Exploring and visualizing data with R

Ecological and Epidemiological Modeling Madagascar, (E2M2)
ValBio, Ranomafana
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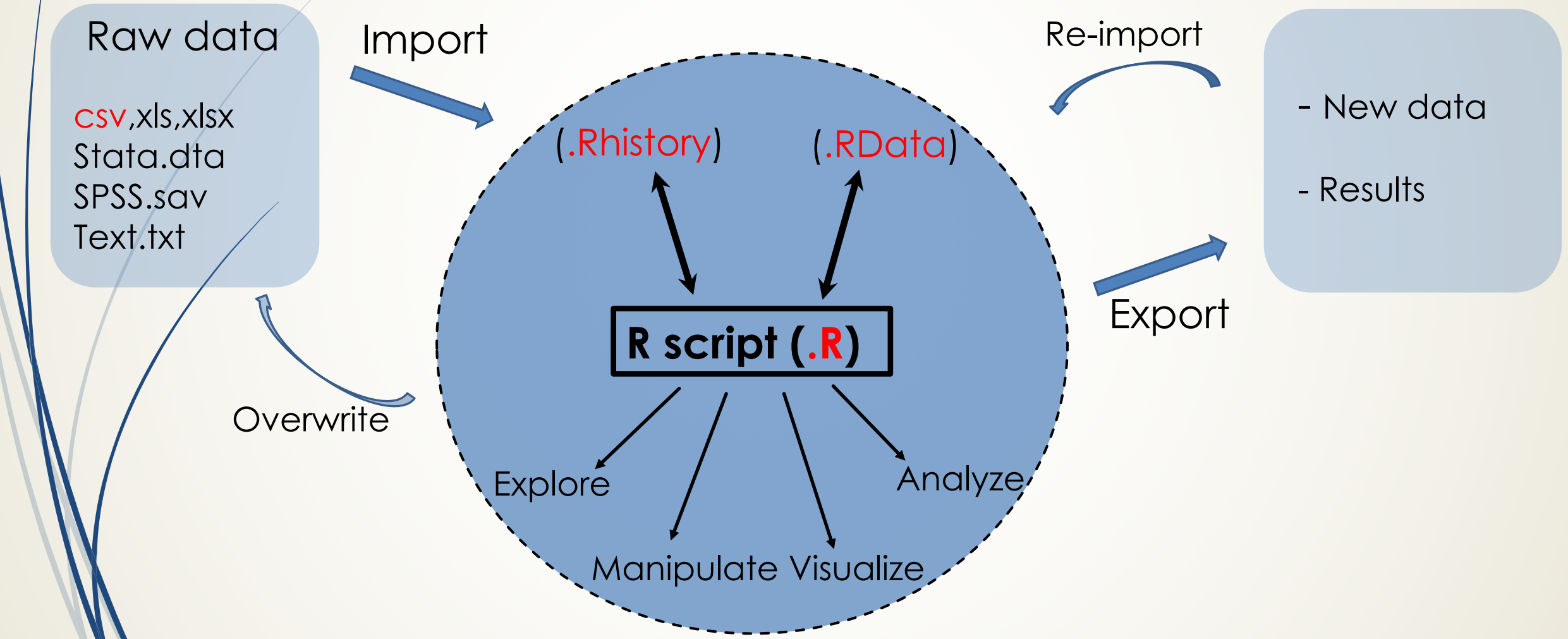
Exploring and visualizing data in R

- R and RStudio software
- Importing data
- Exploring and cleaning data
- Visualizing data
- Tutorial

Database: « e2m2_FB.csv »

