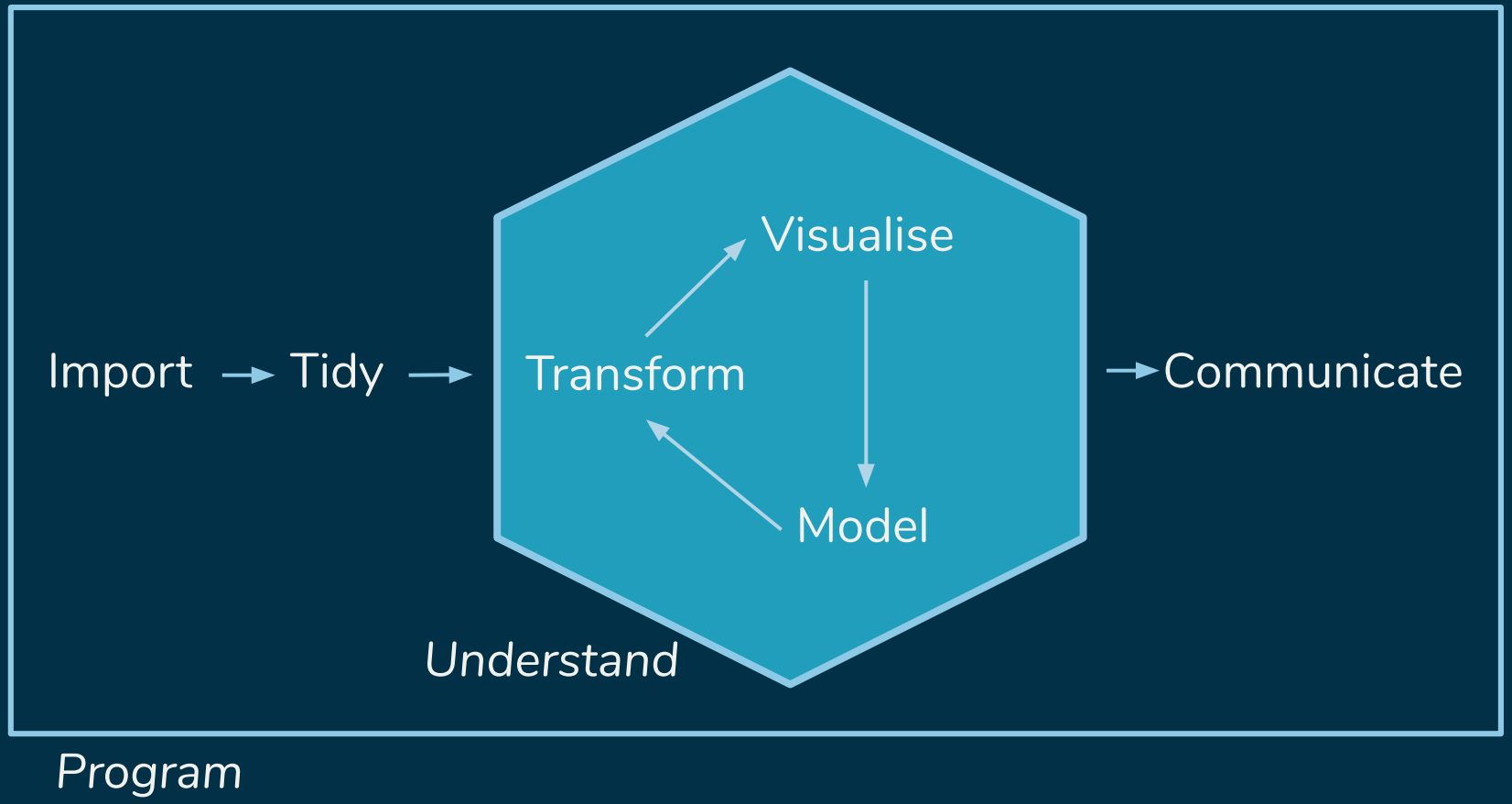
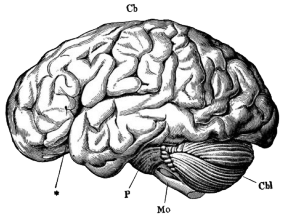
Our goal

Artwork by @allison_horst

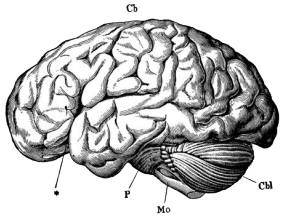
Data science is the art of turning raw data into understanding


Import
Tidy
Transform
Visualise
Model
Communicate
Understand
Program



Human thought ⟷ Machine Language

Source: https://github.com/rstudio-education/arm-workshop-rsc2019



Human thought → Machine Language

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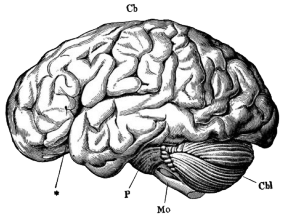


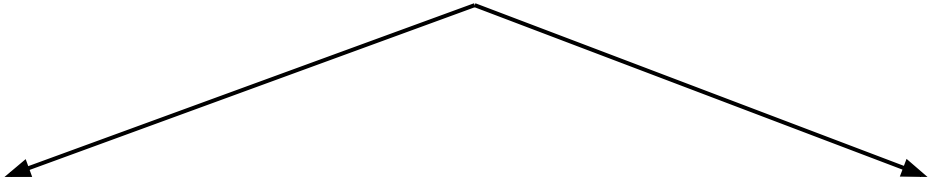
Human thought → Machine Language

Source: https://github.com/rstudio-education/arm-workshop-rsc2019

How do we process

the data?

```
function(arg1, arg2, arg3, ...)
```



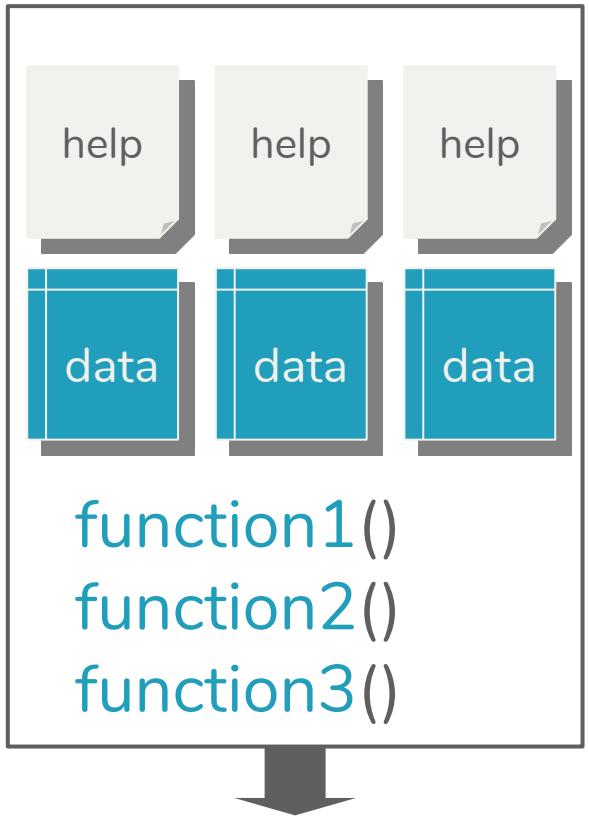
change_the_env(...)

calculate_value(...)

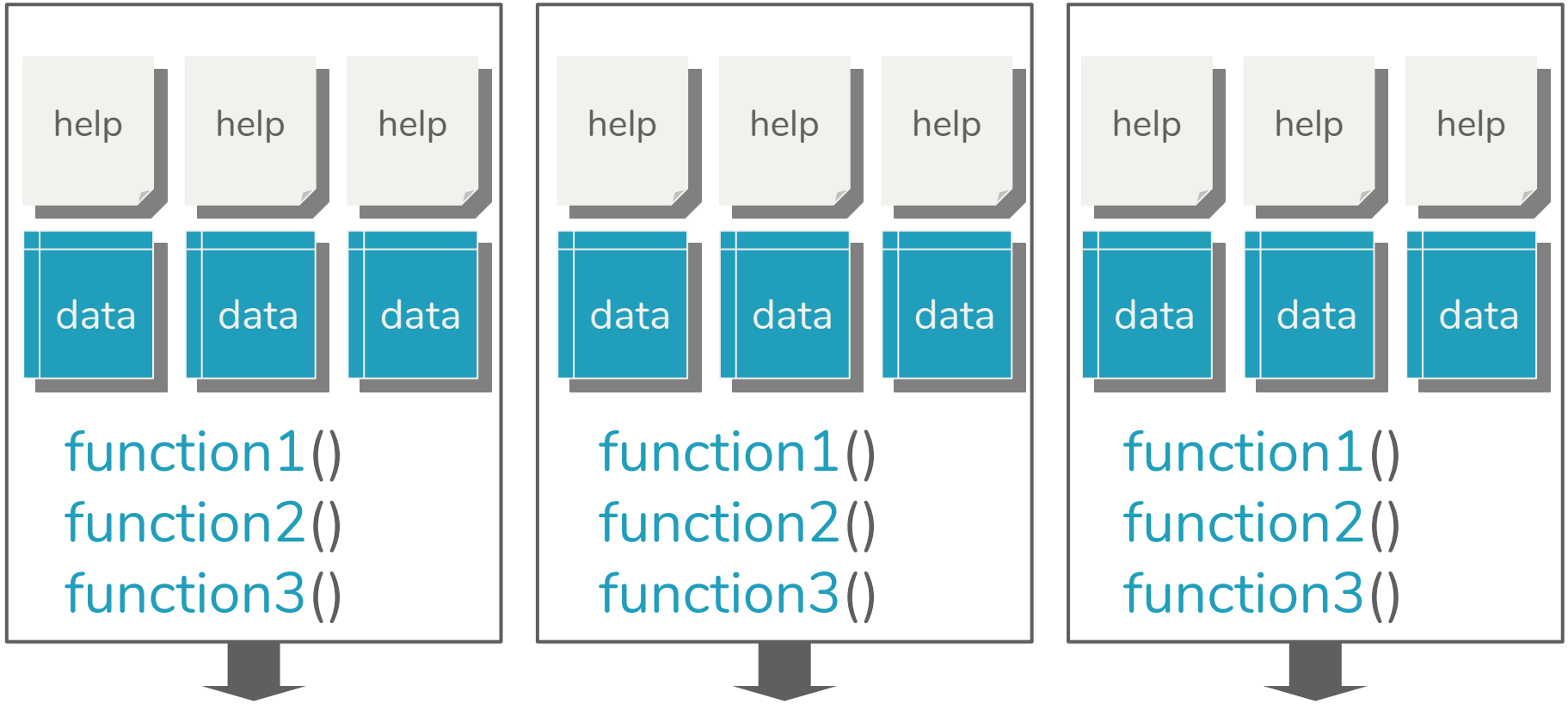
assign. <- , =, ->

- arguments are contexts of a function
- arguments are matched by name, or
- arguments are matched by position, **be careful!**

function1()
function2()
function3()



