R-Courses Training: Day 02

Introduction to tidyverse

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Outline of today

1. Introduction to tidyverse
2. magrittr and the pipe!
3. Wrangling data with dplyr
4. Reshaping data with tidyr
5. Importing data with readr
6. Hands-on tutorial
    a. Interactively walk through RMarkdown (.Rmd) on RStudio Cloud

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

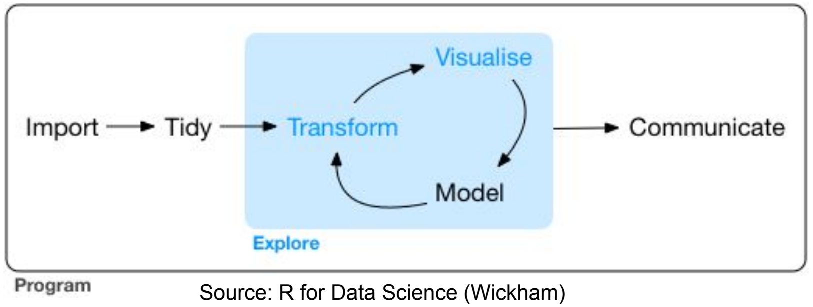
tidyverse

Abstractly: conversation between human and computer about data

Less abstractly: collection of R packages

- High-level design philosophy
- Low-level grammar and data structures

Application programming interface (API) that is at heart of every data science project.



Source: R for Data Science (Wickham)

What comes with the tidyverse?

dplyr, tidyr, readr, purrr, tibble

```
install.packages("tidyverse")

# is equivalent to

install.packages("ggplot2")
install.packages("dplyr")
install.packages("tidyr")
install.packages("readr")
install.packages("purrr")
install.packages("tibble")
```

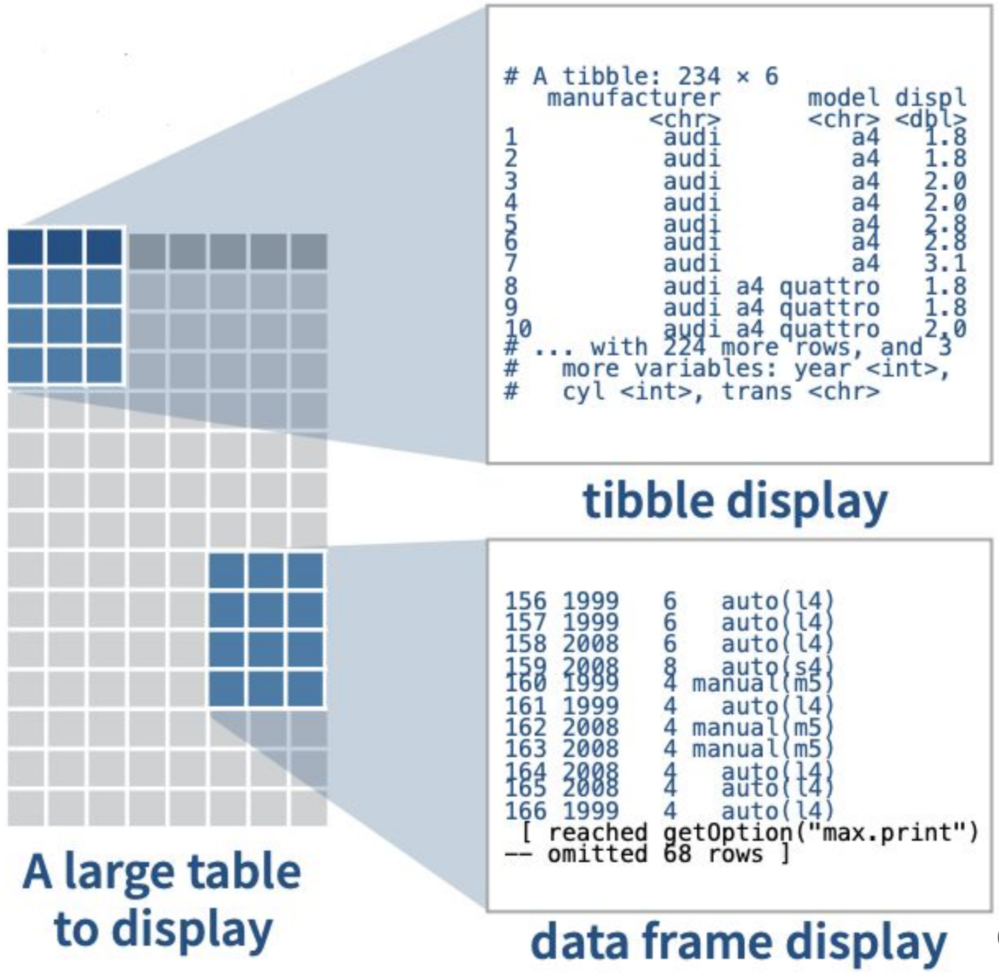
```
library(tidyverse)

# is equivalent to

library(ggplot2)
library(dplyr)
library(tidyr)
library(readr)
library(purrr)
library(tibble)
```

tibbles

The **tibble** R package that provides an “enhanced” data frame for storing and printing tabular data.