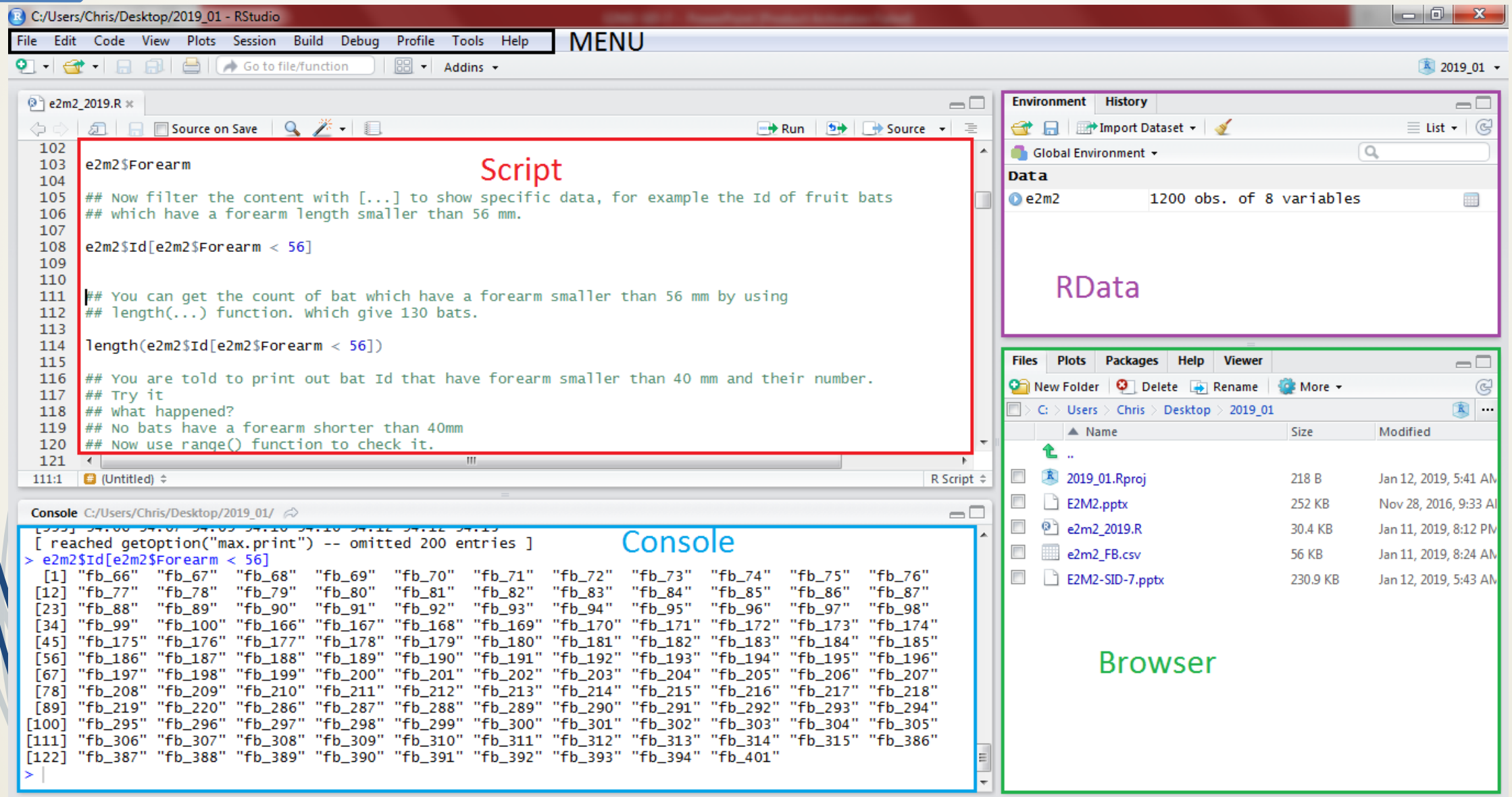
R software (a statistical tool)

- It is free!
- Powerful analysis capability
- Versatile, flexible, open source



RSTUDIO

An interface for R software



Importing Data (loading data into R environment)

- Set working directory (Where to put all files?)