stats, graphics, grDevices, utils,
datasets, methods, base

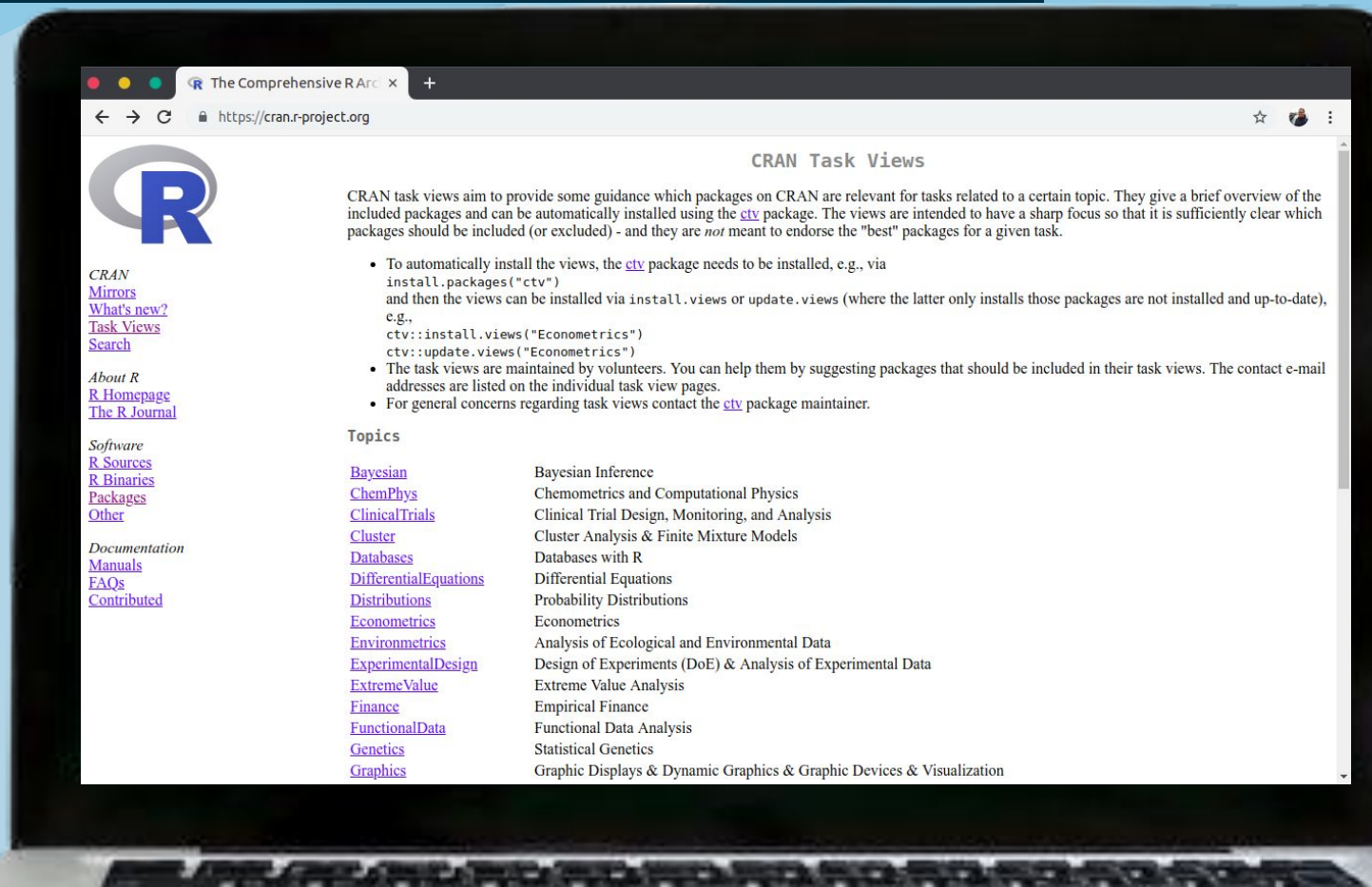


stats, graphics, grDevices, utils, datasets, methods, base

R packages

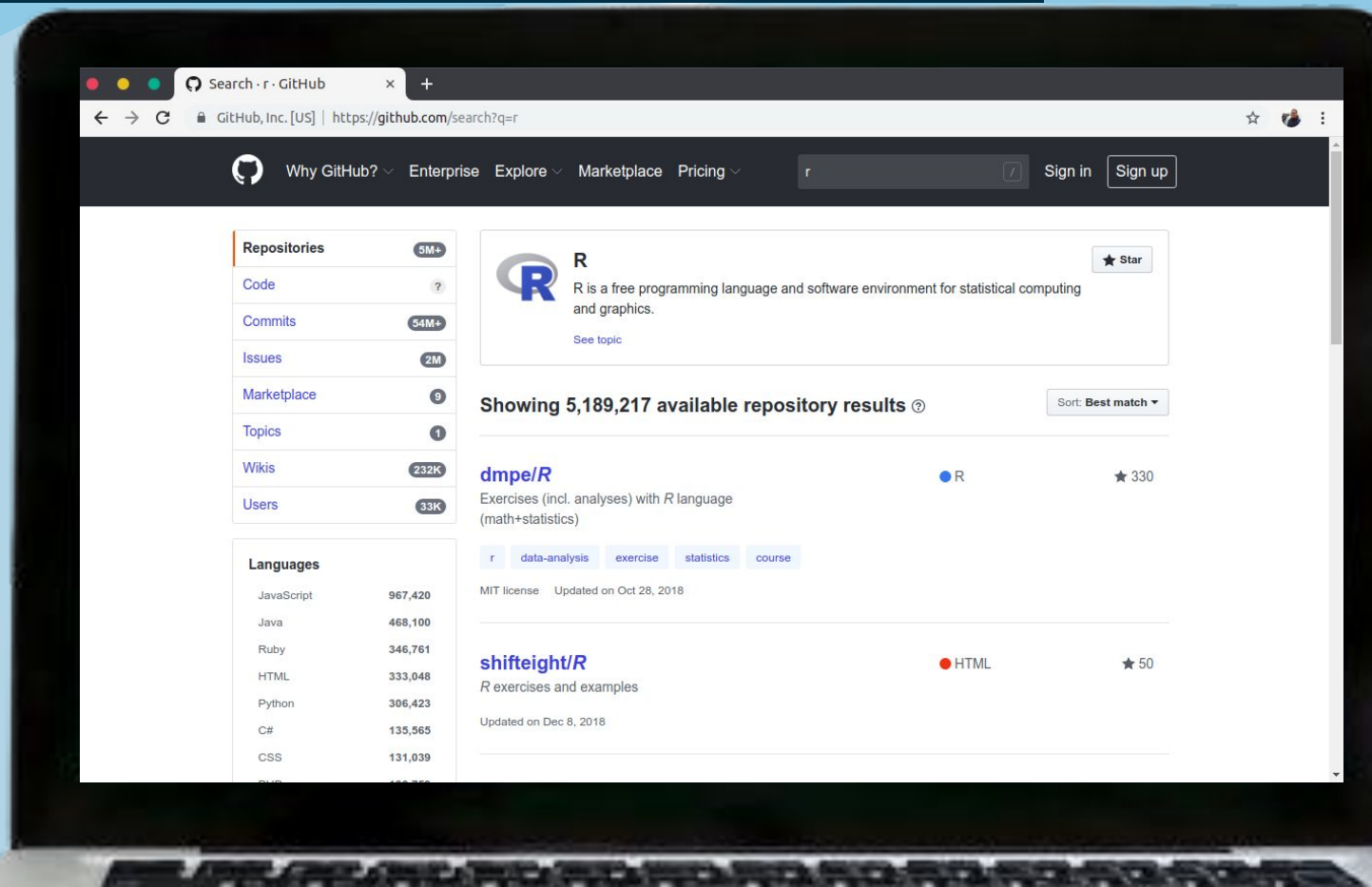
CRAN Task Views

https://cran.r-project.org/web/views/



GitHub

https://github.com/search?q=r



Installing package, only once

```
install.packages(“pkg”) # from CRAN/local
remotes::install_github(“user/pkg”) # from GitHub
remotes::install_bioc(“repo”) # from Bioconductor
```

Loading package, once in every session

```
library(pkg)
pacman::p_load(pkg) # load or install if not
available
```

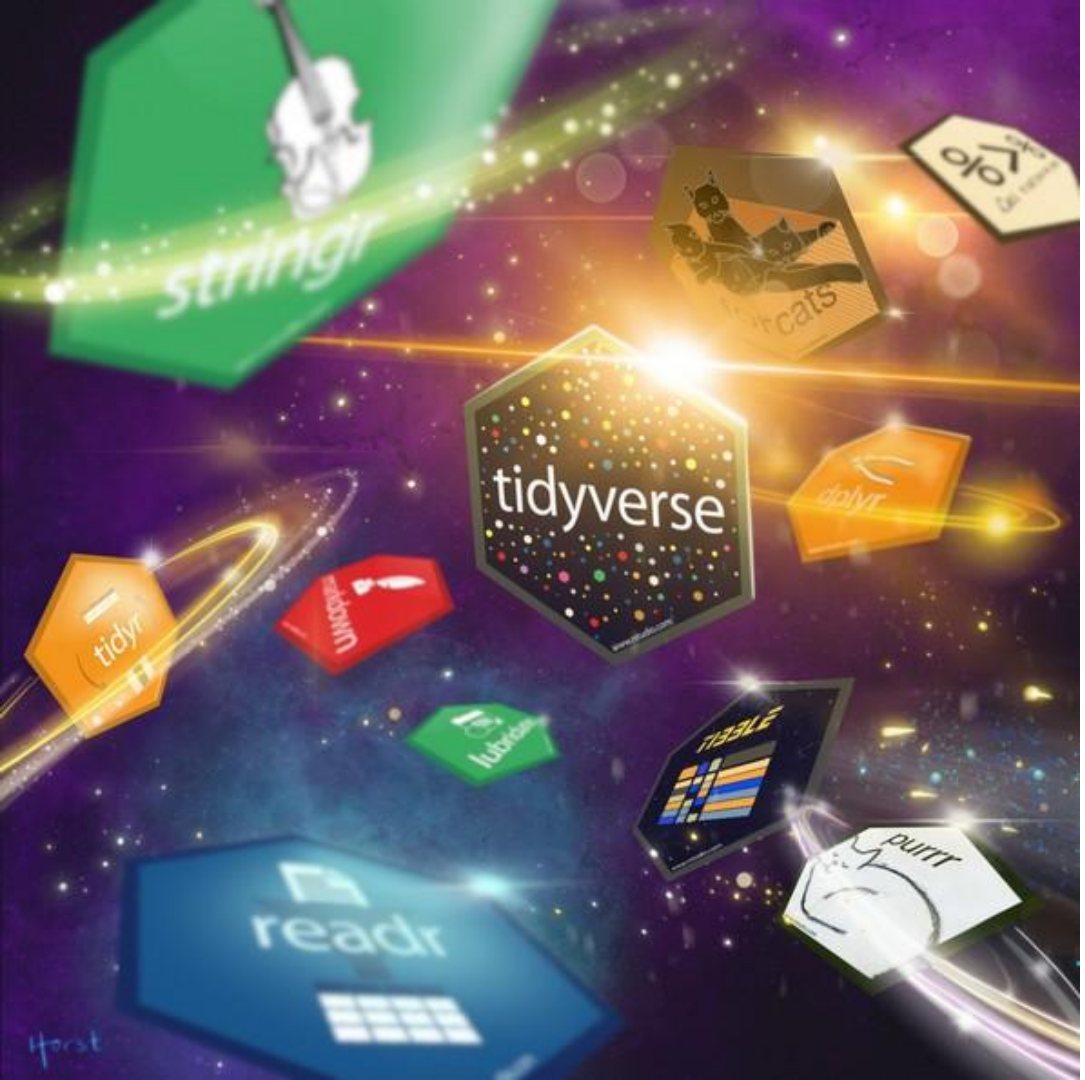
A lot of R packages

to use! :D

A lot of R packages

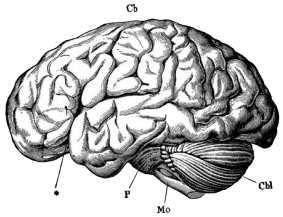
to use! :(


tidyverse
www.rstudio.com



The tidyverse is an opinionated **collection of R packages** designed for **data science**. All packages **share** an underlying **design** philosophy, **grammar**, and **data structures**.

Artwork by @allison_horst



Human thought → Machine Language

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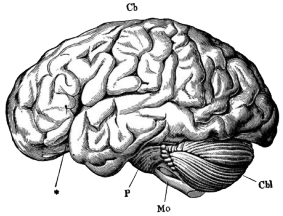


Human thought

Machine Language

Source: https://github.com/rstudio-education/arm-workshop-rsc2019

tidycode

tidymodels

tidync

tidyverts

tidycensus

tidygraph

tidytext

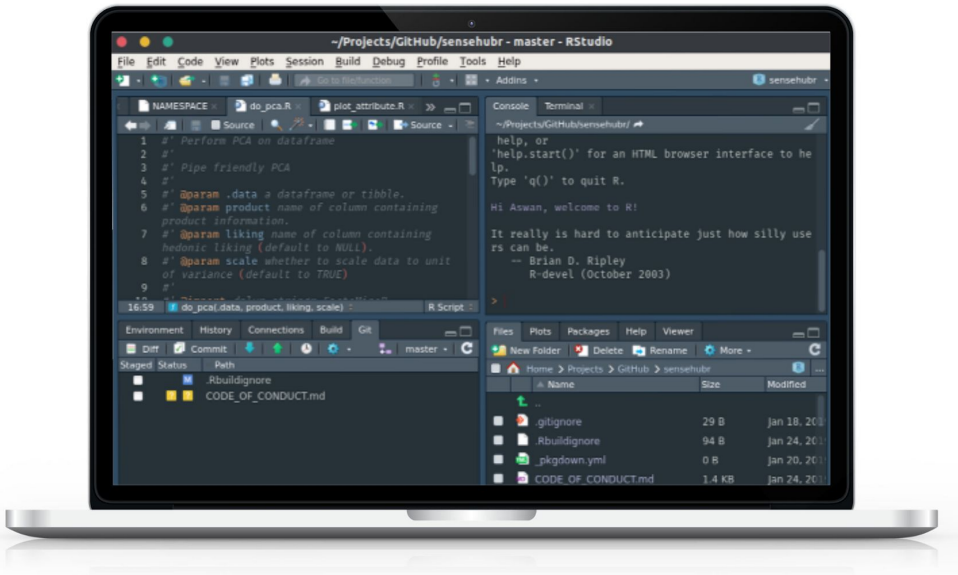
tidygenomics

Where to code?

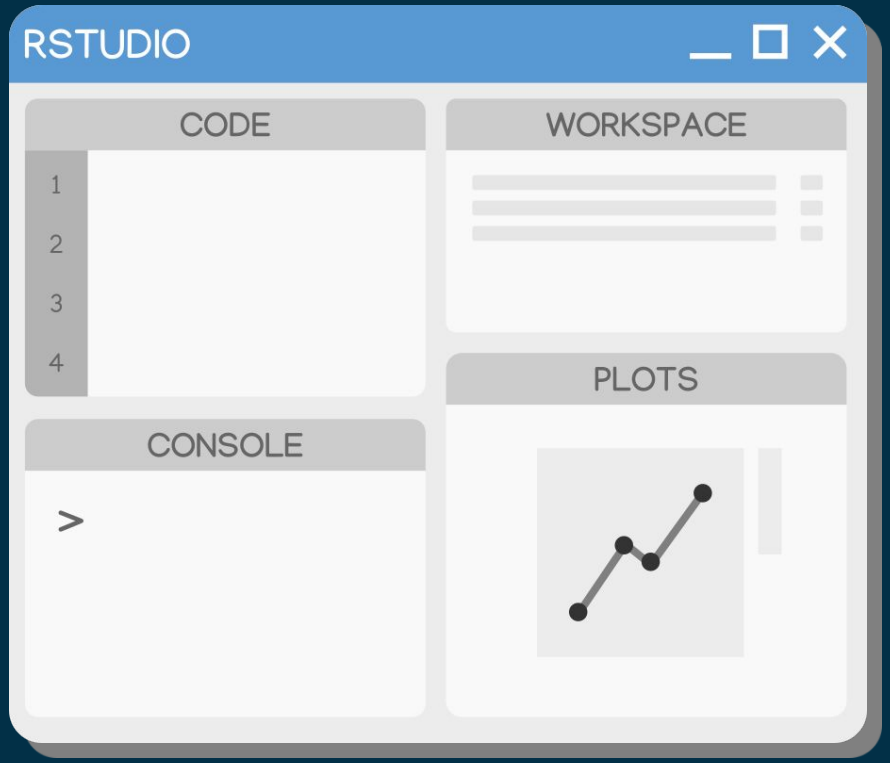
RStudio®

Main features:

