Advanced R

Unit 1

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Course Content - Advanced R (Unit 1)

- Short repetition
  - Reproducibility - Rmarkdown for reports
  - Project structure
  - Visualization with ggplot

```
## Warning in rm(all_chapters): Objekt 'all_chapters' nicht gefunden
```

Repetition

What is reproducibility in science?

- Ability to reproduce results by a peer
- Requires data, methods, and procedures
- Increasingly, science is supposed to be reproducible

Be nice to your future selves!

Reproducibility with RStudio & R

- R with RMarkdown can be used to produce different types of documents [see: http://rmarkdown.rstudio.com/gallery.html]
  - standardised reports (`html`, `pdf`)
  - word documents (`.docx`)
  - slides for presentations (`html`, `pdf`, `powerpoint`)
  - journal articles. using the `rticles` package (`.pdf`)
  - ...

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⇒ **making transparent and reproducible analysis**

Folder structure

Suggestion how to structure your project folder

- project1
  - literature
  - reports
  - ...
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    - Rfiles
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Hint: never touch the original data!

R project

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  - is a way to organize files and folders related to a specific analysis or project
    - easy to switch different projects
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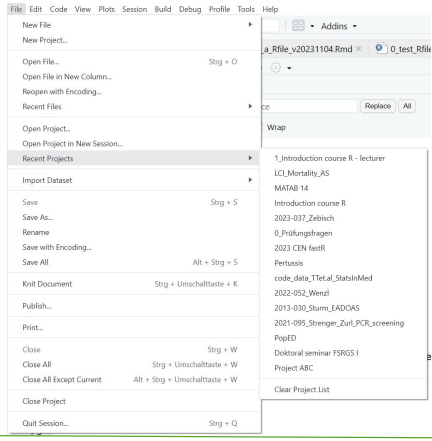

Create folder structure & R project

1) Download prepared folder structure
   - download 'projectstructure_for_students.zip' from GitHub
   - unzip the file
   - put folder 'Course Advanced R' wherever you want to have it
2) Generate a 'R project' (together)
   - File → New Project... → Existing Directory

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  - wide range of high-quality plots and graphics
  - provides a consistent syntax
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    - represents the dataset being visualized
  - **aesthetics** (aes)
    - define how variables are mapped to visual properties (e.g., x-axis, y-axis, color)
  - **geometric objects** (geom)
    - determine the type of plot (e.g., points, lines, bars)

Example - Iris

A famous iris data set gives the measurements in centimeters of the variables

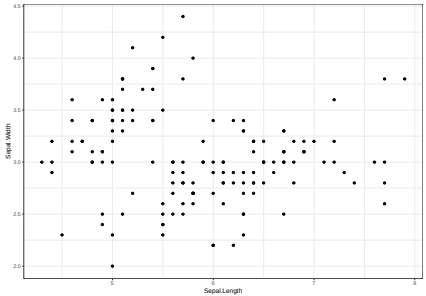
- sepal length
- sepal width
- petal length
- petal width

for 50 flowers from each of 3 species of iris (*Iris setosa*, *versicolor*, and *virginica*).

Iris Versicolor **Iris Setosa** **Iris Virginica**

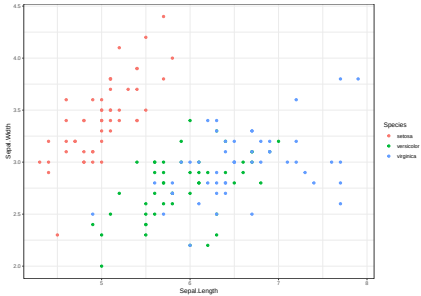
Example - Iris

```
ggplot(data = iris,
       aes(x = Sepal.Length, y = Sepal.Width)) +
    geom_point() +
    theme_bw()
```



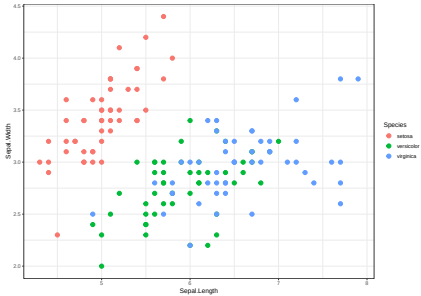
Example - Iris: including species as colour

```
ggplot(data = iris,
       aes(x = Sepal.Length, y = Sepal.Width, colour = Species)) +
    geom_point() +
    theme_bw()
```



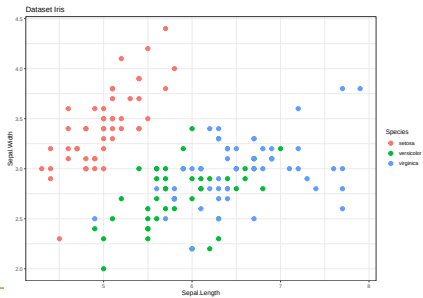
Example - Iris: increase point size

```
ggplot(data = iris,
       aes(x = Sepal.Length, y = Sepal.Width, colour = Species)) +
    geom_point(size = 3) +
    theme_bw()
```



Example - Iris: adding title

```
ggplot(data = iris,
       aes(x = Sepal.Length, y = Sepal.Width, colour = Species)) +
    geom_point(size = 3) +
    labs(title = "Dataset Iris") +
    theme_bw()
```



