2. Manipulate

R^3 training
noaa-iea.github.io/r3-train

Ben Best
2021-06-21

1. Collaborate Recap

- Good job!
  - github.com/noaa-iea/r3-train/**pulls**
    - Open source project example: icons/pull/58
  - github.com/noaa-iea/r3-train/**issues**
  - Merge pull request with Github Desktop; + resolve file conflicts with Atom
- ToDo for me:
  - Respond to notes | r3-train - Google Docs
  - Google Group
  - + Feedback menu
  - Github Discussions

2. Manipulate

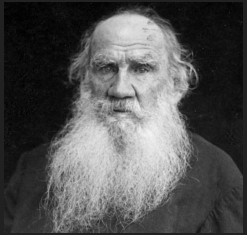
For Big-Data Scientists, ‘Janitor Work’ Is Key Hurdle to Insights

nytimes.com/2014/08/18/technology/for-big-data-scientists-hurdle-to-insights-is-janitor-work.html

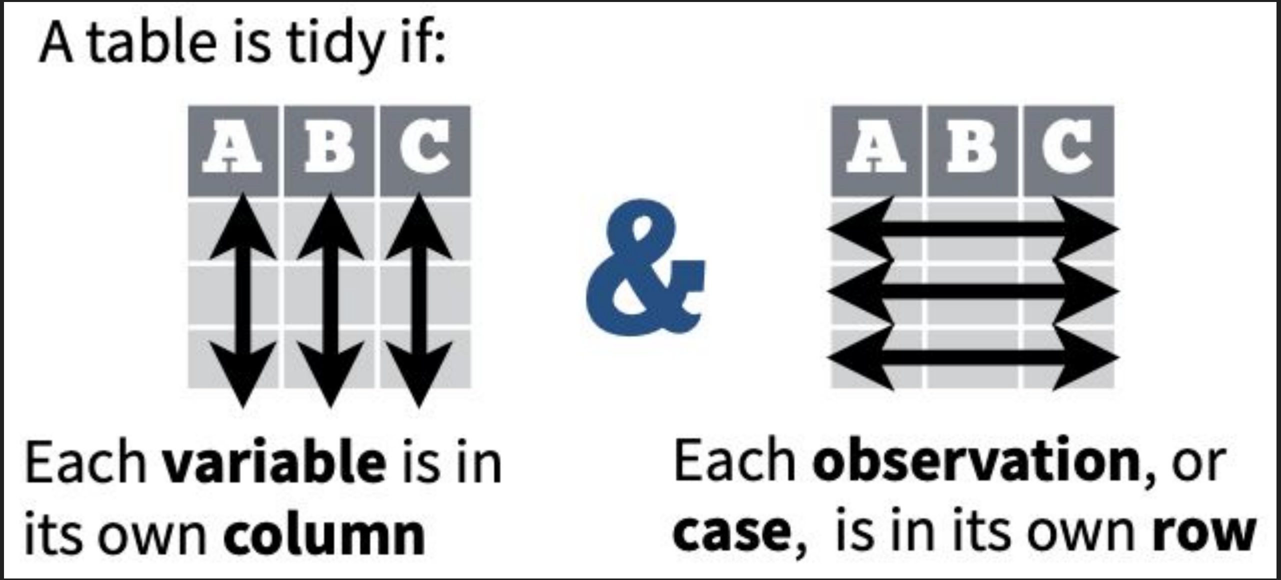
“Data scientists, according to interviews and expert estimates, spend from 50 to 80 percent of their time mired in the mundane labor of collecting and preparing data, before it can be explored for useful information.” — NY Times (2014)

```
mdl      <- maxent( tbl_env, tbl_obs)
tbl_pred <- predict(mdl, tbl_envnew)
```

“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


A table is tidy if:

Each **variable** is in its own **column** & Each **observation**, or **case**, is in its own **row**

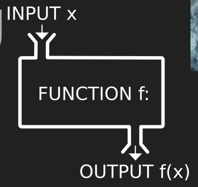
ie "long" vs "wide"

"Tidy datasets are all alike, but every messy dataset is messy in its own way."
— Hadley Wickham