- Console
- Syntax-highlighting editor
- Tools for plotting, history, debugging and workspace management



rstudio.com/products/rstudio/download/



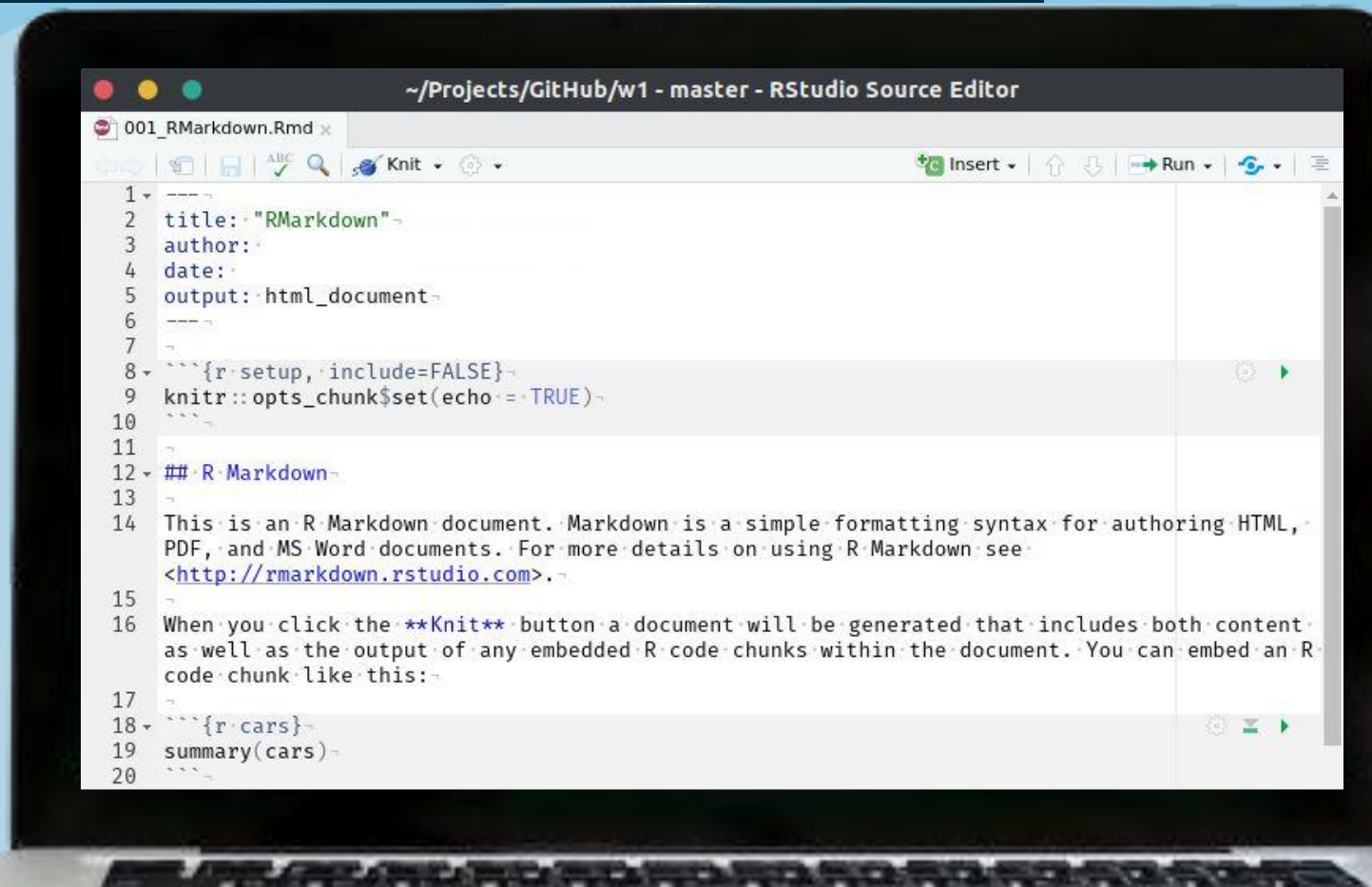
- **Tab**, autocompletion & path navigation
- **Alt + -**, for assignment operator <-
- **Ctrl + Shift + M**, for pipe operator %>%
- **Ctrl + Enter**, run current line code/example on help page
- **Ctrl + Up**, search for code history on console or editor pane
- **Alt + Up/Down**, move code to above or below
- **Alt + Shift + Up/Down**, copy code to above or below
- **Ctrl + D**, delete current line
- **Ctrl + Shift + F10**, restart R session
- **Ctrl + Alt + B**, run code up to current line

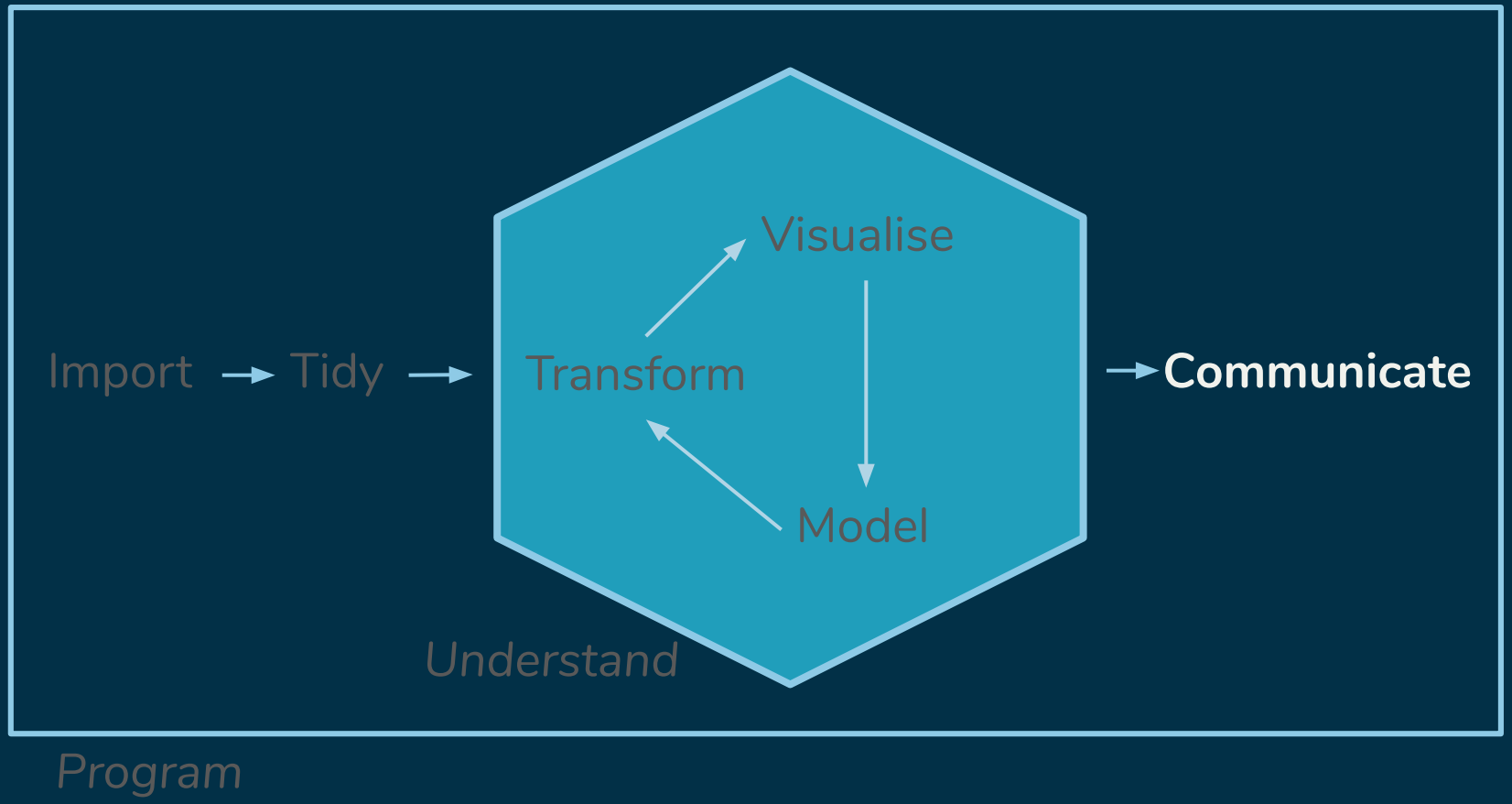
Cheatsheet: https://github.com/rstudio/cheatsheets/raw/master/rstudio-ide.pdf

Artwork by @allison_horst

R Markdown

A document format for authoring data science project

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- Use script (R Markdown or R Script), try to avoid console
- Use Projects, not setwd(...) in script

- Learn the handy shortcuts
- Do not save and load .Rdata
- Use version control system: git!

Reading: happygitwithr.com

Download: git-scm.com

With great codes,
comes great bugs!

- (not) Uncle Ben

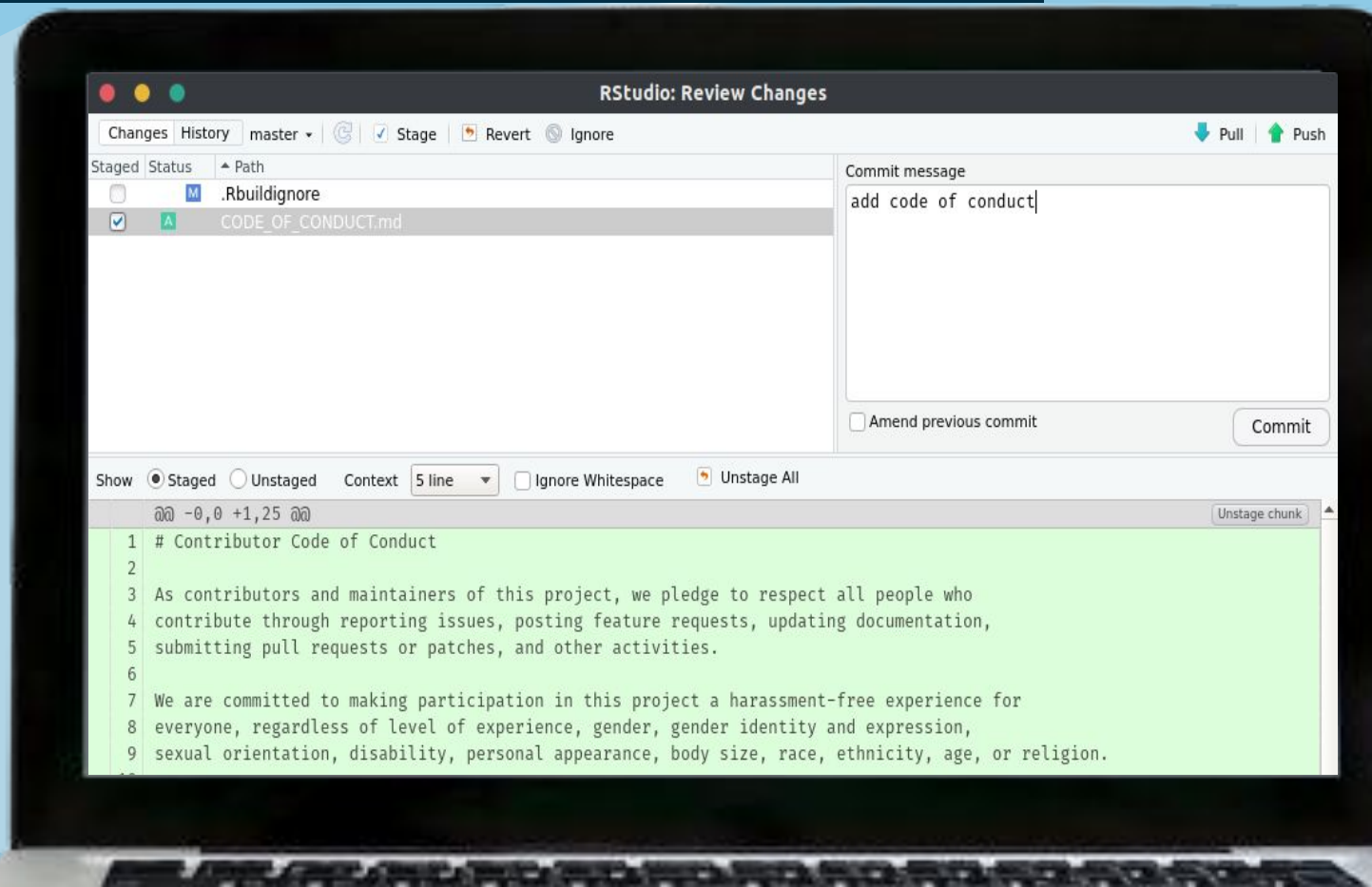
Store and share! Why sharing your work? Motivation here.

- git clone https://github/user/repo
- Do some works!
- git add file.R or git add .
- git commit -m “what you have done”
- git push origin master
- Repeat: work, git add, git commit, git push

git

- git init
- git remote add origin https://github/user/repo
- Do some works!
- git add file.R or git add .
- git commit -m “what you have done”
- git push -u origin master #use -u only once
- Repeat: work, git add, git commit, git push

It is available in RStudio!



Let's get them!

- Download R at **cran.r-project.org**
- Download RStudio at **rstudio.com**
- Download git **git-scm.com**

How to **set**?

- Create account at **github.com**
- In Rstudio, Tools – Global Options – Git/SVN – Browse git executable:
  - Windows:
  - **C:/Program Files/Git/bin/git.exe**
  - UNIX/UNIX-like:
  - **/usr/bin/git**

How to set?

- Open git bash/shell/terminal
- Run:

```
git config --global user.mail
“email@domain.com”
```

```
git config --global user.name
“Your Name”
```

github.com/DS-ifupnyk/praktikum2020.git

Let's get **started**!

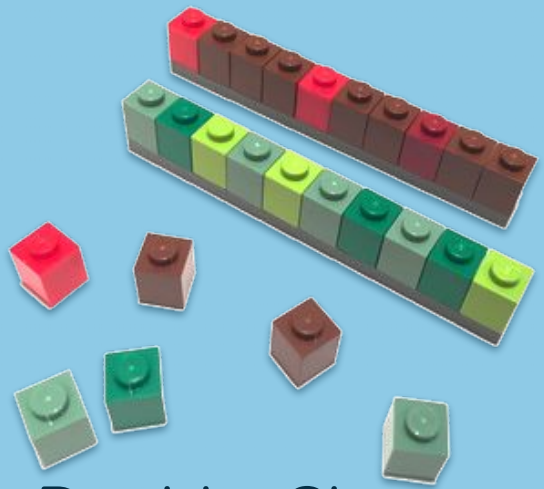
- Hit 'Fork' button
- Click 'Clone or Download', copy the URL
- In RStudio, File – New Project – Version Control – Git. Paste URL

How to use **git**?

- In Environment Pane, hit ‘Git’ tab
- Click commit, a window pane will appear
- Select all files (Ctrl + A), click ‘Stage’
- Fill commit message, the click ‘Commit’
- Hit ‘Push’ Button, done!
- You may check you GitHub now!

