Emotions in social media

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2024-08-15

1. Load dataset

Dataset link

```
tryCatch({
  data <- read.csv("train.csv", header = TRUE)
  print("File read successfully")
}, error = function(e) {
  cat("ERROR when loading the dataset",conditionMessage(e), "\n")
})
```

```
## [1] "File read successfully"
```

2. Preprocessing data

2.1 Delete blank lines (if needed):

```
cat("Rows before:", nrow(data), "\n")
```

```
## Rows before: 2004
```

```
data <- data[rowSums(is.na(data) | data == "") != ncol(data), ]
cat("Rows after:", nrow(data))
```

```
## Rows after: 1000
```

2.2 Check variable types and column names

```
columns <- names(data)
types <- sapply(data, class)
for (i in seq_along(columns)) {
  cat("Column name:", columns[i], " Type:", types[i], "\n")
}
```

```
## Column name: User_ID  Type: integer
## Column name: Age  Type: integer
## Column name: Gender  Type: character
## Column name: Platform  Type: character
## Column name: Daily_Usage_Time..minutes.  Type: integer
## Column name: Posts_Per_Day  Type: integer
## Column name: Likes_Received_Per_Day  Type: integer
## Column name: Comments_Received_Per_Day  Type: integer
## Column name: Messages_Sent_Per_Day  Type: integer
```

```
## Column name: Dominant_Emotion  Type: character
```

Transformations:

- Column “Age” will become an integer
- Column “Daily_Usage_Time..minutes” will be renamed as “Minutes_Per_Day”

```
data_transformed <- transform(data,
                              Age = as.integer(Age))
colnames(data_transformed)[colnames(data_transformed) ==
                             "Daily_Usage_Time..minutes."] <- "Minutes_Per_Day"
```

```
types <- sapply(data_transformed, class)
for (i in seq_along(columns)) {
  cat("Column name:", columns[i], " Type:", types[i], "\n")
}
```

```
## Column name: User_ID  Type: integer
## Column name: Age  Type: integer
## Column name: Gender  Type: character
## Column name: Platform  Type: character
## Column name: Daily_Usage_Time..minutes.  Type: integer
## Column name: Posts_Per_Day  Type: integer
## Column name: Likes_Received_Per_Day  Type: integer
## Column name: Comments_Received_Per_Day  Type: integer
## Column name: Messages_Sent_Per_Day  Type: integer
## Column name: Dominant_Emotion  Type: character
```

2.3 Check if there’s NA values

```
any(is.na(data_transformed))
```

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

3. Descriptive analysis and inferential

3.1 Data distribution per gender, platform, age and dominant emotion

3.1.1 Data distribution per gender

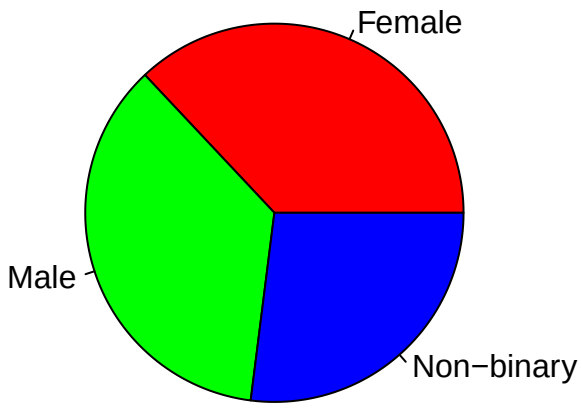
```
genders <- unique(data_transformed$Gender)
print(genders)
```

```
## [1] "Female"     "Male"       "Non-binary"
```

```
percentages_gender <- round(prop.table(table(data_transformed$Gender)) * 100, 2)
for (i in seq_along(genders)) {
  cat("Gender:",  genders[i], "- Percentage:", percentages_gender[i],"%\n")
}
```

```
## Gender: Female - Percentage: 37 %
## Gender: Male - Percentage: 36 %
## Gender: Non-binary - Percentage: 27 %
```

```
pie(table(data_transformed$Gender), main = "Distribution per age",
    col = rainbow(length(unique(data_transformed$Gender))))
```




```
    labels = genders
```

3.1.2 Data distribution per platform

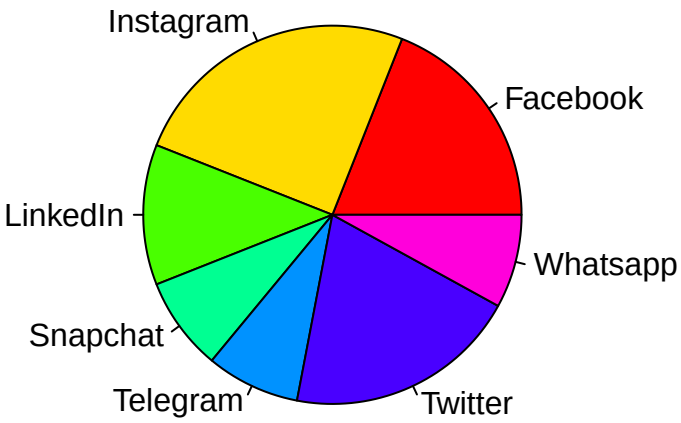
```
platforms <- unique(data_transformed$Platform)
print(platforms)
```

```
## [1] "Instagram" "Twitter"   "Facebook"  "LinkedIn"  "Whatsapp"  "Telegram"
## [7] "Snapchat"
```

```
percentages_platform <- round(prop.table(table(data_transformed$Platform)) * 100, 2)
for (i in seq_along(platforms)) {
  cat("Gender:",  platforms[i], "- Percentage:", percentages_platform[i],"%\n")
}
```

```
## Gender: Instagram - Percentage: 19 %
## Gender: Twitter - Percentage: 25 %
## Gender: Facebook - Percentage: 12 %
## Gender: LinkedIn - Percentage: 8 %
## Gender: Whatsapp - Percentage: 8 %
## Gender: Telegram - Percentage: 20 %
## Gender: Snapchat - Percentage: 8 %
```

```
pie(table(data_transformed$Platform), main = "Distribution per platform",
    col = rainbow(length(unique(data_transformed$Platform))))
```




```
    labels = platforms
```

3.1.3 Data distribution per age

```
ages <- unique(data_transformed$Age)
print(ages)
```

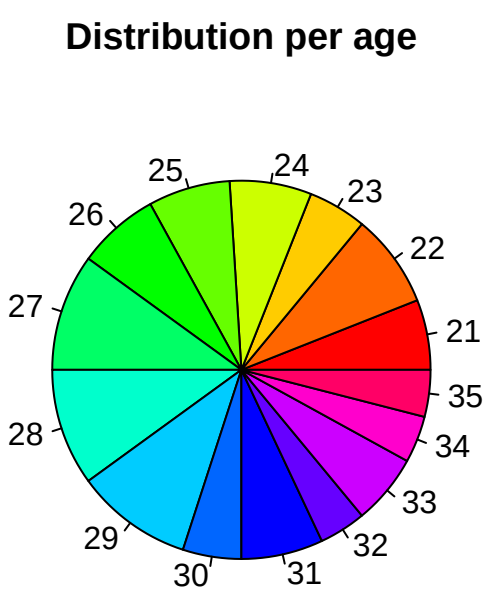
```
##  [1] 25 30 22 28 33 21 27 24 29 31 23 26 34 35 32
```

```
percentages_ages <- round(prop.table(table(data_transformed$Age)) * 100,
                          2)
for (i in seq_along(ages)) {
  cat("Gender:",  ages[i], "- Percentage:", percentages_ages[i],"%\n")
}
```

```
## Gender: 25 - Percentage: 6 %
## Gender: 30 - Percentage: 8 %
## Gender: 22 - Percentage: 5 %
## Gender: 28 - Percentage: 7 %
## Gender: 33 - Percentage: 7 %
## Gender: 21 - Percentage: 7 %
## Gender: 27 - Percentage: 10 %
## Gender: 24 - Percentage: 10 %
## Gender: 29 - Percentage: 10 %
## Gender: 31 - Percentage: 5 %
## Gender: 23 - Percentage: 7 %
## Gender: 26 - Percentage: 4 %
```

```
## Gender: 34 - Percentage: 6 %
## Gender: 35 - Percentage: 4 %
## Gender: 32 - Percentage: 4 %
```

```
pie(table(data_transformed$Age), main = "Distribution per age",
    col = rainbow(length(unique(data_transformed$Age))))
```




```
    labels = ages
```

3.1.4 Data distribution per dominant emotion

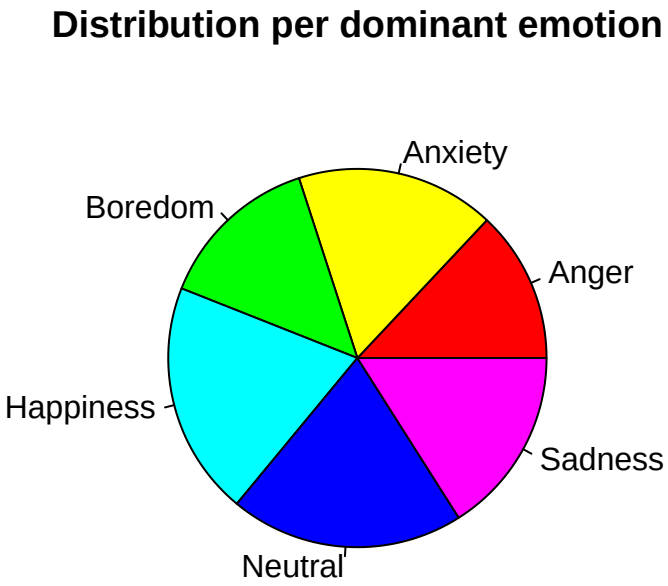
```
emotions <- unique(data_transformed$Dominant_Emotion)
print(emotions)
```

```
## [1] "Happiness" "Anger"     "Neutral"   "Anxiety"   "Boredom"   "Sadness"
```

```
percentages_emotions <- round(prop.table(table(data_transformed$Dominant_Emotion)) * 100, 2)
for (i in seq_along(emotions)) {
  cat("Gender:",  emotions[i], "- Percentage:", percentages_emotions[i],"%\n")
}
```

```
## Gender: Happiness - Percentage: 13 %
## Gender: Anger - Percentage: 17 %
## Gender: Neutral - Percentage: 14 %
## Gender: Anxiety - Percentage: 20 %
## Gender: Boredom - Percentage: 20 %
## Gender: Sadness - Percentage: 16 %
```