Tidy Manifesto

cran.r-project.org/web/packages/tidyverse/vignettes/manifesto.html

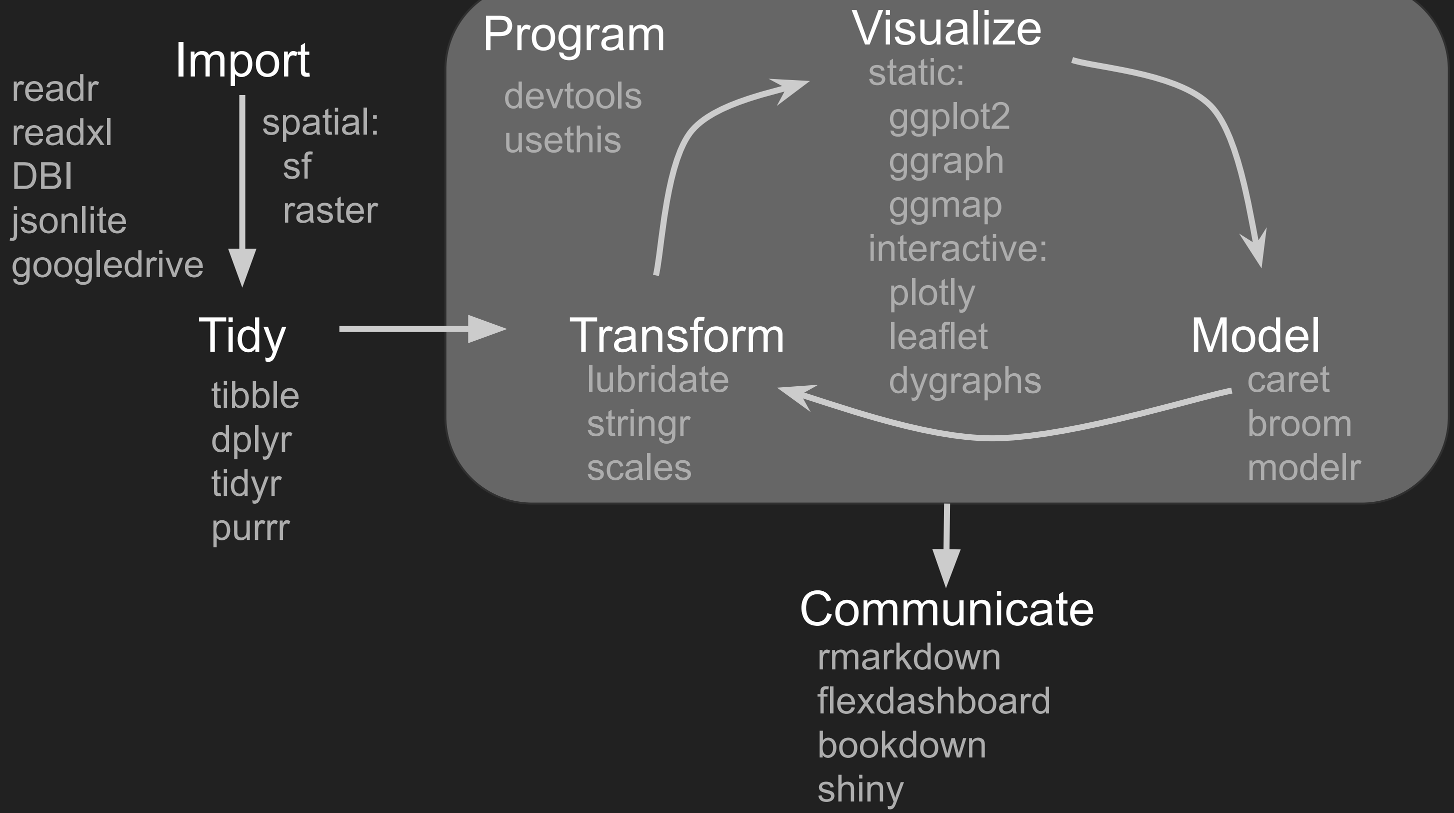
1. Reuse existing data structures
2. Compose simple functions with the pipe
3. Embrace functional programming
4. Design for humans



