# Multi Anova

## libraries

```
library(foreign)
library(ggplot2)
library(plyr)
library(dplyr)
```

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

## The following objects are masked from 'package:plyr':
##
##     arrange, count, desc, failwith, id, mutate, rename, summarise,
##     summarize

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

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

```
library(car)
```

```
## Loading required package: carData

##
## Attaching package: 'car'

## The following object is masked from 'package:dplyr':
##
##     recode
```

```
library(haven)
library(sjstats)
```

```
## Registered S3 methods overwritten by 'lme4':
##   method                          from
##   cooks.distance.influence.merMod car
##   influence.merMod                car
##   dfbeta.influence.merMod         car
##   dfbetas.influence.merMod        car
```

```
library(rstatix)
```

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

```
## The following objects are masked from 'package:plyr':
##
##     desc, mutate
```

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

```
library(psych)
```

```
##
## Attaching package: 'psych'
```

```
## The following object is masked from 'package:sjstats':
##
##     phi
```

```
## The following object is masked from 'package:car':
##
##     logit
```

```
## The following objects are masked from 'package:ggplot2':
##
##     %+%, alpha
```

```
data <- read.dta("WVS_Cross-National_Wave_7_stata_v1_6.dta")
```

```
#View(data)
```

```
plyr::count(data, 'C_COW_ALPHA')
```

```
##    C_COW_ALPHA freq
## 1          AND 1004
## 2          ARG 1003
## 3          AUL 1813
## 4          BNG 1200
## 5          BOL 2067
## 6          BRA 1762
## 7          CHL 1000
## 8          CHN 3036
## 9          COL 1520
## 10         CYP 1000
## 11         DRV 1200
## 12         ECU 1200
```

```
## 13         EGY 1200
## 14         ETH 1230
## 15         GMY 1528
## 16         GRC 1200
## 17         GUA 1203
## 18         HKG 2075
## 19         INS 3200
## 20         IRN 1499
## 21         IRQ 1200
## 22         JOR 1203
## 23         JPN 1353
## 24         KYR 1200
## 25         KZK 1276
## 26         LEB 1200
## 27         MAC 1023
## 28         MAL 1313
## 29         MEX 1739
## 30         MYA 1200
## 31         NEW 1057
## 32         NIC 1200
## 33         NIG 1237
## 34         PAK 1995
## 35         PER 1400
## 36         PHI 1200
## 37         PRI 1127
## 38         ROK 1245
## 39         ROM 1257
## 40         RUS 1810
## 41         SRB 1046
## 42         TAJ 1200
## 43         TAW 1223
## 44         THI 1500
## 45         TUN 1208
## 46         TUR 2415
## 47         UKR 1289
## 48         USA 2596
## 49         ZIM 1215
```

```
plyr::count(data, 'Q241')
```

```
##                                          Q241  freq
## 1         It is against democracy (spontaneous)   427
## 2  Not an essential characteristic of democracy  7824
## 3                                             2  2301
## 4                                             3  3219
## 5                                             4  3381
## 6                                             5  8721
## 7                                             6  5651
## 8                                             7  6897
## 9                                             8  8436
## 10                                            9  5141
## 11     An essential characteristic of democracy 16530
## 12                                         <NA>  2339
```

```
plyr::count(data, 'Q242')
```

```
##                                          Q242  freq
## 1         It is against democracy (spontaneous)  1037
## 2  Not an essential characteristic of democracy 19309
## 3                                             2  5572
## 4                                             3  5612
## 5                                             4  4572
## 6                                             5  9323
## 7                                             6  4805
## 8                                             7  4037
## 9                                             8  3979
## 10                                            9  2422
## 11     An essential characteristic of democracy  6691
## 12                                         <NA>  3508
```

```
plyr::count(data, 'Q243')
```

```
##                                          Q243  freq
## 1         It is against democracy (spontaneous)   191
## 2  Not an essential characteristic of democracy  2836
## 3                                             2  1137
## 4                                             3  1665
## 5                                             4  2031
## 6                                             5  5599
## 7                                             6  3986
## 8                                             7  5203
## 9                                             8  7963
## 10                                            9  7266
## 11     An essential characteristic of democracy 30980
## 12                                         <NA>  2010
```

```
plyr::count(data, 'Q244')
```

```
##                                          Q244  freq
## 1         It is against democracy (spontaneous)   295
## 2  Not an essential characteristic of democracy  5563
## 3                                             2  2192
## 4                                             3  2888
## 5                                             4  3097
## 6                                             5  8200
## 7                                             6  5741
## 8                                             7  6967
## 9                                             8  8557
## 10                                            9  5863
## 11     An essential characteristic of democracy 19396
## 12                                         <NA>  2108
```

```
plyr::count(data, 'Q245')
```

```
##                                          Q245  freq
```

```
## 1         It is against democracy (spontaneous)  1196
## 2  Not an essential characteristic of democracy 15799
## 3                                             2  4421
## 4                                             3  4377
## 5                                             4  3693
## 6                                             5  8377
## 7                                             6  4598
## 8                                             7  4325
## 9                                             8  4646
## 10                                            9  3021
## 11     An essential characteristic of democracy  9345
## 12                                         <NA>  7069
```

```
plyr::count(data, 'Q246')
```

```
##                                          Q246  freq
## 1         It is against democracy (spontaneous)   200
## 2  Not an essential characteristic of democracy  3503
## 3                                             2  1411
## 4                                             3  2003
## 5                                             4  2415
## 6                                             5  7489
## 7                                             6  5267
## 8                                             7  6338
## 9                                             8  8461
## 10                                            9  6807
## 11     An essential characteristic of democracy 23527
## 12                                         <NA>  3446
```

```
plyr::count(data, 'Q247')
```

```
##                                          Q247  freq
## 1         It is against democracy (spontaneous)   359
## 2  Not an essential characteristic of democracy  9093
## 3                                             2  3055
## 4                                             3  3934
## 5                                             4  3667
## 6                                             5  9164
## 7                                             6  6118
## 8                                             7  6570
## 9                                             8  6999
## 10                                            9  4790
## 11     An essential characteristic of democracy 14668
## 12                                         <NA>  2450
```

```
plyr::count(data, 'Q248')
```

```
##                                          Q248  freq
## 1         It is against democracy (spontaneous)   624
## 2  Not an essential characteristic of democracy  8940
## 3                                             2  3171
## 4                                             3  3966
```

```
## 5                                          4  3786
## 6                                          5 10117
## 7                                          6  6039
## 8                                          7  6312
## 9                                          8  6841
## 10                                         9  4691
## 11     An essential characteristic of democracy 13643
## 12                                       <NA>  2737
```

```
plyr::count(data, 'Q249')
```

```
##                                          Q249  freq
## 1         It is against democracy (spontaneous)   190
## 2  Not an essential characteristic of democracy  2777
## 3                                          2  1072
## 4                                          3  1410
## 5                                          4  1760
## 6                                          5  5977
## 7                                          6  4010
## 8                                          7  4654
## 9                                          8  7083
## 10                                         9  7014
## 11     An essential characteristic of democracy 33220
## 12                                       <NA>  1700
```

