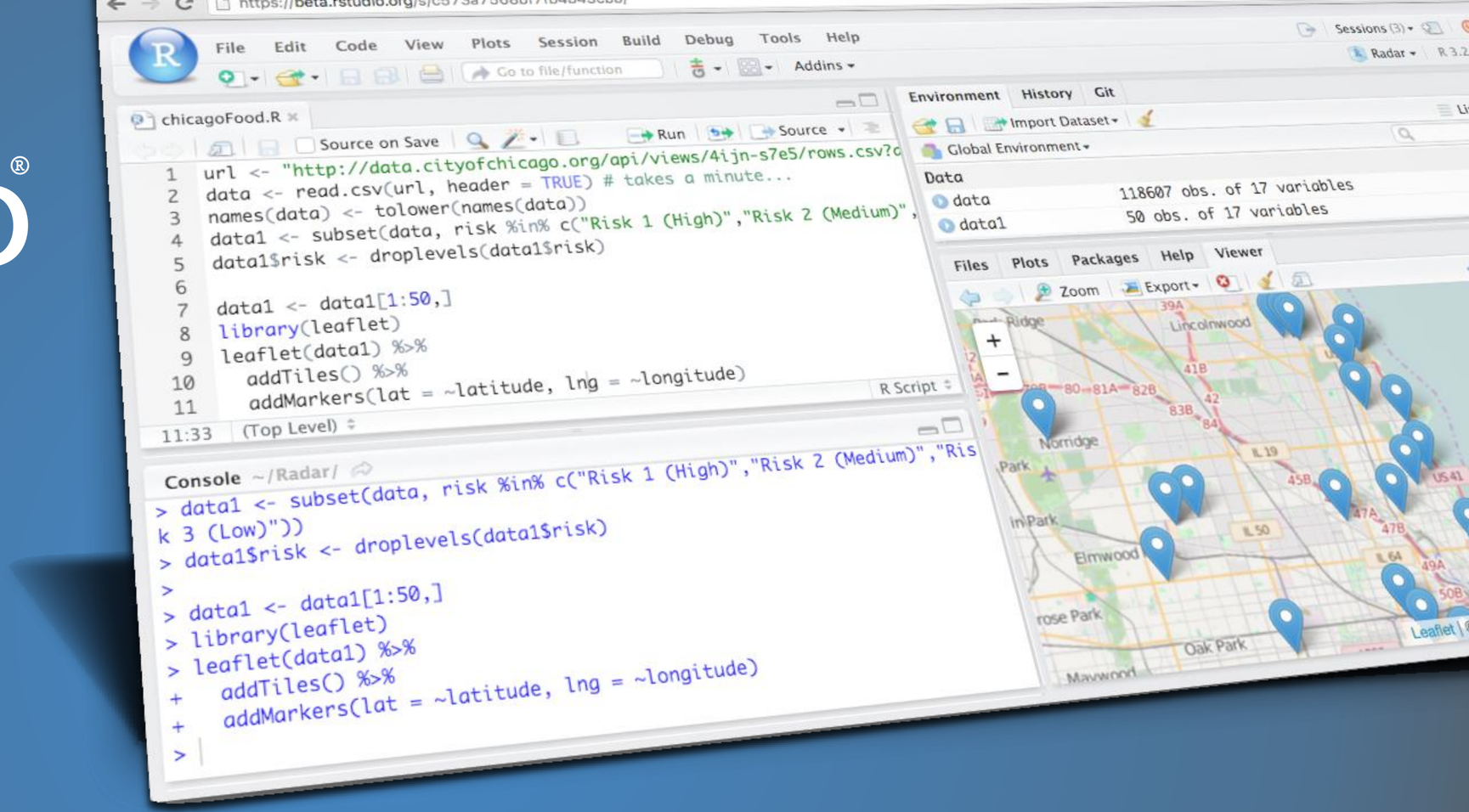
RStudio®



Foundation of the R Workflow

DS Statement

- I have always been inspired by those who can capture the landscape with a minimum of brushstrokes

RStudio®

My Background

- Shiny
- CS
- Pharma
- Audience
- twitter:@rinpharma
- github:philbowsher
- Speed is the name of the game – fastest way to get you started
- Red is an Action Item for you

RStudio®

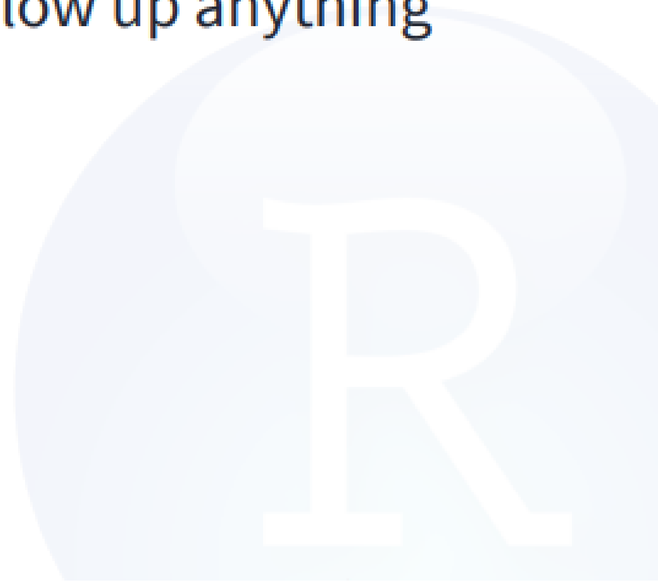
Goals for Today

- Getting to Know RStudio
- Importing data
- Data Viz
- Data Step
- Procs
- ODS
- Macro Variables / Macros

RStudio®

THINGS YOU SHOULD KNOW

- There are no stupid questions
- Because we have limited time, please write down questions as they occur to you, and then ask them when the instructor pauses for questions
- You will not learn all of R today
- Don't be afraid to experiment and try things out; you won't blow up anything important if you make a mistake.



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Workshop Communication

- Zoom Chat
- Polls & Breakout Rooms
- https://calendly.com/rstudio-phil-bowsher/30min?month=2020-10

RStudio®

Your Turn

Form groups of 2-4 people. Introduce yourself to your group members. Tell them:

1. Who you are
2. What you do with data
3. How long you have been using R

Quick Survey

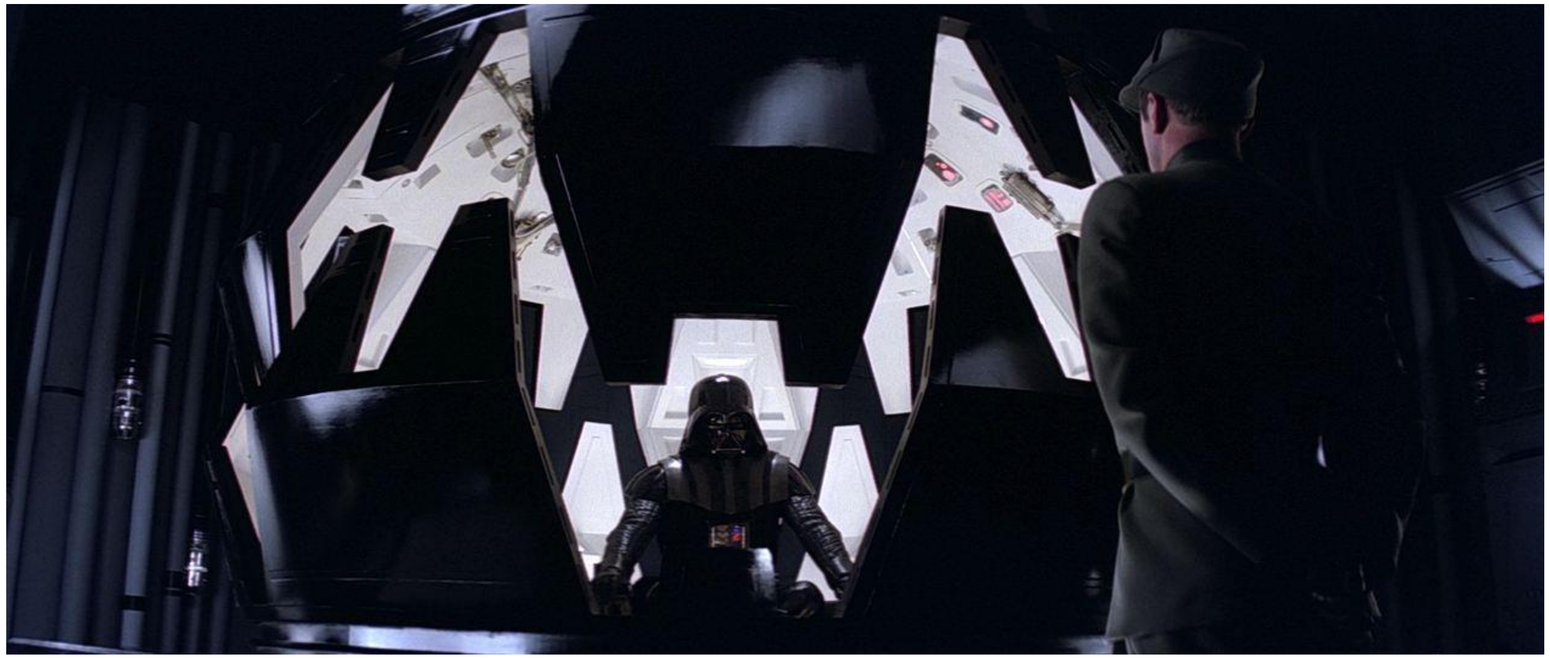
http://rstd.io/phil-me-out

SETUP IN RTT

- Setup
- https://github.com/sol-eng/classroom-getting-started
- http://rstd.io/class

