

# Laboratory Exercise 2

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2023-03-10

```
library(tidyverse)
library(ggpubr)
library(reshape2)
library(car)
library(rstatix)
library(cowplot)
```

## VISION

```
# imports data
vis <- read.csv("C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/1st Semester/BIO 118/Module 1/M
```

```
# organizes data
vis.eye <- vis %>%
  filter(!row_number() %in% c(1, 2, 39)) %>%
  mutate(VisualAcuity = map_dbl(X.4, ~eval(parse(text = .x)))) %>%
  select(X, X.1, VisualAcuity)
```

```
# renames columns
colnames(vis.eye) <- c("Names", "Sex", "VisualAcuity")
```

```
# renames rows
vis.eye$Sex[vis.eye$Sex == "F"] <- "Female"
vis.eye$Sex[vis.eye$Sex == "M"] <- "Male"
```

```
# prints summary of data
group_by(vis.eye, Sex) %>%
  summarise(
    count = n(),
    mean = mean(VisualAcuity, na.rm = TRUE),
    sd = sd(VisualAcuity, na.rm = TRUE)
  )
```

```
## # A tibble: 2 x 4
##   Sex    count mean    sd
##   <chr> <int> <dbl> <dbl>
## 1 Female     35 0.654 0.489
## 2 Male      17 1.01  0.661
```

## Plots

```
# generates box plot
visplot <- ggplot(vis.eye, aes(x = Sex, y = VisualAcuity)) +
  geom_boxplot() +
  ylab("Visual Acuity")

# saves .png of plot
ggsave("C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/1st Semester/BIO 118/Module 1/Module 1 -
```

## T-test

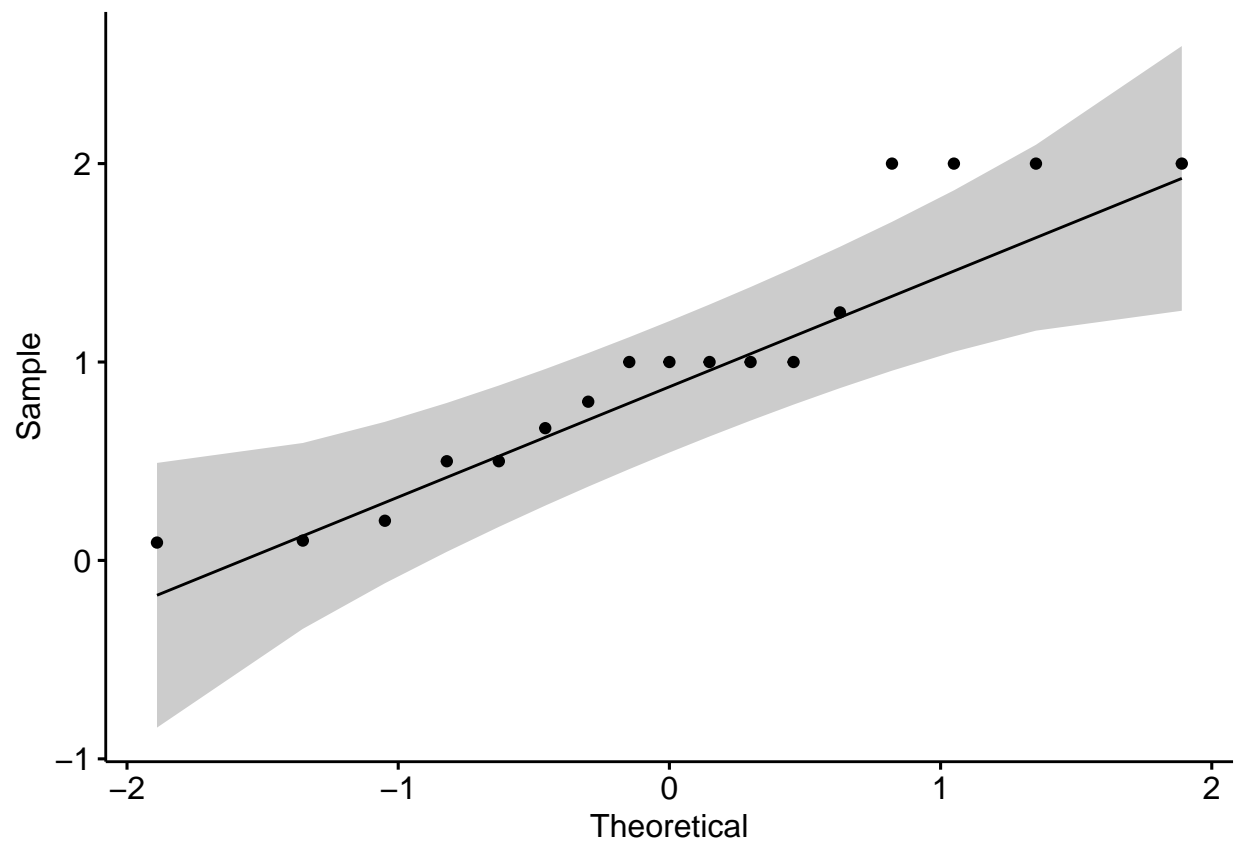
```
# Shapiro-Wilk normality test
shapiro.test(vis.eye$VisualAcuity[vis.eye$Sex == "Female"]) # p < 0.05
```

```