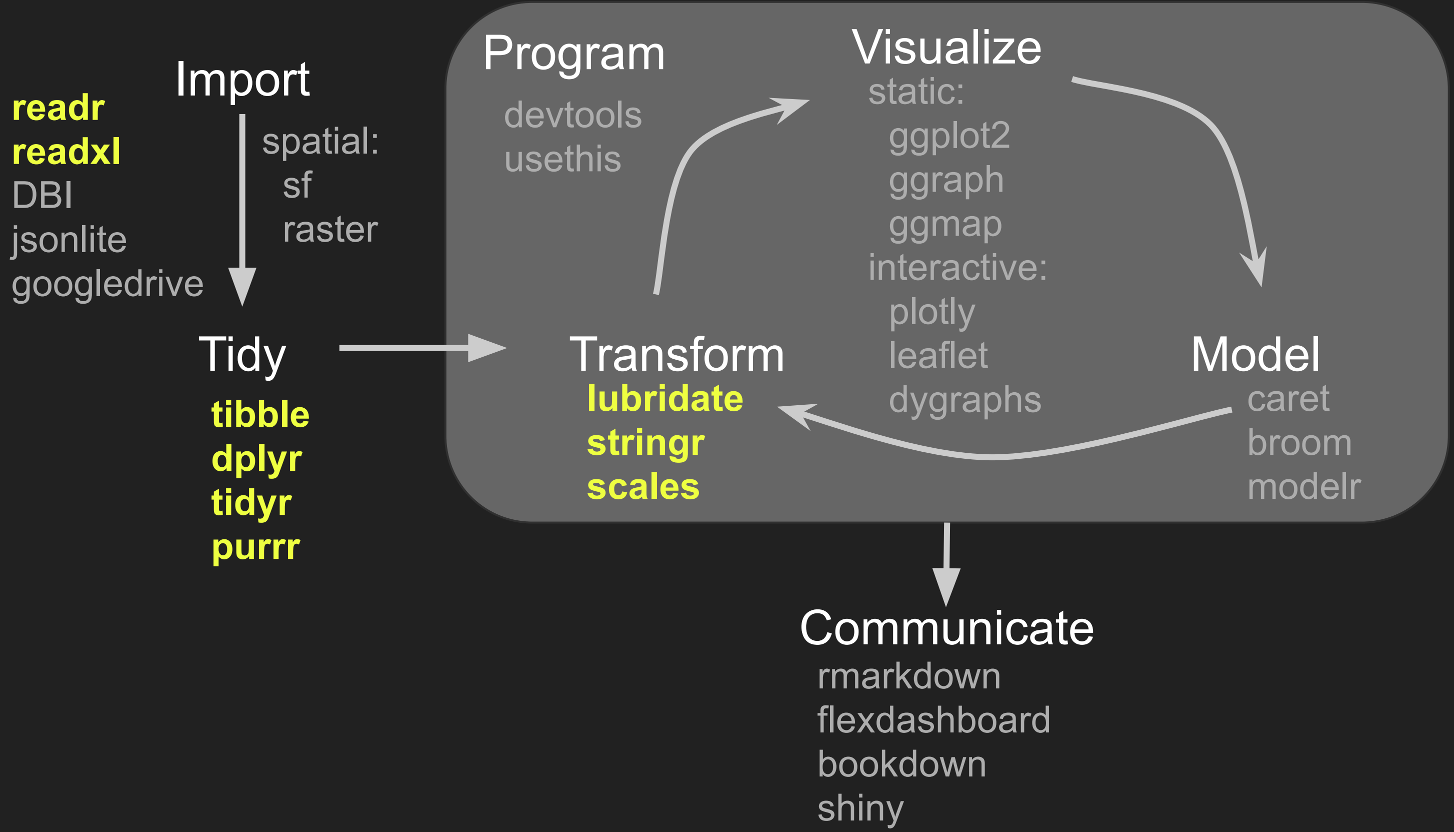
blog.codinghorror.com/falling-into-the-pit-of-success

”