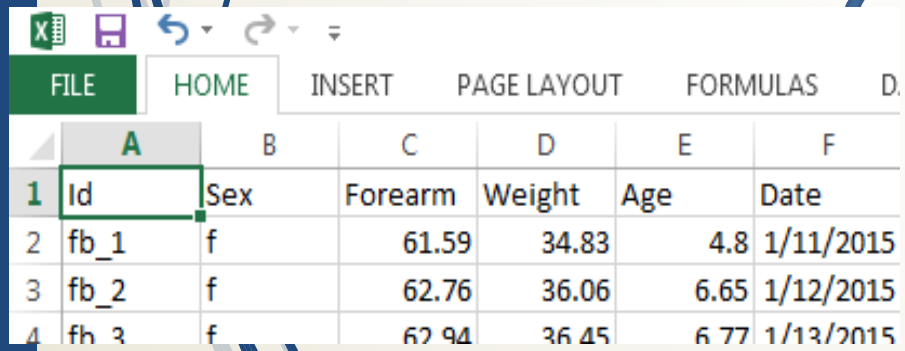
```
getwd()
setwd("Folder path")
```

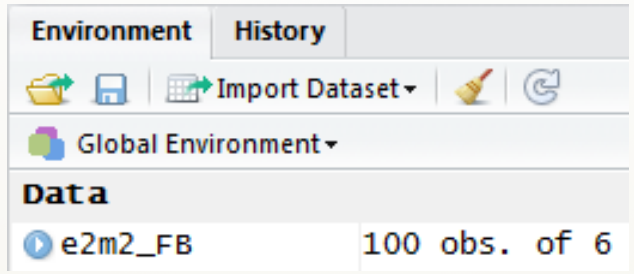
```
?getwd
```

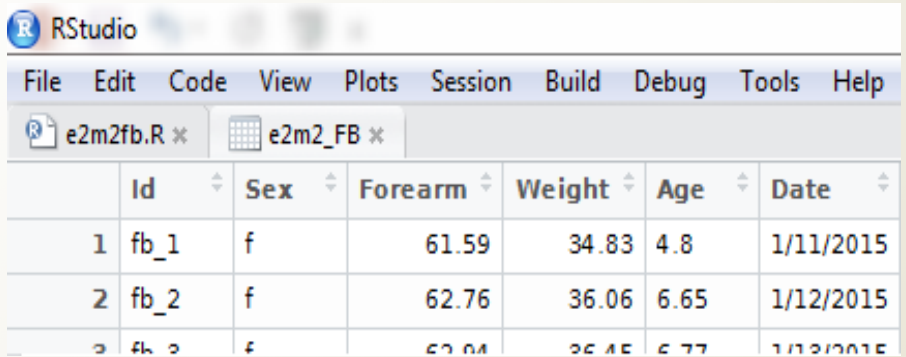
- Import data (read the data source and pack it within RData)

```
e2m2_FB <- read.csv("e2m2_FB.csv", header=T, stringsAsFactors=F)

View(e2m2_FB)
```







Exploring and cleaning Data (look at the dataset)

Data overview

Data frame= e2m2_FB

Variables= Column (names)

Cases= Row (length)

Id	Sex	Forearm	Weight	Age	Date
fb_1	f	61.59	34.83	4.8	1/11/2015
fb_2	f	62.76	36.06	6.65	1/12/2015
fb_3	f	62.94	36.45	6.77	1/13/2015

Value= Contents

```
> dim(e2m2_FB)
[1] 100   6
```

How big is the data frame?

```
> names(e2m2_FB)
[1] "Id"      "Sex"     "Forearm" "Weight"  "Age"     "Date"
```

What are the variables?

Exploring and cleaning Data (Dive into the dataset)

Accessing dataset contents (From Outside to Inside!)

```
> e2m2_FB$Id
 [1] "fb_1"   "fb_2"   "fb_3"   "fb_4"
 [12] "fb_12"  "fb_13"  "fb_14"...
 [100] "fb_100"
```

Data frame > Variables > Contents

Dataset name $ Variable name

```
> e2m2_FB$Id[e2m2_FB$Forearm < 56]

[1] "fb_64" "fb_65"
```

Filter Contents […]

Data frame name $ Variable name [Filter]

Get the Bat Id with Weight > 75

```
> length(e2m2_FB$Id[e2m2_FB$Forearm < 56])

[1]    2
```

Get the count with length(…)

Exploring and cleaning Data (look at the dataset structure)

Variable types and error str(…)

```
> str(e2m2_FB)

 $ Id     : chr  "fb_1" "fb_2" "fb_3" "fb_4"…
 $ Sex    : chr  "f" "f" "f" "F" "f " ...
 $ Weight : num  34.8 36.1 36.5 36.6 38.9 ...
 $ Age    : chr "one" "6.65" "6.77" "seven" ...
 $ Date   : chr  "1/11/2015" "1/12/2015 "…
```

Categorical: Factor (n levels)
Continuous: Numeric (Range)
Time: Date (Range)
Binary: logic (T,F)
Missing Value: NA

as.factor(…)
as.Date(…) **"%Y-%m-%d"**
as.numeric(…)

```
> as.factor(e2m2_FB$Sex)
Levels: f F f  m
> as.numeric(e2m2_FB$Age)
Warning message:
NAs introduced by coercion
> as.Date(e2m2_FB$Date,"%m/%d/%Y")
```

Needed format -> Re-format
Value error -> Correct value
Missing error -> Handle NA values

Exploring and cleaning Data (clean the dataset)

Correcting Values

(Wrong value <- Right Value)

```
> e2m2_FB$Age[e2m2$Age== “one"] <- “1" >
e2m2_FB$Sex[e2m2$Sex== "F"] <- "f"
> e2m2_FB$Sex[e2m2$Sex== "f "] <- "f"
```

```
> as.factor(e2m2_FB$Sex)
Levels: f m
> as.numeric(e2m2_FB$Age)
[1] 4.80  6.65  6.77  7.00
```

Save the format to the variable

```
> e2m2_FB$Sex <- as.factor(e2m2_FB$Sex)
> e2m2_FB$Age <- as.numeric(e2m2_FB$Age)
> e2m2_FB$Date <- as.Date(e2m2_FB$Date,"%m/%d/%Y")
```

```
> str(e2m2_FB)
$ Id     : chr  "fb_1" "fb_2" "fb_3" "fb_4" ...
$ Sex    : Factor w/ 2 levels "f","m": 1 1 1 1  2
$ Age    : num  4.8 6.65 6.77 7 8.89 ...
$ Date   : Date, format: "2015-01-11"
```

```
> e2m2_FB$NewVar <- as.factor(e2m2_FB$Sex)
> e2m2_FB$NewVar <- e2m2_FB$Forearm/2
```

Or create new variable

Visualizing Data (Play with data)

Install and Load Library

```
Install.packages("…")
Installed.packages()
```

```
> library(dplyr)
> require(ggplot2)
```

Data summarizing ("dplyr")

```
> fb_male <-filter(e2m2_FB,Sex=="m")
> range(fb_male$Forearm)
> mean(fb_male$Forearm)
> sd(fb_male$Forearm)
```

