OSC_Data_Analysis

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```
require("knitr")
```

```
## Loading required package: knitr
```

```
knitr::opts_chunk$set(echo = TRUE)
knitr::opts_chunk$set(tidy.opts=list(width.cutoff=50),tidy=TRUE)

library(data.table)
library(tidyverse)
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.0 --

## v ggplot2 3.3.3     v purrr   0.3.4
## v tibble  3.1.0     v dplyr   1.0.5
## v tidyr   1.1.3     v stringr 1.4.0
## v readr   1.4.0     v forcats 0.5.1

## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::between()   masks data.table::between()
## x dplyr::filter()    masks stats::filter()
## x dplyr::first()     masks data.table::first()
## x dplyr::lag()       masks stats::lag()
## x dplyr::last()      masks data.table::last()
## x purrr::transpose() masks data.table::transpose()
```

```
library(magrittr)
```

```
##
## Attaching package: 'magrittr'

## The following object is masked from 'package:purrr':
##
##     set_names

## The following object is masked from 'package:tidyr':
##
##     extract
```

```
library(car)
```

```
## Loading required package: carData
```

```
##
## Attaching package: 'car'
```

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

```
## The following object is masked from 'package:purrr':
##
##     some
```

```
library(gridExtra)
```

```
##
## Attaching package: 'gridExtra'
```

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

```
library(psych)
```

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

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

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

```
library(ggplot2)
library(multcomp)
```

```
## Warning: package 'multcomp' was built under R version 4.0.5
```

```
## Loading required package: mvtnorm
```

```
## Warning: package 'mvtnorm' was built under R version 4.0.5
```

```
## Loading required package: survival
```

```
## Loading required package: TH.data

## Warning: package 'TH.data' was built under R version 4.0.5

## Loading required package: MASS

##
## Attaching package: 'MASS'

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

##
## Attaching package: 'TH.data'

## The following object is masked from 'package:MASS':
##
##     geyser
```

```
library(plotly)
```

```
## Warning: package 'plotly' was built under R version 4.0.5

##
## Attaching package: 'plotly'

## The following object is masked from 'package:MASS':
##
##     select

## The following object is masked from 'package:ggplot2':
##
##     last_plot

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

## The following object is masked from 'package:graphics':
##
##     layout
```

```
library(apaTables)
```

```
## Warning: package 'apaTables' was built under R version 4.0.5
```

```r
library(dplyr)
```

Import Datasets - Full data and Data of correct trials only

```r
data <- read.csv ("OSC_cleaned.csv")
data_ct <- read.csv ("OSC_cleaned_ct.csv")
```

Descriptives/ Preliminary Analyses

```r
data1 <- select (data, ID, AGE, BIRTH_EXP, DIS, REAC_TIME, ACCURACY)
head (data1)
```

```
##   ID AGE BIRTH_EXP DIS REAC_TIME   ACCURACY
## 1  1  11         V   N 0.5485308 0.06299213
## 2  2  15         V   N 0.9695677 0.74803150
## 3  3  17         V   N 0.5612650 0.86718750
## 4  4  12         C   N 0.4761383 0.71666667
## 5  5   8         V   N 0.6655731 0.61403509
## 6  6  11         V   N 0.7001154 0.73437500
```

```r
summary (data1)
```

```
##        ID              AGE         BIRTH_EXP            DIS
##  Min.   :  1.00   Min.   : 6.00   Length:312         Length:312
##  1st Qu.: 85.75   1st Qu.: 8.00   Class :character   Class :character
##  Median :172.50   Median :10.00   Mode  :character   Mode  :character
##  Mean   :182.33   Mean   :10.06
##  3rd Qu.:283.25   3rd Qu.:11.00
##  Max.   :367.00   Max.   :17.00
##    REAC_TIME         ACCURACY
##  Min.   :0.3217   Min.   :0.06299
##  1st Qu.:0.5642   1st Qu.:0.65488
##  Median :0.6945   Median :0.80500
##  Mean   :0.7434   Mean   :0.77916
##  3rd Qu.:0.8829   3rd Qu.:0.91506
##  Max.   :1.5945   Max.   :1.00000
```

```r
describe (data1)
```

```
##             vars   n   mean     sd median trimmed    mad  min    max  range
## ID             1 312 182.33 110.06 172.50  181.71 147.52 1.00 367.00 366.00
## AGE            2 312  10.06   2.24  10.00    9.94   1.48 6.00  17.00  11.00
## BIRTH_EXP*     3 312   1.76   0.43   2.00    1.82   0.00 1.00   2.00   1.00
## DIS*           4 312   1.12   0.32   1.00    1.02   0.00 1.00   2.00   1.00
## REAC_TIME      5 312   0.74   0.24   0.69    0.72   0.22 0.32   1.59   1.27
## ACCURACY       6 312   0.78   0.16   0.80    0.79   0.17 0.06   1.00   0.94
```

```
##             skew kurtosis   se
## ID          0.07    -1.30 6.23
## AGE         0.48    -0.01 0.13
## BIRTH_EXP* -1.21    -0.54 0.02
## DIS*        2.40     3.75 0.02
## REAC_TIME   1.06     1.06 0.01
## ACCURACY   -0.84     0.64 0.01
```

Table : Number of Participants in each Group

Age_Group1 (6 to 8 yrs)	Age_Group2 (9 to 11 yrs)	Age_Group3 (12< yrs)	C-Vaginally_born	sec_born	Gen_dis
83	161	68	237	75	36

Descriptives/ Preliminary Analyses Correct Trials

```
data2 <- select (data_ct, ID, AGE, BIRTH_EXP, DIS, REAC_TIME)
head (data2)
```

```
##   ID AGE BIRTH_EXP DIS REAC_TIME
## 1  1  11         V   N 0.4091609
## 2  2  15         V   N 0.9156219
## 3  3  17         V   N 0.5630435
## 4  4  12         C   N 0.5059130
## 5  5   8         V   N 0.6592565
## 6  6  11         V   N 0.7371474
```

```
summary (data2)
```

```
##        ID              AGE         BIRTH_EXP            DIS
##  Min.   :  1.00   Min.   : 6.00   Length:312         Length:312
##  1st Qu.: 85.75   1st Qu.: 8.00   Class :character   Class :character
##  Median :172.50   Median :10.00   Mode  :character   Mode  :character
##  Mean   :182.33   Mean   :10.06
##  3rd Qu.:283.25   3rd Qu.:11.00
##  Max.   :367.00   Max.   :17.00
##    REAC_TIME
##  Min.   :0.3246
##  1st Qu.:0.5849
##  Median :0.7122
##  Mean   :0.7598
##  3rd Qu.:0.8980
##  Max.   :1.5940
```

```
describe (data2)
```

```
##            vars   n   mean     sd median trimmed    mad  min    max  range
```

```
## ID            1 312 182.33 110.06 172.50  181.71 147.52 1.00 367.00 366.00
## AGE           2 312  10.06   2.24  10.00    9.94   1.48 6.00  17.00  11.00
## BIRTH_EXP*    3 312   1.76   0.43   2.00    1.82   0.00 1.00   2.00   1.00
## DIS*          4 312   1.12   0.32   1.00    1.02   0.00 1.00   2.00   1.00
## REAC_TIME     5 312   0.76   0.23   0.71    0.73   0.22 0.32   1.59   1.27
##              skew kurtosis   se
## ID           0.07    -1.30 6.23
## AGE          0.48    -0.01 0.13
## BIRTH_EXP* -1.21    -0.54 0.02
## DIS*         2.40     3.75 0.02
## REAC_TIME    1.00     0.91 0.01
```

Table : Number of Participants in Each Age Group and their Birth Experience

