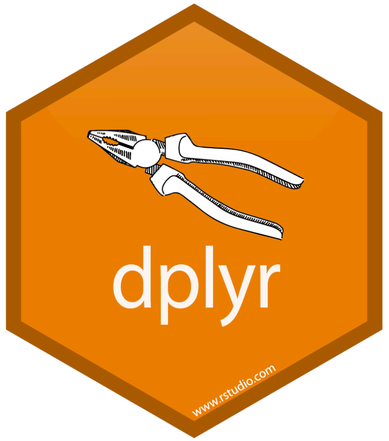
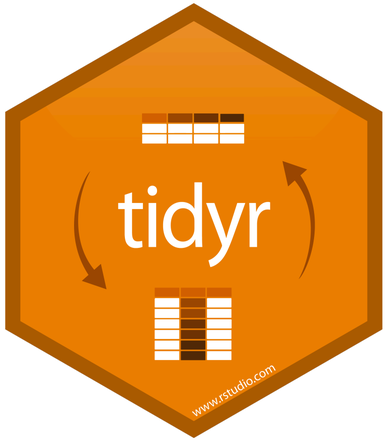
Programme for today

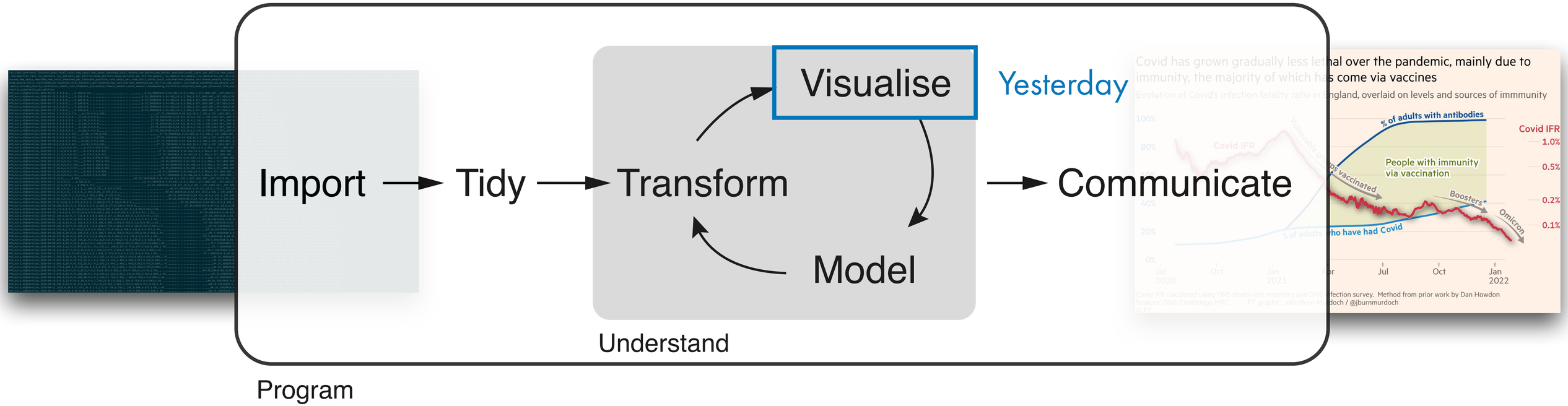
- Introductory lecture
- Hands-on tutorial on data wrangling
- Individual exercises





