Analysis

In this document, we do the analysis presented in the paper.

Currently, the analysis uses fake data.

Setup

```
library(testthat)
library(ggsignif)
```

Reading the data

```
ratings <- readr::read_csv("ratings.csv", show_col_types = FALSE)
n_ratings <- nrow(ratings)
```

There are 1000 ratings.

Analysis

Connecting the ratings to the formations:

```
songs <- dplyr::select(heyahmama::get_songs(), cd_title, song_title)
n_songs <- nrow(songs)
```

There are 270 songs.

```
cds <- dplyr::select(heyahmama::get_cds(), cd_title, formation)
n_cds <- nrow(cds)
```

There are 22 CDs.

```
songs_per_formation <- dplyr::select(merge(songs, cds), song_title, formation)
testthat::expect_equal(n_songs, nrow(songs_per_formation))
knitr::kable(head(songs_per_formation))
```

song_title	formation
10.000 luchtballonnen	3
Kusjessoldaten	3
Als het binnen regent	3
Jodelee	3
Kus van de juf	3
Jij bent de bom!	3

Add the formations to the ratings:

```
ratings_per_formation <- dplyr::select(merge(ratings, songs_per_formation), formation, rating)
testthat::expect_equal(n_ratings, nrow(ratings_per_formation))
ratings_per_formation$formation <- as.factor(ratings_per_formation$formation)
knitr::kable(head(ratings_per_formation))
```

formation	rating
1	5
1	4
1	1
1	8
1	5
3	9

Formations

There are two datasets:

- Dataset A: all 4 formations
- Dataset B: the first 3 formations

4 formations

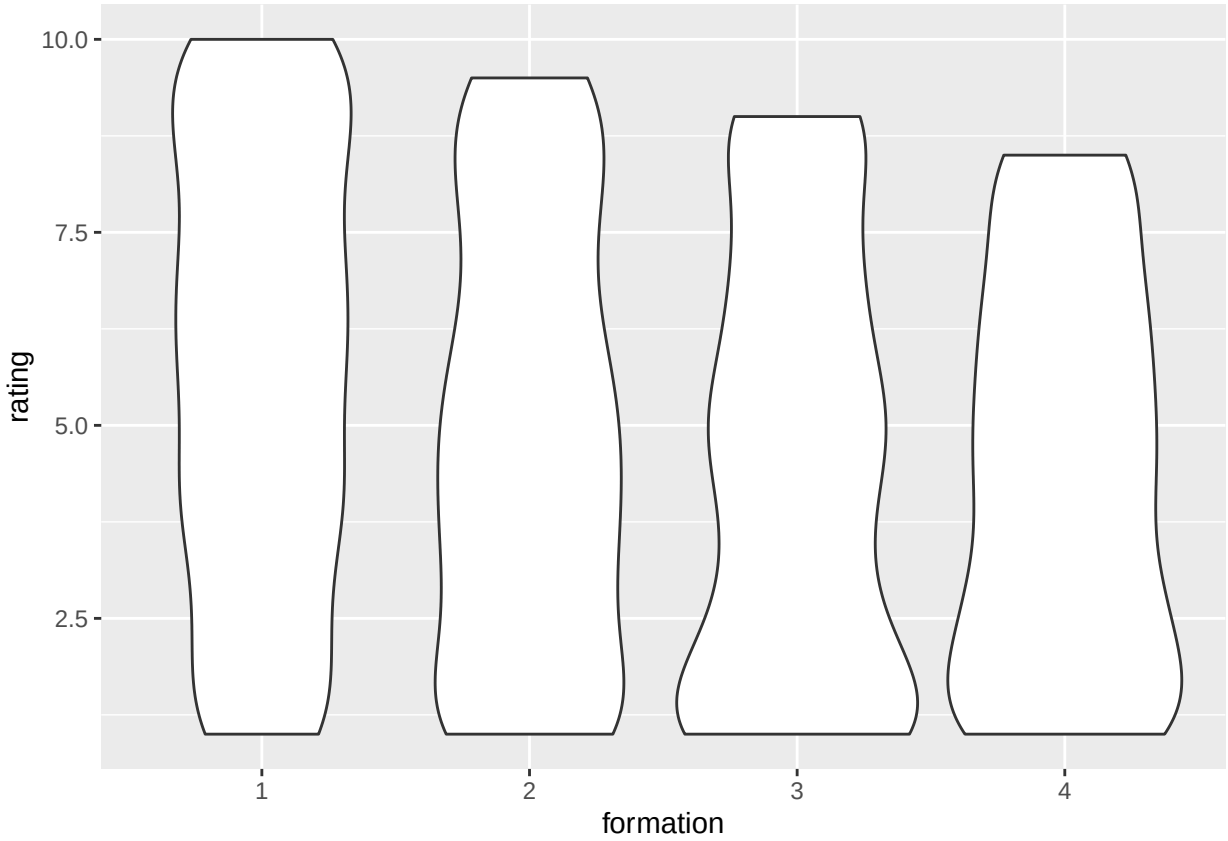
Plot distribution of ratings

General plotting function:

```
plot_ratings <- function(ratings_per_formation) {
  ggplot2::ggplot(
    ratings_per_formation,
    ggplot2::aes(x = formation, y = rating)
  ) + ggplot2::geom_violin()
}
```

Apply this to all ratings:

```
p <- plot_ratings(ratings_per_formation)
p
```



Order formations based on rating

Order formations by ratings:

```
get_ordered_average_rating_per_formation <- function(ratings_per_formation) {
  n_formations <- length(unique(ratings_per_formation$formation))

  average_rating_per_formation <-
    ratings_per_formation |>
    dplyr::group_by(formation) |>
    dplyr::summarise(average_rating = mean(rating))
  testthat::expect_equal(n_formations, nrow(average_rating_per_formation))

  ordered_average_rating_per_formation <-
    average_rating_per_formation |>
    dplyr::arrange(dplyr::desc(average_rating))
  testthat::expect_equal(n_formations, nrow(ordered_average_rating_per_formation))

  ordered_average_rating_per_formation
}
```

```
knitr::kable(
  get_ordered_average_rating_per_formation(
    ratings_per_formation
  )
)
```

formation	average_rating
1	5.730159
2	4.876316
3	4.441606
4	4.338608

Statistics

Do the formations have different ratings?

General function:

```
get_stats_table <- function(ratings_per_formation) {
  n_formations <- length(unique(ratings_per_formation$formation))
  n_combinations <- (n_formations * (n_formations - 1)) / 2
  alpha <- 0.05 / n_combinations

  p_values_table <- tibble::tibble(
    a = rep(NA, n_combinations),
    b = NA,
    p = NA,
    alpha = alpha
  )

  i <- 1
  for (lhs in seq(1, n_formations - 1)) {
    ratings_lhs <- ratings_per_formation[ratings_per_formation$formation == lhs, ]$rating
    for (rhs in seq(lhs + 1, n_formations)) {
      ratings_rhs <- ratings_per_formation[ratings_per_formation$formation == rhs, ]$rating
      p_value <- wilcox.test(ratings_lhs, ratings_rhs, alternative = "two.sided")$p.value
      testthat::expect_true(i >= 1)
      testthat::expect_true(i <= nrow(p_values_table))
      p_values_table$a[i] <- lhs
      p_values_table$b[i] <- rhs
      p_values_table$p[i] <- p_value
      i <- i + 1
    }
  }
  p_values_table$is_the_same <- p_values_table$p > alpha
  p_values_table
}
```

Applying it here:

```
knitr::kable(get_stats_table(ratings_per_formation))
```

a	b	p	alpha	is_the_same
1	2	0.0008208	0.0083333	FALSE
1	3	0.0000000	0.0083333	FALSE
1	4	0.0000003	0.0083333	FALSE
2	3	0.0811276	0.0083333	TRUE
2	4	0.0922982	0.0083333	TRUE
3	4	0.8913167	0.0083333	TRUE