Setup in RTT

- R
- Packages
- IDE
- Projects
- Sessions
- Git/Github
- RSC
- Shiny



Star Wars

RStudio®

Setup & Quick Intro (Panes & Buttons)

A language

Writing software

BUILT-IN DATASETS

- data()
- data(ToothGrowth)
- ?ToothGrowth
- ToothGrowth
- View(ToothGrowth)
- summary(ToothGrowth)
- plot(ToothGrowth)

IDE – Let's explore …

- # getwd()
- library(tidyverse)
- # let us explore the data set a bit
- names(ToothGrowth) # names of the variables
- dim(ToothGrowth) # dimension (number of rows and columns)
- str(ToothGrowth) # structure of the data set
- class(ToothGrowth)
- head(ToothGrowth, n = 5)
- tail(ToothGrowth, n = 5)
- ToothGrowth %>% write_csv('ToothGrowth.csv')
- ToothGrowth2 <- read_csv("ToothGrowth.csv")

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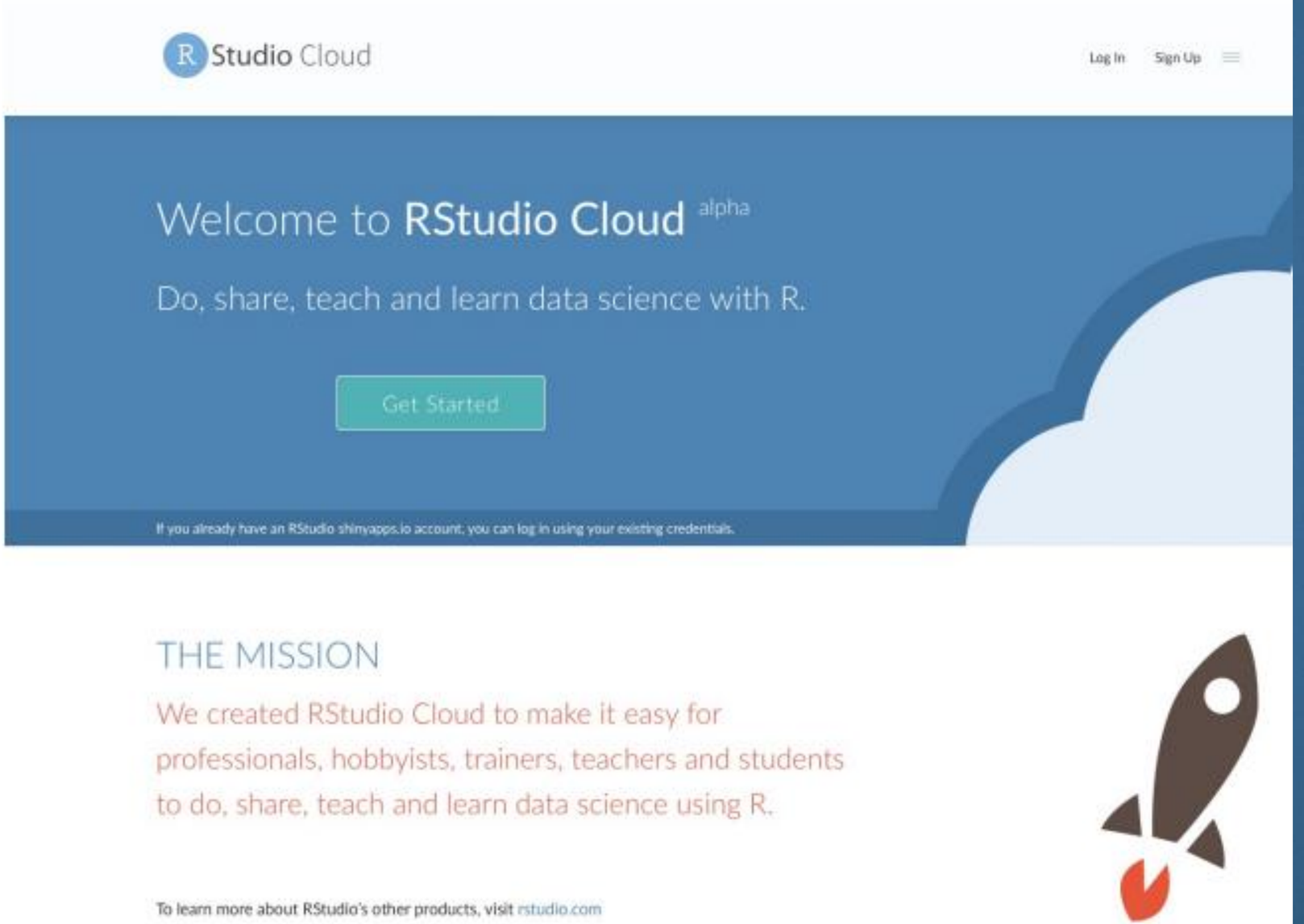
RSTUDIO.CLOUD OVERVIEW



After the workshop, go here:

https://rstudio.cloud/spaces/89287/join?access_code=V%2FvqOUv2%2FMCQF0jGlRPJnlLAeyN41fegtHS0mpPB

By the Way, Books…

- https://mastering-shiny.org/
- https://bookdown.org/yihui/rmarkdown/
- http://r4ds.had.co.nz & https://rstudio.cloud/
- https://r-graphics.org/
- http://www-bcf.usc.edu/~gareth/ISL/
- http://appliedpredictivemodeling.com/
- https://bookdown.org/yihui/rmarkdown/
- https://www.tidytextmining.com/
- https://adv-r.hadley.nz/
- https://plotly-r.com/
- https://therinspark.com/
- https://www.tidymodels.org/books/

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Break Time

- 5-10 Min Break

Your Turn

- Form groups of 2-4 people
- Visual Analytics
- Have you used the Tidyverse?
- What data do you import?
- How much time do you spend cleaning data?

Import Data with

First things First...Data

Read data in

Read in data with `readr`, `haven`, `readxl`

`readr`

- `read_csv()`, `read_tsv()`, `read_delim()`

`haven`

- `read_sas()`, `read_spss()`, `read_stata()`, `read_dta()`

`readxl`

- `read_xls()`, `read_xlsx()`, `read_excel()`

Importing Data

readr

Simple, consistent functions for working with strings.

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

Compared to read.table and its derivatives, readr functions are:

1. ~ 10 times faster
2. Return tibbles
3. Have more intuitive defaults. No row names, no strings as factors.

readr functions

function	reads
read_csv()	Comma separated values
read_csv2()	Semi-comma separated values
read_delim()	General delimited files
read_fwf()	Fixed width files
read_log()	Apache log files
read_table()	Space separated
read_tsv()	Tab delimited values

read_csv()

readr functions share a common syntax

```
df <- read_csv("path/to/file.csv", ...)
```

object to save output into

path from working directory to file

Import Text Data

File/URL:

~/Abbott Workshop/The-Little-R-Workshop-A-Primer-master/Examples/data/landdata-states.csv

Update

Data Preview:

State (character)	region (character)	Date (double)	Home.Value (double)	Structure.Cost (double)	Land.Value (double)	Land.Share..Pct. (double)	Home.Price.Index (double)	Land.Price.Index (double)	Year (double)
AK	West	2010.25	224952	160599	64352	28.6	1.481	1.552	2010
AK	West	2010.50	225511	160252	65259	28.9	1.484	1.576	2010
AK	West	2009.75	225820	163791	62029	27.5	1.486	1.494	2009
AK	West	2010.00	224994	161787	63207	28.1	1.481	1.524	2009

Previewing first 50 entries.

Import Options:

Name: landdata_states

Skip: 0

First Row as Names

Trim Spaces

Open Data Viewer

Delimiter: Comma

Quotes: Default

Locale: Configure...

Escape: None

Comment: Default

NA: Default

Code Preview:

```
library(readr)
landdata_states <- read_csv("Abbott Workshop/The-Little
-R-Workshop-A-Primer-master/Examples/data/landdata
-states.csv")
View(landdata_states)
```