Tidyverse process & R packages



Tidyverse process & R packages



Import

readr
readxl
DBI
jsonlite
googledrive

spatial:
sf
raster

Tidy

tibble
dplyr
tidyr
purrr

Program

devtools
usethis

Visualize

static:
ggplot2
ggraph
ggmap
interactive:
plotly
leaflet
dygraphs

Transform

lubridate
stringr
scales

Model

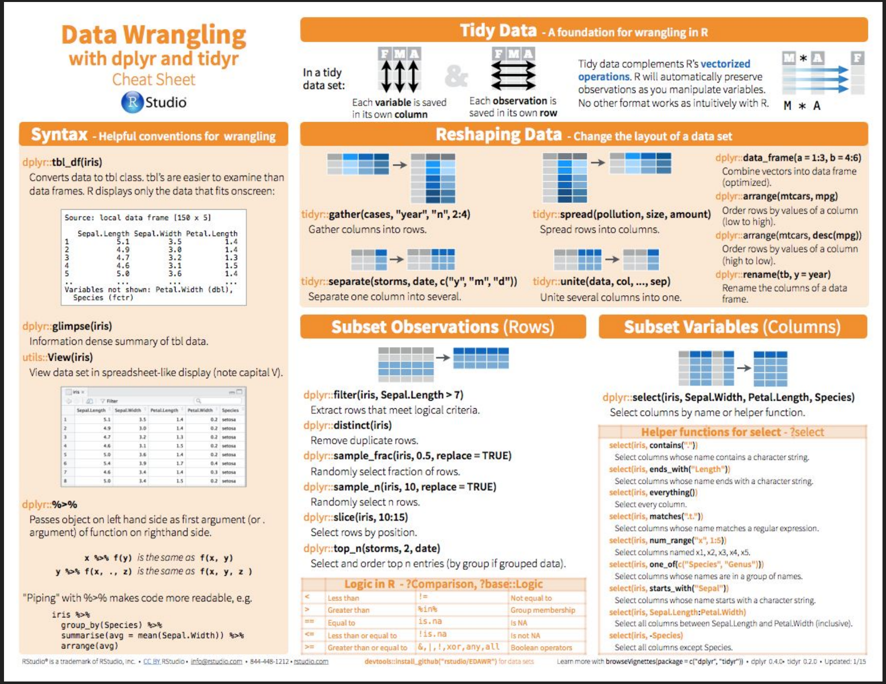
caret
broom
modelr

Communicate

rmarkdown
flexdashboard
bookdown
shiny

Cheatsheets are

RStudio: Help > Cheatsheets > Data wrangling with dplyr



Data Wrangling with dplyr and tidyr Cheat Sheet

RStudio

Tidy Data - A foundation for wrangling in R

In a tidy data set: Each **variable** is saved in its own **column** & Each **observation** is saved in its own **row**

Tidy data complements R's **vectorized operations.** R will automatically preserve observations as you manipulate variables. No other format works as intuitively with R.

M * A

Syntax - Helpful conventions for wrangling

dplyr::**tbl_df(iris)**
Converts data to tbl class. tbl's are easier to examine than data frames. R displays only the data that fits onscreen:

```
Source: local data frame [150 x 5]

   Sepal.Length Sepal.Width Petal.Length
1           5.1         3.5          1.4
2           4.9         3.0          1.4
3           4.7         3.2          1.3
4           4.6         3.1          1.5
5           5.0         3.6          1.4
..          ...         ...          ...
Variables not shown: Petal.Width (dbl),
  Species (fctr)
```

dplyr::**glimpse(iris)**
Information dense summary of tbl data.

utils::**View(iris)**
View data set in spreadsheet-like display (note capital V).

