R: The tidyverse and beyond

1-day workshop
Afternoon practical session

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A: Tibbles

- The tidyverse equivalent of data.frames

4 main points of difference:
1. Printing in the console
2. Subsetting (The use of a placeholder ("."")
3. Interacting with older code
4. Tibbles don't change the input

- Open the script 01_pm_tibbles.R

A: readr and more

- fast way to read rectangular data (like csv, tsv)
- read_csv(): comma separated (CSV) files
- read_tsv(): tab separated files
- read_delim(): general delimited files

- readxl supports both the legacy .xls format and the modern xml-based .xlsx format
- Need to load explicitly

- read_sas(): SAS files
- read_sav(): SPSS files
- read_dta(): Stata files
- Also need to load explicitly

- Open the script 02_pm_readr.R

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Data structures

```
#vectors:
These come in two forms
- A: Atomic vectors contain exactly one type of data

all_numbers          <- c(1, 2, 0.5, -0.5, 3.4)

all_characters       <- c("One", "too", "3")

all_logical          <- c(TRUE, FALSE)

- B: Lists allow combinations of different types of data

this_is_a_list       <- list(1, TRUE, "Three")

- If you try to create a vector with more than one data type, then it will
  undergo coercion to the least common denominator

- The coercion rule goes:
                logical -> integer -> numeric -> complex -> character
```
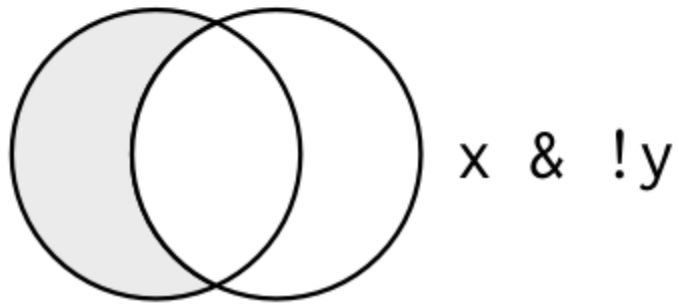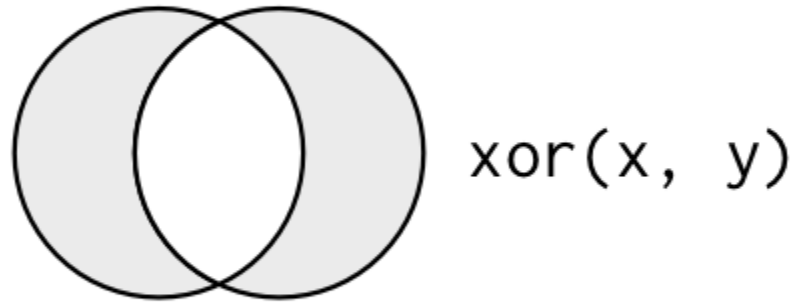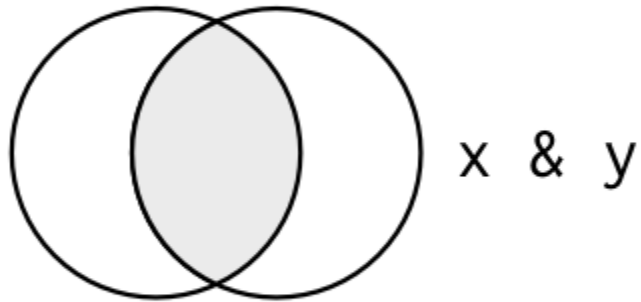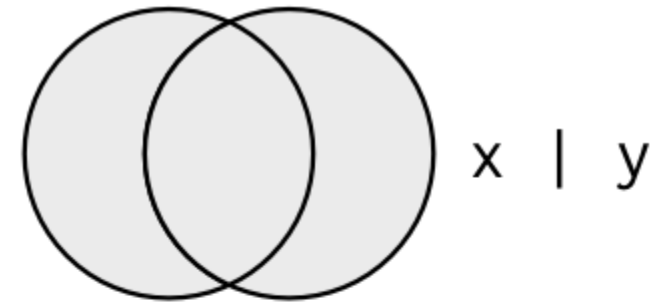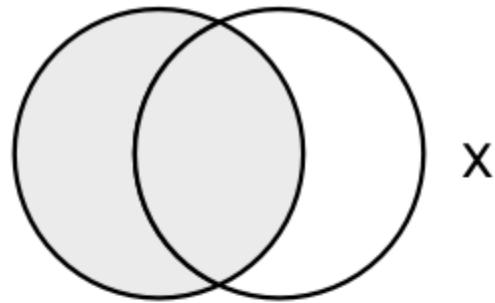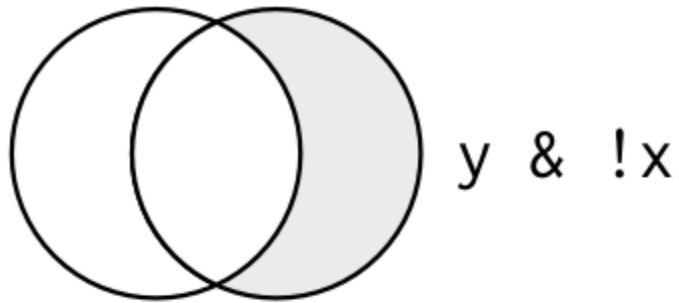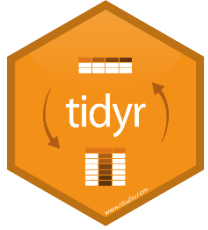
Logical operators and conditional subsetting