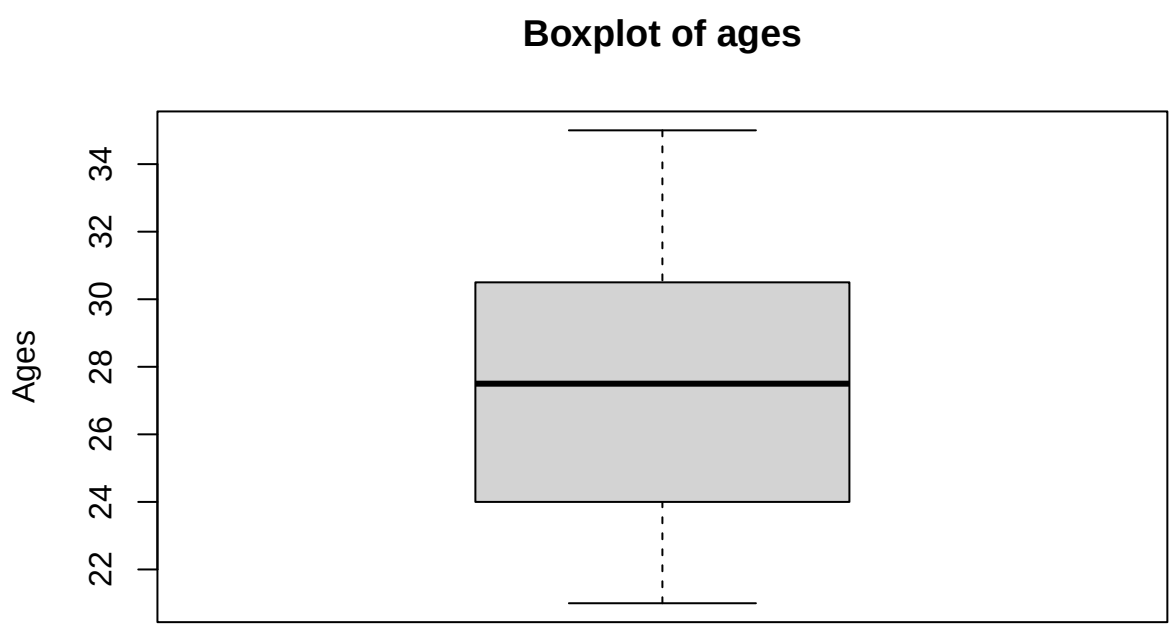
```
pie(table(data_transformed$Dominant_Emotion), main = "Distribution per dominant emotion",
    col = rainbow(length(unique(data_transformed$Dominant_Emotion))))
```




```
    labels = emotions
```

3.2 Check if there are extreme ages

```
boxplot(data_transformed$Age, main = "Boxplot of ages",
        ylab = "Ages")
```




```
cat("Median: ",median(data_transformed$Age),"\n")
```

```
## Median:  27.5
```

```
cat("Quantiles 25%, 50%, 75%: ",quantile(data_transformed$Age, probs = c(0.25, 0.5, 0.75)))
```

```
## Quantiles 25%, 50%, 75%:  24 27.5 30.25
```

Median line -> Closer to Q3 (not too much) -> More people has less than 27 YO.

Box -> Q1 = 24 and Q3 = 30.25 ~ 30 -> 50% of the people has between 24 and 30 YO.

Whiskers -> Top whisker is longer than bottom whisker -> Ages above median are more dispersed (More difference between the median and the max value)

Outliers -> There are no outliers

3.3 Relation between used platform and dominant emotion

H0 -> There's no significant association between both variables

H1 -> There's significant association between both variables

```
chisq_data <- table(data_transformed$Platform, data_transformed$Dominant_Emotion)
chisq_data
```

```
##
##             Anger Anxiety Boredom Happiness Neutral Sadness
##   Facebook      0      50       40         0      70      30
##   Instagram    10      30        0       170      20      20
```

```
##   LinkedIn      0      20      70         0      20      10
##   Snapchat      0      20       0        10      20      30
##   Telegram     10      10      10         0      30      20
##   Twitter      80      20      20        10      20      50
##   Whatsapp     30      20       0        10      20       0
```

```r
# Alpha = 0.05 -> CL = 95%
chisq.test(chisq_data, correct = FALSE)
```

```
##
##  Pearson's Chi-squared test
##
## data:  chisq_data
## X-squared = 1003.9, df = 30, p-value < 2.2e-16
```

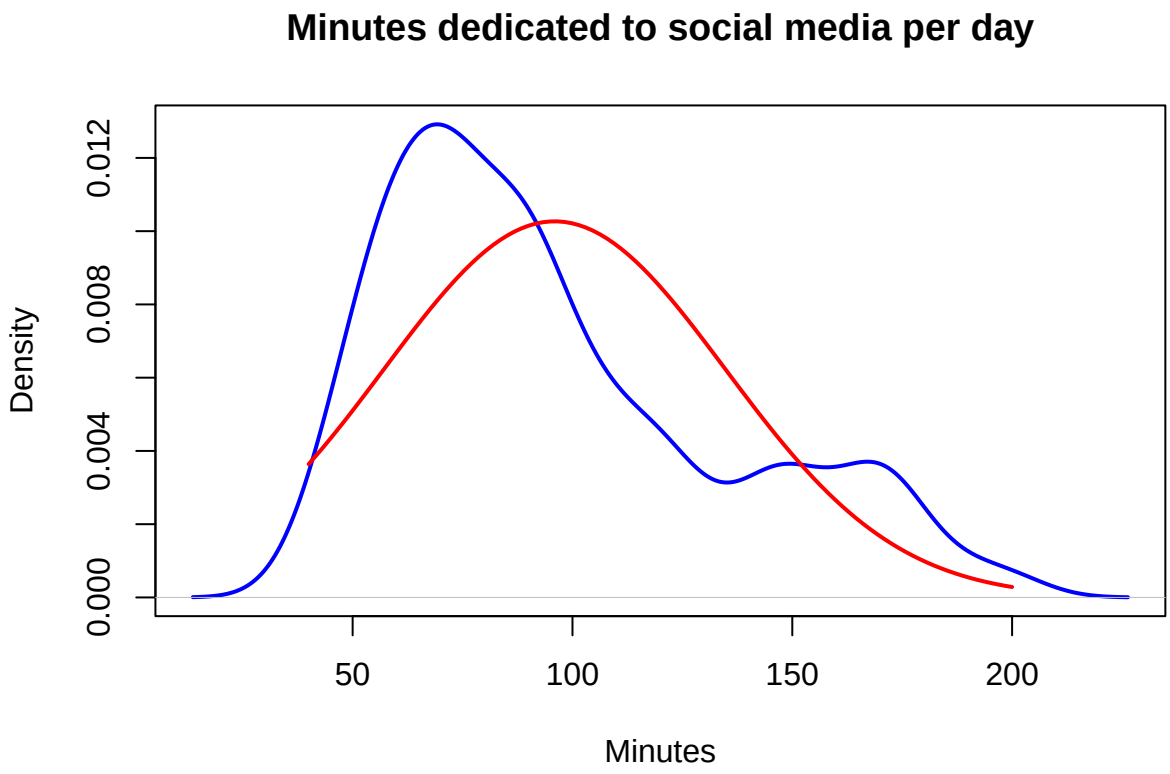
The p value < 0.05(alpha) -> There's enough evidence to refuse H0 with a 95% confidence level

3.4 Dominant emotion depending on the minutes per day spend on social media

H0 -> The spent time on social media is the same regardless of the dominant emotion

H1 -> At least one emotion spends more/less time on social media

```r
plot(density(data_transformed$Minutes_Per_Day),
     main = "Minutes dedicated to social media per day",
     xlab = "Minutes",
     ylab = "Density",
     col = "blue",
     lwd = 2)
values_normal_distribution <- seq(min(data_transformed$Minutes_Per_Day),
                                  max(data_transformed$Minutes_Per_Day),
                                  length = 100)
normal_distribution <- dnorm(values_normal_distribution,
                             mean = abs(mean(data_transformed$Minutes_Per_Day)),
                             sd = sd(data_transformed$Minutes_Per_Day))
lines(values_normal_distribution, normal_distribution, col = "red", lwd = 2)
```



Variable Minutes_Per_Day -> No normal distribution -> ANOVA no possible

```
kruskal <- kruskal.test(Minutes_Per_Day ~ Dominant_Emotion, data = data_transformed)
kruskal
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  Minutes_Per_Day by Dominant_Emotion
## Kruskal-Wallis chi-squared = 475.45, df = 5, p-value < 2.2e-16
```

$p < 0.05$ -> There's enough evidence to refuse H0 with a 95% confidence level -> Suggests relation

```
library(dunn.test)
```

```
results_dunn <- dunn.test(data_transformed$Minutes_Per_Day,
                          data_transformed$Dominant_Emotion, method = "bonferroni")
```

```
##   Kruskal-Wallis rank sum test
##
## data: x and group
## Kruskal-Wallis chi-squared = 475.4502, df = 5, p-value = 0
##
##
##                            Comparison of x by group
##                                  (Bonferroni)
## Col Mean-|
## Row Mean |      Anger    Anxiety    Boredom   Happines    Neutral
## ---------+------------------------------------------------------
```

```
##  Anxiety |   0.609369
##          |     1.0000
##          |
##  Boredom |   8.552439   8.505242
##          |    0.0000*    0.0000*
##          |
## Happines |  -10.06400  -11.54933  -19.74230
##          |    0.0000*    0.0000*    0.0000*
##          |
##  Neutral |   4.740492   4.438969  -4.606576   16.67876
##          |    0.0000*    0.0001*    0.0000*    0.0000*
##          |
##  Sadness |   2.720632   2.271944  -6.225303   13.71841  -2.006476
##          |     0.0489     0.1732    0.0000*    0.0000*     0.3360
##
## alpha = 0.05
## Reject Ho if p <= alpha/2
```

```
print(results_dunn)
```

```
## $chi2
## [1] 475.4502
##
## $Z
##  [1]   0.6093694   8.5524400   8.5052428 -10.0640024 -11.5493378 -19.7423090
##  [7]   4.7404926   4.4389697  -4.6065762  16.6787652   2.7206324   2.2719444
## [13]  -6.2253040  13.7184142  -2.0064764
##
## $P
##  [1] 2.711398e-01 6.025671e-18 9.060798e-18 3.984555e-24 3.719570e-31
##  [6] 4.670510e-87 1.065996e-06 4.519528e-06 2.046765e-06 9.352266e-63
## [11] 3.257859e-03 1.154493e-02 2.403117e-10 3.938471e-43 2.240272e-02
##
## $P.adjusted
##  [1] 1.000000e+00 9.038506e-17 1.359120e-16 5.976832e-23 5.579356e-30
##  [6] 7.005765e-86 1.598994e-05 6.779291e-05 3.070148e-05 1.402840e-61
## [11] 4.886788e-02 1.731740e-01 3.604675e-09 5.907706e-42 3.360408e-01
##
## $comparisons
##  [1] "Anger - Anxiety"     "Anger - Boredom"     "Anxiety - Boredom"
##  [4] "Anger - Happiness"   "Anxiety - Happiness" "Boredom - Happiness"
##  [7] "Anger - Neutral"     "Anxiety - Neutral"   "Boredom - Neutral"
## [10] "Happiness - Neutral" "Anger - Sadness"     "Anxiety - Sadness"
## [13] "Boredom - Sadness"   "Happiness - Sadness" "Neutral - Sadness"
```

Significant difference = Between both emotions, one of them spends more/less time on social media than the other emotion.