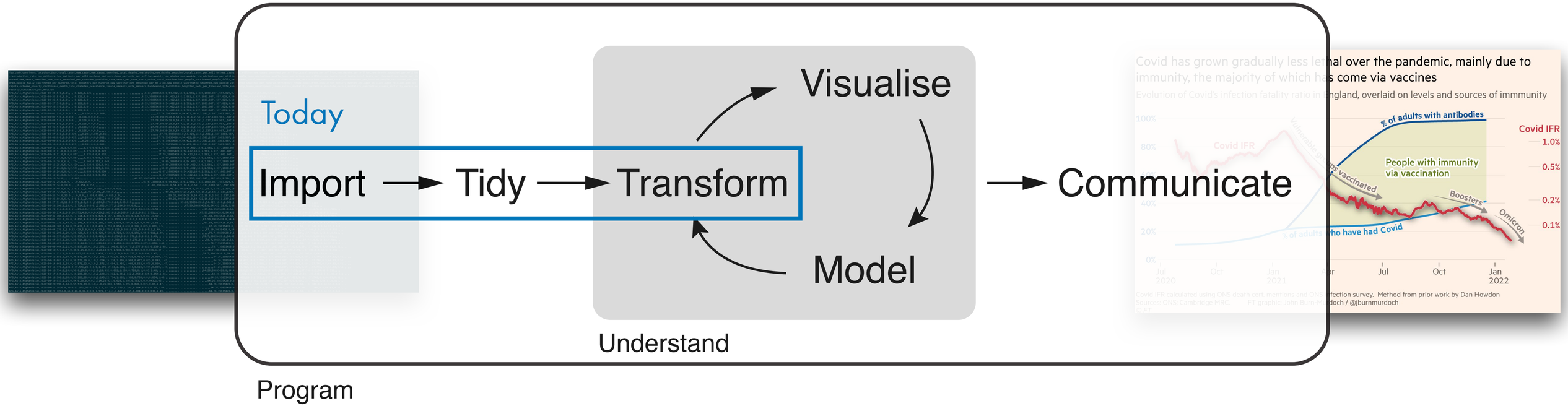
At the end of the day you should be familiar with transforming and tidying data in R using the dplyr and tidy packages

A data science project workflow



https://r4ds.had.co.nz/introduction.html

A data science project workflow



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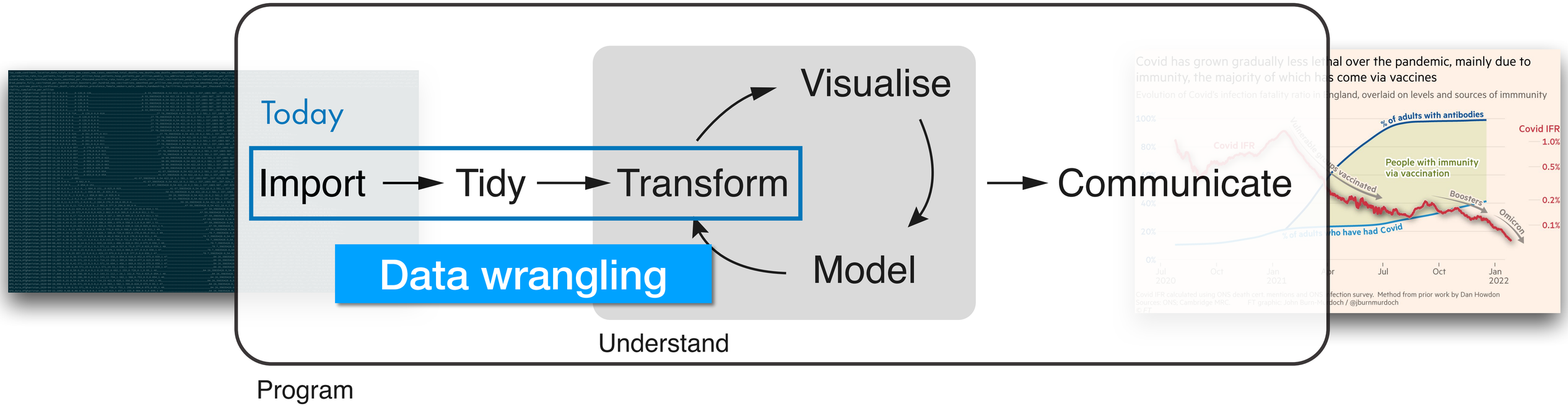
A data science project workflow



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When data is messy ...

species	habitat	weight	length	latitude/longitude	date
Alligator mississippiensis	swamp	431 lb	4 ft 2	29.531,-82.184	Sept 15, 2015
Puma concolor	forest	125 lb	2.2m	29.125,-81.682	08/10/2015
Ursus americanus	forest	88 kg	133 cm	N29°7'30"/W81°40'55.2"	07-13-2015

In which ways is this dataset "untidy"?