```
table(data1$BIRTH_EXP,data1$AGE_GROUPS)
```

```
##
##       1   2   3
##   C  20  40  15
##   V  63 121  53
```

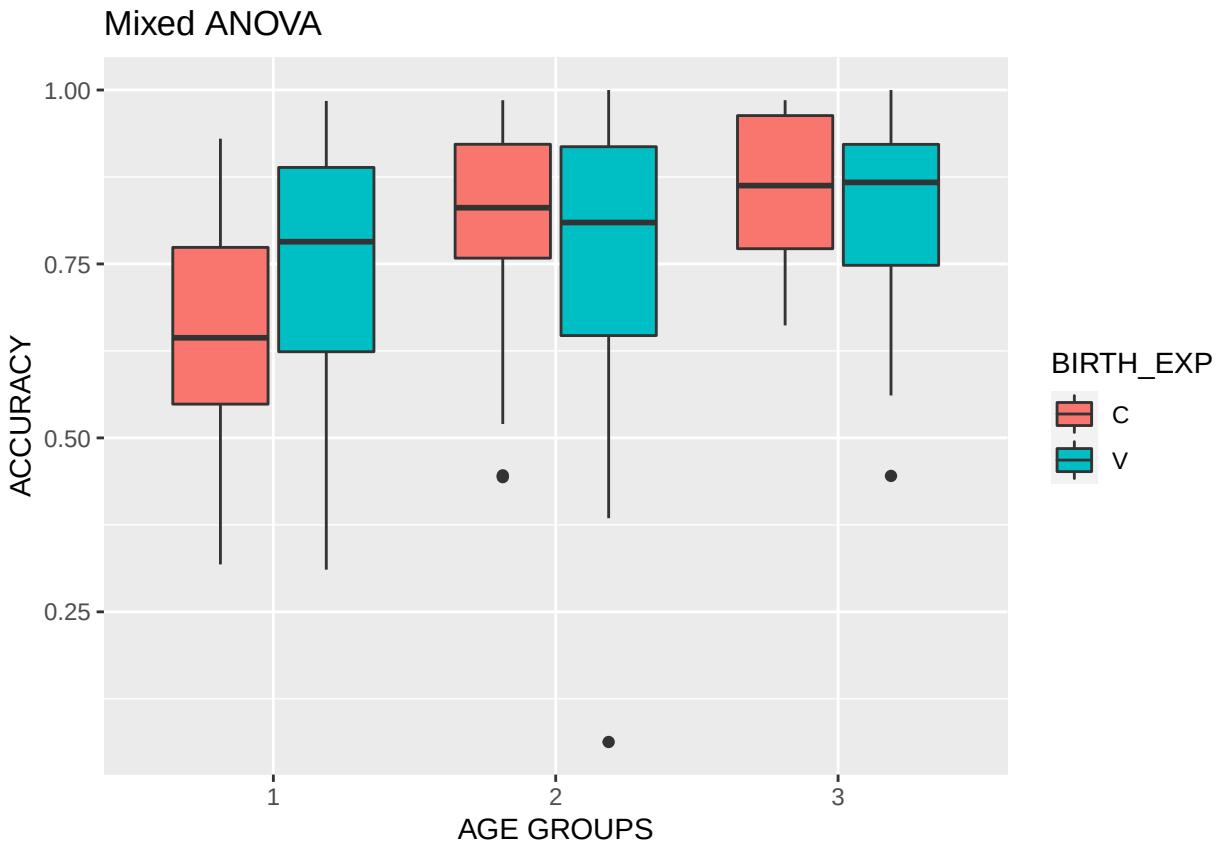
Table : Number of Participants with Disability and their Birth Experience

```
table(data1$BIRTH_EXP,data1$DIS)
```

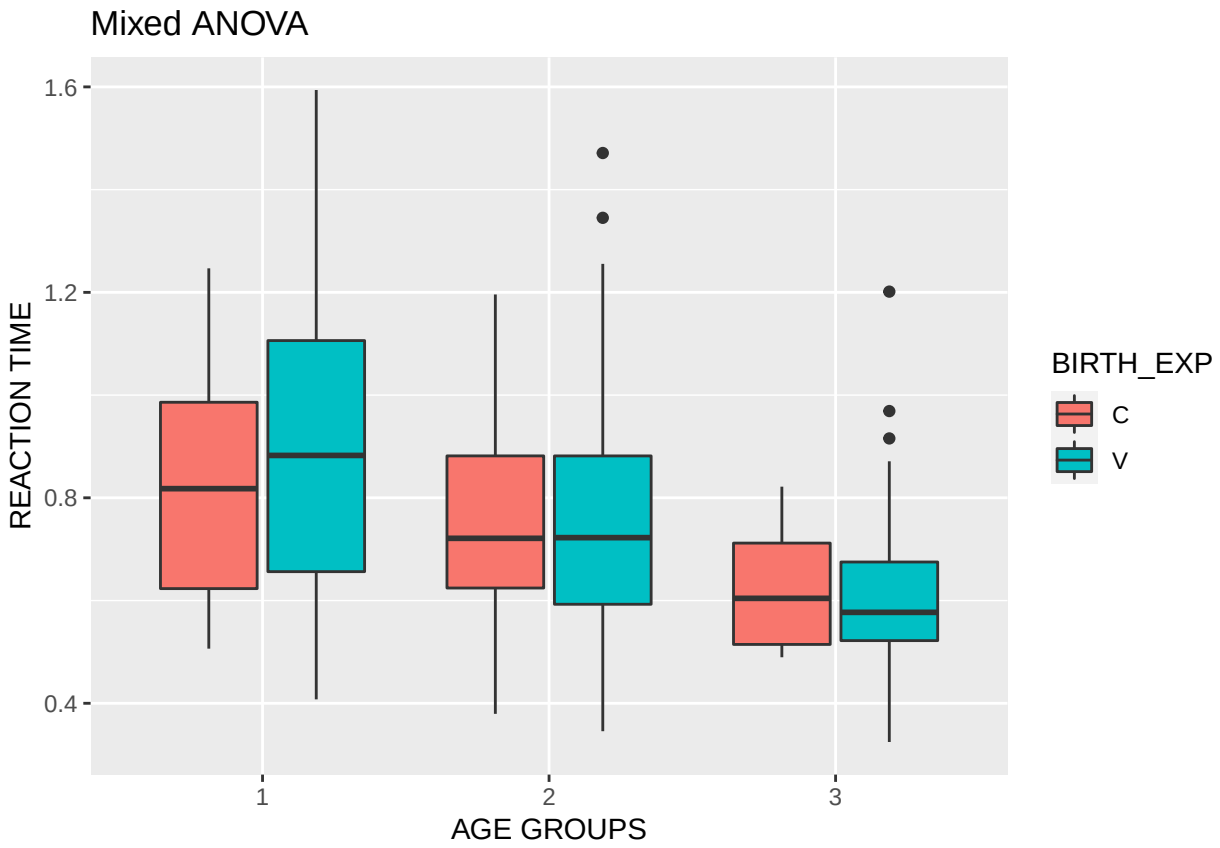
```
##
##       N   Y
##   C  67   8
##   V 209  28
```

Data Distribution Plots

```
# Boxplot for Accuracy in Trials and Birth Experience
qplot(AGE_GROUPS, ACCURACY, data=data1, fill = BIRTH_EXP, geom = 'boxplot', main = "Mixed ANOVA", xlab =
```

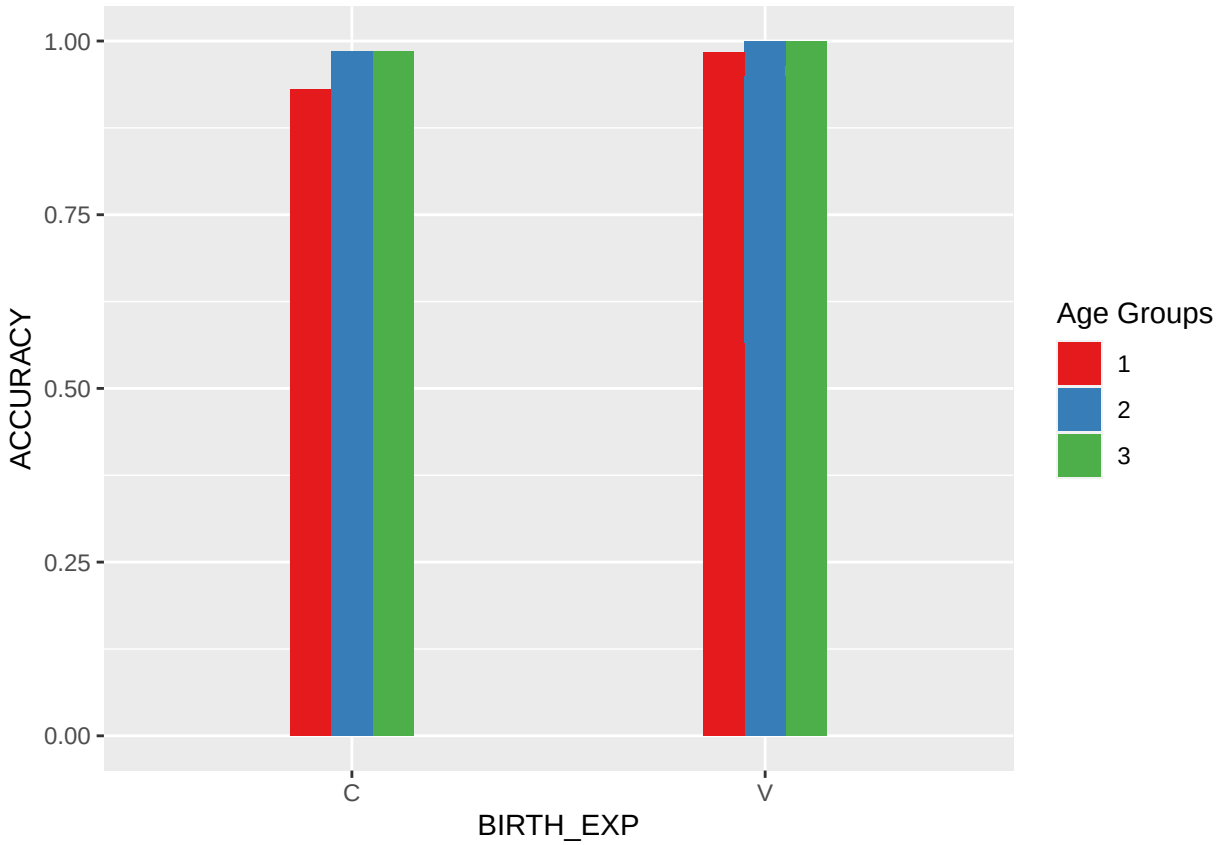