Since numeric variables are required, string variables should be assigned numeric values

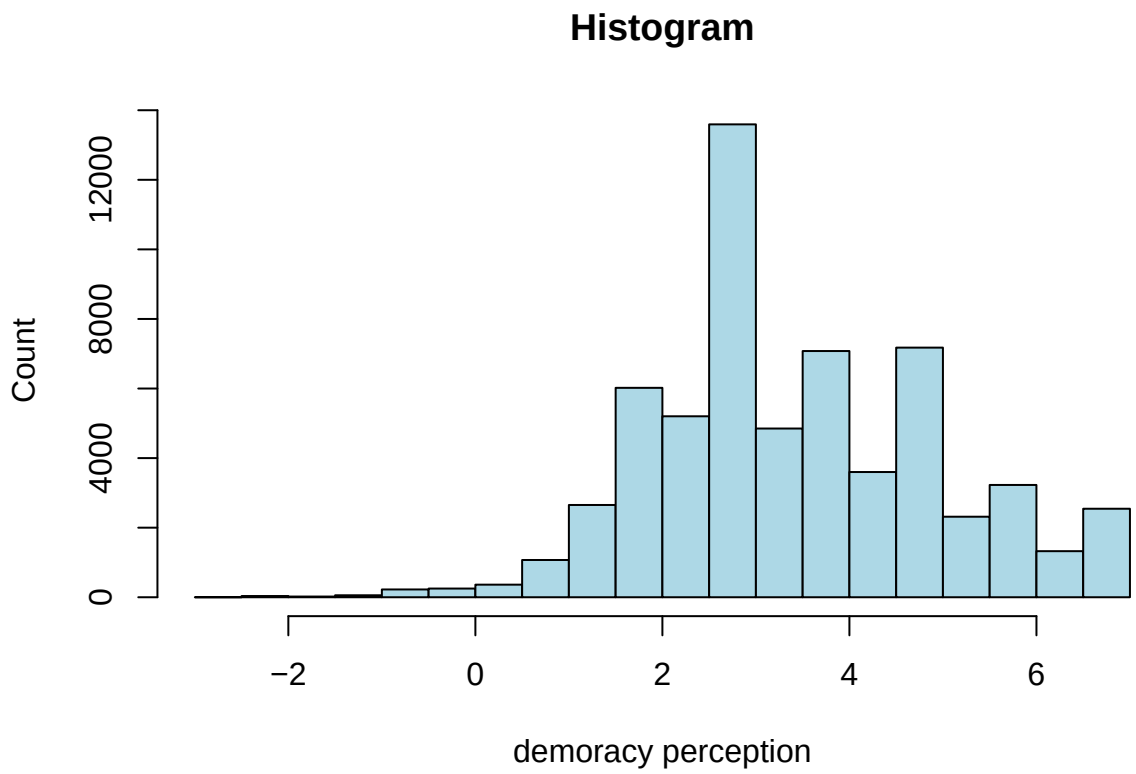
```
data['dem1'] <- mapvalues(data$Q241, from = c('It is against democracy (spontaneous)','Not an essential
data['dem2'] <- mapvalues(data$Q242, from = c('It is against democracy (spontaneous)','Not an essential
data['dem3'] <- mapvalues(data$Q243, from = c('It is against democracy (spontaneous)','Not an essential
data['dem4'] <- mapvalues(data$Q244, from = c('It is against democracy (spontaneous)','Not an essential
data['dem5'] <- mapvalues(data$Q245, from = c('It is against democracy (spontaneous)','Not an essential
data['dem6'] <- mapvalues(data$Q246, from = c('It is against democracy (spontaneous)','Not an essential
data['dem7'] <- mapvalues(data$Q247, from = c('It is against democracy (spontaneous)','Not an essential
data['dem8'] <- mapvalues(data$Q248, from = c('It is against democracy (spontaneous)','Not an essential
data['dem9'] <- mapvalues(data$Q249, from = c('It is against democracy (spontaneous)','Not an essential
```

Create a new column as a dependent variable

```
data['dem_num']<- (as.numeric(data$dem3) - as.numeric(data$dem5) + as.numeric(data$dem6) - as.numeric(da
```

Histogram for dependent variable

```
hist(data$dem_num, main = "Histogram", ylab = "Count", xlab = "demoracy perception", col = "lightblue")
```




factors reducing affecting the level of education

```
data['edu'] <- mapvalues(data$Q275, from = c('Early childhood education (ISCED 0) / no education',
                                             'Primary education (ISCED 1)',
                                             "Lower secondary education (ISCED 2)",
                                             "Upper secondary education (ISCED 3)",
                                             "Post-secondary non-tertiary education (ISCED 4)",
                                             "Short-cycle tertiary education (ISCED 5)",
                                             "Bachelor or equivalent (ISCED 6)",
                                             "Master or equivalent (ISCED 7)",
                                             "Doctoral or equivalent (ISCED 8)"),
          to = c("no-edu",
                 "Primary",
                 "Secondary",
                 "Secondary",
                 "Secondary",
                 "Tertiary",
                 "Tertiary",
                 "Tertiary",
                 "Tertiary"
                 ))
```

Create a new data frame for the model

```
data_sub <- subset.data.frame(data, select = c('D_INTERVIEW','dem3','dem5','dem6','dem8','dem9','H_URBRU
```

Create a new column as a dependent variable

```
data_sub['dem_val']<-(
  (as.numeric(data_sub$dem3)*sum(as.numeric(data_sub$dem3), na.rm = TRUE)  / 69867 /10) -
  (as.numeric(data_sub$dem5)*sum(as.numeric(data_sub$dem5), na.rm = TRUE)  / 69867 /10) +
   (as.numeric(data_sub$dem6)*sum(as.numeric(data_sub$dem6), na.rm = TRUE)  / 69867 /10) -

   (as.numeric(data_sub$dem8)*sum(as.numeric(data_sub$dem8), na.rm = TRUE)  / 69867 /10) +
  (as.numeric(data_sub$dem9)*sum(as.numeric(data_sub$dem9), na.rm = TRUE)  / 69867 /10)) /5
```