Reading rectangular data using readr

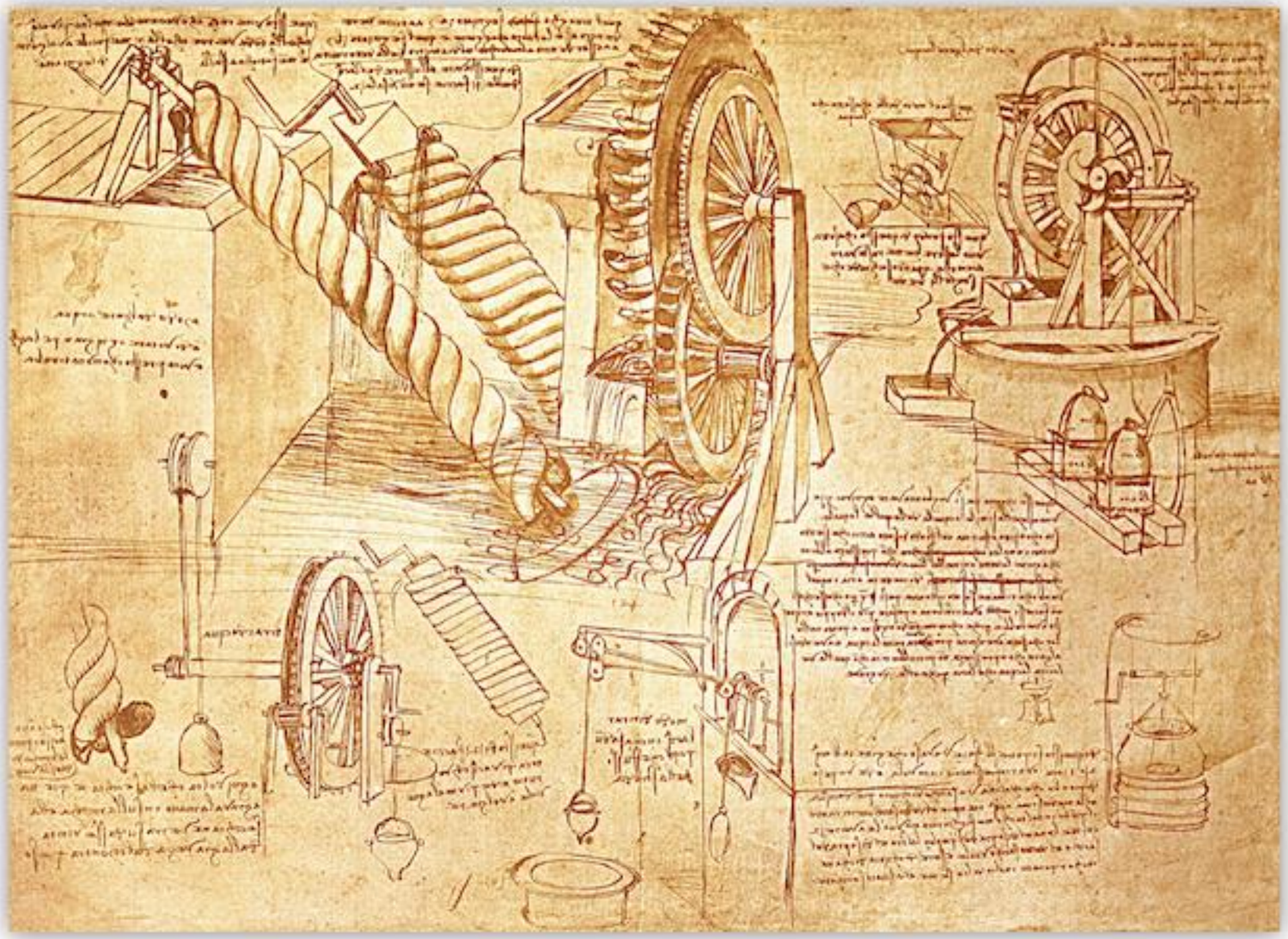
Import

Cancel

RStudio

Let's Chat about Notebooks…

Leonardo da Vinci…Page from the Codex Atlanticus shows notes and images about water wheels and Archimedean Screws

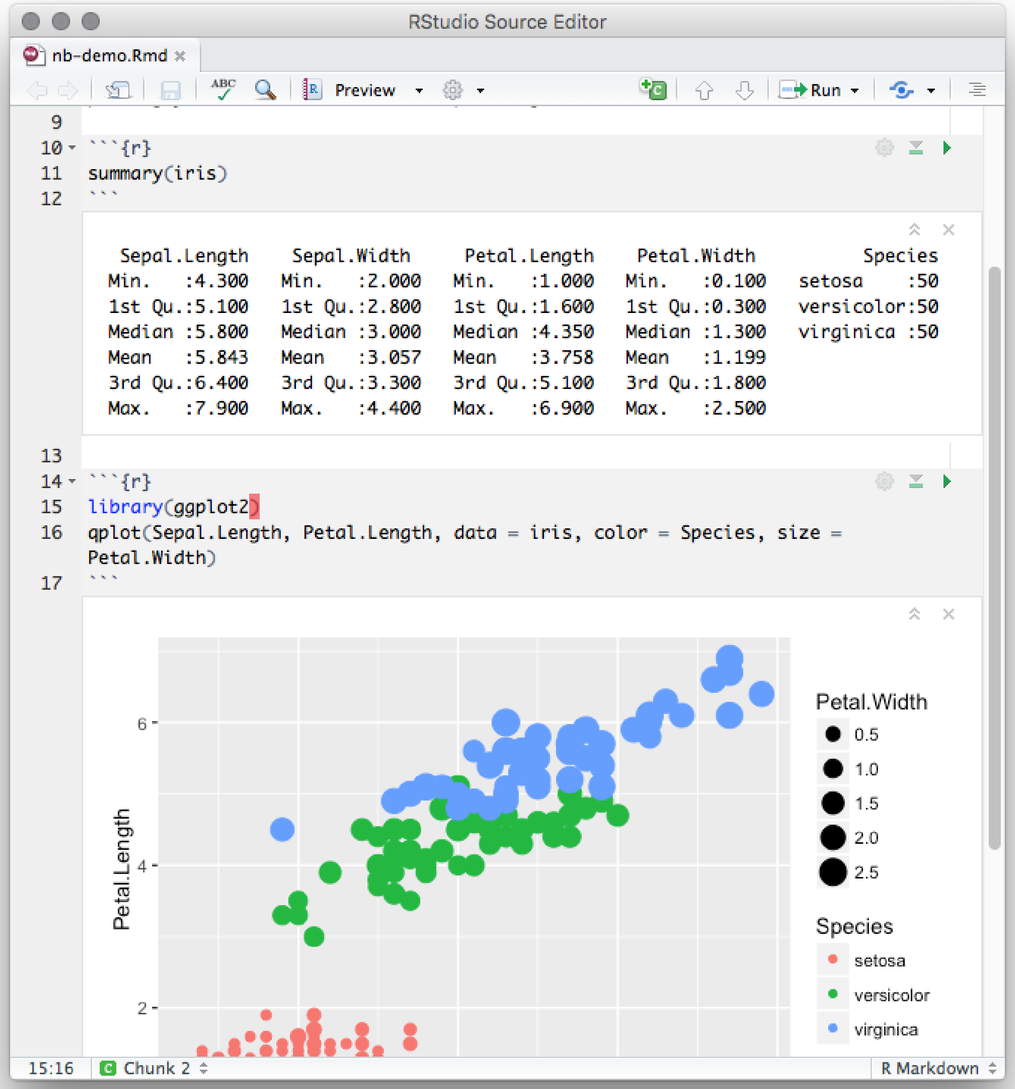


Notebooks

- Number 3: Notebooks are for doing science
- Number 2: R Notebooks have great features
- Number 1: R Notebooks make it easy to create and share reports

https://rviews.rstudio.com/2017/03/15/why-i-love-r-notebooks/
http://r4ds.had.co.nz/r-markdown-workflow.html

Notebooks



Combine in a single document:

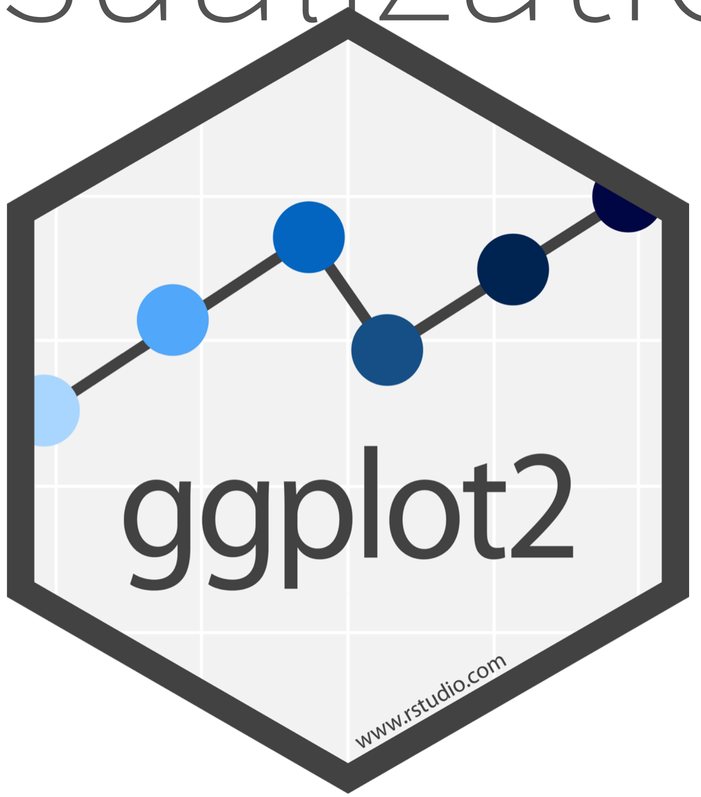
- Narrative
- Code
- Output

Then Render to HTML

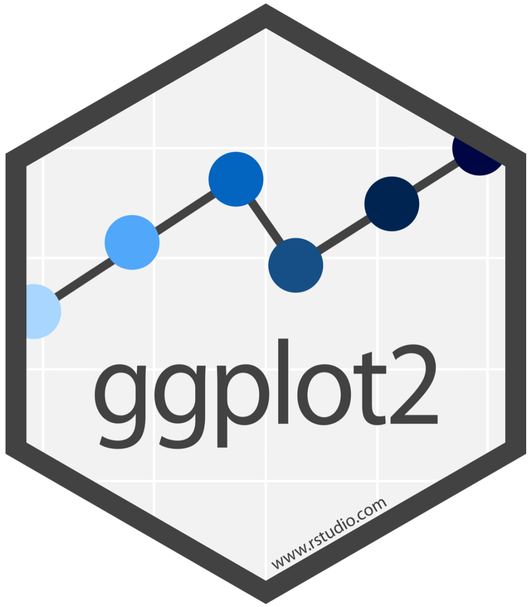
Setup

The setup chunk is always run once before anything else and is a great place to load packages

Data Visualization with



ggplot2



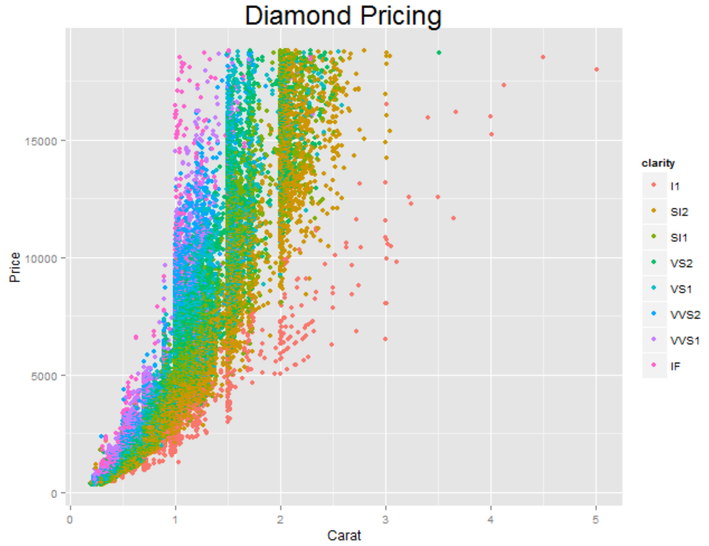
A package that visualizes data.

ggplot2 implements the *grammar of graphics*, a system for building visualizations that is built around **cases** and **variables**.