Considering significance = 0.05 -> CL = 95%: - “Anger - Boredom”

- “Anxiety - Boredom”
- “Anger - Happiness”
- “Anxiety - Happiness”
- “Boredom - Happiness”

- “Anger - Neutral”
- “Anxiety - Neutral”
- “Boredom - Neutral”
- “Happiness - Neutral”
- “Anger - Sadness”

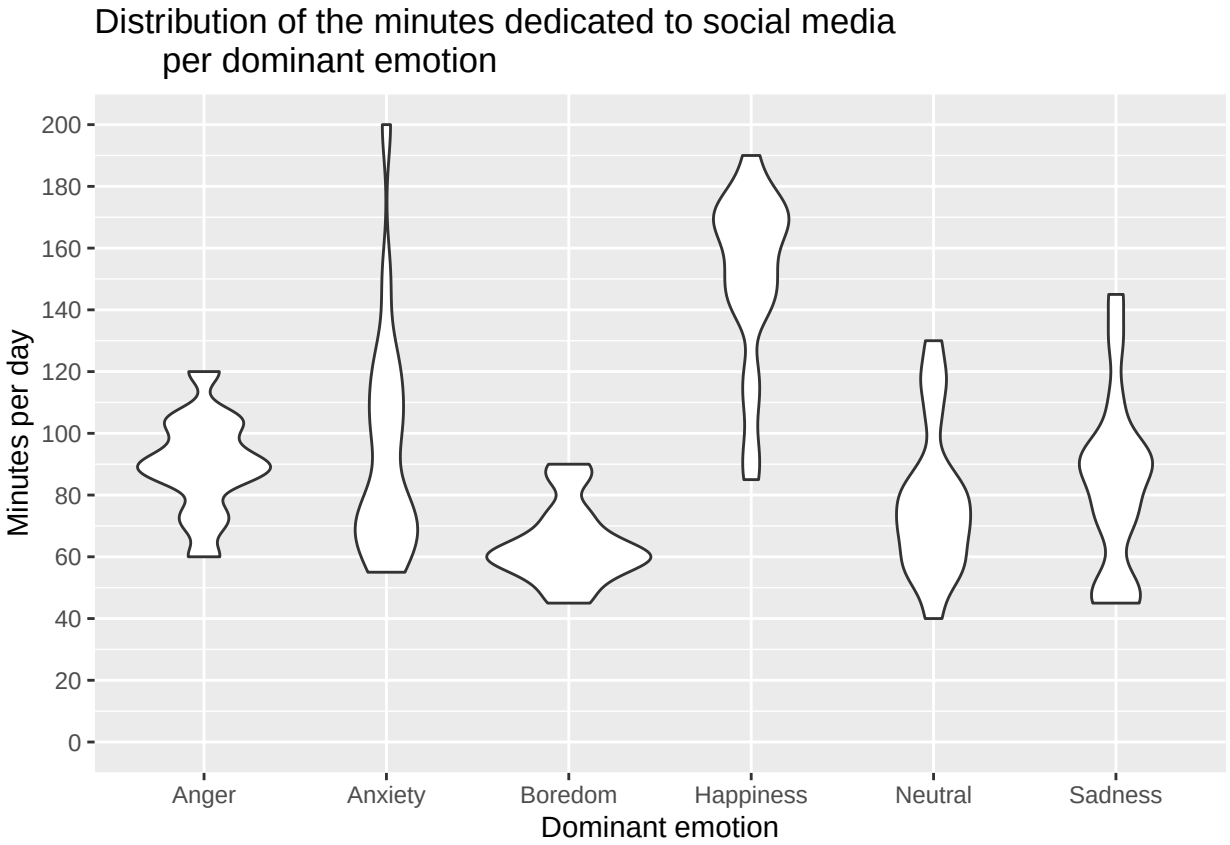
```
library(ggplot2)
library(dplyr)
```

```
##
## 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
```

```
ggplot(data_transformed, aes(x = Dominant_Emotion, y = Minutes_Per_Day)) +
  geom_violin() +
  scale_y_continuous(limits = c(0, 200),
                     breaks = seq(0, 200, by = 20)) +
  labs(title = "Distribution of the minutes dedicated to social media
       per dominant emotion",
       x = "Dominant emotion",
       y = "Minutes per day")
```



Taking a look at the graphic above, H1 is confirmed.

```
minutes_platform <- data_transformed %>%
  group_by(Platform) %>%
  summarise(suma = sum(Minutes_Per_Day)) %>%
  arrange(desc(suma))
print(minutes_platform)
```

```
## # A tibble: 7 x 2
##   Platform   suma
##   <chr>     <int>
## 1 Instagram 38350
## 2 Twitter   16750
## 3 Facebook  13700
## 4 Snapchat   7200
## 5 Whatsapp   7000
## 6 LinkedIn   6700
## 7 Telegram   6250
```

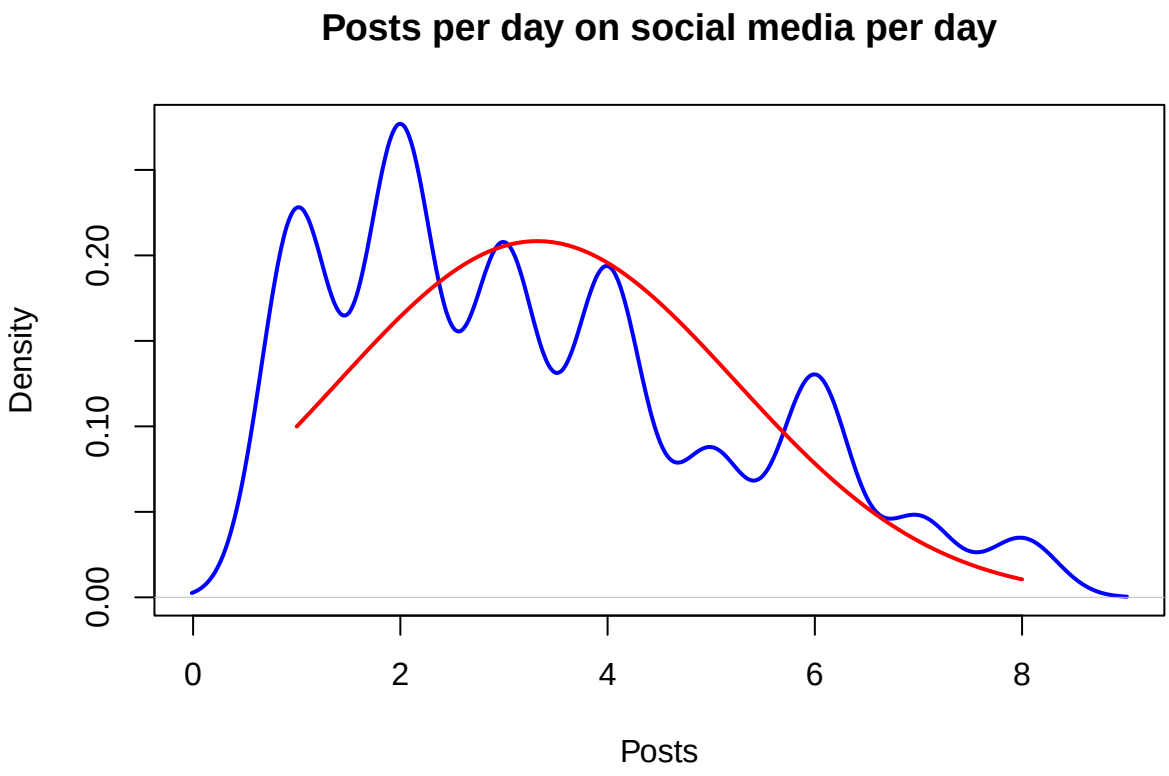
3.5 Dominant emotion depending on the posts per day spend on social media

H0 -> The daily posts are the same regardless of the dominant emotion

H1 -> At least one emotion has more/less daily posts

```
plot(density(data_transformed$Posts_Per_Day),
     main = "Posts per day on social media per day",
     xlab = "Posts",
```

```
     ylab = "Density",
     col = "blue",
     lwd = 2)
values_normal_distribution <- seq(min(data_transformed$Posts_Per_Day),
                                  max(data_transformed$Posts_Per_Day),
                                  length = 100)
normal_distribution <- dnorm(values_normal_distribution,
                             mean = abs(mean(data_transformed$Posts_Per_Day)),
                             sd = sd(data_transformed$Posts_Per_Day))
lines(values_normal_distribution, normal_distribution, col = "red", lwd = 2)
```



Variable Posts_Per_Day -> No normal distribution -> ANOVA no possible

```
kruskal <- kruskal.test(Posts_Per_Day ~ Dominant_Emotion, data = data_transformed)
kruskal
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  Posts_Per_Day by Dominant_Emotion
## Kruskal-Wallis chi-squared = 474.09, df = 5, p-value < 2.2e-16
```

$p < 0.05$ -> There's enough evidence to refuse H0 with a 95% confidence level -> Suggests relation

```
results_dunn <- dunn.test(data_transformed$Posts_Per_Day,
                          data_transformed$Dominant_Emotion, method = "bonferroni")
```

```
##   Kruskal-Wallis rank sum test
```

```
##
## data: x and group
## Kruskal-Wallis chi-squared = 474.0937, df = 5, p-value = 0
##
##
##                           Comparison of x by group
##                                 (Bonferroni)
## Col Mean-|
## Row Mean |      Anger    Anxiety    Boredom   Happines    Neutral
## ---------+-----------------------------------------------------
##  Anxiety |   4.530421
##          |    0.0000*
##          |
##  Boredom |   11.31303   7.448500
##          |    0.0000*    0.0000*
##          |
## Happines |  -7.023301  -12.64480  -19.68489
##          |    0.0000*    0.0000*    0.0000*
##          |
##  Neutral |   7.200801   2.716701  -5.142541   16.02489
##          |    0.0000*     0.0495    0.0000*    0.0000*
##          |
##  Sadness |   3.894544  -0.617199  -7.932991   11.79552  -3.312889
##          |    0.0007*     1.0000    0.0000*    0.0000*    0.0069*
##
## alpha = 0.05
## Reject Ho if p <= alpha/2
```

```
print(results_dunn)
```