Create a new data frame for the model

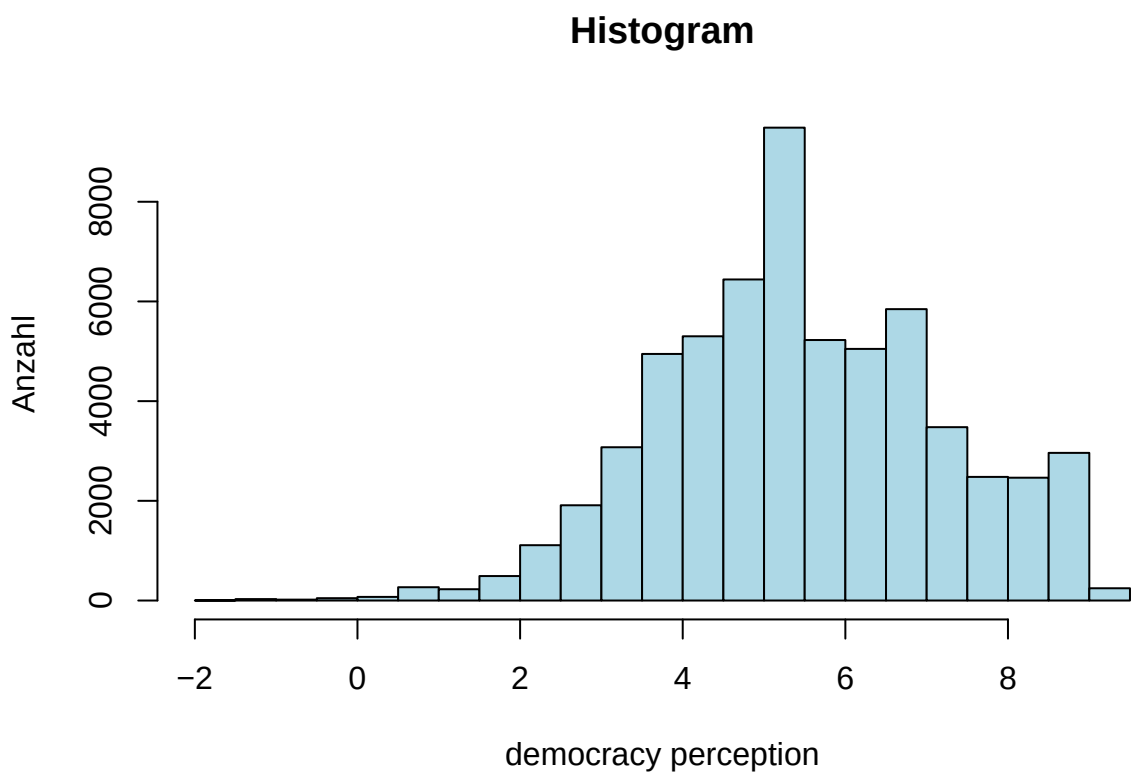
```
d_m <- data_sub[,c('edu',"dem_val", "H_URBRURAL")]
```

Delete missing values

```
d_m <- na.omit(d_m)
```

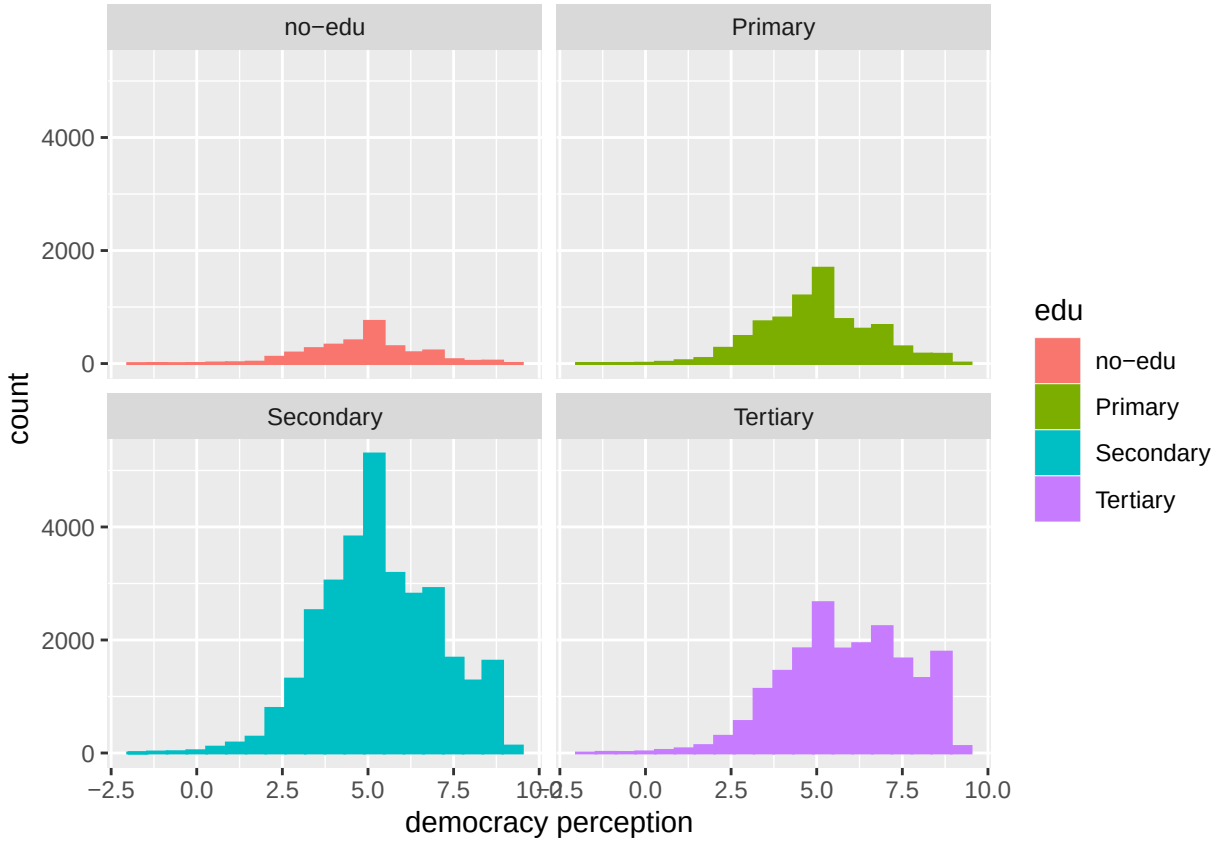
Histogram for dependent variable

```
hist(d_m$dem_val, main = "Histogram", ylab = "Anzahl", xlab = "democracy perception", col = "lightblue"
```