##
## Shapiro-Wilk normality test
##
## data: vis.eye$VisualAcuity[vis.eye$Sex == "Female"]
## W = 0.90125, p-value = 0.004274
```

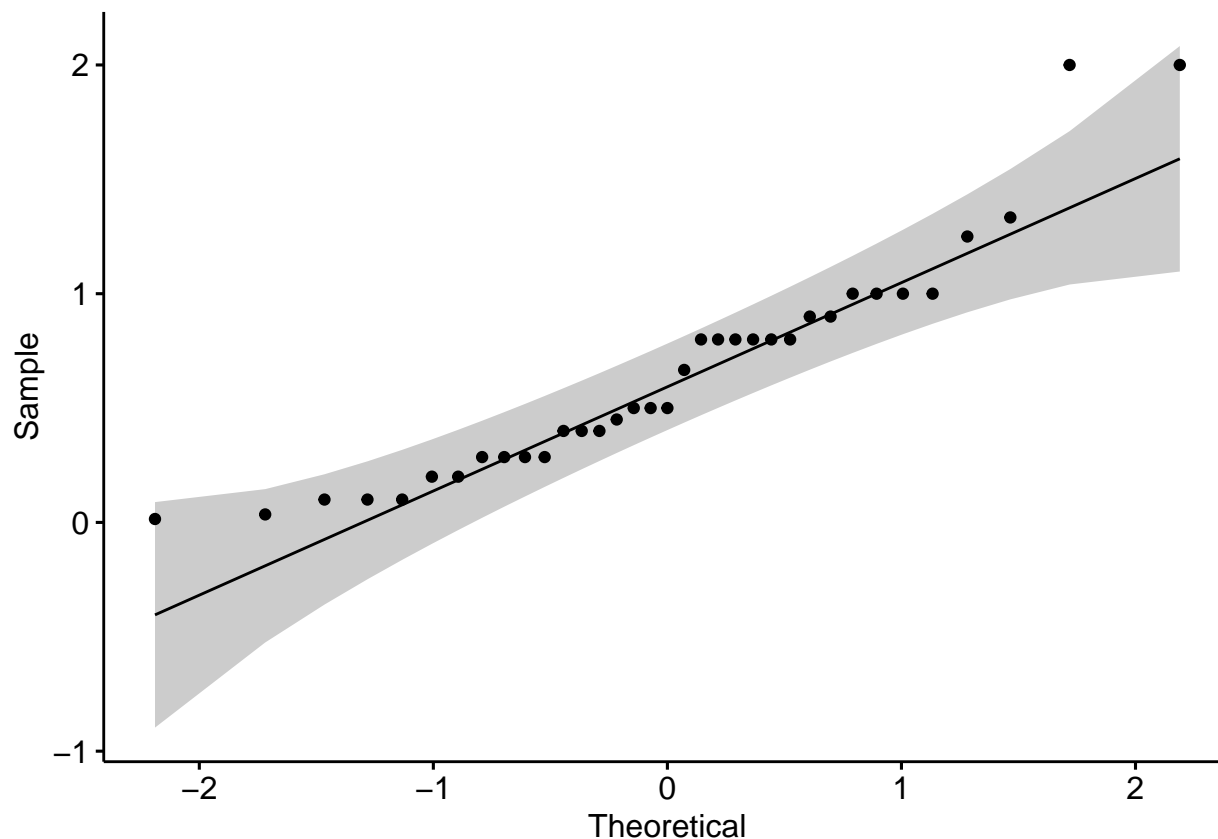
```
shapiro.test(vis.eye$VisualAcuity[vis.eye$Sex == "Male"]) # p < 0.05
```

```
##
## Shapiro-Wilk normality test
##
## data: vis.eye$VisualAcuity[vis.eye$Sex == "Male"]
## W = 0.88785, p-value = 0.04271
```

```
# QQ
ggqqplot(vis.eye$VisualAcuity[vis.eye$Sex == "Male"])
```



```
ggqqplot(vis.eye$VisualAcuity[vis.eye$Sex == "Female"])
```



```
# homoscedasticity
leveneTest(VisualAcuity ~ Sex, vis.eye)
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group 1  1.0906 0.3014
##      50
```

```
# p > 0.05
# accept null hypothesis that variances between two groups are not
##significantly different
# assume homoscedasticity
```

```
t.test(VisualAcuity ~ Sex, data = vis.eye, alternative = "two.sided", var.equal = TRUE)
```

```
##
## Two Sample t-test
##
## data: VisualAcuity by Sex
## t = -2.1655, df = 50, p-value = 0.03514
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
## 95 percent confidence interval:
## -0.6788540 -0.0255318
## sample estimates:
```

```
## mean in group Female    mean in group Male
##           0.6540816           1.0062745
```

```
# p < 0.05
# Reject Ho; there is a significant difference between male and female vision acuity
```

## AUDITORY

```
# imports data
ear <- read.csv("C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/1st Semester/BIO 118/Module 1/M