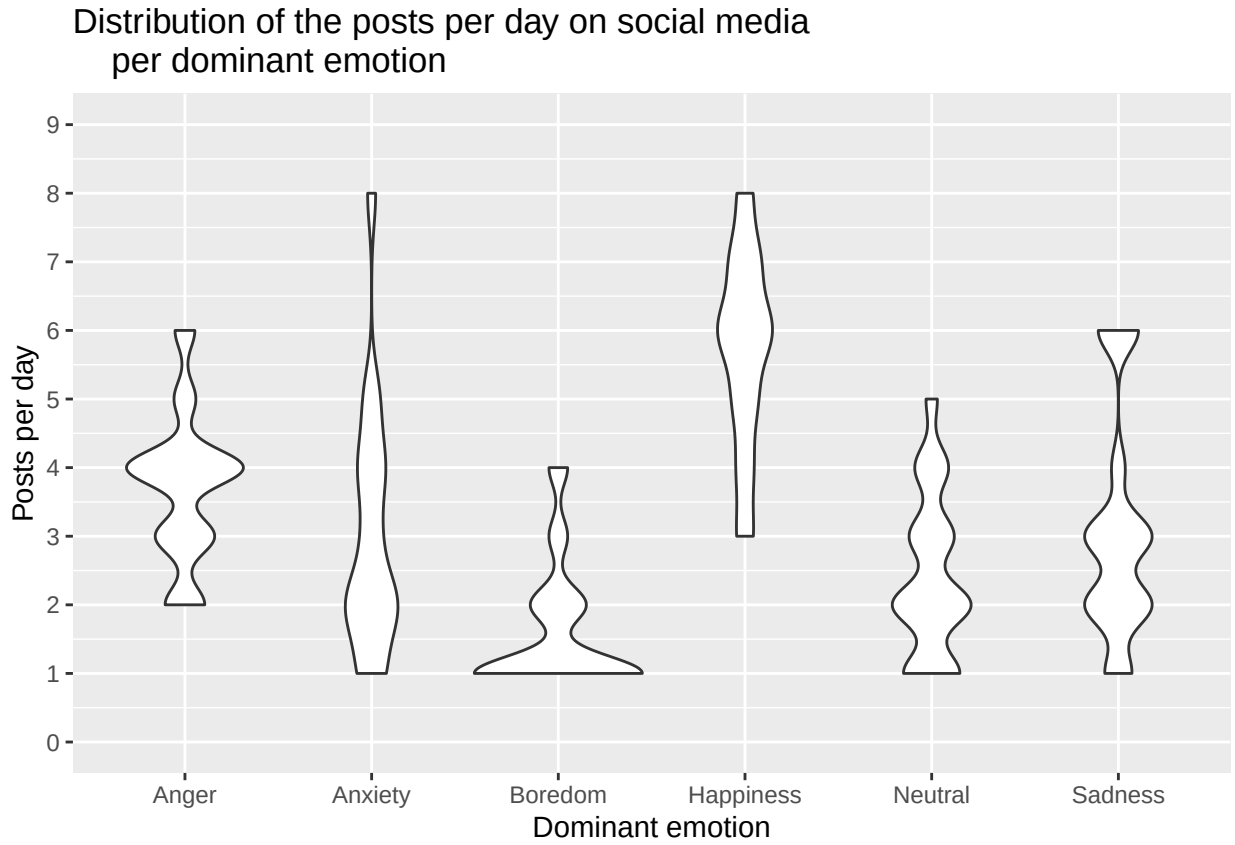
```
## $chi2
## [1] 474.0937
##
## $Z
##  [1]   4.5304217  11.3130314   7.4485001  -7.0233013 -12.6448033 -19.6848957
##  [7]   7.2008010   2.7167015  -5.1425414  16.0248939   3.8945449  -0.6171998
## [13]  -7.9329919  11.7955258  -3.3128891
##
## $P
##  [1] 2.943303e-06 5.655637e-30 4.720368e-14 1.083431e-12 5.976165e-37
##  [6] 1.452671e-86 2.992992e-13 3.296802e-03 1.355233e-07 4.281844e-58
## [11] 4.919163e-05 2.685515e-01 1.069642e-15 2.058108e-32 4.616879e-04
##
## $P.adjusted
##  [1] 4.414955e-05 8.483455e-29 7.080553e-13 1.625147e-11 8.964247e-36
##  [6] 2.179007e-85 4.489488e-12 4.945204e-02 2.032850e-06 6.422766e-57
## [11] 7.378745e-04 1.000000e+00 1.604463e-14 3.087163e-31 6.925319e-03
##
## $comparisons
##  [1] "Anger - Anxiety"     "Anger - Boredom"     "Anxiety - Boredom"
##  [4] "Anger - Happiness"   "Anxiety - Happiness" "Boredom - Happiness"
##  [7] "Anger - Neutral"     "Anxiety - Neutral"   "Boredom - Neutral"
## [10] "Happiness - Neutral" "Anger - Sadness"     "Anxiety - Sadness"
## [13] "Boredom - Sadness"   "Happiness - Sadness" "Neutral - Sadness"
```

Significant difference = Between both emotions, one of them posts more/less on social media than the other emotion.

Considering significance = 0.05 -> CL = 95%: - “Anger - Anxiety”

- “Anger - Boredom”
- “Anxiety - Boredom”
- “Anger - Happiness”
- “Anxiety - Happiness”
- “Boredom - Happiness”
- “Anger - Neutral”
- “Anxiety - Neutral”
- “Boredom - Neutral”
- “Happiness - Neutral”
- “Anger - Sadness”
- “Boredom - Sadness”
- “Happiness - Sadness”
- “Neutral - Sadness”

```
ggplot(data_transformed, aes(x = Dominant_Emotion, y = Posts_Per_Day)) +
  geom_violin() +
  scale_y_continuous(limits = c(0, 9),
                     breaks = seq(0, 9, by = 1)) +
  labs(
    title = "Distribution of the posts per day on social media
    per dominant emotion",
       x = "Dominant emotion",
       y = "Posts per day")
```



Taking a look at the graphic above, H1 is confirmed.

```
posts_platform <- data_transformed %>%
  group_by(Platform) %>%
  summarise(suma = sum(Posts_Per_Day)) %>%
  arrange(desc(suma))
print(posts_platform)
```

```
## # A tibble: 7 x 2
##   Platform   suma
##   <chr>     <int>
## 1 Instagram  1450
## 2 Twitter     681
## 3 Facebook    370
## 4 Whatsapp    240
## 5 Telegram    220
## 6 Snapchat    210
## 7 LinkedIn    150
```

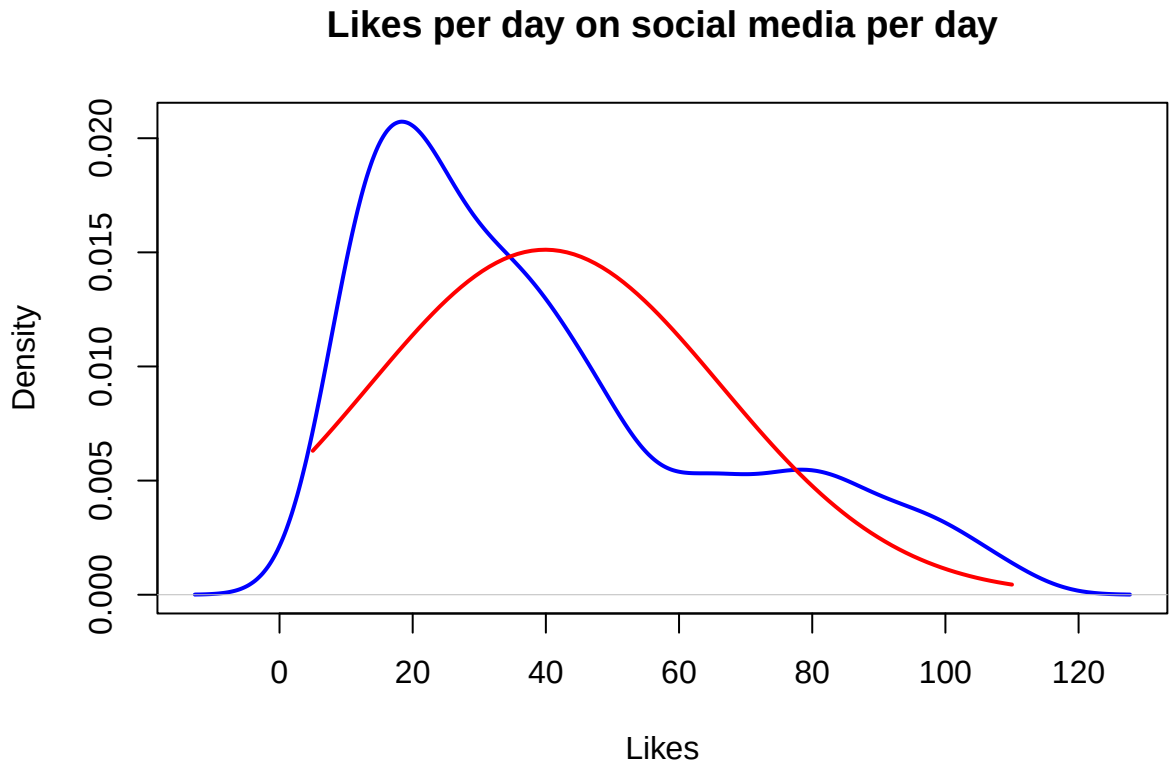
3.6 Dominant emotion depending on the likes received per day spend on social media

H0 -> The likes received are the same regardless of the dominant emotion

H1 -> At least one emotion has more/less likes

```
plot(density(data_transformed$Likes_Received_Per_Day),
     main = "Likes per day on social media per day",
```

```
     xlab = "Likes",
     ylab = "Density",
     col = "blue",
     lwd = 2)
values_normal_distribution <- seq(min(data_transformed$Likes_Received_Per_Day),
                                  max(data_transformed$Likes_Received_Per_Day),
                                  length = 100)
normal_distribution <- dnorm(values_normal_distribution,
                             mean = abs(mean(data_transformed$Likes_Received_Per_Day)),
                             sd = sd(data_transformed$Likes_Received_Per_Day))
lines(values_normal_distribution, normal_distribution, col = "red", lwd = 2)
```



Variable Likes_Received_Per_Day -> No normal distribution -> ANOVA no possible

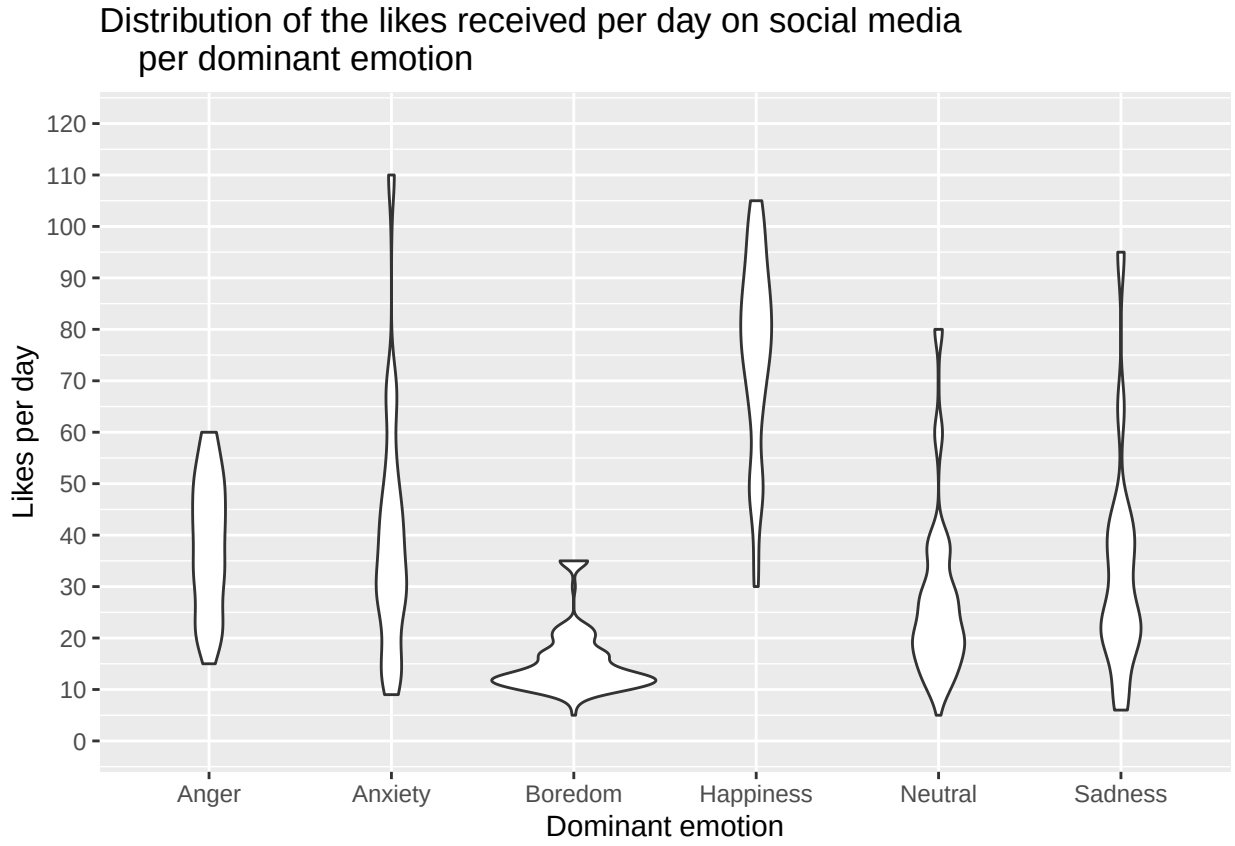
```
kruskal <- kruskal.test(Likes_Received_Per_Day ~ Dominant_Emotion, data = data_transformed)
kruskal
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  Likes_Received_Per_Day by Dominant_Emotion
## Kruskal-Wallis chi-squared = 529.6, df = 5, p-value < 2.2e-16
```