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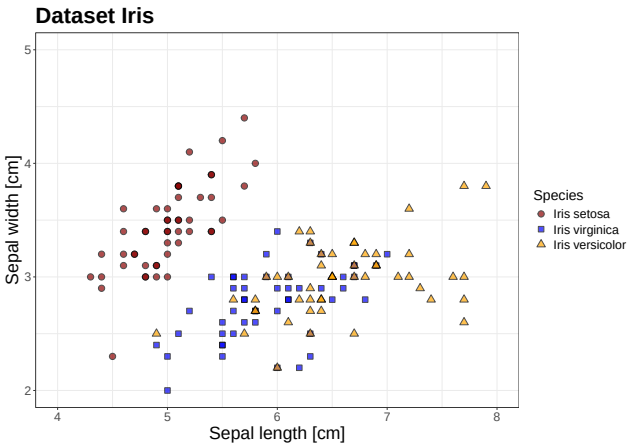
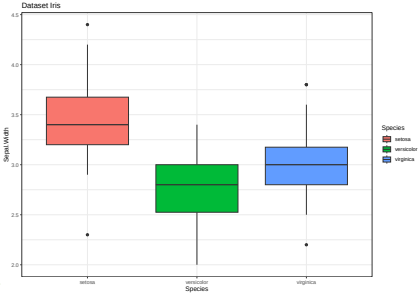


Example - Iris: using another geom

```
ggplot(data = iris,
       aes(x = Species, y = Sepal.Width, fill = Species)) +
    geom_boxplot() +
    labs(title = "Dataset Iris") +
    theme_bw()
```



Saving ggplots

```
plot_iris <-
  ggplot(data = iris,
         aes(x = Sepal.Length, y = Sepal.Width, colour = Species)) +
      geom_point() +
      theme_bw()

ggsave(filename = "../Routputs/example_iris.png", plot = plot_iris,
       units = "cm", width = 12, height = 7)
```

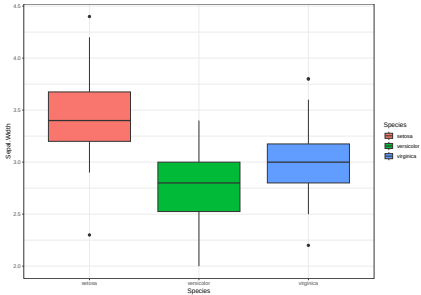
Exercise repetition

- Work through ‘Unit 1 - Exercise 1’

Placeholders

Example - Iris

```
ggplot(data = iris,
       aes(x = Species, y = Sepal.Width, fill = Species)) +
    geom_boxplot() +
    theme_bw()
```



Working with variables as placeholders

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ggplot(data = iris,
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```
ggplot(data = iris,
       aes(x = Species, y = Sepal.Width, fill = Species)) +
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```

```
var_int <- "Sepal.Width"
group_int <- "Species"
```

Working with variables as placeholders

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ggplot(data = iris,
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    geom_boxplot() +
    theme_bw()
```

```
var_int <- "Sepal.Width"
group_int <- "Species"
```

```
ggplot(data = iris,
       aes(x = get(group_int), y = get(var_int), fill = get(group_int))) +
    geom_boxplot() +
    theme_bw()
```

Working with variables as placeholders

```
ggplot(data = iris,
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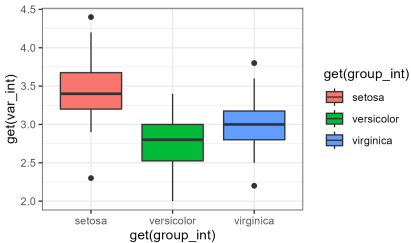

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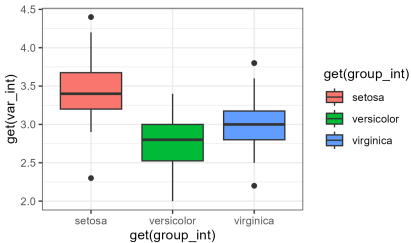

Problem: axis labels and legend title → need to adapt them too

Working with variables as placeholders

```
var_int <- "Sepal.Width"
var_int_lab <- "Sepal width [cm]"

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```
ggplot(data = iris,
       aes(x = get(group_int), y = get(var_int), fill = get(group_int))) +
  geom_boxplot() +

  guides(fill = guide_legend(group_int_lab)) +

  xlab(group_int_lab) +
  ylab(var_int_lab) +

  theme_bw()
```

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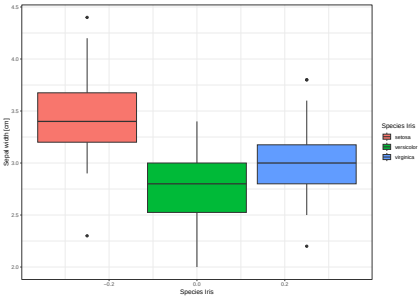

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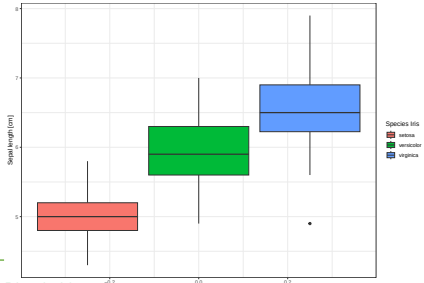

Exercise placeholders

- Work through ‘Unit 1 - Exercise 2’

Links

Links (I)

- Introduction to R
  - R for Data Science (https://r4ds.hadley.nz/)
- Plots using ggplot
  - Overview with further links to course material: https://ggplot2.tidyverse.org/
- Display tables using flextable
  - flextable bool https://ardata-fr.github.io/flextable-book/
  - Function references https://davidgohel.github.io/flextable/reference/index.html
- knit_child()
  - link (https://bookdown.org/yihui/rmarkdown-cookbook/child-document.html)

Links (II)

- Download R
  - CRAN (https://cran.r-project.org/)
- Download RStudio
  - RStudio Desktop (https://posit.co/download/rstudio-desktop/)