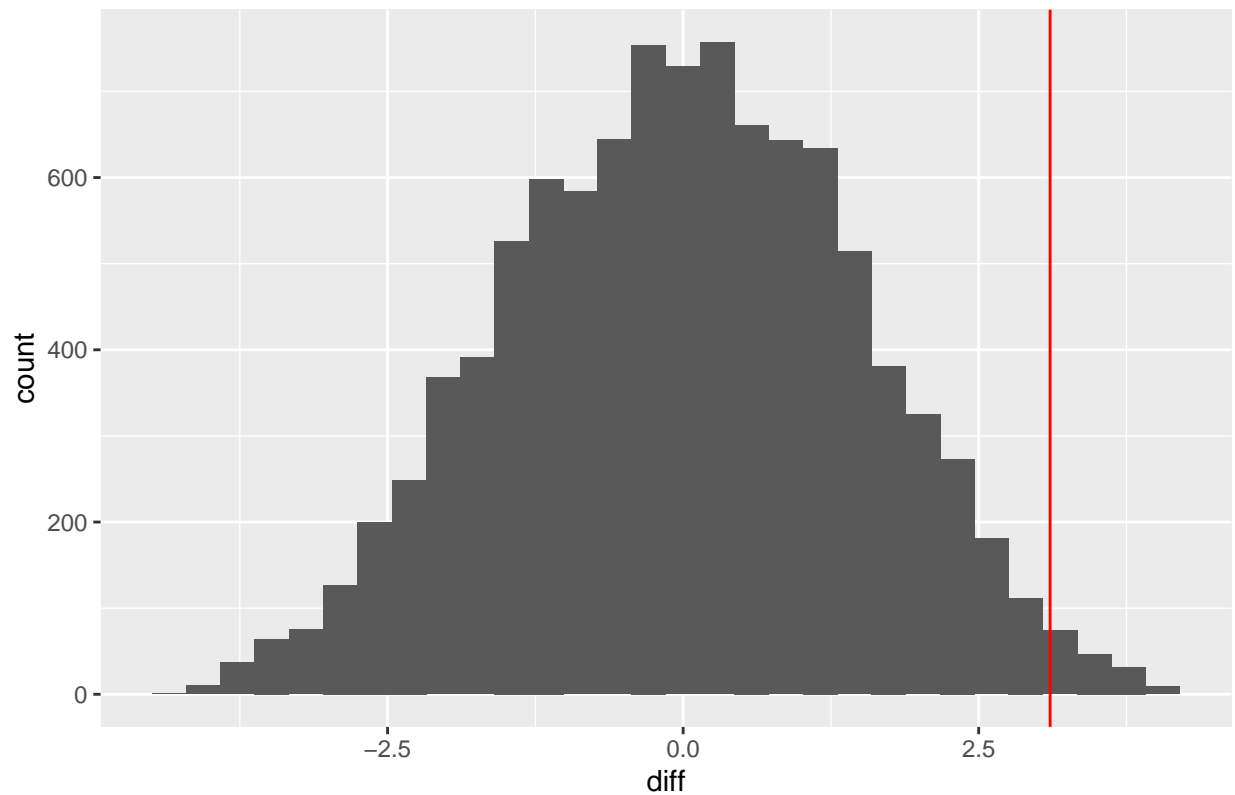
```

```

## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[9]][[3]][[2]]
## [1] 0
##
##
## [[2]][[3]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "8.74818181818181"
##
##
##
##
## [[2]][[4]]
## [[2]][[4]][[1]]
## [1] "Womens"                "fp"
## [3] "# of Obs."              "12"
## [5] "Standard Deviation of Observations" "4.25277223950653"
##
## [[2]][[4]][[2]]
##
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 63, p-value = 0.03198
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[3]]
## [[2]][[4]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[4]][[3]][[2]]

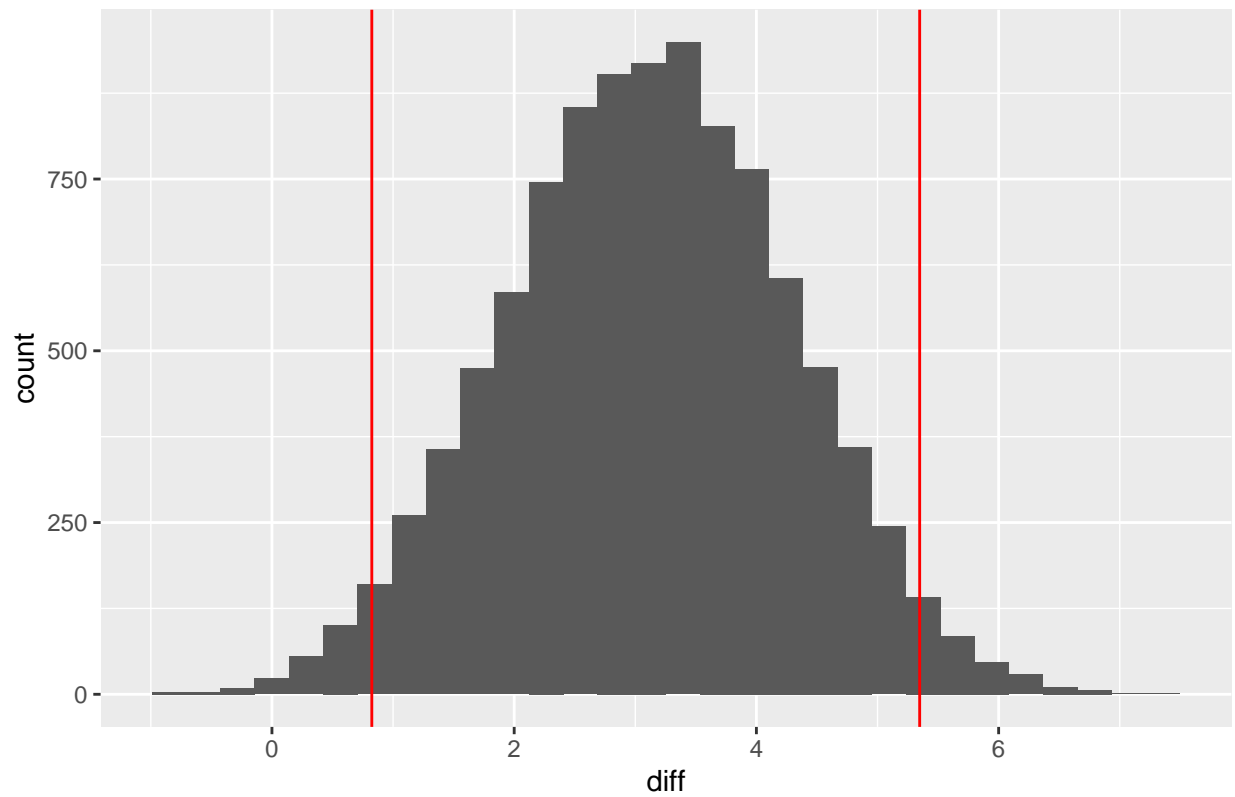
```

# Permutation test from panel mean, Womens fp at 2019 GP NHK Trophy

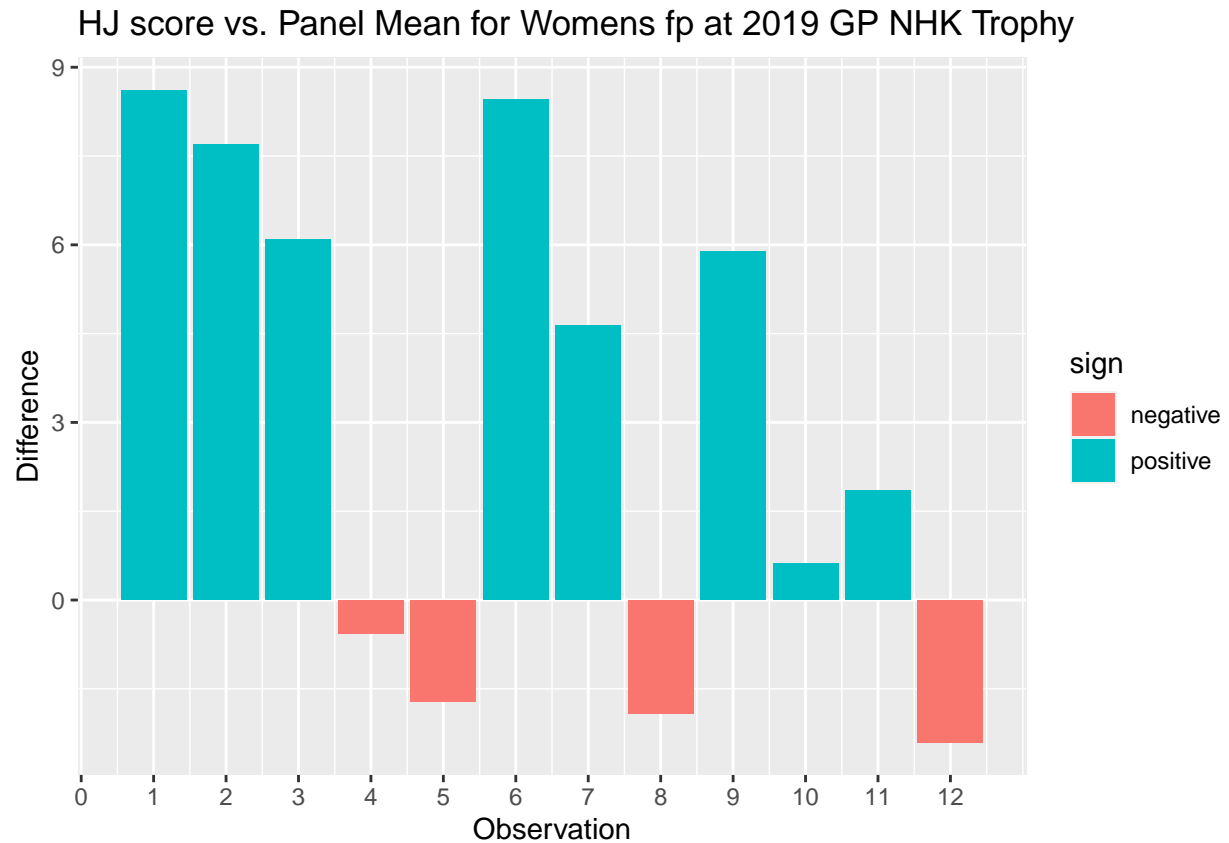


```
##
## [[2]][[4]][[3]][[3]]
## [1] 0.0142
##
## [[2]][[4]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[4]][[4]]
## [[2]][[4]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[4]][[4]][[2]]
```

# Bootstrap Confidence Interval for from total, Womens fp at 2019 GP NHK T



```
##
## [[2]] [[4]] [[4]] [[3]]
## [1] 0.8245156 5.3480703
##
## [[2]] [[4]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[4]] [[4]] [[5]]
## [1] 2.261777
##
##
## [[2]] [[4]] [[5]]
```



```
##
## [[2]][[4]][[6]]
## [[2]][[4]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[4]][[6]][[2]]
## [[2]][[4]][[6]][[2]][[1]]
## [[2]][[4]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[4]][[6]][[2]][[1]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[1]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[1]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[2]]
## [[2]][[4]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[4]][[6]][[2]][[2]][[2]]
##
```



```

## Wilcoxon rank sum exact test
##
## data: home and away
## W = 25, p-value = 0.01818
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[2]][[3]]
## [[2]][[4]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.0425
##
##
## [[2]][[4]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "4.36555555555556"
##
##
## [[2]][[4]][[6]][[2]][[3]]
## [[2]][[4]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[4]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 6, p-value = 0.5
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[3]][[3]]
## [[2]][[4]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.4177
##
##
## [[2]][[4]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "0.14818181818182"
##
##
## [[2]][[4]][[6]][[2]][[4]]
## [[2]][[4]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[4]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 16, p-value = 0.3636

```

```

## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[4]][[3]]
## [[2]][[4]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.3454
##
##
## [[2]][[4]][[6]][[2]][[4]][[4]]
## [1] "diff in means"      "0.747777777777781"
##
##
## [[2]][[4]][[6]][[2]][[5]]
## [[2]][[4]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[4]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 25, p-value = 0.01818
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[5]][[3]]
## [[2]][[4]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.0103
##
##
## [[2]][[4]][[6]][[2]][[5]][[4]]
## [1] "diff in means"      "3.47444444444444"
##
##
## [[2]][[4]][[6]][[2]][[6]]
## [[2]][[4]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[4]][[6]][[2]][[6]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[6]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "NaN"
##
##

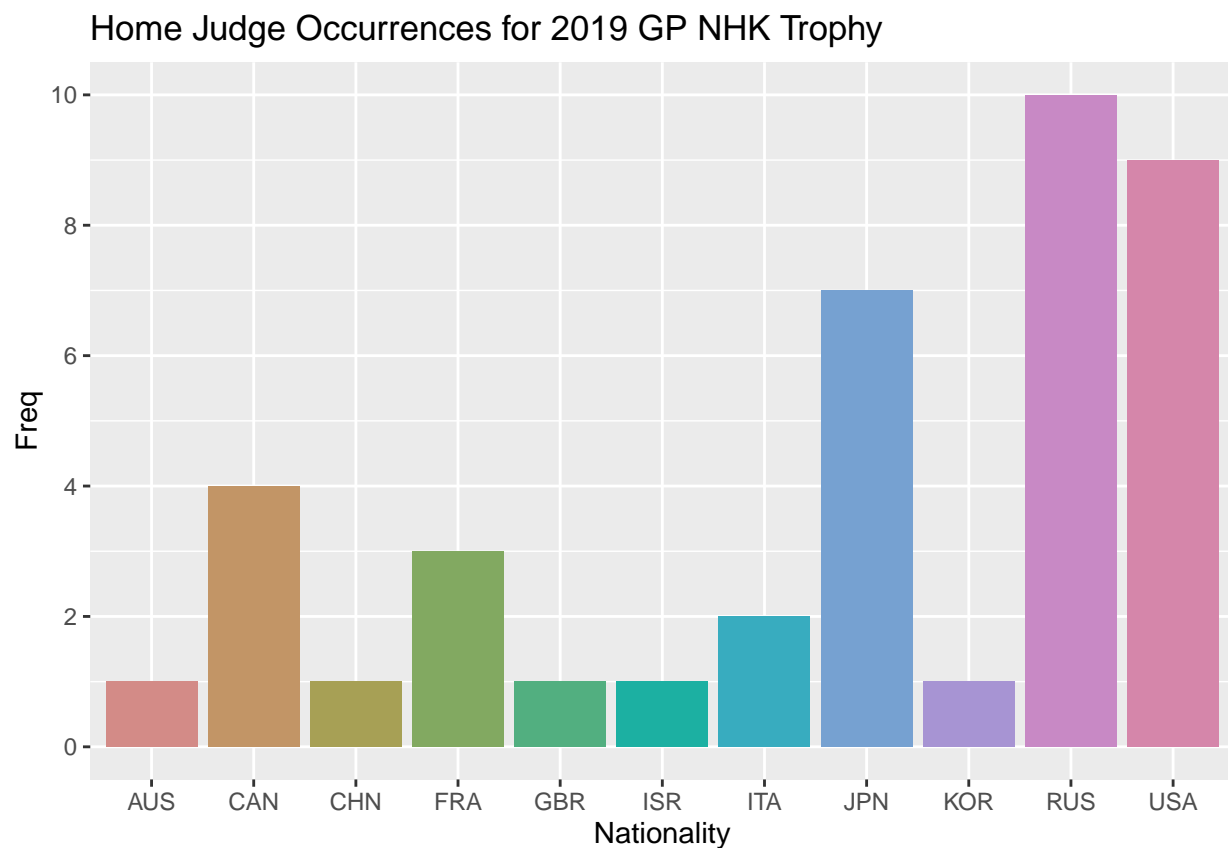
```

```

## [[2]][[4]][[6]][[2]][[7]]
## [[2]][[4]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[4]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 11, p-value = 0.08333
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[7]][[3]]
## [[2]][[4]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[7]][[3]][[2]]
## [1] 0
##
##
## [[2]][[4]][[6]][[2]][[7]][[4]]
## [1] "diff in means" "4.61454545454547"
##
##
## [[2]][[4]][[6]][[2]][[8]]
## [[2]][[4]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[4]][[6]][[2]][[8]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[8]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[8]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[9]]
## [[2]][[4]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[4]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 7.5, p-value = 0.3317
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[9]][[3]]
## [[2]][[4]][[6]][[2]][[9]][[3]][[1]]

```

```
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.4173
##
##
## [[2]][[4]][[6]][[2]][[9]][[4]]
## [1] "diff in means"    "1.3309090909091"
##
##
##
##
##
## [[3]]
```



```
results <- analyze_event("European Championships", "2020")
```

```
## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties
```

```
## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties
```

```
## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties
```

```
## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties

## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties

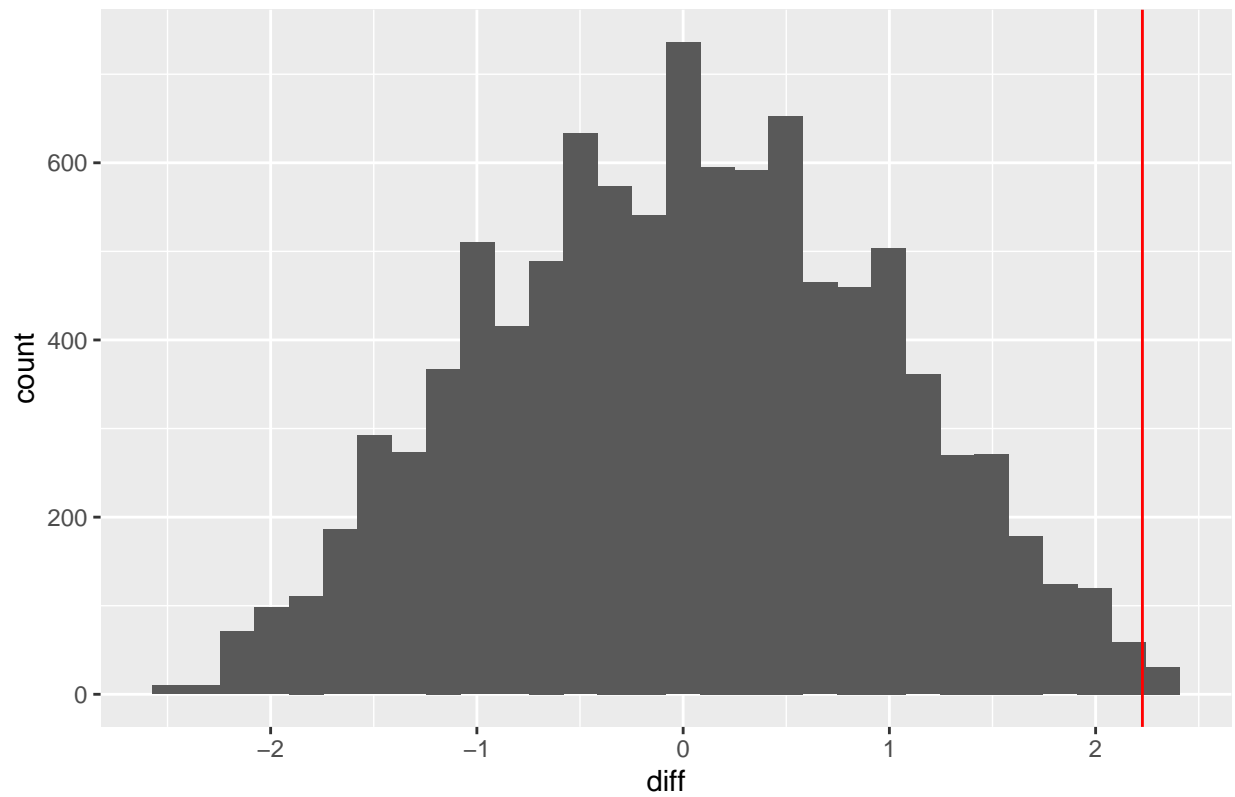
## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties

## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties
```

## results

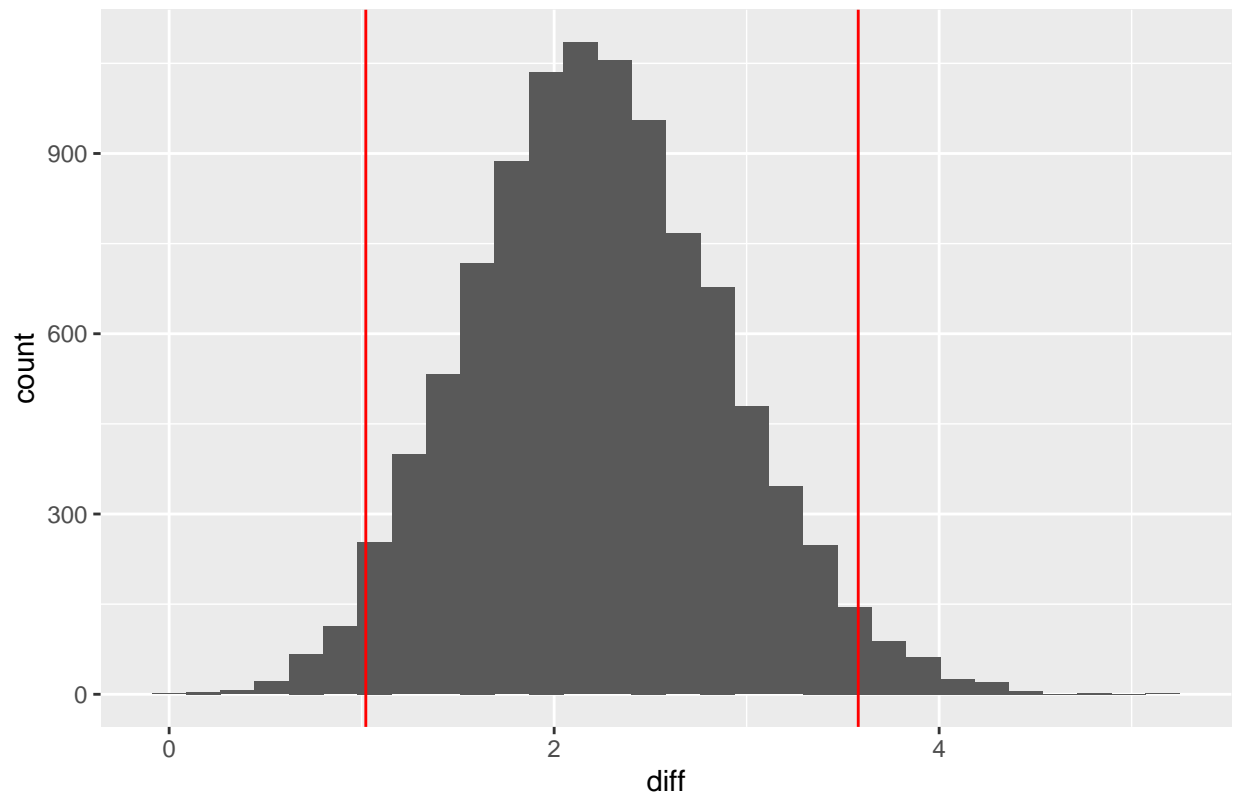
```
## [[1]]
## [1] "Results for 2020 European Championships"
##
## [[2]]
## [[2]][[1]]
## [[2]][[1]][[1]]
## [1] "Mens" "sp"
## [3] "# of Obs." "10"
## [5] "Standard Deviation of Observations" "2.18807232195627"
##
## [[2]][[1]][[2]]
##
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 52, p-value = 0.004883
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[3]]
## [[2]][[1]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[1]][[3]][[2]]
```

# Permutation test from panel mean, Mens sp at 2020 European Championsl



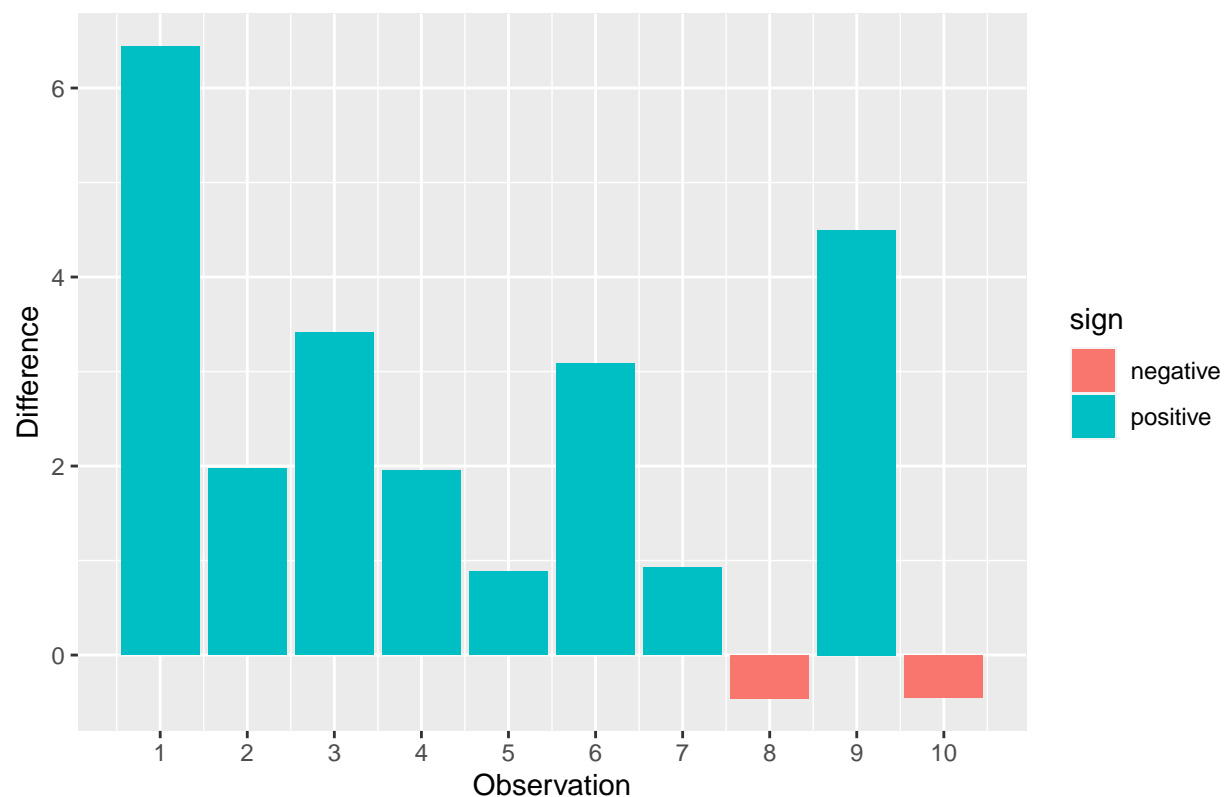
```
##
## [[2]][[1]][[3]][[3]]
## [1] 0.0037
##
## [[2]][[1]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[1]][[4]]
## [[2]][[1]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[1]][[4]][[2]]
```

# Bootstrap Confidence Interval for from total, Mens sp at 2020 European Ch