R Graphics:

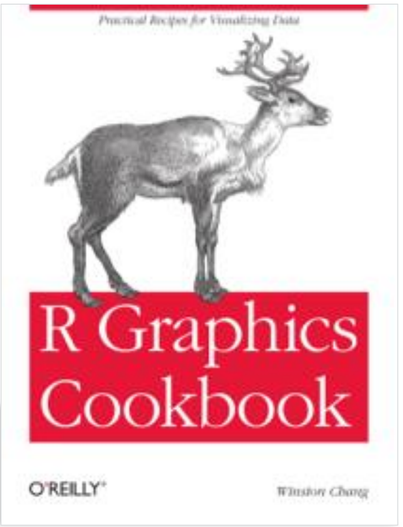
Four Main Graphical Systems in R:

- R's Base Graphics
- Grid Graphics System
- The lattice Package
- The ggplot2 Package – Created by Hadley Wickham

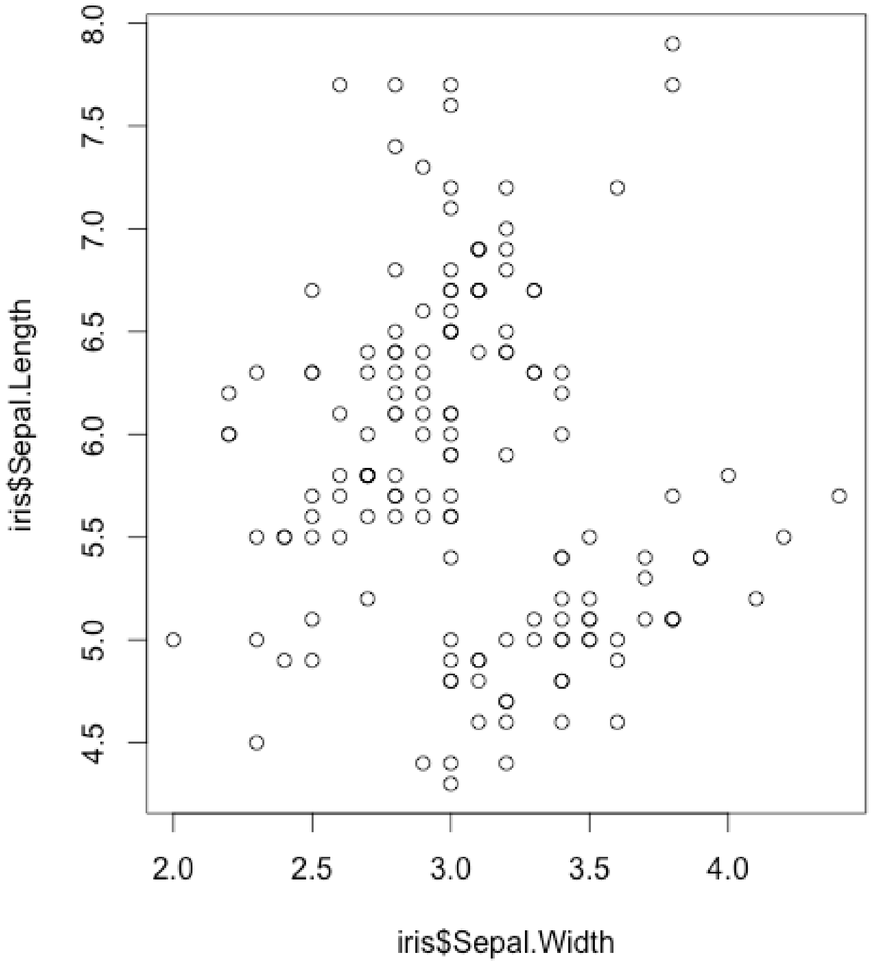


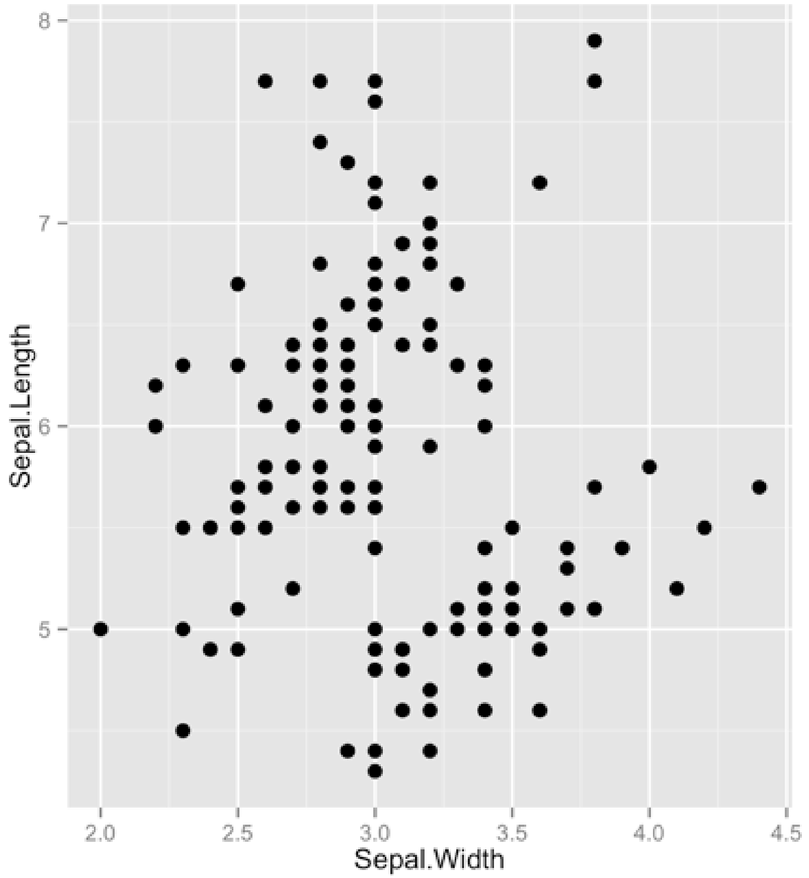
Why ggplot2?

- Consistent underlying - Grammar of Graphics (Wilkinson, 2005)
- Very flexible
- Mature and complete graphics system
- Many users, active mailing list
- http://www.cookbook-r.com & http://tutorials.iq.harvard.edu/R/Rgraphics/Rgraphics.html

