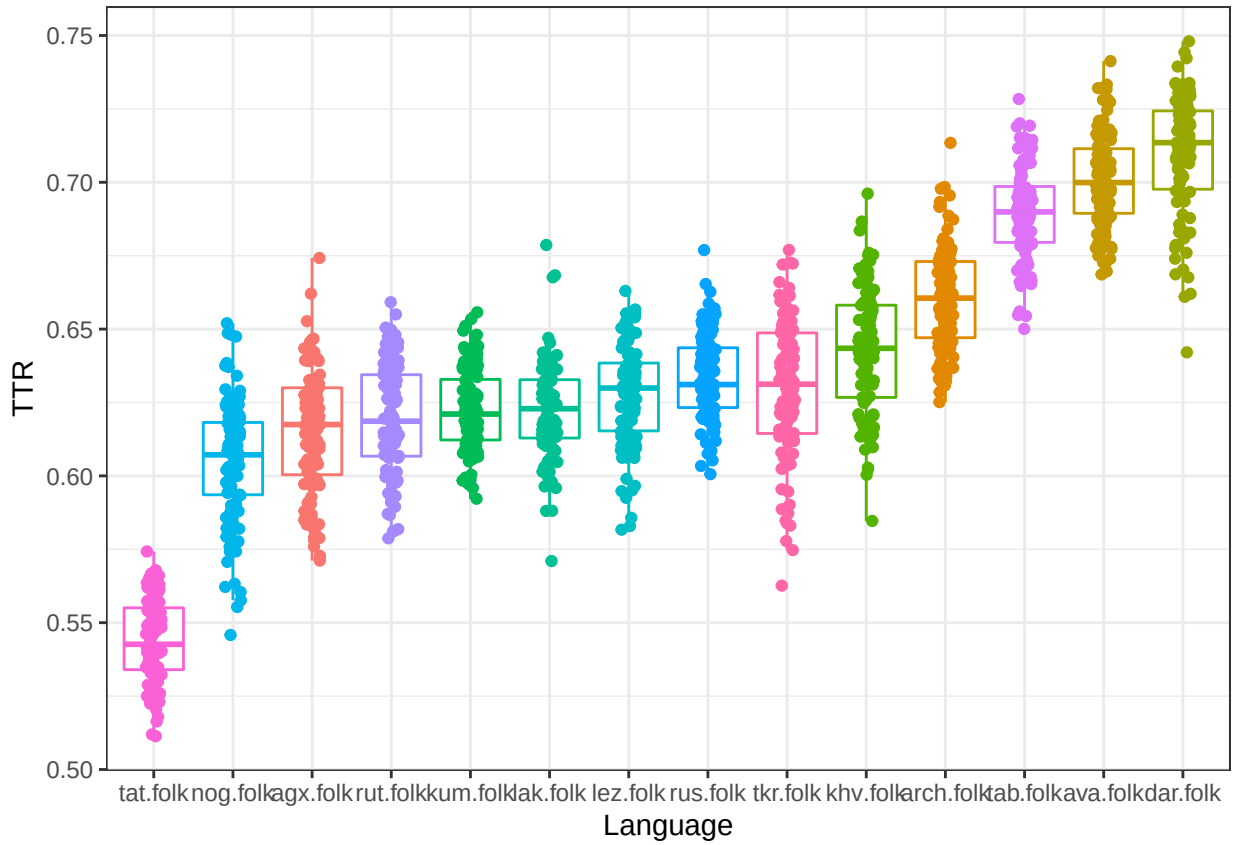
TTR

100 TTRs per language

```
df1 <- read.csv("TTR_100_datapoints_per_language.txt",
                header = TRUE, sep = ",")
df1_long <- gather(df1)
head(df1_long)
```

```
##        key     value
## 1 agx.folk 0.5849057
## 2 agx.folk 0.6420846
## 3 agx.folk 0.6250000
## 4 agx.folk 0.6620553
## 5 agx.folk 0.6105675
## 6 agx.folk 0.5928144
```

```
df1_long  %>%
  ggplot(aes(reorder(key, value, FUN = median), value, color = key))+
  geom_boxplot(outlier.shape = NA)+
  geom_jitter(width = 0.1)+
  labs(x = "Language",
       y = "TTR")+
  theme_bw()+
  theme(legend.position = "none")
```