$p < 0.05$ -> There's enough evidence to refuse H0 with a 95% confidence level -> Suggests relation

```
ggplot(data_transformed, aes(x = Dominant_Emotion, y = Likes_Received_Per_Day)) +
  geom_violin() +
    scale_y_continuous(limits = c(0, 120),
```

```
                    breaks = seq(0, 120, by = 10)) +
  labs(
    title ="Distribution of the likes received per day on social media
    per dominant emotion",
       x = "Dominant emotion",
       y = "Likes per day")
```



Taking a look at the graphic above, H1 is confirmed.

```
likes_platform <- data_transformed %>%
  group_by(Platform) %>%
  summarise(suma = sum(Likes_Received_Per_Day)) %>%
  arrange(desc(suma))
print(likes_platform)
```

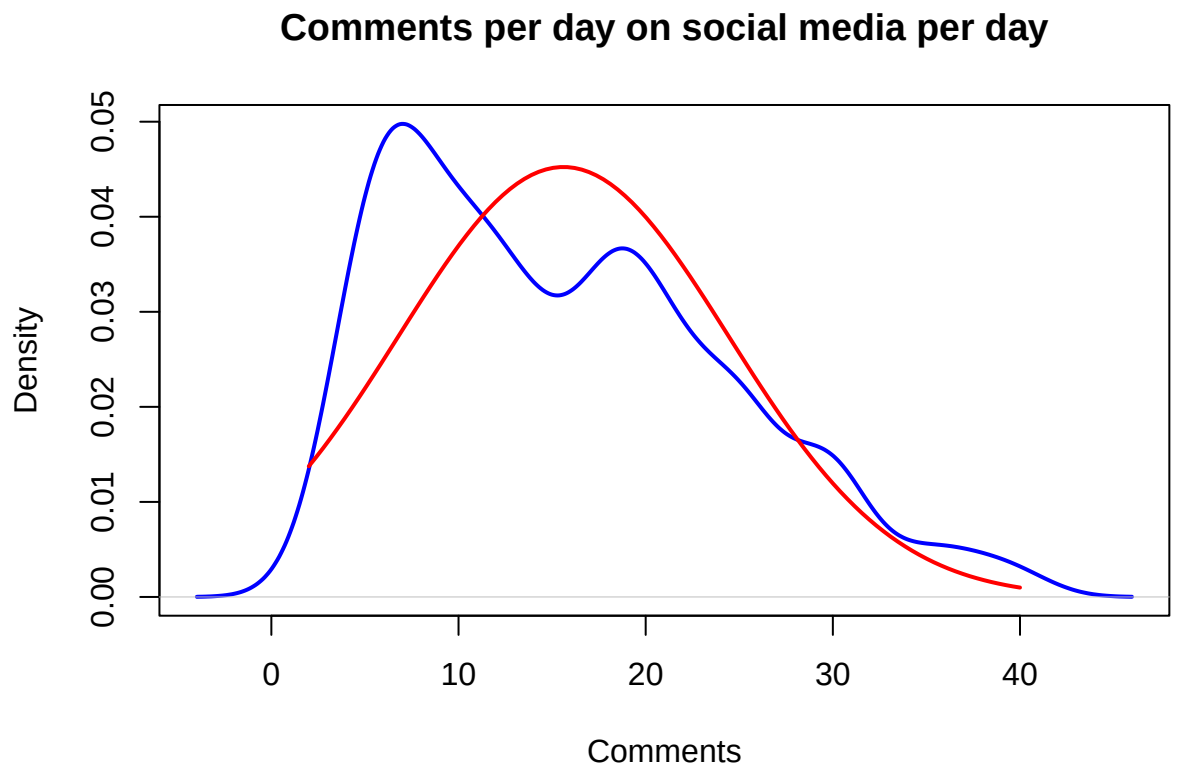
```
## # A tibble: 7 x 2
##   Platform   suma
##   <chr>     <int>
## 1 Instagram 19818
## 2 Twitter    7049
## 3 Facebook   3748
## 4 Whatsapp   2916
## 5 Snapchat   2436
## 6 Telegram   2386
## 7 LinkedIn   1545
```

3.7 Dominant emotion depending on the comments received per day spend on social media

H0 -> The comments received are the same regardless of the dominant emotion

H1 -> At least one emotion has more/less comments

```
plot(density(data_transformed$Comments_Received_Per_Day),
     main = "Comments per day on social media per day",
     xlab = "Comments",
     ylab = "Density",
     col = "blue",
     lwd = 2)
values_normal_distribution <- seq(min(data_transformed$Comments_Received_Per_Day),
                                  max(data_transformed$Comments_Received_Per_Day),
                                  length = 100)
normal_distribution <- dnorm(values_normal_distribution,
                             mean = abs(mean(data_transformed$Comments_Received_Per_Day)),
                             sd = sd(data_transformed$Comments_Received_Per_Day))
lines(values_normal_distribution, normal_distribution, col = "red", lwd = 2)
```



Variable Comments_Received_Per_Day -> No normal distribution -> ANOVA no possible

```
kruskal <- kruskal.test(Comments_Received_Per_Day ~ Dominant_Emotion, data = data_transformed)
kruskal
```

```
##
##  Kruskal-Wallis rank sum test
##
```

```
## data:  Comments_Received_Per_Day by Dominant_Emotion
## Kruskal-Wallis chi-squared = 553.55, df = 5, p-value < 2.2e-16
```

$p < 0.05$ -> There's enough evidence to refuse H0 with a 95% confidence level -> Suggests relation

```
results_dunn <- dunn.test(data_transformed$Comments_Received_Per_Day,
                          data_transformed$Dominant_Emotion, method = "bonferroni")
```

```
##   Kruskal-Wallis rank sum test
##
## data: x and group
## Kruskal-Wallis chi-squared = 553.5507, df = 5, p-value = 0
##
##
##                             Comparison of x by group
##                                   (Bonferroni)
## Col Mean-|
## Row Mean |      Anger    Anxiety    Boredom   Happines    Neutral
## ---------+---------------------------------------------------------
##  Anxiety |   3.834512
##          |    0.0009*
##          |
##  Boredom |   12.50938   9.435710
##          |    0.0000*    0.0000*
##          |
## Happines |  -6.936749  -11.77408  -20.91875
##          |    0.0000*    0.0000*    0.0000*
##          |
##  Neutral |   8.578942   4.982284  -5.055914   17.48000
##          |    0.0000*    0.0000*    0.0000*    0.0000*
##          |
##  Sadness |   5.857789   2.223511  -7.189008   13.88916  -2.591136
##          |    0.0000*     0.1964    0.0000*    0.0000*     0.0717
##
## alpha = 0.05
## Reject Ho if p <= alpha/2
```

```
print(results_dunn)
```

```
## $chi2
## [1] 553.5507
##
## $Z
##  [1]   3.834513  12.509388   9.435710  -6.936749 -11.774090 -20.918757
##  [7]   8.578943   4.982284  -5.055914  17.480001   5.857789   2.223511
## [13]  -7.189009  13.889167  -2.591136
##
## $P
##  [1] 6.290670e-05 3.316685e-36 1.941773e-21 2.006123e-12 2.654348e-32
##  [6] 1.807069e-97 4.787452e-18 3.141901e-07 2.141669e-07 1.017478e-68
## [11] 2.345344e-09 1.309067e-02 3.263166e-13 3.684376e-44 4.782981e-03
##
## $P.adjusted
##  [1] 9.436006e-04 4.975028e-35 2.912660e-20 3.009185e-11 3.981523e-31
##  [6] 2.710603e-96 7.181178e-17 4.712852e-06 3.212503e-06 1.526217e-67
## [11] 3.518016e-08 1.963601e-01 4.894750e-12 5.526564e-43 7.174472e-02
```

