Import and Export Data with readr

Day 1 - Introduction to Data Analysis with R

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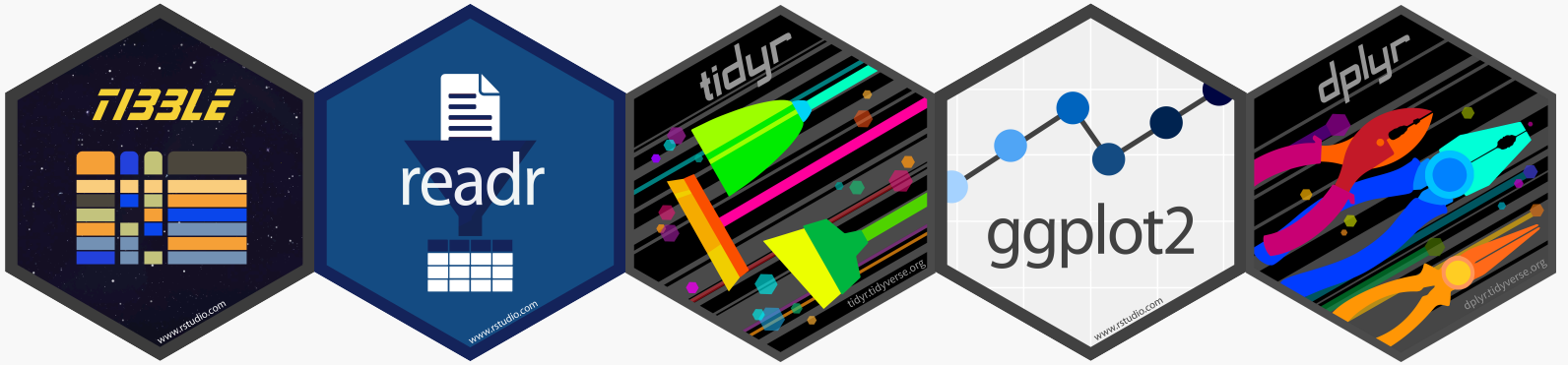
The tidyverse

The tidyverse

> The tidyverse is an opinonated **collection of R packages** designed for data science. All packages share an underlying design philosophy, grammar, and data structures.
>
> (www.tidyverse.org)

These are the main packages from the tidyverse that we will use:



Workflow data analysis

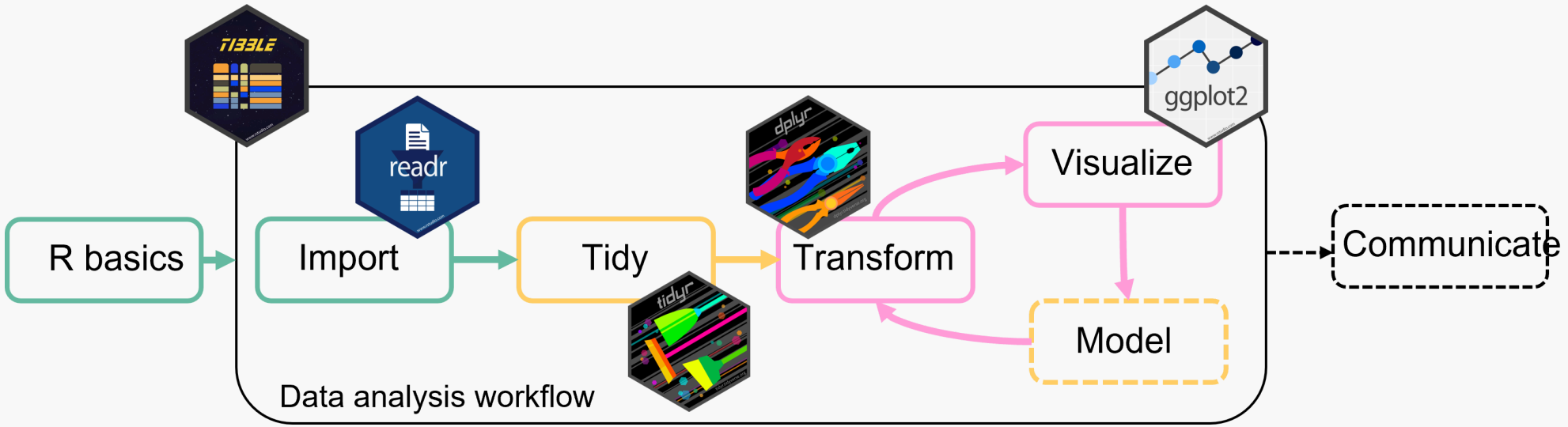


Image adapted from Wickham & Grolemund: R for Data Science

The tidyverse

Install the tidyverse once with:

```
install.packages("tidyverse")
```

Then load and attach the packages at the beginning of your script:

```
library(tidyverse)
```

You can also install and load the tidyverse packages individually, but since we will use so many of them together, it's easier to load and attach them together.