```
##
## [[2]] [[1]] [[4]] [[3]]
## [1] 1.021622 3.579656
##
## [[2]] [[1]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[1]] [[4]] [[5]]
## [1] 1.279017
##
##
## [[2]] [[1]] [[5]]
```

## HJ score vs. Panel Mean for Mens sp at 2020 European Championships



```
##
## [[2]][[1]][[6]]
## [[2]][[1]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[1]][[6]][[2]]
## [[2]][[1]][[6]][[2]][[1]]
## [[2]][[1]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[1]][[6]][[2]][[1]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 61, p-value = 0.02017
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[1]][[3]]
## [[2]][[1]][[6]][[2]][[1]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[1]][[3]][[2]]
## [1] 0.0075
##
```



```

##
## [[2]][[1]][[6]][[2]][[1]][[4]]
## [1] "diff in means"      "4.29151515151516"
##
##
## [[2]][[1]][[6]][[2]][[2]]
## [[2]][[1]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[1]][[6]][[2]][[2]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 24, p-value = 0.3143
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[2]][[3]]
## [[2]][[1]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.2832
##
##
## [[2]][[1]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "1.4264705882353"
##
##
## [[2]][[1]][[6]][[2]][[3]]
## [[2]][[1]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[1]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 22, p-value = 0.3714
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[3]][[3]]
## [[2]][[1]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.3436
##
##
## [[2]][[1]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "1.38705882352942"
##

```

```

##
## [[2]][[1]][[6]][[2]][[4]]
## [[2]][[1]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[1]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 29, p-value = 0.1714
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[4]][[3]]
## [[2]][[1]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.1429
##
##
## [[2]][[1]][[6]][[2]][[4]][[4]]
## [1] "diff in means" "1.87705882352942"
##
##
## [[2]][[1]][[6]][[2]][[5]]
## [[2]][[1]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[1]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 34, p-value = 0.02857
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[5]][[3]]
## [[2]][[1]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[5]][[3]][[2]]
## [1] 0
##
##
## [[2]][[1]][[6]][[2]][[5]][[4]]
## [1] "diff in means" "4.47911764705882"
##
##
## [[2]][[1]][[6]][[2]][[6]]
## [[2]][[1]][[6]][[2]][[6]][[1]]
## [1] "j_6"

```

```

##
## [[2]][[1]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 13, p-value = 0.3645
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[1]][[6]][[2]][[6]][[3]]
## [[2]][[1]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[6]][[3]][[2]]
## [1] 0.3818
##
##
## [[2]][[1]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "-0.344705882352941"
##
##
## [[2]][[1]][[6]][[2]][[7]]
## [[2]][[1]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[1]][[6]][[2]][[7]][[2]]
## [1] "No home scores to test"
##
## [[2]][[1]][[6]][[2]][[7]][[3]]
## [1] "No home scores to test"
##
## [[2]][[1]][[6]][[2]][[7]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[1]][[6]][[2]][[8]]
## [[2]][[1]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[1]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 35, p-value = 0.5697
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[1]][[6]][[2]][[8]][[3]]
## [[2]][[1]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[8]][[3]][[2]]

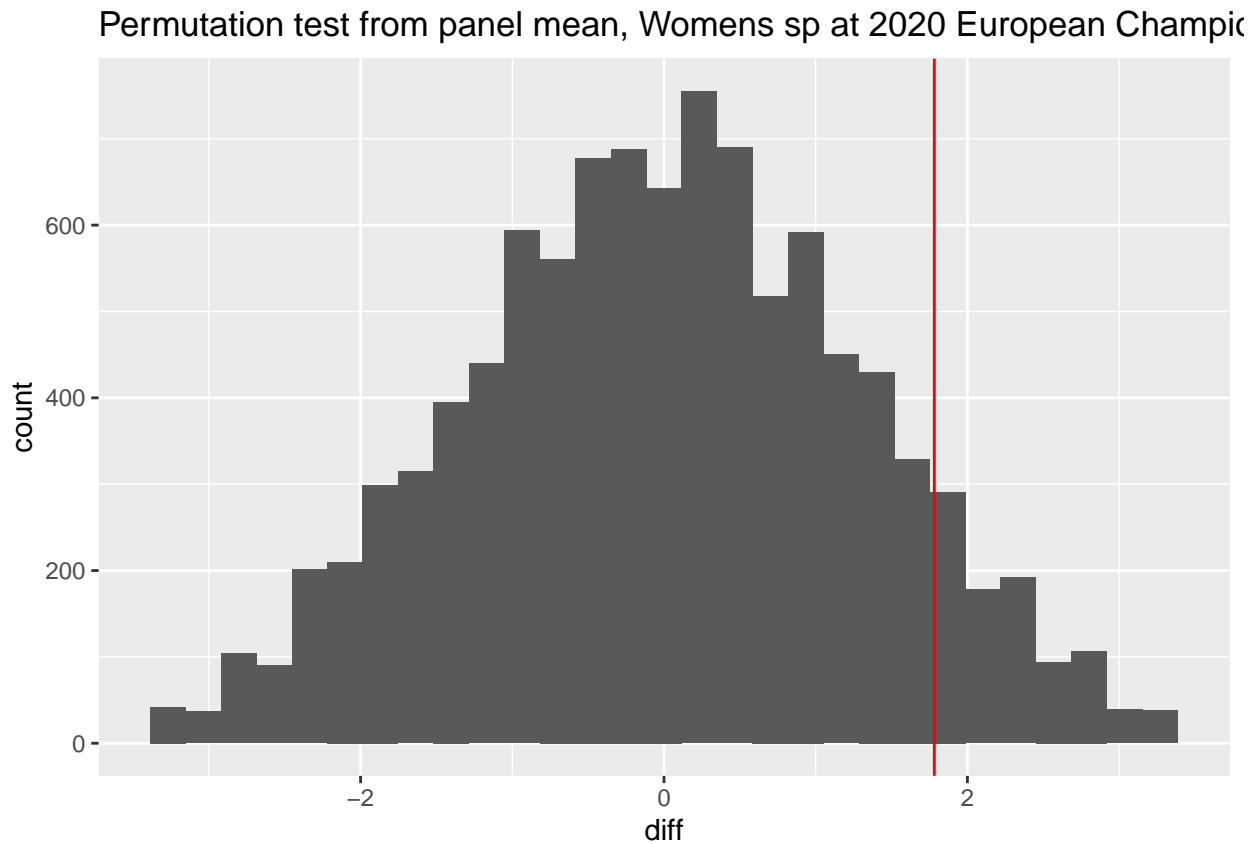
```

```

## [1] 0.4736
##
##
## [[2]][[1]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "-0.2137878787881"
##
##
## [[2]][[1]][[6]][[2]][[9]]
## [[2]][[1]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[1]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data:  home and away
## W = 31, p-value = 0.09065
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[9]][[3]]
## [[2]][[1]][[6]][[2]][[9]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.1735
##
##
## [[2]][[1]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "2.4764705882353"
##
##
##
##
## [[2]][[2]]
## [[2]][[2]][[1]]
## [1] "Womens"                  "sp"
## [3] "# of Obs."              "10"
## [5] "Standard Deviation of Observations" "3.9109687365579"
##
## [[2]][[2]][[2]]
##
## Wilcoxon signed rank exact test
##
## data:  home_judge and panel_mean
## V = 37, p-value = 0.1875
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[3]]
## [[2]][[2]][[3]][[1]]
## [1] "Permuation Test p-value"
##

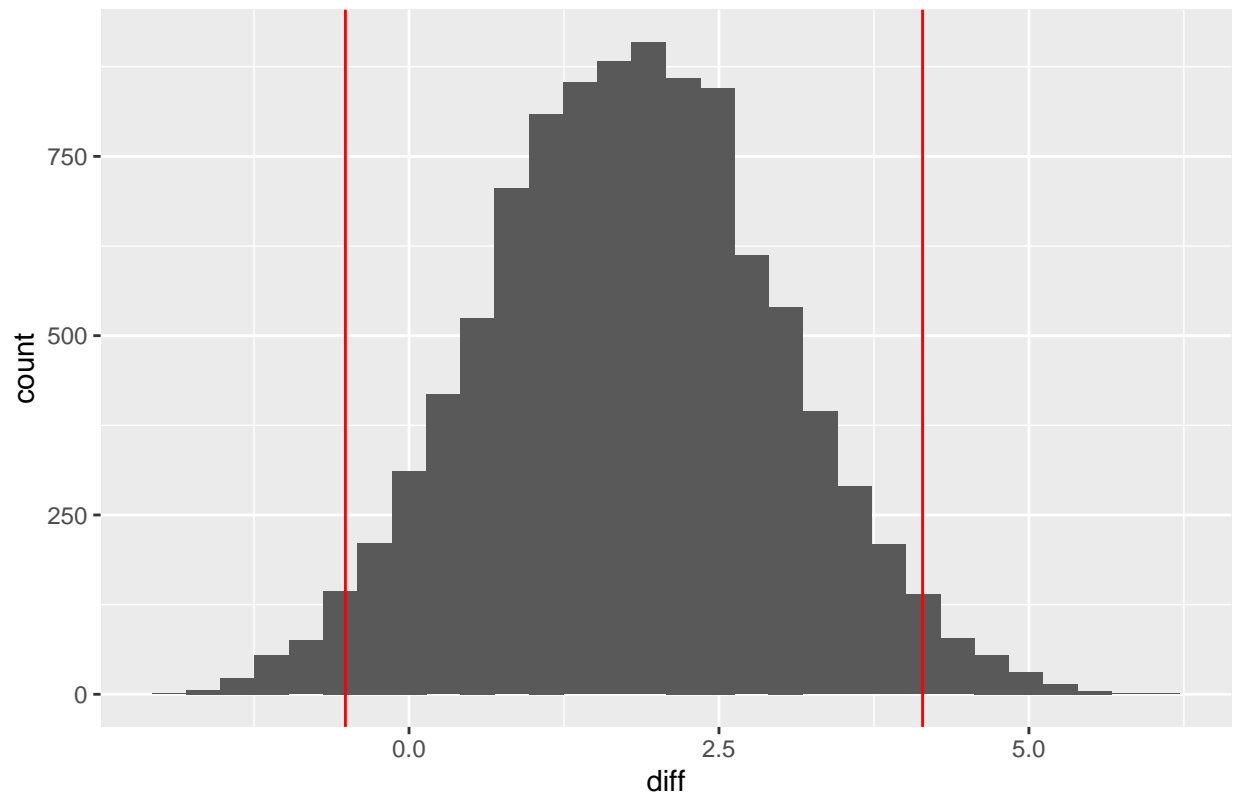
```

```
## [[2]][[2]][[3]][[2]]
```



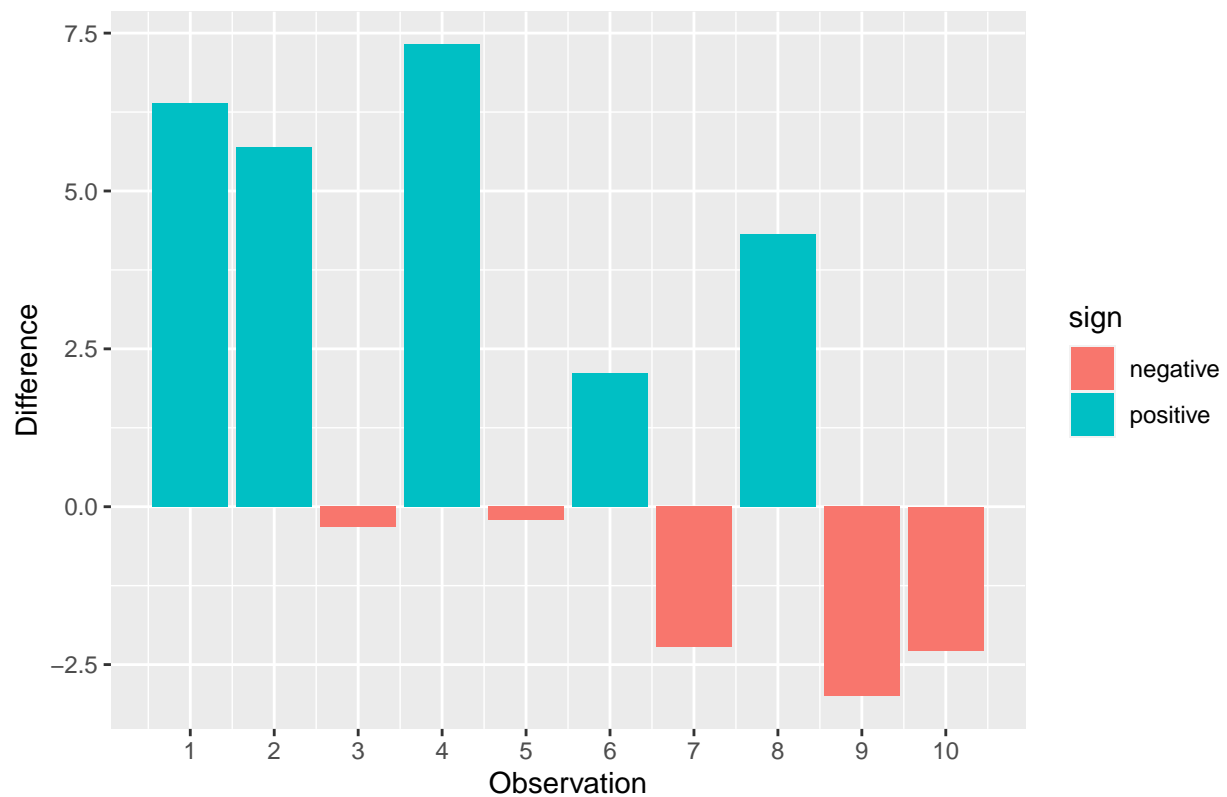
```
##
## [[2]][[2]][[3]][[3]]
## [1] 0.0914
##
## [[2]][[2]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[2]][[4]]
## [[2]][[2]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[2]][[4]][[2]]
```

# Bootstrap Confidence Interval for from total, Womens sp at 2020 European



```
##
## [[2]] [[2]] [[4]] [[3]]
## [1] -0.5131563 4.1424156
##
## [[2]] [[2]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[2]] [[4]] [[5]]
## [1] 2.327786
##
##
## [[2]] [[2]] [[5]]
```

## HJ score vs. Panel Mean for Womens sp at 2020 European Championship



```
##
## [[2]][[2]][[6]]
## [[2]][[2]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[2]][[6]][[2]]
## [[2]][[2]][[6]][[2]][[1]]
## [[2]][[2]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[2]][[6]][[2]][[1]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 34, p-value = 0.07328
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[1]][[3]]
## [[2]][[2]][[6]][[2]][[1]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[1]][[3]][[2]]
## [1] 0.0797
##
```

```

##
## [[2]][[2]][[6]][[2]][[1]][[4]]
## [1] "diff in means"      "3.180555555555556"
##
##
## [[2]][[2]][[6]][[2]][[2]]
## [[2]][[2]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[2]][[6]][[2]][[2]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data:  home and away
## W = 17, p-value = 0.4813
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[2]][[6]][[2]][[2]][[3]]
## [[2]][[2]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.4587
##
##
## [[2]][[2]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "-0.008055555555555637"
##
##
## [[2]][[2]][[6]][[2]][[3]]
## [[2]][[2]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[2]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 10, p-value = 0.2973
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[2]][[6]][[2]][[3]][[3]]
## [[2]][[2]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.2901
##
##
## [[2]][[2]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "-0.9583333333333338"
##
##

```



```

##
## [[2]][[2]][[6]][[2]][[4]]
## [[2]][[2]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[2]][[6]][[2]][[4]][[2]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[4]][[3]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[4]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[2]][[6]][[2]][[5]]
## [[2]][[2]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[2]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 20, p-value = 0.4595
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[5]][[3]]
## [[2]][[2]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.4347
##
##
## [[2]][[2]][[6]][[2]][[5]][[4]]
## [1] "diff in means" "0.390277777777779"
##
##
## [[2]][[2]][[6]][[2]][[6]]
## [[2]][[2]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[2]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 1, p-value = 0.06111
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[2]][[6]][[2]][[6]][[3]]

```

```

## [[2]][[2]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[6]][[3]][[2]]
## [1] 0.0548
##
##
## [[2]][[2]][[6]][[2]][[6]][[4]]
## [1] "diff in means"      "-2.75916666666667"
##
##
## [[2]][[2]][[6]][[2]][[7]]
## [[2]][[2]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[2]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 96, p-value = 0.00296
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[7]][[3]]
## [[2]][[2]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.0052
##
##
## [[2]][[2]][[6]][[2]][[7]][[4]]
## [1] "diff in means"      "3.90725490196078"
##
##
## [[2]][[2]][[6]][[2]][[8]]
## [[2]][[2]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[2]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 21, p-value = 0.4324
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[8]][[3]]
## [[2]][[2]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[8]][[3]][[2]]

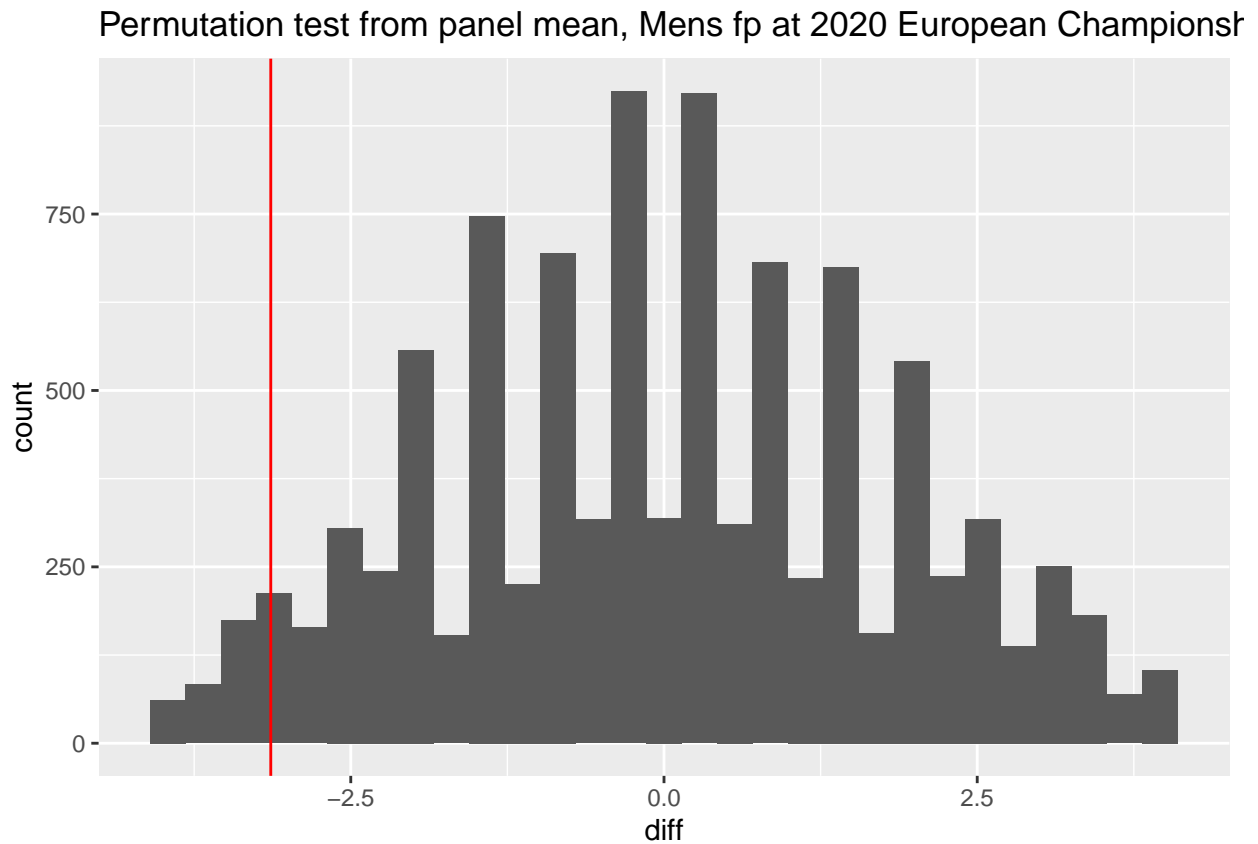
```

```

## [1] 0.4128
##
##
## [[2]][[2]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "0.366666666666665"
##
##
## [[2]][[2]][[6]][[2]][[9]]
## [[2]][[2]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[2]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data:  home and away
## W = 35, p-value = 0.06111
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[9]][[3]]
## [[2]][[2]][[6]][[2]][[9]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.0528
##
##
## [[2]][[2]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "3.71694444444445"
##
##
##
##
## [[2]][[3]]
## [[2]][[3]][[1]]
## [1] "Mens"                  "fp"
## [3] "# of Obs."            "7"
## [5] "Standard Deviation of Observations" "3.78375328393521"
##
## [[2]][[3]][[2]]
##
## Wilcoxon signed rank exact test
##
## data:  home_judge and panel_mean
## V = 4, p-value = 0.05469
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[3]]
## [[2]][[3]][[3]][[1]]
## [1] "Permuation Test p-value"
##