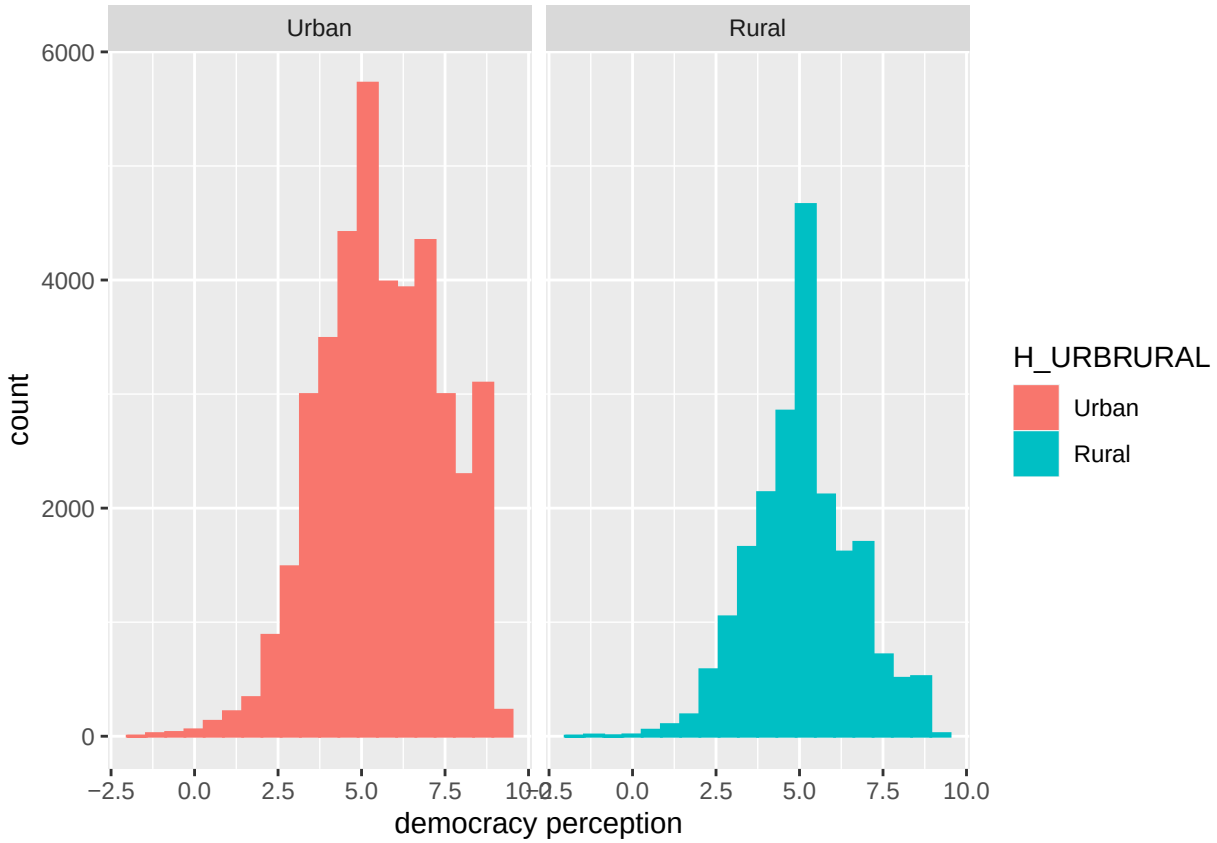

Education

```
d_m %>%
  group_by(edu) %>%
  ggplot(aes(dem_val, color=edu)) +
  geom_histogram(aes(fill = edu), bins = 20) +
  facet_wrap(~edu) +
  theme_grey()+
  labs(x= "democracy perception",y = "count" )
```