y & !x

x

x | y

x & y

xor(x, y)

x & !y

y
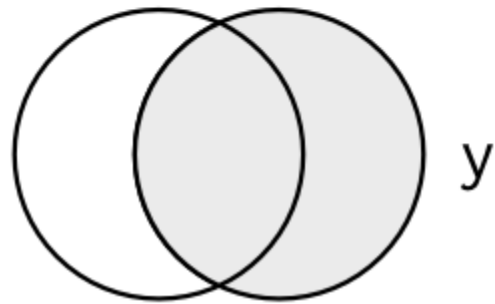
- & -> AND
- | -> OR (inclusive)
- ! -> NOT
- == -> EQUAL (identity)
- != -> NOT EQUAL

A: tidyr

- The tidyverse works with tidy data
  1. Each variable a column
  2. Each observation a row
  3. Each value is a cell

Main functions:
- gather()
- separate()

- Open the script 03_pm_tidyr.R

Journal of Statistical Software

MMMMMM YYYY, Volume VV, Issue II.   http://www.jstatsoft.org/

Tidy Data

Hadley Wickham
RStudio

Abstract

A huge amount of effort is spent cleaning data to get it ready for analysis, but there has been little research on how to make data cleaning as easy and effective as possible. This paper tackles a small, but important, component of data cleaning: data tidying. Tidy datasets are easy to manipulate, model and visualise, and have a specific structure: each variable is a column, each observation is a row, and each type of observational unit is a table. This framework makes it easy to tidy messy datasets because only a small set of tools are needed to deal with a wide range of un-tidy datasets. This structure also makes it easier to develop tidy tools for data analysis, tools that both input and output tidy datasets. The advantages of a consistent data structure and matching tools are demonstrated with a case study free from mundane data manipulation chores.

Keywords: data cleaning, data tidying, relational databases, R.

B: dplyr for data transformation
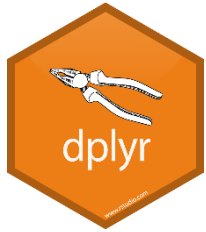
 - Solves the most common data manipulation challenges

```
Main functions:
- select()
- filter()
- mutate()
- group_by()
- summarise()
- ………… and many many more


- Open the script 04_pm_dplyr.R
```

Time for some hands on application

\- Open the script 05_pm_practise.R

C: ggplot2

- Data visualisation based on "[The Grammar of Graphics](#)"

```
ggplot(data = <DATA>) +

    <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>))    +

    linear model  +

    axes formatting  +

    legend formatting  +

    title  + etc. etc.
```
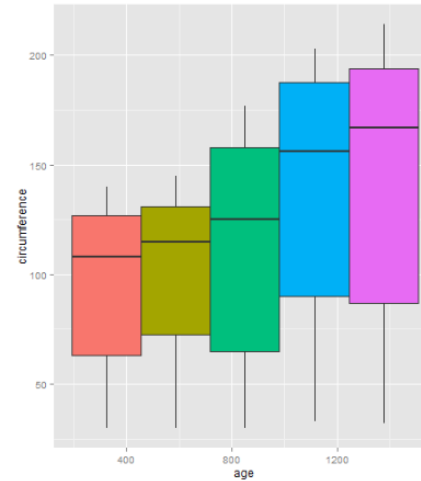
C: ggplot2