# organizes data
ear.lr <- ear %>%
  select(1,2,5,6,7,8) %>%
  na.omit()

# changes column names
colnames(ear.lr) <- c("Names", "Sex", "Away.Right", "Towards.Right",
                      "Away.Left", "Towards.Left")

# changes row names
ear.lr$Sex[ear.lr$Sex == "F"] <- "Female"
ear.lr$Sex[ear.lr$Sex == "M"] <- "Male"

ear.lr <- ear.lr[c(1, 2, 3, 5, 4, 6)]
```

## T-test

```
# summarizes data
group_by(vis.eye, Sex) %>%
  summarise(
    count = n(),
    mean = mean(VisualAcuity, na.rm = TRUE),
    sd = sd(VisualAcuity, na.rm = TRUE)
  )
```

```
## # A tibble: 2 x 4
##   Sex    count mean    sd
##   <chr> <int> <dbl> <dbl>
## 1 Female    35 0.654 0.489
## 2 Male     17 1.01  0.661
```

## Plots

```
# box plot for right ear away
r.away <- ggplot(ear.lr, aes(x = Sex, y = Away.Right)) +
```

```

geom_boxplot() +
ggtitle("a") +
ylab("Ticking last heard by right ear (cm)") +
theme(axis.title.y = element_text(size = 8))

# box plot for left ear away
l.away <- ggplot(ear.lr, aes(x = Sex, y = Away.Left)) +
geom_boxplot() +
ggtitle("b") +
ylab("Ticking last heard by left ear (cm)") +
theme(axis.title.y = element_text(size = 8))

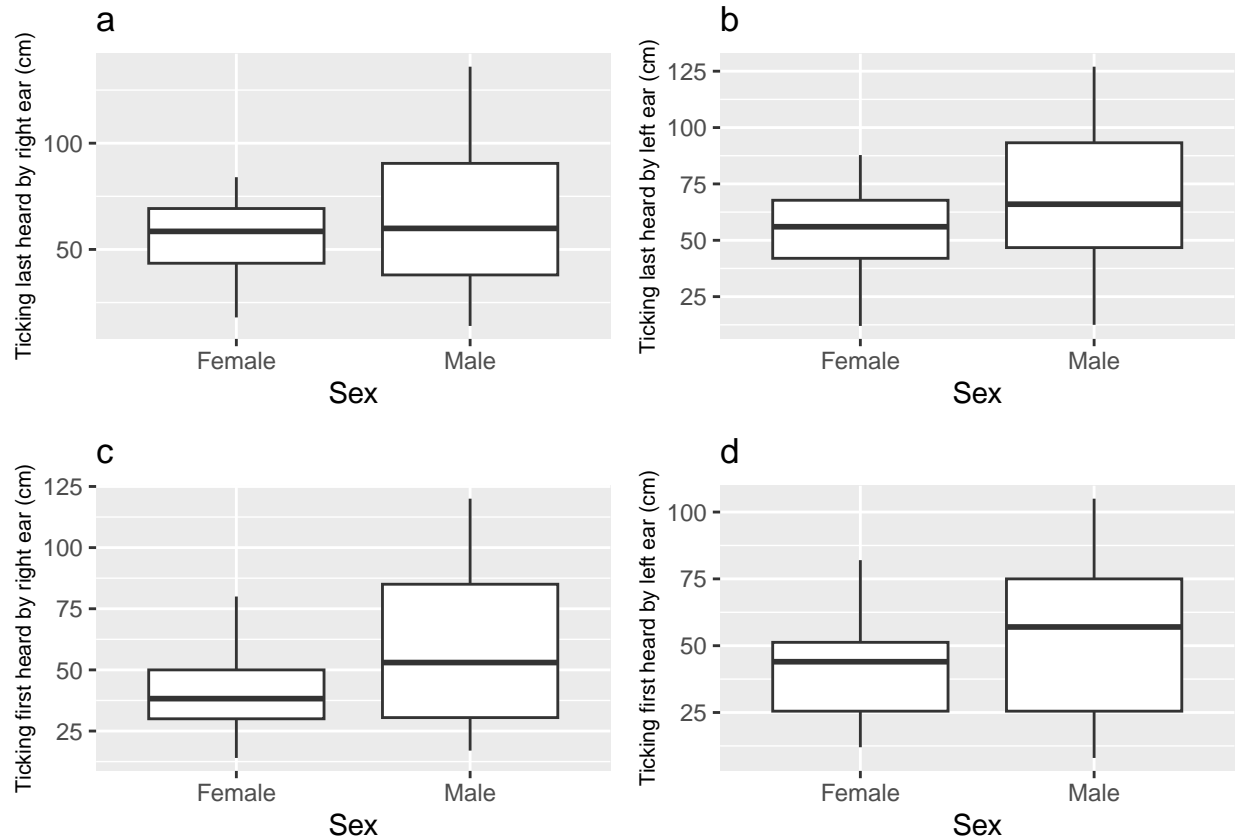
# box plot for right ear towards
r.towards <- ggplot(ear.lr, aes(x = Sex, y = Towards.Right)) +
geom_boxplot() +
ggtitle("c") +
ylab("Ticking first heard by right ear (cm)") +
theme(axis.title.y = element_text(size = 8))

# box plot for left ear towards
l.towards <- ggplot(ear.lr, aes(x = Sex, y = Towards.Left)) +