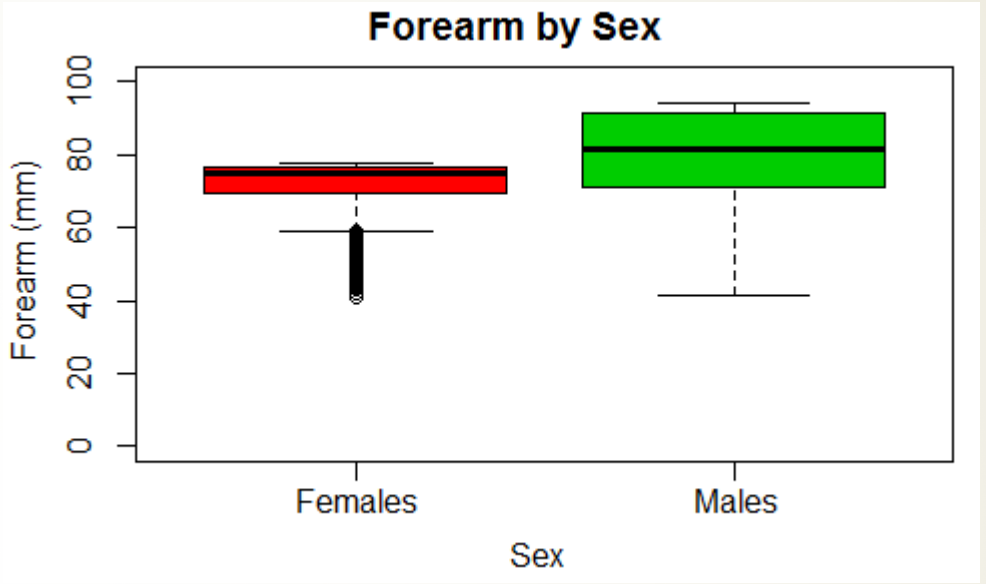
	Sex	mean_forearm	sd_forearm	nbr
	(fctr)	(dbl)	(dbl)	(int)
1	f	59.6040	11.90278	60
2	m	60.9985	14.12073	40

```
gp_fb <- group_by(e2m2_FB,Sex)
gp_fb_stat <- summarise(gp_fb,
                        mean_forearm=mean(Forearm,na.rm=T),
                        sd_forearm=sd(Forearm,na.rm=T),
                                nbr=n())
```

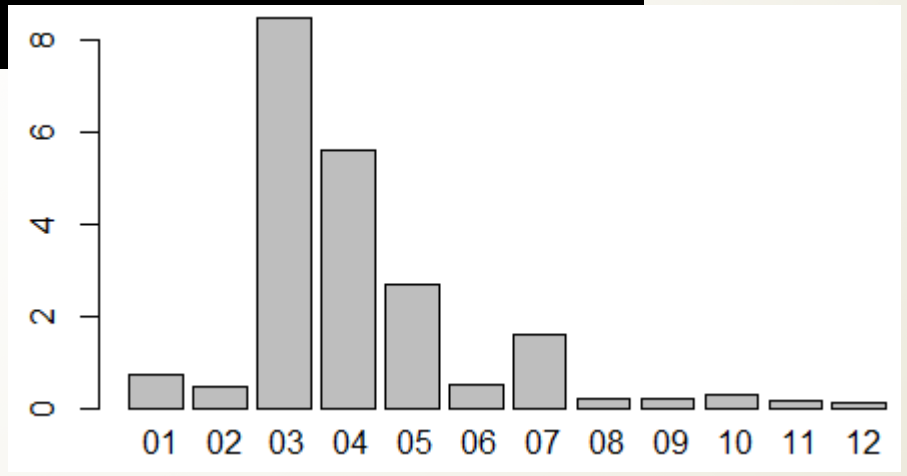
Visualizing Data (Present de data)

R base graphical function

```
boxplot(Forearm~Sex,
        names=c("Females","Males"),
        col=c(2:3),
        main="Forearm by Sex",
        xlab="Sex",
        ylab="Forearm (mm)",
        ylim=c(0,100))
```




```
PLoad <- tapply(e2m2$ParLoad,factor(format(e2m2$Date,"%m")),mean)
barplot(PLoad)
```



Visualizing Data (Present de data)