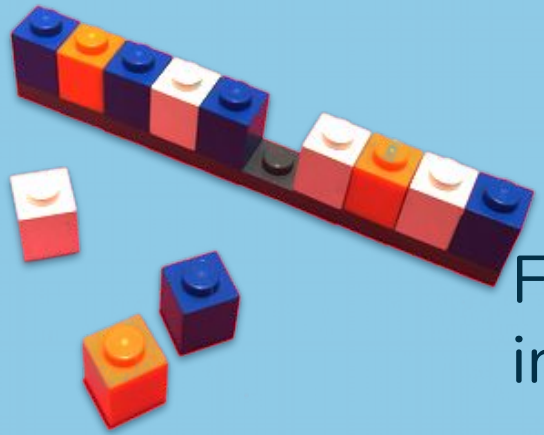
Data structure

Dimension	Homogenous	Heterogenous
1d	Atomic vectors	List
2d	Matrix	Dataframe
nd	Array	



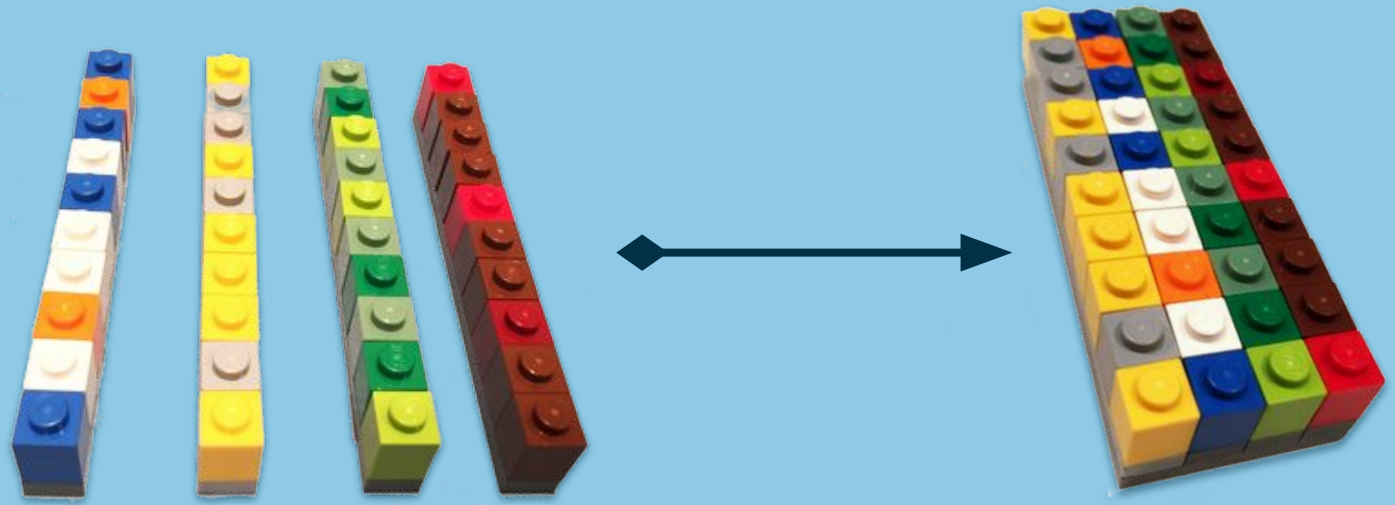
Integer, Double, Character

Logical



Factor (basically integer with class)

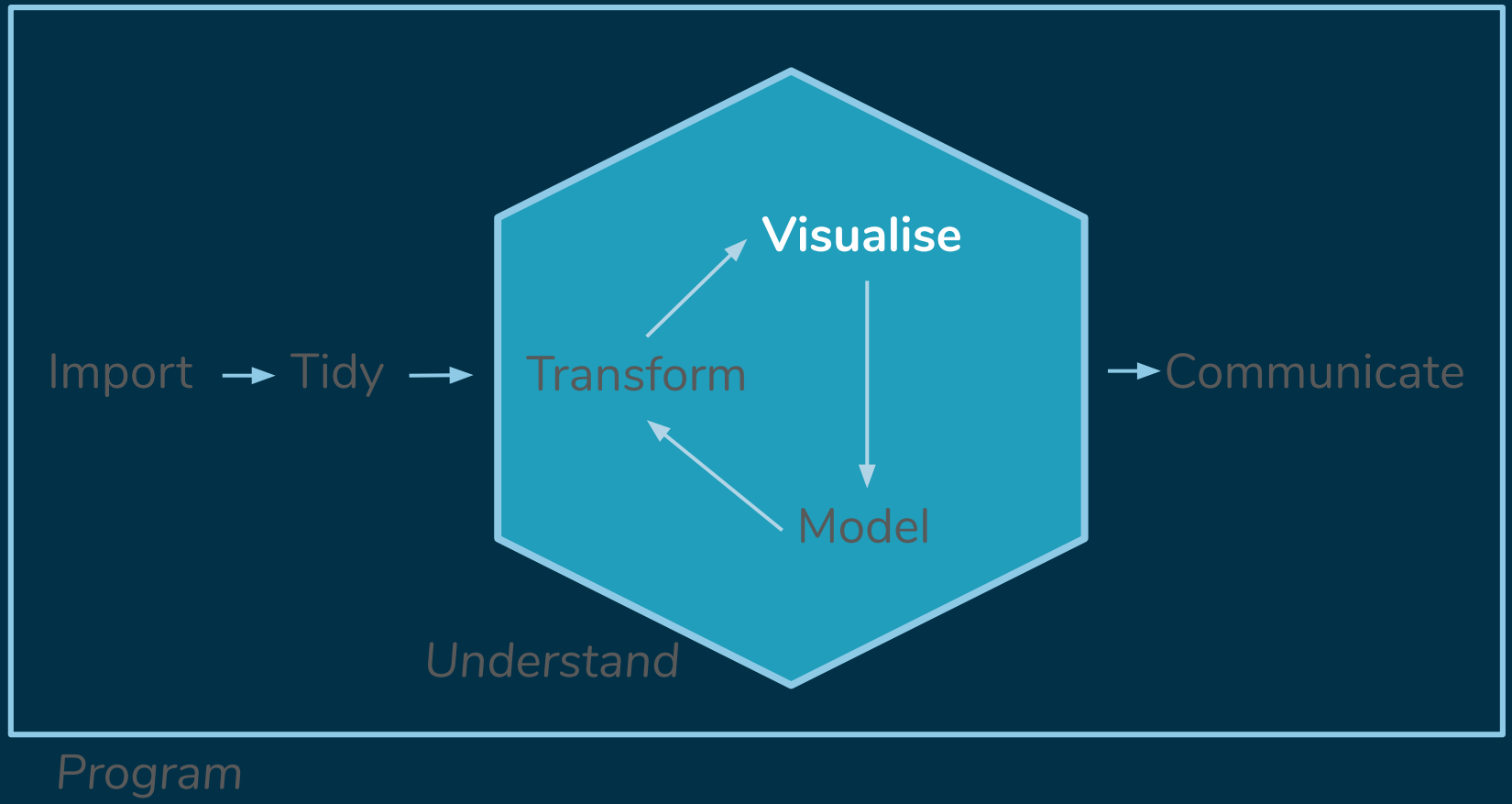
Artwork by @JennyBryan



Vectors of same length

Dataframe

Artwork by @JennyBryan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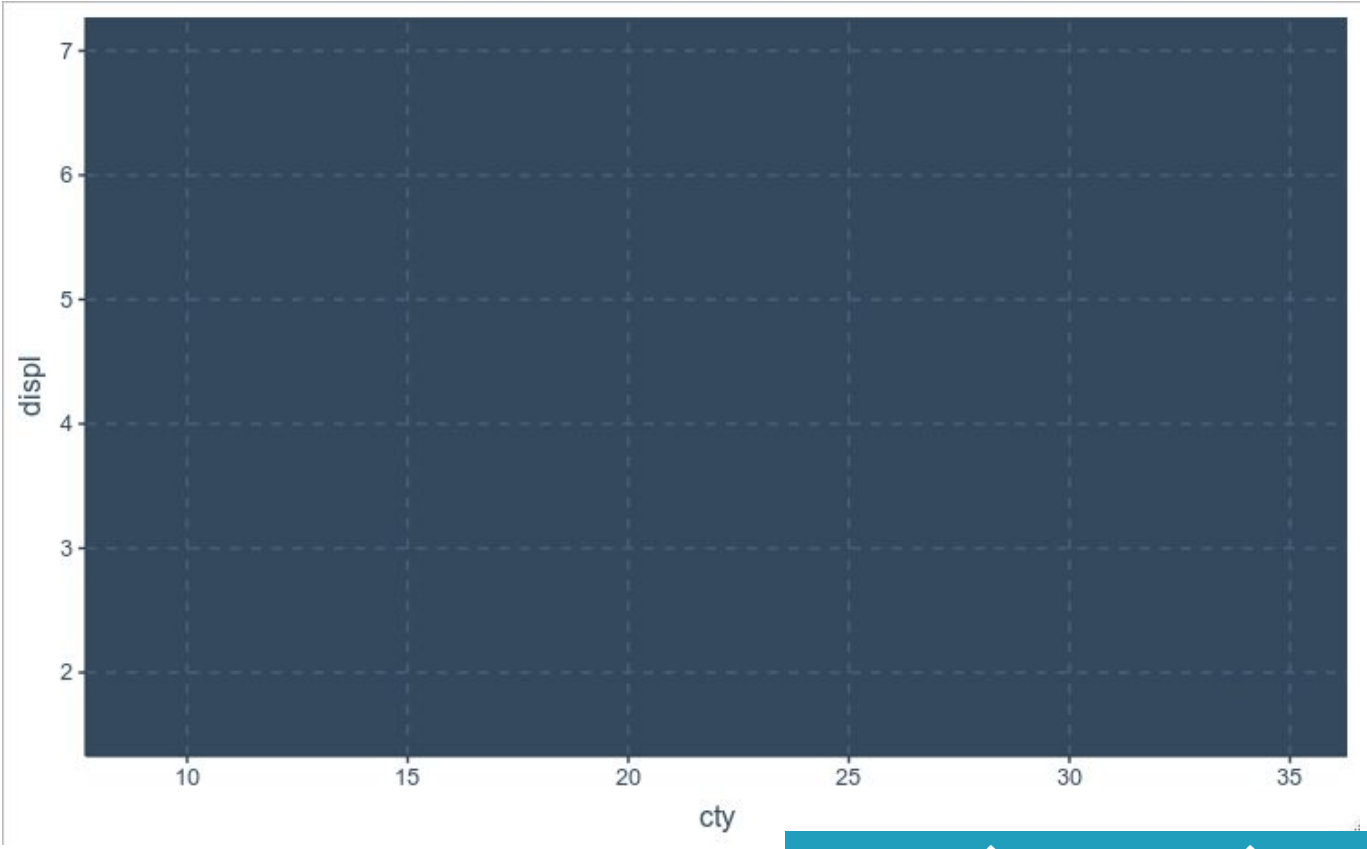
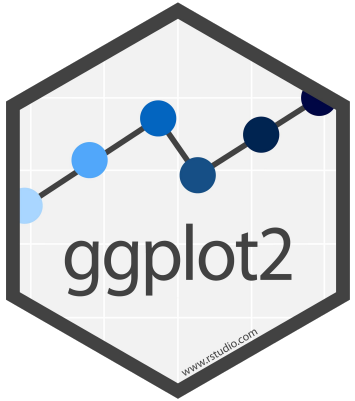
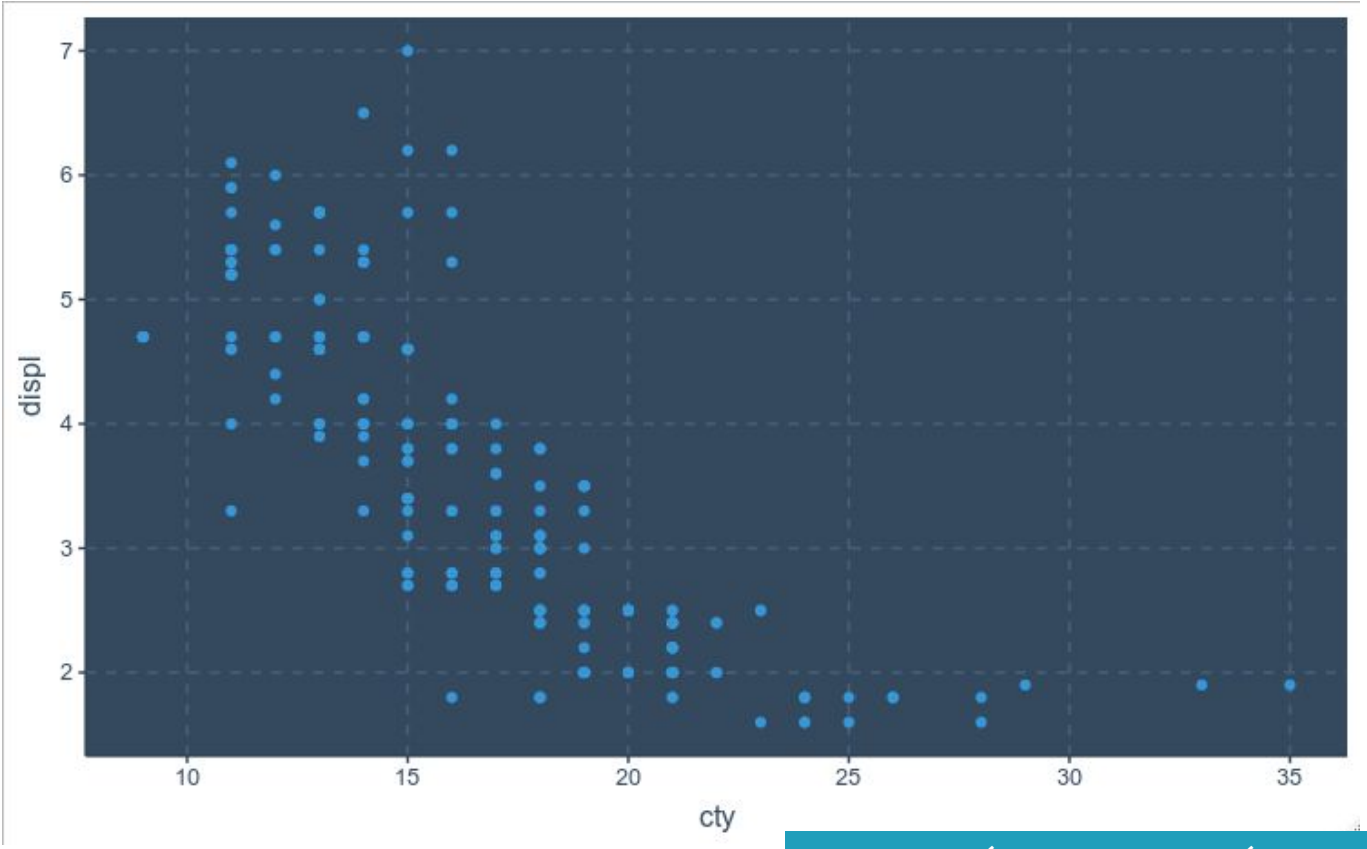
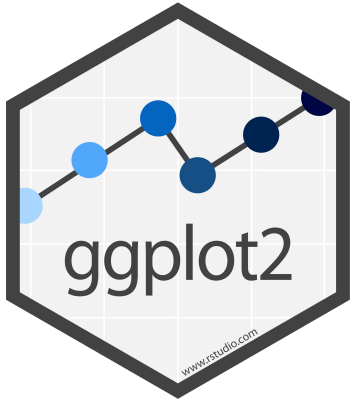
Artwork by @allison_horst