- Very versatile
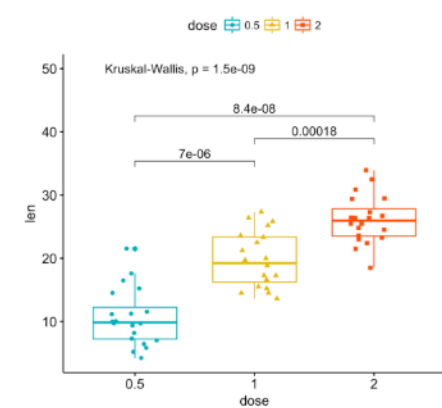- Allows you to go from   to
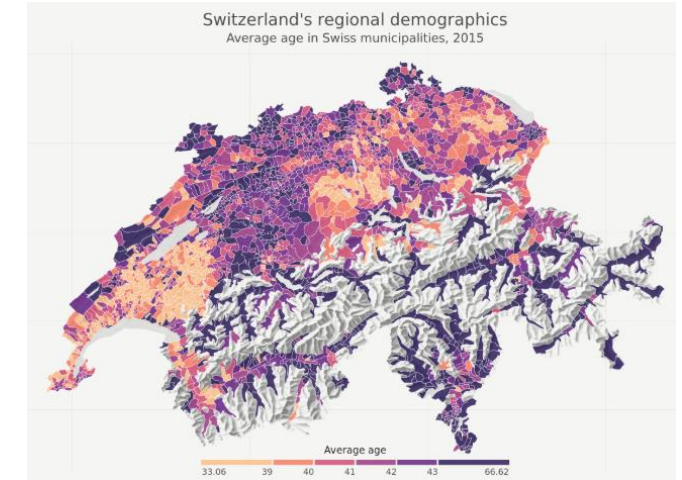
- Lots of add-on packages

ggmap
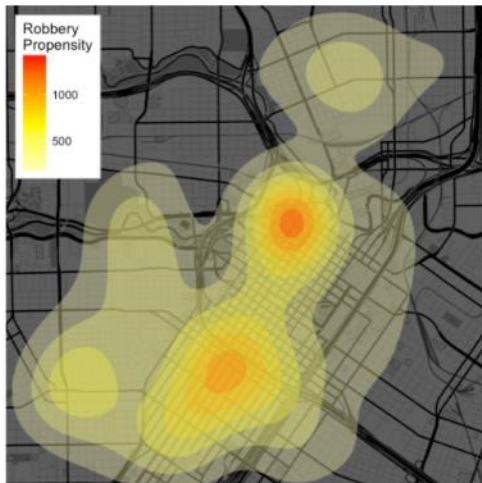
gganimate
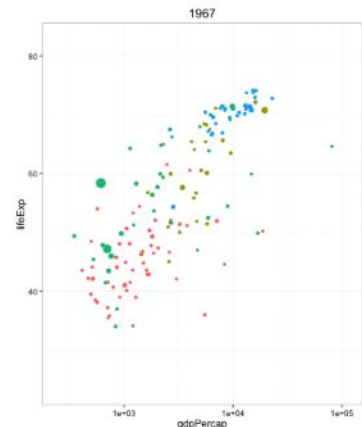
patchwork
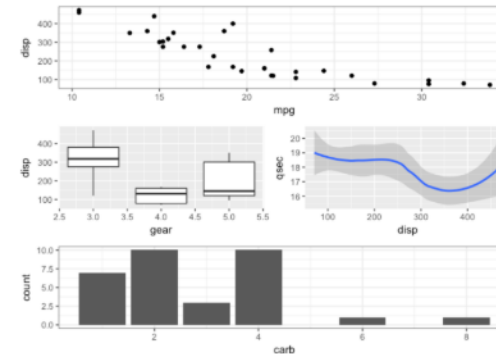
ggdendro
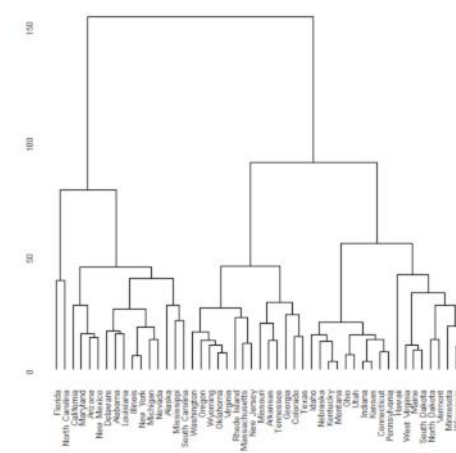
ggpubr