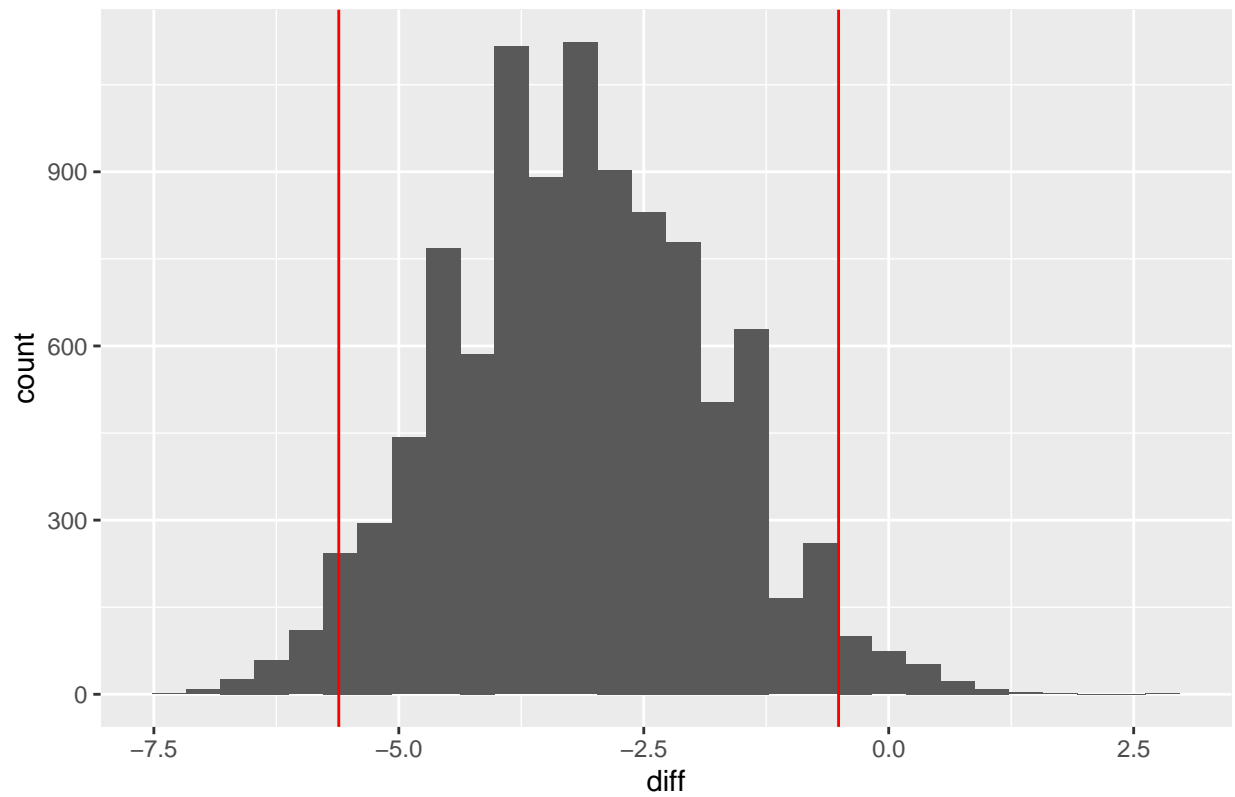
```

```
## [[2]][[3]][[3]][[2]]
```



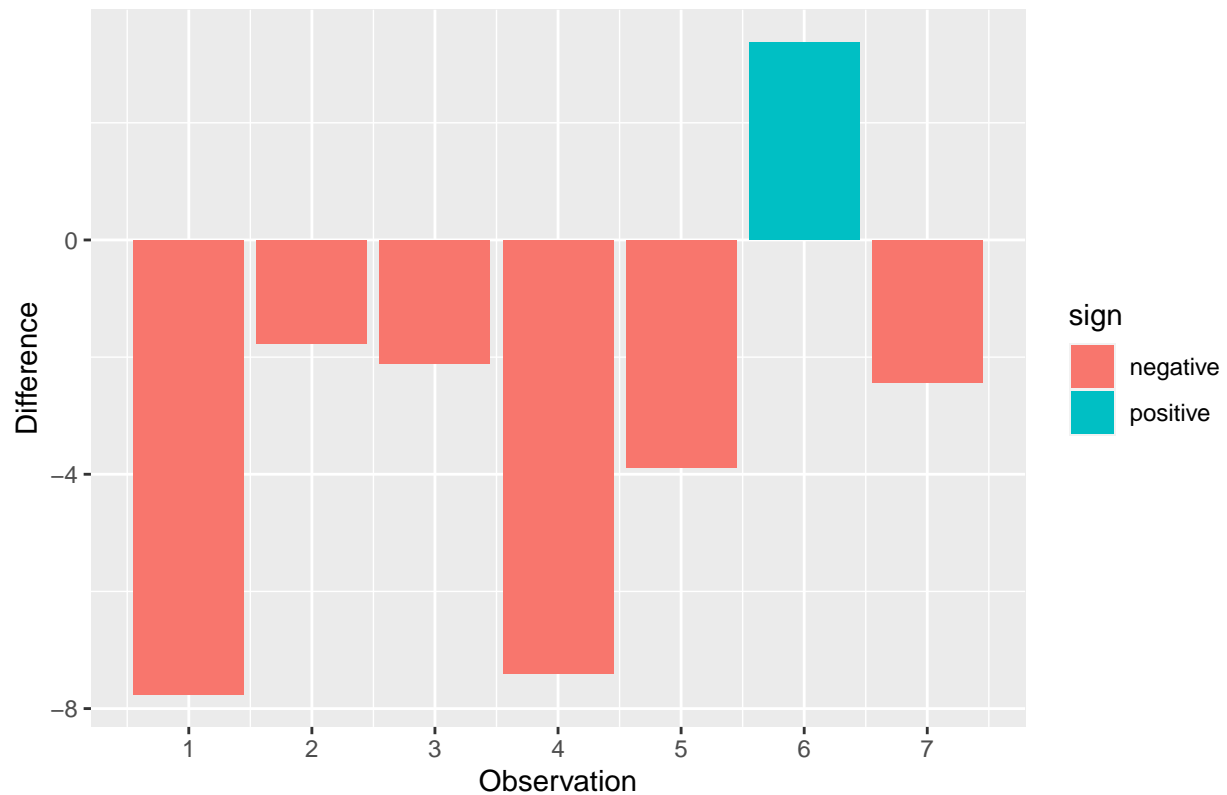
```
##
## [[2]][[3]][[3]][[3]]
## [1] 0.0392
##
## [[2]][[3]][[3]][[4]]
## [1] "hA = true mean is less than 0 (underscoring)"
##
##
## [[2]][[3]][[4]]
## [[2]][[3]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[3]][[4]][[2]]
```

Bootstrap Confidence Interval for from total, Mens fp at 2020 European Ch:



```
##
## [[2]][[3]][[4]][[3]]
## [1] -5.6128571 -0.5117857
##
## [[2]][[3]][[4]][[4]]
## [1] "MOE"
##
## [[2]][[3]][[4]][[5]]
## [1] 2.550536
##
##
## [[2]][[3]][[5]]
```

## HJ score vs. Panel Mean for Mens fp at 2020 European Championships



```
##
## [[2]][[3]][[6]]
## [[2]][[3]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[3]][[6]][[2]]
## [[2]][[3]][[6]][[2]][[1]]
## [[2]][[3]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[3]][[6]][[2]][[1]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 9, p-value = 0.0958
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[1]][[3]]
## [[2]][[3]][[6]][[2]][[1]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[1]][[3]][[2]]
## [1] 0.133
##
```

```

##
## [[2]][[3]][[6]][[2]][[1]][[4]]
## [1] "diff in means"      "-3.04045454545454"
##
##
## [[2]][[3]][[6]][[2]][[2]]
## [[2]][[3]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[3]][[6]][[2]][[2]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 8, p-value = 0.375
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[2]][[3]]
## [[2]][[3]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.3694
##
##
## [[2]][[3]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "-0.975217391304346"
##
##
## [[2]][[3]][[6]][[2]][[3]]
## [[2]][[3]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[3]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 10, p-value = 0.4583
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[3]][[3]]
## [[2]][[3]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.4556
##
##
## [[2]][[3]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "-0.397826086956524"
##

```

```

##
## [[2]][[3]][[6]][[2]][[4]]
## [[2]][[3]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[3]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 5, p-value = 0.25
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[4]][[3]]
## [[2]][[3]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.2472
##
##
## [[2]][[3]][[6]][[2]][[4]][[4]]
## [1] "diff in means"      "-1.87304347826087"
##
##
## [[2]][[3]][[6]][[2]][[5]]
## [[2]][[3]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[3]][[6]][[2]][[5]][[2]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[5]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[5]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[3]][[6]][[2]][[6]]
## [[2]][[3]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[3]][[6]][[2]][[6]][[2]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[6]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "NaN"
##
##

```



```

## [[2]][[3]][[6]][[2]][[7]]
## [[2]][[3]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[3]][[6]][[2]][[7]][[2]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[7]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[7]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[3]][[6]][[2]][[8]]
## [[2]][[3]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[3]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 10, p-value = 0.4583
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[8]][[3]]
## [[2]][[3]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[8]][[3]][[2]]
## [1] 0.46
##
##
## [[2]][[3]][[6]][[2]][[8]][[4]]
## [1] "diff in means" "-0.87304347826089"
##
##
## [[2]][[3]][[6]][[2]][[9]]
## [[2]][[3]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[3]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 4, p-value = 0.2083
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[9]][[3]]
## [[2]][[3]][[6]][[2]][[9]][[3]][[1]]

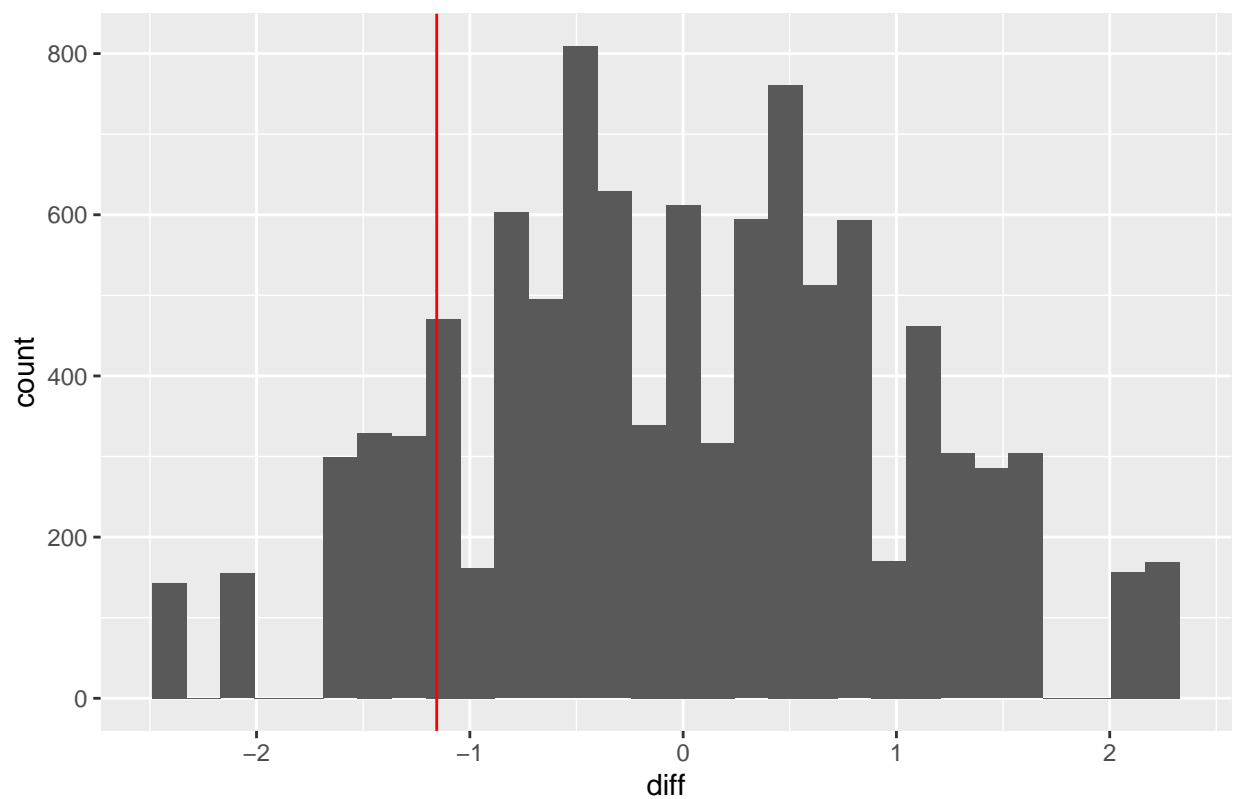
```

```

## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.2084
##
##
## [[2]][[3]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "-6.73217391304347"
##
##
##
##
## [[2]][[4]]
## [[2]][[4]][[1]]
## [1] "Womens"                "fp"
## [3] "# of Obs."              "6"
## [5] "Standard Deviation of Observations" "2.38461834166742"
##
## [[2]][[4]][[2]]
##
## Wilcoxon signed rank exact test
##
## data:  home_judge and panel_mean
## V = 6, p-value = 0.2188
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[3]]
## [[2]][[4]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[4]][[3]][[2]]

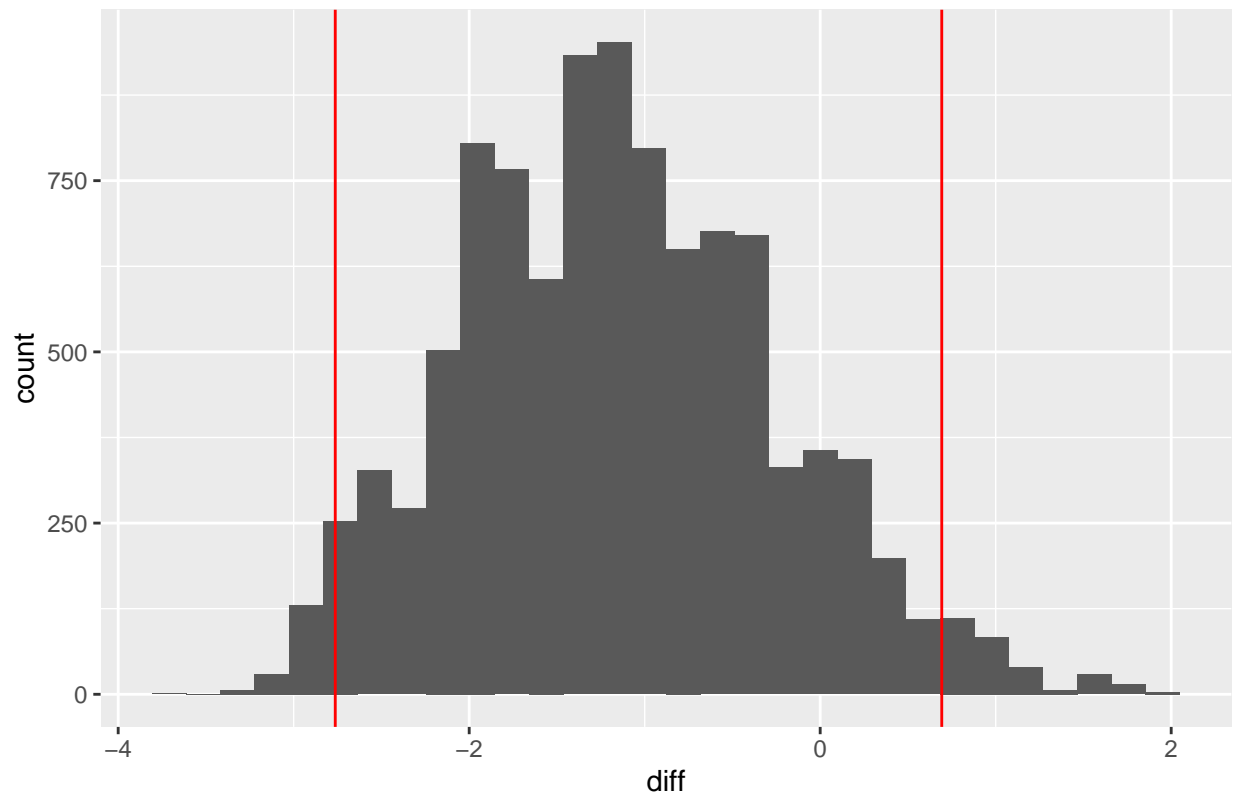
```

Permutation test from panel mean, Womens fp at 2020 European Champio



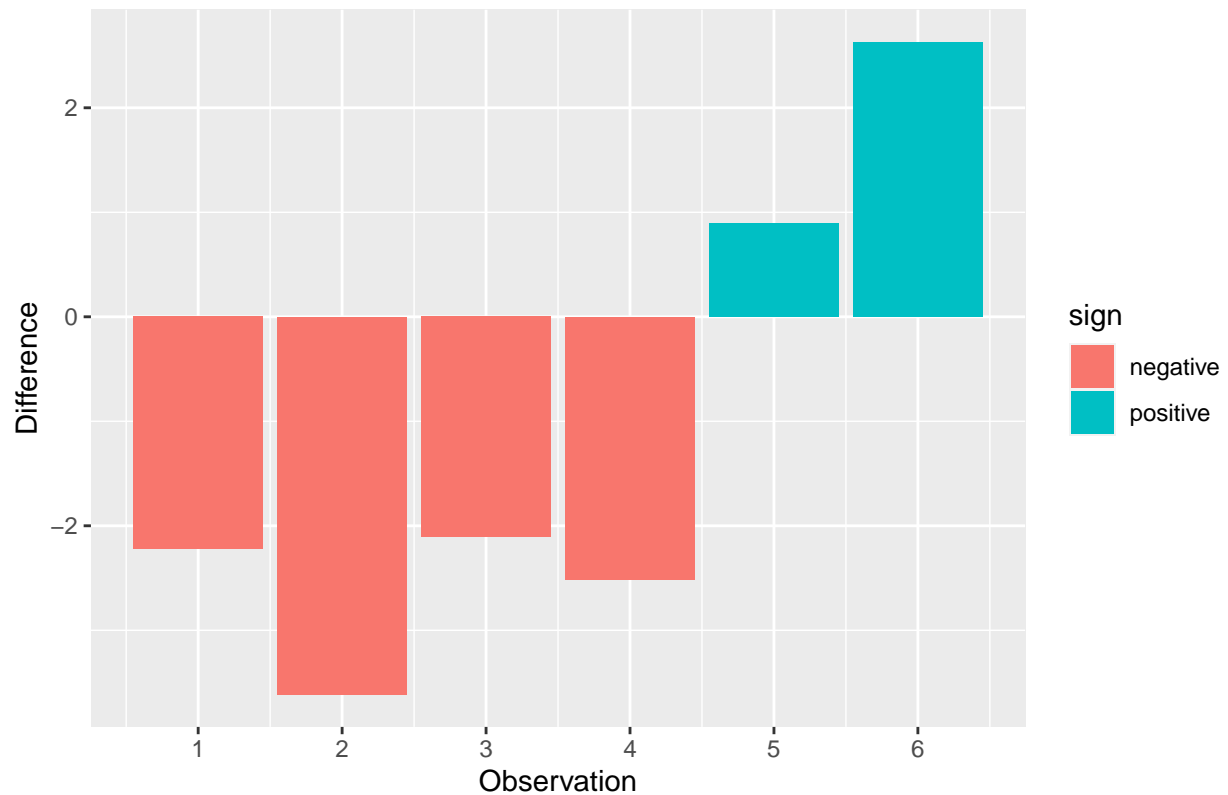
```
##
## [[2]][[4]][[3]][[3]]
## [1] 0.1576
##
## [[2]][[4]][[3]][[4]]
## [1] "hA = true mean is less than 0 (underscoring)"
##
##
## [[2]][[4]][[4]]
## [[2]][[4]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[4]][[4]][[2]]
```

Bootstrap Confidence Interval for from total, Womens fp at 2020 European



```
##
## [[2]][[4]][[4]][[3]]
## [1] -2.7631250  0.6927083
##
## [[2]][[4]][[4]][[4]]
## [1] "MOE"
##
## [[2]][[4]][[4]][[5]]
## [1] 1.727917
##
##
## [[2]][[4]][[5]]
```

## HJ score vs. Panel Mean for Womens fp at 2020 European Championships



```
##
## [[2]][[4]][[6]]
## [[2]][[4]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[4]][[6]][[2]]
## [[2]][[4]][[6]][[2]][[1]]
## [[2]][[4]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[4]][[6]][[2]][[1]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 2, p-value = 0.125
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[6]][[2]][[1]][[3]]
## [[2]][[4]][[6]][[2]][[1]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[1]][[3]][[2]]
## [1] 0.1222
##
```

```

##
## [[2]][[4]][[6]][[2]][[1]][[4]]
## [1] "diff in means"      "-3.430000000000001"
##
##
## [[2]][[4]][[6]][[2]][[2]]
## [[2]][[4]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[4]][[6]][[2]][[2]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[2]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[2]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[3]]
## [[2]][[4]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[4]][[6]][[2]][[3]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[3]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[3]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[4]]
## [[2]][[4]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[4]][[6]][[2]][[4]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[4]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[4]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[5]]
## [[2]][[4]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[4]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test

```