geom_boxplot() +
ggtitle("d") +
ylab("Ticking first heard by left ear (cm)") +
theme(axis.title.y = element_text(size = 8))

# arranges plots into grid
hearing <- plot_grid(r.away, l.away, r.towards, l.towards)

hearing

```



```
# saves .png of plots
ggsave("C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/1st Semester/BIO 118/Module 1/Module 1 -

## Shapiro-Wilk normality test
# Away.Right
shapiro.test(ear.lr$Away.Right[ear.lr$Sex == "Female"]) # p < 0.05; not normal

##
## Shapiro-Wilk normality test
##
## data: ear.lr$Away.Right[ear.lr$Sex == "Female"]
## W = 0.92737, p-value = 0.02624

shapiro.test(ear.lr$Away.Right[ear.lr$Sex == "Male"]) # p > 0.05; normal

##
## Shapiro-Wilk normality test
##
## data: ear.lr$Away.Right[ear.lr$Sex == "Male"]
## W = 0.95831, p-value = 0.6312

# Away.Left
shapiro.test(ear.lr$Away.Left[ear.lr$Sex == "Female"]) # p > 0.05; normal
```

```
##
## Shapiro-Wilk normality test
##
## data: ear.lr$Away.Left[ear.lr$Sex == "Female"]
## W = 0.97406, p-value = 0.5818

shapiro.test(ear.lr$Away.Left[ear.lr$Sex == "Male"]) # p > 0.05; normal

##
## Shapiro-Wilk normality test
##
## data: ear.lr$Away.Left[ear.lr$Sex == "Male"]
## W = 0.97013, p-value = 0.8406

# Towards.Right
shapiro.test(ear.lr$Towards.Right[ear.lr$Sex == "Female"]) # p > 0.05; normal

##
## Shapiro-Wilk normality test
##
## data: ear.lr$Towards.Right[ear.lr$Sex == "Female"]
## W = 0.9752, p-value = 0.618

shapiro.test(ear.lr$Towards.Right[ear.lr$Sex == "Male"]) # p > 0.05; normal

