R for Data Science

Using the *tidyverse*

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Workshop material: bit.ly/comos-r

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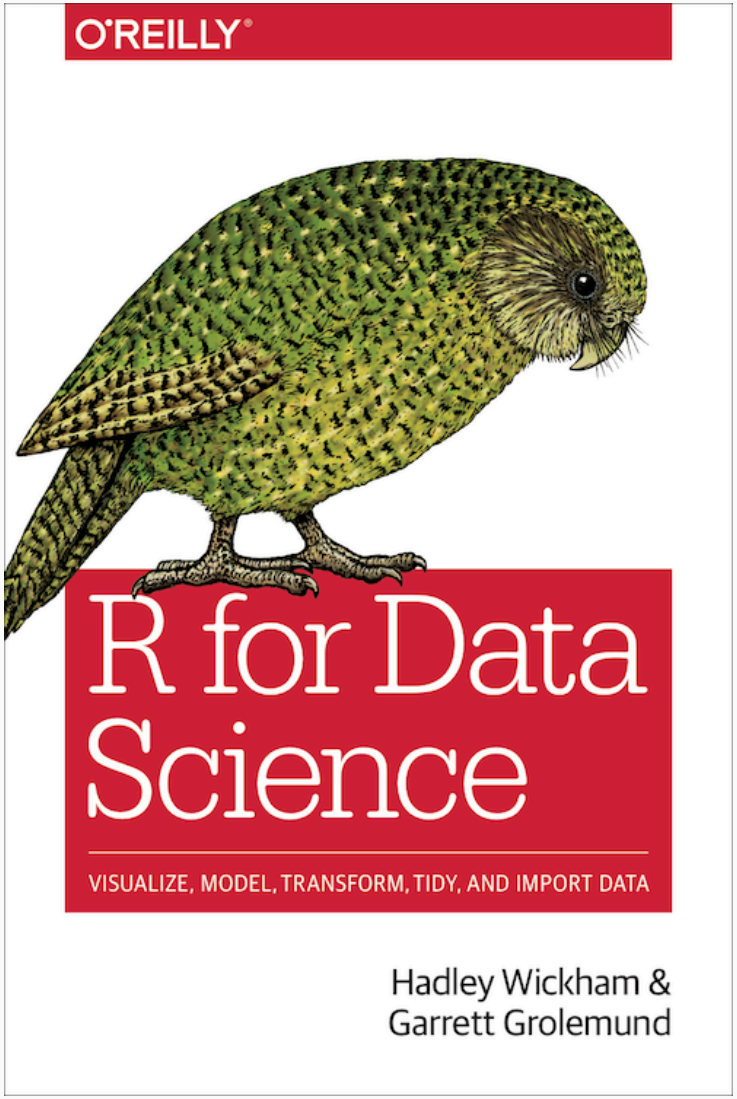
References