R plot() function

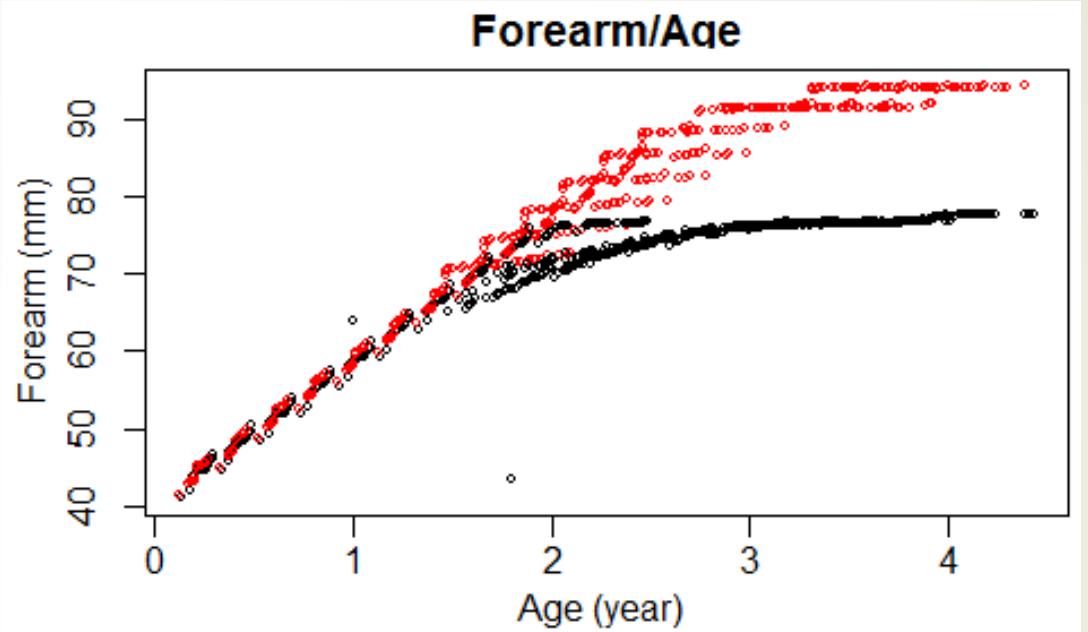
```
plot(e2m2$ Forearm~ e2m2$Age,
       main = "Forearm/Age",
       ylab ="Forearm (mm)", xlab = "Age (year)",
       col=Sex)
```

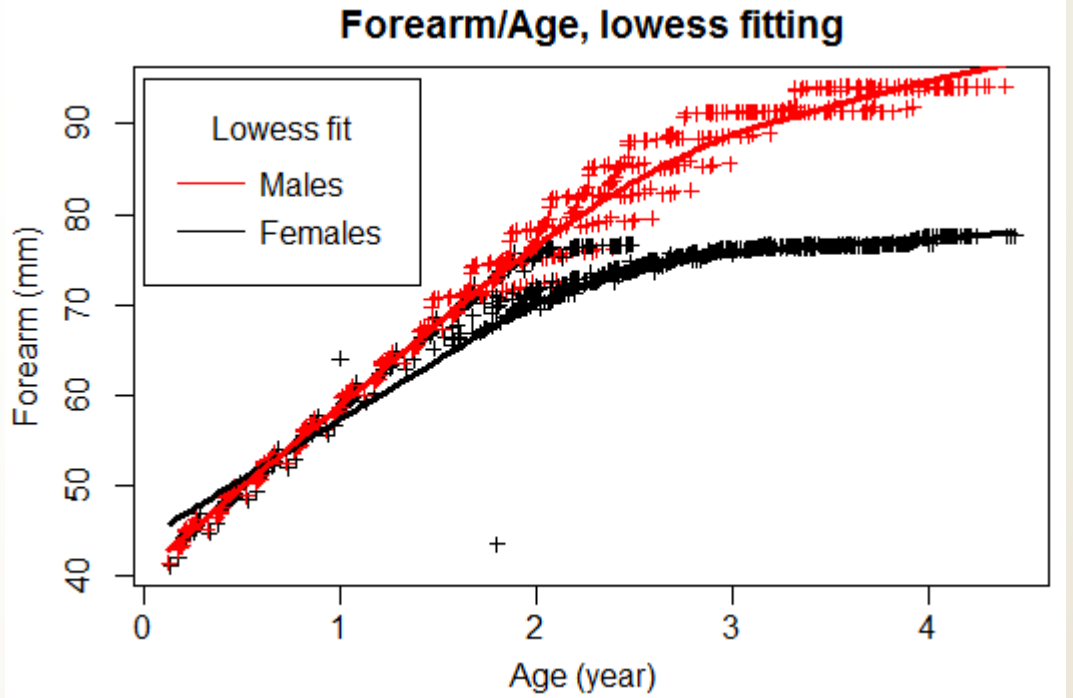
```
fitfem <- lowess(datfem$Forearm~datfem$Age)
fitmal <- lowess(datmal$Forearm~datmal$Age)

plot(e2m2$Forearm~e2m2$Age,
    main="Forearm/Age, lowess fitting",
    xlab="Age (year)",ylab="Forearm (mm)",
    type="p",pch=3,cex=0.7,
    col=e2m2$Sex)

lines(fitfem,col="black",lwd=3)
lines(fitmal,col="red",lwd=3)

legend(x=0, y=95,legend=c("Males","Females"),
      col=c("red","black"),title="Lowess fit",
      lty=1,x.intersp = .5,y.intersp = .8)
```





Visualizing Data (Present de data)