	Sepal.Length	Sepal.Width	Petal.Length	Petal.Width	Species
1	5.1	3.5	1.4	0.2	setosa
2	4.9	3.0	1.4	0.2	setosa
3	4.7	3.2	1.3	0.2	setosa
4	4.6	3.1	1.5	0.2	setosa
5	5.0	3.6	1.4	0.2	setosa
6	5.4	3.9	1.7	0.4	setosa
7	4.6	3.4	1.4	0.3	setosa
8	5.0	3.4	1.5	0.2	setosa

dplyr::**%>%**
Passes object on left hand side as first argument (or . argument) of function on righthand side.

```
   x %>% f(y)  is the same as f(x, y)
y %>% f(x, ., z)  is the same as f(x, y, z )
```

"Piping" with %>% makes code more readable, e.g.

```
iris %>%
  group_by(Species) %>%
  summarise(avg = mean(Sepal.Width)) %>%
  arrange(avg)
```

Reshaping Data - Change the layout of a data set

tidyr::**gather(cases, "year", "n", 2:4)**
Gather columns into rows.

tidyr::**spread(pollution, size, amount)**
Spread rows into columns.

tidyr::**separate(storms, date, c("y", "m", "d"))**
Separate one column into several.

tidyr::**unite(data, col, ..., sep)**
Unite several columns into one.

dplyr::**data_frame(a = 1:3, b = 4:6)**
Combine vectors into data frame (optimized).

dplyr::**arrange(mtcars, mpg)**
Order rows by values of a column (low to high).

dplyr::**arrange(mtcars, desc(mpg))**
Order rows by values of a column (high to low).

dplyr::**rename(tb, y = year)**
Rename the columns of a data frame.

Subset Observations (Rows)

dplyr::**filter(iris, Sepal.Length > 7)**
Extract rows that meet logical criteria.

dplyr::**distinct(iris)**
Remove duplicate rows.

dplyr::**sample_frac(iris, 0.5, replace = TRUE)**
Randomly select fraction of rows.

dplyr::**sample_n(iris, 10, replace = TRUE)**
Randomly select n rows.

dplyr::**slice(iris, 10:15)**
Select rows by position.

dplyr::**top_n(storms, 2, date)**
Select and order top n entries (by group if grouped data).

Logic in R - ?Comparison, ?base::Logic

<	Less than	!=	Not equal to
>	Greater than	%in%	Group membership
==	Equal to	is.na	Is NA
<=	Less than or equal to	!is.na	Is not NA
>=	Greater than or equal to	&,|,!,xor,any,all	Boolean operators

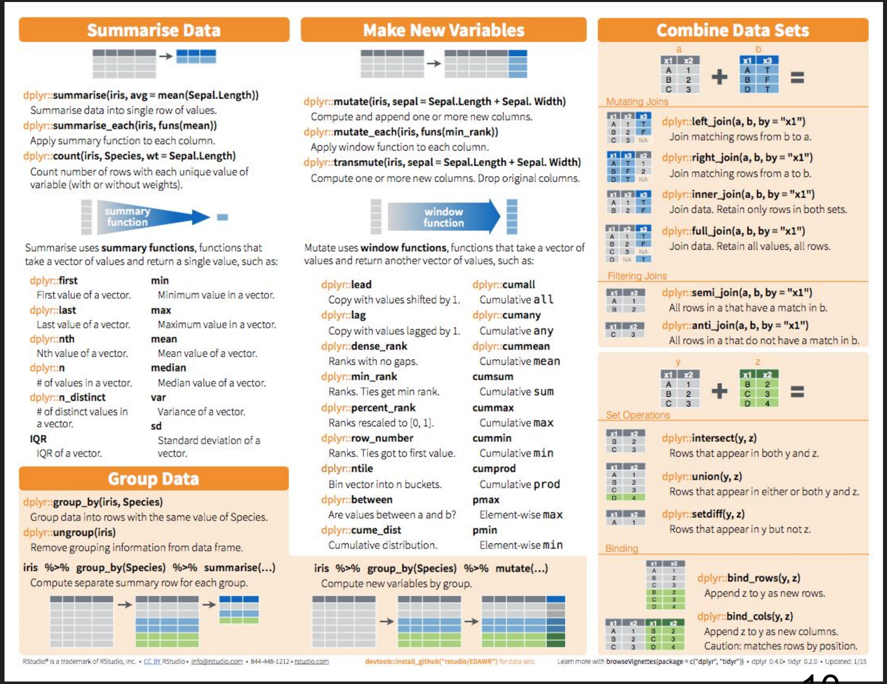
Subset Variables (Columns)

dplyr::**select(iris, Sepal.Width, Petal.Length, Species)**
Select columns by name or helper function.