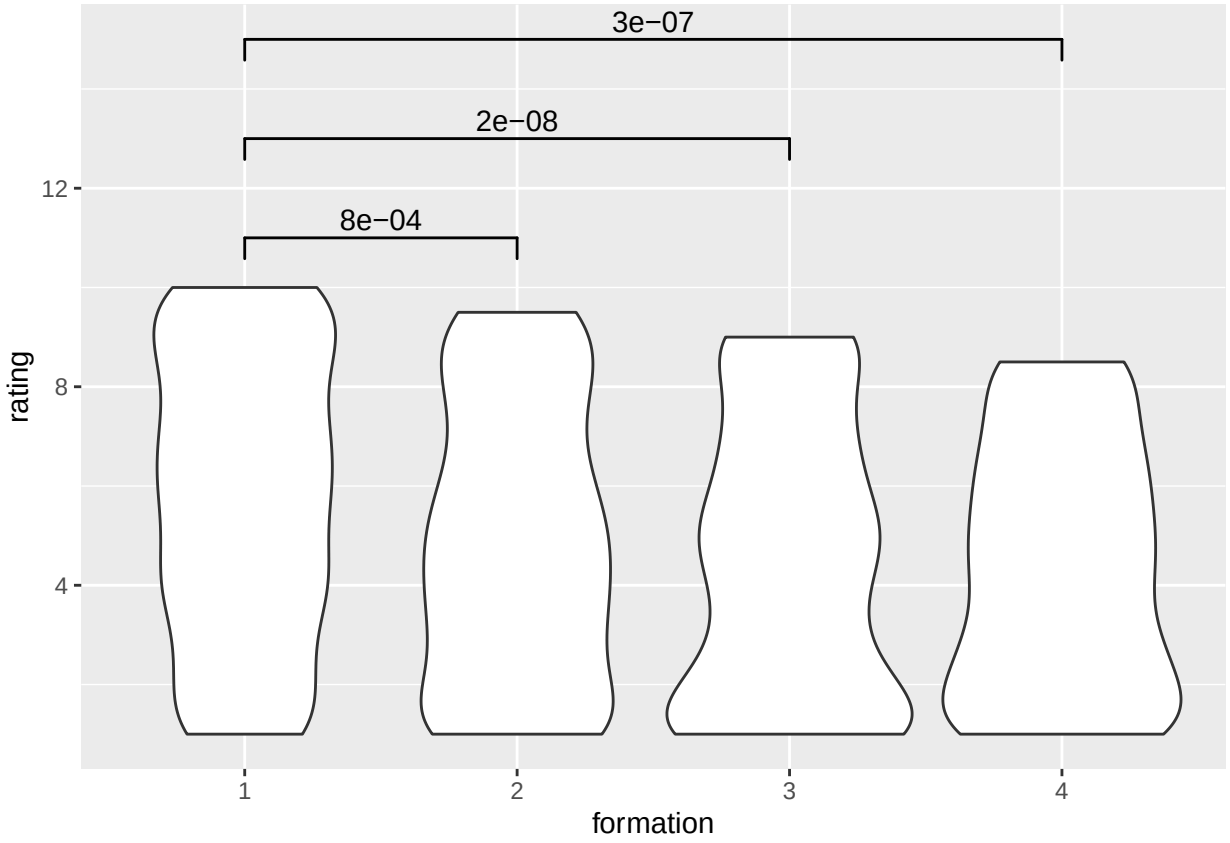
Plot with significance indicators

General function:

```
plot_ratings_with_indicators <- function(ratings_per_formation) {
  p <- plot_ratings(ratings_per_formation)
  t_all <- get_stats_table(ratings_per_formation)

  t <- t_all[t_all$is_the_same == FALSE, ]

  t$annotation <- scales::scientific(t$p, digits = 1)
  t$y_position <- seq(
    from = 11.0,
    to = 11.0 + ((nrow(t) - 1) * 2.0),
    by = 2.0
  )
  p + ggsignif::geom_signif(
    data = t,
    ggplot2::aes(
      xmin = a,
      xmax = b,
      annotations = annotation,
      y_position = y_position
    ),
    manual = TRUE
  )

}
```