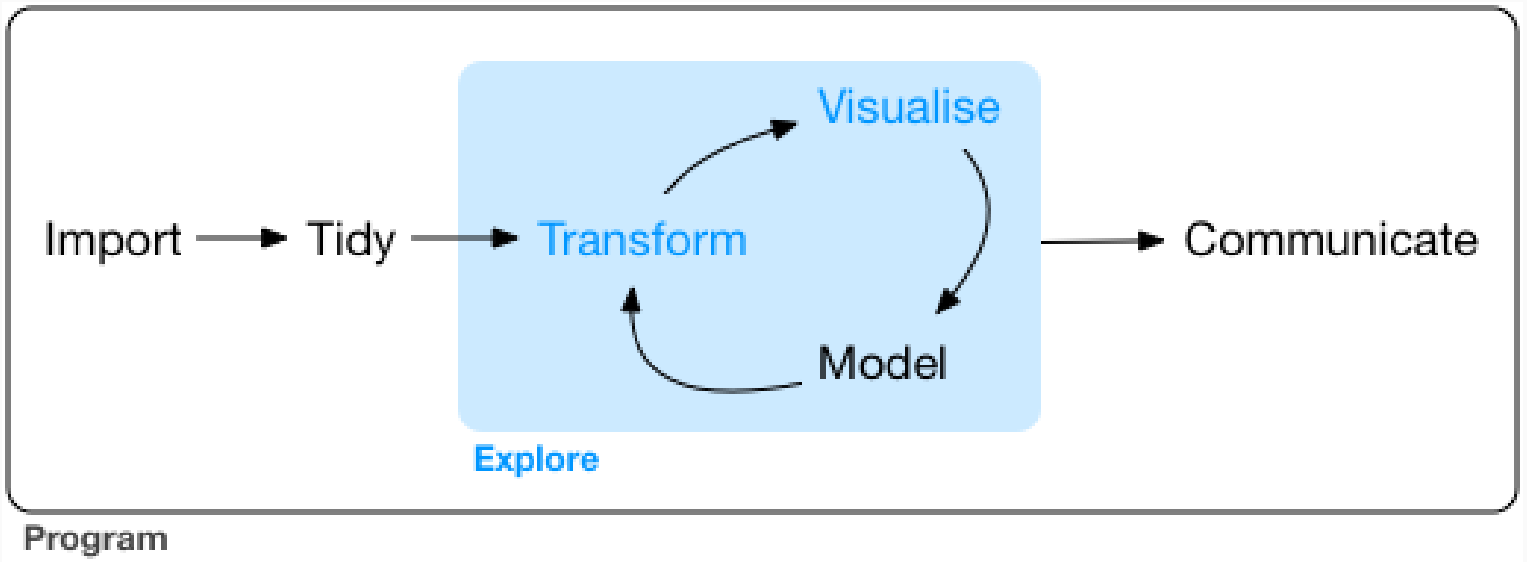


- Workshop material: bit.ly/comos-r
- RStudio *Cheat sheets* rstudio.com/resources/cheatsheets/
- Book *R for Data Science* (Garrett Grolemund, Hadley Wickham):
  - Online version: http://r4ds.had.co.nz/
  - Paperback: *R for Data Science: Import, Tidy, Transform, Visualize, and Model Data*, O'Reilly Media, 2017.

Workshop outline

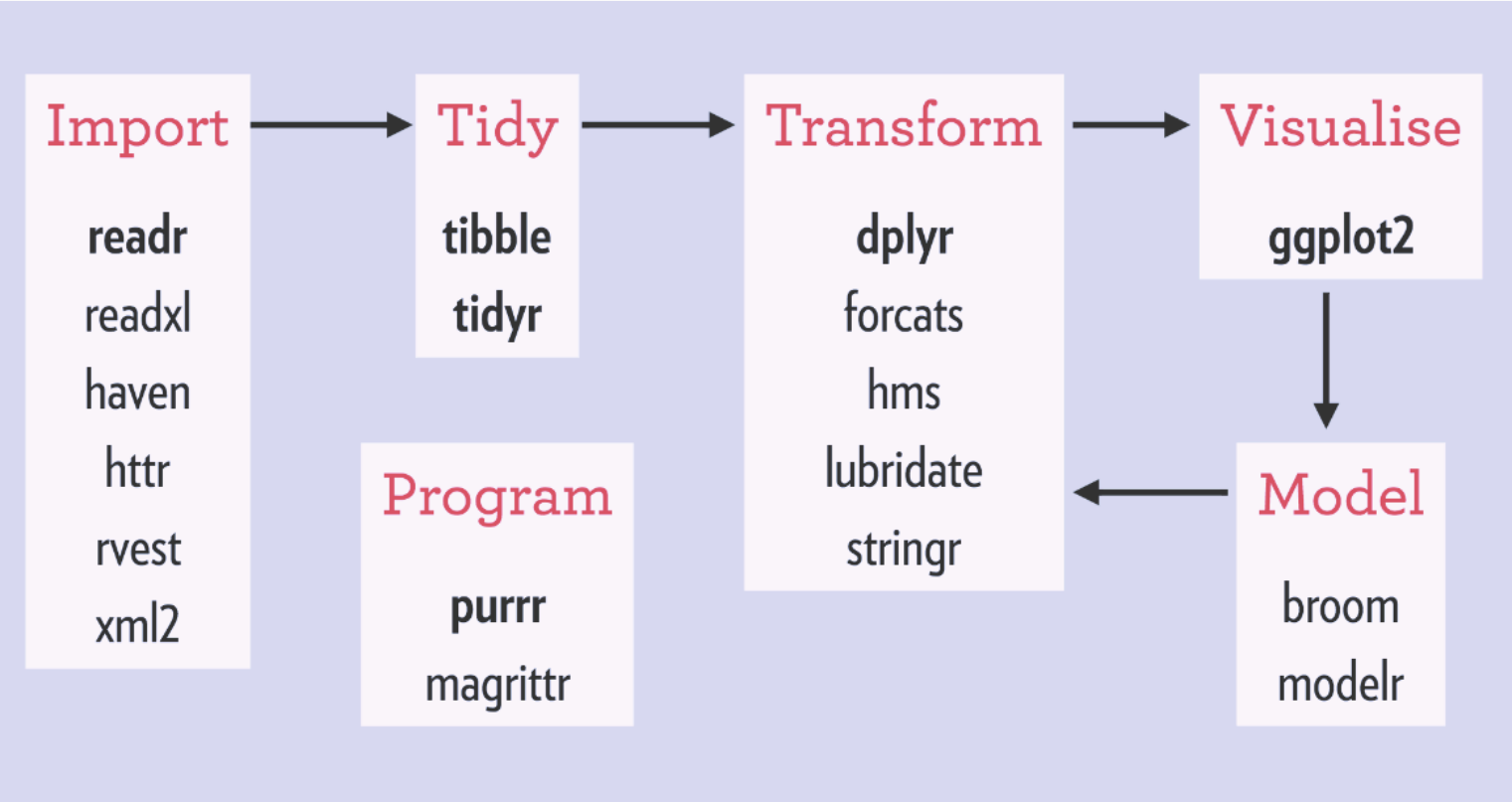
- Today:
  - Overview of Data Science workflow
  - *tidyverse* fundamentals
  - Data transformation with *dplyr*
  - Merging datasets with *join* operations
  - Data input strategies with *readr*
- Tomorrow:
  - Handling categorical variables with *forcats*
  - Data tidying with *tidyr*
  - String manipulation with *stringr*
  - Functional programming with *purrr*
- Friday:
  - Data visualization with *ggplot2*
  - Model estimation and selection with *broom*
  - Web scraping with *rvest*
  - ? More dataviz? (maps)

