University of Antwerp

ico

ICO Workshop R & RStudio

Part 3

Data manipulation with `dplyr`

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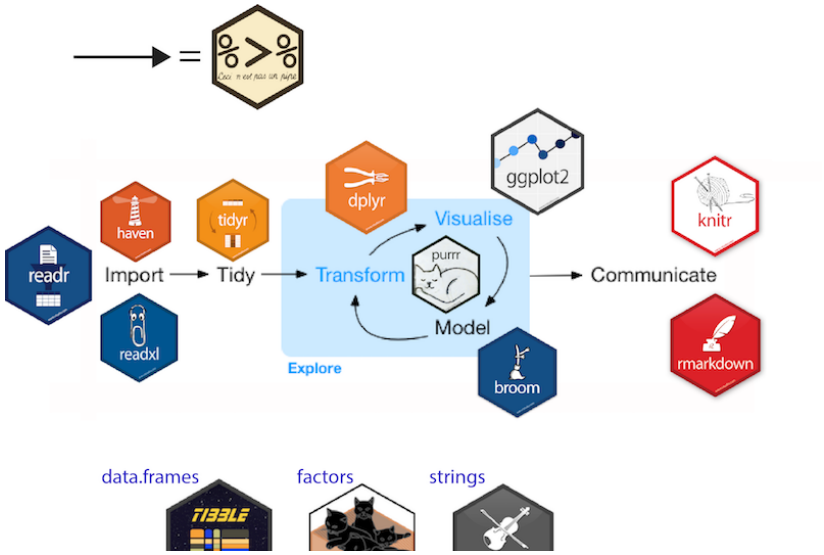
Overview

- Tidyverse --- (Click here)
- The `dplyr` package --- (Cliick here)

1. Tidyverse

Welcom in the `tidyverse`



Why `tidyverse`?

- more accessible for beginners
- consistent approach for all potential tasks
- powerful potential applications mith minimum 'effort'
- can give confidence to explore `R`

Tibble

Normally we work with a dataframe in `R` but we can have very complex data-structures as well (e.g., lists, matrices, ...)

In the `tidyverse` ecosystem we work with a simple form of data-structure: a `tibble`

A tibble is a dataframe that fits the **tidy data** principle

```
Friends
```

```
## # A tibble: 108 × 4
##    student occassion condition fluency
##      <dbl>     <dbl>     <dbl>   <dbl>
##  1       1         1         1   101.
##  2       1         2         1   104.
##  3       1         3         1   117.
##  4       2         1         2    98.8
##  5       2         2         2   107.
##  6       2         3         2   111.
##  7       3         1         3   105.
##  8       3         2         3   102.
##  9       3         3         3   101.
## 10       4         1         1   102.
## # … with 98 more rows
```

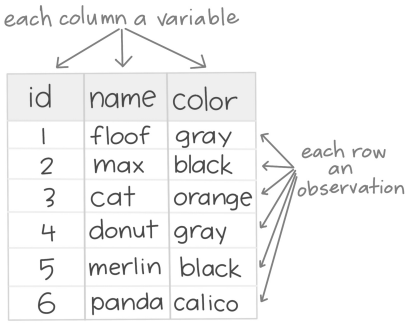
What is **tidy data**?

"TIDY DATA is a standard way of mapping the meaning of a dataset to its structure."

–HADLEY WICKHAM

In tidy data:

- each variable forms a column
- each observation forms a row
- each cell is a single measurement



Wickham, H. (2014). Tidy Data. Journal of Statistical Software 59 (10). DOI: 10.18637/jss.v059.i10

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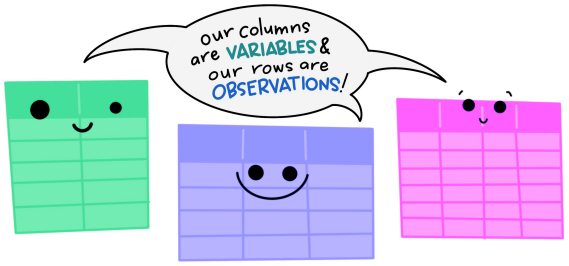
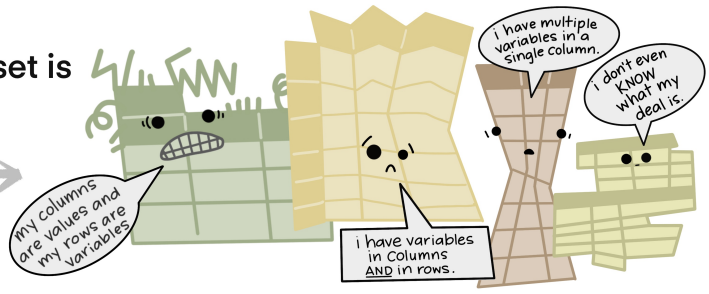
What is **tidy data**?