Hart et al (2016) PLoS Comp Biol (https://doi.org/10.1371/journal.pcbi.1005097)

When data is messy … we tidy it up

species	habitat	weight	length	latitude/longitude	date
Alligator mississippiensis	swamp	431 lb	4 ft 2	29.531,-82.184	Sept 15, 2015
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Ursus americanus	forest	88 kg	133 cm	N29°7'30"/W81°40'55.2"	07-13-2015

meta-data

data

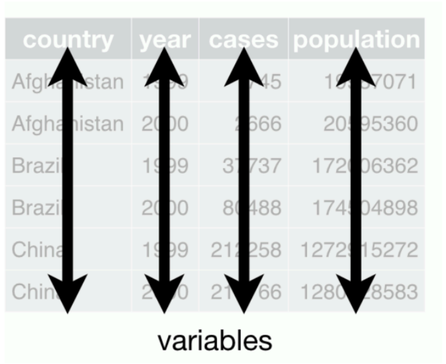
species_code	date	station_code	weight_kg	length_cm
TSN 551771	2015-09-15	1	196	127
TSN 55247	2015-08-10	2	57	220
TSN 180544	2015-07-13	2	88	133

station_code	habitat	latitude	longitude
1	swamp	29.531	-82.184
2	forest	29.125	-81.682

species_code	class	genus	species
TSN 551771	Reptilia	Alligator	mississippiensis
TSN 55247	Mammalia	Puma	concolor
TSN 180544	Mammalia	Ursus	americanus

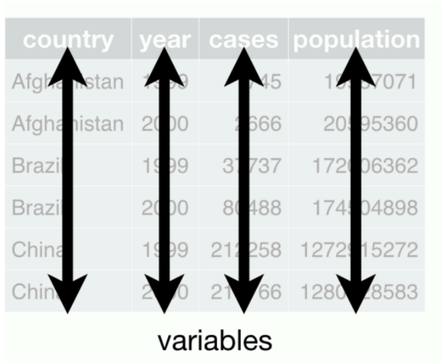
Hart et al (2016) PLoS Comp Biol (https://doi.org/10.1371/journal.pcbi.1005097)

Principles of tidy data



1. Each variable has its own column

Principles of tidy data



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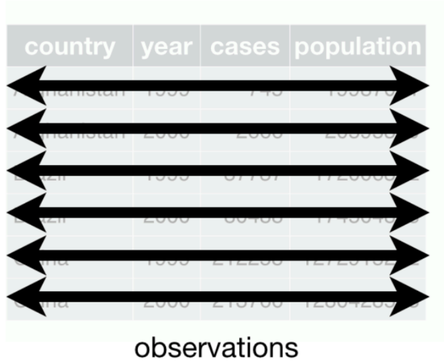
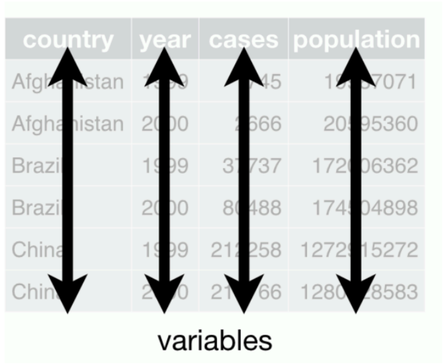


2. Each observation has its own row

Principles of tidy data



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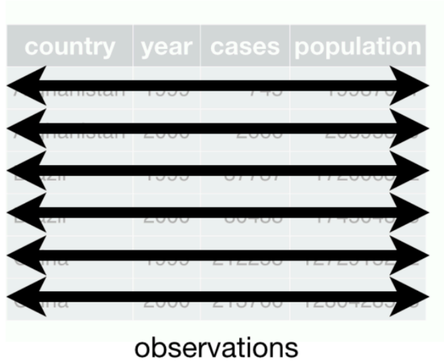