```

##
## data:  home and away
## W = 19, p-value = 0.2083
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[5]][[3]]
## [[2]][[4]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.1646
##
##
## [[2]][[4]][[6]][[2]][[5]][[4]]
## [1] "diff in means"      "3.02043478260869"
##
##
## [[2]][[4]][[6]][[2]][[6]]
## [[2]][[4]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[4]][[6]][[2]][[6]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[6]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[7]]
## [[2]][[4]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[4]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 19, p-value = 0.1551
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[6]][[2]][[7]][[3]]
## [[2]][[4]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.1443
##
##
## [[2]][[4]][[6]][[2]][[7]][[4]]

```

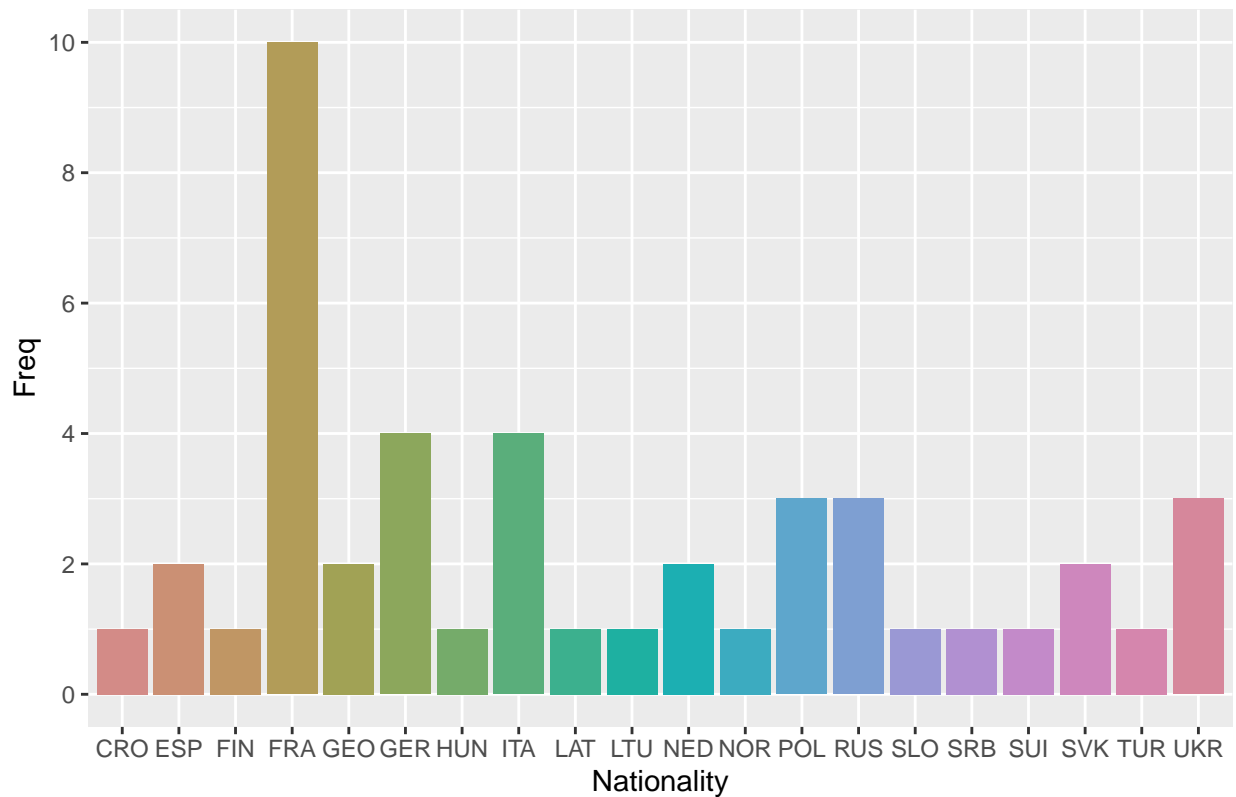
```

## [1] "diff in means"      "-1.56285714285714"
##
##
## [[2]][[4]][[6]][[2]][[8]]
## [[2]][[4]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[4]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 6, p-value = 0.2917
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[6]][[2]][[8]][[3]]
## [[2]][[4]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[8]][[3]][[2]]
## [1] 0.2827
##
##
## [[2]][[4]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "-1.98956521739131"
##
##
## [[2]][[4]][[6]][[2]][[9]]
## [[2]][[4]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[4]][[6]][[2]][[9]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[9]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[9]][[4]]
## [1] "diff in means" "NaN"
##
##
##
##
##
##
## [[3]]

```



## Home Judge Occurrences for 2020 European Championships



```
results <- analyze_event("World Championships", "2021")
```

```
## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties
```

```
## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties
```

```
## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties
```

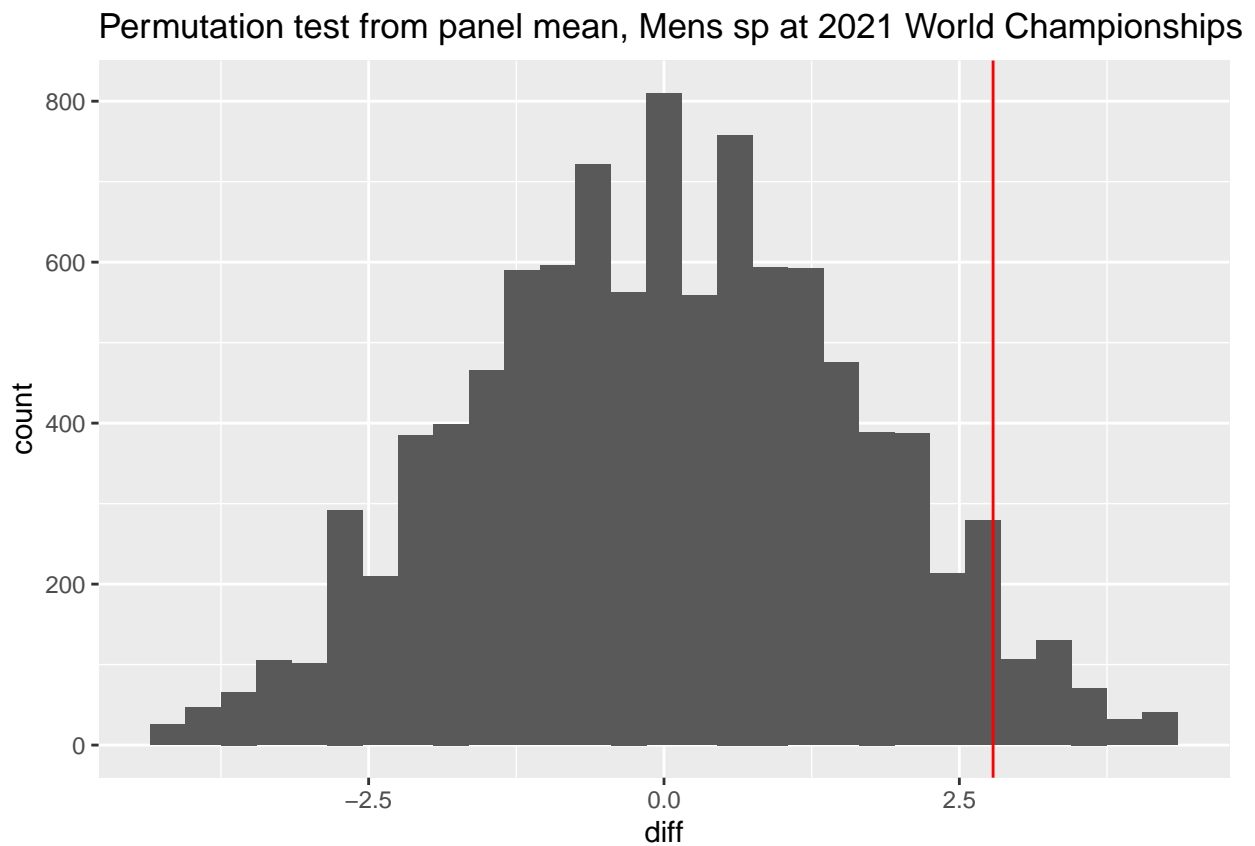
```
## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties
```

```
## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties
```

```
results
```

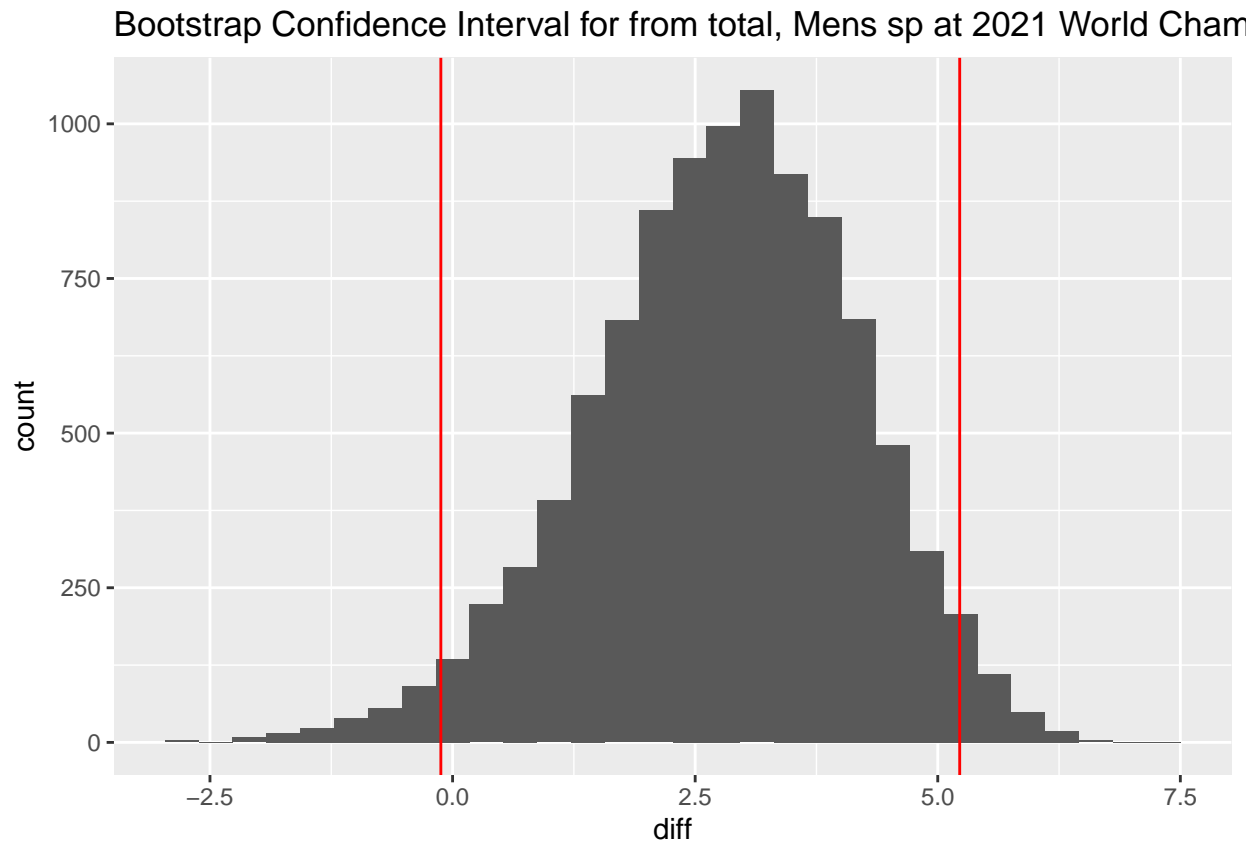
```
## [[1]]
## [1] "Results for 2021 World Championships"
##
## [[2]]
## [[2]][[1]]
```

```
## [[2]][[1]][[1]]
## [1] "Mens"                                "sp"
## [3] "# of Obs."                          "10"
## [5] "Standard Deviation of Observations" "4.59442200489113"
##
## [[2]][[1]][[2]]
##
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 46, p-value = 0.03223
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[3]]
## [[2]][[1]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[1]][[3]][[2]]
```



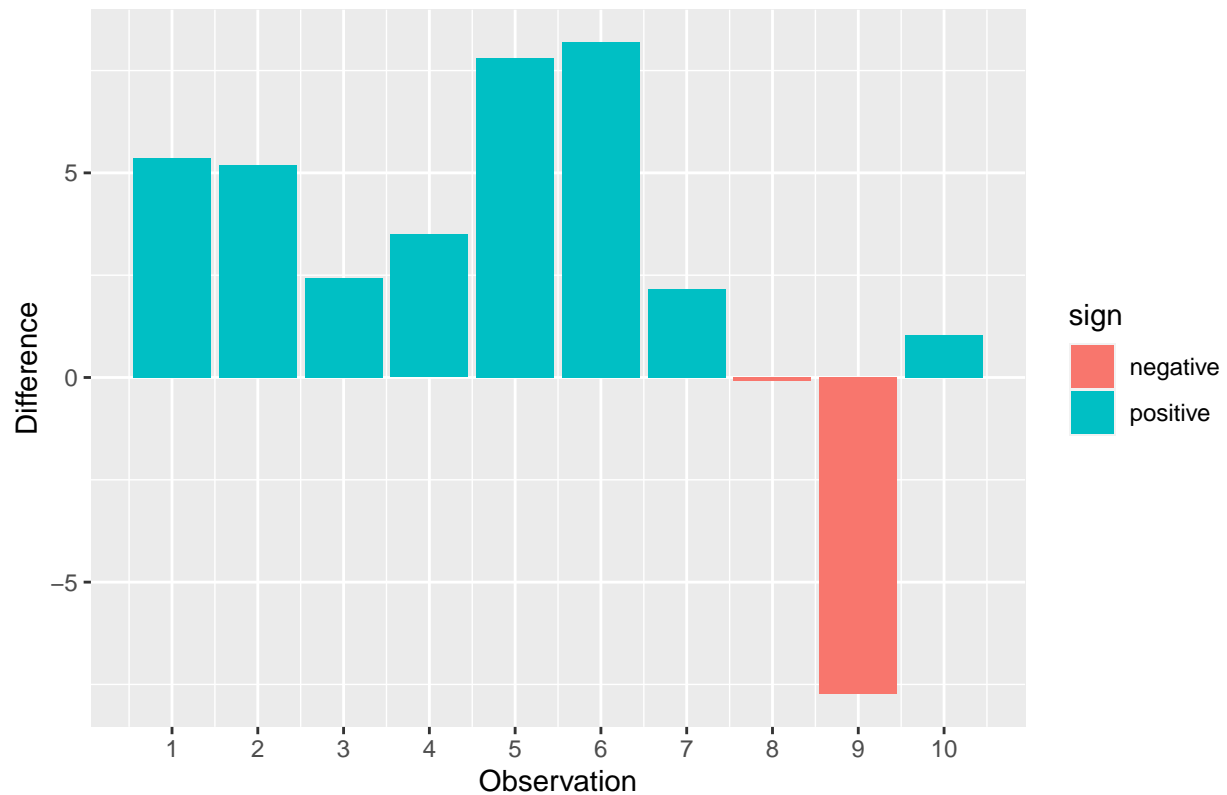
```
##
## [[2]][[1]][[3]][[3]]
## [1] 0.0435
##
## [[2]][[1]][[3]][[4]]
```

```
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[1]][[4]]
## [[2]][[1]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[1]][[4]][[2]]
```



```
##
## [[2]][[1]][[4]][[3]]
## [1] -0.1207687  5.2262219
##
## [[2]][[1]][[4]][[4]]
## [1] "MOE"
##
## [[2]][[1]][[4]][[5]]
## [1] 2.673495
##
##
## [[2]][[1]][[5]]
```

## HJ score vs. Panel Mean for Mens sp at 2021 World Championships



```
##
## [[2]][[1]][[6]]
## [[2]][[1]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[1]][[6]][[2]]
## [[2]][[1]][[6]][[2]][[1]]
## [[2]][[1]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[1]][[6]][[2]][[1]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 8, p-value = 0.2727
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[1]][[6]][[2]][[1]][[3]]
## [[2]][[1]][[6]][[2]][[1]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[1]][[3]][[2]]
## [1] 0.2769
##
```

```

##
## [[2]][[1]][[6]][[2]][[1]][[4]]
## [1] "diff in means" "-1.2853125"
##
##
## [[2]][[1]][[6]][[2]][[2]]
## [[2]][[1]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[1]][[6]][[2]][[2]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 29, p-value = 0.1212
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[2]][[3]]
## [[2]][[1]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.0945
##
##
## [[2]][[1]][[6]][[2]][[2]][[4]]
## [1] "diff in means" "2.7875"
##
##
## [[2]][[1]][[6]][[2]][[3]]
## [[2]][[1]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[1]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 17, p-value = 0.4848
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[3]][[3]]
## [[2]][[1]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.4541
##
##
## [[2]][[1]][[6]][[2]][[3]][[4]]
## [1] "diff in means" "0.0193749999999933"
##

```

```

##
## [[2]][[1]][[6]][[2]][[4]]
## [[2]][[1]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[1]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 20, p-value = 0.3566
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[4]][[3]]
## [[2]][[1]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.3976
##
##
## [[2]][[1]][[6]][[2]][[4]][[4]]
## [1] "diff in means"      "0.860624999999997"
##
##
## [[2]][[1]][[6]][[2]][[5]]
## [[2]][[1]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[1]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 32, p-value = 0.0303
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[5]][[3]]
## [[2]][[1]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[5]][[3]][[2]]
## [1] 0
##
##
## [[2]][[1]][[6]][[2]][[5]][[4]]
## [1] "diff in means"      "7.812812500000001"
##
##
## [[2]][[1]][[6]][[2]][[6]]
## [[2]][[1]][[6]][[2]][[6]][[1]]
## [1] "j_6"

```

```

##
## [[2]][[1]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 32, p-value = 0.05175
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[6]][[3]]
## [[2]][[1]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[6]][[3]][[2]]
## [1] 0
##
##
## [[2]][[1]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "6.92343749999999"
##
##
## [[2]][[1]][[6]][[2]][[7]]
## [[2]][[1]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[1]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 21, p-value = 0.3636
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[7]][[3]]
## [[2]][[1]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.3439
##
##
## [[2]][[1]][[6]][[2]][[7]][[4]]
## [1] "diff in means" "1.11656250000001"
##
##
## [[2]][[1]][[6]][[2]][[8]]
## [[2]][[1]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[1]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum test with continuity correction

```

```

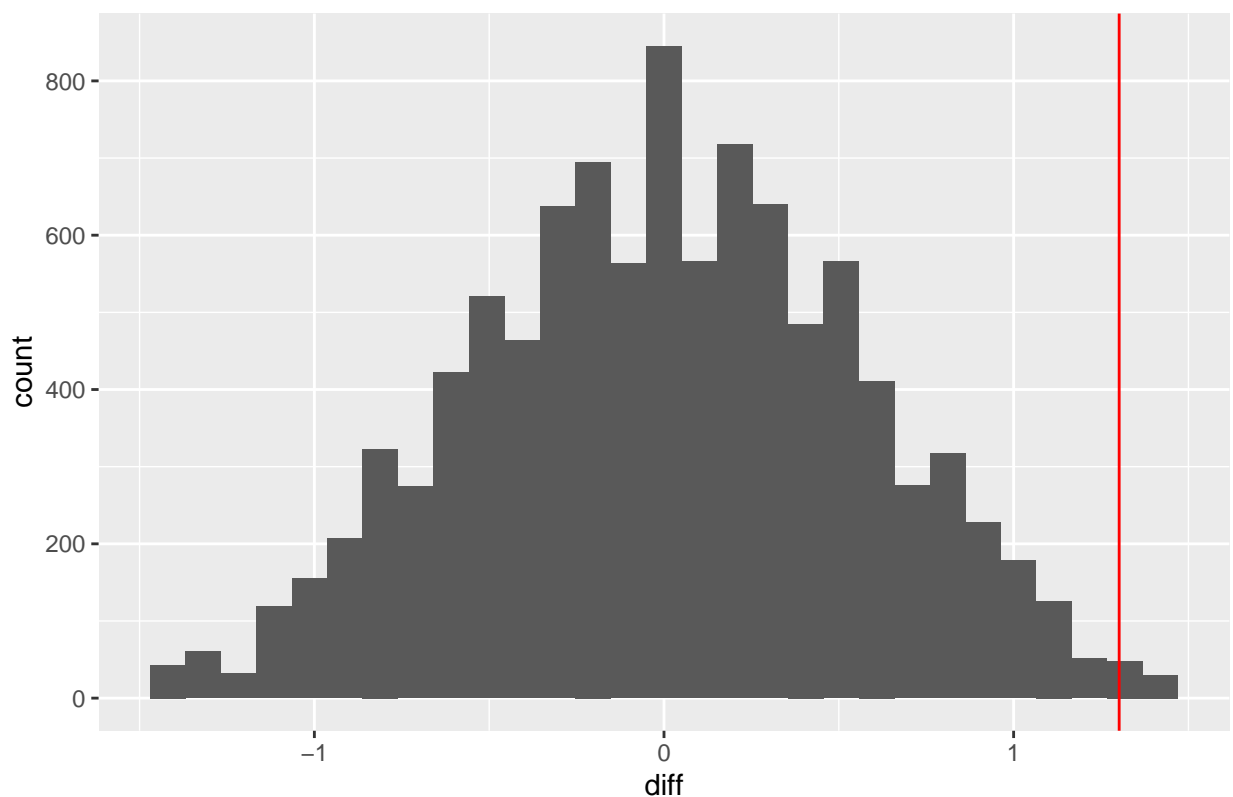
##
## data:  home and away
## W = 58, p-value = 0.02277
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[8]][[3]]
## [[2]][[1]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[8]][[3]][[2]]
## [1] 0.0085
##
##
## [[2]][[1]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "2.73193548387097"
##
##
## [[2]][[1]][[6]][[2]][[9]]
## [[2]][[1]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[1]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 17, p-value = 0.4848
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[9]][[3]]
## [[2]][[1]][[6]][[2]][[9]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.4591
##
##
## [[2]][[1]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "0.170312499999992"
##
##
##
##
## [[2]][[2]]
## [[2]][[2]][[1]]
## [1] "Womens"                                "sp"
## [3] "# of Obs."                            "10"
## [5] "Standard Deviation of Observations" "1.2589536619418"
##
## [[2]][[2]][[2]]
##

```



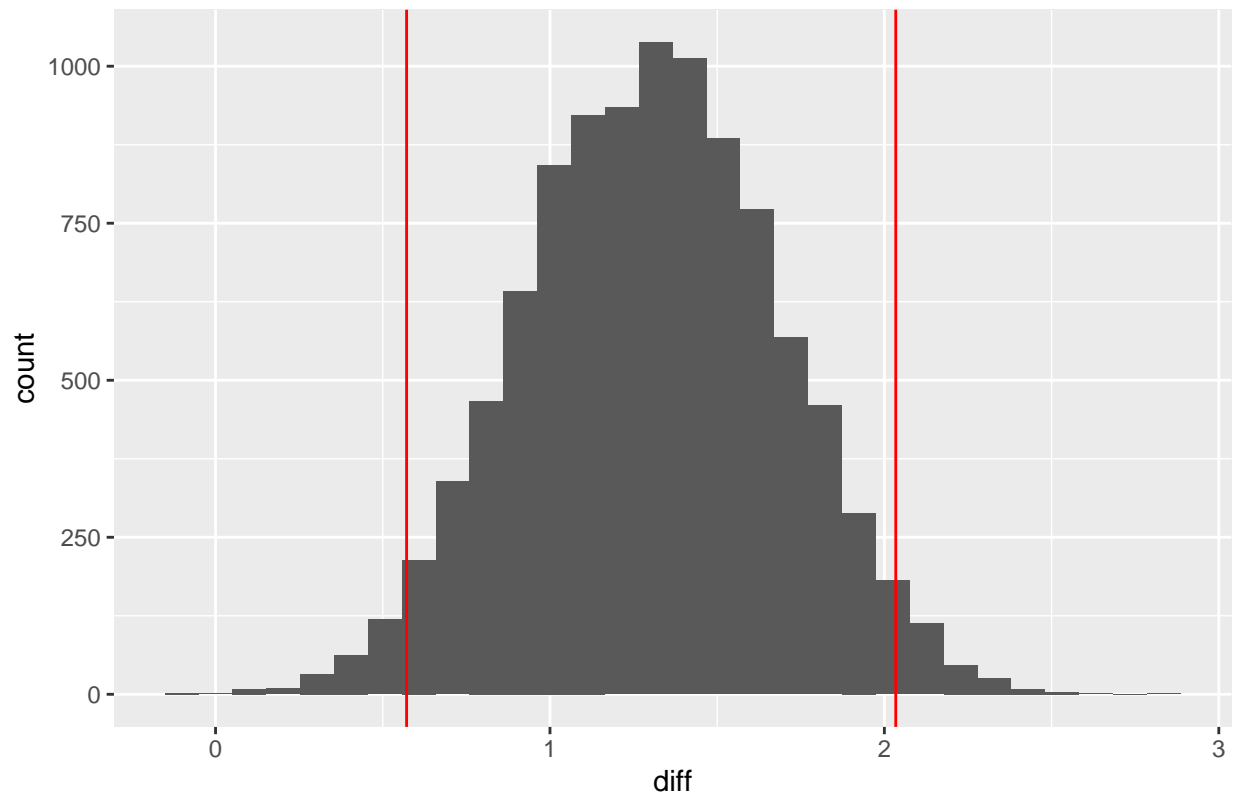
```
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 49, p-value = 0.01367
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[3]]
## [[2]][[2]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[2]][[3]][[2]]
```

Permutation test from panel mean, Womens sp at 2021 World Championsh



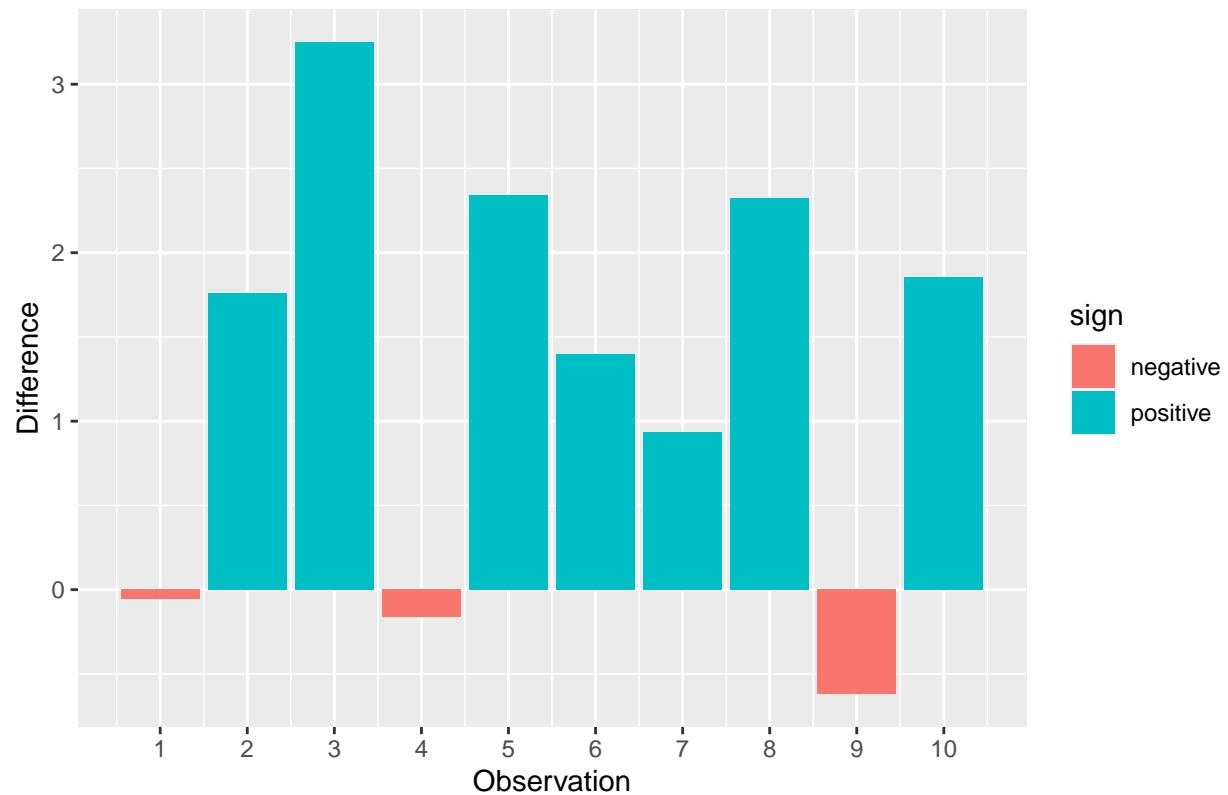
```
##
## [[2]][[2]][[3]][[3]]
## [1] 0.0052
##
## [[2]][[2]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[2]][[4]]
## [[2]][[2]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[2]][[4]][[2]]
```

Bootstrap Confidence Interval for from total, Womens sp at 2021 World Cr