The standard structure of tidy data means that "tidy datasets are all alike..."



"...but every messy dataset is messy in its own way."

–HADLEY WICKHAM



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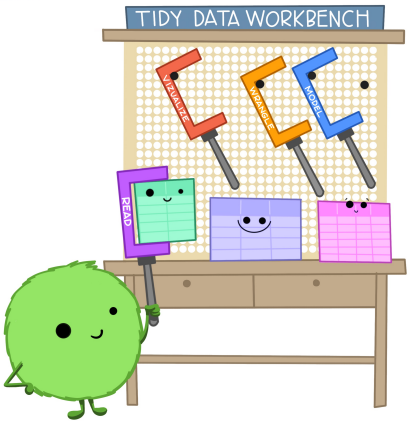
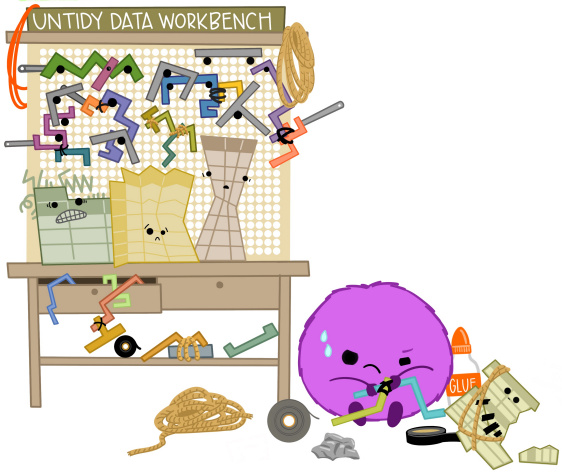
What is **tidy data**?

When working with tidy data, we can use the same tools in similar ways for different datasets...



...but working with untidy data often means reinventing the wheel with one-time approaches that are hard to iterate or reuse.



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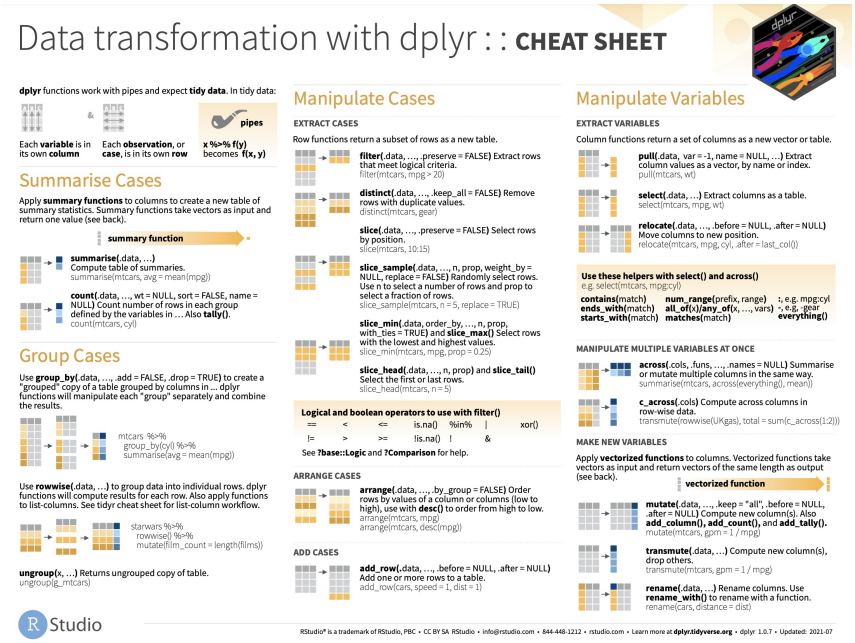
2. The `dplyr` package

`dplyr` ...

is THE package to work with tidy data !