Pairwise t-test

Holm-Bonferroni method

```
p.values <- pairwise.t.test(df1_long$value, df1_long$key,
                    paired = T, p.adjust.method = "holm")
p.values
```

```
##
##  Pairwise comparisons using paired t tests
##
## data:  df1_long$value and df1_long$key
##
##           agx.folk arch.folk ava.folk dar.folk khv.folk kum.folk lak.folk
## arch.folk < 2e-16  -         -        -        -        -        -
## ava.folk  < 2e-16  < 2e-16   -        -        -        -        -
## dar.folk  < 2e-16  < 2e-16   0.0115   -        -        -        -
## khv.folk  6.2e-14  2.0e-07   < 2e-16  < 2e-16  -        -        -
## kum.folk  0.0929   < 2e-16   < 2e-16  < 2e-16  8.1e-10  -        -
## lak.folk  0.1310   < 2e-16   < 2e-16  < 2e-16  1.6e-08  1.0000   -
## lez.folk  0.0011   < 2e-16   < 2e-16  < 2e-16  3.8e-06  0.1695   0.2973
## nog.folk  0.0097   < 2e-16   < 2e-16  < 2e-16  < 2e-16  5.9e-08  2.9e-08
## rus.folk  1.1e-09  < 2e-16   < 2e-16  < 2e-16  0.0060   2.2e-05  8.0e-05
## rut.folk  1.0000   < 2e-16   < 2e-16  < 2e-16  1.6e-11  1.0000   1.0000
```

```
## tab.folk  < 2e-16  < 2e-16   4.1e-05  8.2e-09  < 2e-16  < 2e-16  < 2e-16
## tat.folk  < 2e-16  < 2e-16   < 2e-16  < 2e-16  < 2e-16  < 2e-16  < 2e-16
## tkr.folk  9.0e-05  7.1e-16   < 2e-16  < 2e-16  0.0013   0.1310   0.2364
##           lez.folk nog.folk rus.folk rut.folk tab.folk tat.folk
## arch.folk -        -        -        -        -        -
## ava.folk  -        -        -        -        -        -
## dar.folk  -        -        -        -        -        -
## khv.folk  -        -        -        -        -        -
## kum.folk  -        -        -        -        -        -
## lak.folk  -        -        -        -        -        -
## lez.folk  -        -        -        -        -        -
## nog.folk  1.6e-13  -        -        -        -        -
## rus.folk  0.1695   < 2e-16  -        -        -        -
## rut.folk  0.0283   3.9e-05  1.6e-06  -        -        -
## tab.folk  < 2e-16  < 2e-16  < 2e-16  < 2e-16  -        -
## tat.folk  < 2e-16  < 2e-16  < 2e-16  < 2e-16  < 2e-16  -
## tkr.folk  1.0000   6.7e-12  1.0000   0.0157   < 2e-16  < 2e-16
##
## P value adjustment method: holm
```