```
##
## [[2]] [[2]] [[4]] [[3]]
## [1] 0.5713469 2.0340000
##
## [[2]] [[2]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[2]] [[4]] [[5]]
## [1] 0.7313266
##
##
## [[2]] [[2]] [[5]]
```

HJ score vs. Panel Mean for Womens sp at 2021 World Championships



```
##
## [[2]][[2]][[6]]
## [[2]][[2]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[2]][[6]][[2]]
## [[2]][[2]][[6]][[2]][[1]]
## [[2]][[2]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[2]][[6]][[2]][[1]][[2]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[1]][[3]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[1]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[2]][[6]][[2]][[2]]
## [[2]][[2]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[2]][[6]][[2]][[2]][[2]]
##
```

```

## Wilcoxon rank sum test with continuity correction
##
## data:  home and away
## W = 29, p-value = 0.1627
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[2]][[3]]
## [[2]][[2]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.1873
##
##
## [[2]][[2]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "1.558333333333334"
##
##
## [[2]][[2]][[6]][[2]][[3]]
## [[2]][[2]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[2]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 53, p-value = 0.1351
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[3]][[3]]
## [[2]][[2]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.1385
##
##
## [[2]][[2]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "1.66785714285714"
##
##
## [[2]][[2]][[6]][[2]][[4]]
## [[2]][[2]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[2]][[6]][[2]][[4]][[2]]
## [1] "No home scores to test"
##
## [[2]][[2]][[6]][[2]][[4]][[3]]
## [1] "No home scores to test"
##
##

```

```

## [[2]][[2]][[6]][[2]][[4]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[2]][[6]][[2]][[5]]
## [[2]][[2]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[2]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 35, p-value = 0.05405
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[5]][[3]]
## [[2]][[2]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.0251
##
##
## [[2]][[2]][[6]][[2]][[5]][[4]]
## [1] "diff in means" "2.52972222222222"
##
##
## [[2]][[2]][[6]][[2]][[6]]
## [[2]][[2]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[2]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 36, p-value = 0.02703
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[6]][[3]]
## [[2]][[2]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[6]][[3]][[2]]
## [1] 0
##
##
## [[2]][[2]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "2.64166666666667"
##
##

```

```

## [[2]][[2]][[6]][[2]][[7]]
## [[2]][[2]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[2]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 27, p-value = 0.213
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[7]][[3]]
## [[2]][[2]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.2673
##
##
## [[2]][[2]][[6]][[2]][[7]][[4]]
## [1] "diff in means"      "1.19083333333334"
##
##
## [[2]][[2]][[6]][[2]][[8]]
## [[2]][[2]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[2]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 63, p-value = 0.271
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[8]][[3]]
## [[2]][[2]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[8]][[3]][[2]]
## [1] 0.2484
##
##
## [[2]][[2]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "0.670588235294117"
##
##
## [[2]][[2]][[6]][[2]][[9]]
## [[2]][[2]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##

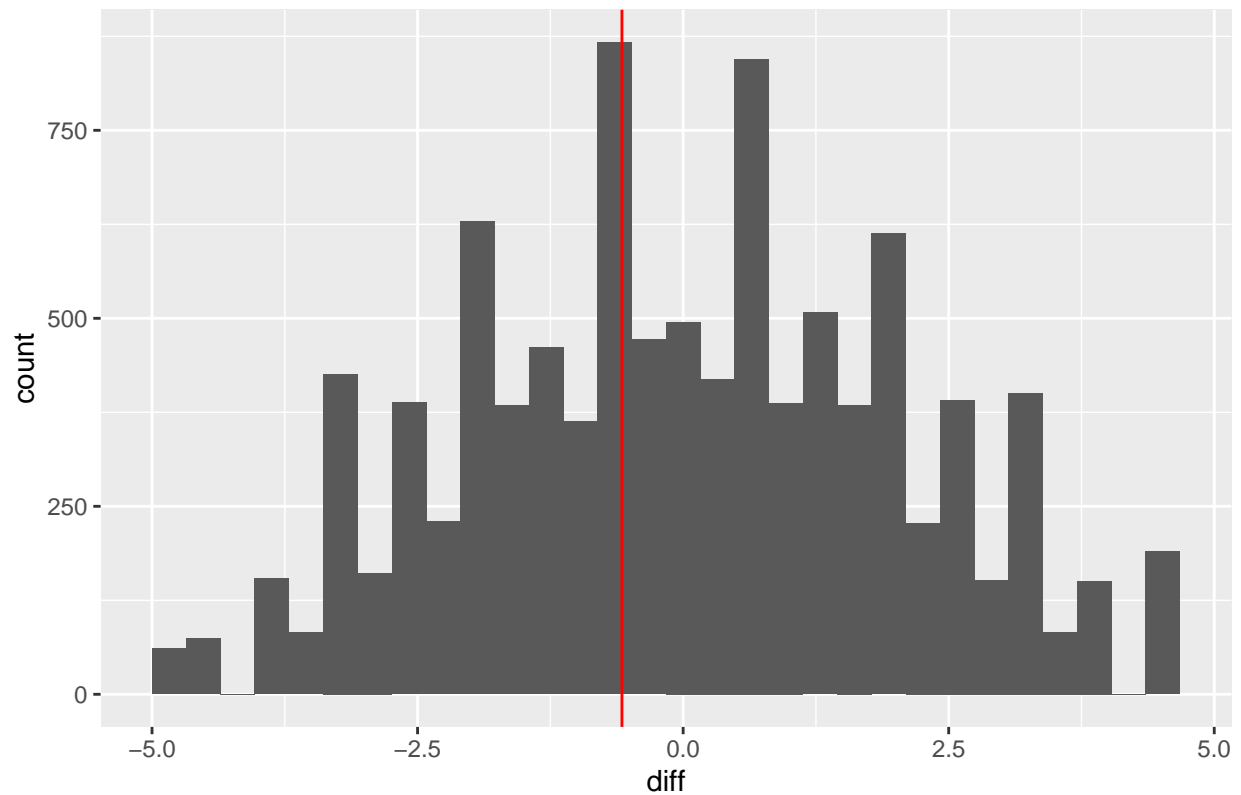
```

```

## [[2]][[2]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 15, p-value = 0.4324
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[2]][[6]][[2]][[9]][[3]]
## [[2]][[2]][[6]][[2]][[9]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.4259
##
##
## [[2]][[2]][[6]][[2]][[9]][[4]]
## [1] "diff in means" "-0.895555555555553"
##
##
##
##
## [[2]][[3]]
## [[2]][[3]][[1]]
## [1] "Mens" "fp"
## [3] "# of Obs." "7"
## [5] "Standard Deviation of Observations" "5.73010236731256"
##
## [[2]][[3]][[2]]
##
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 14, p-value = 0.5313
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[3]]
## [[2]][[3]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[3]][[3]][[2]]

```

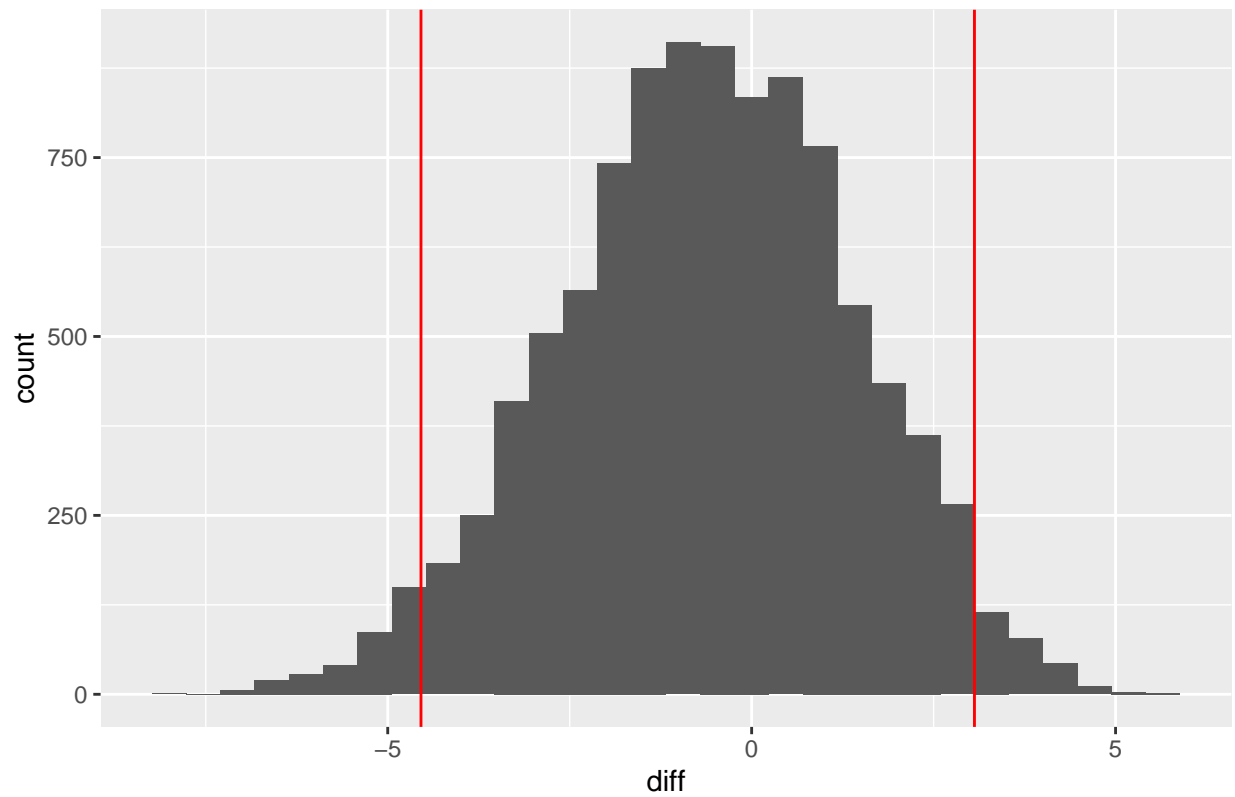
# Permutation test from panel mean, Mens fp at 2021 World Championships



```
##
## [[2]][[3]][[3]][[3]]
## [1] 0.4211
##
## [[2]][[3]][[3]][[4]]
## [1] "hA = true mean is less than 0 (underscoring)"
##
##
## [[2]][[3]][[4]]
## [[2]][[3]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[3]][[4]][[2]]
```

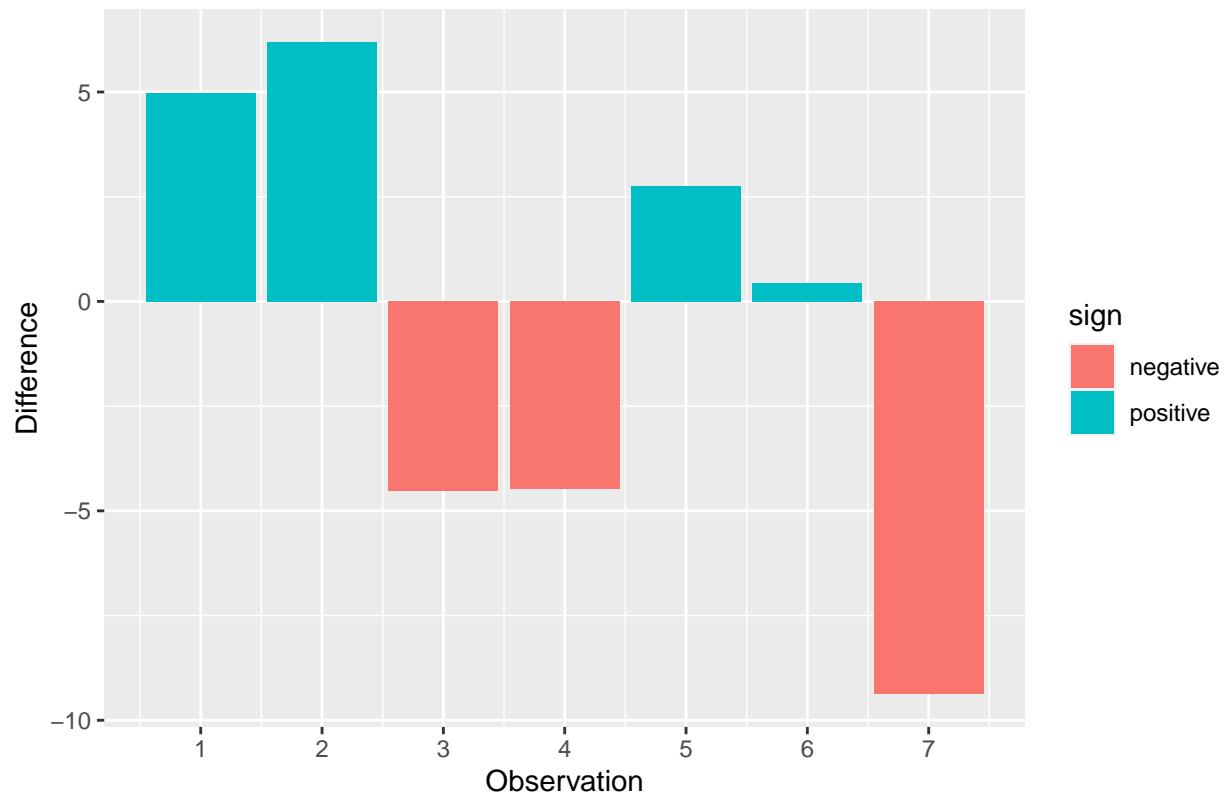


# Bootstrap Confidence Interval for from total, Mens fp at 2021 World Champ



```
##
## [[2]] [[3]] [[4]] [[3]]
## [1] -4.543214 3.060893
##
## [[2]] [[3]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[3]] [[4]] [[5]]
## [1] 3.802054
##
##
## [[2]] [[3]] [[5]]
```

HJ score vs. Panel Mean for Mens fp at 2021 World Championships



```
##
## [[2]][[3]][[6]]
## [[2]][[3]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[3]][[6]][[2]]
## [[2]][[3]][[6]][[2]][[1]]
## [[2]][[3]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[3]][[6]][[2]][[1]][[2]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[1]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[1]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[3]][[6]][[2]][[2]]
## [[2]][[3]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[3]][[6]][[2]][[2]][[2]]
## [1] "No home scores to test"
```

```

##
## [[2]][[3]][[6]][[2]][[2]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[2]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[3]][[6]][[2]][[3]]
## [[2]][[3]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[3]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 11, p-value = 0.5417
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[3]][[3]]
## [[2]][[3]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.5076
##
##
## [[2]][[3]][[6]][[2]][[3]][[4]]
## [1] "diff in means" "0.0934782608695561"
##
##
## [[2]][[3]][[6]][[2]][[4]]
## [[2]][[3]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[3]][[6]][[2]][[4]][[2]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[4]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[4]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[3]][[6]][[2]][[5]]
## [[2]][[3]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[3]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test

```

```

##
## data:  home and away
## W = 2, p-value = 0.125
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[5]][[3]]
## [[2]][[3]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.126
##
##
## [[2]][[3]][[6]][[2]][[5]][[4]]
## [1] "diff in means"      "-7.91347826086956"
##
##
## [[2]][[3]][[6]][[2]][[6]]
## [[2]][[3]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[3]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 0, p-value = 0.04167
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[6]][[3]]
## [[2]][[3]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[6]][[3]][[2]]
## [1] 0.0403
##
##
## [[2]][[3]][[6]][[2]][[6]][[4]]
## [1] "diff in means"      "-7.73434782608695"
##
##
## [[2]][[3]][[6]][[2]][[7]]
## [[2]][[3]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[3]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 6, p-value = 0.2917
## alternative hypothesis: true location shift is less than 0

```

```

##
##
## [[2]][[3]][[6]][[2]][[7]][[3]]
## [[2]][[3]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.29
##
##
## [[2]][[3]][[6]][[2]][[7]][[4]]
## [1] "diff in means"      "-3.09565217391305"
##
##
## [[2]][[3]][[6]][[2]][[8]]
## [[2]][[3]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[3]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 40, p-value = 0.03261
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[8]][[3]]
## [[2]][[3]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[8]][[3]][[2]]
## [1] 0.0471
##
##
## [[2]][[3]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "4.70227272727272"
##
##
## [[2]][[3]][[6]][[2]][[9]]
## [[2]][[3]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[3]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 23, p-value = 0.04167
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[9]][[3]]
## [[2]][[3]][[6]][[2]][[9]][[3]][[1]]

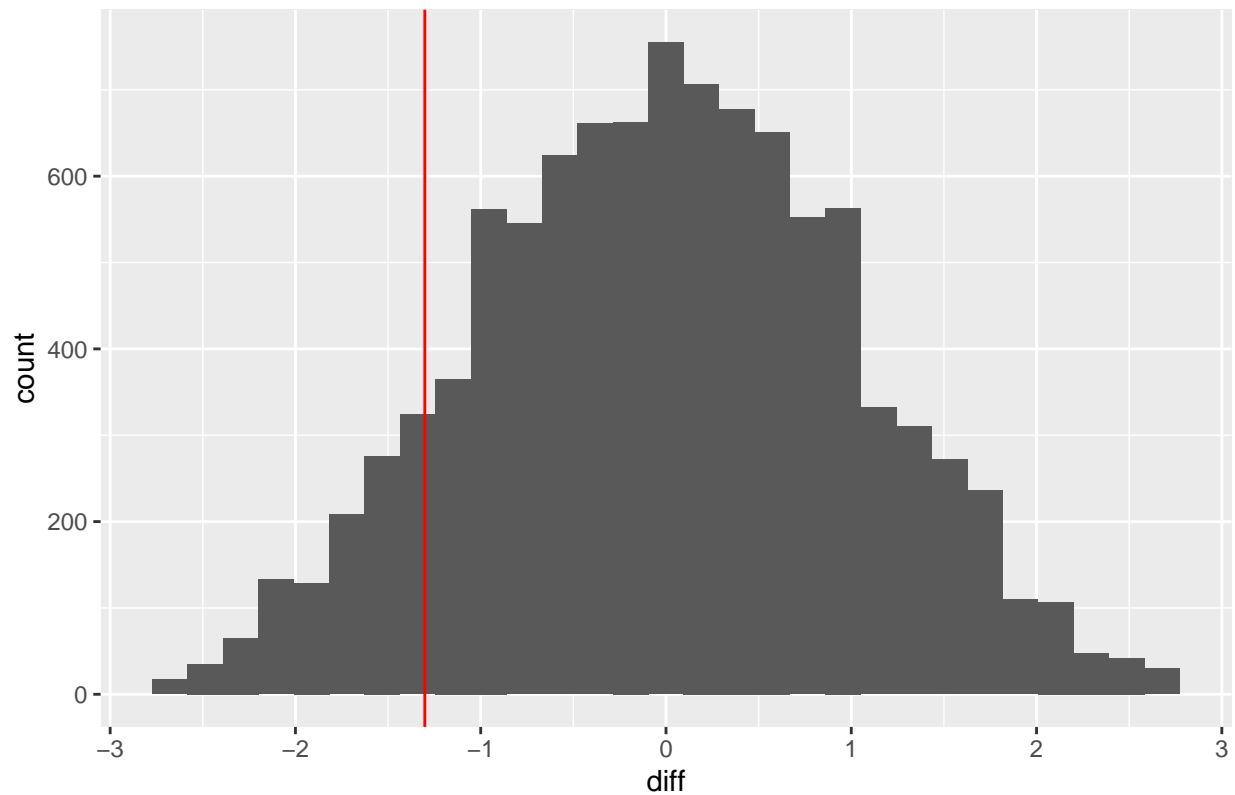
```

```

## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[9]][[3]][[2]]
## [1] 0
##
##
## [[2]][[3]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "4.46173913043478"
##
##
##
##
## [[2]][[4]]
## [[2]][[4]][[1]]
## [1] "Womens"                "fp"
## [3] "# of Obs."              "9"
## [5] "Standard Deviation of Observations" "2.91290662397544"
##
## [[2]][[4]][[2]]
##
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 13, p-value = 0.1504
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[3]]
## [[2]][[4]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[4]][[3]][[2]]