VERBS are at the core:

- `filter()`
- `mutate()`
- `select()`
- `group_by() + summarise()`
- `arrange()`
- `rename()`
- `relocate()`
- `join()`



https://raw.githubusercontent.com/rstudio/cheatsheets/master/data-transformation.pdf

The %>% operator (a 'pipe')

To create
a chain of functions

Instead of

```
mean(c(1,2,3,4))
```

or

```
Numbers <- c(1,2,3,4)
mean(Numbers)
```

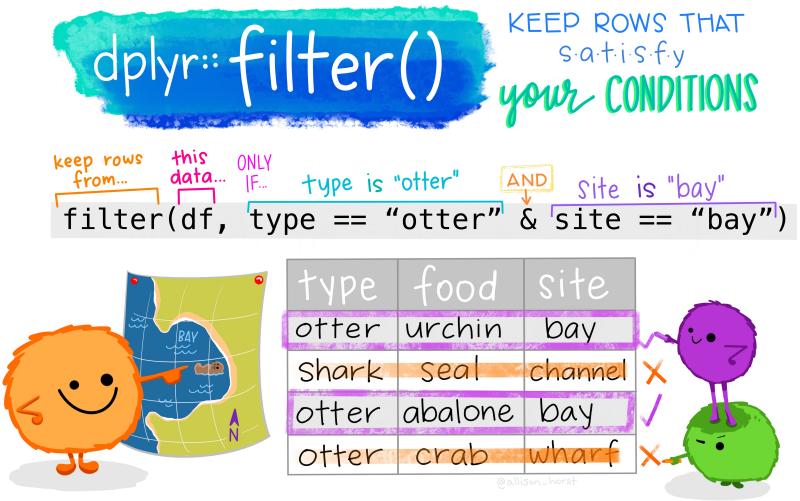
you can do

```
c(1,2,3,4) %>%
  mean( )
```

With the %>% you can write a sentence like:

> *I %>% woke up %>%, took a shower %>%, got breakfast %>%, took the train %>% and arrived at the ICO course %>% …*

filter()



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Let's apply `filter()`

With the FRIENDS data:

> *We only select observations from the first measurement occassion in condition 1*

```
Friends_Occ1 <- Friends %>%
  filter(occassion == 1 & condition == 1)
```

`==` is *equals* (notice the 2 = signs!)

> *Let's clean some data, and only keep observations with fluency values lower than 300 and that do not equal 0*

```
Friends_clean <- Friends %>%
  filter(fluency < 300 & fluency != 0)
```

`!=` means *not equal to*

`mutate()`

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Let's apply `mutate()`

With the Friends data:

> *We calculate a new variable containing the fluency scores minus the average of fluency*

```
Friends <- Friends %>%
  mutate(
    fluency_centered = fluency - mean(fluency, na.rm = T)
    )
```


Let's apply `mutate()`

With the Friends data:

> *We create a factor for condition*

```
Friends <- Friends %>%
  mutate(
    condition_factor = as.factor(condition)
  )

str(Friends$condition_factor)
```

```
##  Factor w/ 3 levels "1","2","3": 1 1 1 2 2 2 3 3 3 1 ...
```

Let's apply `select()`

To select variables.

Some examples with the Friends data:

> *We only select `condition` and `occasion` and inspect the result with the `str()` function*

```
Friends %>%
  select(
    condition, occassion
  ) %>%
  str()
```

```
## tibble [108 × 2] (S3: tbl_df/tbl/data.frame)
##  $ condition: num [1:108] 1 1 1 2 2 2 3 3 3 1 ...
##   ..- attr(*, "value.labels")= Named chr [1:3] "3" "2" "1"
##   .. ..- attr(*, "names")= chr [1:3] "No subtitles" "Spanish" "English"
##  $ occassion: num [1:108] 1 2 3 1 2 3 1 2 3 1 ...
##  - attr(*, "variable.labels")= Named chr(0)
##   ..- attr(*, "names")= chr(0)
##  - attr(*, "codepage")= int 1252
```


Rename variables with `rename()`

Notice how the variable `occassion` is misspelled! Pretty enoying when coding... But we can easily rename variables.