##
## Shapiro-Wilk normality test
##
## data: ear.lr$Towards.Right[ear.lr$Sex == "Male"]
## W = 0.93697, p-value = 0.3135

# Towards.Left
shapiro.test(ear.lr$Towards.Left[ear.lr$Sex == "Female"]) # p > 0.05; normal

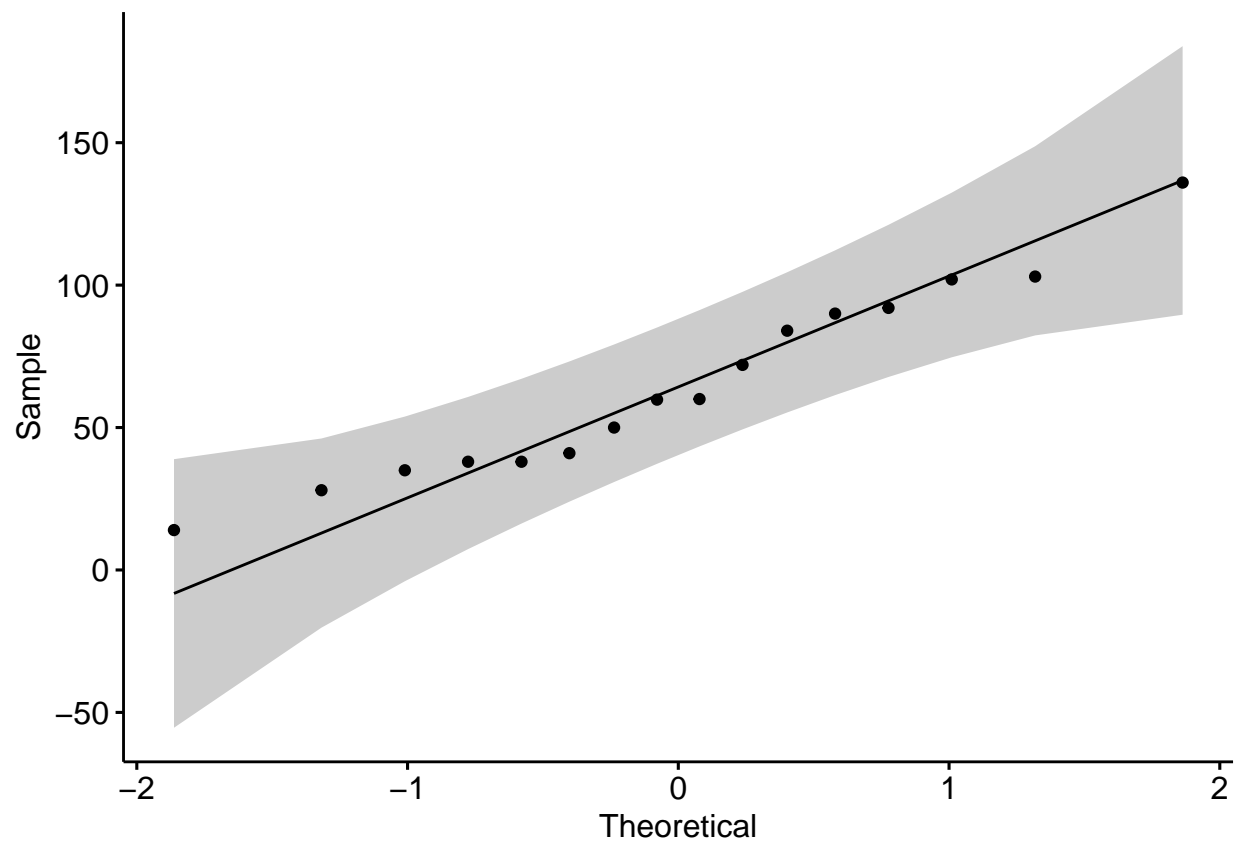
##
## Shapiro-Wilk normality test
##
## data: ear.lr$Towards.Left[ear.lr$Sex == "Female"]
## W = 0.97039, p-value = 0.4723

shapiro.test(ear.lr$Towards.Left[ear.lr$Sex == "Male"]) # p > 0.05; normal

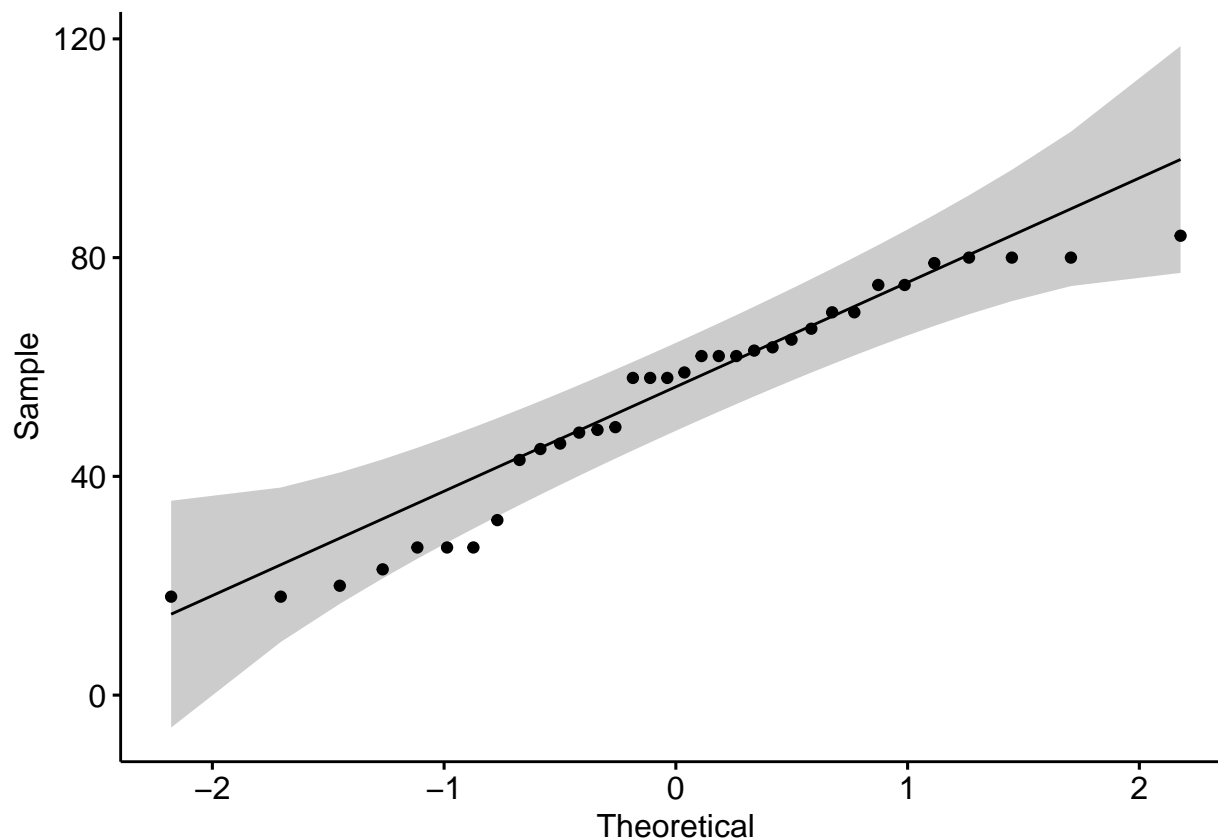
##
## Shapiro-Wilk normality test
##
## data: ear.lr$Towards.Left[ear.lr$Sex == "Male"]
## W = 0.93461, p-value = 0.2881
```



```
## QQ  
ggqqplot(ear.lr$Away.Right[ear.lr$Sex == "Male"])
```



```
ggqqplot(ear.lr$Away.Right[ear.lr$Sex == "Female"])
```



```
# homoscedasticity
## Away.Right
leveneTest(Away.Right ~ Sex, ear.lnr)
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group 1  5.9973 0.01803 *
##      48
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# p < 0.05
# reject null hypo that variances between two groups are not significantly different
# assume hetero
```

```
## Away.Left
leveneTest(Away.Left ~ Sex, ear.lnr)
```

```
## Levene's Test for Homogeneity of Variance (center = median)
##      Df F value Pr(>F)
## group 1  5.8569 0.01935 *
##      48
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# p < 0.05
# reject null hypo that variances between two groups are not significantly different
# assume hetero
```