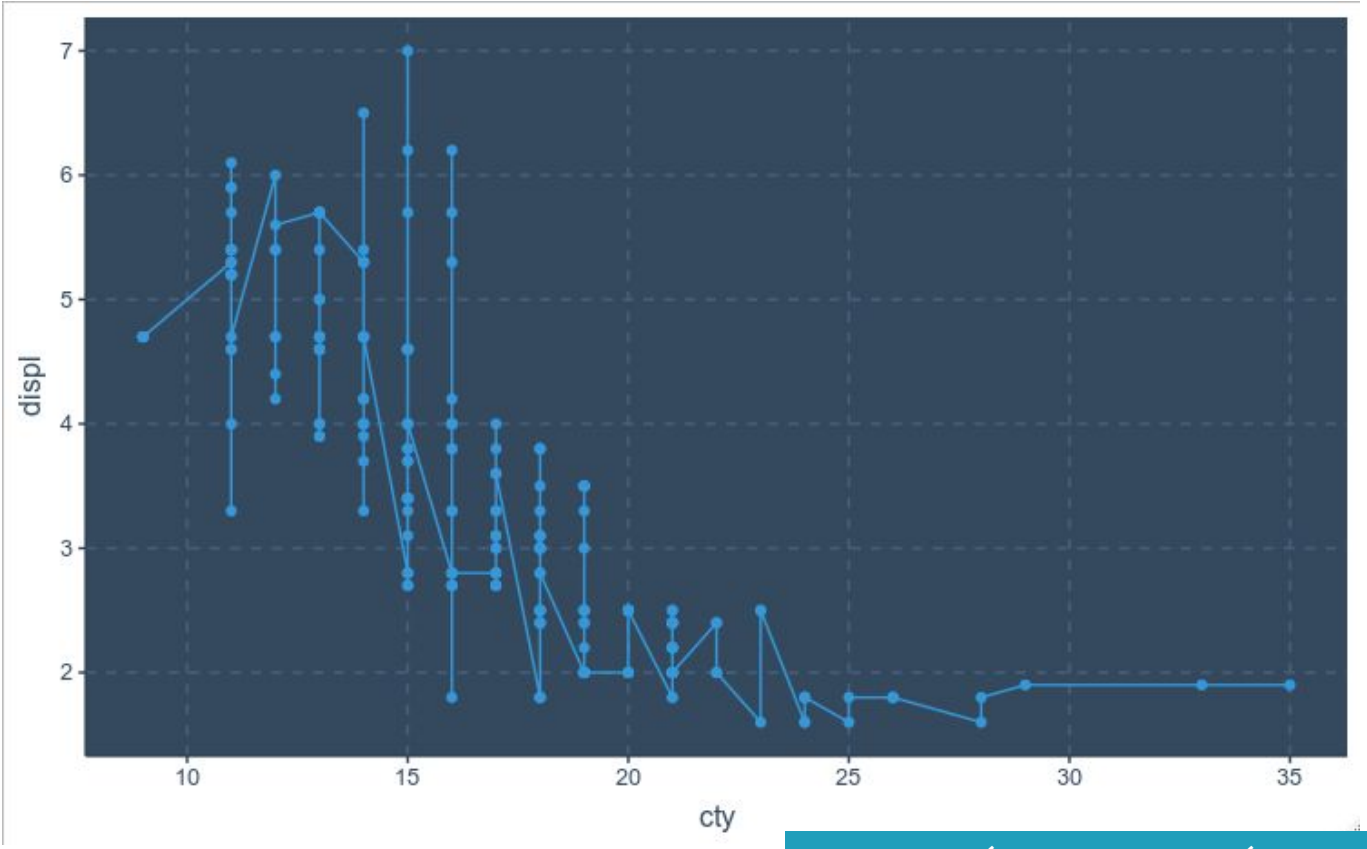


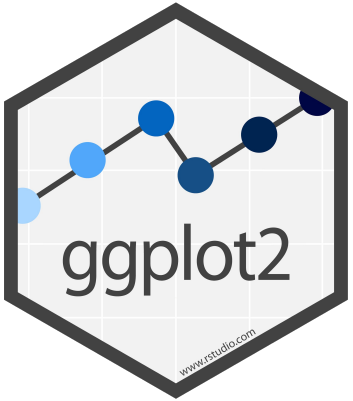

```
ggplot(mpg, aes(x = cty, y = displ))
```



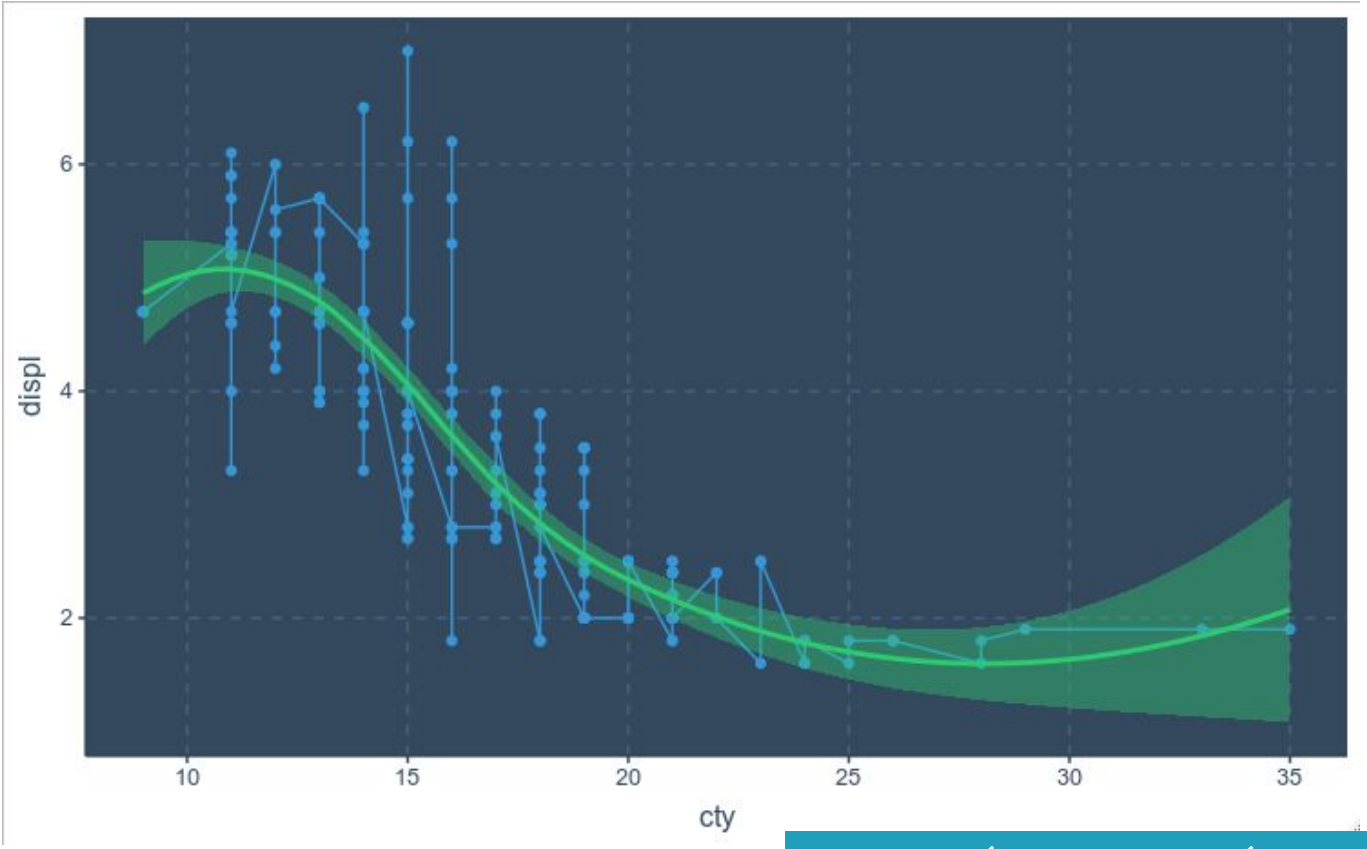


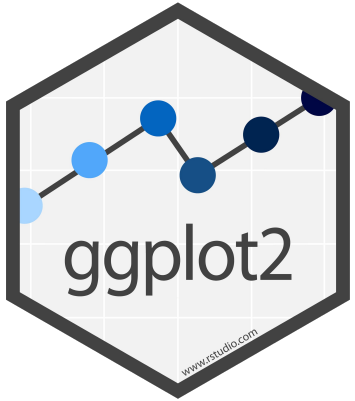

```
ggplot(mpg, aes(x = cty, y = displ)) +
  geom_point()
```






```
ggplot(mpg, aes(x = cty, y = displ)) +
  geom_point() +
  geom_line()
```



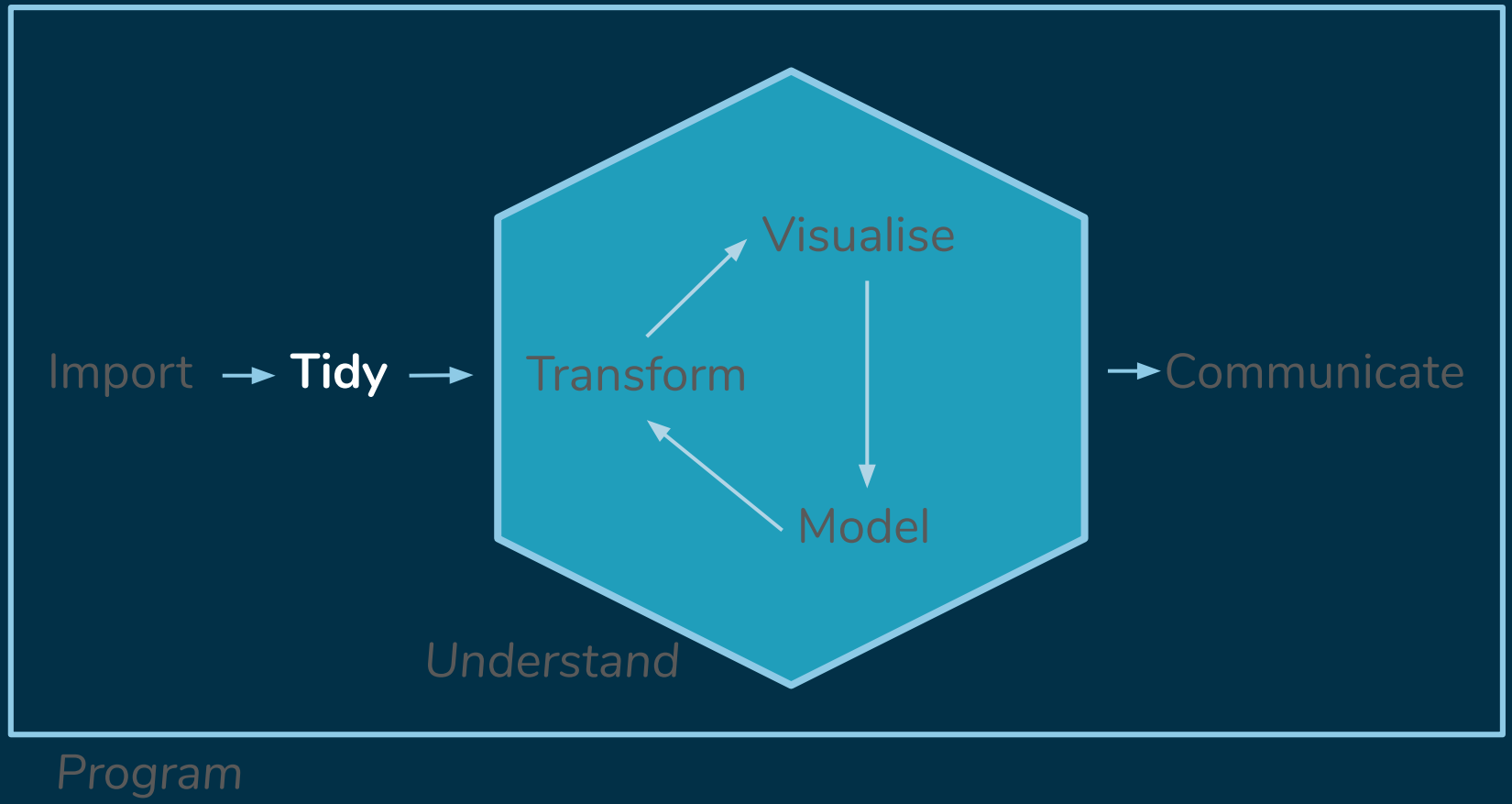



```
ggplot(mpg, aes(x = cty, y = displ)) +
  geom_point() +
  geom_line() +
  geom_smooth()
```

Let's do **practice**!

Solution: bit.ly/modul8RMD

- Open 'modul8.Rmd'
- Do not forget to push your works into GitHub!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Tidy datasets are all alike,
but every messy dataset is
messy in its own way!