Effect sizes

```
library("rstatix")
```

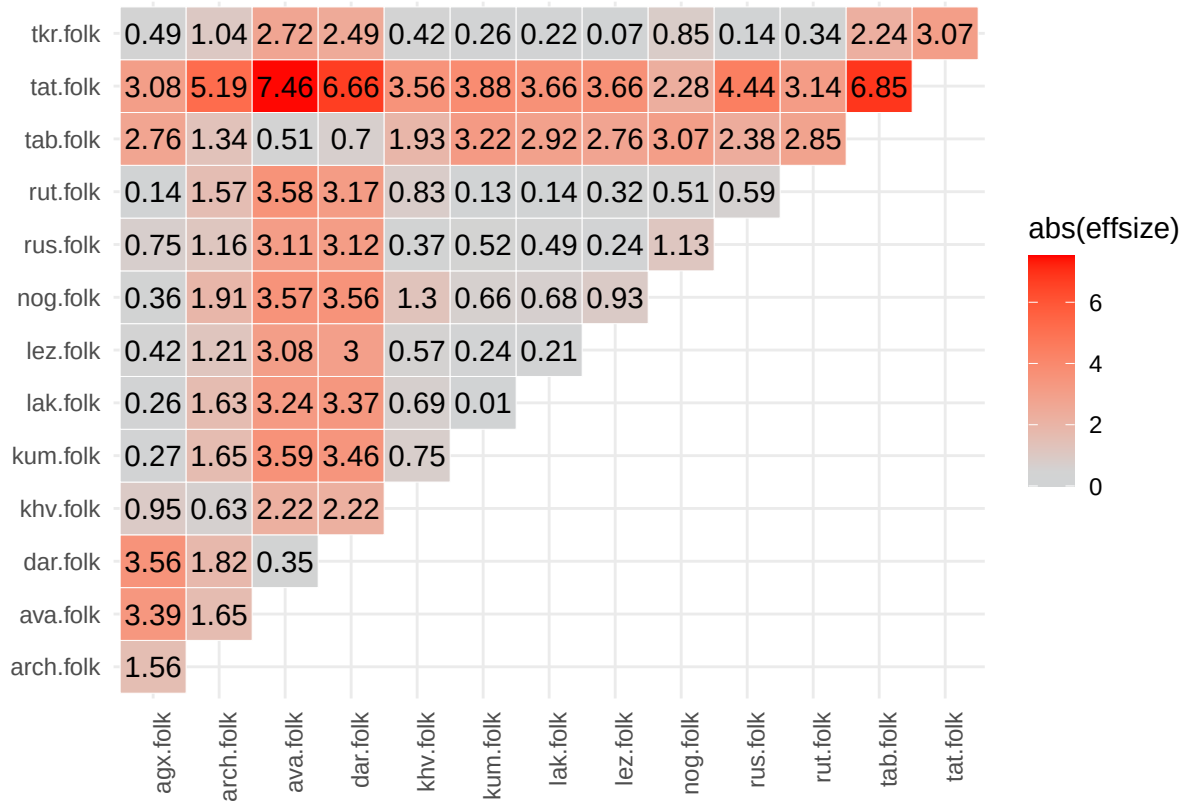
```
##
## Attaching package: 'rstatix'

## The following object is masked from 'package:stats':
##
##     filter
```

```
effect.sizes <- cohens_d(df1_long, value ~ key, paired = T)
print(effect.sizes)
```

```
## # A tibble: 91 x 7
##    .y.   group1   group2    effsize    n1    n2 magnitude
##  * <chr> <chr>    <chr>       <dbl> <int> <int> <ord>
##  1 value agx.folk arch.folk  -1.56    100   100 large
##  2 value agx.folk ava.folk   -3.39    100   100 large
##  3 value agx.folk dar.folk   -3.56    100   100 large
##  4 value agx.folk khv.folk   -0.946   100   100 large
##  5 value agx.folk kum.folk   -0.275   100   100 small
##  6 value agx.folk lak.folk   -0.257   100   100 small
##  7 value agx.folk lez.folk   -0.421   100   100 small
##  8 value agx.folk nog.folk    0.356   100   100 small
##  9 value agx.folk rus.folk   -0.747   100   100 moderate
## 10 value agx.folk rut.folk   -0.136   100   100 negligible
## # ... with 81 more rows
```

Effect size heatmap

```
effect.sizes.plot <- ggplot(as.data.frame(effect.sizes), aes(group1, group2)) +
  geom_tile(aes(fill = abs(effsize)), color = "white") +
  scale_fill_gradient2(low = "light blue", mid = "light grey", high = "red",
                       midpoint = 0.5, limit = c(0, 7.5)) +
  geom_text(aes(label = round(abs(effsize), 2))) +
  labs(x = "", y = "") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 90, hjust = 1))
effect.sizes.plot
```



