(A bit of) Advanced R

Part 3 - a tour of the `tidyverse`

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https://github.com/jchiquet/CourseAdvancedR

Université Paris Dauphine, Juin 2018

Outline

1. Introduction to tidy data and tidyverse

2. magrittr

3. tidyr

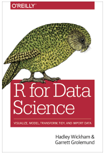
4. dplyr

5. tibble

References

Many ideas/examples inspired/stolen there:

R for data science (Wickham & Grolemund, 2016), http://r4ds.had.co.nz



Tidyverse website, https://www.tidyverse.org/

Prerequisites

Data Structures in base R

1. Atomic vector (integer, double, logical, character)
2. Recursive vector (list)
3. Factor
4. Matrix and array
5. Data Frame

R base programming

1. Control Statements
2. Functions
3. Functionals
4. Input/output
5. Rstudio API (application programming interface)

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Tidy data: motivation

Collected data are (never) under a proper canonical format

> *"Happy families are all alike; every unhappy family is unhappy in its own way." – Leo Tolstoy*

> *"Tidy datasets are all alike, but every messy dataset is messy in its own way." – Hadley Wickham*[1]

[1] Rstudio's chief scientific advisor

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> *"Tidy datasets are all alike, but every messy dataset is messy in its own way." – Hadley Wickham*[1]

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Tidy data: what?

First, a subjective question

What is the *observation/statistical unit* in your data?

Definition

Tidy data is a standard way of mapping the meaning of a dataset to its structure. A dataset is messy or tidy depending on how rows, columns and tables are matched up with observations, variables and types.

In tidy data,

1. each variable forms a column,
2. each observation forms a row,
3. each type of observational unit forms a table.

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Tidy data: why?

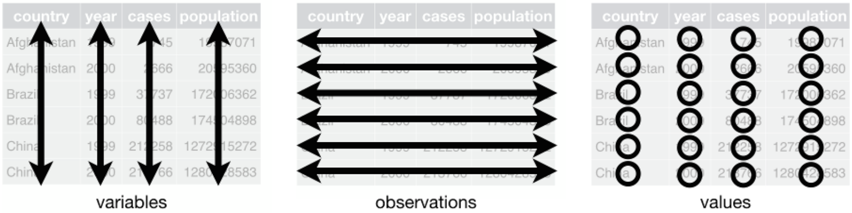

Figure 1: Tidy data

- make manipulation, visualization and modelling easier
- a common structure for all packages
- a philosophy for data representation (beyond the R framework)

Tidy or not ?

```r
tidyr::table3
```

```
## # A tibble: 6 x 3
##   country      year rate
## * <chr>       <int> <chr>
## 1 Afghanistan  1999 745/19987071
## 2 Afghanistan  2000 2666/20595360
## 3 Brazil       1999 37737/172006362
## 4 Brazil       2000 80488/174504898
## 5 China        1999 212258/1272915272
## 6 China        2000 213766/1280428583
```

Tidy or not ?

```r
tidyr::table2
```

```
## # A tibble: 12 x 4
##    country      year type            count
##    <chr>       <int> <chr>           <int>
##  1 Afghanistan  1999 cases             745
##  2 Afghanistan  1999 population   19987071
##  3 Afghanistan  2000 cases            2666
##  4 Afghanistan  2000 population   20595360
##  5 Brazil       1999 cases           37737
##  6 Brazil       1999 population  172006362
##  7 Brazil       2000 cases           80488
##  8 Brazil       2000 population  174504898
##  9 China        1999 cases          212258
## 10 China        1999 population 1272915272
## 11 China        2000 cases          213766
## 12 China        2000 population 1280428583
```