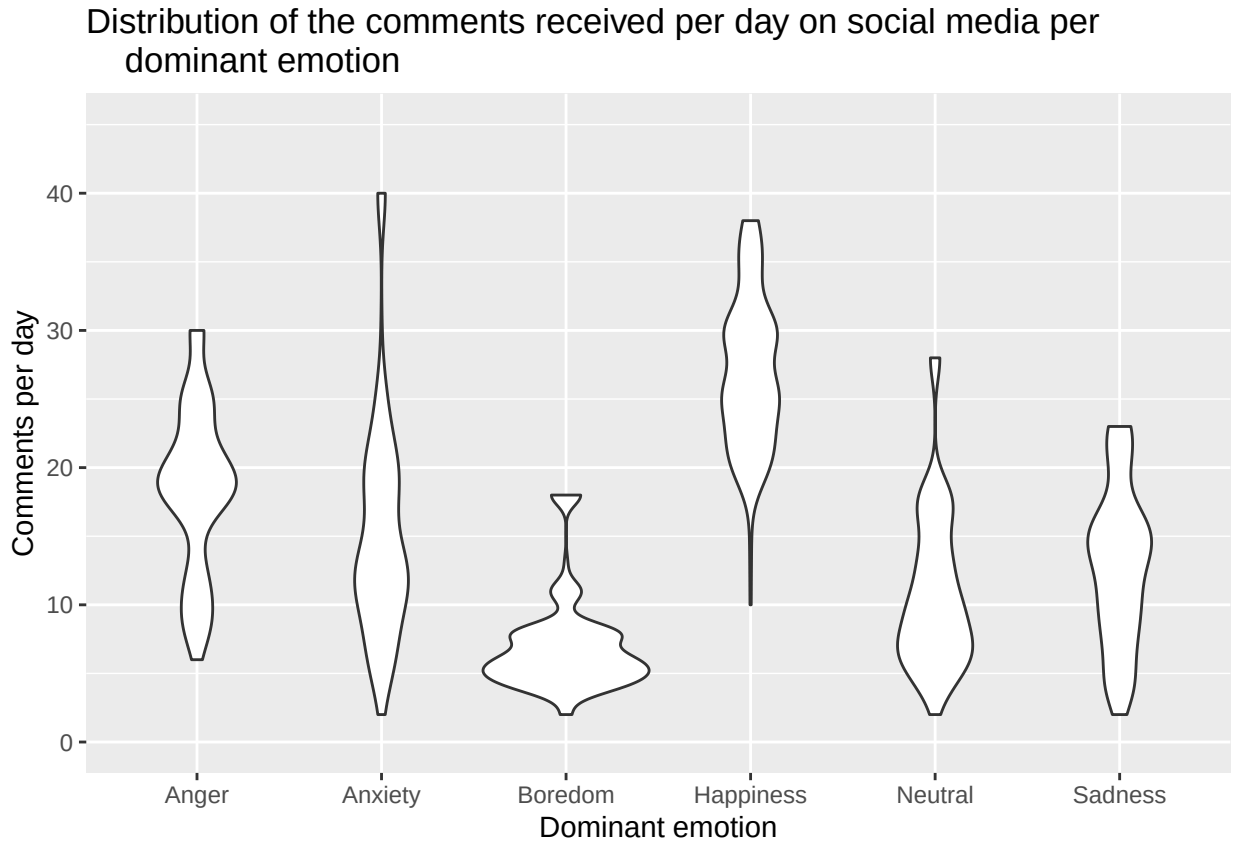
```
##
## $comparisons
##  [1] "Anger - Anxiety"     "Anger - Boredom"     "Anxiety - Boredom"
##  [4] "Anger - Happiness"   "Anxiety - Happiness" "Boredom - Happiness"
##  [7] "Anger - Neutral"     "Anxiety - Neutral"   "Boredom - Neutral"
## [10] "Happiness - Neutral" "Anger - Sadness"     "Anxiety - Sadness"
## [13] "Boredom - Sadness"   "Happiness - Sadness" "Neutral - Sadness"
```

Significant difference = Between both emotions, one of them posts more/less on social media than the other emotion.

Considering significance = 0.05 -> CL = 95%:

- "Anger - Anxiety"
- "Anger - Boredom"
- "Anxiety - Boredom"
- "Anger - Happiness"
- "Anxiety - Happiness"
- "Boredom - Happiness"
- "Anger - Neutral"
- "Anxiety - Neutral"
- "Boredom - Neutral"
- "Happiness - Neutral"
- "Anger - Sadness"
- "Anxiety - Sadness"
- "Happiness - Sadness"
- "Neutral - Sadness"

```
ggplot(data_transformed, aes(x = Dominant_Emotion, y = Comments_Received_Per_Day)) +
  geom_violin() +
    scale_y_continuous(limits = c(0, 45),
                       breaks = seq(0, 45, by = 10)) +
  labs(
    title = "Distribution of the comments received per day on social media per
    dominant emotion",
       x = "Dominant emotion",
       y = "Comments per day")
```



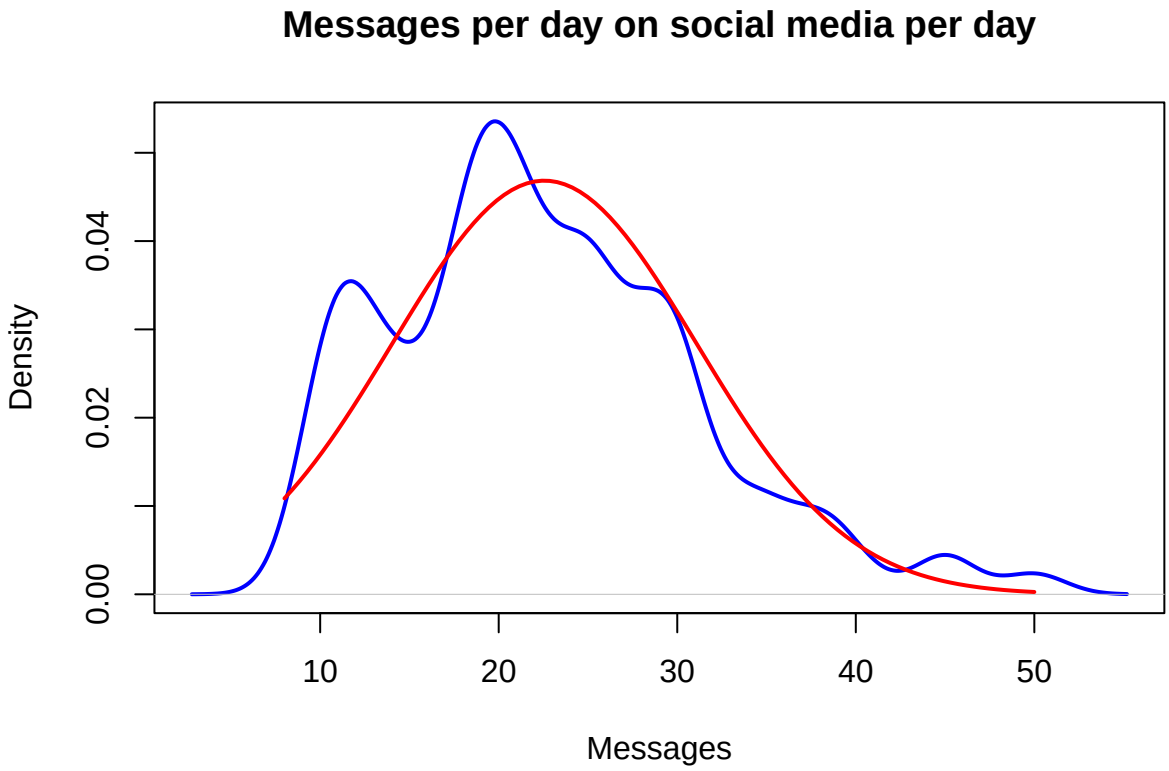
Taking a look at the graphic above, H1 is confirmed.

3.8 Dominant emotion depending on the messages sent per day spend on social media

H0 -> The messages sent are the same regardless of the dominant emotion

H1 -> At least one emotion has more/less messages

```
plot(density(data_transformed$Messages_Sent_Per_Day),
     main = "Messages per day on social media per day",
     xlab = "Messages",
     ylab = "Density",
     col = "blue",
     lwd = 2)
values_normal_distribution <- seq(min(data_transformed$Messages_Sent_Per_Day),
                                  max(data_transformed$Messages_Sent_Per_Day),
                                  length = 100)
normal_distribution <- dnorm(values_normal_distribution,
                             mean = abs(mean(data_transformed$Messages_Sent_Per_Day)),
                             sd = sd(data_transformed$Messages_Sent_Per_Day))
lines(values_normal_distribution, normal_distribution, col = "red", lwd = 2)
```



Variable Comments_Received_Per_Day -> No normal distribution -> ANOVA no possible

```
kruskal <- kruskal.test(Messages_Sent_Per_Day ~ Dominant_Emotion, data = data_transformed)
kruskal
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  Messages_Sent_Per_Day by Dominant_Emotion
## Kruskal-Wallis chi-squared = 465.51, df = 5, p-value < 2.2e-16
```

$p < 0.05$ -> There's enough evidence to refuse H0 with a 95% confidence level -> Suggests relation

```
messages_dunn <- dunn.test(data_transformed$Messages_Sent_Per_Day,
                           data_transformed$Dominant_Emotion, method = "bonferroni")
```

```
##   Kruskal-Wallis rank sum test
##
## data: x and group
## Kruskal-Wallis chi-squared = 465.5125, df = 5, p-value = 0
##
##
##                             Comparison of x by group
##                                   (Bonferroni)
## Col Mean-|
## Row Mean |      Anger    Anxiety    Boredom   Happines    Neutral
## ---------+---------------------------------------------------------
##  Anxiety |  -1.050281
```

```
##          |     1.0000
##          |
##  Boredom |   9.423240   11.12887
##          |    0.0000*    0.0000*
##          |
## Happines |  -9.329874  -8.902889  -19.95426
##          |    0.0000*    0.0000*    0.0000*
##          |
##  Neutral |   4.650077   6.194941  -5.661522   15.74983
##          |    0.0000*    0.0000*    0.0000*    0.0000*
##          |
##  Sadness |   1.826229   3.068676  -8.054360   11.94295  -2.906131
##          |     0.5086    0.0161*    0.0000*    0.0000*     0.0274
##
## alpha = 0.05
## Reject Ho if p <= alpha/2
```

```
print(results_dunn)
```

```
## $chi2
## [1] 553.5507
##
## $Z
##  [1]   3.834513  12.509388   9.435710  -6.936749 -11.774090 -20.918757
##  [7]   8.578943   4.982284  -5.055914  17.480001   5.857789   2.223511
## [13]  -7.189009  13.889167  -2.591136
##
## $P
##  [1] 6.290670e-05 3.316685e-36 1.941773e-21 2.006123e-12 2.654348e-32
##  [6] 1.807069e-97 4.787452e-18 3.141901e-07 2.141669e-07 1.017478e-68
## [11] 2.345344e-09 1.309067e-02 3.263166e-13 3.684376e-44 4.782981e-03
##
## $P.adjusted
##  [1] 9.436006e-04 4.975028e-35 2.912660e-20 3.009185e-11 3.981523e-31
##  [6] 2.710603e-96 7.181178e-17 4.712852e-06 3.212503e-06 1.526217e-67
## [11] 3.518016e-08 1.963601e-01 4.894750e-12 5.526564e-43 7.174472e-02
##
## $comparisons
##  [1] "Anger - Anxiety"     "Anger - Boredom"     "Anxiety - Boredom"
##  [4] "Anger - Happiness"   "Anxiety - Happiness" "Boredom - Happiness"
##  [7] "Anger - Neutral"     "Anxiety - Neutral"   "Boredom - Neutral"
## [10] "Happiness - Neutral" "Anger - Sadness"     "Anxiety - Sadness"
## [13] "Boredom - Sadness"   "Happiness - Sadness" "Neutral - Sadness"
```