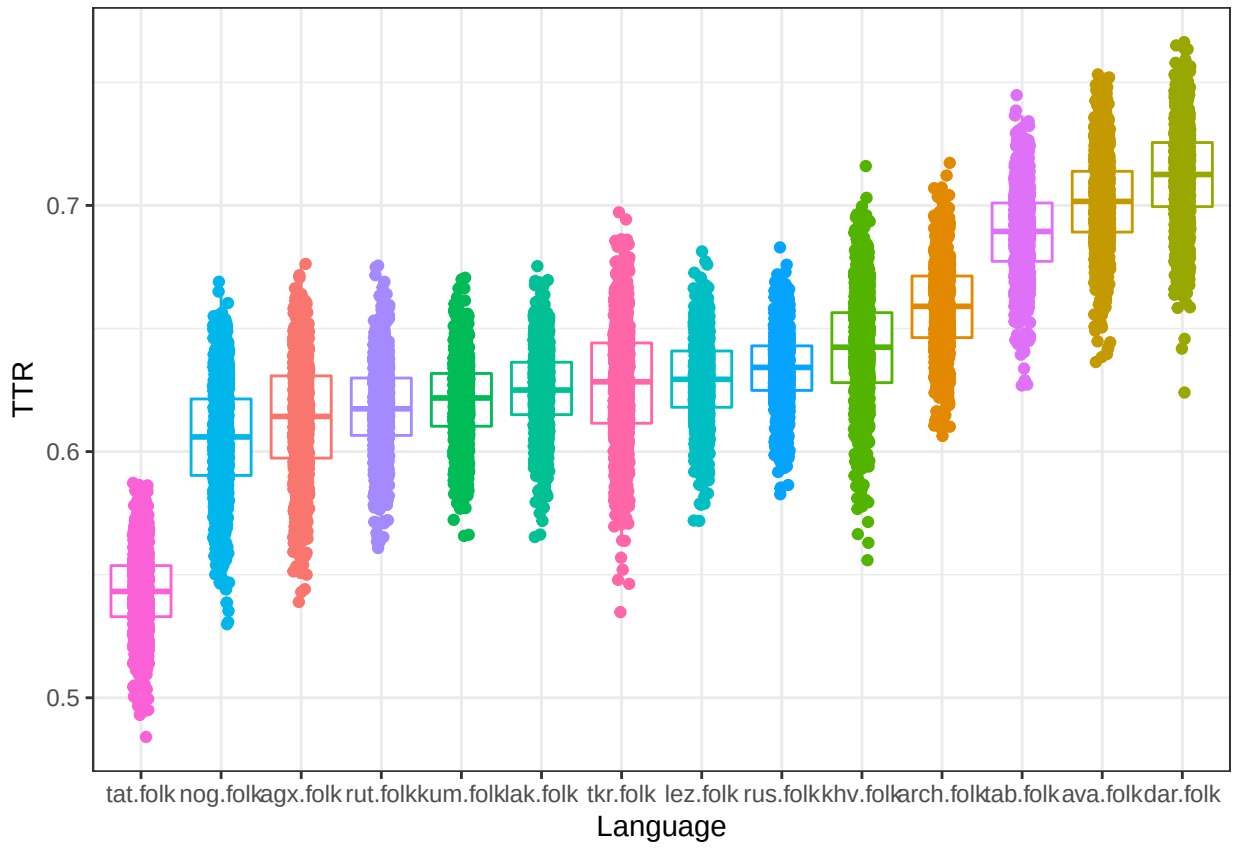
1000 TTRs per language

```
df2 <- read.csv("TTR_1000_datapoints_per_language.txt",
                header = TRUE, sep = ",")
df2_long <- gather(df2)
head(df2_long)
```

```
##        key     value
## 1 agx.folk 0.5940594
```

```
## 2 agx.folk 0.6343656
## 3 agx.folk 0.6179104
## 4 agx.folk 0.6000000
## 5 agx.folk 0.6305419
## 6 agx.folk 0.6510469
```

```
df2_long  %>%
  ggplot(aes(reorder(key, value, FUN = median), value, color = key))+
  geom_boxplot(outlier.shape = NA)+
  geom_jitter(width = 0.1)+
  labs(x = "Language",
       y = "TTR")+
  theme_bw()+
  theme(legend.position = "none")
```