Import and export data with readr

Readr

`readr` is a tidyverse package. To use it, you can load the tidyverse:

```
library(tidyverse) # or library(readr)
```

The most important functions are:

- `read_csv`/`write_csv` to read/write **comma delimited** files
- `read_tsv`/`write_tsv` to read/write **tab delimited** files
- `read_delim`/`write_delim` to read/write files with **any delimiter**

Read files with `read_*()`

All `read_*` functions take a path to the data file as a first argument:

```
read_*(file = "path/to/your/file", …)
```

Import files with a `readr` function fitting the delimiter of your file:

```
dat <- read_csv("data/your_data.csv") # comma delimiter

dat <- read_tsv("data/your_data.txt") # tab delimiter
```

Use `read_delim` for a generic type of delimiter:

```
dat <- read_delim("data/your_data.csv", delim = ";") # semicolon delimiter

dat <- read_delim("data/your_data.txt", delim = "----") # ---- delimiter
```

All `read_*` functions return a `tibble`

Read files with `read_*()`

The read functions provide several options to modify the reading of data.

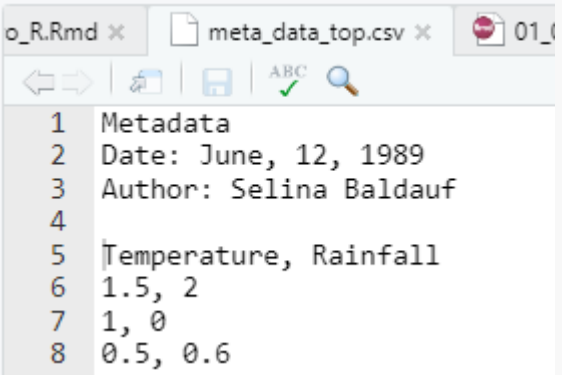
Have a look at `?read_delim` for all options.

Useful if your data is not a "perfect table"

Read files with `read_*()`

Specify number of lines to skip reading with `skip`

- Useful if you have metadata on top of the file




```
# without skipping first lines
read_csv(file = "data/meta_data_top.csv
```

```
#> # A tibble: 6 × 1
#>   Metadata
#>   <chr>
#> 1 Date: June, 12, 1989
#> 2 Author: Selina Baldauf
#> 3 Temperature, Rainfall
#> 4 1.5, 2
#> 5 1, 0
#> 6 0.5, 0.6
```

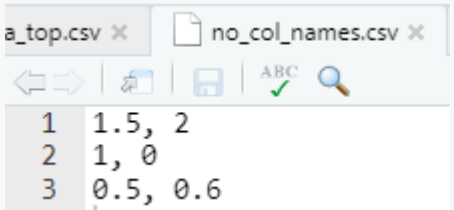
```
# skip meta data lines
read_csv(
  file = "data/meta_data_top.csv",
  skip = 4
)
```

```
#> # A tibble: 3 × 2
#>   Temperature Rainfall
#>         <dbl>    <dbl>
#> 1         1.5        2
#> 2         1          0
#> 3         0.5        0.6
```

Read files with `read_*()`

Specify whether the data has a header column or not with `col_names`

- Useful if you don't have column names or you want to change them




```
# First line expected to be column name
read_csv(file = "data/no_col_names.csv"
```

```
#> # A tibble: 2 × 2
#>   `1.5`   `2`
#>   <dbl> <dbl>
#> 1   1     0
#> 2   0.5   0.6
```

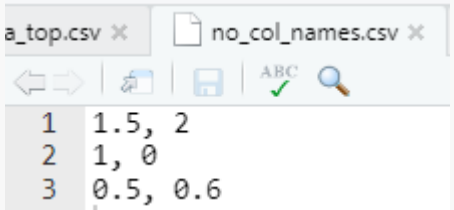
```
# Default column names are given
read_csv(
  file = "data/no_col_names.csv",
  col_names = FALSE
)
```

```
#> # A tibble: 3 × 2
#>      X1    X2
#>   <dbl> <dbl>
#> 1   1.5   2
#> 2   1     0
#> 3   0.5   0.6
```