View full dataset

- **View()**
- **glimpse()**



```
# A tibble: 234 × 6
  manufacturer      model displ
         <chr>      <chr> <dbl>
1         audi         a4   1.8
2         audi         a4   1.8
3         audi         a4   2.0
4         audi         a4   2.0
5         audi         a4   2.8
6         audi         a4   2.8
7         audi         a4   3.1
8         audi a4 quattro   1.8
9         audi a4 quattro   1.8
10        audi a4 quattro   2.0
# ... with 224 more rows, and 3
#   more variables: year <int>,
#   cyl <int>, trans <chr>
```

```
156 1999   6    auto(l4)
157 1999   6    auto(l4)
158 2008   6    auto(l4)
159 2008   8    auto(s4)
160 1999   4  manual(m5)
161 1999   4    auto(l4)
162 2008   4  manual(m5)
163 2008   4  manual(m5)
164 2008   4    auto(l4)
165 2008   4    auto(l4)
166 1999   4    auto(l4)
 [ reached getOption("max.print")
-- omitted 68 rows ]
```

Create sample data with tibble

Construct a tibble in two ways:

tibble(...) -- construct by columns

```
tibble(x=1:3, y=c("a","b","c"))
```

tribble(...) -- construct by rows

```
tribble(~x, ~y,
        1, "a",
        2, "b",
        3, "c")
```

as_tibble(x, …)
convert data.frame to tibble

enframe(x, name=”name”, value=”value)
convert named vector to a tibble

is_tibble(x)
test whether x is a tibble

Example dataset

Datasets

Two datasets:

1. `data(who)` - World Health Organization Tuberculosis (TB) Report 1960-2013
   a. data.frame with 7240 rows and columns
      i. country - country name
      ii. iso2, iso3 - ISO country codes, 2 letter and 3 letter abbreviation
      iii. year - year
      iv. new_sp_m014-new_relf65 - counts of new TB cases recorded by group
         1. column names encode three variables that describe the group
            a. Details available here
2. `data(populations)` - Accompanying Global Populations
   a. country - country name
   b. year - year
   c. population - nominal value of population

%>%
Ceci n'est pas un pipe.
www.tidyverse.org

magrittr and the pipe!

The pipe operator `%>%` offers to make your code more readable

- structure data operations from left-to-right (as opposed to inside-out)
- avoid nested function calls
- minimize need for local variables and functions
- easy to add/remove steps in sequence of operations

1929 Painting by René Magritte

Pipe basic usage

Basic usage:
`x %>% f` is equivalent to `f(x)`
`x %>% f(y)` is equivalent to `f(x, y)`
`x %>% f %>% g %>% h` is equivalent to `h(g(f(x)))`

“Equivalent” is technically not exact, evaluation is non-standard, and left-hand side is evaluated before right-hand side of expression.

The argument placeholder
`x %>% f(y, .)` is equivalent to `f(y,x)`
`x %>% f(y, z = .)` is equivalent to `f(y, z = x)`

Pipes example

tidyverse syntax with magrittr pipes

```
> iris %>%                              ← data
    filter(Species=="virginica") %>%    ← function(argument)
    head()                              ← function(no argument)
  Sepal.Length Sepal.Width Petal.Length Petal.Width   Species
1          6.3         3.3          6.0         2.5 virginica
2          5.8         2.7          5.1         1.9 virginica
3          7.1         3.0          5.9         2.1 virginica
4          6.3         2.9          5.6         1.8 virginica
5          6.5         3.0          5.8         2.2 virginica
6          7.6         3.0          6.6         2.1 virginica
```

nested base R syntax

```
> head(filter(iris, Species=="virginica"))
```

```r
install.packages("dplyr")
library(dplyr)
```

Data transformation with dplyr

dplyr (https://dplyr.tidyverse.org/)

Grammar for data wrangling; consistent set of verbs to help solve most common problems

Key functions:

- Isolate/extract/manipulate data
- Group and summarize cases
- Combine tables (joins)

```r
install.packages("tidyr")
library(tidyr)
```

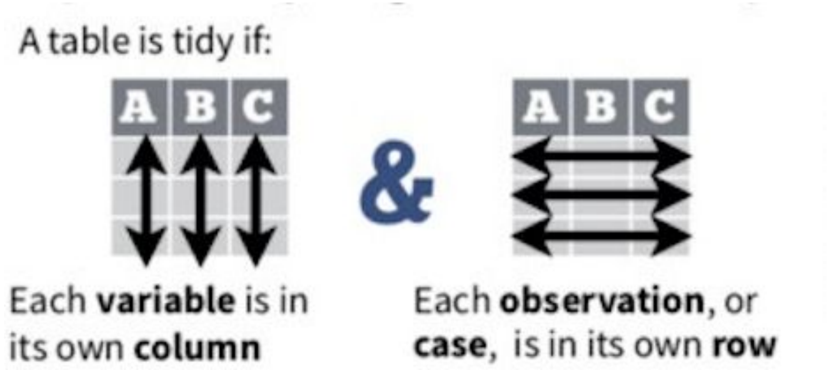
Tidy data with tidyr

tidyr (tidyr.tidyverse.org)

1. Every column is variable.
2. Every row is an observation.
3. Every cell is a single value

Key package features:

- Reshape data
- Split cells
- Handle missing values
- Expand tables


A table is tidy if:
A B C
&
A B C
Each **variable** is in its own **column**
Each **observation**, or **case**, is in its own **row**

readr

www.rstudio.com

```r
install.packages("readr")
library(readr)
```

Reading tabular and non-tabular data

The goal of readr is provide a fast and friendly way to read rectangular data. It was designed to be flexible and parse many types of data found in the wild

Key features:

- It has seven different `read_` functions
- Can declare explicit column data types.
- Has ways to read files line by line or chunks

Other types of data

Try one of the following packages:

- haven - SAS, SPSS, Stata files
- readxl - MS excel files (.xlsx and .xls)
- DBI - databases (SQL, Postgres)
- jsonlite - json files
- xml2 - XML files
- httr - connect with web API and curl commands
- rvest - for scraping HTML (Web scraping)

Now time for
hands on tutorial!