Pairwise t-test

Holm-Bonferroni method

```
p.values <- pairwise.t.test(df2_long$value, df2_long$key,
                            paired = T, p.adjust.method = "holm")
p.values
```

```
##
```

```
##  Pairwise comparisons using paired t tests
##
## data:  df2_long$value and df2_long$key
##
##           agx.folk arch.folk ava.folk dar.folk khv.folk kum.folk lak.folk
## arch.folk < 2e-16  -         -        -        -        -        -
## ava.folk  < 2e-16  < 2e-16   -        -        -        -        -
## dar.folk  < 2e-16  < 2e-16   < 2e-16  -        -        -        -
## khv.folk  < 2e-16  < 2e-16   < 2e-16  < 2e-16  -        -        -
## kum.folk  6.2e-15  < 2e-16   < 2e-16  < 2e-16  < 2e-16  -        -
## lak.folk  < 2e-16  < 2e-16   < 2e-16  < 2e-16  < 2e-16  5.0e-07  -
## lez.folk  < 2e-16  < 2e-16   < 2e-16  < 2e-16  < 2e-16  < 2e-16  3.3e-07
## nog.folk  6.1e-15  < 2e-16   < 2e-16  < 2e-16  < 2e-16  < 2e-16  < 2e-16
## rus.folk  < 2e-16  < 2e-16   < 2e-16  < 2e-16  < 2e-16  < 2e-16  < 2e-16
## rut.folk  3.3e-05  < 2e-16   < 2e-16  < 2e-16  < 2e-16  4.9e-05  < 2e-16
## tab.folk  < 2e-16  < 2e-16   < 2e-16  < 2e-16  < 2e-16  < 2e-16  < 2e-16
## tat.folk  < 2e-16  < 2e-16   < 2e-16  < 2e-16  < 2e-16  < 2e-16  < 2e-16
## tkr.folk  < 2e-16  < 2e-16   < 2e-16  < 2e-16  < 2e-16  1.0e-11  0.0067
##           lez.folk nog.folk rus.folk rut.folk tab.folk tat.folk
## arch.folk -        -        -        -        -        -
## ava.folk  -        -        -        -        -        -
## dar.folk  -        -        -        -        -        -
## khv.folk  -        -        -        -        -        -
## kum.folk  -        -        -        -        -        -
## lak.folk  -        -        -        -        -        -
## lez.folk  -        -        -        -        -        -
## nog.folk  < 2e-16  -        -        -        -        -
## rus.folk  3.6e-08  < 2e-16  -        -        -        -
## rut.folk  < 2e-16  < 2e-16  < 2e-16  -        -        -
## tab.folk  < 2e-16  < 2e-16  < 2e-16  < 2e-16  -        -
## tat.folk  < 2e-16  < 2e-16  < 2e-16  < 2e-16  < 2e-16  -
## tkr.folk  0.1477   < 2e-16  2.1e-09  < 2e-16  < 2e-16  < 2e-16
##
## P value adjustment method: holm
```

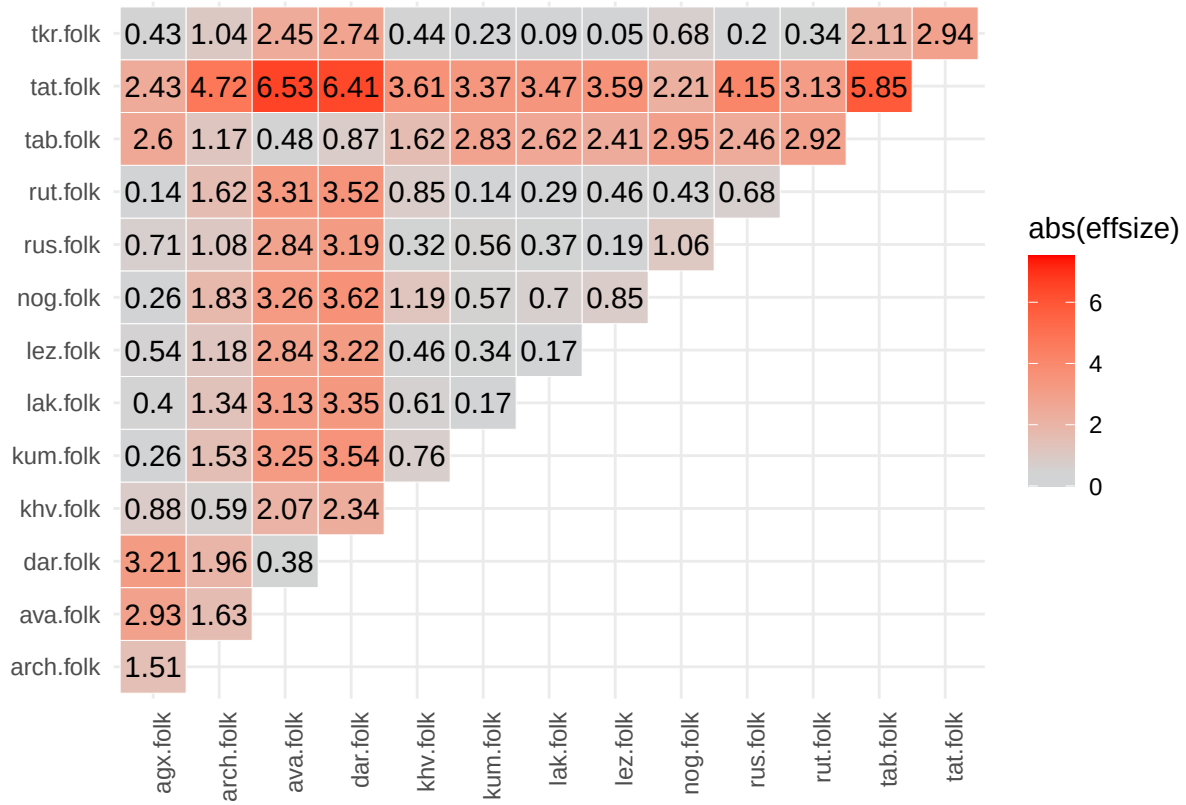
Effect sizes

```
effect.sizes <- cohens_d(df2_long, value ~ key, paired = T)
head(effect.sizes)
```

```
## # A tibble: 6 x 7
##   .y.   group1   group2    effsize    n1    n2 magnitude
##   <chr> <chr>    <chr>       <dbl> <int> <int> <ord>
## 1 value agx.folk arch.folk  -1.51   1000  1000 large
## 2 value agx.folk ava.folk   -2.93   1000  1000 large
## 3 value agx.folk dar.folk   -3.21   1000  1000 large
## 4 value agx.folk khv.folk   -0.878  1000  1000 large
## 5 value agx.folk kum.folk   -0.260  1000  1000 small
## 6 value agx.folk lak.folk   -0.405  1000  1000 small
```