- *Hadley Wickham*

A Tidy dataset

	Name	Gender	Age
1	Jane	Male	44
2	Lisbon	Female	38
3	John	Male	NA

A variable has its own column

	Var. 1	Var. 2	Var. 3
Obs. 1	A	B	C
Obs. 2	D	E	F
Obs. 3	G	H	I

An observation has its own row

	Var. 1	Var. 2	Var. 3
Obs. 1	A	B	C
Obs. 2	D	E	F
Obs. 3	G	H	I

A value has its own cell

	Var. 1	Var. 2	Var. 3
Obs. 1	A	B	C
Obs. 2	D	E	F
Obs. 3	G	H	I

Artwork by @allison_horst

dplyr basic functions:

- filter() selects rows based on their values
- mutate() creates new variables
- select() picks columns by name
- summarise() calculates summary statistics
- arrange() sorts the rows

Operators:

- ! (not)
- | (or)
- & (and)
- ==, !=
- <, <=, >, >=
- %in%
- is.na()

Credits to Michael Toth

```
function(arg1, arg2, arg3, ...)
```

```
arg1 %>%
  function(arg2, arg3, ...)
```

```
function(arg1, arg2, arg3, ...)
```

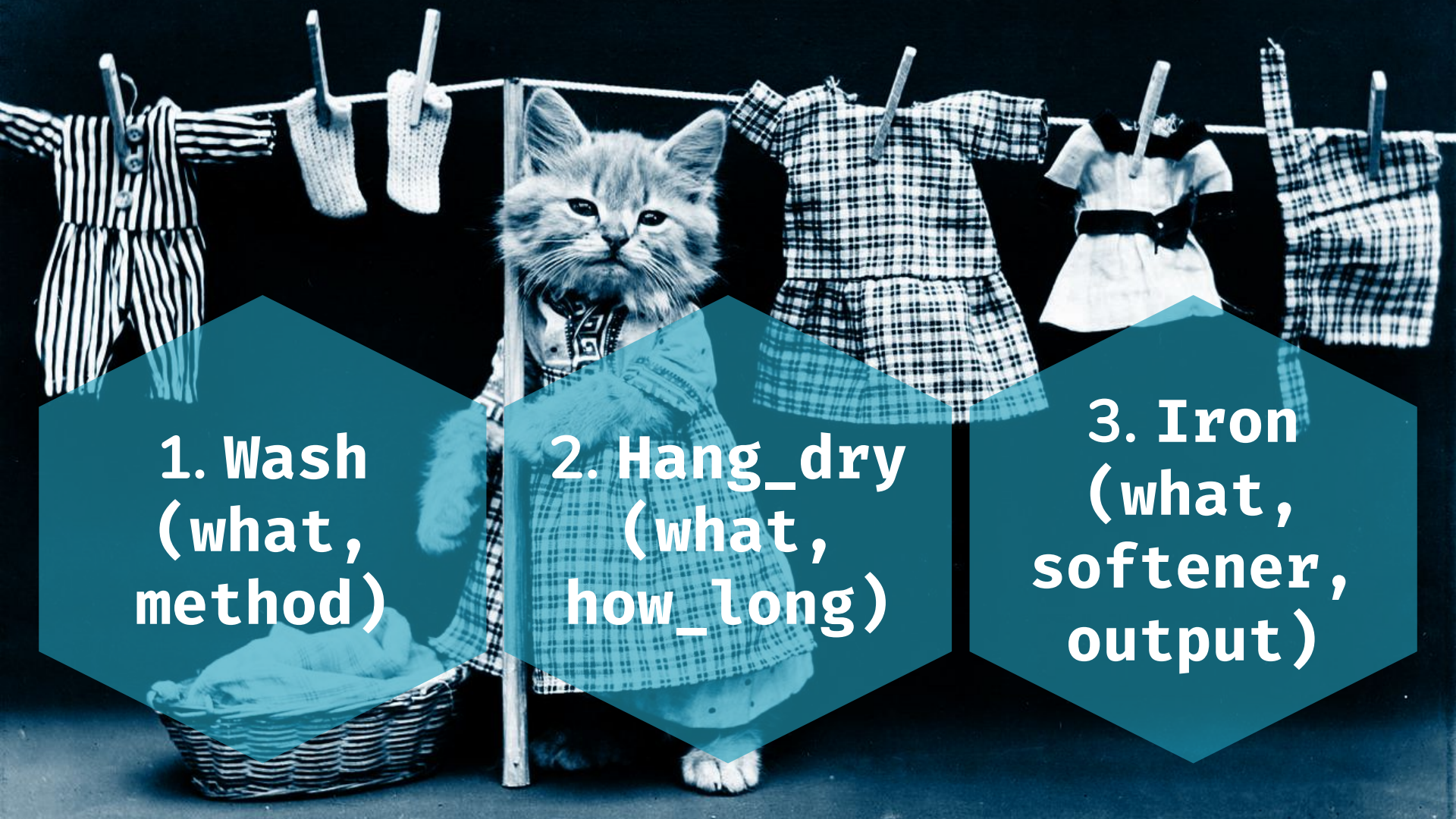
```
arg2 %>%
  function(arg1, arg2=., arg3,
           ...)
```

magrittr

How can I

chain?

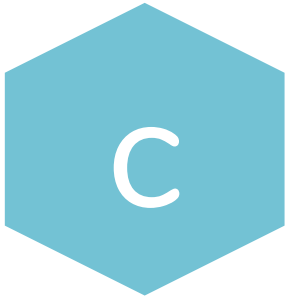

1. Wash
2. Hang_dry
3. Iron


1. Wash (what, method)
2. Hang_dry (what, how_long)
3. Iron (what, softener, output)


```
> washed_clothes ← wash(what = dirty_clothes,
                        method = “handwash”)
> dry_clothes ← hang_dry(what =
                         washed_clothes,
                         how_long = 8)
> iron(what = dry_clothes, softener = TRUE,
       output = “neat.clothes”)
```


```
> washed_clothes ← wash(what = dirty_clothes,
                        method = “handwash”)
> dry_clothes ← hang_dry(what =
                         washed_clothes,
                         how_long = 8)
> iron(what = dry_clothes, softener = TRUE,
       output = “neat.clothes”)
```


```
> iron(
      hang_dry(
            wash(what = dirty_clothes, method =
                  “handwash”),
            how_long = 8),
      softener = TRUE,
      output = “neat.clothes”)
```



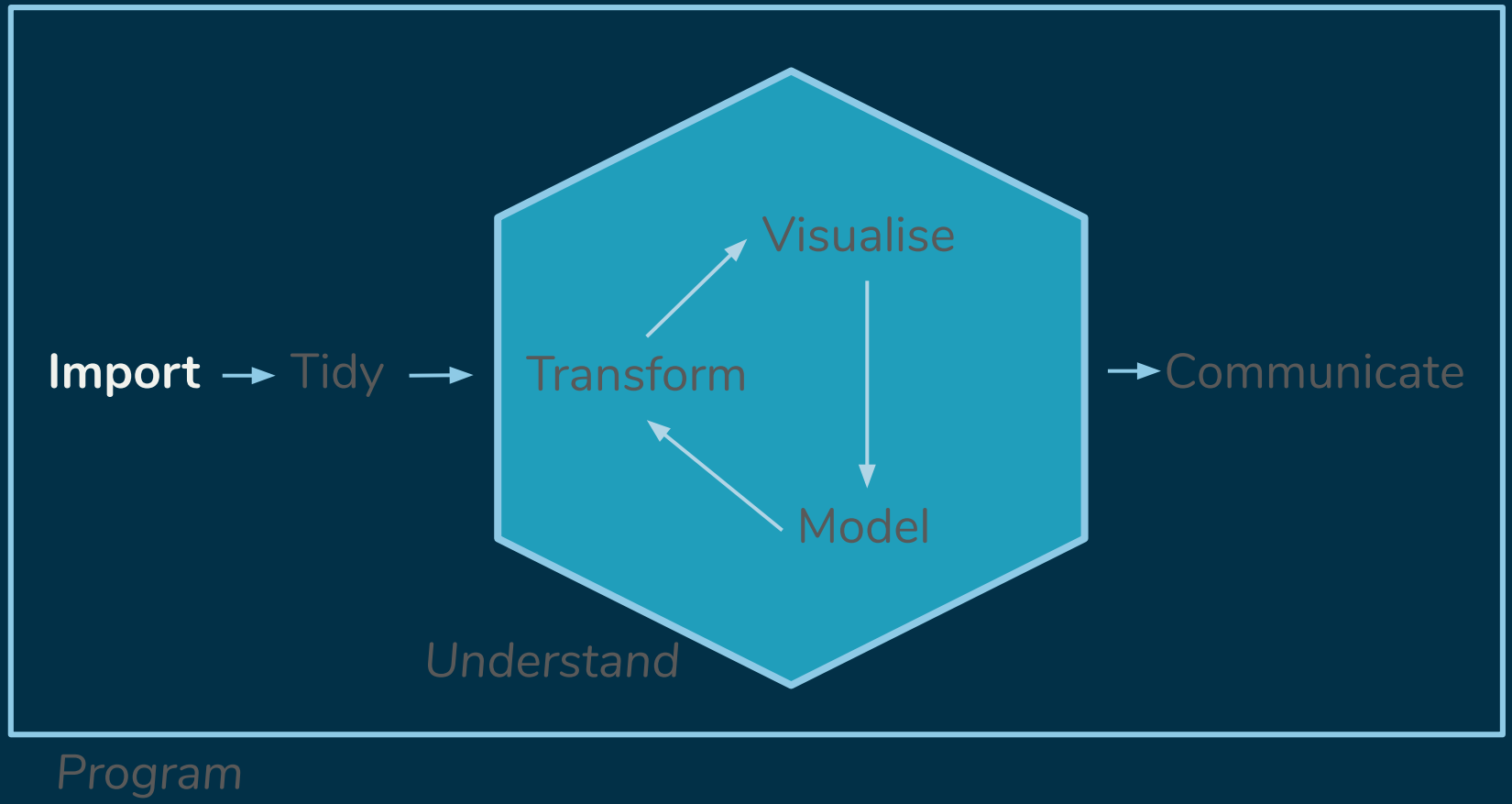

```
> wash(what = dirty_clothes,
       method = “handwash”) %>%
     hang_dry(how_long = 8) %>%
          iron(softener = TRUE,
               output = “neat.clothes”)
```

```
x <- something
for (i in seq_along(x) {
  function(x[[i]])
}
```

```
x <- something
*apply(x, function)
```

```
x <- something
map_*(x, function)
```

purrr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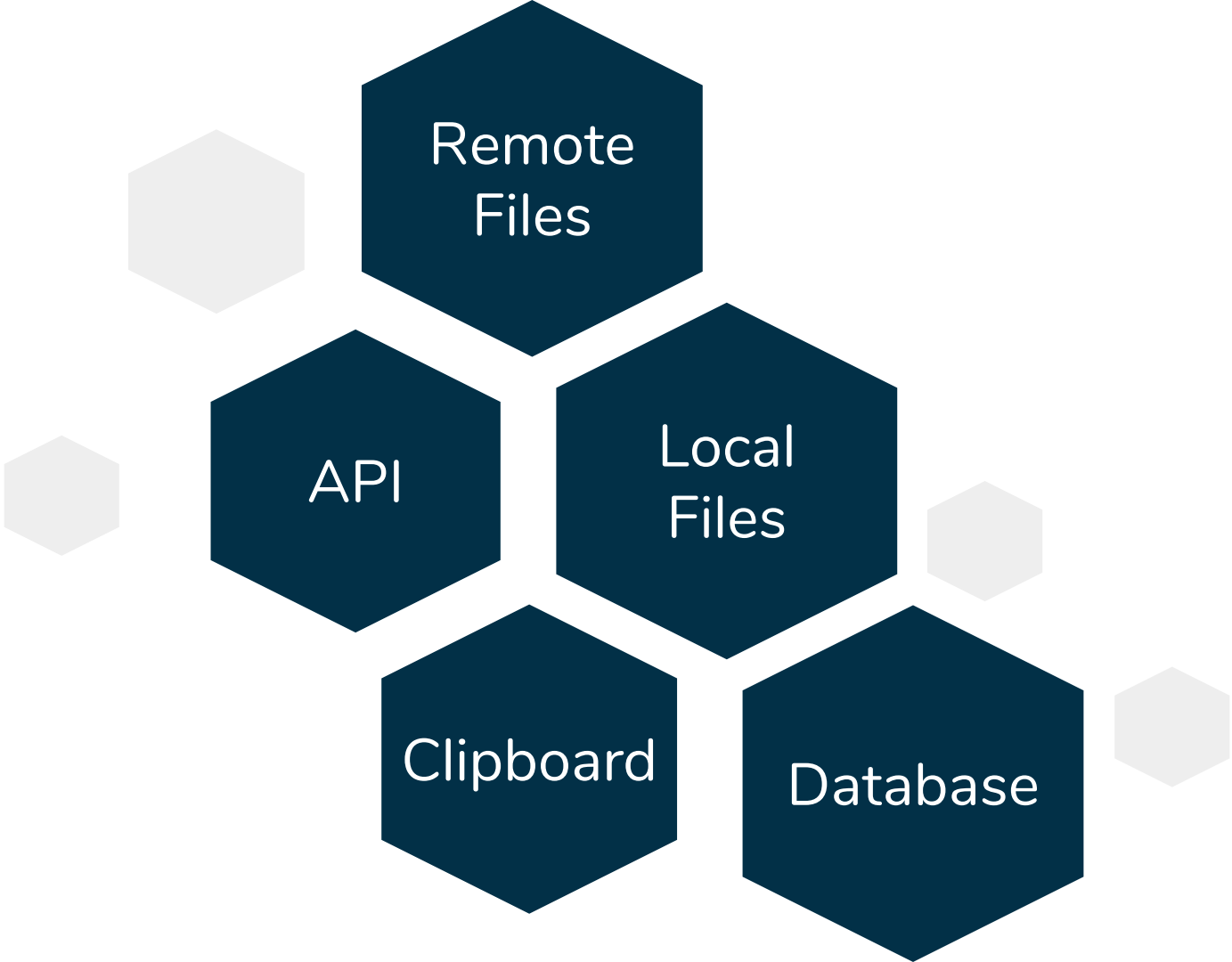
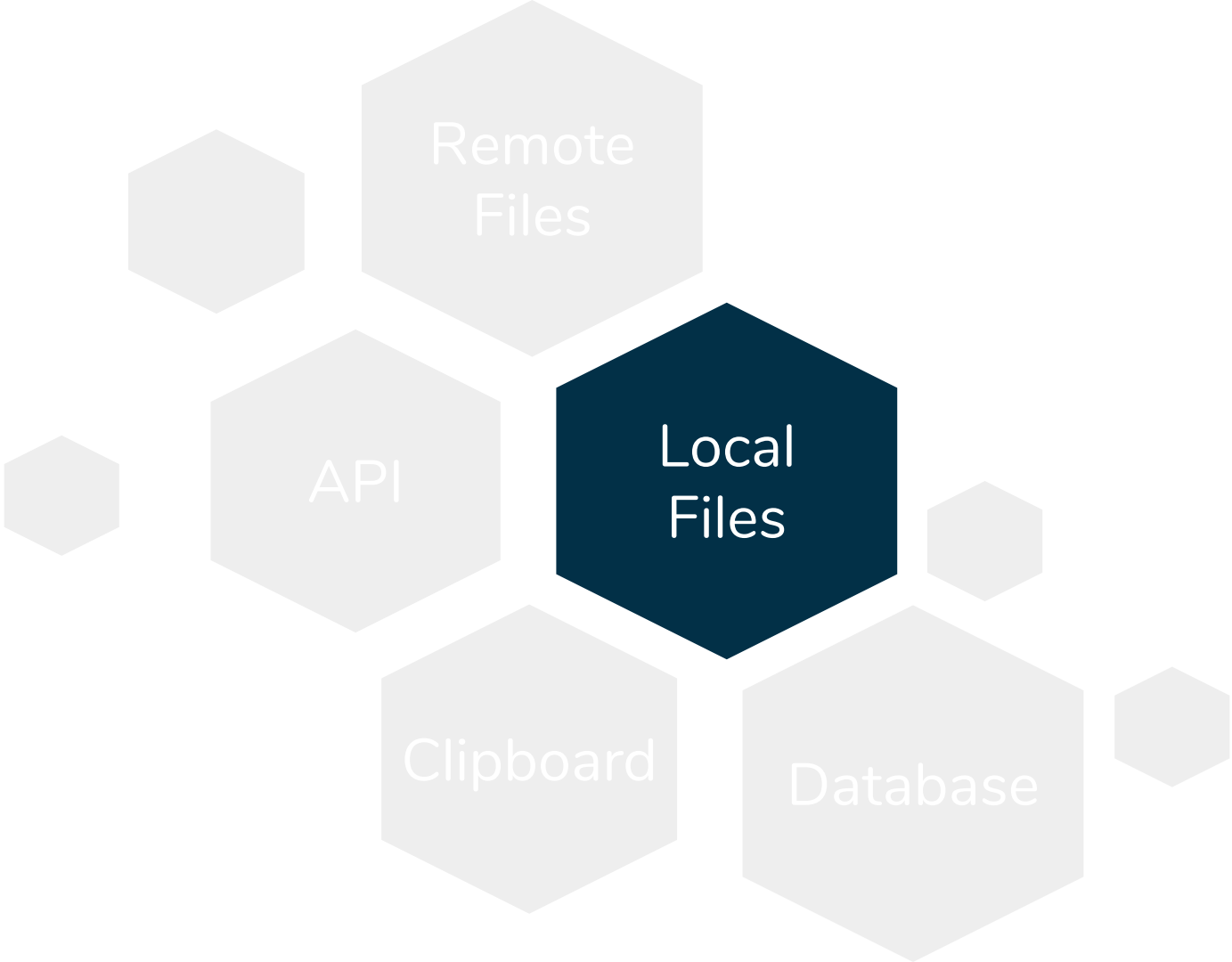