Helper functions for select - ?select

select(iris, **contains(".")**)
Select columns whose name contains a character string.
select(iris, **ends_with("Length")**)
Select columns whose name ends with a character string.
select(iris, **everything()**)
Select every column.
select(iris, **matches(".t.")**)
Select columns whose name matches a regular expression.
select(iris, **num_range("x", 1:5)**)
Select columns named x1, x2, x3, x4, x5.
select(iris, **one_of(c("Species", "Genus"))**)
Select columns whose names are in a group of names.
select(iris, **starts_with("Sepal")**)
Select columns whose name starts with a character string.
select(iris, Sepal.Length:Petal.Width)
Select all columns between Sepal.Length and Petal.Width (inclusive).
select(iris, -Species)
Select all columns except Species.

devtools::install_github("rstudio/EDAWR") for data sets Learn more with browseVignettes(package = c("dplyr", "tidyr")) • dplyr 0.4.0• tidyr 0.2.0 • Updated: 1/15



Summarise Data

dplyr::**summarise(iris, avg = mean(Sepal.Length))**
Summarise data into single row of values.

dplyr::**summarise_each(iris, funs(mean))**
Apply summary function to each column.

dplyr::**count(iris, Species, wt = Sepal.Length)**
Count number of rows with each unique value of variable (with or without weights).

summary function

Summarise uses **summary functions**, functions that take a vector of values and return a single value, such as:

dplyr::**first** First value of a vector.	**min** Minimum value in a vector.
dplyr::**last** Last value of a vector.	**max** Maximum value in a vector.
dplyr::**nth** Nth value of a vector.	**mean** Mean value of a vector.
dplyr::**n** # of values in a vector.	**median** Median value of a vector.
dplyr::**n_distinct** # of distinct values in a vector.	**var** Variance of a vector.
IQR IQR of a vector.	**sd** Standard deviation of a vector.

Group Data

dplyr::**group_by(iris, Species)**
Group data into rows with the same value of Species.

dplyr::**ungroup(iris)**
Remove grouping information from data frame.

iris %>% group_by(Species) %>% summarise(…)
Compute separate summary row for each group.

Make New Variables

dplyr::**mutate(iris, sepal = Sepal.Length + Sepal. Width)**
Compute and append one or more new columns.

dplyr::**mutate_each(iris, funs(min_rank))**
Apply window function to each column.

dplyr::**transmute(iris, sepal = Sepal.Length + Sepal. Width)**
Compute one or more new columns. Drop original columns.

Mutate uses **window functions**, functions that take a vector of values and return another vector of values, such as:

dplyr::**lead** Copy with values shifted by 1.	dplyr::**cumall** Cumulative `all`
dplyr::**lag** Copy with values lagged by 1.	dplyr::**cumany** Cumulative `any`
dplyr::**dense_rank** Ranks with no gaps.	dplyr::**cummean** Cumulative `mean`
dplyr::**min_rank** Ranks. Ties get min rank.	**cumsum** Cumulative `sum`
dplyr::**percent_rank** Ranks rescaled to [0, 1].	**cummax** Cumulative `max`
dplyr::**row_number** Ranks. Ties got to first value.	**cummin** Cumulative `min`
dplyr::**ntile** Bin vector into n buckets.	**cumprod** Cumulative `prod`
dplyr::**between** Are values between a and b?	**pmax** Element-wise `max`
dplyr::**cume_dist** Cumulative distribution.	**pmin** Element-wise `min`

iris %>% group_by(Species) %>% mutate(…)
Compute new variables by group.

Combine Data Sets

Mutating Joins

dplyr::**left_join(a, b, by = "x1")**
Join matching rows from b to a.

dplyr::**right_join(a, b, by = "x1")**
Join matching rows from a to b.

dplyr::**inner_join(a, b, by = "x1")**
Join data. Retain only rows in both sets.

dplyr::**full_join(a, b, by = "x1")**
Join data. Retain all values, all rows.