```
# Boxplot for Reaction Time in Correct Trials and Birth Experience
qplot(AGE_GROUPS, REAC_TIME, data=data2, fill = BIRTH_EXP, geom = 'boxplot', main = "Mixed ANOVA",xlab =
```

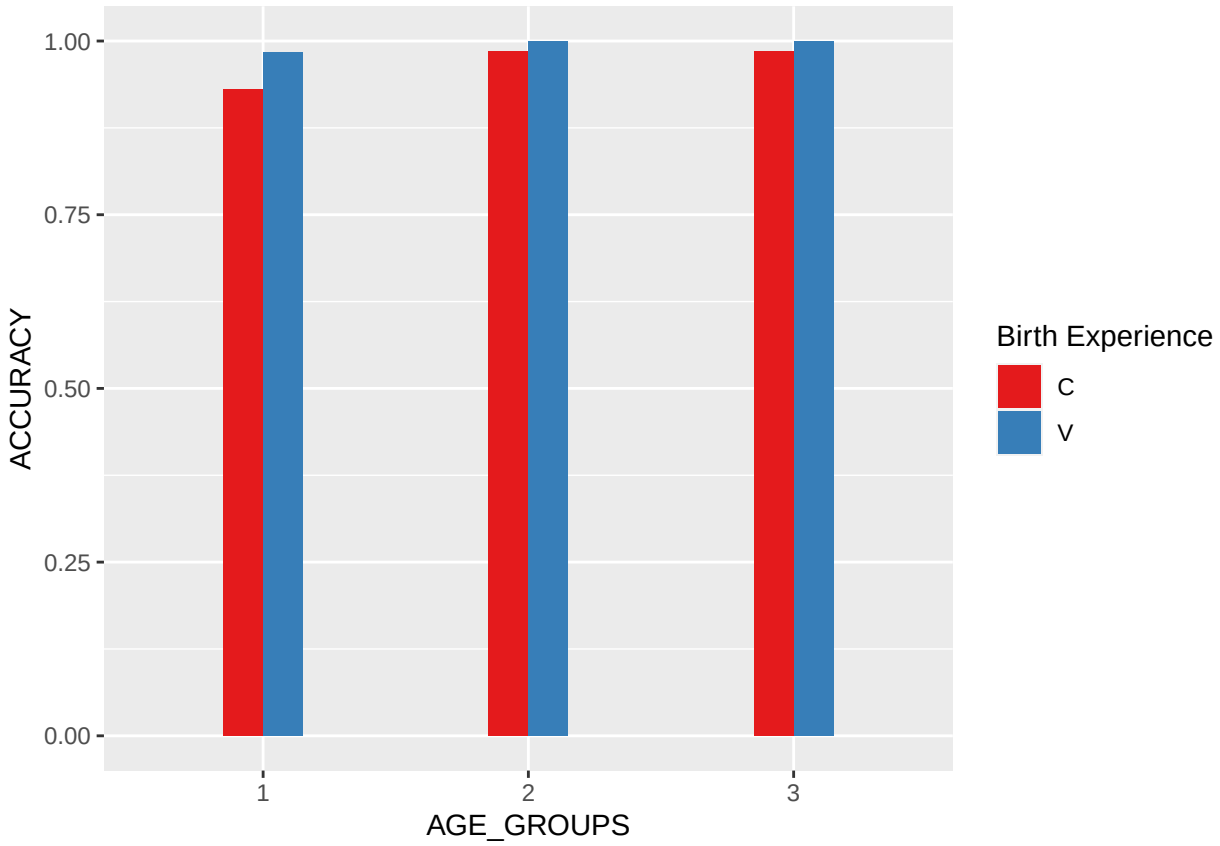


Bar Graph Accuracy vs Age-Groups

```
ggplot(data1, aes(BIRTH_EXP, ACCURACY, fill = AGE_GROUPS)) +
  geom_bar(stat="identity", position = "dodge", width=0.3) +
  scale_fill_brewer(palette = "Set1", labs(y="Age Groups"))
```

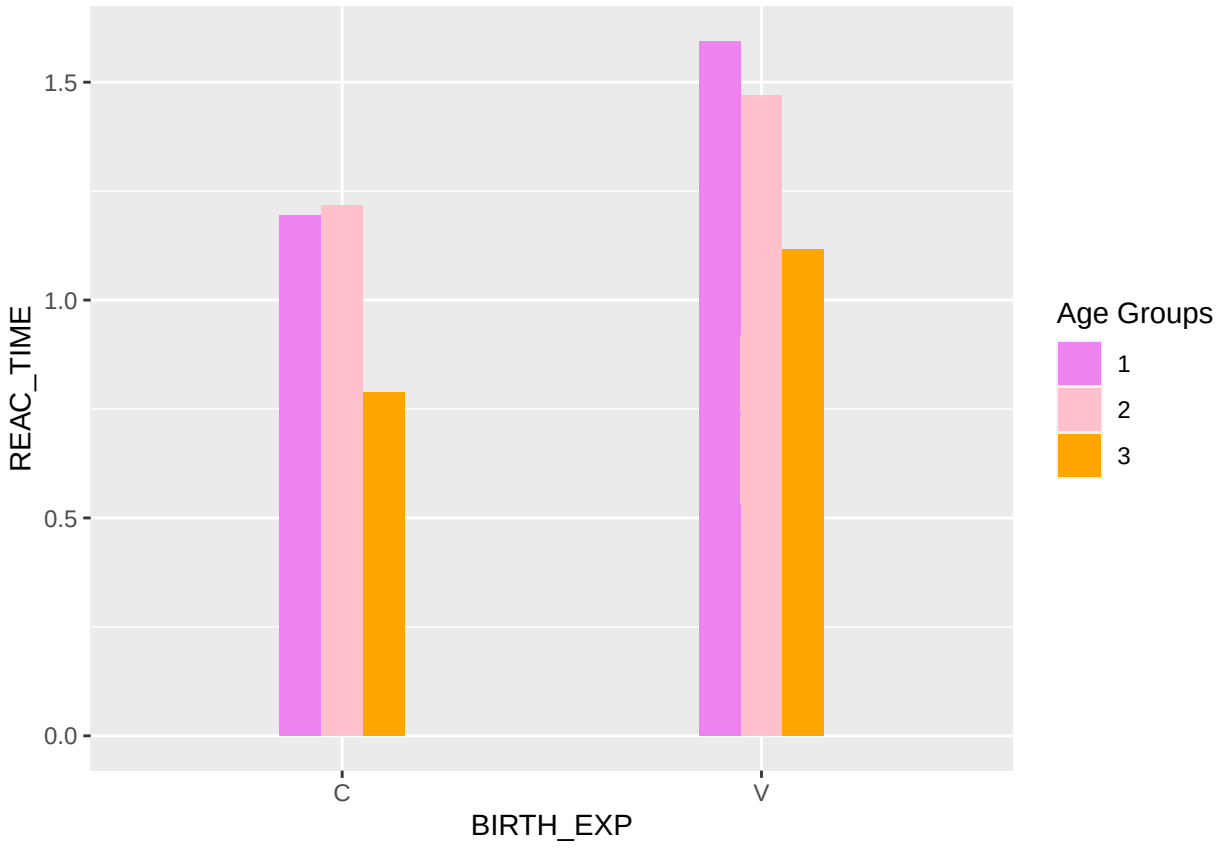