Remote Files
API
Local Files
Clipboard
Database


Remote Files
API
Local Files
Clipboard
Database

- vroom(): comma separated (CSV) files
- vroom(): tab separated files
- vroom(): general delimited files
- vroom(): fixed width files
- vroom(): tabular files where columns are separated by white-space.

Let's do **practice**!

- Open 'modul7.Rmd'
- Do not forget to push your works into GitHub!

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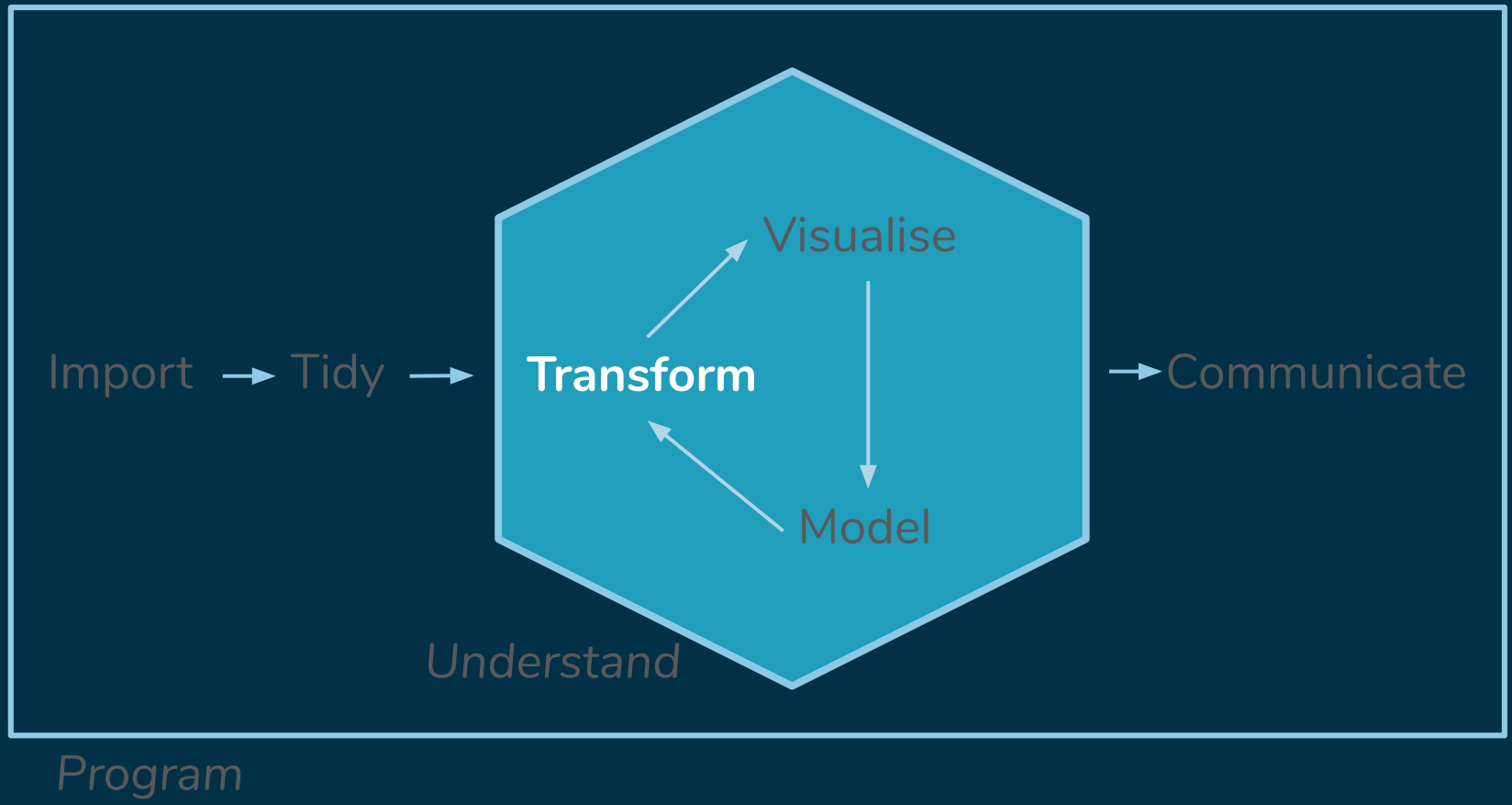
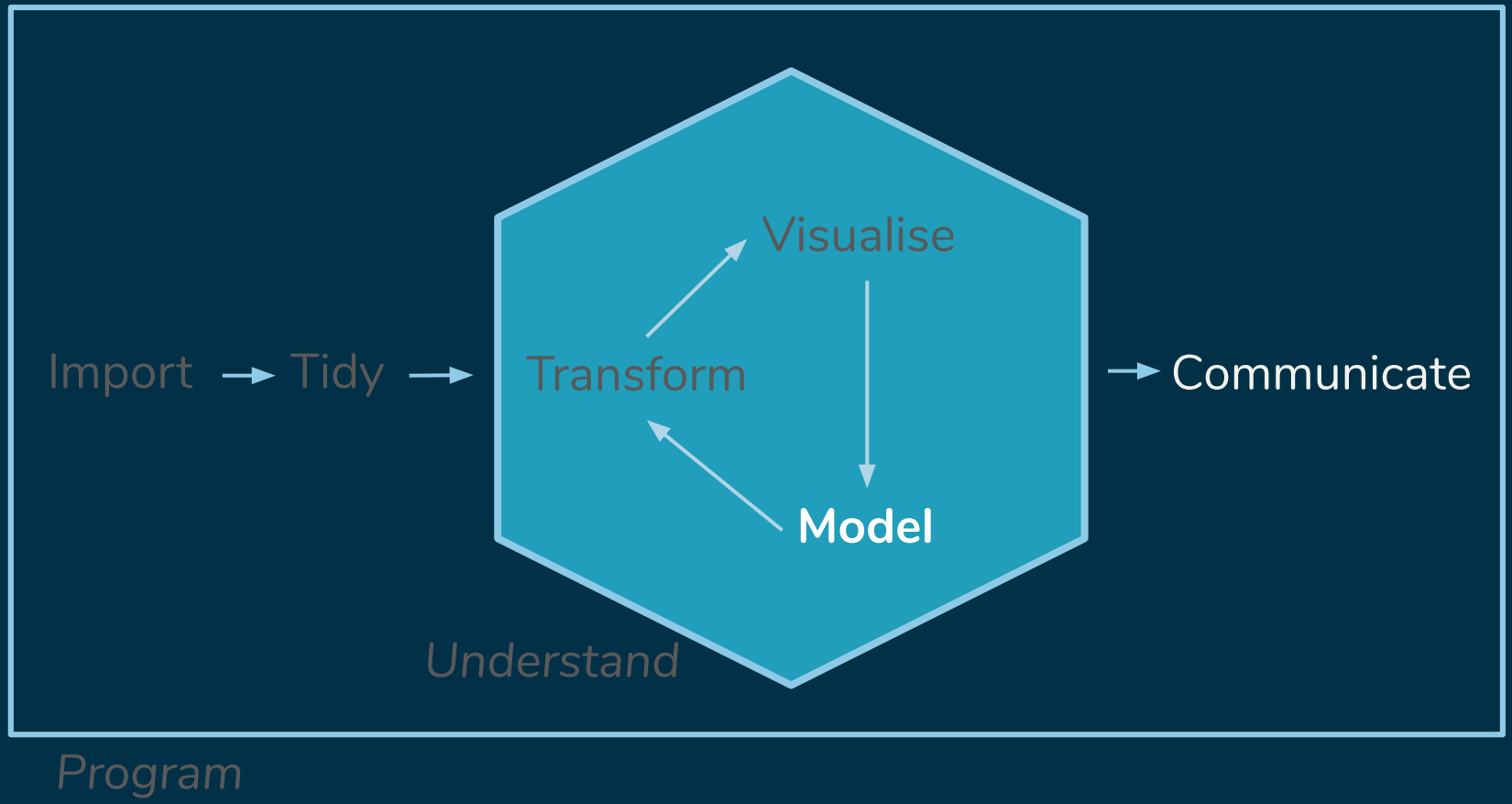
- Do not forget to push your works into GitHub!