Tidy or not ?

```
tidyr::table1
```

```
## # A tibble: 6 x 4
##   country      year  cases population
##   <chr>       <int>  <int>      <int>
## 1 Afghanistan  1999    745   19987071
## 2 Afghanistan  2000   2666   20595360
## 3 Brazil       1999  37737  172006362
## 4 Brazil       2000  80488  174504898
## 5 China        1999 212258 1272915272
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```

The process of data analysis

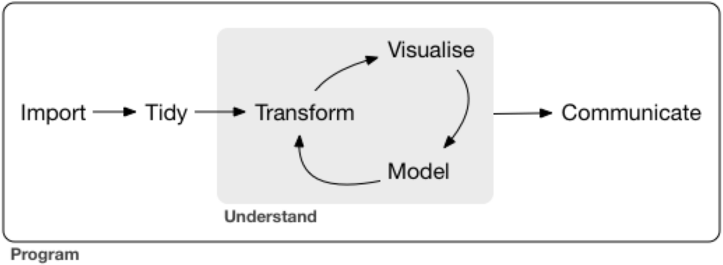

Figure 2: scheme for data analysis process

- **import:** read/load the data
- **tidy:** formating (individuals/variables data frame)
- **transform:** suppression/creation/filtering/selection
- **visualization:** representation and validation
- **model**: statistical fits
- **communication**: diffusion (web/talk/article)

The tidyverse

Definition

- contraction of ‘tidy’ (“well arranged) and ‘universe’.
- an *opinionated collection* of R packages designed for data science.
- all packages share an underlying *design philosophy*, *grammar*, and *data structures*

Phylosophy

> *allows the user to focus on the important statistical questions rather than focusing on the technical aspects of data analysis*

Let’s have a look

The core tidyverse loads ggplot2, tibble, tidyr, readr, purrr, stringr, forecats, dplyr and others in a fancy and unconflicted way.

```
library(tidyverse)
tidyverse:::tidyverse_conflicts()
```

```
## -- Conflicts ------------------------------------------------------------------------------
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
tidyverse:::tidyverse_deps()
```

```
## # A tibble: 25 x 4
##    package cran  local behind
##    <chr>   <chr> <chr> <lgl>
##  1 broom   0.4.4 0.4.3 TRUE
##  2 cli     1.0.0 1.0.0 FALSE
##  3 crayon  1.3.4 1.3.4 FALSE
##  4 dbplyr  1.2.1 1.2.1 FALSE
##  5 dplyr   0.7.5 0.7.4 TRUE
##  6 forcats 0.3.0 0.3.0 FALSE
##  7 ggplot2 2.2.1 2.2.1 FALSE
##  8 haven   1.1.1 1.1.1 FALSE
##  9 hms     0.4.2 0.4.2 FALSE
## 10 httr    1.3.1 1.3.1 FALSE
## # ... with 15 more rows
```

Packages roles and overview I

tibble

a modern re-imagining of the data frame

tidyr

a set of functions that help you get to tidy data

dplyr

a consistent set of verbs that solve the most common data manipulation challenges

Packages roles and overview II

readr

a fast and friendly way to read rectangular data (like csv, tsv, and fwf)

stringr

a cohesive set of functions designed to make working with strings as easy as possible

forcats

a suite of useful tools that solve common problems with factors

Packages roles and overview III

ggplot2

a system for declaratively creating graphics, based on The Grammar of Graphics

purrr

enhances R's functional programming (FP) toolkit

magrittr

offers a set of operators which make your code more readable

Data analysis with the tidyverse

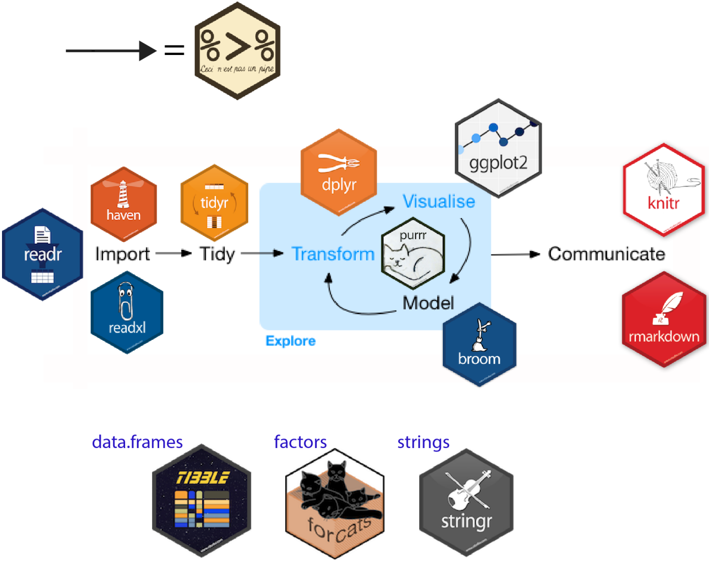

Figure 3: Updated scheme for data analysis process

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R Core Team. (2017). *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing. Retrieved from https://www.R-project.org/

Wickham, H. (2014). *Advanced r*. CRC Press. Retrieved from http://adv-r.had.co.nz/

Wickham, H., & Grolemund, G. (2016). *R for data science: Import, tidy, transform, visualize, and model data*. " O'Reilly Media, Inc." Retrieved from http://r4ds.had.co.nz