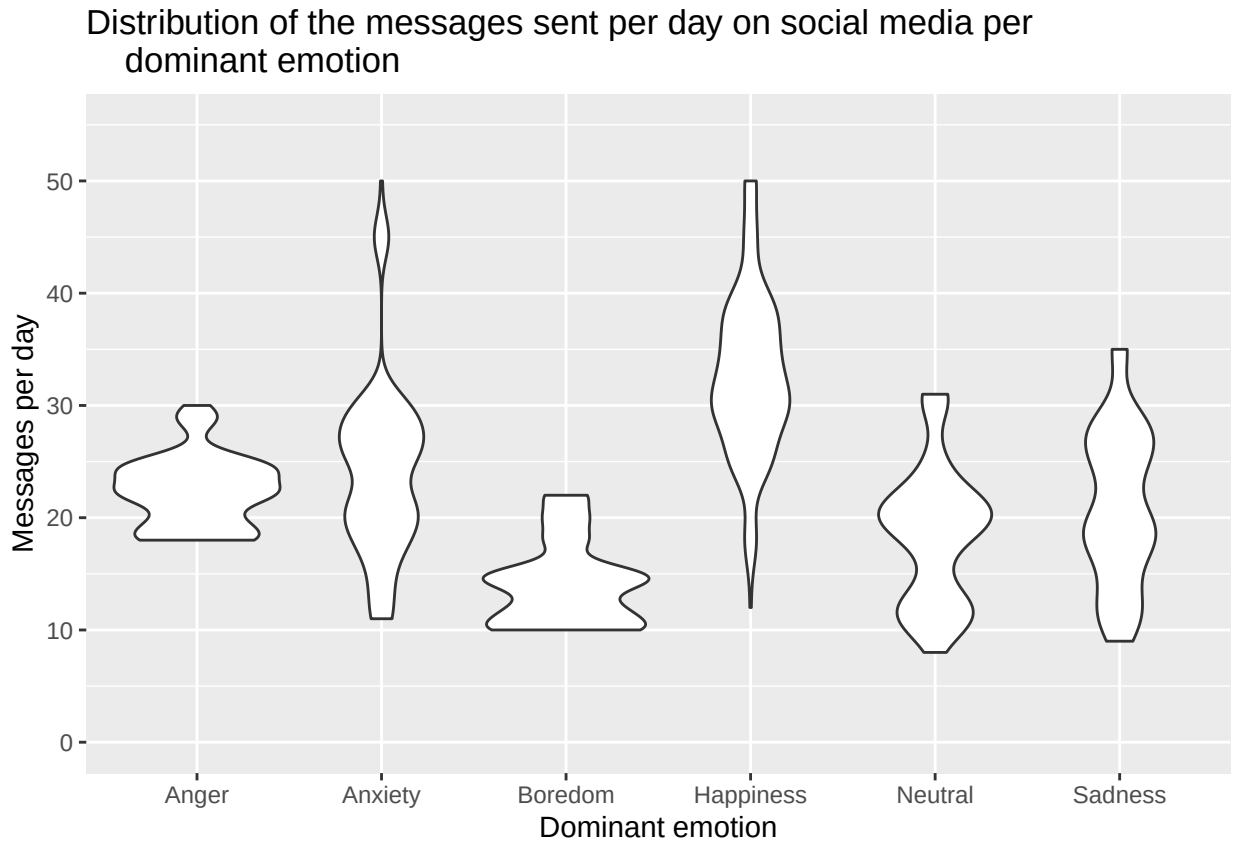
Significant difference = Between both emotions, one of them send more/less messages on social media than the other emotion.

Considering significance = 0.05 -> CL = 95%:

- “Anger - Anxiety”
- “Anger - Boredom”
- “Anxiety - Boredom”
- “Anger - Happiness”
- “Anxiety - Happiness”

- “Boredom - Happiness”
- “Anger - Neutral”
- “Anxiety - Neutral”
- “Boredom - Neutral”
- “Happiness - Neutral”
- “Anger - Sadness”
- “Anxiety - Sadness”
- “Boredom - Sadness”

```
ggplot(data_transformed, aes(x = Dominant_Emotion, y = Messages_Sent_Per_Day)) +
  geom_violin() +
      scale_y_continuous(limits = c(0, 55),
                         breaks = seq(0, 55, by = 10)) +
  labs(
    title = "Distribution of the messages sent per day on social media per
    dominant emotion",
       x = "Dominant emotion",
       y = "Messages per day")
```



Taking a look at the graphic above, H1 is confirmed.

3.9 Relation between dominant emotion and gender

H0 -> There’s no significant association between both variables

H1 -> There's significant association between both variables

```
chisq_data_2 <- table(data_transformed$Gender, data_transformed$Dominant_Emotion)
chisq_data_2
```

```
##
##              Anger Anxiety Boredom Happiness Neutral Sadness
##   Female        60      60      30       110      60      50
##   Male          60      60      60        70      50      60
##   Non-binary    10      50      50        20      90      50
```

```
# Alpha = 0.05 -> CL = 95%
chisq.test(chisq_data_2, correct = FALSE)
```

```
##
##  Pearson's Chi-squared test
##
## data:  chisq_data_2
## X-squared = 115.03, df = 10, p-value < 2.2e-16
```

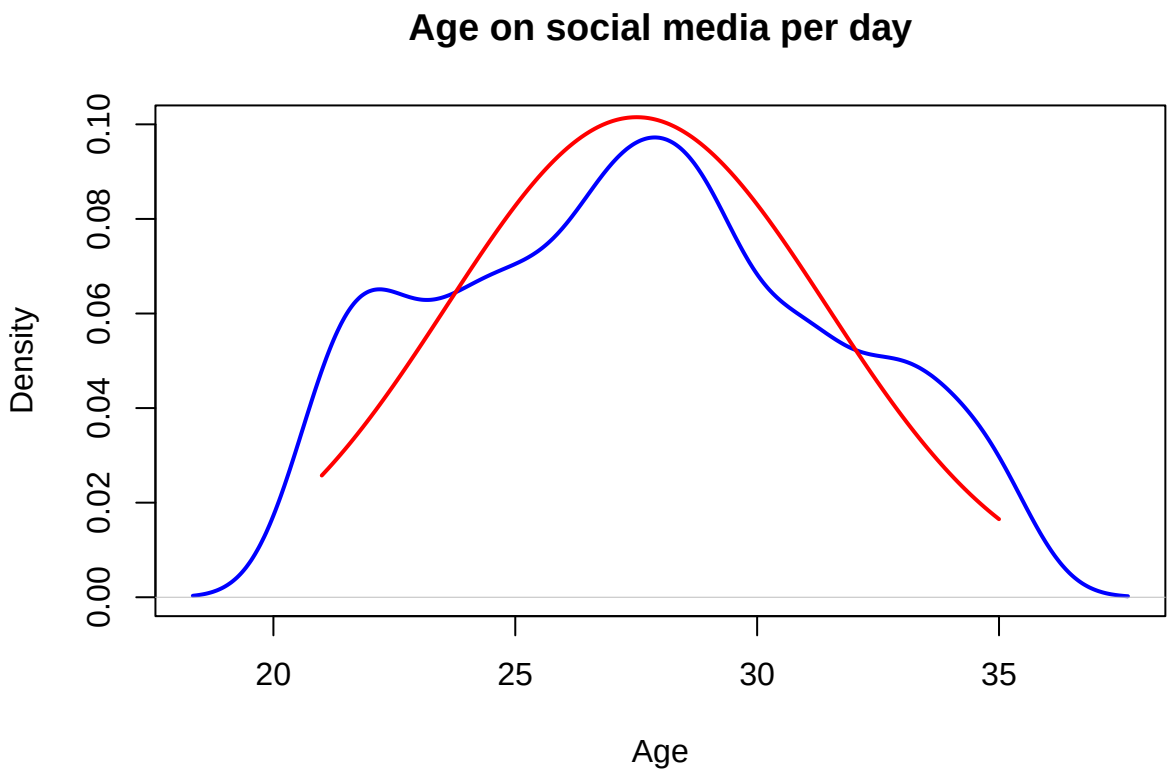
The p value < 0.05(alpha) -> There's enough evidence to refuse H0 with a 95% confidence level

3.10 Dominant emotion depending on age

H0 -> The age is the same regardless of the dominant emotion

H1 -> At least one emotion has more/less age

```
plot(density(data_transformed$Age),
     main = "Age on social media per day",
     xlab = "Age",
     ylab = "Density",
     col = "blue",
     lwd = 2,
     ylim = c(0, 0.10))
values_normal_distribution <- seq(min(data_transformed$Age),
                                  max(data_transformed$Age),
                                  length = 1000)
normal_distribution <- dnorm(values_normal_distribution,
                             mean = abs(mean(data_transformed$Age)),
                             sd = sd(data_transformed$Age))
lines(values_normal_distribution, normal_distribution, col = "red", lwd = 2)
```



Variable Age -> No normal distribution -> ANOVA no possible

```
kruskal <- kruskal.test(Age ~ Dominant_Emotion, data = data_transformed)
kruskal
```

```
##
##  Kruskal-Wallis rank sum test
##
## data:  Age by Dominant_Emotion
## Kruskal-Wallis chi-squared = 123.95, df = 5, p-value < 2.2e-16
```

$p < 0.05$ -> There's enough evidence to refuse H0 with a 95% confidence level -> Suggests relation

```
messages_dunn <- dunn.test(data_transformed$Age,
                           data_transformed$Dominant_Emotion, method = "bonferroni")
```

```
##   Kruskal-Wallis rank sum test
##
## data: x and group
## Kruskal-Wallis chi-squared = 123.9519, df = 5, p-value = 0
##
##
##                             Comparison of x by group
##                                   (Bonferroni)
## Col Mean-|
## Row Mean |      Anger    Anxiety    Boredom   Happines    Neutral
## ---------+---------------------------------------------------------
##  Anxiety |   0.856336
```

```
##           |     1.0000
##           |
##  Boredom  |  -3.757854  -4.884667
##           |    0.0013*    0.0000*
##           |
## Happines  |   0.704750  -0.195312   4.874129
##           |     1.0000     1.0000    0.0000*
##           |
##  Neutral  |   6.067731   5.596508   10.35710   6.041942
##           |    0.0000*    0.0000*    0.0000*    0.0000*
##           |
##  Sadness  |   3.535984   2.884767   7.562816   3.187854  -2.508542
##           |    0.0030*     0.0294    0.0000*    0.0107*     0.0909
##
## alpha = 0.05
## Reject Ho if p <= alpha/2
```

```
print(results_dunn)
```

```
## $chi2
## [1] 553.5507
##
## $Z
##  [1]   3.834513  12.509388   9.435710  -6.936749 -11.774090 -20.918757
##  [7]   8.578943   4.982284  -5.055914  17.480001   5.857789   2.223511
## [13]  -7.189009  13.889167  -2.591136
##
## $P
##  [1] 6.290670e-05 3.316685e-36 1.941773e-21 2.006123e-12 2.654348e-32
##  [6] 1.807069e-97 4.787452e-18 3.141901e-07 2.141669e-07 1.017478e-68
## [11] 2.345344e-09 1.309067e-02 3.263166e-13 3.684376e-44 4.782981e-03
##
## $P.adjusted
##  [1] 9.436006e-04 4.975028e-35 2.912660e-20 3.009185e-11 3.981523e-31
##  [6] 2.710603e-96 7.181178e-17 4.712852e-06 3.212503e-06 1.526217e-67
## [11] 3.518016e-08 1.963601e-01 4.894750e-12 5.526564e-43 7.174472e-02
##
## $comparisons
##  [1] "Anger - Anxiety"     "Anger - Boredom"     "Anxiety - Boredom"
##  [4] "Anger - Happiness"   "Anxiety - Happiness" "Boredom - Happiness"
##  [7] "Anger - Neutral"     "Anxiety - Neutral"   "Boredom - Neutral"
## [10] "Happiness - Neutral" "Anger - Sadness"     "Anxiety - Sadness"
## [13] "Boredom - Sadness"   "Happiness - Sadness" "Neutral - Sadness"
```