Function `rename(new_name = old_name)`

> *Rename the variable `occassion` to `occasion`*

```
Friends <- Friends %>%
  rename(
    occasion = occassion
  )
```

Super combo 1: `group_by() + summarize( )`

- transform a tibble to a *grouped tibble* making use of `group_by()`
- calculate summary stats per group making use of `summarize()`

> *Calculate the average fluency and standard deviation per condition*

```
Friends %>%
  group_by(
    condition
  ) %>%
  summarize(
    mean_fluency = mean(fluency),
    sd_fluency   = sd(fluency)
  )
```

```
## # A tibble: 3 × 3
##   condition mean_fluency sd_fluency
##       <dbl>        <dbl>      <dbl>
## 1         1         109.       9.08
## 2         2         108.       6.02
## 3         3         103.       4.17
```


Super combo 1: `group_by() + summarize( )`

> *Calculate the number of observations for each combination of condition and occasion*

```
Friends %>%
  group_by(
    occasion, condition
  ) %>%
  summarize(
    n_observations  = n()
  )
```

```
## # A tibble: 9 × 3
## # Groups:   occasion [3]
##   occasion condition n_observations
##      <dbl>     <dbl>          <int>
## 1        1         1             12
## 2        1         2             12
## 3        1         3             12
## 4        2         1             12
## 5        2         2             12
## 6        2         3             12
## 7        3         1             12
## 8        3         2             12
## 9        3         3             12
```

Super combo 2: `mutate() + case_when( )`

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Super combo 2: `mutate() + case_when( )`

To recode variables into new variables!

> *We create a new categorical variant of fluency with 3 groups, then we select this new variable and have a look to the top 5 observations...*

```
Friends %>%
  mutate(
    fluency_grouped = case_when(
      fluency < 106.625 - 7.1 ~ 'low',
      fluency >= 106.625 - 7.1 & fluency < 106.625 + 7.1 ~ 'aver
      fluency >= 106.625 + 7.1 ~ 'high'
    )
  ) %>%
  select(
    fluency,
    fluency_grouped
    ) %>%
  head(5)
```

```
## # A tibble: 5 × 2
##   fluency fluency_grouped
##     <dbl> <chr>
## 1   101.  average
## 2   104.  average
## 3   117.  high
## 4    98.8 low
## 5   107.  average
```

How to define conditions

- `x == y` → 'x is equal to y'
- `x != y` → 'x is NOT equal to y'
- `x < y` → 'x is smaller than y'
- `x <= y` → 'x is smaller or equal to y'
- `x > y` → 'x is higher than y'
- `x >= y` → 'x is higher or equal to y'

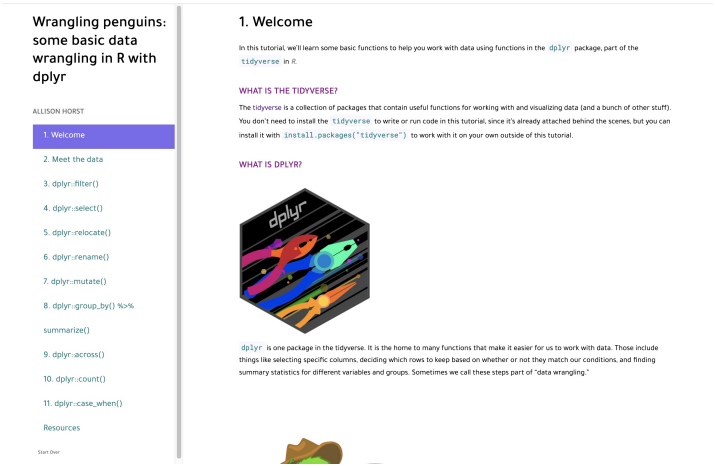
Bolean operators

We can combine conditions!

- `&` → 'and' → example: `gender == 1 & age <=18`
- `|` → 'or' → example: `gender == 1 | gender == 2`
- `!` → 'not' → example: `gender == 1 & !age <=18`

Interactive tutorial about `dplyr()`

If you want some more material and a place to exercise your skills? This online and freetutorial (made with the package `learnr`) is strongly advised!



https://allisonhorst.shinyapps.io/dplyr-learnr/#section-welcome

Exercise `dplyr`

- You can find the qmd-file `Exercises_dplyr.qmd` on the Open Science Framework (Exercises > Exercise2_dplyr)
- Open this document in an R project for the Exercises folder
- You get a set of tasks with empty code blocks to start coding
- Write and test the necessary code
- Stuck? No Worries!
  - We are there
  - Help each other
  - There is a solution key (`Exercises_dplyr_solutions.qmd`)