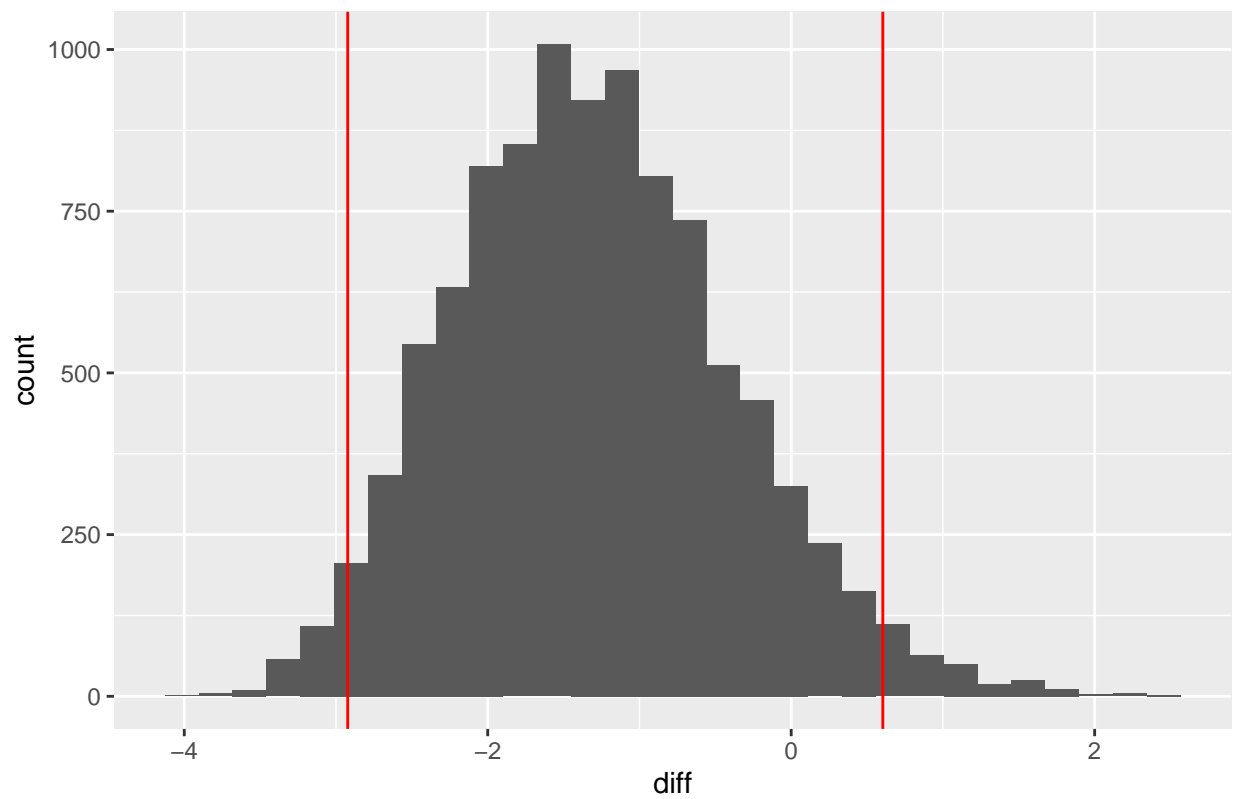
```

# Permutation test from panel mean, Womens fp at 2021 World Championsh



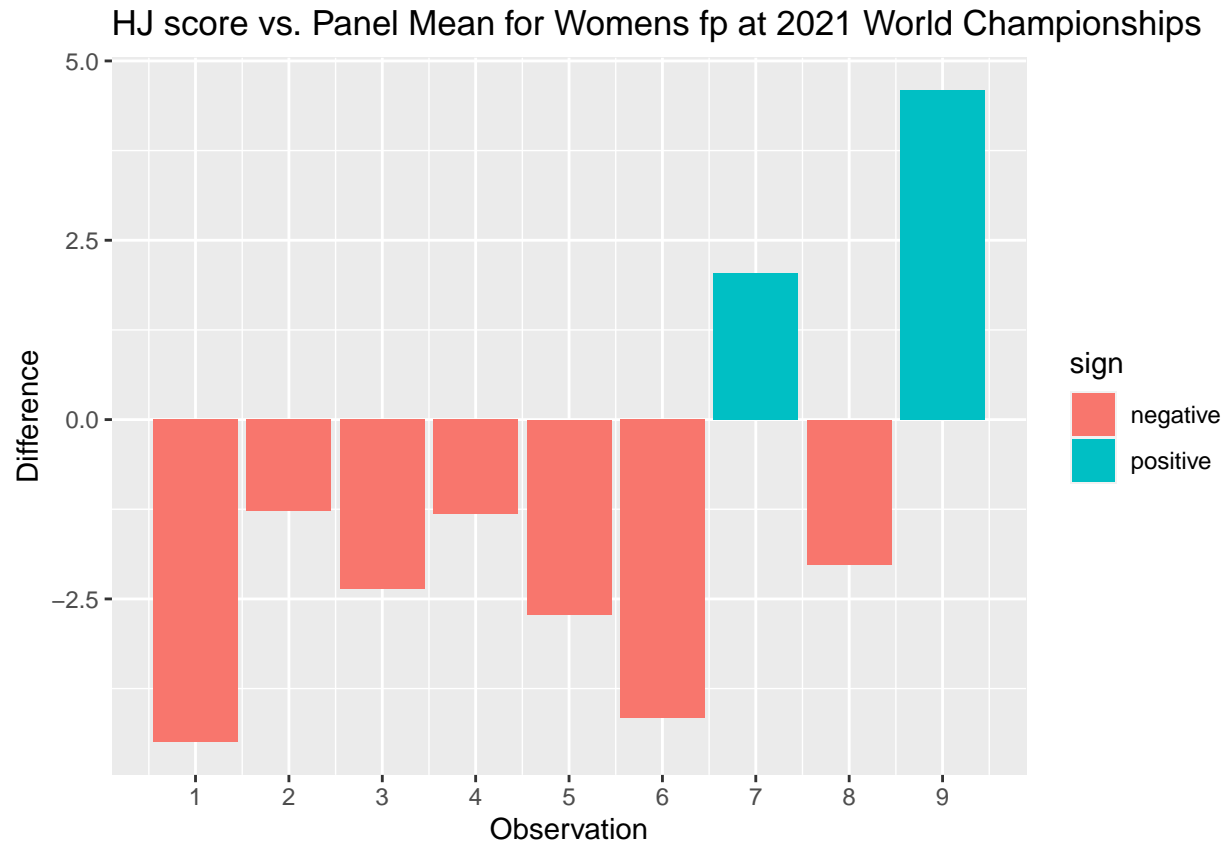
```
##
## [[2]][[4]][[3]][[3]]
## [1] 0.1084
##
## [[2]][[4]][[3]][[4]]
## [1] "hA = true mean is less than 0 (underscoring)"
##
##
## [[2]][[4]][[4]]
## [[2]][[4]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[4]][[4]][[2]]
```

Bootstrap Confidence Interval for from total, Womens fp at 2021 World Ch



```
##
## [[2]] [[4]] [[4]] [[3]]
## [1] -2.9226458 0.6038889
##
## [[2]] [[4]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[4]] [[4]] [[5]]
## [1] 1.763267
##
##
## [[2]] [[4]] [[5]]
```





```
##
## [[2]][[4]][[6]]
## [[2]][[4]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[4]][[6]][[2]]
## [[2]][[4]][[6]][[2]][[1]]
## [[2]][[4]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[4]][[6]][[2]][[1]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[1]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[1]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[2]]
## [[2]][[4]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[4]][[6]][[2]][[2]][[2]]
##
```

```

## Wilcoxon rank sum exact test
##
## data: home and away
## W = 3, p-value = 0.1667
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[6]][[2]][[2]][[3]]
## [[2]][[4]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.1667
##
##
## [[2]][[4]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "-1.91347826086955"
##
##
## [[2]][[4]][[6]][[2]][[3]]
## [[2]][[4]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[4]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 19, p-value = 0.3986
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[6]][[2]][[3]][[3]]
## [[2]][[4]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.426
##
##
## [[2]][[4]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "-0.89454545454545"
##
##
## [[2]][[4]][[6]][[2]][[4]]
## [[2]][[4]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[4]][[6]][[2]][[4]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[4]][[3]]
## [1] "No home scores to test"
##

```

```

## [[2]][[4]][[6]][[2]][[4]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[5]]
## [[2]][[4]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[4]][[6]][[2]][[5]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[5]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[5]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[6]]
## [[2]][[4]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[4]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 21, p-value = 0.125
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[6]][[3]]
## [[2]][[4]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[6]][[3]][[2]]
## [1] 0.0816
##
##
## [[2]][[4]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "2.91782608695652"
##
##
## [[2]][[4]][[6]][[2]][[7]]
## [[2]][[4]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[4]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 6, p-value = 0.2917
## alternative hypothesis: true location shift is less than 0

```

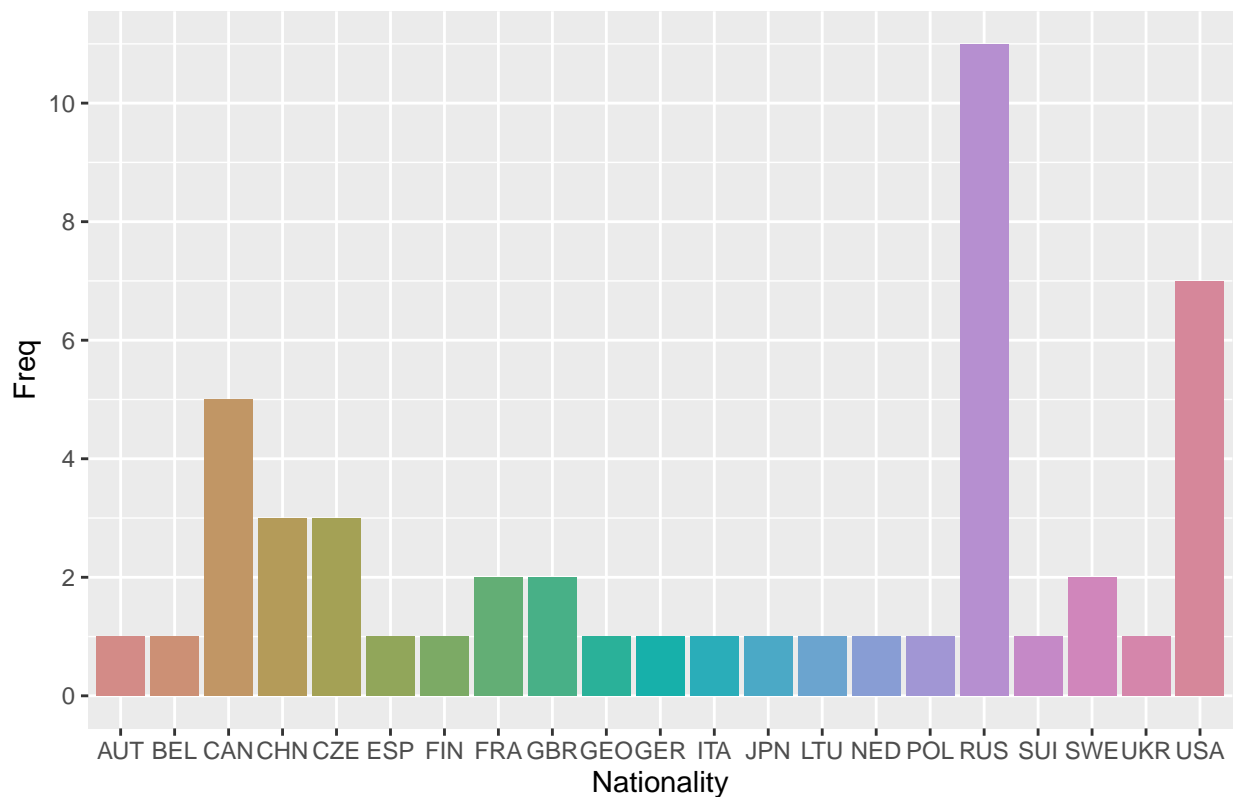
```

##
##
## [[2]][[4]][[6]][[2]][[7]][[3]]
## [[2]][[4]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.2934
##
##
## [[2]][[4]][[6]][[2]][[7]][[4]]
## [1] "diff in means"      "-1.7995652173913"
##
##
## [[2]][[4]][[6]][[2]][[8]]
## [[2]][[4]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[4]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 14, p-value = 0.07263
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[6]][[2]][[8]][[3]]
## [[2]][[4]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[8]][[3]][[2]]
## [1] 0.1004
##
##
## [[2]][[4]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "-2.66761904761904"
##
##
## [[2]][[4]][[6]][[2]][[9]]
## [[2]][[4]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[4]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 14, p-value = 0.4167
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[9]][[3]]
## [[2]][[4]][[6]][[2]][[9]][[3]][[1]]

```

```
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.3774
##
##
## [[2]][[4]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "1.34304347826086"
##
##
##
##
##
## [[3]]
```

Home Judge Occurrences for 2021 World Championships



```
results <- analyze_event("Olympic Winter Games", "2022")
```

```
## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties
```

```
## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties
```

```
## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties
```

```
## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties

## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties

## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties

## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties

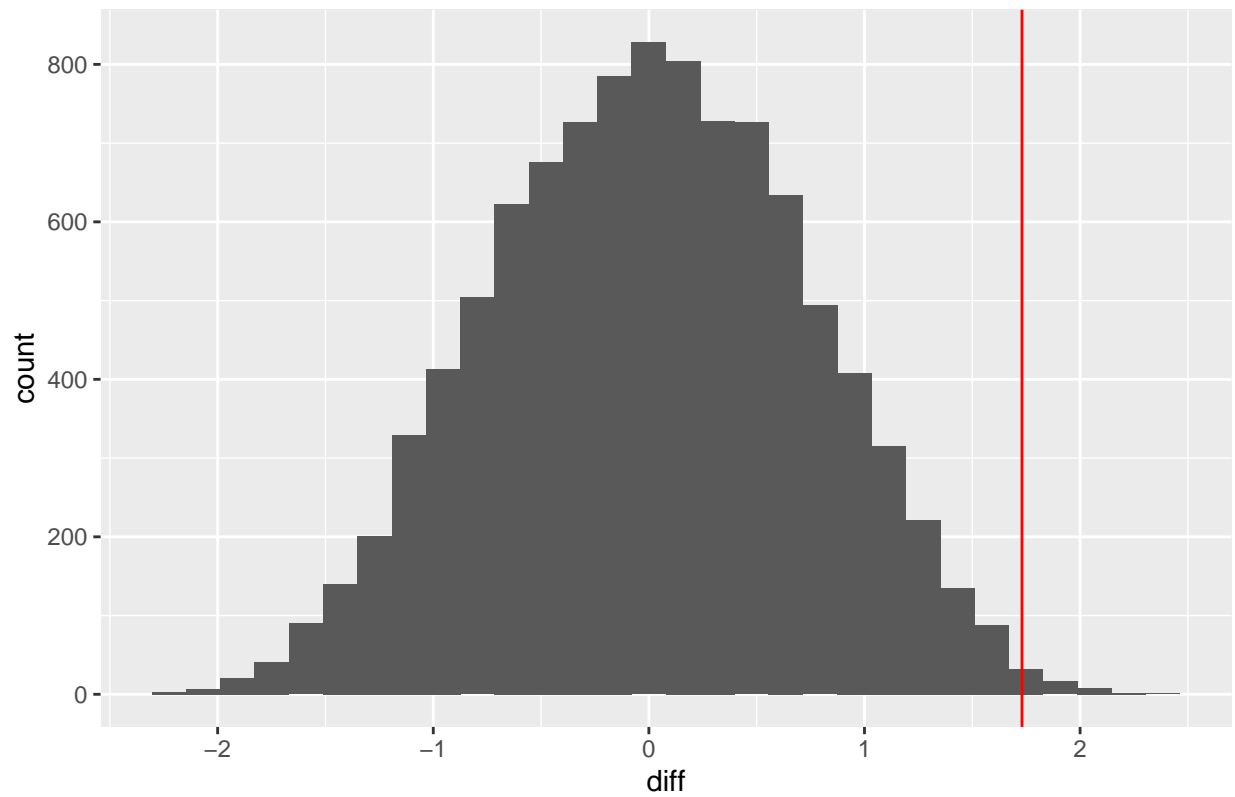
## Warning in wilcox.test.default(home, away, alternative = "greater"): cannot
## compute exact p-value with ties

## Warning in wilcox.test.default(home, away, alternative = "less"): cannot
## compute exact p-value with ties
```

## results

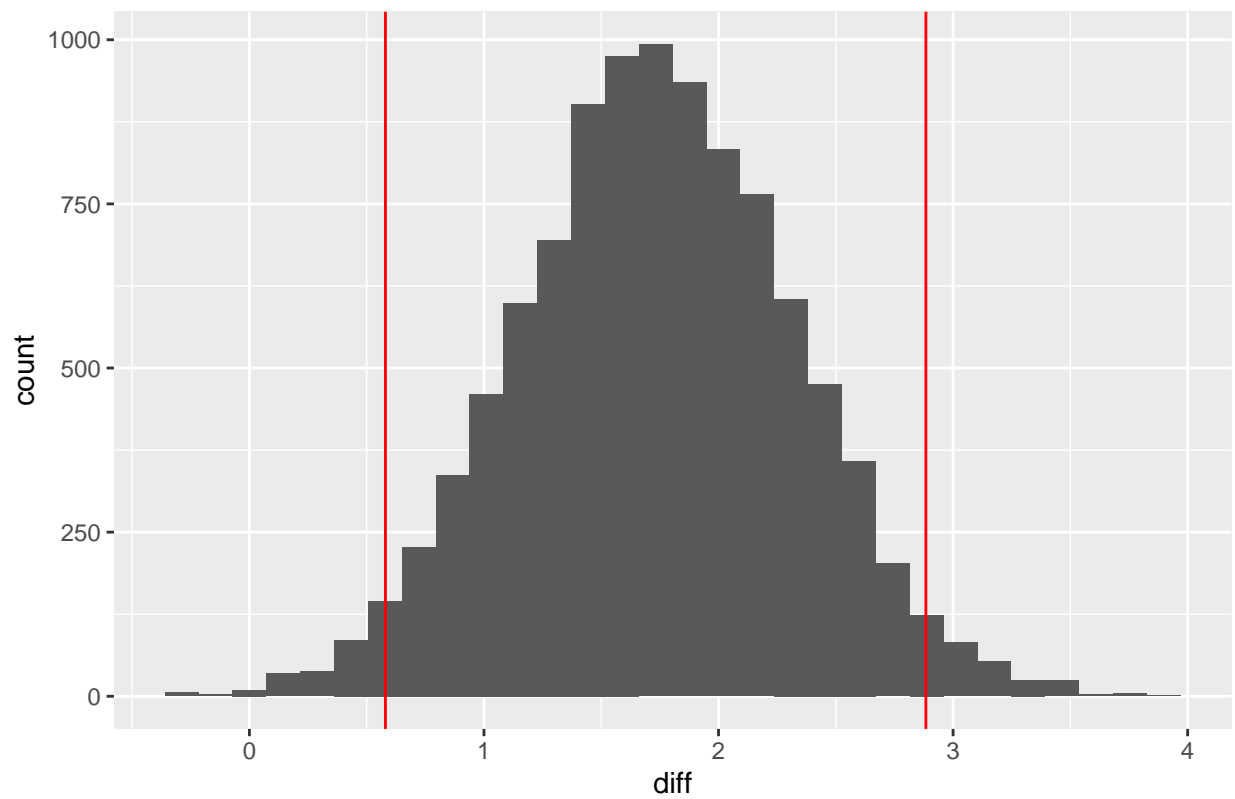
```
## [[1]]
## [1] "Results for 2022 Olympic Winter Games"
##
## [[2]]
## [[2]][[1]]
## [[2]][[1]][[1]]
## [1] "Mens" "sp"
## [3] "# of Obs." "15"
## [5] "Standard Deviation of Observations" "2.35084681108035"
##
## [[2]][[1]][[2]]
##
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 103, p-value = 0.006226
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[3]]
## [[2]][[1]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[1]][[3]][[2]]
```

# Permutation test from panel mean, Mens sp at 2022 Olympic Winter Game



```
##
## [[2]][[1]][[3]][[3]]
## [1] 0.0047
##
## [[2]][[1]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[1]][[4]]
## [[2]][[1]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[1]][[4]][[2]]
```

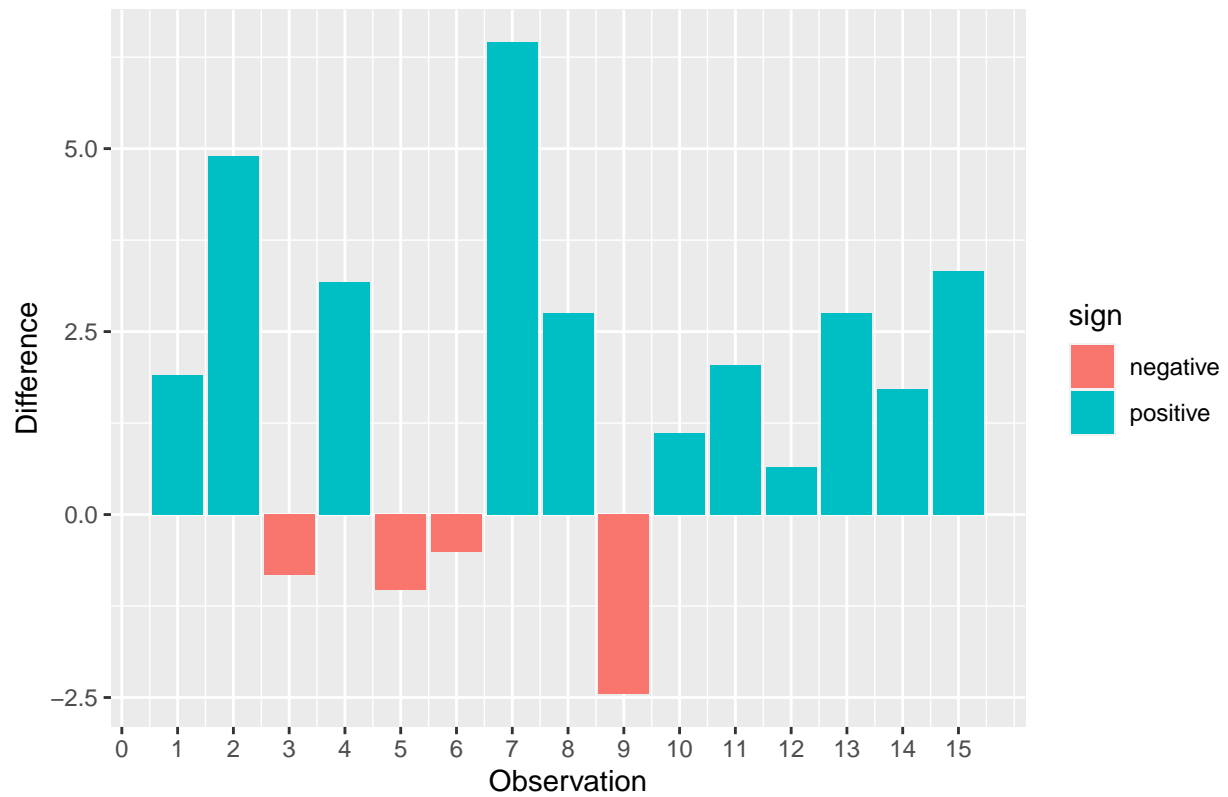
Bootstrap Confidence Interval for from total, Mens sp at 2022 Olympic Wir