```
ggplot(data1, aes(AGE_GROUPS, ACCURACY, fill = BIRTH_EXP)) +
  geom_bar(stat="identity", position = "dodge", width=0.3) +
  scale_fill_brewer(palette = "Set1", labs(y="Birth Experience"))
```

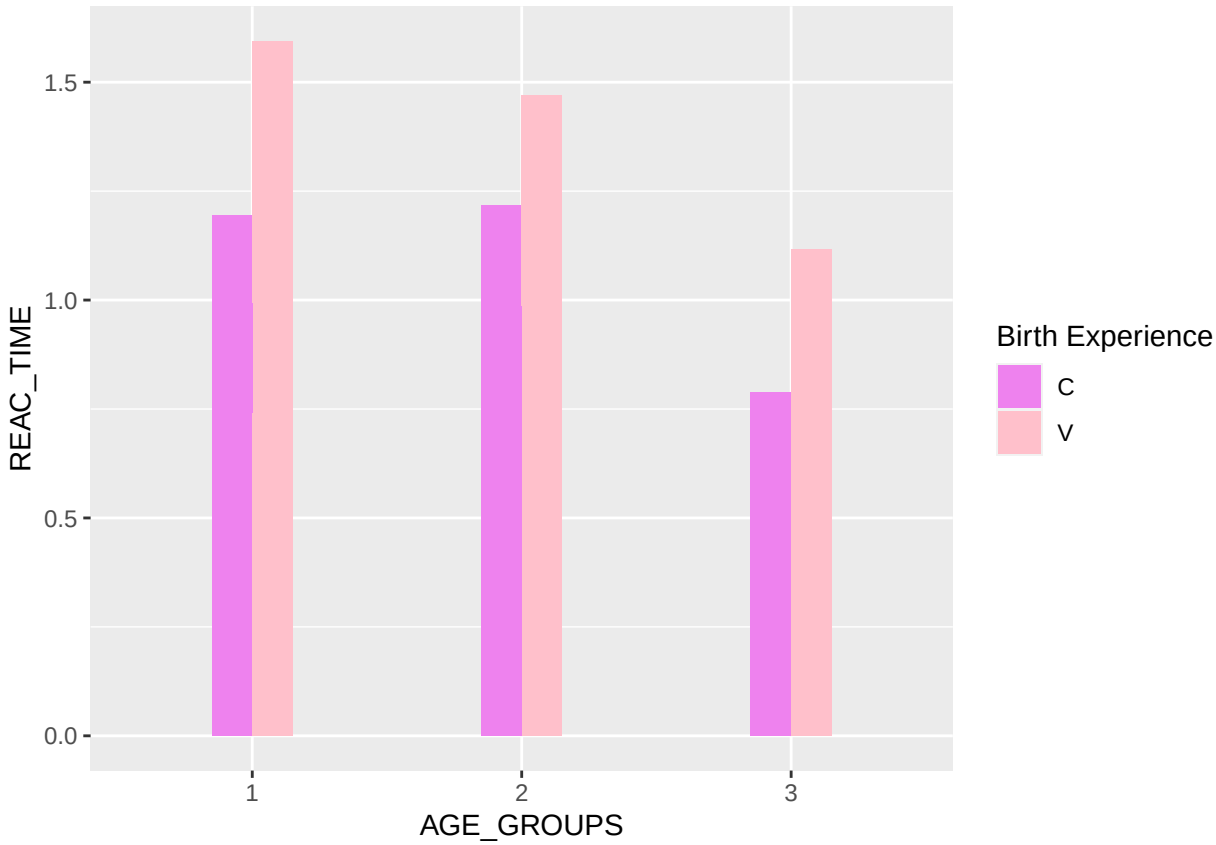


Bar Graph Reaction Time vs Age-Groups

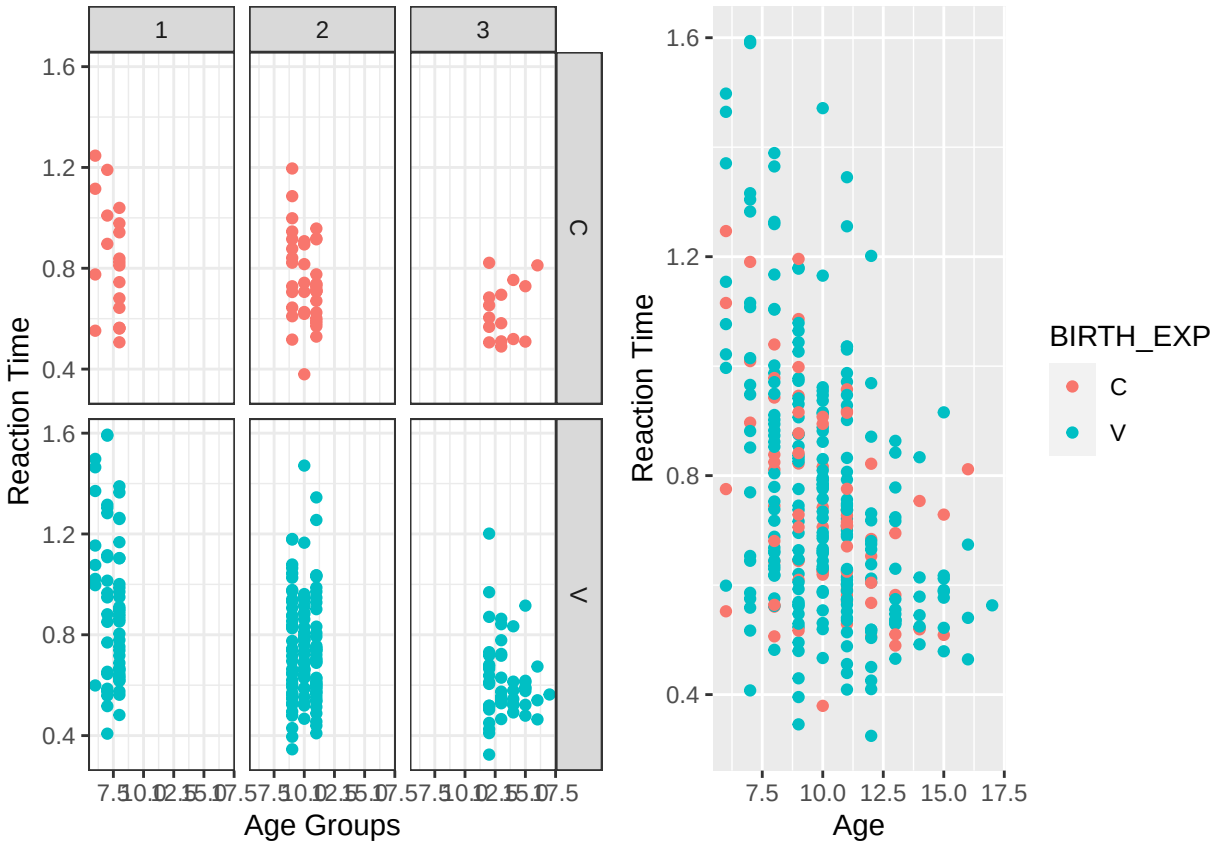
```
ggplot(data1, aes(BIRTH_EXP, REAC_TIME, fill = AGE_GROUPS)) +
  geom_bar(stat="identity", position = "dodge",  width=0.3) +
  scale_fill_manual(values = c("violet","pink", "orange"), labs(y="Age Groups"))
```




```
ggplot(data1, aes(AGE_GROUPS, REAC_TIME, fill = BIRTH_EXP)) +
  geom_bar(stat="identity", position = "dodge", width=0.3) +
 scale_fill_manual(values = c("violet", "pink" ), labs(y="Birth Experience"))
```