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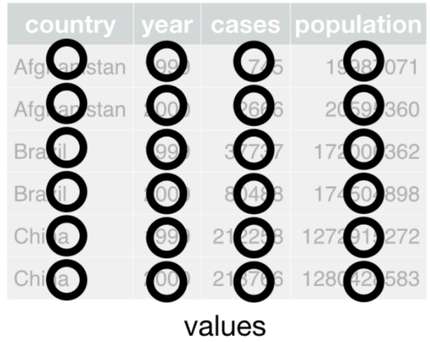
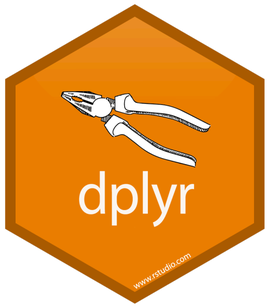
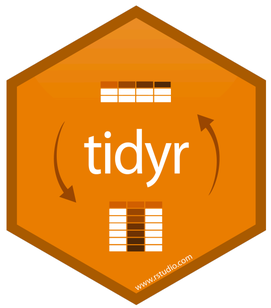


3. Each values has its own cell

Data transformation

Data tidying





Data transformation

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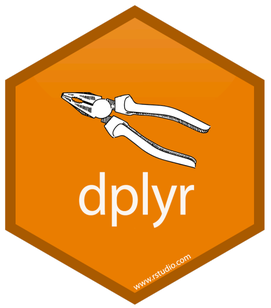
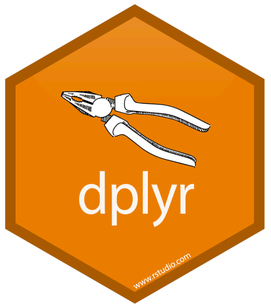


Data transformation

Data tidying

select(.data, …**)** Extract columns as a table.
select(mtcars, mpg, wt)



Simple transformations

https://rstudio.github.io/cheatsheets/data-transformation.pdf

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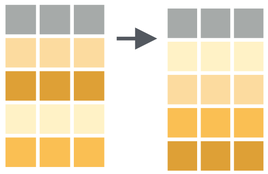
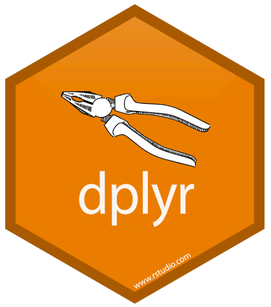


arrange(.data, …, .by_group = FALSE**)** Order rows by values of a column or columns (low to high), use with **desc()** to order from high to low.
arrange(mtcars, mpg)
arrange(mtcars, desc(mpg))



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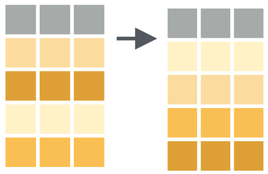

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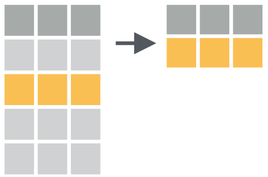
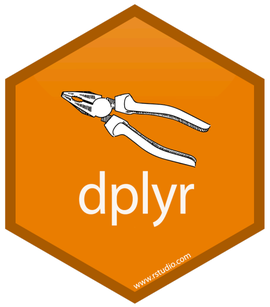


filter(.data, …, .preserve = FALSE**)** Extract rows that meet logical criteria.
filter(mtcars, mpg > 20)



Simple transformations

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Data transformation

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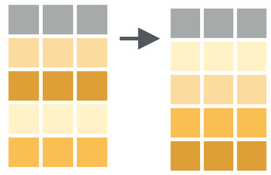
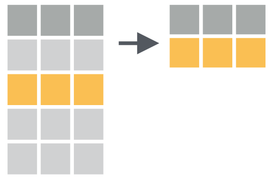


arrange(.data, …, .by_group = FALSE**)** Order rows by values of a column or columns (low to high), use with **desc()** to order from high to low.
arrange(mtcars, mpg)
arrange(mtcars, desc(mpg))



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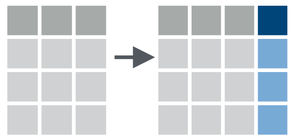
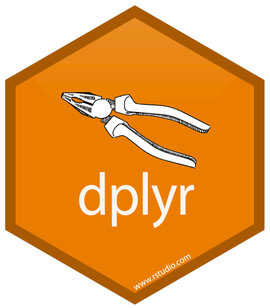


mutate(.data, …, .keep = "all", .before = NULL, .after = NULL**)** Compute new column(s). Also **add_column(), add_count(),** and **add_tally().**
mutate(mtcars, gpm = 1 / mpg)