Effect size heatmap

```
effect.sizes.plot <- ggplot(as.data.frame(effect.sizes), aes(group1, group2)) +
  geom_tile(aes(fill = abs(effsize)), color = "white") +
  scale_fill_gradient2(low = "light blue", mid = "light grey", high = "red",
                       midpoint = 0.5, limit = c(0, 7.5)) +
  geom_text(aes(label = round(abs(effsize), 2))) +
  labs(x = "", y = "") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 90, hjust = 1))
effect.sizes.plot
```



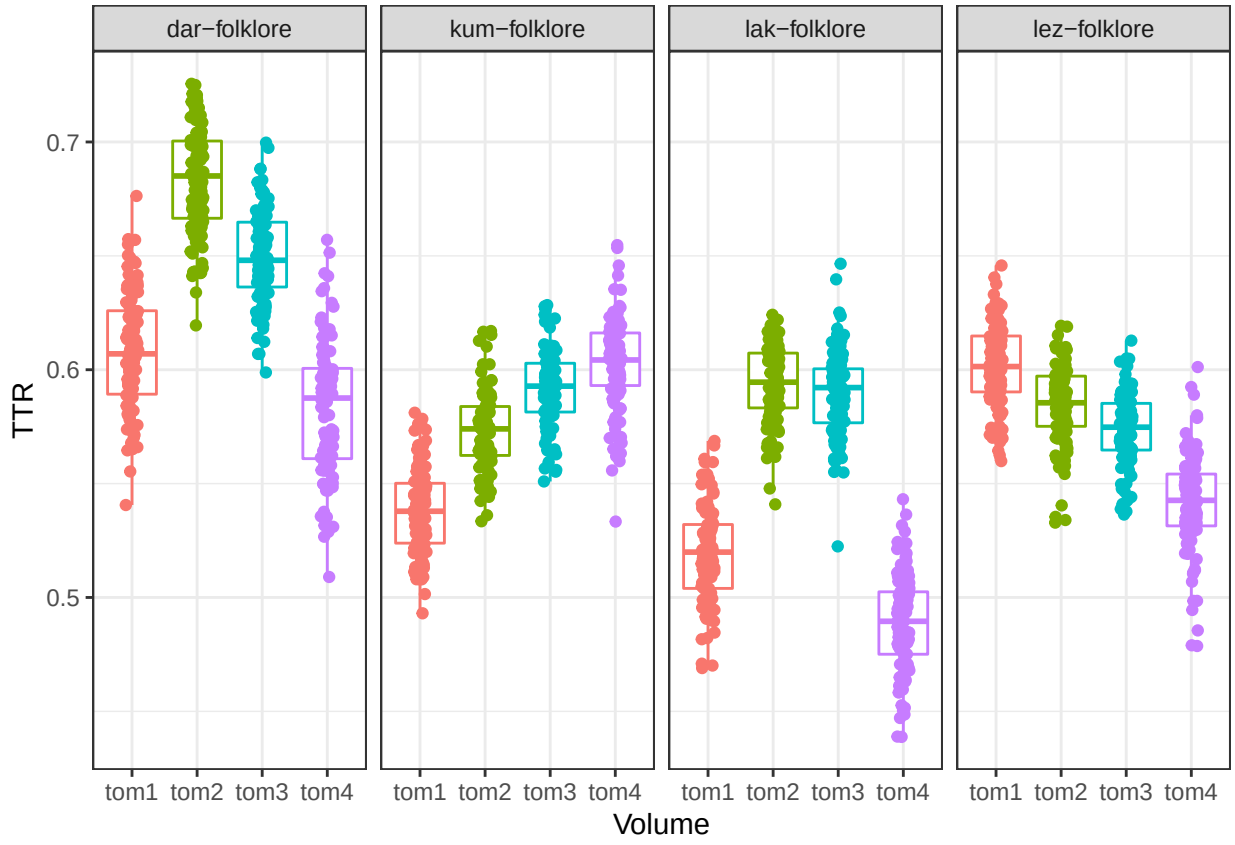
Volume comparison

```
df3 <- read.csv("volume_comparison_100_datapoints_per_volume.txt",
                header = TRUE, sep = ",")
head(df3)
```

```
##   Volume       TTR     Language
## 1   tom1 0.5014985 kum-folklore
## 2   tom1 0.5276680 kum-folklore
```

```
## 3   tom1 0.5345850 kum-folklore
## 4   tom1 0.5811209 kum-folklore
## 5   tom1 0.5374016 kum-folklore
## 6   tom1 0.5351137 kum-folklore
```

```
df3  %>%
  ggplot(aes(Volume, TTR, color = Volume))+
  geom_boxplot(outlier.shape = NA)+
  geom_jitter(width = 0.1)+
  labs(x = "Volume",
       y = "TTR")+
  theme_bw()+
  theme(legend.position = "none")+
  facet_grid(cols = vars(Language))
```