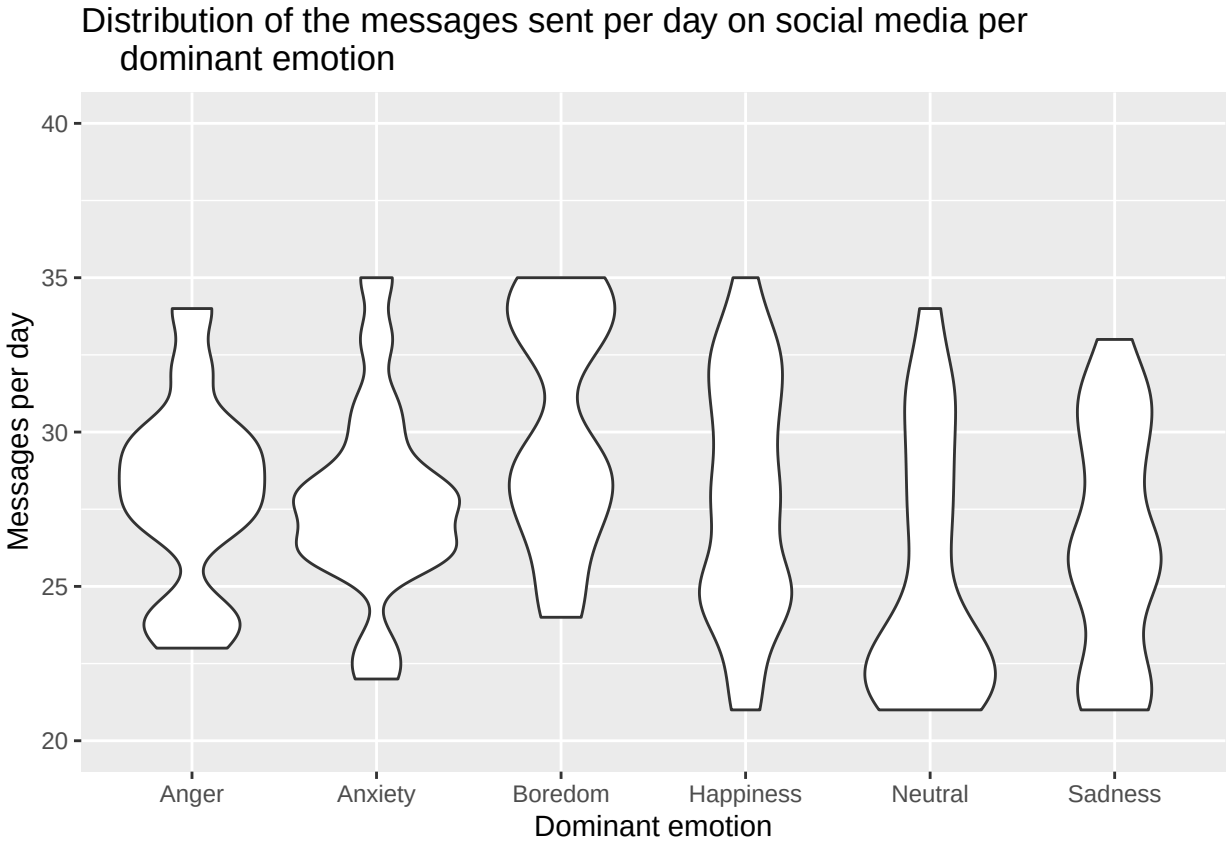
Significant difference = Between both emotions, one of them has more/less age

Considering significance = 0.05 -> CL = 95%:

- “Anger - Anxiety”
- “Anger - Boredom”
- “Anxiety - Boredom”
- “Anger - Happiness”
- “Anxiety - Happiness”
- “Boredom - Happiness”

- “Anger - Neutral”
- “Anxiety - Neutral”
- “Boredom - Neutral”
- “Happiness - Neutral”
- “Anger - Sadness”

```
ggplot(data_transformed, aes(x = Dominant_Emotion, y = Age)) +
  geom_violin() +
        scale_y_continuous(limits = c(20, 40),
                           breaks = seq(20, 40, by = 5)) +
  labs(
    title = "Distribution of the messages sent per day on social media per
    dominant emotion",
       x = "Dominant emotion",
       y = "Messages per day")
```



Taking a look at the graphic above, H1 is confirmed.

4. Random forest prediction

```
library(randomForest)
```

```
## randomForest 4.7-1.1
## Type rfNews() to see new features/changes/bug fixes.
```

```
##
## Attaching package: 'randomForest'

## The following object is masked from 'package:dplyr':
##
##     combine

## The following object is masked from 'package:ggplot2':
##
##     margin
```

```
library(caret)
```

```
## Loading required package: lattice
```

```
set.seed(123)
index <- sample(1:nrow(data_transformed), 0.8 * nrow(data_transformed))
training_data <- data_transformed[index, ]
test_data <- data_transformed[-index, ]
```

```
control <- trainControl(method = "repeatedcv", number = 10, repeats = 3,
                        search = "random")
model_random_forest <- train(Dominant_Emotion ~ Gender + Age + Platform +
                                      Minutes_Per_Day + Posts_Per_Day +
                                      Likes_Received_Per_Day +
                                      Comments_Received_Per_Day +
                                      Messages_Sent_Per_Day,
                             data = training_data,
                             method = "rf",
                             metric = "Accuracy",
                             tuneLength = 13,
                             trControl = control)
print(model_random_forest)
```

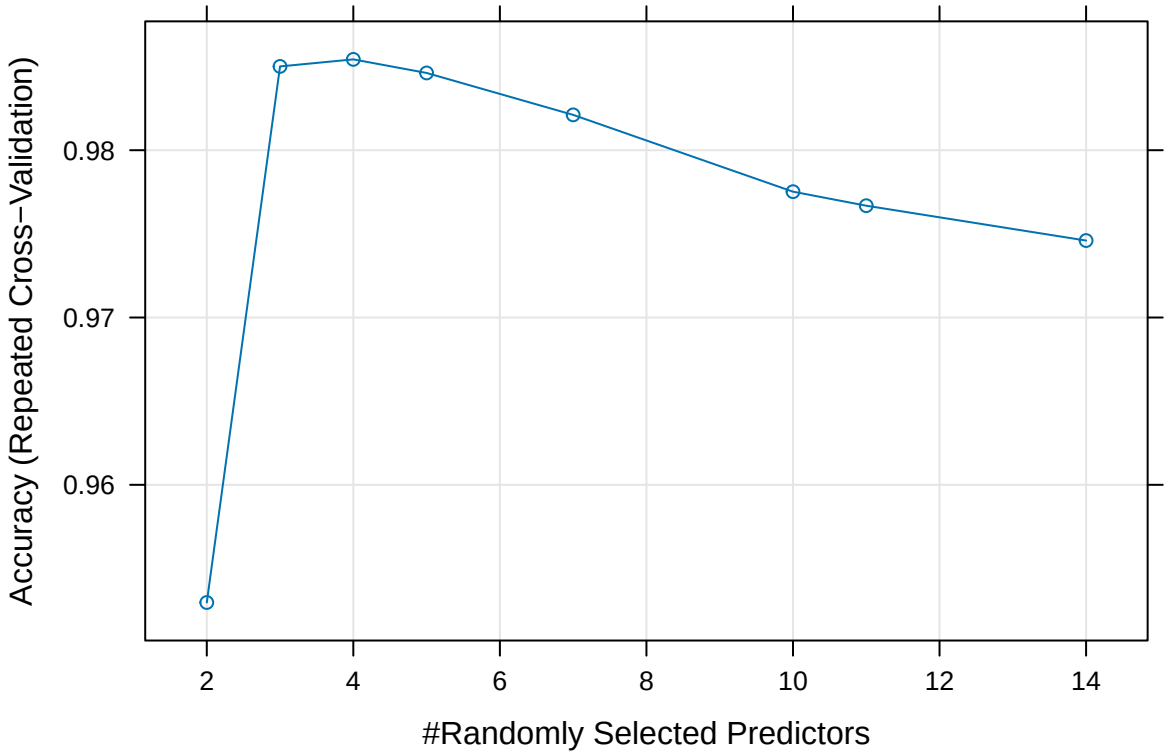
```
## Random Forest
##
## 800 samples
##   8 predictor
##   6 classes: 'Anger', 'Anxiety', 'Boredom', 'Happiness', 'Neutral', 'Sadness'
##
## No pre-processing
## Resampling: Cross-Validated (10 fold, repeated 3 times)
## Summary of sample sizes: 720, 720, 721, 719, 719, 719, ...
## Resampling results across tuning parameters:
##
##   mtry  Accuracy   Kappa
##    2    0.9529669  0.9432009
##    3    0.9850078  0.9818920
##    4    0.9854298  0.9823969
##    5    0.9846170  0.9814116
##    7    0.9821115  0.9783782
##   10    0.9775225  0.9728331
##   11    0.9766839  0.9718204
##   14    0.9746004  0.9693087
##
## Accuracy was used to select the optimal model using the largest value.
## The final value used for the model was mtry = 4.
```

```r
predictions <- predict(model_random_forest, test_data)
confusionMatrix(as.factor(predictions), as.factor(test_data$Dominant_Emotion))
```

```
## Confusion Matrix and Statistics
##
##            Reference
## Prediction  Anger Anxiety Boredom Happiness Neutral Sadness
##   Anger        28       0       0         0       0       0
##   Anxiety       0      27       0         0       0       0
##   Boredom       0       2      32         0       0       0
##   Happiness     0       0       0        32       0       0
##   Neutral       0       0       0         1      51       0
##   Sadness       2       0       0         0       0      25
##
## Overall Statistics
##
##                Accuracy : 0.975
##                  95% CI : (0.9426, 0.9918)
##     No Information Rate : 0.255
##     P-Value [Acc > NIR] : < 2.2e-16
##
##                   Kappa : 0.9696
##
##  Mcnemar's Test P-Value : NA
##
## Statistics by Class:
##
##                      Class: Anger Class: Anxiety Class: Boredom
## Sensitivity                0.9333         0.9310         1.0000
## Specificity                1.0000         1.0000         0.9881
## Pos Pred Value             1.0000         1.0000         0.9412
## Neg Pred Value             0.9884         0.9884         1.0000
## Prevalence                 0.1500         0.1450         0.1600
## Detection Rate             0.1400         0.1350         0.1600
## Detection Prevalence       0.1400         0.1350         0.1700
## Balanced Accuracy          0.9667         0.9655         0.9940
##                      Class: Happiness Class: Neutral Class: Sadness
## Sensitivity                    0.9697         1.0000         1.0000
## Specificity                    1.0000         0.9933         0.9886
## Pos Pred Value                 1.0000         0.9808         0.9259
## Neg Pred Value                 0.9940         1.0000         1.0000
## Prevalence                     0.1650         0.2550         0.1250
## Detection Rate                 0.1600         0.2550         0.1250
## Detection Prevalence           0.1600         0.2600         0.1350
## Balanced Accuracy              0.9848         0.9966         0.9943
```

Test data accuracy is 97.5%

```r
plot(model_random_forest)
```


Accuracy (Repeated Cross−Validation)
0.98
0.97
0.96
2
4
6
8
10
12
14
#Randomly Selected Predictors