Simple transformations

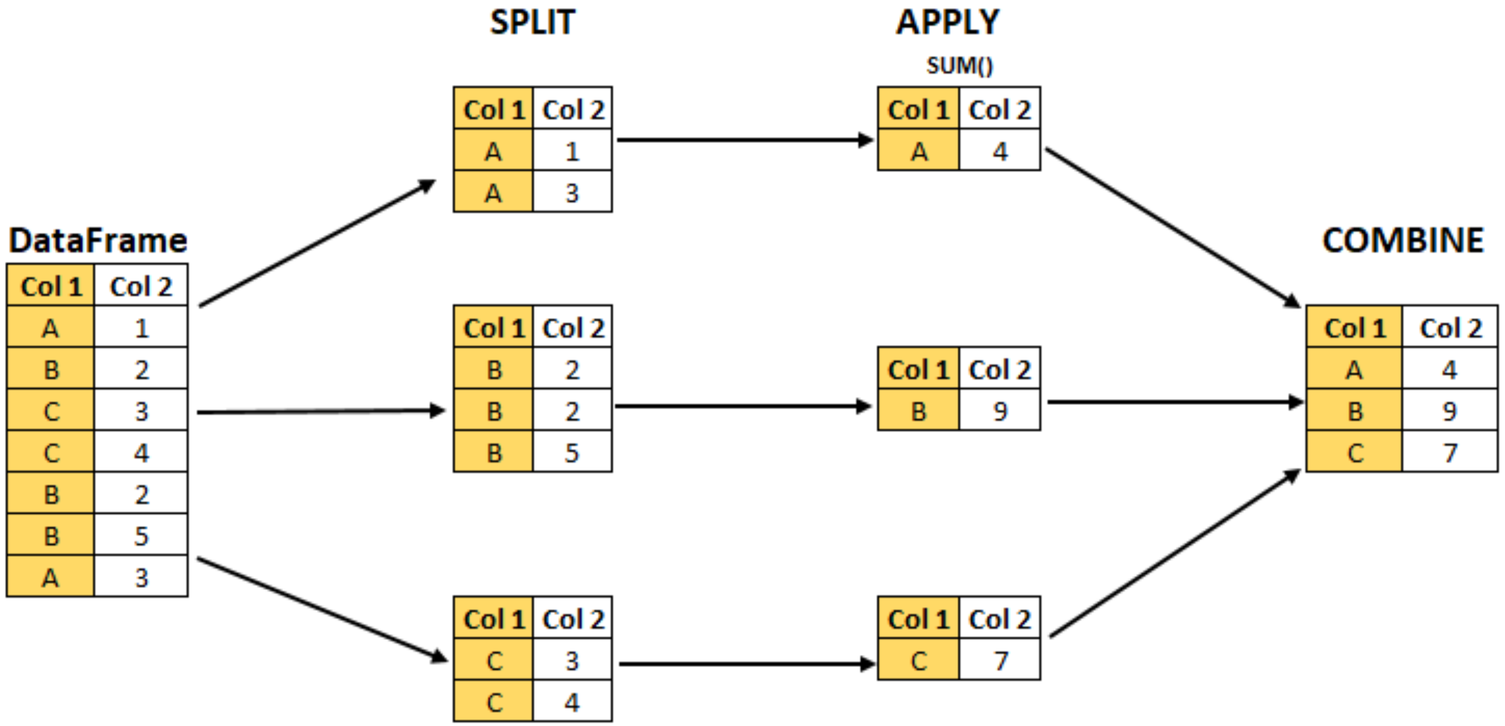
https://rstudio.github.io/cheatsheets/data-transformation.pdf

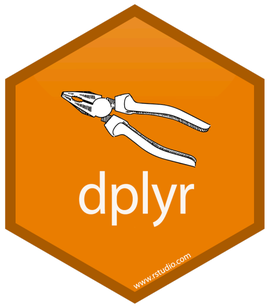
The pipe


```
do_another_thing(do_something(data))

# versus

data %>%
    do_something() %>%
    do_another_thing()
```