Solution: Modul Praktikum Bab 7

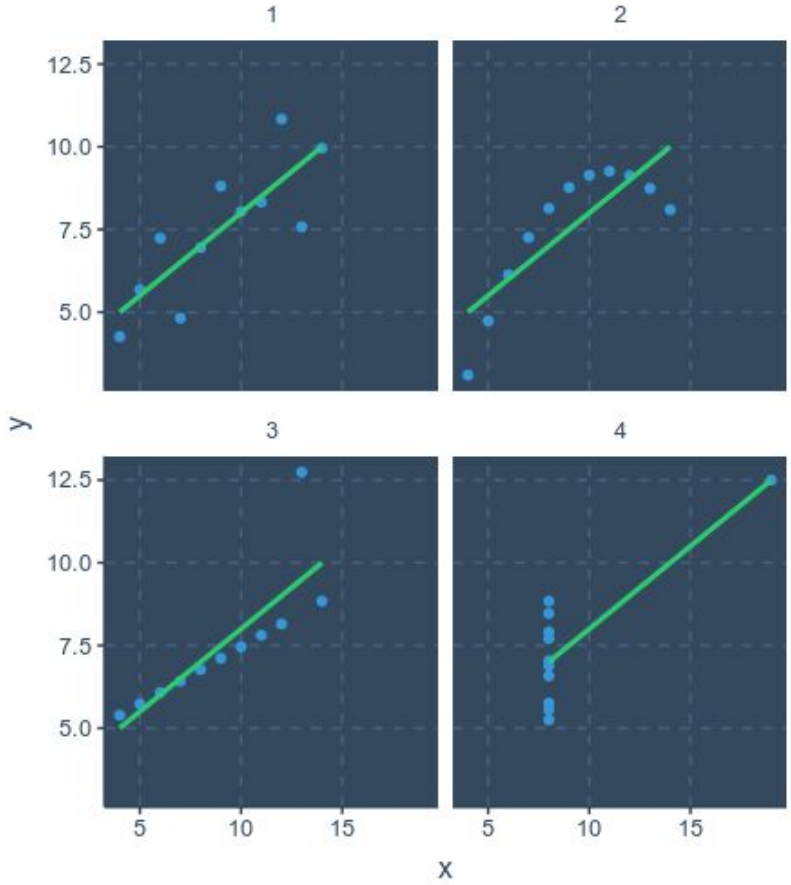

Import
Tidy
Transform
Visualise
Model
Communicate
Understand
Program

Artwork by @allison_horst


Import
Tidy
Transform
Visualise
Model
Communicate
Understand
Program

A low dimensional description of a higher dimensional data set

Source: https://github.com/rstudio-education/arm-workshop-rsc2019



Outcome ~ Predictor/Explanatory

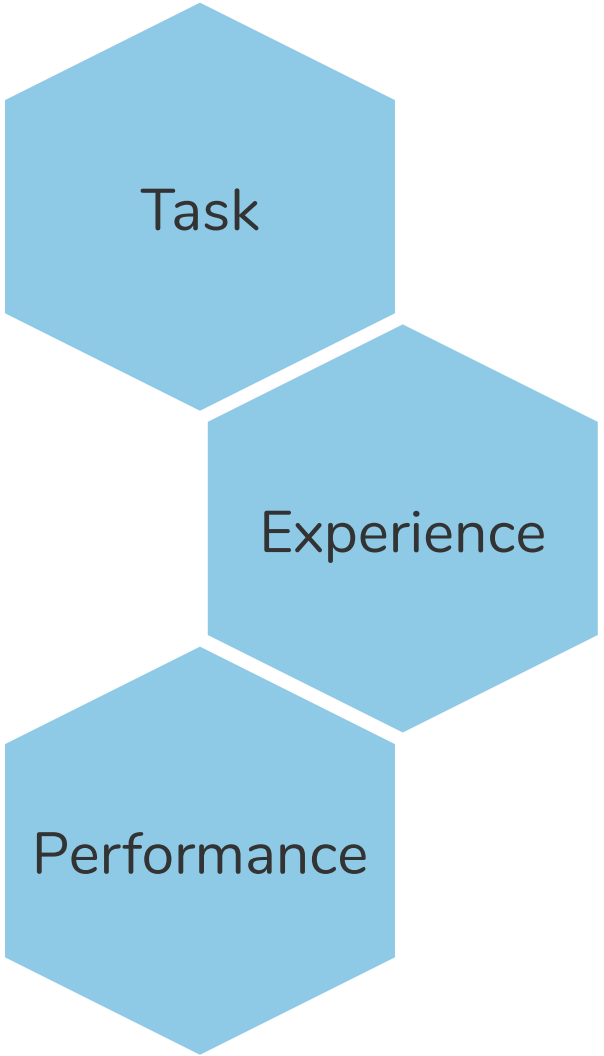
To predict

To explain

- All models are wrong, but some are useful – George Box

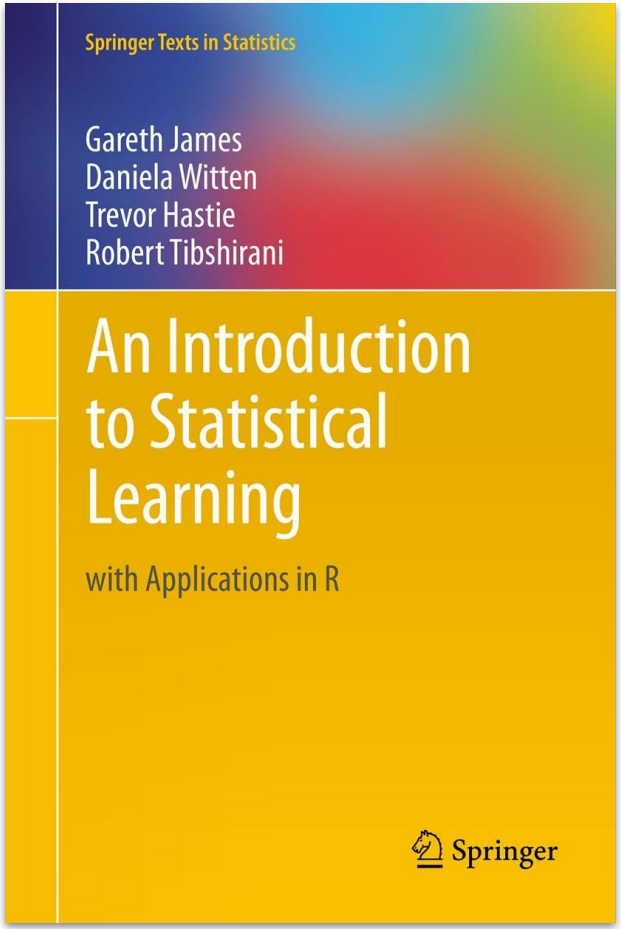
Machine Learning

$$y = f(x) + e$$



Supervised learning

Unsupervised learning



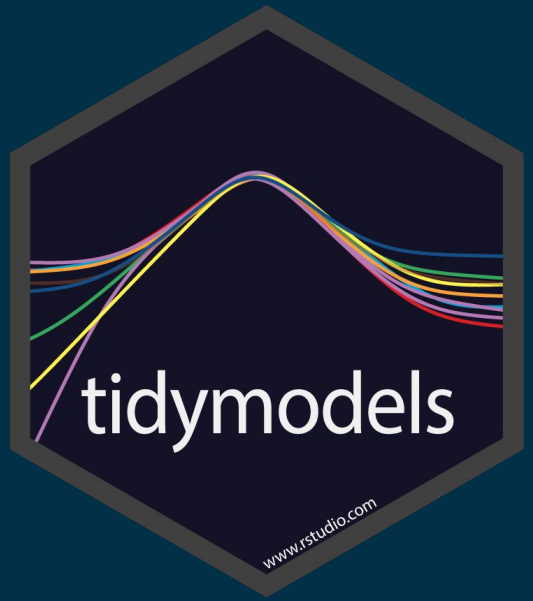
http://faculty.marshall.usc.edu/gareth-james/ISL/

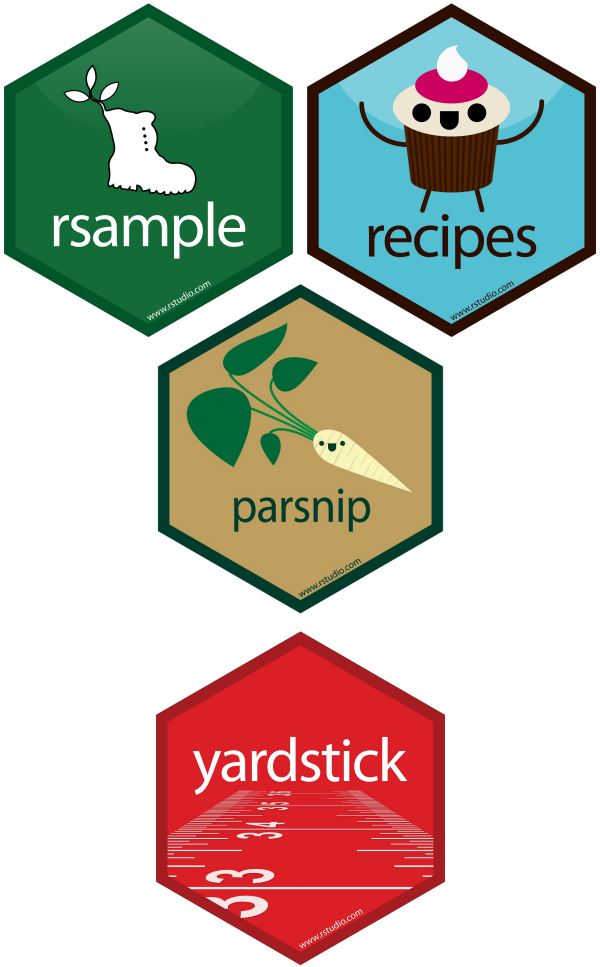
Pre-process

Train

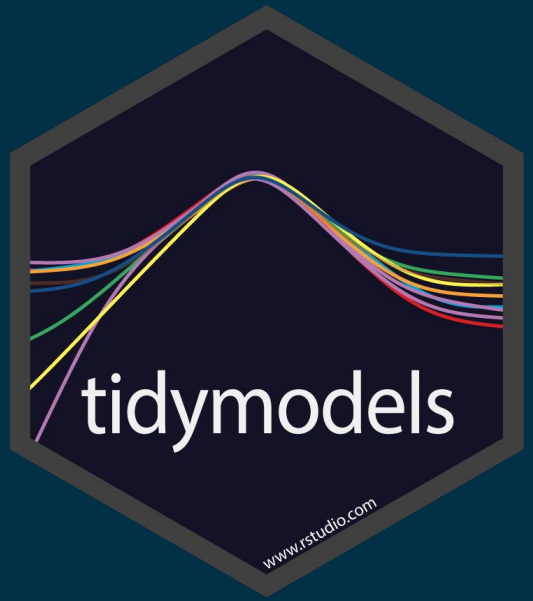
Validate

tidymodels




rsample
www.rstudio.com
recipes
www.rstudio.com
parsnip
www.rstudio.com
yardstick
www.rstudio.com

tidymodels


tidymodels
www.rstudio.com

Let's do **practice**!

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Solution: bit.ly/supervised-Solution

Let's do **practice**!

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Let's do **practice**!

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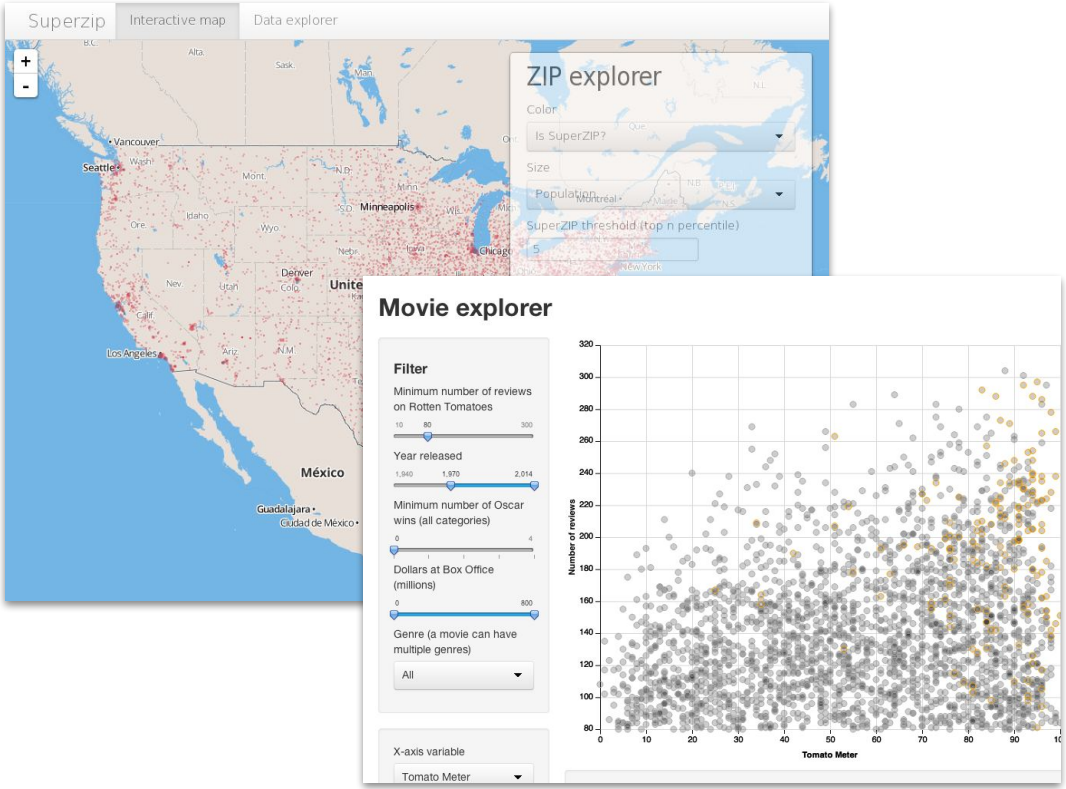
Solution: bit.ly/unsupervisedlearning-Solution



Images from shiny.rstudio.com

shiny

Shiny

www.rstudio.com

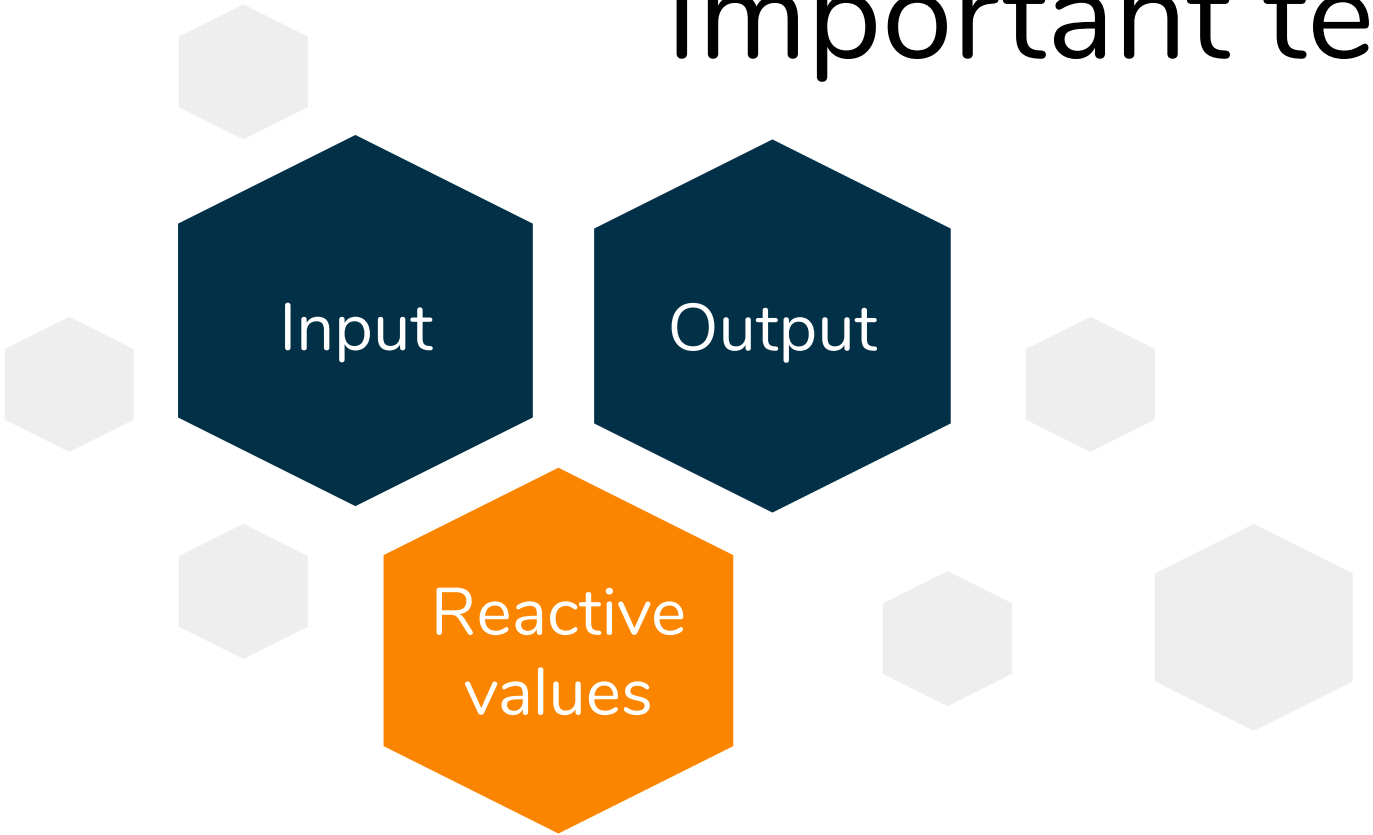
```
library(shiny)
mydata <- load(“mydata.rda”)

ui <- fluidPage(
# define user interface here
)

server <- function(input, output) {
# put logic and computation here
}

shinyApp(ui = ui, server = server)
```

Important terms!



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shinyApp(ui = ui, server = server)
```

- Inputs are defined and laid out
- Outputs are laid out

- Inputs are taken
- Outputs are calculated/made

```
library(shiny)
mydata <- load("mydata.rda")

ui <- fluidPage(
# define user interface here
)

server <- function(input, output) {
# put logic and computation here
}

shinyApp(ui = ui, server = server)
```

1. Take input value from **input$xx**
2. Perform processing/calculation in reactive context (expression/observer)
3. Build objects to display using **render*()**
4. Save objects to display to **output$xx**

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Let's do **practice**!

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Solution: bit.ly/shiny-Solution

Congrats!

Artwork by @allison_horst

Contact me

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Email : vynspermadi@upnyk.ac.id