```
# Scatterplot

aggregated <- ggplot(data2, aes(AGE, REAC_TIME, colour=BIRTH_EXP)) + geom_point()+ labs(x = "Age", y = 

facetted <-data2 %>%
ggplot(aes(x=AGE, y = REAC_TIME, color = BIRTH_EXP)) +
geom_point() +
facet_grid(cols = vars(AGE_GROUPS), rows = vars(BIRTH_EXP)) +
labs(x = "Age Groups", y = "Reaction Time") +
theme_bw() +
theme(legend.position="none")

grid.arrange(facetted, aggregated, ncol = 2)
```



#TWO-WAY ANOVA - ACCURACY

```
# IV- Birth Experience and Age Groups, DV - Reaction Time

model1 <- aov(ACCURACY~BIRTH_EXP+AGE_GROUPS, data = data1)
summary (model1)
```

```
##              Df Sum Sq Mean Sq F value   Pr(>F)
## BIRTH_EXP     1  0.002 0.00189   0.082 0.775051
## AGE_GROUPS    2  0.378 0.18891   8.159 0.000353 ***
## Residuals   308  7.131 0.02315
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
int_mod1 <- aov (ACCURACY~BIRTH_EXP*AGE_GROUPS, data= data1)
summary (int_mod1)
```

```
##                       Df Sum Sq Mean Sq F value   Pr(>F)
## BIRTH_EXP              1  0.002 0.00189   0.083 0.772813
## AGE_GROUPS             2  0.378 0.18891   8.327 0.000301 ***
## BIRTH_EXP:AGE_GROUPS   2  0.189 0.09459   4.169 0.016349 *
## Residuals            306  6.942 0.02269
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
TukeyHSD(int_mod1)
```

```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = ACCURACY ~ BIRTH_EXP * AGE_GROUPS, data = data1)
##
## $BIRTH_EXP
##            diff         lwr        upr     p adj
## V-C 0.005766121 -0.03350068 0.04503292 0.7728129
##
## $AGE_GROUPS
##           diff          lwr        upr     p adj
## 2-1 0.05600337  0.008068667 0.10393807 0.0172357
## 3-1 0.09919122  0.041167971 0.15721448 0.0002108
## 3-2 0.04318786 -0.008116880 0.09449259 0.1182337
##
## $`BIRTH_EXP:AGE_GROUPS`
##                diff         lwr        upr     p adj
## V:1-C:1  0.09983958 -0.01102611 0.21070528 0.1046637
## C:2-C:1  0.15113087  0.03283379 0.26942795 0.0039394
## V:2-C:1  0.12533255  0.02106594 0.22959917 0.0083985
## C:3-C:1  0.20659902  0.05905664 0.35414140 0.0010449
## V:3-C:1  0.16617308  0.05281515 0.27953100 0.0004901
## C:2-V:1  0.05129128 -0.03603837 0.13862094 0.5431802
## V:2-V:1  0.02549297 -0.04161736 0.09260330 0.8853981
## C:3-V:1  0.10675944 -0.01734143 0.23086030 0.1372571
## V:3-V:1  0.06633349 -0.01417917 0.14684616 0.1728164
## V:2-C:2 -0.02579831 -0.10458152 0.05298489 0.9360427
## C:3-C:2  0.05546815 -0.07531419 0.18625050 0.8286986
## V:3-C:2  0.01504221 -0.07543036 0.10551478 0.9969240
## C:3-V:2  0.08126647 -0.03697629 0.19950922 0.3614387
## V:3-V:2  0.04084053 -0.03031152 0.11199257 0.5685890
## V:3-C:3 -0.04042594 -0.16675821 0.08590633 0.9417957
```