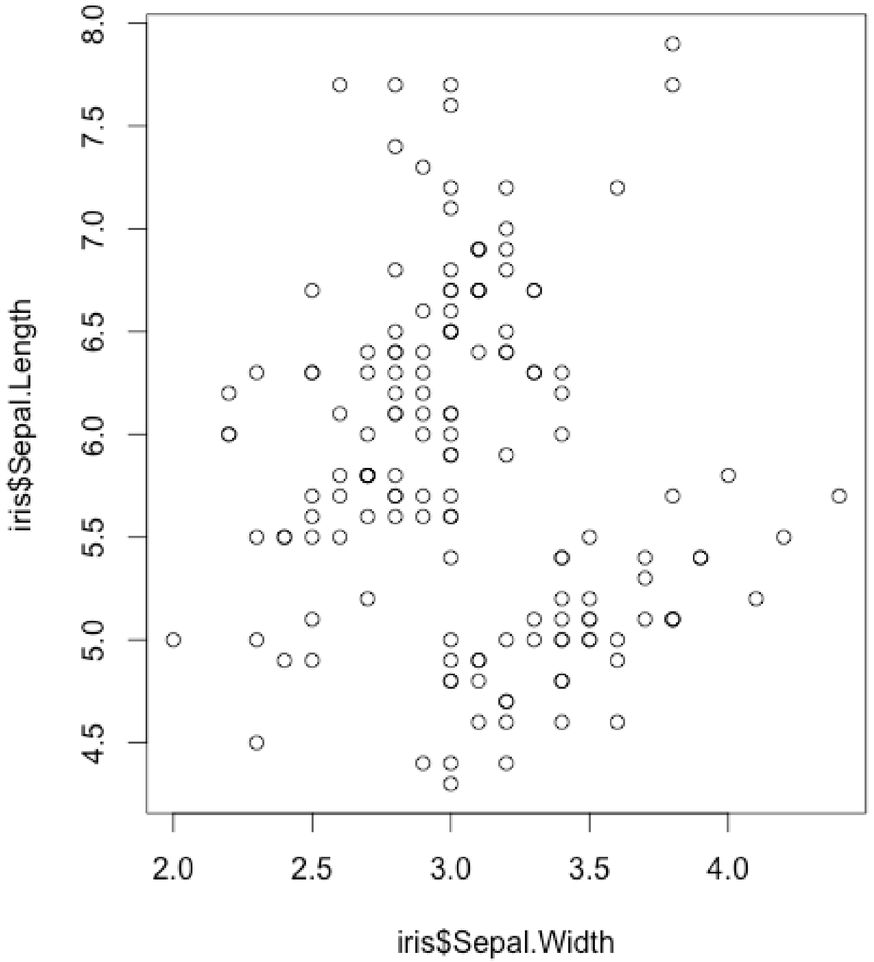


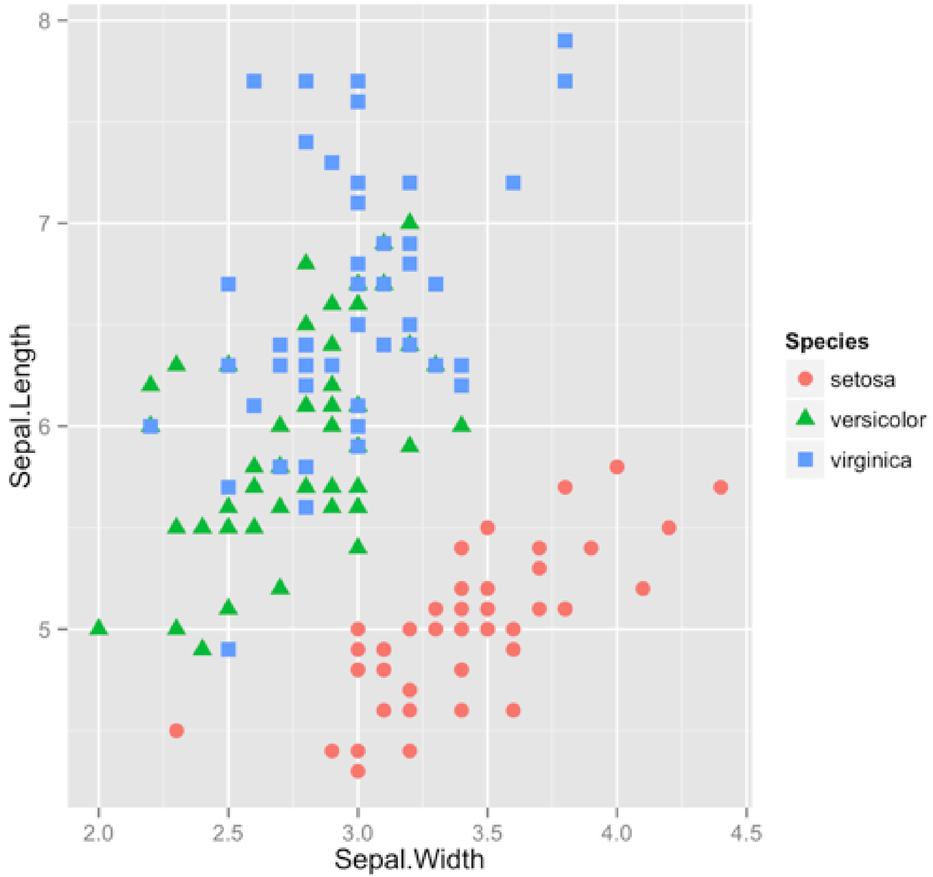
ggplot2



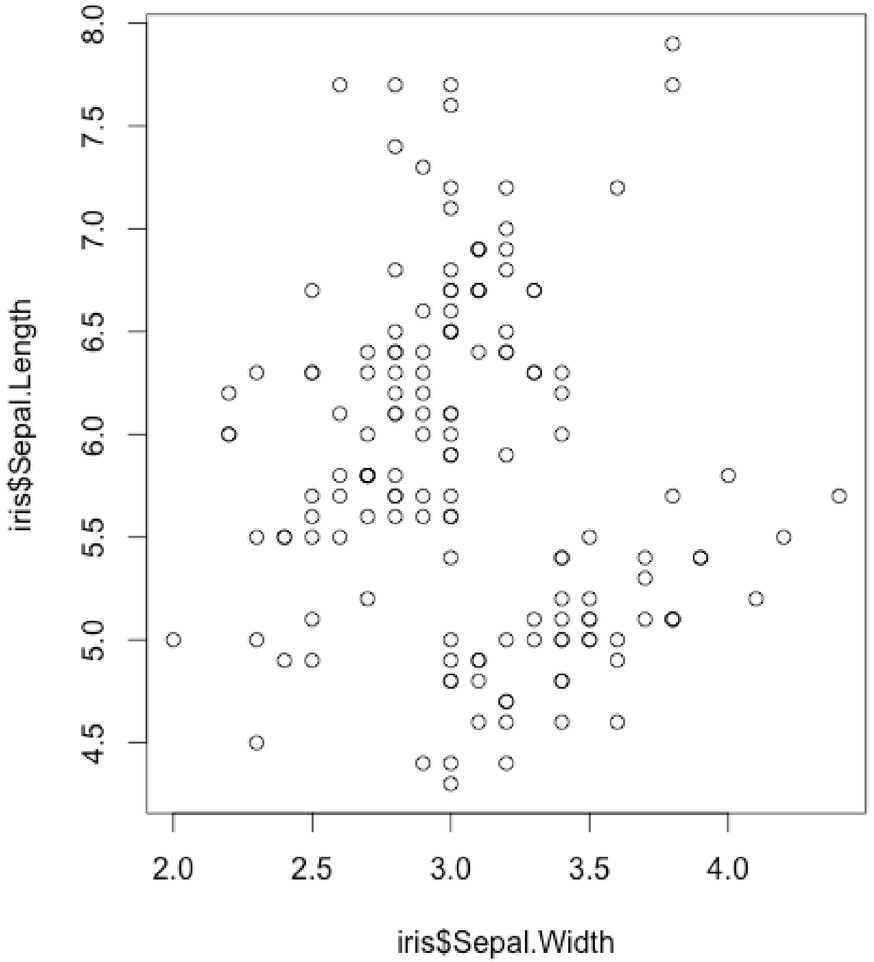


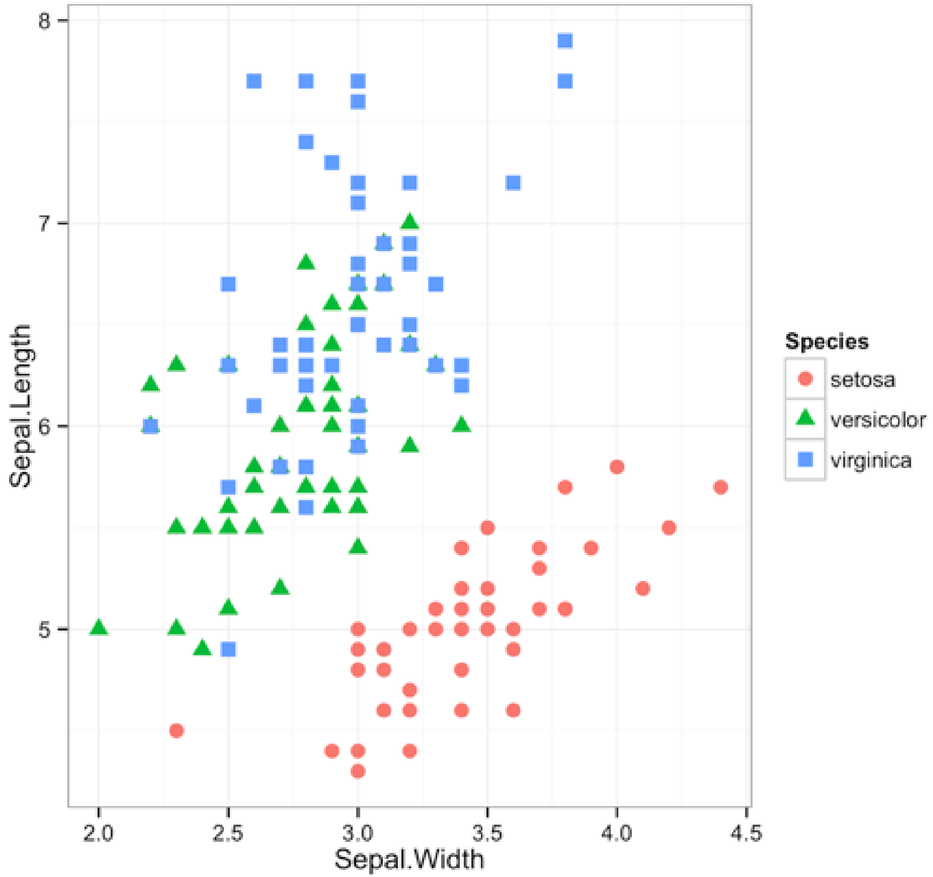
ggplot2



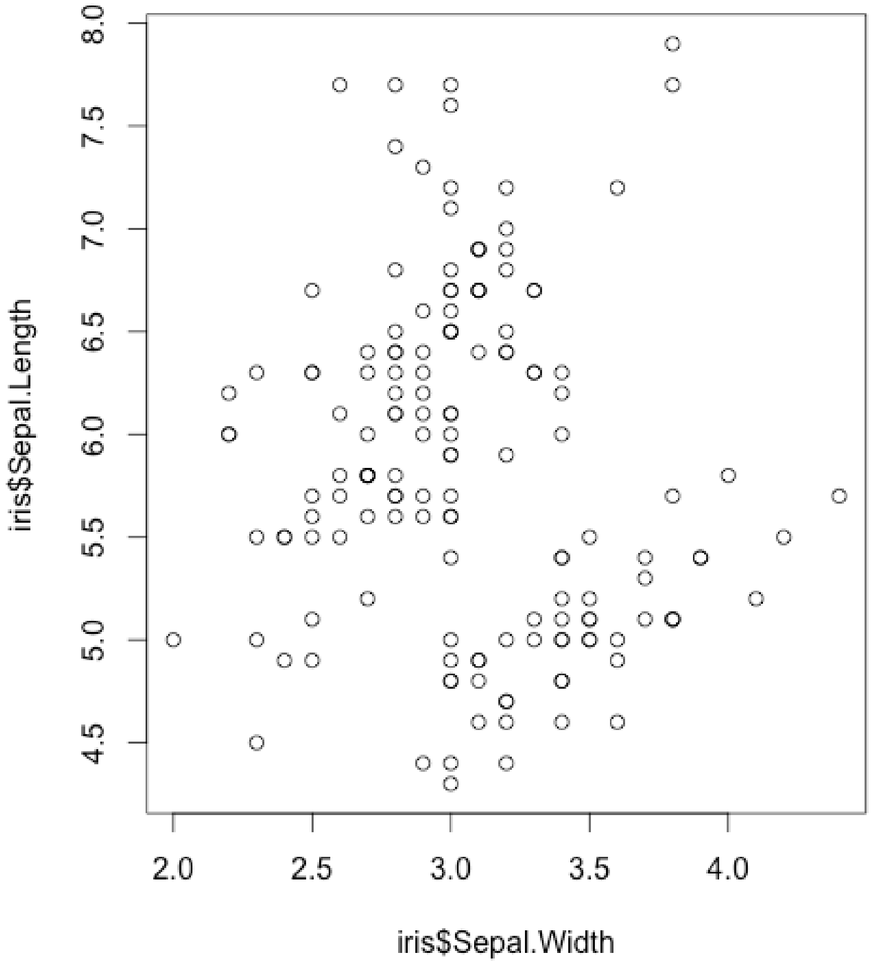