```
## Towards.Right
```

```
leveneTest(Towards.Right ~ Sex, ear.lnr)
```

```
## Levene's Test for Homogeneity of Variance (center = median)
```

```
##      Df F value    Pr(>F)
```

```
## group 1  16.173 0.0002036 ***
```

```
##      48
```

```
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# p < 0.05
```

```
# reject null hypo that variances between two groups are not significantly different
# assume hetero
```

```
## Towards.Left
```

```
leveneTest(Towards.Left ~ Sex, ear.lnr)
```

```
## Levene's Test for Homogeneity of Variance (center = median)
```

```
##      Df F value    Pr(>F)
```

```
## group 1   8.2653 0.006007 **
```

```
##      48
```

```
## ---
```

```
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# p < 0.05
```

```
# reject null hypo that variances between two groups are not significantly different
# assume hetero
```

```
## Welch's T-test for non-equal variance
```

```
#Away.Right
```

```
t.test(Away.Right ~ Sex, data = ear.lnr, alternative = "two.sided", var.equal = FALSE)
```

```
##
```

```
## Welch Two Sample t-test
```

```
##
```

```
## data: Away.Right by Sex
```

```
## t = -1.2147, df = 20.292, p-value = 0.2384
```

```
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
```

```
## 95 percent confidence interval:
```

```
## -29.861302  7.870126
```

```
## sample estimates:
```

```
## mean in group Female    mean in group Male
```

```
##          54.17941          65.17500
```

```