```
##
## [[2]] [[1]] [[4]] [[3]]
## [1] 0.5798271 2.8840958
##
## [[2]] [[1]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[1]] [[4]] [[5]]
## [1] 1.152134
##
##
## [[2]] [[1]] [[5]]
```



## HJ score vs. Panel Mean for Mens sp at 2022 Olympic Winter Games



```
##
## [[2]][[1]][[6]]
## [[2]][[1]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[1]][[6]][[2]]
## [[2]][[1]][[6]][[2]][[1]]
## [[2]][[1]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[1]][[6]][[2]][[1]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 34, p-value = 0.298
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[1]][[3]]
## [[2]][[1]][[6]][[2]][[1]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[1]][[3]][[2]]
## [1] 0.2392
##
```

```

##
## [[2]][[1]][[6]][[2]][[1]][[4]]
## [1] "diff in means"      "0.945925925925926"
##
##
## [[2]][[1]][[6]][[2]][[2]]
## [[2]][[1]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[1]][[6]][[2]][[2]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 28, p-value = 0.03448
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[2]][[3]]
## [[2]][[1]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[2]][[3]][[2]]
## [1] 0
##
##
## [[2]][[1]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "4.69392857142857"
##
##
## [[2]][[1]][[6]][[2]][[3]]
## [[2]][[1]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[1]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 27, p-value = 0.06897
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[3]][[3]]
## [[2]][[1]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.035
##
##
## [[2]][[1]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "4.2592857142857"
##

```

```

##
## [[2]][[1]][[6]][[2]][[4]]
## [[2]][[1]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[1]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 76, p-value = 0.001095
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[4]][[3]]
## [[2]][[1]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[4]][[3]][[2]]
## [1] 9e-04
##
##
## [[2]][[1]][[6]][[2]][[4]][[4]]
## [1] "diff in means" "4.17833333333333"
##
##
## [[2]][[1]][[6]][[2]][[5]]
## [[2]][[1]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[1]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 19, p-value = 0.2593
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[1]][[6]][[2]][[5]][[3]]
## [[2]][[1]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.2906
##
##
## [[2]][[1]][[6]][[2]][[5]][[4]]
## [1] "diff in means" "-1.06555555555555"
##
##
## [[2]][[1]][[6]][[2]][[6]]
## [[2]][[1]][[6]][[2]][[6]][[1]]
## [1] "j_6"

```

```

##
## [[2]][[1]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 46, p-value = 0.05564
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[6]][[3]]
## [[2]][[1]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[6]][[3]][[2]]
## [1] 0.0875
##
##
## [[2]][[1]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "1.89555555555555"
##
##
## [[2]][[1]][[6]][[2]][[7]]
## [[2]][[1]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[1]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 14.5, p-value = 0.5
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[7]][[3]]
## [[2]][[1]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.4494
##
##
## [[2]][[1]][[6]][[2]][[7]][[4]]
## [1] "diff in means" "0.48607142857143"
##
##
## [[2]][[1]][[6]][[2]][[8]]
## [[2]][[1]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[1]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test

```

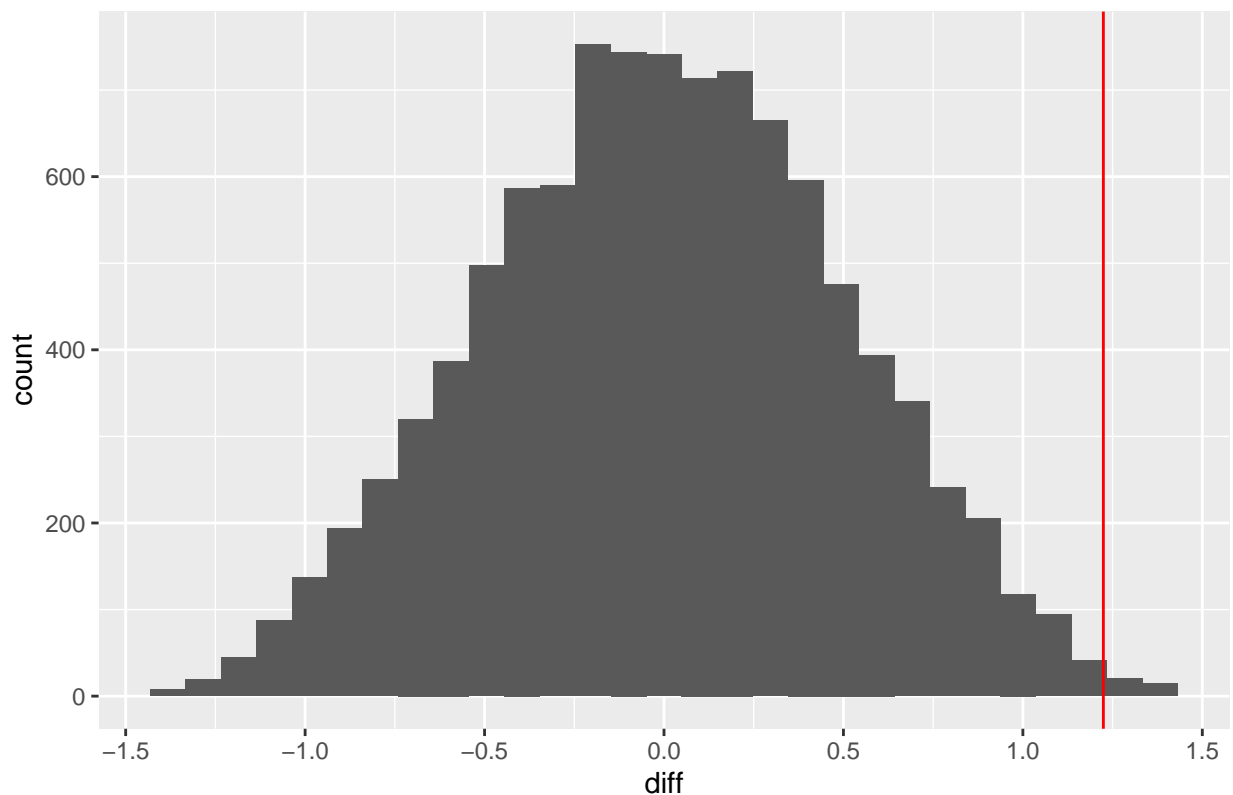
```

##
## data:  home and away
## W = 22, p-value = 0.2414
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[1]][[6]][[2]][[8]][[3]]
## [[2]][[1]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[8]][[3]][[2]]
## [1] 0.2064
##
##
## [[2]][[1]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "1.90214285714285"
##
##
## [[2]][[1]][[6]][[2]][[9]]
## [[2]][[1]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[1]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data:  home and away
## W = 22, p-value = 0.3493
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[1]][[6]][[2]][[9]][[3]]
## [[2]][[1]][[6]][[2]][[9]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[1]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.3253
##
##
## [[2]][[1]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "-0.785370370370363"
##
##
##
##
## [[2]][[2]]
## [[2]][[2]][[1]]
## [1] "Womens"                                "sp"
## [3] "# of Obs."                            "12"
## [5] "Standard Deviation of Observations" "1.29401983992419"
##
## [[2]][[2]][[2]]
##

```

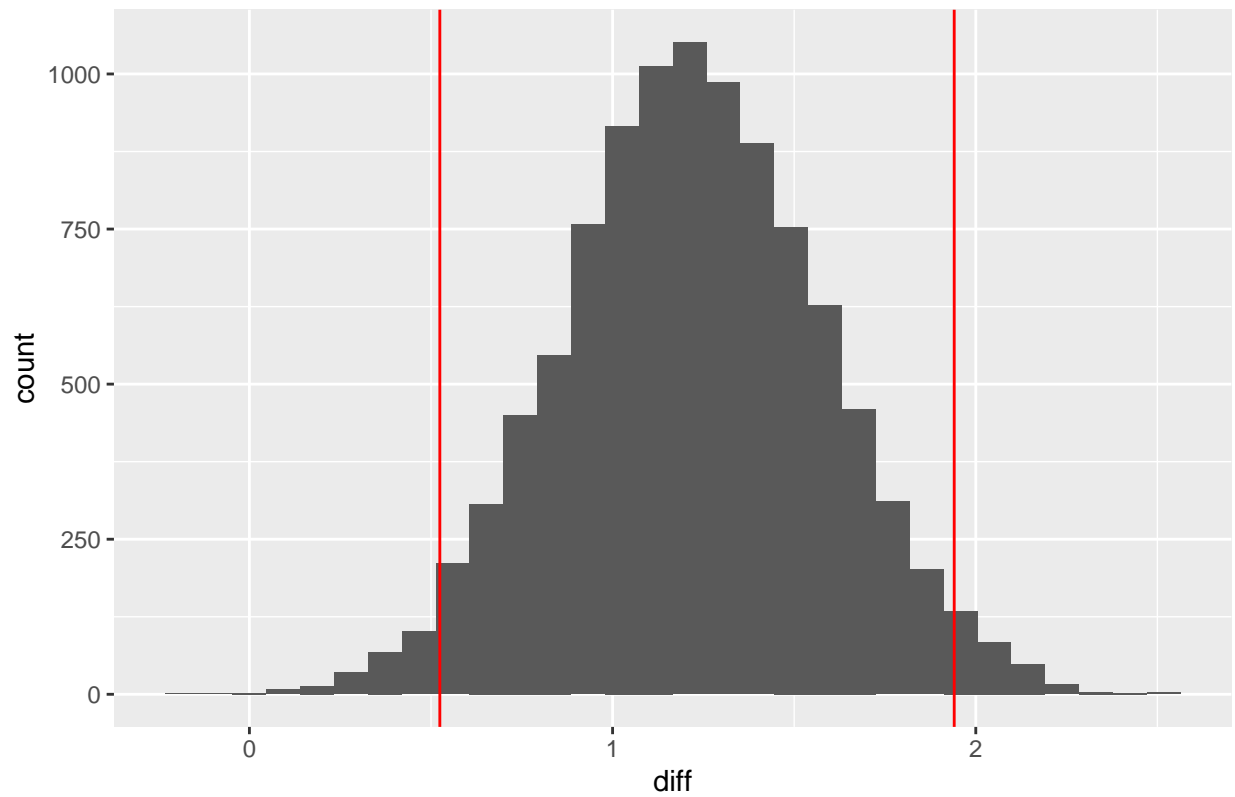
```
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 71, p-value = 0.004639
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[3]]
## [[2]][[2]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[2]][[3]][[2]]
```

Permutation test from panel mean, Womens sp at 2022 Olympic Winter Ga



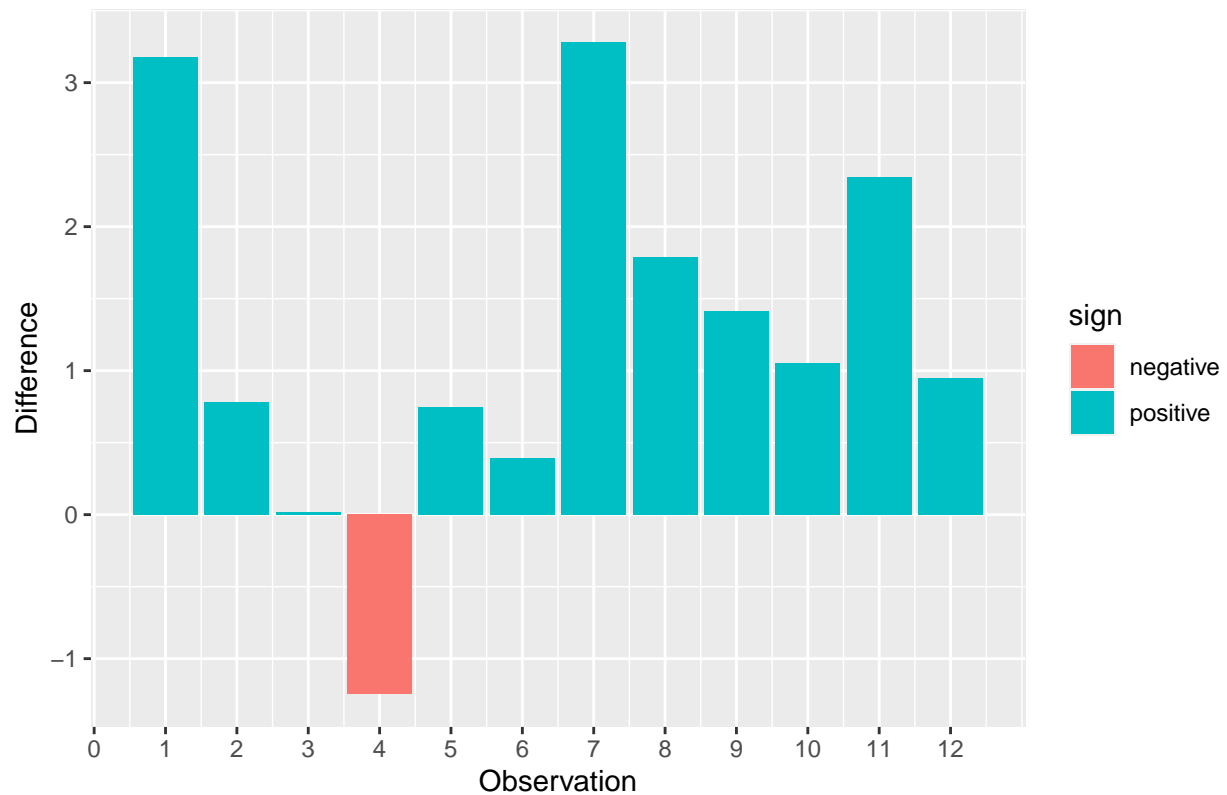
```
##
## [[2]][[2]][[3]][[3]]
## [1] 0.0038
##
## [[2]][[2]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[2]][[4]]
## [[2]][[2]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[2]][[4]][[2]]
```

# Bootstrap Confidence Interval for from total, Womens sp at 2022 Olympic



```
##
## [[2]] [[2]] [[4]] [[3]]
## [1] 0.5243672 1.9405547
##
## [[2]] [[2]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[2]] [[4]] [[5]]
## [1] 0.7080938
##
##
## [[2]] [[2]] [[5]]
```

## HJ score vs. Panel Mean for Womens sp at 2022 Olympic Winter Games



```
##
## [[2]][[2]][[6]]
## [[2]][[2]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[2]][[6]][[2]]
## [[2]][[2]][[6]][[2]][[1]]
## [[2]][[2]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[2]][[6]][[2]][[1]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 17, p-value = 0.4086
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[1]][[3]]
## [[2]][[2]][[6]][[2]][[1]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[1]][[3]][[2]]
## [1] 0.3956
##
```



```

##
## [[2]][[2]][[6]][[2]][[1]][[4]]
## [1] "diff in means"      "0.286206896551728"
##
##
## [[2]][[2]][[6]][[2]][[2]]
## [[2]][[2]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[2]][[6]][[2]][[2]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data:  home and away
## W = 19, p-value = 0.322
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[2]][[3]]
## [[2]][[2]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.3599
##
##
## [[2]][[2]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "0.625862068965519"
##
##
## [[2]][[2]][[6]][[2]][[3]]
## [[2]][[2]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[2]][[6]][[2]][[3]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 28, p-value = 0.06667
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[3]][[3]]
## [[2]][[2]][[6]][[2]][[3]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[3]][[3]][[2]]
## [1] 0.0349
##
##
## [[2]][[2]][[6]][[2]][[3]][[4]]
## [1] "diff in means"      "2.35724137931035"
##

```

```

##
## [[2]][[2]][[6]][[2]][[4]]
## [[2]][[2]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[2]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 28, p-value = 0.06653
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[4]][[3]]
## [[2]][[2]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.0684
##
##
## [[2]][[2]][[6]][[2]][[4]][[4]]
## [1] "diff in means" "2.76586206896552"
##
##
## [[2]][[2]][[6]][[2]][[5]]
## [[2]][[2]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[2]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 27, p-value = 0.1
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[5]][[3]]
## [[2]][[2]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.0663
##
##
## [[2]][[2]][[6]][[2]][[5]][[4]]
## [1] "diff in means" "2.62724137931034"
##
##
## [[2]][[2]][[6]][[2]][[6]]
## [[2]][[2]][[6]][[2]][[6]][[1]]
## [1] "j_6"

```

```

##
## [[2]][[2]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data: home and away
## W = 50, p-value = 0.2669
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[6]][[3]]
## [[2]][[2]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[6]][[3]][[2]]
## [1] 0.3057
##
##
## [[2]][[2]][[6]][[2]][[6]][[4]]
## [1] "diff in means" "0.352222222222222"
##
##
## [[2]][[2]][[6]][[2]][[7]]
## [[2]][[2]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[2]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 21, p-value = 0.3
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[7]][[3]]
## [[2]][[2]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.2652
##
##
## [[2]][[2]][[6]][[2]][[7]][[4]]
## [1] "diff in means" "0.999310344827578"
##
##
## [[2]][[2]][[6]][[2]][[8]]
## [[2]][[2]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[2]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum test with continuity correction

```

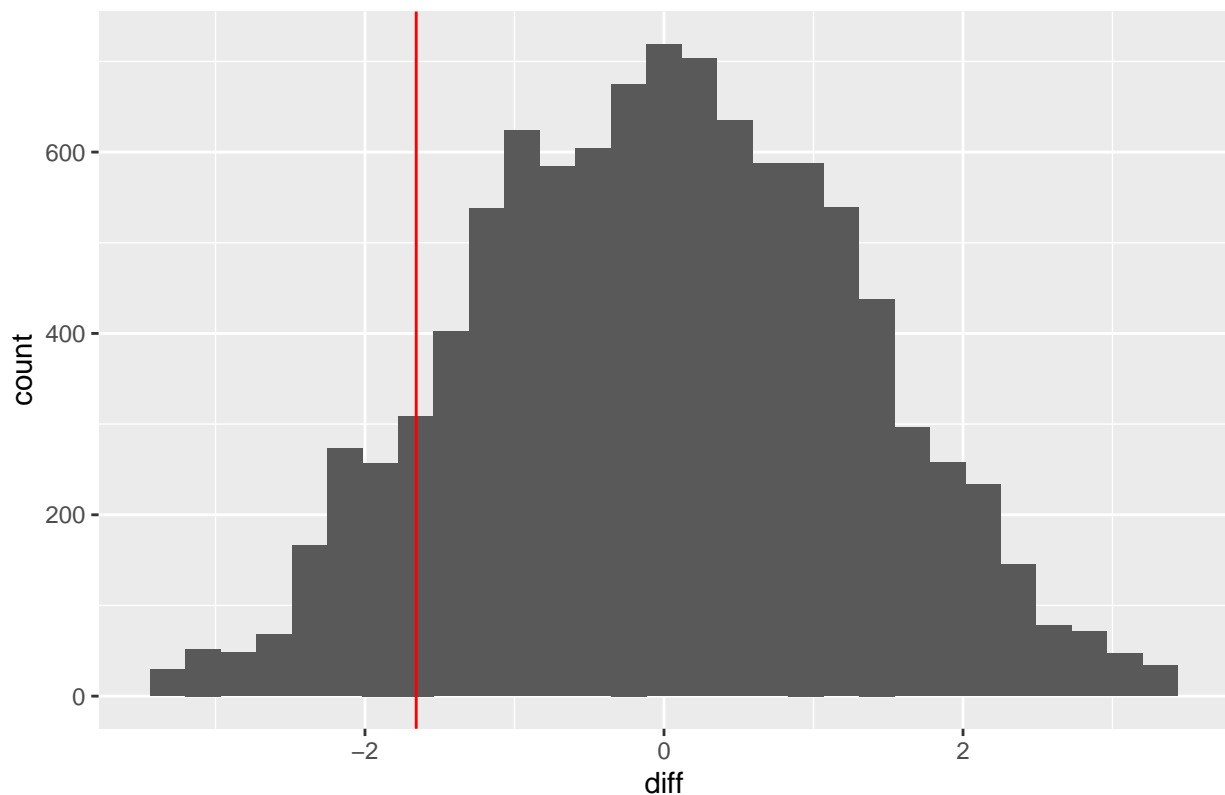
```