Data transformation

Data tidying





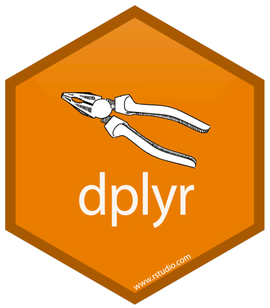
split-apply-combine

https://medium.com/analytics-vidhya/split-apply-combine-strategy-for-data-mining-4fd6e2a0cc99

Data transformation

Data tidying

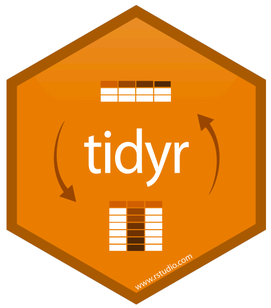
```
mtcars  %>%
  group_by(cyl) %>%
  summarise(avg = mean(mpg))
```



Group and summarise

https://medium.com/analytics-vidhya/split-apply-combine-strategy-for-data-mining-4fd6e2a0cc99

Data tidying

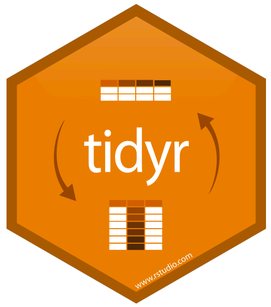


Data tidying

country	1999	2000
A	0.7K	2K
B	37K	80K
C	212K	213K

country	year	cases
A	1999	0.7K
B	1999	37K
C	1999	212K
A	2000	2K
B	2000	80K
C	2000	213K

pivot_longer(data, cols, names_to = "name", values_to = "value", values_drop_na = FALSE**)**

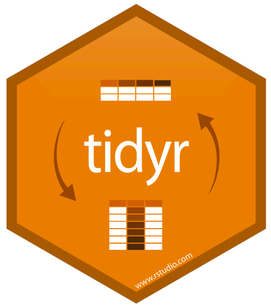


Reshape “wide” data to “long” data

Data tidying

country	year	type	count
A	1999	cases	0.7K
A	1999	pop	19M
A	2000	cases	2K
A	2000	pop	20M
B	1999	cases	37K
B	1999	pop	172M
B	2000	cases	80K
B	2000	pop	174M
C	1999	cases	212K
C	1999	pop	1T
C	2000	cases	213K
C	2000	pop	1T

country	year	cases	pop
A	1999	0.7K	19M
A	2000	2K	20M
B	1999	37K	172M
B	2000	80K	174M
C	1999	212K	1T
C	2000	213K	1T



pivot_wider(data, names_from = "name", values_from = "value"**)**

Reshape “long” data to “wide” data

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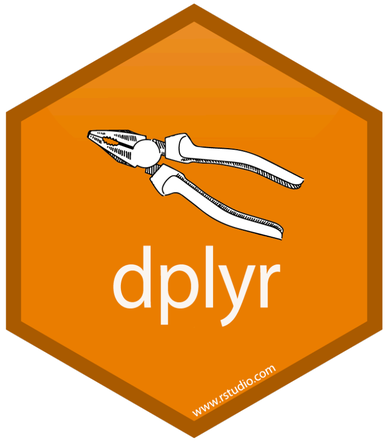

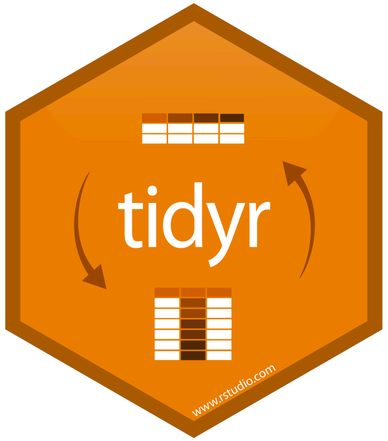

At the end of the day you should be familiar with transforming and tidying data in R using the dplyr and tidy packages

https://ucph.padlet.org/martinsikora4/data_analysis_2025_wrangle