# p > 0.05
```

```
# Accept; there is no sign diff bet male and female aud. acuity for right away
```

```
#Away.Left
```

```
t.test(Away.Left ~ Sex, data = ear.lr, alternative = "two.sided", var.equal = FALSE)
```

```
##
```

```
## Welch Two Sample t-test
```

```
##
```

```
## data: Away.Left by Sex
```

```
## t = -1.8768, df = 20.395, p-value = 0.07492
```

```
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
```

```
## 95 percent confidence interval:
```

```
## -35.227865 1.837424
```

```
## sample estimates:
```

```
## mean in group Female mean in group Male
```

```
## 53.77353 70.46875
```

```
# p > 0.05
```

```
# Accept; there is no sign diff bet male and female aud. acuity for left away
```

```
#Towards.Right
```

```
t.test(Towards.Right ~ Sex, data = ear.lr, alternative = "two.sided", var.equal = FALSE)
```

```
##
```

```
## Welch Two Sample t-test
```

```
##
```

```
## data: Towards.Right by Sex
```

```
## t = -2.0473, df = 18.528, p-value = 0.05507
```

```
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
```

```
## 95 percent confidence interval:
```

```
## -35.0306667 0.4166961
```

```
## sample estimates:
```

```
## mean in group Female mean in group Male
```

```
## 40.26176 57.56875
```

```
# p > 0.05
```

```
# Accept; there is no sign diff bet male and female aud. acuity for right towards
```

```
#Towards.Left
```

```
t.test(Towards.Left ~ Sex, data = ear.lr, alternative = "two.sided", var.equal = FALSE)
```