The Data Science Workflow



Credit *R for Data Science*

The Tidyverse Ecosystem



credit Joseph Rickert

Tidyverse philosophy

The tidyverse is organised around a few principles:

- **Tidy data**: each variable is a column, each observation is a row, and each type of observational unit is a table (see article by Hadley on JSS);
- **Code readability**: consistent, expressive syntax;
- **Functional programming**: functions applied to all elements of objects (no iterators); pass data along function pipeline %>%;
- **Compatibility**: classes and functions are mostly backward compatible with "Base R".

Tidyverse Philosophy

Key differences with "Base R"

- `tibble` replaces `data.frame` class for rectangular datasets:
  - better preview printing;
  - "lazy and surly": less type coercion (strings not converted to factors); doesn't change variable names;
  - doesn't use `row.names`
- style: function names are in `snake_case`
  e.g.: `read_csv()` instead of `read.csv()`
- data is first argument of functions.

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Pseudocode: baking pipeline

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ingredients %>%                {flour, water, eggs}
  blend() %>%                  batter
  cook() %>%                   whole cake
  slice()                      slice of cake
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If a function `h(x,y)` has more than one argument (or data is not the first argument), `.` is an explicit placeholder: `y %>% h(x, .)` ≡ `h(x, y)`.

Data manipulation with *dplyr*

In the tidyverse, *dplyr* provides a grammar of data manipulation, with consistent set of verbs that help you solve the most common data manipulation challenges:

- `mutate()` adds new variables that are functions of existing variables

These all combine naturally with `group_by()` which allows to perform any operation by groups of values.

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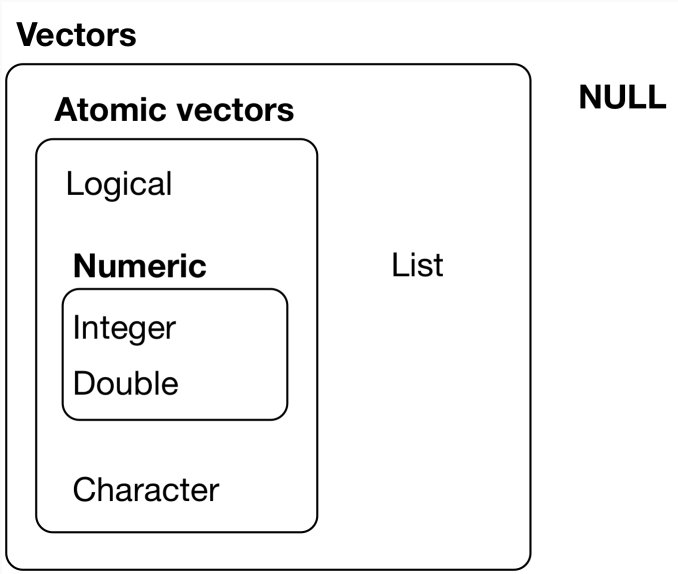
Data structure

Vectors are the fundamental object class in R.



There are two types of vectors:

1. **Atomic vectors** (homogeneous) of six types: *logical*, *integer*, *double*, *character*, *complex*, and *raw*. Integer and double vectors are collectively known as *numeric* vectors.
2. **Lists** (heterogeneous) which are sometimes called recursive vectors because lists can contain other lists.