Pairwise t-tests

Holm-Bonferroni method

```
p.values <-   pairwise.t.test(filter(df3, Language == "dar-folklore")$TTR,
                              filter(df3, Language == "dar-folklore")$Volume,
                              paired = T, p.adjust.method = "holm")
p.values
```

```
##
##  Pairwise comparisons using paired t tests
##
## data:  filter(df3, Language == "dar-folklore")$TTR and filter(df3, Language == "dar-folklore")$Volume
##
##      tom1    tom2    tom3
## tom2 < 2e-16 -       -
## tom3 < 2e-16 < 2e-16 -
## tom4 6.1e-08 < 2e-16 < 2e-16
##
## P value adjustment method: holm
```

```
p.values <-   pairwise.t.test(filter(df3, Language == "kum-folklore")$TTR,
                              filter(df3, Language == "kum-folklore")$Volume,
                              paired = T, p.adjust.method = "holm")
p.values
```

```
##
##  Pairwise comparisons using paired t tests
##
## data:  filter(df3, Language == "kum-folklore")$TTR and filter(df3, Language == "kum-folklore")$Volume
##
##      tom1    tom2    tom3
## tom2 < 2e-16 -       -
## tom3 < 2e-16 1.6e-12 -
## tom4 < 2e-16 < 2e-16 2.5e-05
##
## P value adjustment method: holm
```

```
p.values <-   pairwise.t.test(filter(df3, Language == "lak-folklore")$TTR,
                              filter(df3, Language == "lak-folklore")$Volume,
                              paired = T, p.adjust.method = "holm")
p.values
```

```
##
##  Pairwise comparisons using paired t tests
##
## data:  filter(df3, Language == "lak-folklore")$TTR and filter(df3, Language == "lak-folklore")$Volume
##
##      tom1   tom2   tom3
## tom2 <2e-16 -      -
## tom3 <2e-16 0.14   -
## tom4 <2e-16 <2e-16 <2e-16
##
## P value adjustment method: holm
```

```
p.values <-   pairwise.t.test(filter(df3, Language == "lez-folklore")$TTR,
                              filter(df3, Language == "lak-folklore")$Volume,
                              paired = T, p.adjust.method = "holm")
p.values
```

```
##
```

```
##  Pairwise comparisons using paired t tests
##
## data:  filter(df3, Language == "lez-folklore")$TTR and filter(df3, Language == "lak-folklore")$Volum
##
##      tom1    tom2    tom3
## tom2 9.6e-09 -       -
## tom3 < 2e-16 2.5e-05 -
## tom4 < 2e-16 < 2e-16 < 2e-16
##
## P value adjustment method: holm
```