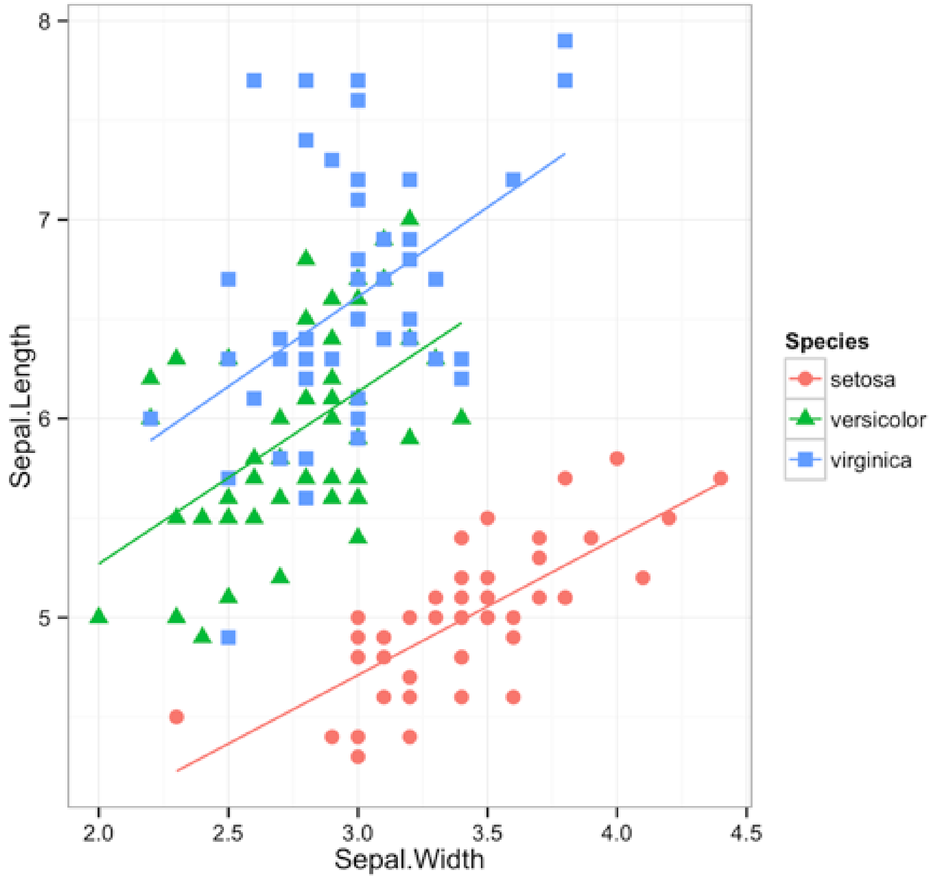
ggplot2



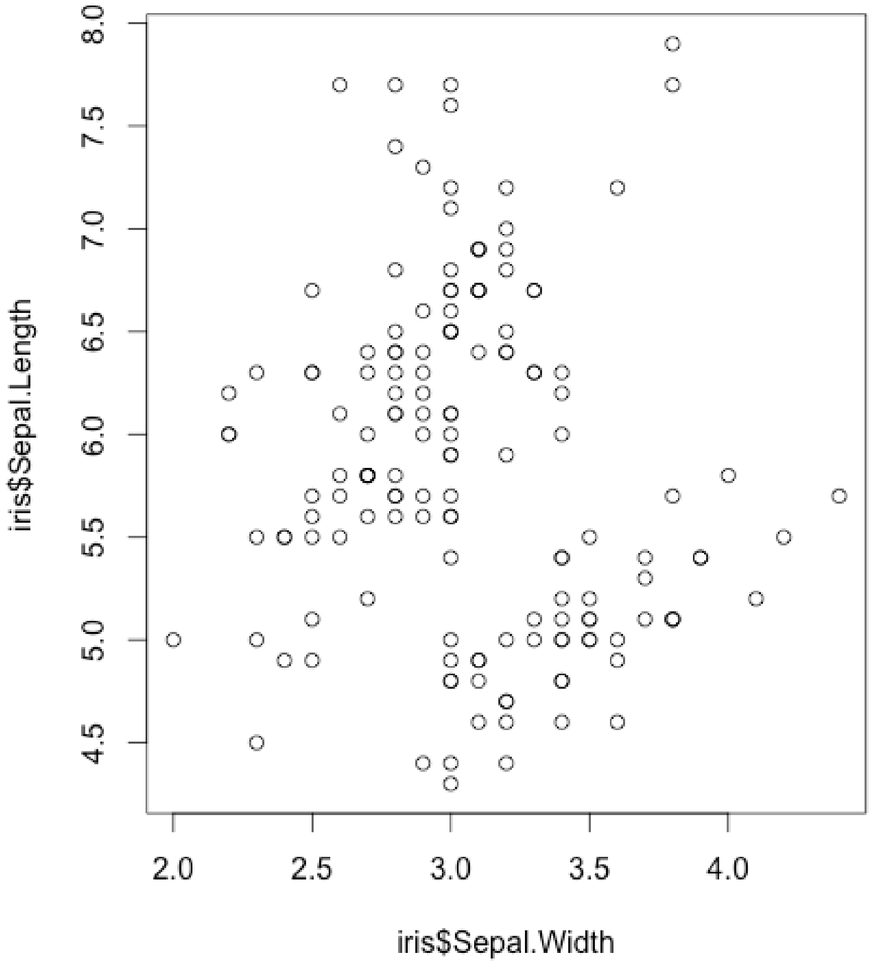


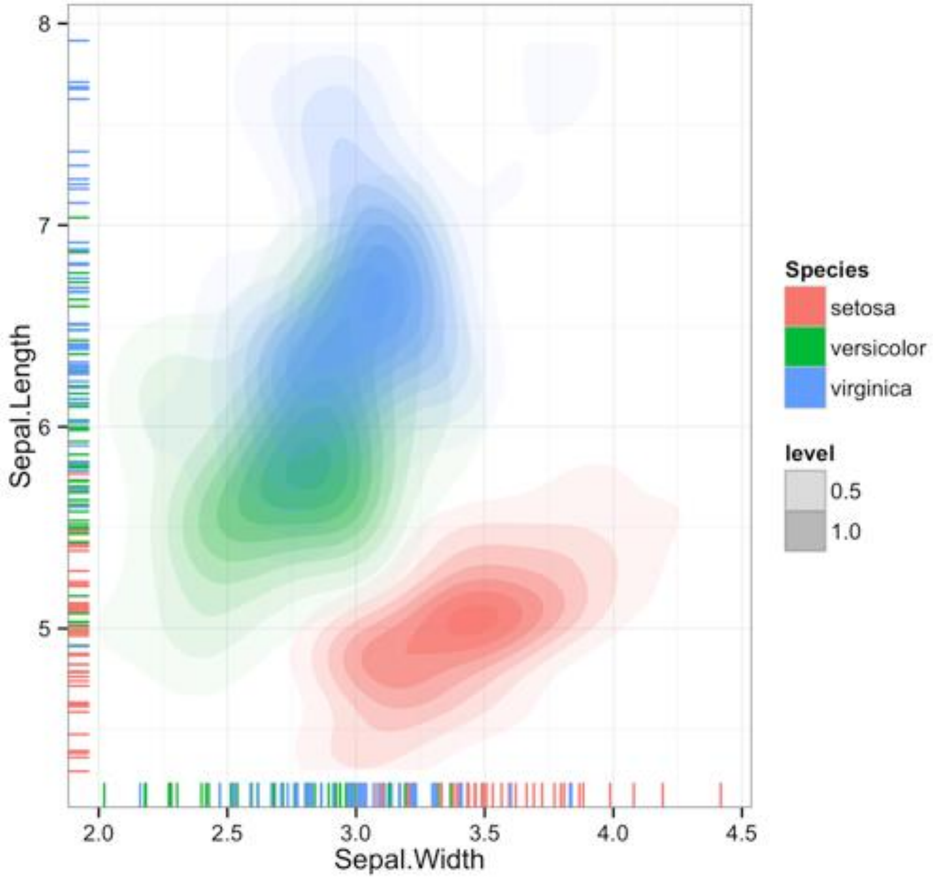
ggplot2



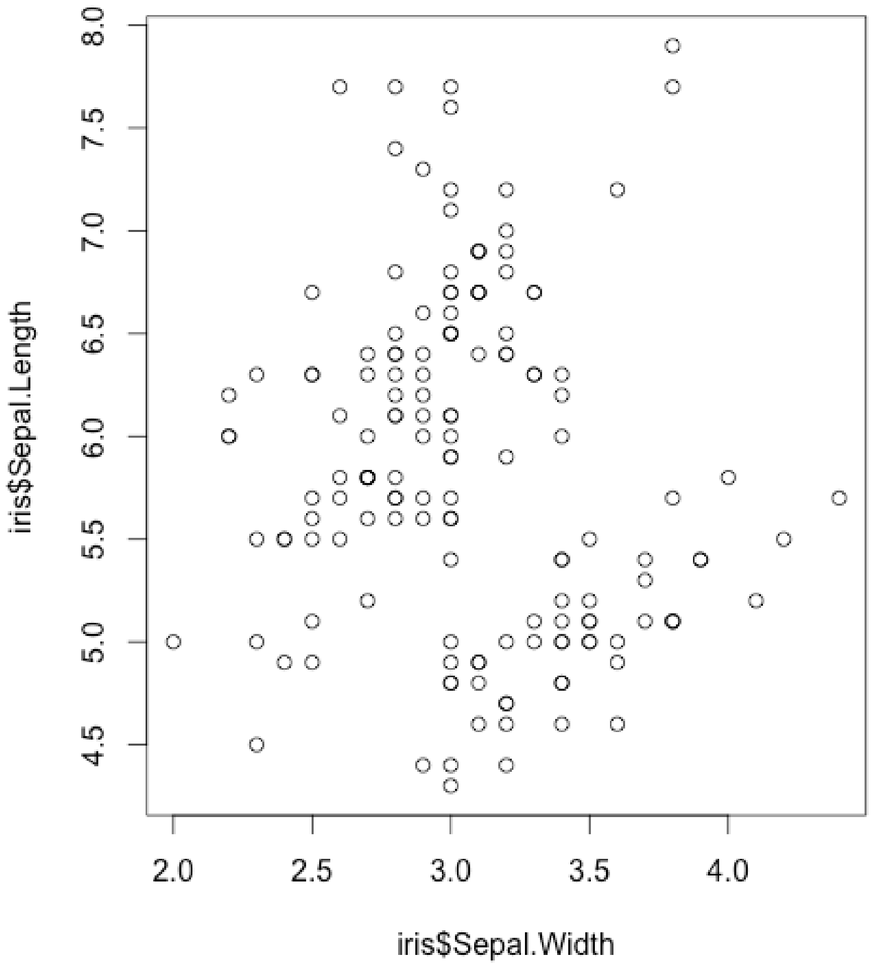