Filtering Joins

dplyr::**semi_join(a, b, by = "x1")**
All rows in a that have a match in b.

dplyr::**anti_join(a, b, by = "x1")**
All rows in a that do not have a match in b.

Set Operations

dplyr::**intersect(y, z)**
Rows that appear in both y and z.

dplyr::**union(y, z)**
Rows that appear in either or both y and z.

dplyr::**setdiff(y, z)**
Rows that appear in y but not z.

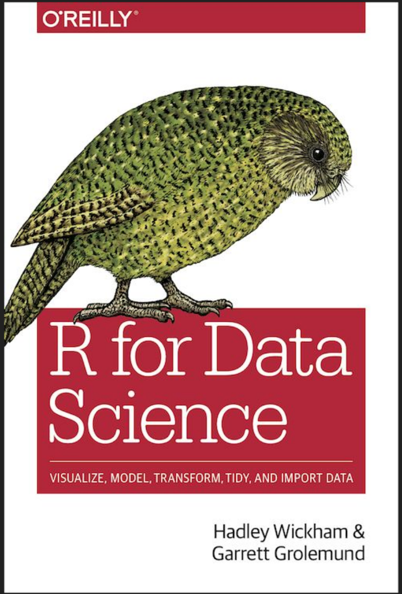
Binding

dplyr::**bind_rows(y, z)**
Append z to y as new rows.

dplyr::**bind_cols(y, z)**
Append z to y as new columns.
Caution: matches rows by position.

devtools::install_github("rstudio/EDAWR") for data sets Learn more with browseVignettes(package = c("dplyr", "tidyr")) • dplyr 0.4.0• tidyr 0.2.0 • Updated: 1/15

Resources

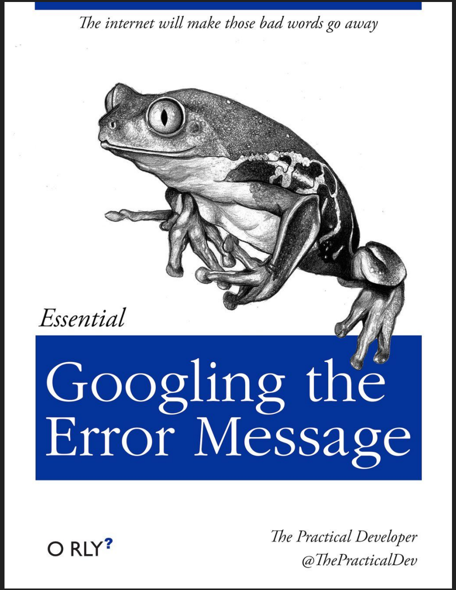

O'REILLY

R for Data Science

VISUALIZE, MODEL, TRANSFORM, TIDY, AND IMPORT DATA

Hadley Wickham & Garrett Grolemund

[r4ds.had.co.nz](r4ds.had.co.nz)


The internet will make those bad words go away

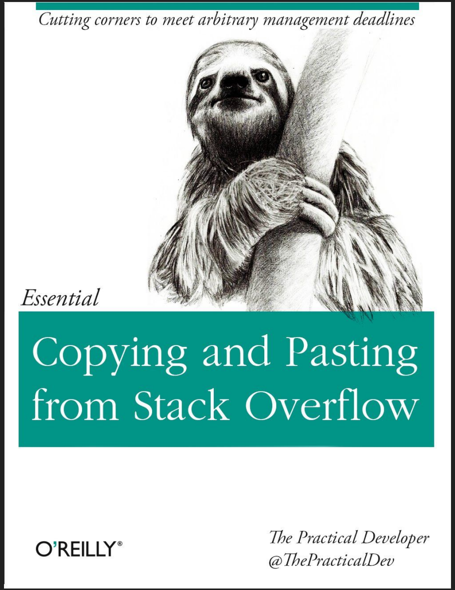
Essential

Googling the Error Message

O RLY?

The Practical Developer
@ThePracticalDev

google.com


Cutting corners to meet arbitrary management deadlines

Essential

Copying and Pasting from Stack Overflow

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stackoverflow.com

Lesson

noaa-iea.github.io/r3-train/manipulate.html