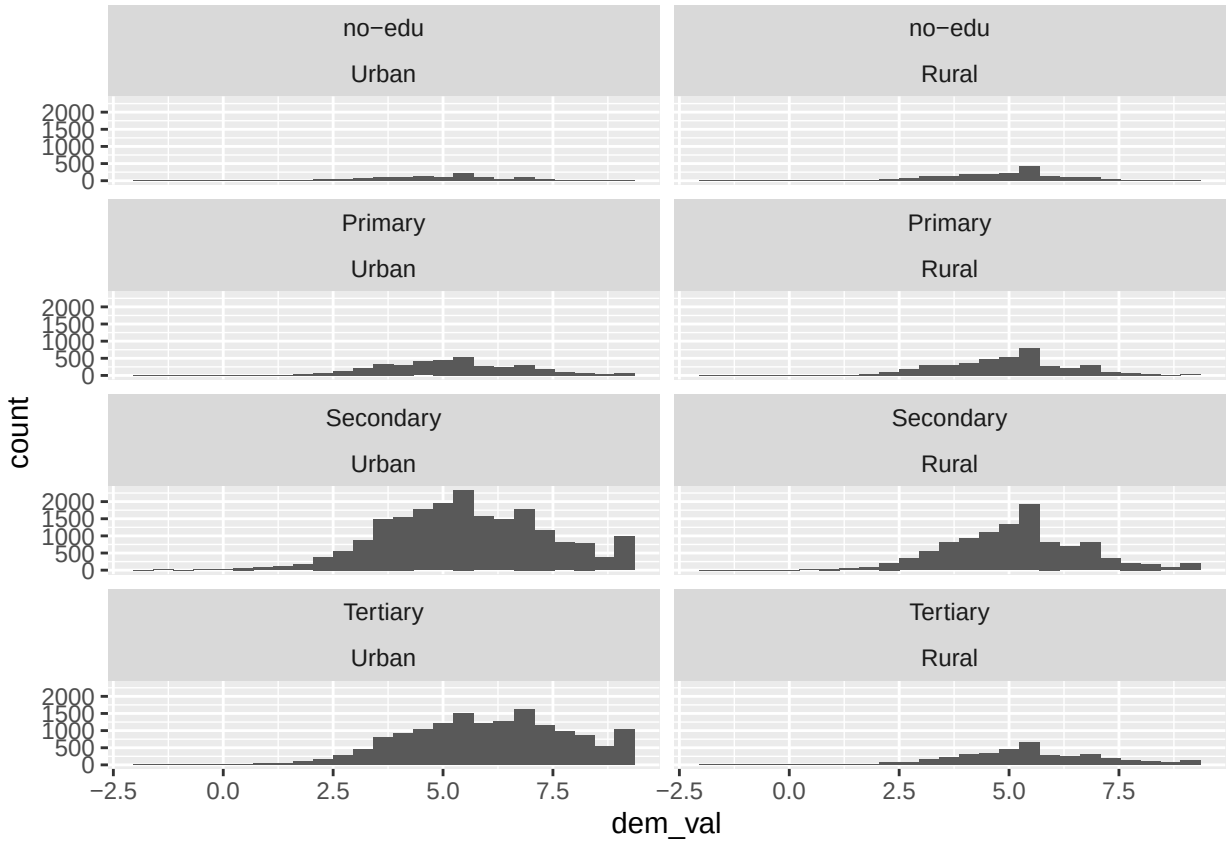



Location

```
d_m %>%
  group_by(H_URBRURAL) %>%
  ggplot(aes(dem_val, color=H_URBRURAL)) +
  geom_histogram(aes(fill = H_URBRURAL), bins = 20) +
  facet_wrap(~H_URBRURAL) +
  theme_grey()+
  labs(x= "democracy perception",y = "count" )
```

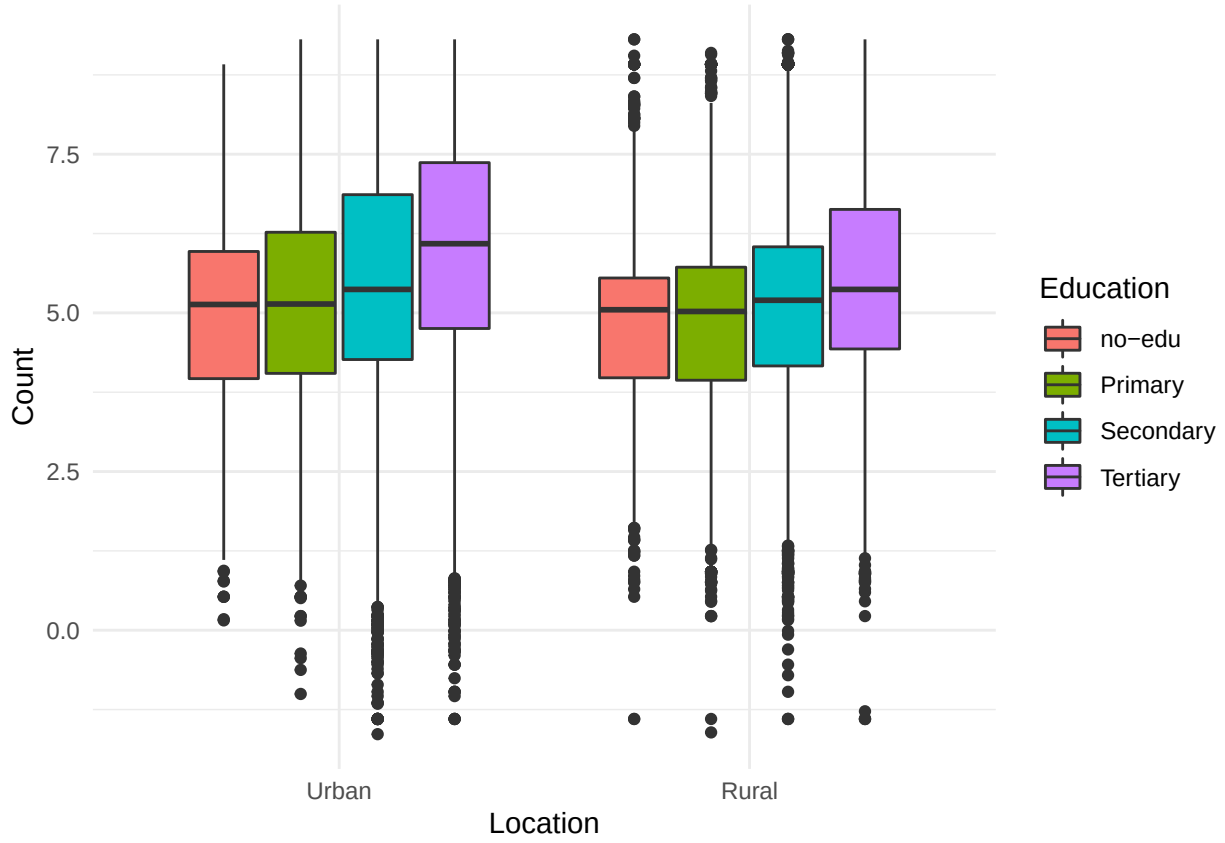



```
ggplot(d_m, aes(x=dem_val))+
geom_histogram(bins = 25)+
theme_grey()+
facet_wrap(edu~H_URBRURAL, ncol = 2)
```




Boxplot

```
ggplot(d_m, aes(H_URBRURAL, dem_val, fill=factor(edu))) +
geom_boxplot() +
theme_minimal()+
labs(fill = "Education", x="Location", y="Count")
```




```
d_m %>%
group_by(edu) %>%
  dplyr::summarize(Anzahl = n(), Mittelwert = mean(dem_val), Median = median(dem_val), Standardabweichu
  mutate_if(is.numeric, round, 2)
```

```
## # A tibble: 4 x 5
##   edu       Anzahl Mittelwert Median Standardabweichung
##   <fct>      <dbl>      <dbl>  <dbl>              <dbl>
## 1 no-edu      2967       4.94   5.08               1.47
## 2 Primary     8063       5.03   5.07               1.55
## 3 Secondary  31024       5.39   5.37               1.72
## 4 Tertiary   19122       5.91   5.89               1.78
```

At the non-education level, the average perception of democracy is 4.94 (SD = 1.47, n = 2967), At the primary level, the average perception of democracy is 5.03 (SD = 1.55, n = 8063), At the secondary level the perception is of democracy on average 5.39 (SD = 1.72, n = 31024), at the tertiary level of education the perception of democracy is on average 5.91 (SD = 1.78, n = 19122)

```
d_m %>%
group_by( H_URBRURAL) %>%
  dplyr::summarize(Anzahl = n(), Mittelwert = mean(dem_val), Median = median(dem_val), Standardabweichu
  mutate_if(is.numeric, round, 2)
```

```
## # A tibble: 2 x 5
```

```
##   H_URBRURAL Anzahl Mittelwert Median Standardabweichung
##   <fct>       <dbl>      <dbl>  <dbl>              <dbl>
## 1 Urban       40672       5.66   5.55               1.81
## 2 Rural       20504       5.13   5.2                1.53
```