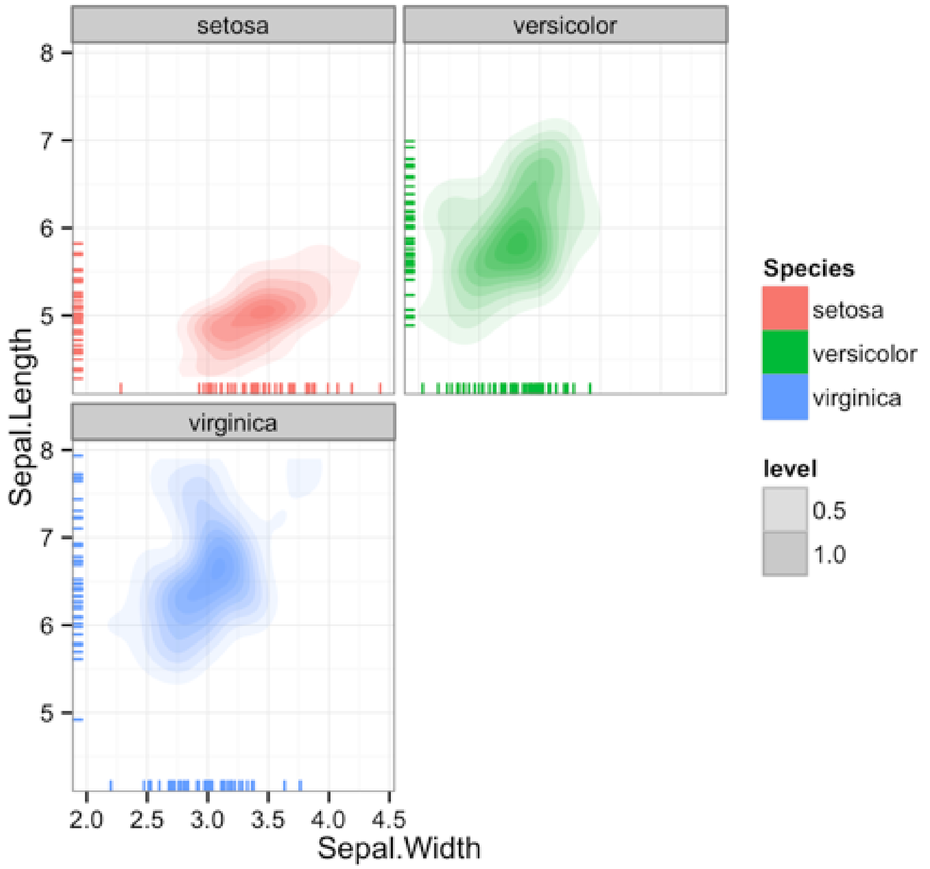
ggplot2

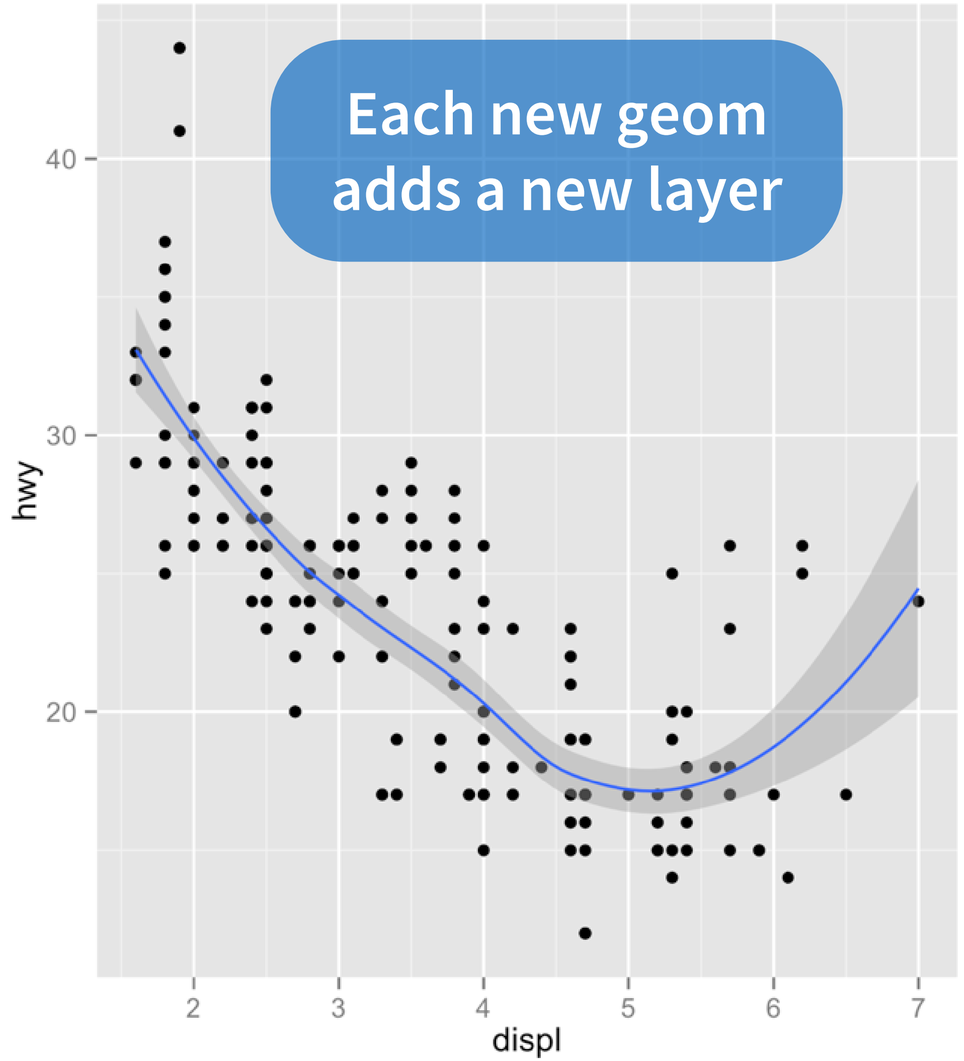




ggplot2








```
ggplot(mpg) +
  geom_point(mapping = aes(x = displ, y = hwy)) +
  geom_smooth(mapping = aes(x = displ, y = hwy))
```