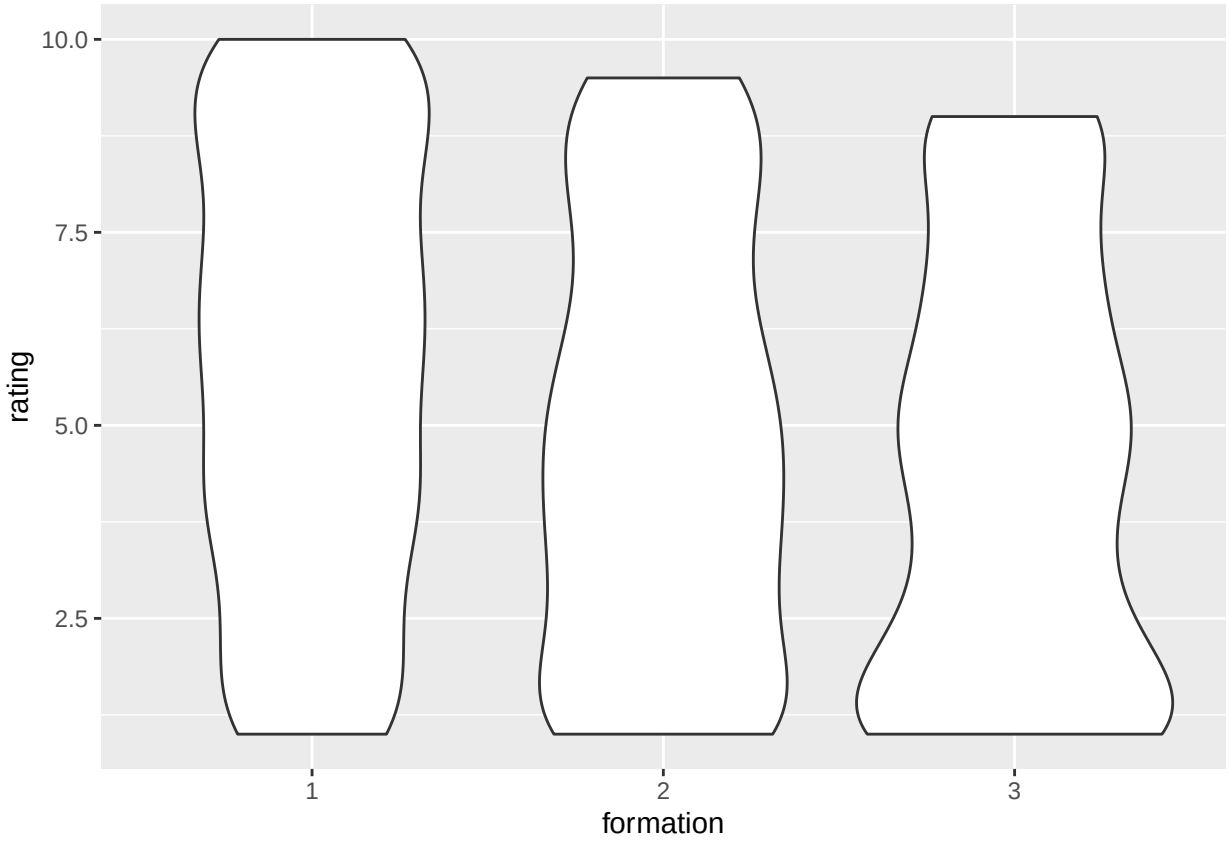
To these ratings

```
plot_ratings_with_indicators(ratings_per_formation)
#> Warning in ggsignif::geom_signif(data = t, ggplot2::aes(xmin = a, xmax = b, :
#> Ignoring unknown aesthetics: xmin, xmax, annotations, and y_position
```



3 formations

```
t <- ratings_per_formation[ratings_per_formation$formation != 4, ]
p <- plot_ratings(t)
p
```