Beim Urban ist die Wahrnehmung der Demokratie im Durchschnitt 5.66 (SD = 1.81, n =40672), Beim Rural ist die Wahrnehmung der Demokratie im Durchschnitt 5.13 (SD = 1.53, n=20504).

```
d_m %>%
group_by(edu, H_URBRURAL) %>%
  dplyr::summarize(Anzahl = n(), Mittelwert = mean(dem_val), Median = median(dem_val), Standardabweichu
  mutate_if(is.numeric, round, 2)
```

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

```
## `mutate_if()` ignored the following grouping variables:
## Column `edu`
```

```
## # A tibble: 8 x 6
## # Groups:   edu [4]
##   edu       H_URBRURAL Anzahl Mittelwert Median Standardabweichung
##   <fct>     <fct>       <dbl>      <dbl>  <dbl>              <dbl>
## 1 no-edu    Urban        1145       5.04   5.13               1.56
## 2 no-edu    Rural        1822       4.87   5.05               1.4
## 3 Primary   Urban        3838       5.16   5.14               1.62
## 4 Primary   Rural        4225       4.91   5.02               1.46
## 5 Secondary Urban       20356       5.52   5.37               1.81
## 6 Secondary Rural       10668       5.14   5.2                1.51
## 7 Tertiary  Urban       15333       6.02   6.09               1.8
## 8 Tertiary  Rural        3789       5.49   5.37               1.63
```

In urban the perception of democracy is on average 5.66 (SD = 1.81, n = 40672), in rural the perception of democracy is on average 5.13 (SD = 1.53, n = 20504).

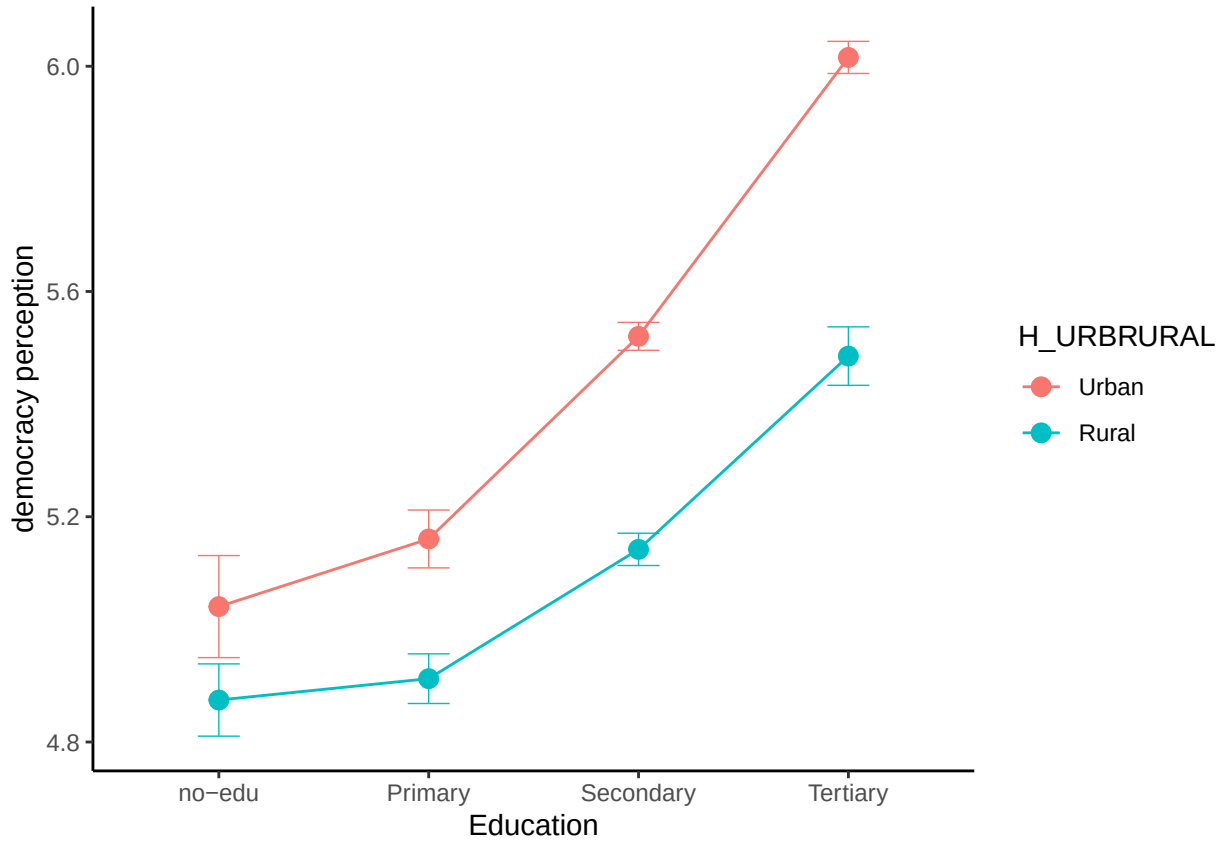
Not; Although the difference seems small, it is tolerable since there is a large data set.

## Profildiagramm

```
ggplot(d_m, aes(x=edu, y=dem_val, group=H_URBRURAL, color = H_URBRURAL))+
  stat_summary(fun.y = mean, geom="point", size=3)+
  stat_summary(fun.y = mean, geom="line")+
  stat_summary(fun.data = mean_cl_normal, geom="errorbar",width=.2, size=.25)+
  labs(x="Education", y="democracy perception")+
  theme_classic()
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```

```
## Warning: `fun.y` is deprecated. Use `fun` instead.
```




Levene -Test

```
leveneTest(dem_val ~ edu*H_URBRURAL, data = data_sub, center = "mean")
```

```
## Levene's Test for Homogeneity of Variance (center = "mean")
##          Df F value    Pr(>F)
## group     7   178.7 < 2.2e-16 ***
##       61168
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

In the present example, the Levene test is significant (F (7.61168) = 178.7, p = .000), so that heterogeneity of variance can be assumed. Since the variances are unfortunately not the same, it is recommended to carry out a correction using the Welch test.