```r
options(contrasts = c("contr.sum", "contr.poly"))
lm_output <- lm(ACCURACY ~ BIRTH_EXP*AGE_GROUPS, data = data1)
apa.aov.table(lm_output)
```

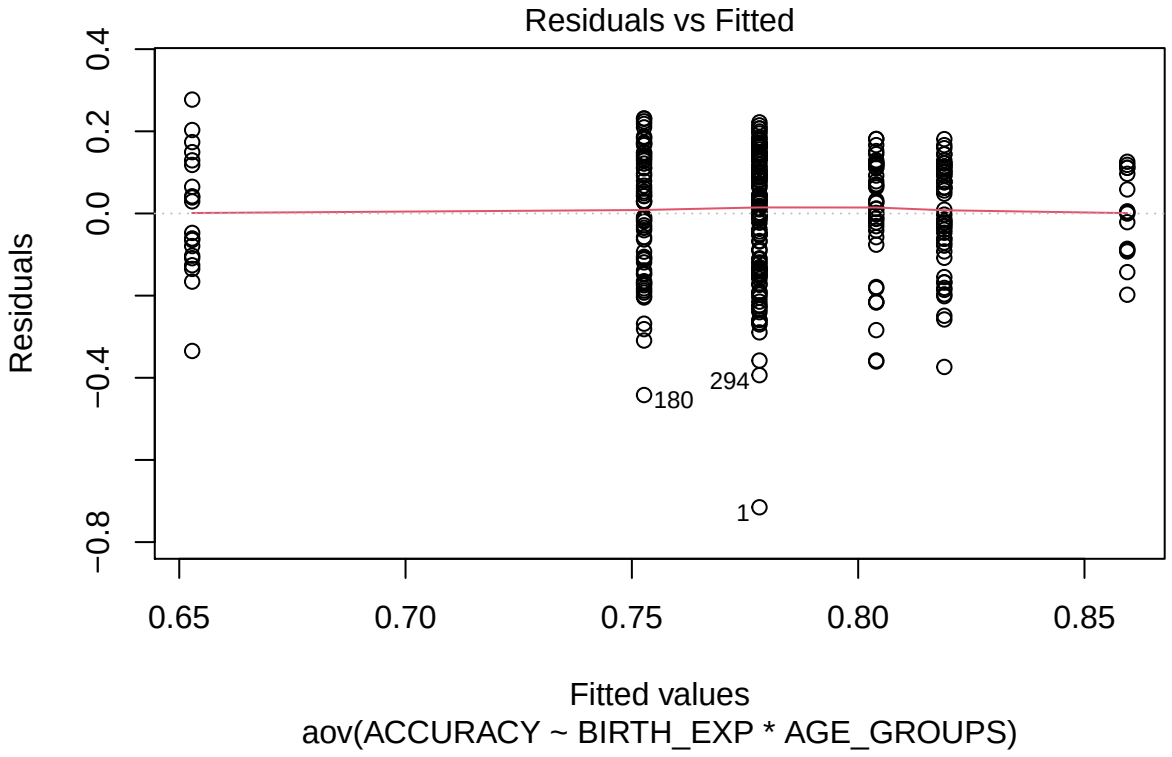
```
##
##
## ANOVA results using ACCURACY as the dependent variable
##
##
##               Predictor     SS  df     MS       F    p partial_eta2
##             (Intercept) 117.90   1 117.90 5197.10 .000
##               BIRTH_EXP   0.01   1   0.01    0.27 .604          .00
##              AGE_GROUPS   0.54   2   0.27   11.89 .000          .07
##  BIRTH_EXP x AGE_GROUPS   0.19   2   0.10    4.17 .016          .03
##                   Error   6.94 306   0.02
##  CI_90_partial_eta2
##
```

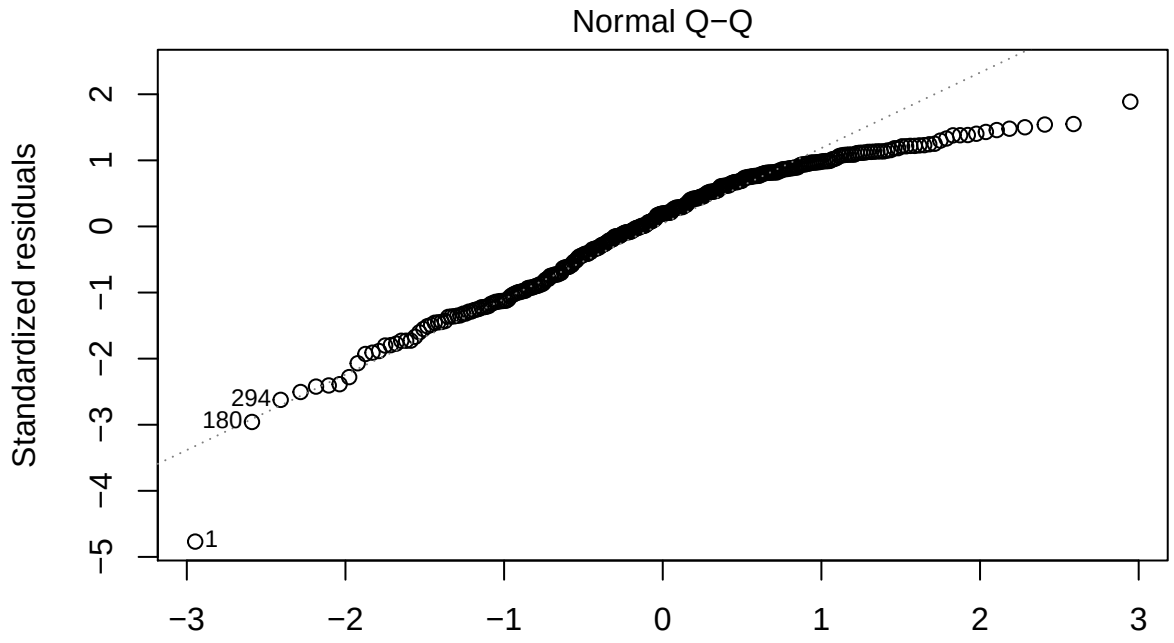
```
##          [.00, .01]
##          [.03, .12]
##          [.00, .06]
##
##
## Note: Values in square brackets indicate the bounds of the 90% confidence interval for partial eta-s
```

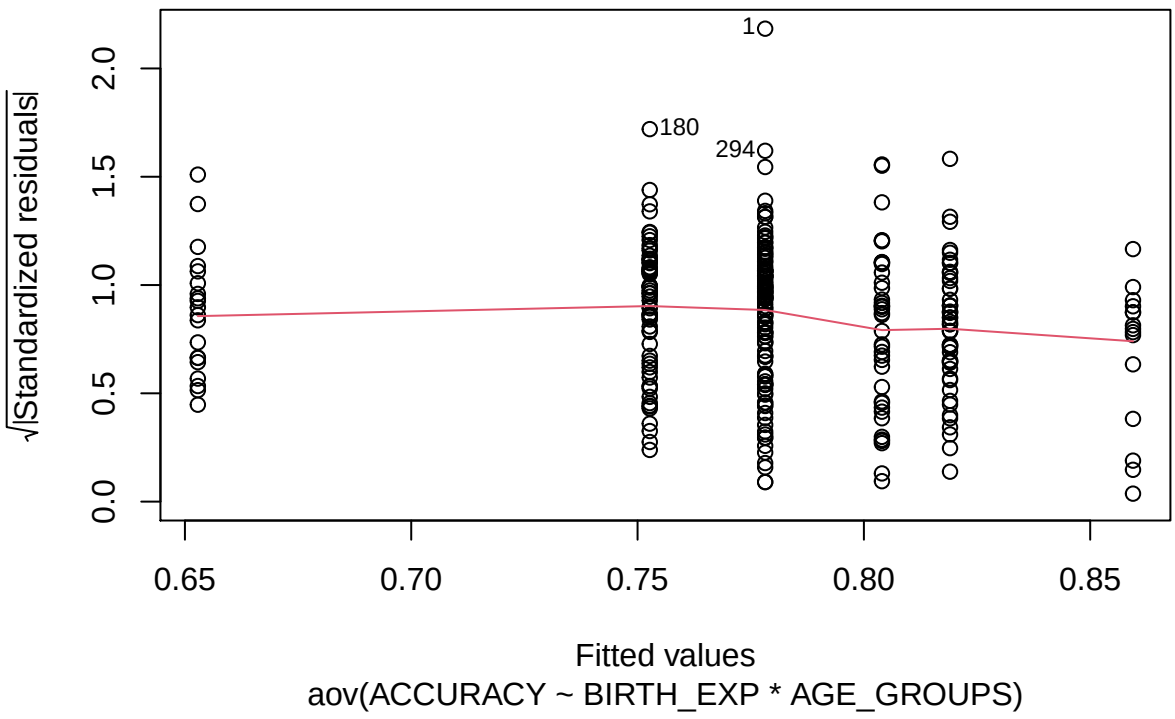
```
apa.2way.table(BIRTH_EXP, AGE_GROUPS, ACCURACY, data = data1)
```

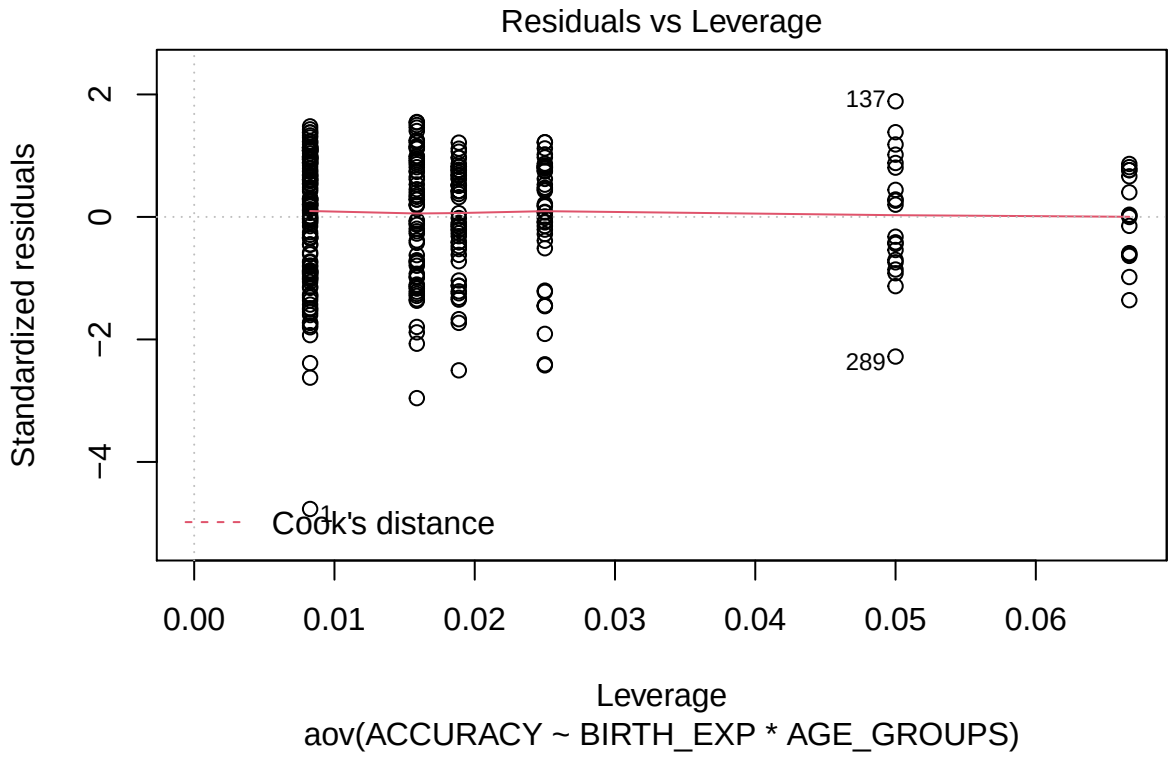
```
##
##
## Means and standard deviations for ACCURACY as a function of a 2(BIRTH_EXP) X 3(AGE_GROUPS) design
##
##            AGE_GROUPS
##                     1         2         3
##  BIRTH_EXP          M   SD    M   SD    M   SD
##          C       0.65 0.15 0.80 0.15 0.86 0.10
##          V       0.75 0.16 0.78 0.16 0.82 0.13
##
## Note. M and SD represent mean and standard deviation, respectively.
```