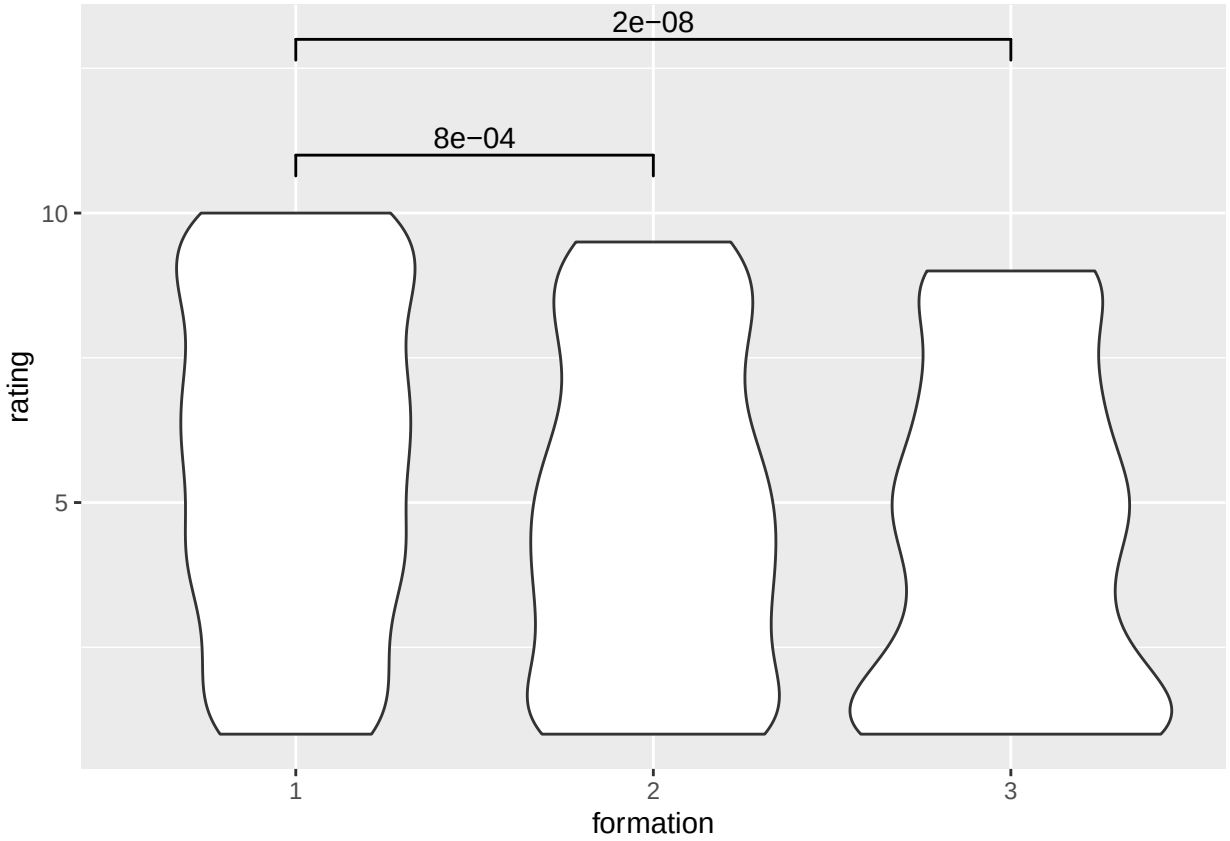

```
knitr::kable(
  get_ordered_average_rating_per_formation(t)
)
```

formation	average_rating
1	5.730159
2	4.876316
3	4.441606

```
t <- ratings_per_formation[ratings_per_formation$formation != 4, ]
knitr::kable(get_stats_table(ratings_per_formation = t))
```

a	b	p	alpha	is_the_same
1	2	0.0008208	0.0166667	FALSE
1	3	0.0000000	0.0166667	FALSE
2	3	0.0811276	0.0166667	TRUE

```
plot_ratings_with_indicators(t)
#> Warning in ggsignif::geom_signif(data = t, ggplot2::aes(xmin = a, xmax = b, :
#> Ignoring unknown aesthetics: xmin, xmax, annotations, and y_position
```


2e−08
8e−04
10
5
rating
1
2
3
formation