C: Plotting using base R graphics vs ggplot2

```
7   # Here's an example using the graphics packages that comes with base R
8   plot(iris$Sepal.Length, iris$Sepal.Width,
9        bg = iris$Species, # Fill colour
10       pch = 21, # Shape: circles that can filed
11       xlab = "Sepal Length", ylab = "Sepal Width", # Labels
12       axes = FALSE, # Don't plot the axes
13       frame.plot = FALSE, # Remove the frame
14       xlim = c(4, 8), ylim = c(2, 4.5), # Limits
15       panel.first = abline(h = seq(2, 4.5, 0.5), col = "grey80"))
16
17  at = pretty(iris$Sepal.Length)
18  mtext(side = 1, text = at, at = at,
19        col = "grey20", line = 1, cex = 0.9)
20
21  at = pretty(iris$Sepal.Width)
22  mtext(side = 2, text = at, at = at, col = "grey20", line = 1, cex = 0.9)
23
24  legend("topright", legend = c("Setosa", "Versicolor", "Virginica"),
25        title = "Species", fill=c("black", "red", "green"), cex=0.8)
26
27  title("The infamous IRIS data",
28        cex.main = 0.8, font.main = 2, col.main = "black")
29
```

```
30  # Now lets view the ggplot2 version
31  # library(tidyverse)
32  ggplot(iris, aes(x = Sepal.Length, y = Sepal.Width, colour = Species)) +
33    geom_point() +
34    scale_colour_manual(values = c("black", "red", "green")) +
35    theme_minimal() +
36    labs(title = "The infamous IRIS data",
37         x = "Sepal Length",
38         y = "Sepl Width")
39  |
```