##
## data:  home and away
## W = 24, p-value = 0.1492
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[8]][[3]]
## [[2]][[2]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[8]][[3]][[2]]
## [1] 0.2263
##
##
## [[2]][[2]][[6]][[2]][[8]][[4]]
## [1] "diff in means"    "1.1796551724138"
##
##
## [[2]][[2]][[6]][[2]][[9]]
## [[2]][[2]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[2]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 38, p-value = 0.2299
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[2]][[6]][[2]][[9]][[3]]
## [[2]][[2]][[6]][[2]][[9]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[2]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.1952
##
##
## [[2]][[2]][[6]][[2]][[9]][[4]]
## [1] "diff in means"    "0.829642857142861"
##
##
##
##
## [[2]][[3]]
## [[2]][[3]][[1]]
## [1] "Mens"                                "fp"
## [3] "# of Obs."                          "12"
## [5] "Standard Deviation of Observations" "4.2943067862168"
##
## [[2]][[3]][[2]]
##

```

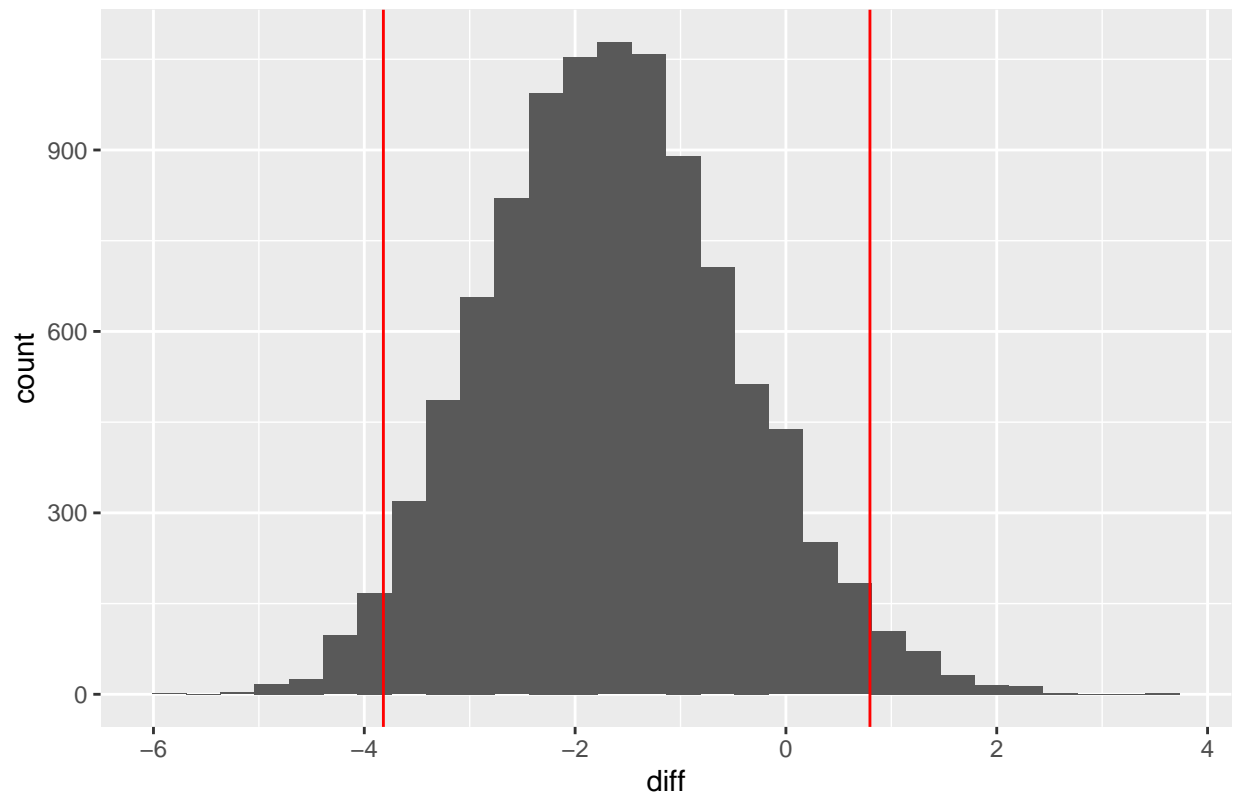
```
## Wilcoxon signed rank exact test
##
## data: home_judge and panel_mean
## V = 24, p-value = 0.1331
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[3]]
## [[2]][[3]][[3]][[1]]
## [1] "Permuation Test p-value"
##
## [[2]][[3]][[3]][[2]]
```

Permutation test from panel mean, Mens fp at 2022 Olympic Winter Games



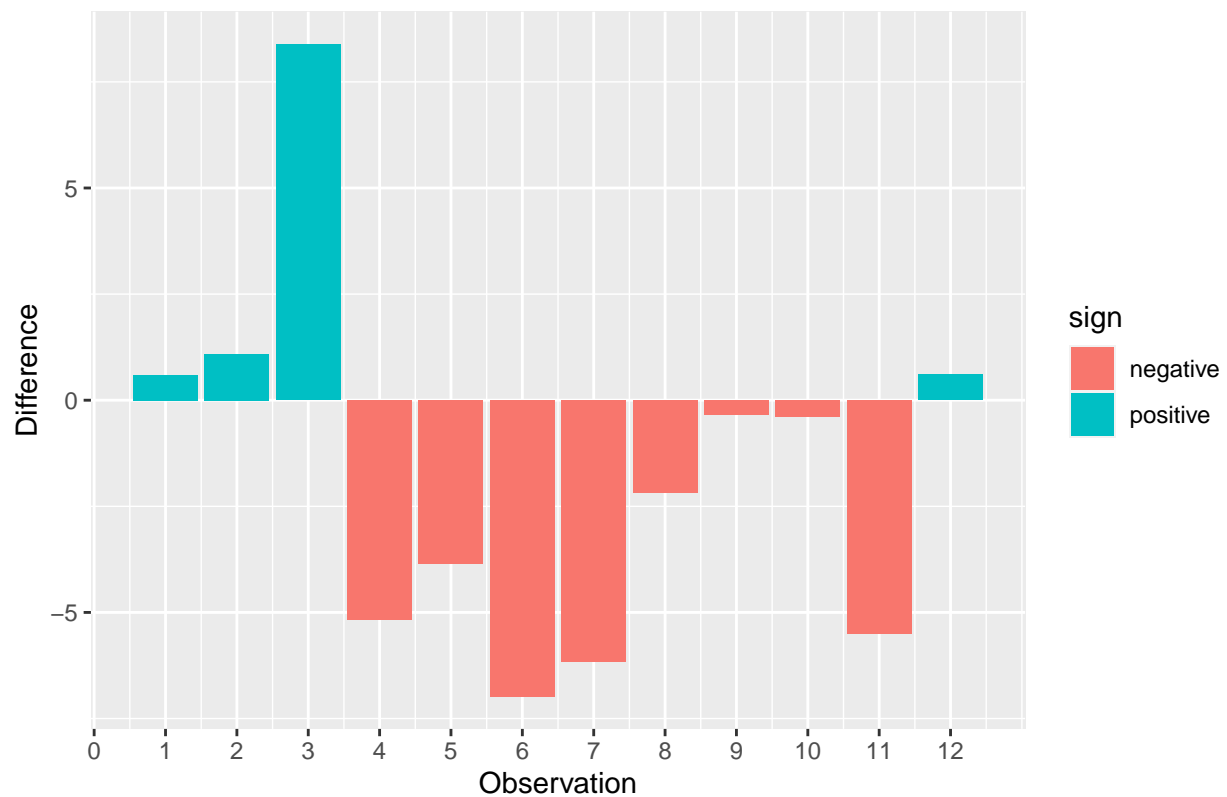
```
##
## [[2]][[3]][[3]][[3]]
## [1] 0.1059
##
## [[2]][[3]][[3]][[4]]
## [1] "hA = true mean is less than 0 (underscoring)"
##
##
## [[2]][[3]][[4]]
## [[2]][[3]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[3]][[4]][[2]]
```

Bootstrap Confidence Interval for from total, Mens fp at 2022 Olympic Winter



```
##
## [[2]] [[3]] [[4]] [[3]]
## [1] -3.818935 0.796974
##
## [[2]] [[3]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[3]] [[4]] [[5]]
## [1] 2.307954
##
##
## [[2]] [[3]] [[5]]
```

## HJ score vs. Panel Mean for Mens fp at 2022 Olympic Winter Games



```
##
## [[2]][[3]][[6]]
## [[2]][[3]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[3]][[6]][[2]]
## [[2]][[3]][[6]][[2]][[1]]
## [[2]][[3]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[3]][[6]][[2]][[1]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 33, p-value = 0.1522
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[1]][[3]]
## [[2]][[3]][[6]][[2]][[1]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[1]][[3]][[2]]
## [1] 0.0765
##
```

```

##
## [[2]][[3]][[6]][[2]][[1]][[4]]
## [1] "diff in means"      "3.18590909090908"
##
##
## [[2]][[3]][[6]][[2]][[2]]
## [[2]][[3]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[3]][[6]][[2]][[2]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 2, p-value = 0.125
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[2]][[3]]
## [[2]][[3]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.1253
##
##
## [[2]][[3]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "-4.77043478260868"
##
##
## [[2]][[3]][[6]][[2]][[3]]
## [[2]][[3]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[3]][[6]][[2]][[3]][[2]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[3]][[3]]
## [1] "No home scores to test"
##
## [[2]][[3]][[6]][[2]][[3]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[3]][[6]][[2]][[4]]
## [[2]][[3]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[3]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum test with continuity correction
##
## data:  home and away
## W = 20.5, p-value = 0.1796

```



```

## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[4]][[3]]
## [[2]][[3]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.2032
##
##
## [[2]][[3]][[6]][[2]][[4]][[4]]
## [1] "diff in means"      "-2.61285714285714"
##
##
## [[2]][[3]][[6]][[2]][[5]]
## [[2]][[3]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[3]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 8, p-value = 0.09058
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[5]][[3]]
## [[2]][[3]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.1088
##
##
## [[2]][[3]][[6]][[2]][[5]][[4]]
## [1] "diff in means"      "-2.13636363636365"
##
##
## [[2]][[3]][[6]][[2]][[6]]
## [[2]][[3]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[3]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 5, p-value = 0.25
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[6]][[3]]

```

```

## [[2]][[3]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[6]][[3]][[2]]
## [1] 0.2491
##
##
## [[2]][[3]][[6]][[2]][[6]][[4]]
## [1] "diff in means"      "-3.03782608695654"
##
##
## [[2]][[3]][[6]][[2]][[7]]
## [[2]][[3]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[3]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 4, p-value = 0.2083
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[7]][[3]]
## [[2]][[3]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.209
##
##
## [[2]][[3]][[6]][[2]][[7]][[4]]
## [1] "diff in means"      "-3.83304347826087"
##
##
## [[2]][[3]][[6]][[2]][[8]]
## [[2]][[3]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[3]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 14, p-value = 0.4167
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[3]][[6]][[2]][[8]][[3]]
## [[2]][[3]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[8]][[3]][[2]]

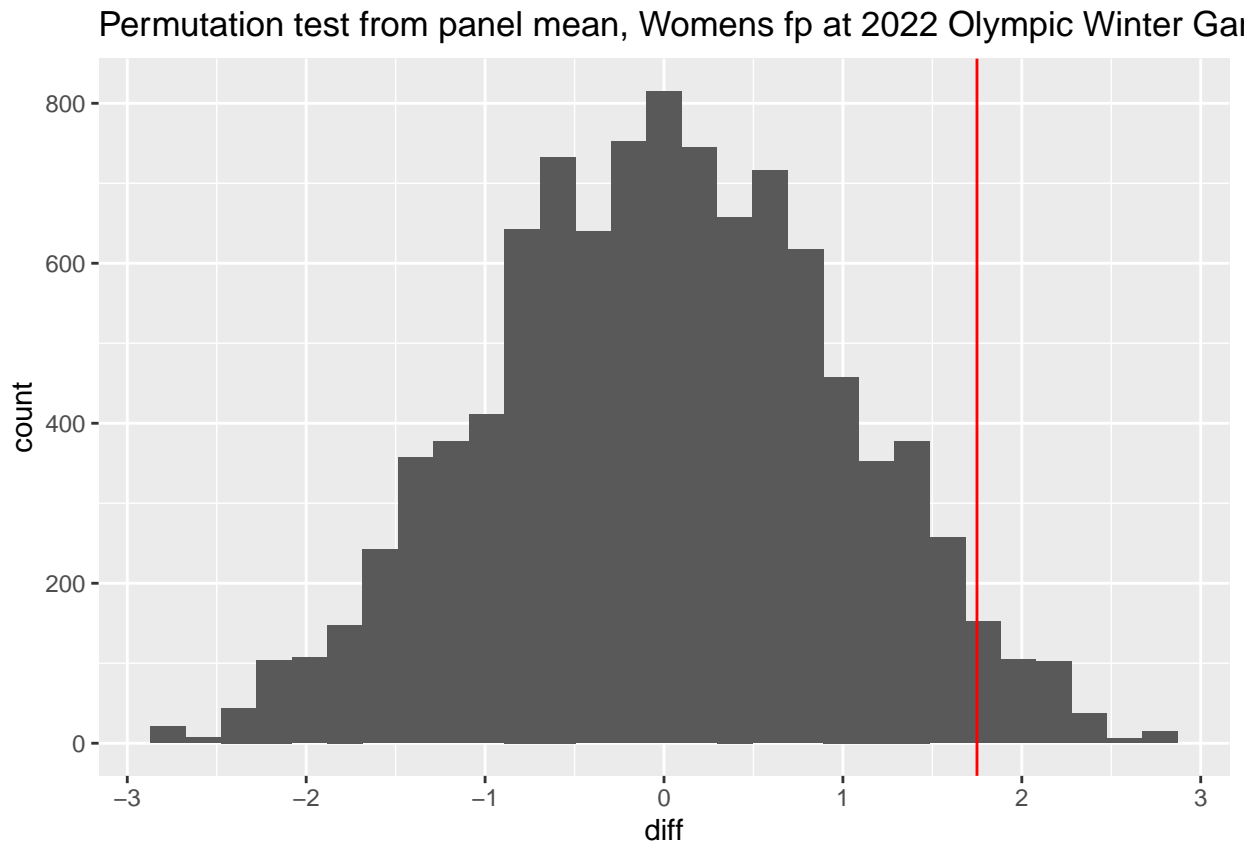
```

```

## [1] 0.3746
##
##
## [[2]][[3]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "0.62260869565216"
##
##
## [[2]][[3]][[6]][[2]][[9]]
## [[2]][[3]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##
## [[2]][[3]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 1, p-value = 0.08333
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[3]][[6]][[2]][[9]][[3]]
## [[2]][[3]][[6]][[2]][[9]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[3]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.0821
##
##
## [[2]][[3]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "-5.8104347826087"
##
##
##
##
## [[2]][[4]]
## [[2]][[4]][[1]]
## [1] "Womens"                "fp"
## [3] "# of Obs."              "10"
## [5] "Standard Deviation of Observations" "2.72165526125391"
##
## [[2]][[4]][[2]]
##
## Wilcoxon signed rank exact test
##
## data:  home_judge and panel_mean
## V = 44, p-value = 0.05273
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[3]]
## [[2]][[4]][[3]][[1]]
## [1] "Permuation Test p-value"
##

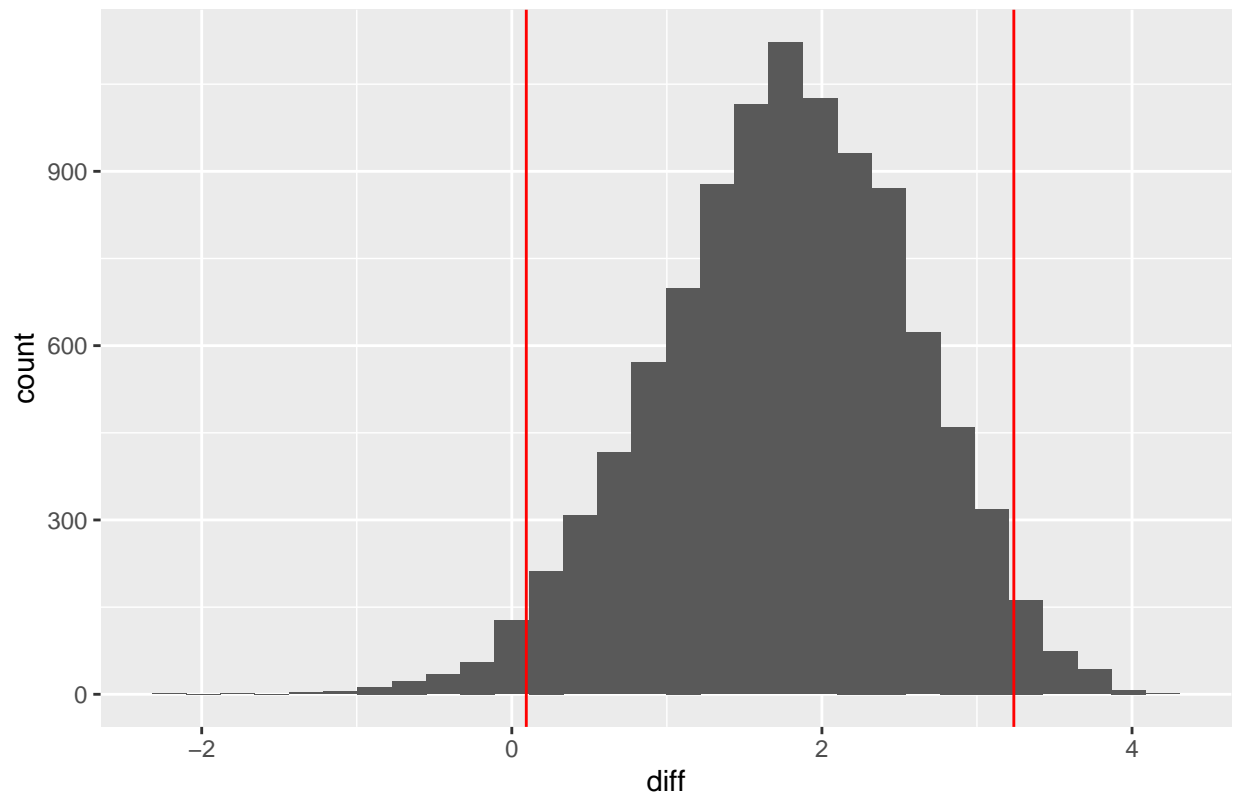
```

```
## [[2]][[4]][[3]][[2]]
```



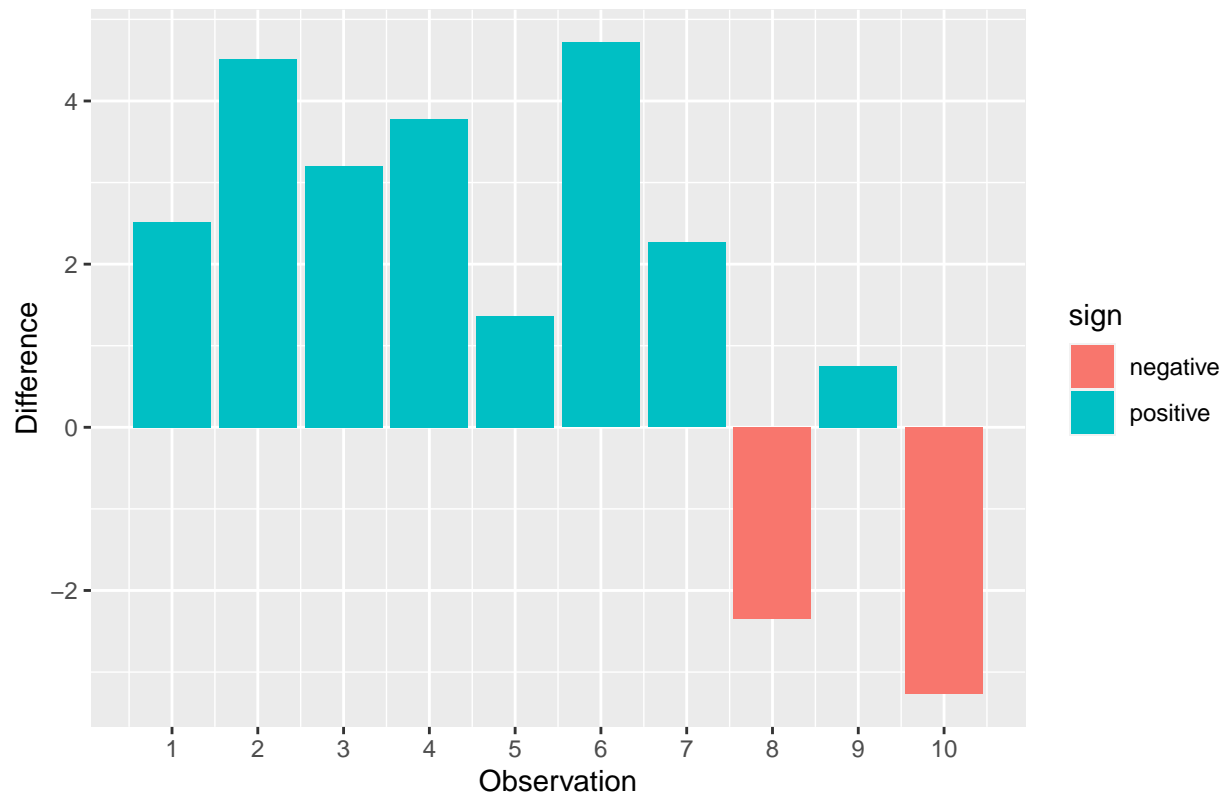
```
##
## [[2]][[4]][[3]][[3]]
## [1] 0.0363
##
## [[2]][[4]][[3]][[4]]
## [1] "hA = true mean is greater than 0 (overscoring)"
##
##
## [[2]][[4]][[4]]
## [[2]][[4]][[4]][[1]]
## [1] "Bootstrap Confidence Interval"
##
## [[2]][[4]][[4]][[2]]
```

Bootstrap Confidence Interval for from total, Womens fp at 2022 Olympic V



```
##
## [[2]] [[4]] [[4]] [[3]]
## [1] 0.09341562 3.23775938
##
## [[2]] [[4]] [[4]] [[4]]
## [1] "MOE"
##
## [[2]] [[4]] [[4]] [[5]]
## [1] 1.572172
##
##
## [[2]] [[4]] [[5]]
```

HJ score vs. Panel Mean for Womens fp at 2022 Olympic Winter Games



```
##
## [[2]][[4]][[6]]
## [[2]][[4]][[6]][[1]]
## [1] "Individual Judge Analysis"
##
## [[2]][[4]][[6]][[2]]
## [[2]][[4]][[6]][[2]][[1]]
## [[2]][[4]][[6]][[2]][[1]][[1]]
## [1] "j_1"
##
## [[2]][[4]][[6]][[2]][[1]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[1]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[1]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[2]]
## [[2]][[4]][[6]][[2]][[2]][[1]]
## [1] "j_2"
##
## [[2]][[4]][[6]][[2]][[2]][[2]]
##
```

```

## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 23, p-value = 0.08
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[2]][[3]]
## [[2]][[4]][[6]][[2]][[2]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[2]][[3]][[2]]
## [1] 0.041
##
##
## [[2]][[4]][[6]][[2]][[2]][[4]]
## [1] "diff in means"      "3.93666666666667"
##
##
## [[2]][[4]][[6]][[2]][[3]]
## [[2]][[4]][[6]][[2]][[3]][[1]]
## [1] "j_3"
##
## [[2]][[4]][[6]][[2]][[3]][[2]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[3]][[3]]
## [1] "No home scores to test"
##
## [[2]][[4]][[6]][[2]][[3]][[4]]
## [1] "diff in means" "NaN"
##
##
## [[2]][[4]][[6]][[2]][[4]]
## [[2]][[4]][[6]][[2]][[4]][[1]]
## [1] "j_4"
##
## [[2]][[4]][[6]][[2]][[4]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 16, p-value = 0.36
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[4]][[3]]
## [[2]][[4]][[6]][[2]][[4]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[4]][[3]][[2]]
## [1] 0.3127
##
##

```

```

## [[2]][[4]][[6]][[2]][[4]][[4]]
## [1] "diff in means"      "0.4937499999999996"
##
##
## [[2]][[4]][[6]][[2]][[5]]
## [[2]][[4]][[6]][[2]][[5]][[1]]
## [1] "j_5"
##
## [[2]][[4]][[6]][[2]][[5]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 8, p-value = 0.36
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[6]][[2]][[5]][[3]]
## [[2]][[4]][[6]][[2]][[5]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[5]][[3]][[2]]
## [1] 0.3653
##
##
## [[2]][[4]][[6]][[2]][[5]][[4]]
## [1] "diff in means"      "-0.831666666666665"
##
##
## [[2]][[4]][[6]][[2]][[6]]
## [[2]][[4]][[6]][[2]][[6]][[1]]
## [1] "j_6"
##
## [[2]][[4]][[6]][[2]][[6]][[2]]
##
## Wilcoxon rank sum exact test
##
## data:  home and away
## W = 44, p-value = 0.1991
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[6]][[3]]
## [[2]][[4]][[6]][[2]][[6]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[6]][[3]][[2]]
## [1] 0.1997
##
##
## [[2]][[4]][[6]][[2]][[6]][[4]]
## [1] "diff in means"      "1.02878787878789"
##
##

```



```

## [[2]][[4]][[6]][[2]][[7]]
## [[2]][[4]][[6]][[2]][[7]][[1]]
## [1] "j_7"
##
## [[2]][[4]][[6]][[2]][[7]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 6, p-value = 0.28
## alternative hypothesis: true location shift is less than 0
##
##
## [[2]][[4]][[6]][[2]][[7]][[3]]
## [[2]][[4]][[6]][[2]][[7]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[7]][[3]][[2]]
## [1] 0.2778
##
##
## [[2]][[4]][[6]][[2]][[7]][[4]]
## [1] "diff in means"      "-1.39208333333332"
##
##
## [[2]][[4]][[6]][[2]][[8]]
## [[2]][[4]][[6]][[2]][[8]][[1]]
## [1] "j_8"
##
## [[2]][[4]][[6]][[2]][[8]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 14, p-value = 0.44
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[8]][[3]]
## [[2]][[4]][[6]][[2]][[8]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[8]][[3]][[2]]
## [1] 0.402
##
##
## [[2]][[4]][[6]][[2]][[8]][[4]]
## [1] "diff in means"      "0.161666666666664"
##
##
## [[2]][[4]][[6]][[2]][[9]]
## [[2]][[4]][[6]][[2]][[9]][[1]]
## [1] "j_9"
##

```

```
## [[2]][[4]][[6]][[2]][[9]][[2]]
##
## Wilcoxon rank sum exact test
##
## data: home and away
## W = 25, p-value = 0.44
## alternative hypothesis: true location shift is greater than 0
##
##
## [[2]][[4]][[6]][[2]][[9]][[3]]
## [[2]][[4]][[6]][[2]][[9]][[3]][[1]]
## [1] "Permutation test"
##
## [[2]][[4]][[6]][[2]][[9]][[3]][[2]]
## [1] 0.4102
##
##
## [[2]][[4]][[6]][[2]][[9]][[4]]
## [1] "diff in means"      "0.370217391304351"
##
##
##
##
##
##
##
## [[3]]
```