```
plot(int_mod1)
```

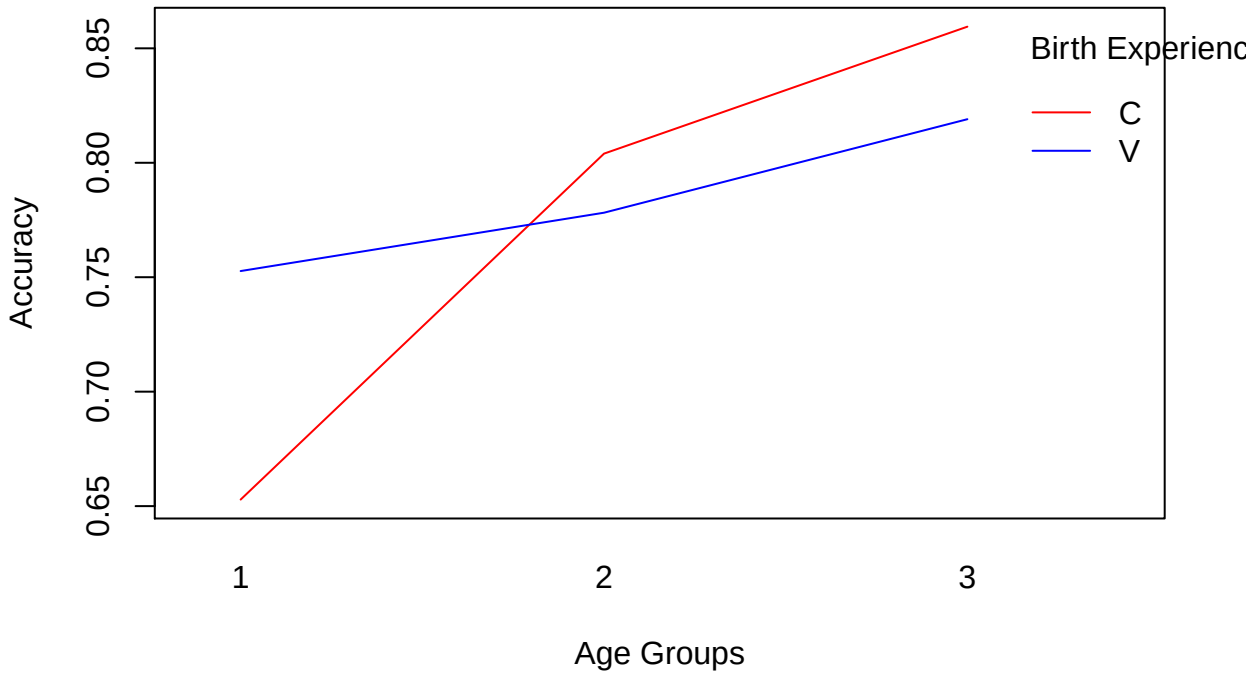



Normal Q−Q
Standardized residuals
Theoretical Quantiles
aov(ACCURACY ~ BIRTH_EXP * AGE_GROUPS)
294
180
1


Scale−Location
√|Standardized residuals|
Fitted values
aov(ACCURACY ~ BIRTH_EXP * AGE_GROUPS)
1
180
294




```r
with (data1, {
  interaction.plot(AGE_GROUPS, BIRTH_EXP, ACCURACY, fun = mean,
                type = c("l", "p", "b", "o", "c"), legend = TRUE,
                trace.label = "Birth Experience",
                fixed = TRUE,
                col = c ("red", "blue"),
                lty = 1,
                xlab = "Age Groups",
                ylab = "Accuracy")


})
```



#TWO-WAY ANOVA - REACTION TIME

```
# IV- Birth Experience and Age Groups, DV - Reaction Time

model2 <- aov(REAC_TIME~ BIRTH_EXP+AGE_GROUPS, data = data2)
summary(model2)
```

```
##              Df Sum Sq Mean Sq F value   Pr(>F)
## BIRTH_EXP     1  0.021  0.0205   0.446    0.505
## AGE_GROUPS    2  2.902  1.4511  31.524 3.51e-13 ***
## Residuals   308 14.178  0.0460
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
int_mod2 <- aov (REAC_TIME~BIRTH_EXP*AGE_GROUPS, data= data2)
summary (int_mod2)
```