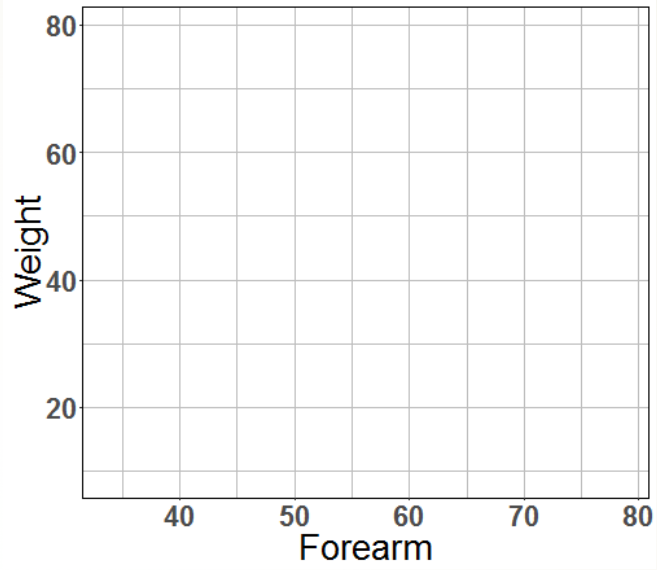
Data Plotting with (ggplo2)

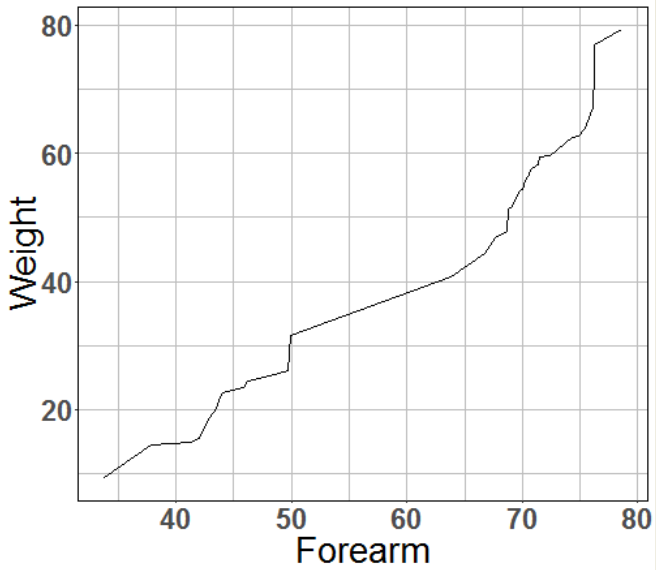
Base plot

```
ggplot(data,aes(x,y))
```

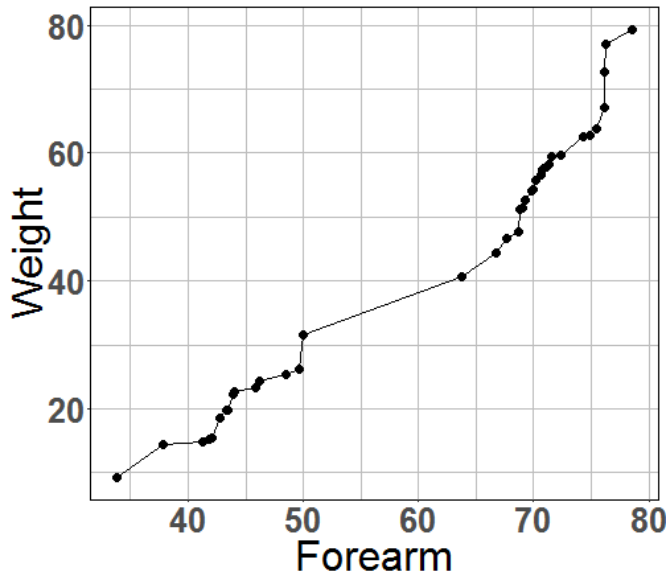
+ geom

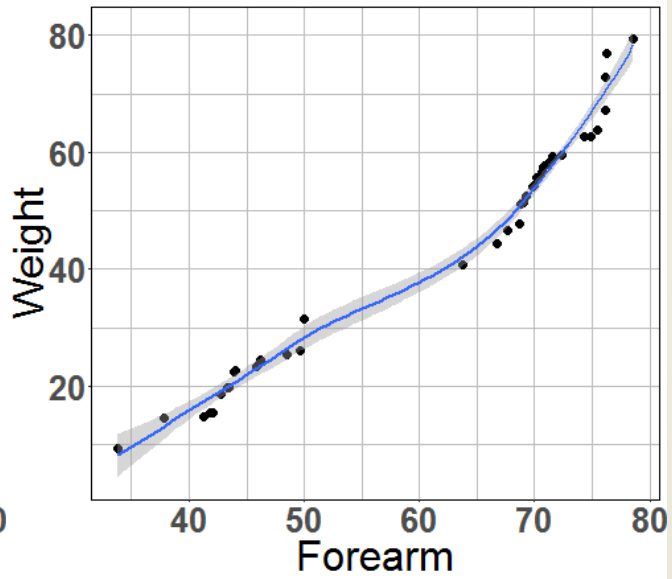
```
geom_line()
geom_point()
geom_boxplot()
geom_bar()
```






```
ggplot(fb_male,aes(Forearm,Weight))
  + geom_line()
  + geom_point()
  + geom_smooth()
```