without Welch-Korrektur

```
mehrAnova1 <- lm(dem_val ~ edu*H_URBRURAL, data = data_sub)
myAnova <- Anova(mehrAnova1 , type = 3)
myAnova
```

```
## Anova Table (Type III tests)
##
## Response: dem_val
##                Sum Sq    Df    F value    Pr(>F)
```

```
## (Intercept)     29090     1 10106.2784 < 2.2e-16 ***
## edu              3734     3   432.3802 < 2.2e-16 ***
## H_URBRURAL         19     1     6.7261  0.009503 **
## edu:H_URBRURAL    136     3    15.7329 3.181e-10 ***
## Residuals      176066 61168
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Gesamtmodel wird signifikant.

with Welch-Korrektur

```
educ <- oneway.test(dem_val ~ edu, data = d_m, var.equal = F)
educ
```

```
##
##  One-way analysis of means (not assuming equal variances)
##
## data:  dem_val and edu
## F = 756.52, num df = 3, denom df = 11969, p-value < 2.2e-16
```

There is a major effect that education levels have on the perception of democracy. (F (3.11969) = 756.52, p = .000). This means that the perception of democracy depends on the level of education

```
loc <- oneway.test(dem_val ~ H_URBRURAL, data = d_m, var.equal = F)
loc
```

```
##
##  One-way analysis of means (not assuming equal variances)
##
## data:  dem_val and H_URBRURAL
## F = 1422, num df = 1, denom df = 47683, p-value < 2.2e-16
```

There is one major effect of the location on the perception of democracy. (F (1.47683) = 1422, p = .000). That means that the perception of democracy is dependent on the location

```
lage <- oneway.test(dem_val ~ edu*H_URBRURAL, data = d_m, var.equal = F)
lage
```

```
##
##  One-way analysis of means (not assuming equal variances)
##
## data:  dem_val and edu * H_URBRURAL
## F = 436.4, num df = 7.0, denom df = 9917.6, p-value < 2.2e-16
```

The interaction term of educational level and location on the perception of democracy is also significant (F (7,9917.6) = 436.4, p = .000).

## Post-Hoc-Test

```r
PostHoc <- aov(dem_val ~ edu*H_URBRURAL, data = d_m)
TukeyHSD(PostHoc)
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = dem_val ~ edu * H_URBRURAL, data = d_m)
##
## $edu
##                           diff          lwr       upr     p adj
## Primary-no-edu     0.09201336 -0.001575966 0.1856027 0.0560253
## Secondary-no-edu   0.45172974  0.367972963 0.5354865 0.0000000
## Tertiary-no-edu    0.97206267  0.886060723 1.0580646 0.0000000
## Secondary-Primary  0.35971638  0.305232930 0.4141998 0.0000000
## Tertiary-Primary   0.88004931  0.822173726 0.9379249 0.0000000
## Tertiary-Secondary 0.52033292  0.480260255 0.5604056 0.0000000
##
## $H_URBRURAL
##                    diff        lwr        upr p adj
## Rural-Urban -0.3576343 -0.3861148 -0.3291538     0
##
## $`edu:H_URBRURAL`
##                                          diff         lwr         upr     p adj
## Primary:Urban-no-edu:Urban         0.12013944 -0.05301552  0.29329440 0.4128865
## Secondary:Urban-no-edu:Urban       0.47991700  0.32373712  0.63609689 0.0000000
## Tertiary:Urban-no-edu:Urban        0.97526003  0.81772372  1.13279633 0.0000000
## no-edu:Rural-no-edu:Urban         -0.16593574 -0.35985751  0.02798603 0.1581096
## Primary:Rural-no-edu:Urban        -0.12800111 -0.29932414  0.04332193 0.3134280
## Secondary:Rural-no-edu:Urban       0.10160783 -0.05830399  0.26151966 0.5329235
## Tertiary:Rural-no-edu:Urban        0.44486775  0.27145570  0.61827979 0.0000000
## Secondary:Urban-Primary:Urban      0.35977756  0.26928771  0.45026741 0.0000000
## Tertiary:Urban-Primary:Urban       0.85512058  0.76230924  0.94793193 0.0000000
## no-edu:Rural-Primary:Urban        -0.28607518 -0.43236910 -0.13978126 0.0000001
## Primary:Rural-Primary:Urban       -0.24814055 -0.36280458 -0.13347652 0.0000000
## Secondary:Rural-Primary:Urban     -0.01853161 -0.11532029  0.07825707 0.9991053
## Tertiary:Rural-Primary:Urban       0.32472830  0.20696586  0.44249075 0.0000000
## Tertiary:Urban-Secondary:Urban     0.49534302  0.44035702  0.55032902 0.0000000
## no-edu:Rural-Secondary:Urban      -0.64585274 -0.77159623 -0.52010925 0.0000000
## Primary:Rural-Secondary:Urban     -0.60791811 -0.69485116 -0.52098506 0.0000000
## Secondary:Rural-Secondary:Urban   -0.37830917 -0.43977106 -0.31684728 0.0000000
## Tertiary:Rural-Secondary:Urban    -0.03504926 -0.12603007  0.05593155 0.9411005
## no-edu:Rural-Tertiary:Urban       -1.14119577 -1.26862009 -1.01377144 0.0000000
## Primary:Rural-Tertiary:Urban      -1.10326113 -1.19260814 -1.01391412 0.0000000
## Secondary:Rural-Tertiary:Urban    -0.87365219 -0.93848349 -0.80882090 0.0000000
## Tertiary:Rural-Tertiary:Urban     -0.53039228 -0.62368237 -0.43710219 0.0000000
## Primary:Rural-no-edu:Rural         0.03793463 -0.10618633  0.18205560 0.9932806
## Secondary:Rural-no-edu:Rural       0.26754357  0.13719381  0.39789334 0.0000000
## Tertiary:Rural-no-edu:Rural        0.61080348  0.46420538  0.75740159 0.0000000
## Secondary:Rural-Primary:Rural      0.22960894  0.13613706  0.32308082 0.0000000
## Tertiary:Rural-Primary:Rural       0.57286885  0.45781697  0.68792074 0.0000000
## Tertiary:Rural-Secondary:Rural     0.34325991  0.24601206  0.44050776 0.0000000
```

Since there is heterogeneity of variance, we should use Games Howell's test. For this we need new columns

as an interaction.