```
##
```

```
## Welch Two Sample t-test
```

```
##
```

```
## data: Towards.Left by Sex
```

```
## t = -1.7381, df = 19.705, p-value = 0.09779
```

```
## alternative hypothesis: true difference in means between group Female and group Male is not equal to
```

```
## 95 percent confidence interval:
```

```
## -31.579461 2.887549
```

```
## sample estimates:
```

```
## mean in group Female mean in group Male
```

```
## 40.83529 55.18125
```

```
# p > 0.05
# Accept; there is no sign diff bet male and female aud. acuity for left towards
```

## Organizes data for export

```
library(writexl)

ra.ear <- ear.lr %>%
  select(c(1,2,3)) %>%
  spread(Sex, Away.Right) %>%
  select(c(2,3))

write_xlsx(ra.ear, "C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/2nd Semester/BIO 122/lab/Exercise 1/ra.ear.xlsx")

la.ear <- ear.lr %>%
  select(c(1,2,4)) %>%
  spread(Sex, Away.Left) %>%
  select(c(2,3))

write_xlsx(la.ear, "C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/2nd Semester/BIO 122/lab/Exercise 1/la.ear.xlsx")

rt.ear <- ear.lr %>%
  select(c(1,2,5)) %>%
  spread(Sex, Towards.Right) %>%
  select(c(2,3))

write_xlsx(rt.ear, "C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/2nd Semester/BIO 122/lab/Exercise 1/rt.ear.xlsx")

lt.ear <- ear.lr %>%
  select(c(1,2,6)) %>%
  spread(Sex, Towards.Left) %>%
  select(c(2,3))

write_xlsx(lt.ear, "C:/Users/Xyrine/Documents/School Stuff/BS BIO 4th Year/2nd Semester/BIO 122/lab/Exercise 1/lt.ear.xlsx")
```