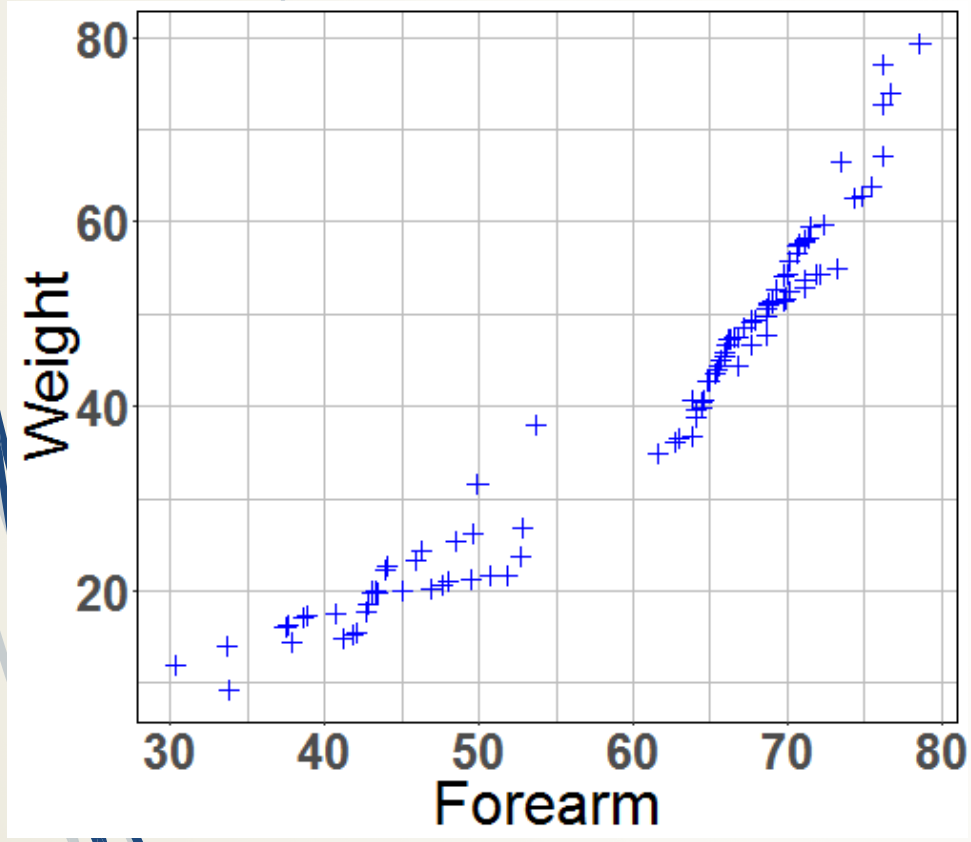




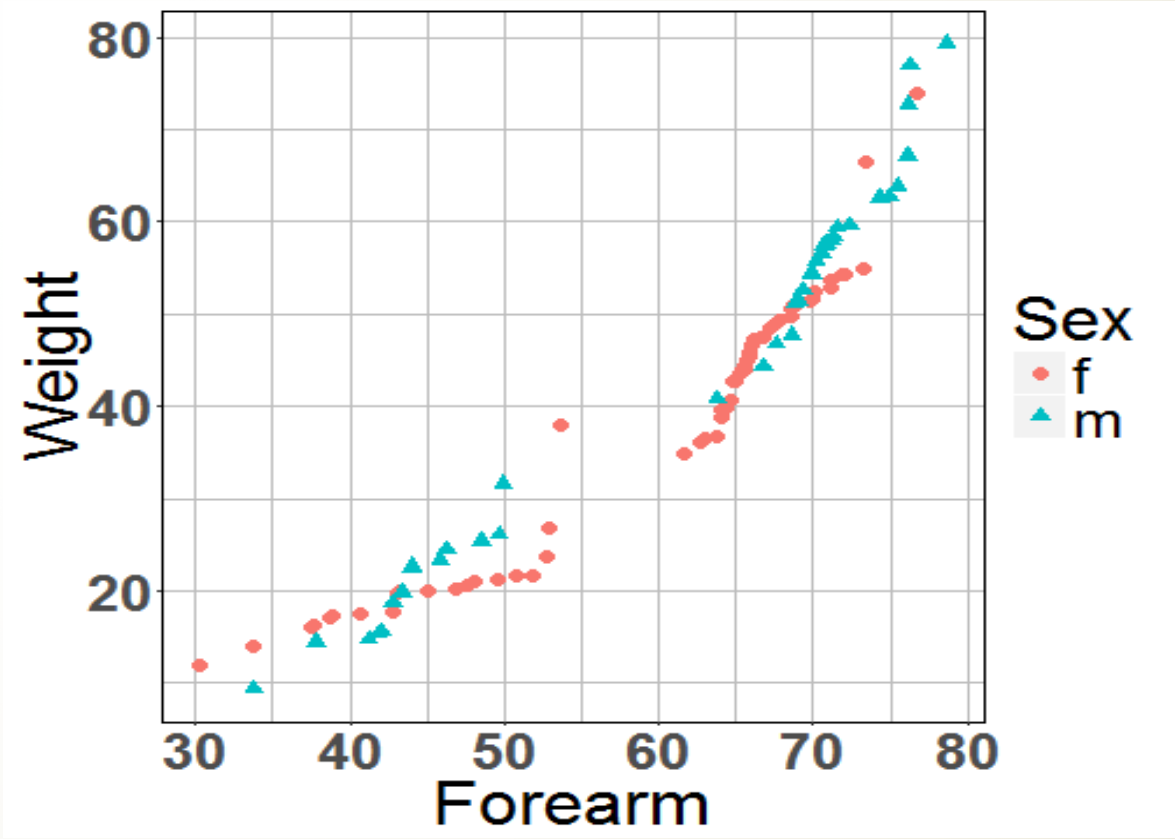
Visualizing Data (Present de data)