Read files with `read_*()`

Specify whether the data has a header column or not with `col_names`

- Useful if you don't have column names or you want to change them




```
# First line expected to be column name
read_csv(file = "data/no_col_names.csv"
```

```
#> # A tibble: 2 × 2
#>   `1.5`   `2`
#>   <dbl> <dbl>
#> 1   1     0
#> 2   0.5   0.6
```

```
# Specify custom column names
read_csv(
  file = "data/no_col_names.csv",
  col_names = c("Temperature", "Rainfal
)
```

```
#> # A tibble: 3 × 2
#>   Temperature Rainfall
#>         <dbl>    <dbl>
#> 1         1.5      2
#> 2         1        0
#> 3         0.5      0.6
```

Write files with `write_*()`

Every `read_*` has a corresponding `write_*` function to export data from R.

Write data from R e.g.

- To share transformed or summarized data
- Summarize complex raw data and continue working with summarized data
- ...

Write files with `write_*()`

All `write_*` functions take the data to write as the first and the file to write to as the second argument:

```
write_*(x = dat, file = "path/to/save/file.*", …)
```

```
write_csv(dat, file = "data-clean/your_data.csv") # comma delimiter

write_tsv(dat, file = "data-clean/your_data.txt") # tab delimiter
```

Use `write_delim` for a generic type of delimiter:

```
write_delim(dat, file = "data-clean/your_data.csv", delim = ";") # semicolon deli

write_delim(dat, file = "data-clean/your_data.txt", delim = "----") # ---- delimi
```

Import excel files

Readxl

The `readxl` package is part of the tidyverse, but you need to load it explicitly

```
library(readxl)
```

Use the `read_excel` function to read an excel file:

```
dat <- read_excel(path = "data/your_data.xlsx")
```

By default, this reads the first sheet. You can read other sheets with

```
dat <- read_excel(path = "data/your_data.xlsx", sheet = "sheetName") # via sheet
dat <- read_excel(path = "data/your_data.xlsx", sheet = 2) # via sheet number
```

- `read_excel` also has other functionality, like skipping rows etc.
- Check out `?read_excel` and the package documentation for more functionality

Readxl

A little warning:

- Reading from a text file (.txt or .csv) is more reliable
- Be careful with complicated excel sheets with formulas etc.
- Always double check the data that you imported, e.g. by using the `summary` function and checking if the number of rows etc. is correct

Absolute vs. relative paths in R

Absolute paths

`C:/Users/Selina/folder1/folder2/data/file_to_read.csv`

Relative paths

`data/file_to_read.csv`

- Relative paths are interpreted relative to the **working directory**
- Check out where your working directory is with `getwd()`
- In RStudio projects, the **working directory is always the project root**

Absolute vs. relative paths

Working with R and RStudio, the best way is to:

- **Organize your work in an RStudio project**
  - The project root is automatically the working directory
  - All your files (also your data) are in one place
- **Use paths relative to the project root**

Why?

- No need to change the working directory
- Portable paths: will also work on other machines that copied the project
- Makes the code more readable
- Less error prone

Guidelines for data sets in 

Data format

Follow these guidelines to make data import to R easier and less frustrating

- In general: prefer machine-readable file formats (`.csv`, `.txt` instead of `.xlsx`)

Save an Excel spreadsheet as csv

1. **File -> Save As** and select comma separated from the drop down menu
2. **File -> Export**

Data format

Follow these guidelines to make data import to R easier and less frustrating

- In general: prefer machine-readable file formats (`.csv`, `.txt` instead of `.xlsx`)
- No white space in column headers
  - Use a character as separator, e.g. `species_name` instead of `species name`
  - If this is unpractical, have a look at the function `janitor::clean_names()` from the `janitor` package
- No special characters in column headers (ä,, ß, é, ê, %, °C, µ ...)
- Use `.` as a decimal separator (not `,`)

Paths and file names

- Avoid white space in paths and file names
  - `data-raw/my_data.csv` instead of `data raw/my data.csv`
- Avoid special characters in paths

Now you

Task (20 min)

Read and write data files

Find the task description here