C: Plotting using base R graphics vs ggplot2
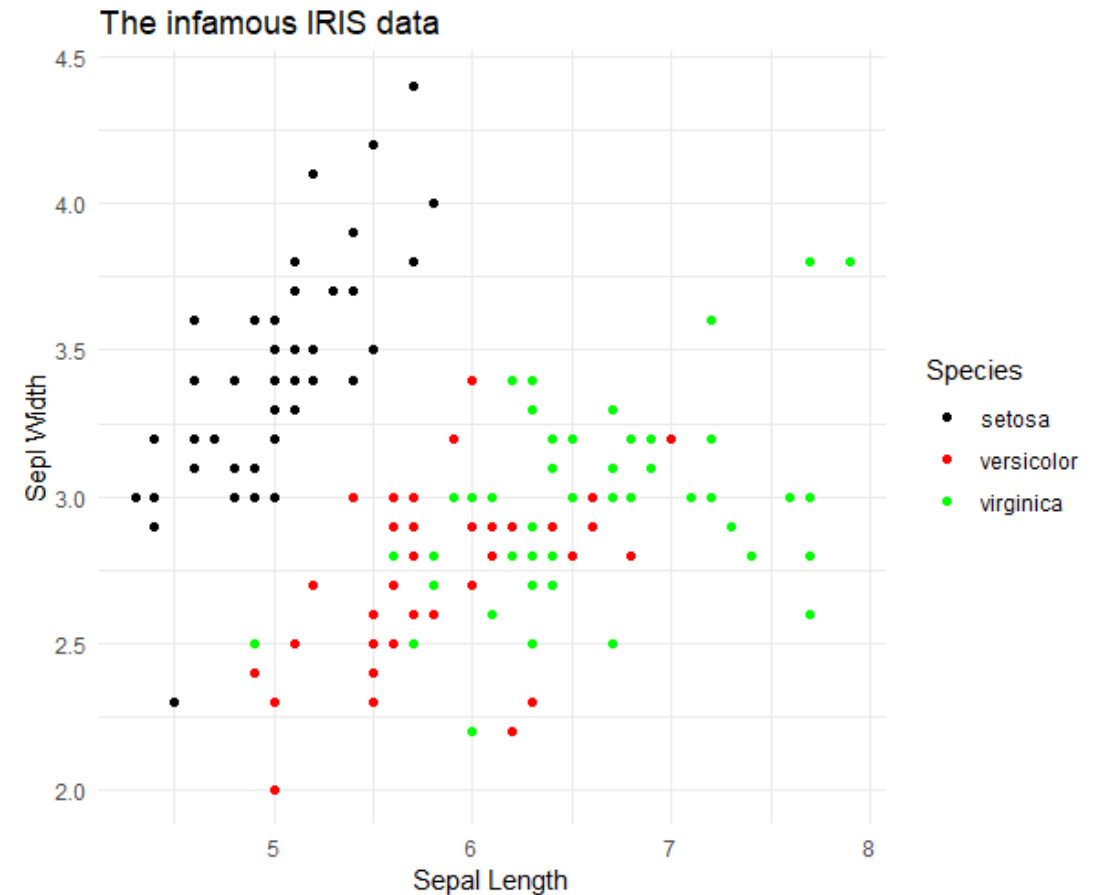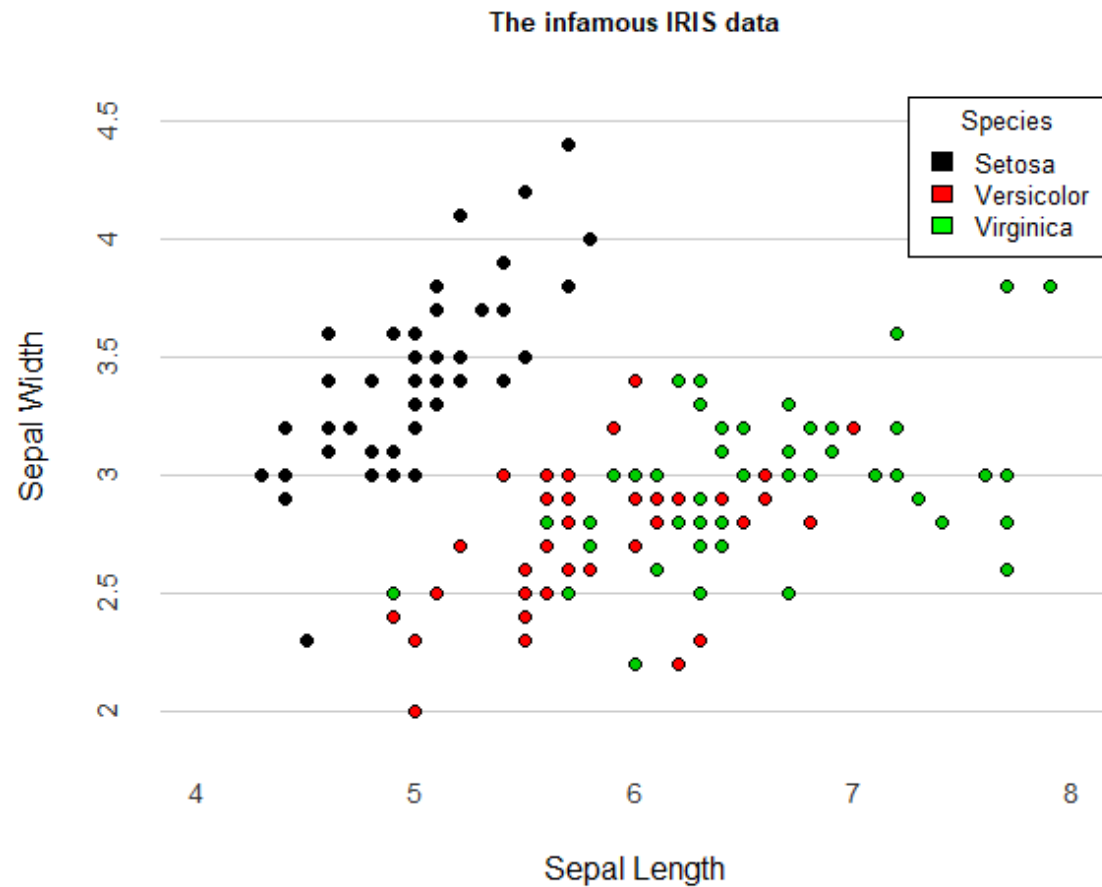
- Open the script 06_pm_graphics_example.R to see for yourself

C: Whistle-stop tour of ggplot2

```
Main features:
1. The data
2. The geoms
3. The mappings (x, y, colour, shape etc.)
4. Legends
5. Labels
6. Themes

and many many more


- Open the script 07_pm_ggplot2.R

- Open the script 08_pm_practise_plots.R
```

Where to next?

rstudio::conf 2019 Workshop materials now available

February 5, 2019

By Mine Çetinkaya-Rundel

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(This article was first published on **RStudio Blog**, and kindly contributed to R-bloggers)

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rstudio::conf 2019 featured 15 workshops on tidyverse, Shiny, R Markdown, modeling and machine learning, deep learning, big data, and what they forgot to teach you about working with R. Some of the new workshops for this year touched on topics like putting Shiny applications into production at scale and R