```
#first way
 f1 <- function(a,b){
  if (a == "Primary" & b == "Urban"){
   return("Primary:Urban")
  }else if(a == "no-edu" & b == "Urban"){
   return("no-edu:Urban")
  }else if(a == "Secondary" & b == "Urban"){
   return("Secondary:Urban")
  }else if(a == "Tertiary" & b == "Urban"){
   return("Tertiary:Urban")
  }else if (a == "Primary" & b == "Rural"){
   return("Primary:Rural")
  }else if(a == "no-edu" & b == "Rural"){
   return("no-edu:Rural")
  }else if(a == "Secondary" & b == "Rural"){
   return("Secondary:Rural")
  }else if(a == "Tertiary" & b == "Rural"){
   return("Tertiary:Rural")
  }
 }

d_m['eu'] <- mapply(f1, d_m$edu, d_m$H_URBRURAL)

#second way
d_m$eu <- paste(d_m$edu,d_m$H_URBRURAL)
```

```
head(d_m)
```

```
##         edu  dem_val H_URBRURAL              eu
## 1 Secondary 5.373242      Urban Secondary Urban
## 2  Tertiary 8.060219      Urban  Tertiary Urban
## 3  Tertiary 6.613058      Urban  Tertiary Urban
## 4 Secondary 6.445563      Urban Secondary Urban
## 5 Secondary 5.476532      Urban Secondary Urban
## 6   Primary 8.915964      Urban   Primary Urban
```

```
gm <- rbind(games_howell_test(d_m, dem_val ~ edu),games_howell_test(d_m, dem_val ~ H_URBRURAL),games_hou
gm
```

```
## # A tibble: 35 x 8
##    .y.    group1    group2    estimate conf.low conf.high     p.adj p.adj.signif
##    <chr>  <chr>     <chr>        <dbl>    <dbl>     <dbl>     <dbl> <chr>
##  1 dem_v~ no-edu    Primary     0.0920  0.00995     0.174   2.10e-2 *
##  2 dem_v~ no-edu    Secondary   0.452   0.378       0.525   1.39e-8 ****
##  3 dem_v~ no-edu    Tertiary    0.972   0.895       1.05    4.35e-8 ****
##  4 dem_v~ Primary   Secondary   0.360   0.309       0.411   2.03e-9 ****
##  5 dem_v~ Primary   Tertiary    0.880   0.825       0.935   3.31e-8 ****
##  6 dem_v~ Secondary Tertiary    0.520   0.479       0.562   0.      ****
##  7 dem_v~ Urban     Rural      -0.525  -0.553      -0.498   0.      ****
##  8 dem_v~ no-edu R~ no-edu U~   0.166  -0.00580     0.338   6.70e-2 ns
```

```
##  9 dem_v~ no-edu R~ Primary ~   0.0379 -0.0825      0.158   9.80e-1 ns
## 10 dem_v~ no-edu R~ Primary ~   0.286   0.159       0.413   3.14e-8 ****
## # ... with 25 more rows
```

```
subset(gm, subset = p.adj.signif == "ns")
```

```
## # A tibble: 7 x 8
##   .y.     group1      group2      estimate conf.low conf.high p.adj p.adj.signif
##   <chr>   <chr>       <chr>          <dbl>    <dbl>     <dbl> <dbl> <chr>
## 1 dem_val no-edu Rur~ no-edu Urb~   0.166  -0.00580    0.338  0.067 ns
## 2 dem_val no-edu Rur~ Primary Ru~   0.0379 -0.0825     0.158  0.98  ns
## 3 dem_val no-edu Urb~ Primary Ru~  -0.128  -0.284      0.0279 0.2   ns
## 4 dem_val no-edu Urb~ Primary Ur~   0.120  -0.0410     0.281  0.315 ns
## 5 dem_val no-edu Urb~ Secondary ~   0.102  -0.0455     0.249  0.417 ns
## 6 dem_val Primary Ur~ Secondary ~  -0.0185 -0.110      0.0725 0.999 ns
## 7 dem_val Secondary ~ Tertiary R~  -0.0350 -0.124      0.0539 0.934 ns
```

```
subset(gm, subset = estimate == max(gm$estimate))
```

```
## # A tibble: 1 x 8
##   .y.     group1     group2       estimate conf.low conf.high p.adj p.adj.signif
##   <chr>   <chr>      <chr>           <dbl>    <dbl>     <dbl> <dbl> <chr>
## 1 dem_val no-edu Ru~ Tertiary Ur~     1.14     1.03      1.25     0 ****
```

```
eta <- effectsize::eta_squared(mehrAnova1, partial = TRUE)
eta
```

```
## Parameter      | Eta2 (partial) |       90% CI
## -------------------------------------------------
## edu            |           0.03 | [0.03, 0.04]
## H_URBRURAL     |           0.01 | [0.01, 0.01]
## edu:H_URBRURAL |       7.71e-04 | [0.00, 0.00]
```

```
for (i in 1:length(eta$Parameter)){
  st <- sqrt(eta$Eta2_partial[i]/(1-eta$Eta2_partial[i]))

  a <- sprintf("Effect size f=%s fürs f= %.3f", eta$Parameter[i],st)
  print(a)
}
```

```
## [1] "Effect size f=edu fürs f= 0.189"
## [1] "Effect size f=H_URBRURAL fürs f= 0.103"
## [1] "Effect size f=edu:H_URBRURAL fürs f= 0.028"
```

It turns out that there is a difference between the level of education and the perception of democracy (F (3.11969) = 756.52, p <.000). H1 for the main effect A is accepted. In addition, depending on the location, there is a difference between the perception of democracy (F (1.47683) = 1422, p <.000). H1 for the main effect B is accepted. The interaction term of educational level and situation on the perception of democracy is significant (F (7,9917.6) = 436.4, p <.000). Therefore H1 for the interaction effect AXB is accepted

The PostHoc was carried out with Games Howell. It shows that all groups (with the exception of Primary and non-education (p = 2.10e-02)) differ significantly in terms of educational level and location. And there

was a significant difference between primary and non-education. In relation to the Games Howell table of results, the differences between the combination of non-education and primary with location also appear to be insignificant. In general,the differences between the Urban and the Rural is also based on education level, and rural areas follows urban areas one step behind. For instance, the differences between Urban with secondary level education and Rural with tertiary level is not clear.Finally, as expected, the biggest difference is between non-education rural and tertiary urban (e = 1.14, p = 0)

The effect sizes are a weak effect for the main effect of educational level and location (f = 0.189, f = 0.103)