Mapping aesthetic vs fixed value

```
ggplot(e2m2_FB,aes(Forearm,Weight)) +
geom_point(color="blue", shape=3)
```




```
ggplot(e2m2_FB,aes(Forearm,Weight)) +
geom_point(aes(color=Sex, shape=Sex))
```



Visualizing Data (Present de data)

Polish the plot

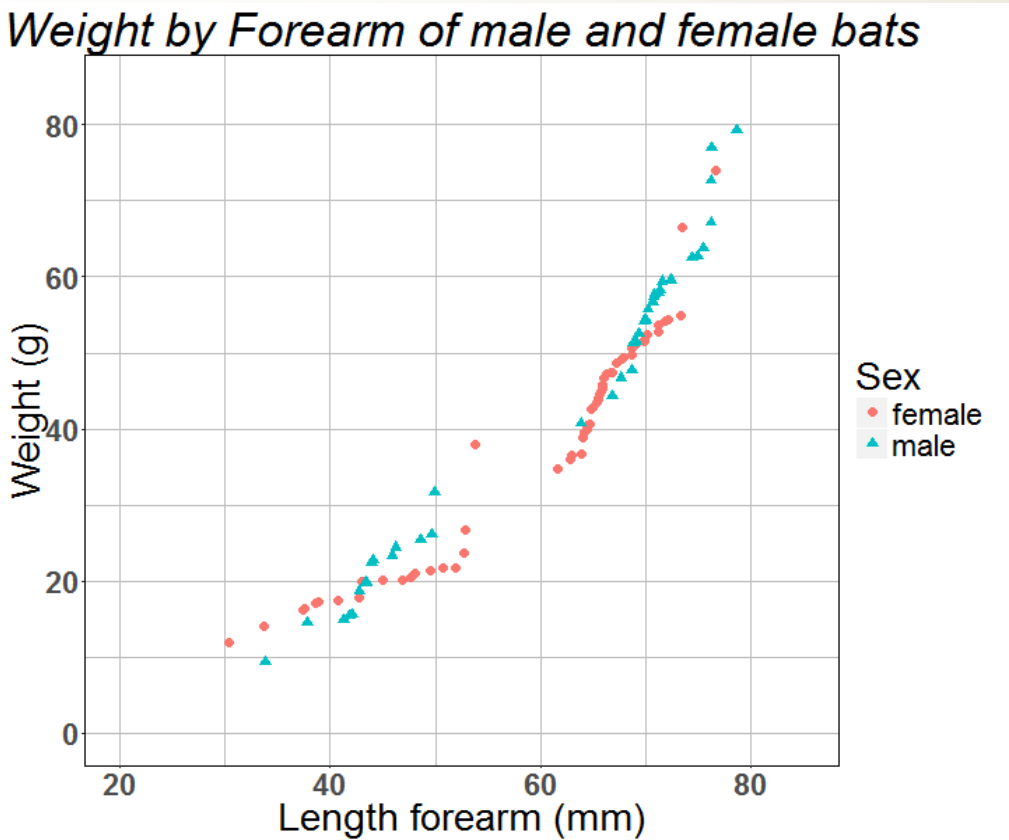
```
ggtitle("Weight by Forearm of male and female")+

scale_x_continuous(name="Length forearm (mm)",
                   limits=c(20,85))+

scale_y_continuous(name="Weight (g)",
                   limits=c(0,85))+

scale_color_discrete(name="Sex",
                     breaks=c("f","m"),
                     label=c("female","male"))+

scale_shape_discrete(name="Sex",
                     breaks=c("f","m"),
                     label=c("female","male"))
```



Conclusion

R software:

- Powerful data management
- Simple syntax
- Large graphic vocabularies
- Packages to fit needs