```
##                       Df Sum Sq Mean Sq F value   Pr(>F)
## BIRTH_EXP              1  0.021  0.0205   0.447    0.504
## AGE_GROUPS             2  2.902  1.4511  31.559 3.46e-13 ***
## BIRTH_EXP:AGE_GROUPS   2  0.108  0.0539   1.172    0.311
## Residuals            306 14.070  0.0460
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
options(contrasts = c("contr.sum", "contr.poly"))
lm_output2 <- lm(REAC_TIME ~ BIRTH_EXP*AGE_GROUPS, data = data2)
apa.aov.table(lm_output2)
```

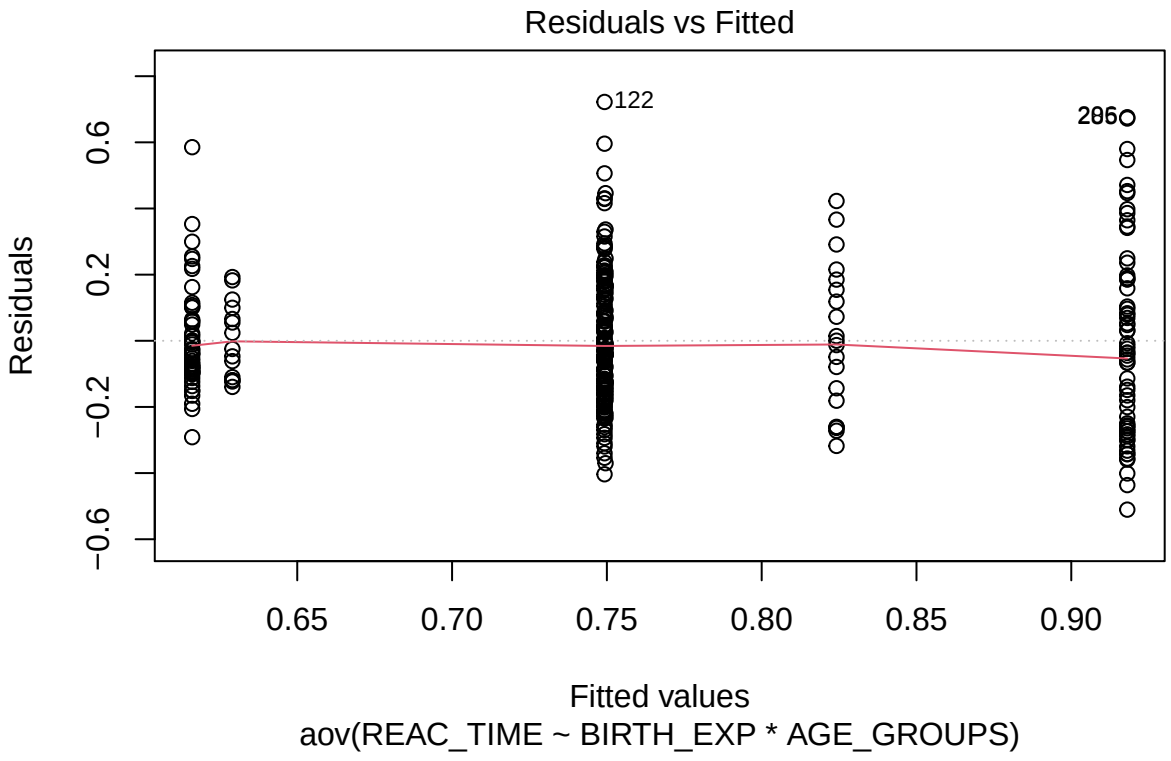
```
##
```

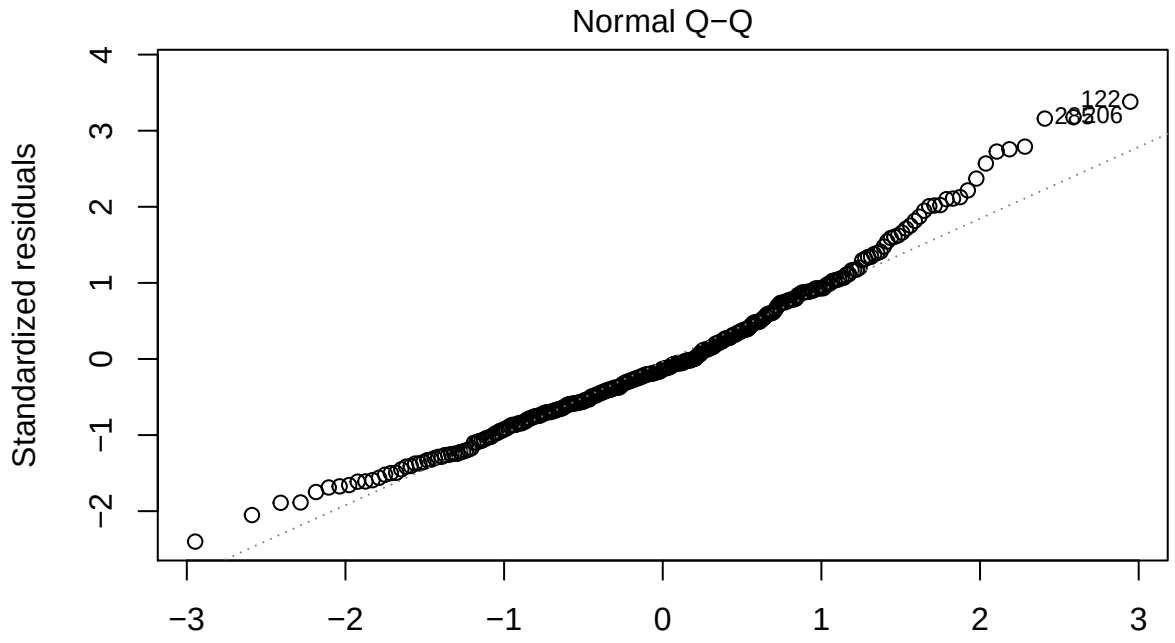
```
##
## ANOVA results using REAC_TIME as the dependent variable
##
##
##                Predictor     SS  df     MS       F    p partial_eta2
##              (Intercept) 108.98   1 108.98 2370.16 .000
##                BIRTH_EXP   0.04   1   0.04    0.77 .382          .00
##               AGE_GROUPS   1.64   2   0.82   17.87 .000          .10
##  BIRTH_EXP x AGE_GROUPS   0.11   2   0.06    1.17 .311          .01
##                    Error  14.07 306   0.05
##  CI_90_partial_eta2
##
##          [.00, .02]
##          [.05, .16]
##          [.00, .03]
##
##
## Note: Values in square brackets indicate the bounds of the 90% confidence interval for partial eta-s
```

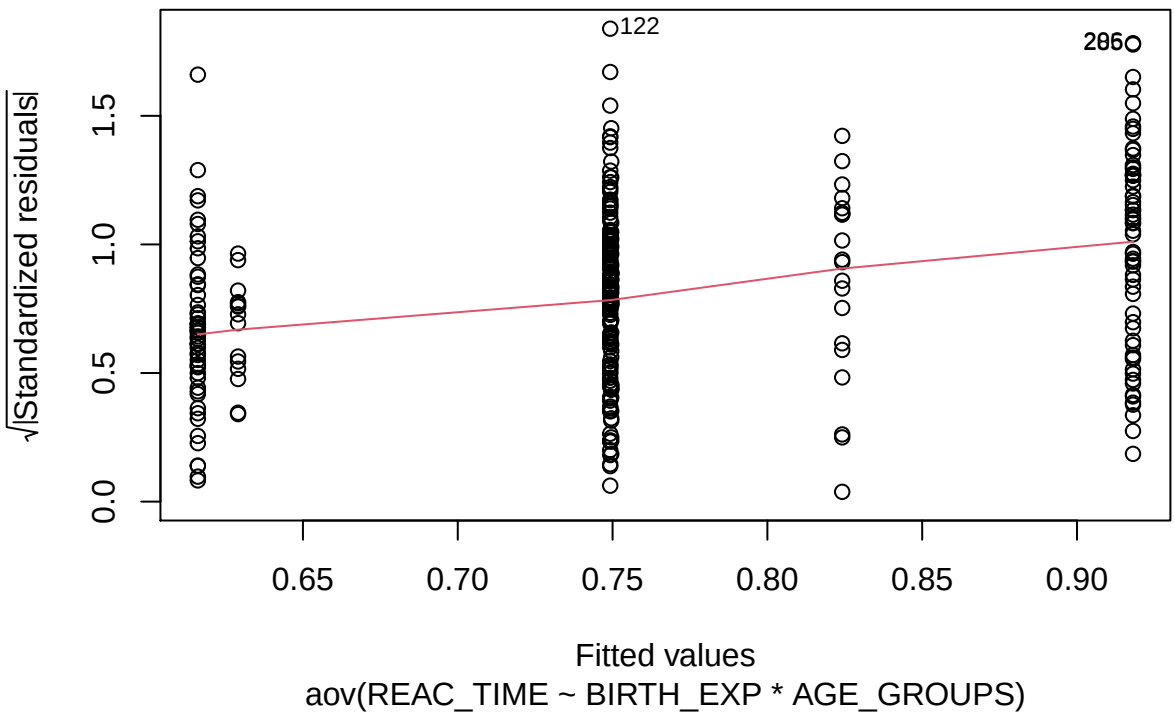
```
apa.2way.table(BIRTH_EXP, AGE_GROUPS, REACT_TIME, data = data1)
```

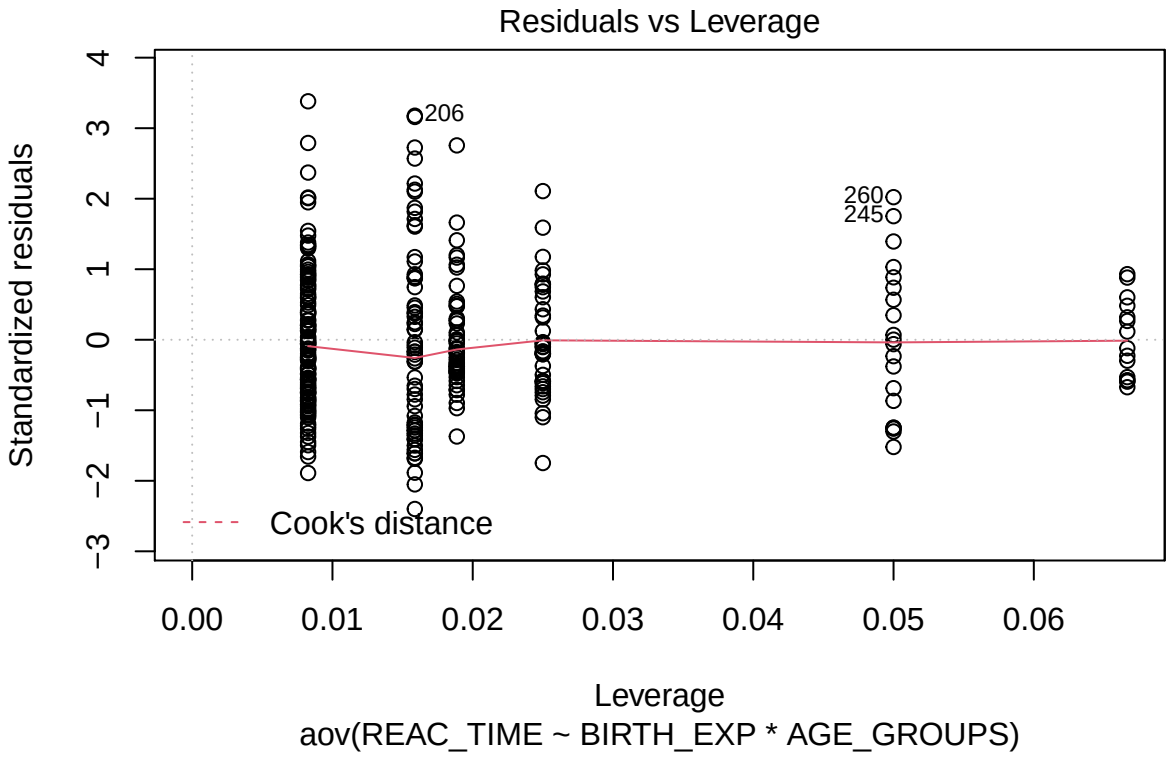
```
## apa.mean.table error:
## REACT_TIME is not a valid column name.
##
## apa.mean.table error:
## A valid dependent variable (dv) must be specified.

## [1] FALSE
```

```
plot(int_mod2)
```




Normal Q−Q
Standardized residuals
Theoretical Quantiles
aov(REAC_TIME ~ BIRTH_EXP * AGE_GROUPS)


Scale−Location
√|Standardized residuals|
Fitted values
aov(REAC_TIME ~ BIRTH_EXP * AGE_GROUPS)


Residuals vs Leverage
Standardized residuals
4
3
2
1
0
−1
−2
−3
206
260
245
Cook's distance
0.00
0.01
0.02
0.03
0.04
0.05
0.06
Leverage
aov(REAC_TIME ~ BIRTH_EXP * AGE_GROUPS)