A ggplot2 template

Make any plot by filling in the parameters of this template

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>),
                  stat = <STAT>) +
  <FACET_FUNCTION>
```

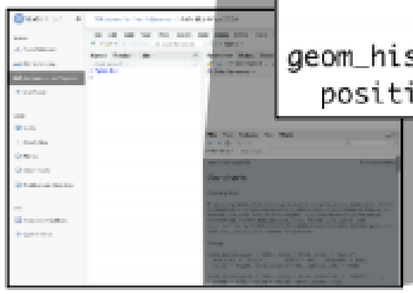
```
ggplot(data = diamonds) +
  geom_bar(mapping = aes(x = cut), stat = "count")
```

"Help" pages

To open the documentation for a function, type

```
?geom_histogram
```

? — **function name** (no parentheses)



geom_freqpoly {ggplot2} R Documentation

Histograms and frequency polygons

Description

Visualise the distribution of a single continuous variable by dividing the x axis into bins and counting the number of observations in each bin. Histograms (geom_histogram()) display the counts with bars; frequency polygons (geom_freqpoly()) display the counts with lines. Frequency polygons are more suitable when you want to compare the distribution across the levels of a categorical variable.

Usage

```
geom_freqpoly(mapping = NULL, data = NULL, stat = "bin",
  position = "identity", ..., na.rm = FALSE, show.legend = NA,
  inherit.aes = TRUE)

geom_histogram(mapping = NULL, data = NULL, stat = "bin",
  position = "stack", ..., binwidth = NULL, bins = NULL,
```

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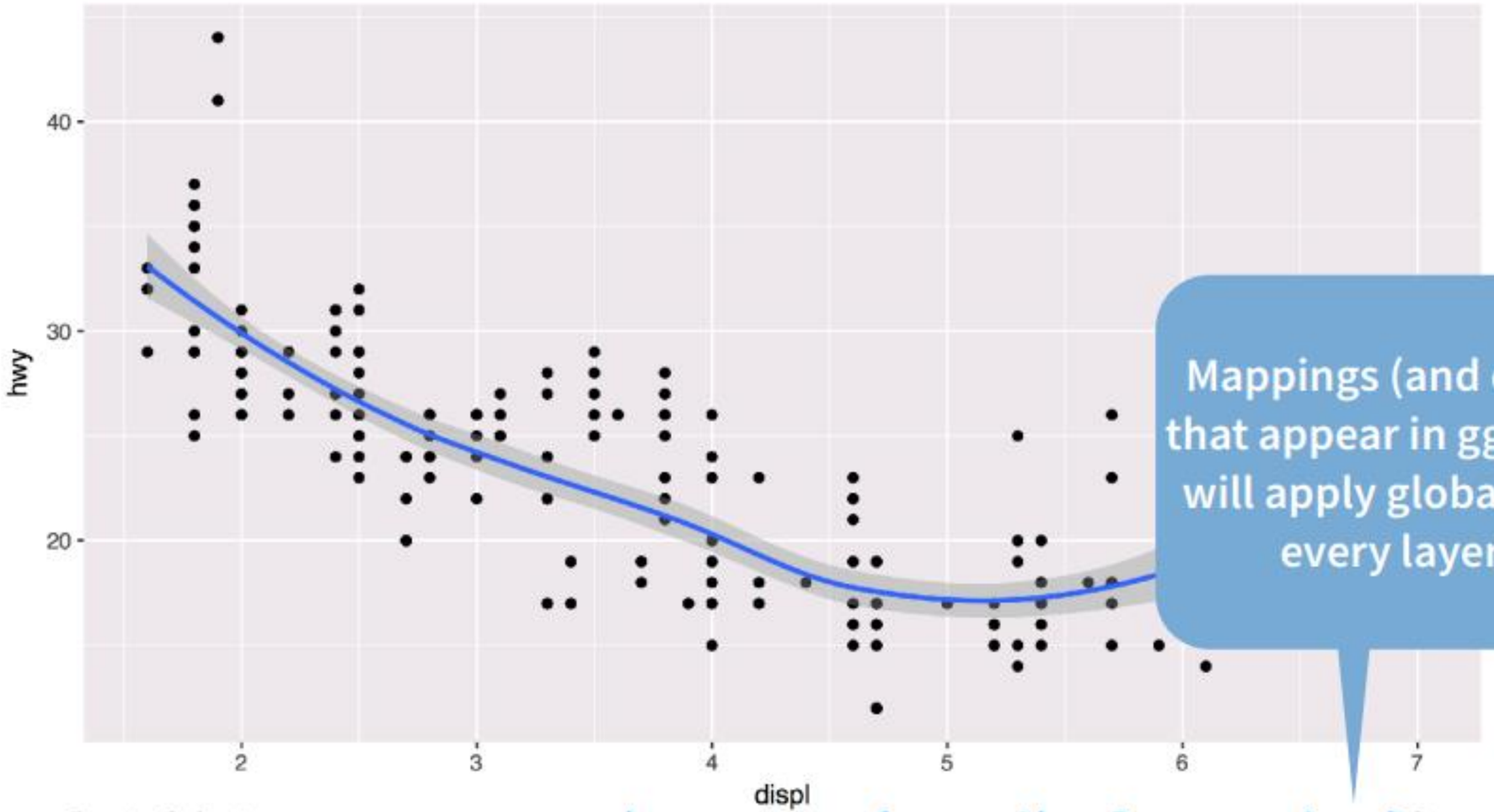
global vs. local

RStudio®



Mappings (and data) that appear in ggplot() will apply globally to every layer

```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy)) +
  geom_point() +
  geom_smooth()
```

ggplot2

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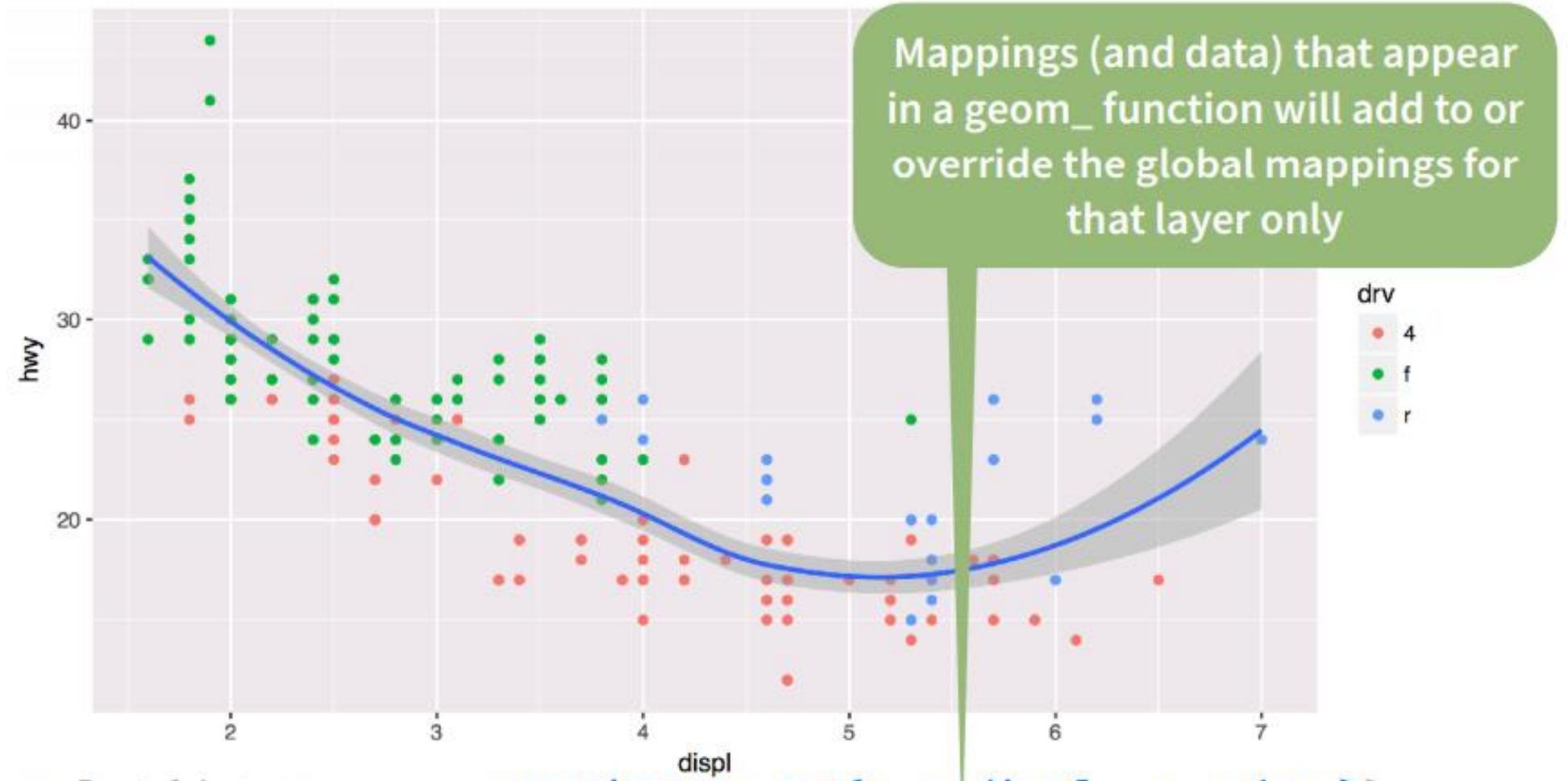


```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy)) +
  geom_point(mapping = aes(color = drv)) +
  geom_smooth()
```

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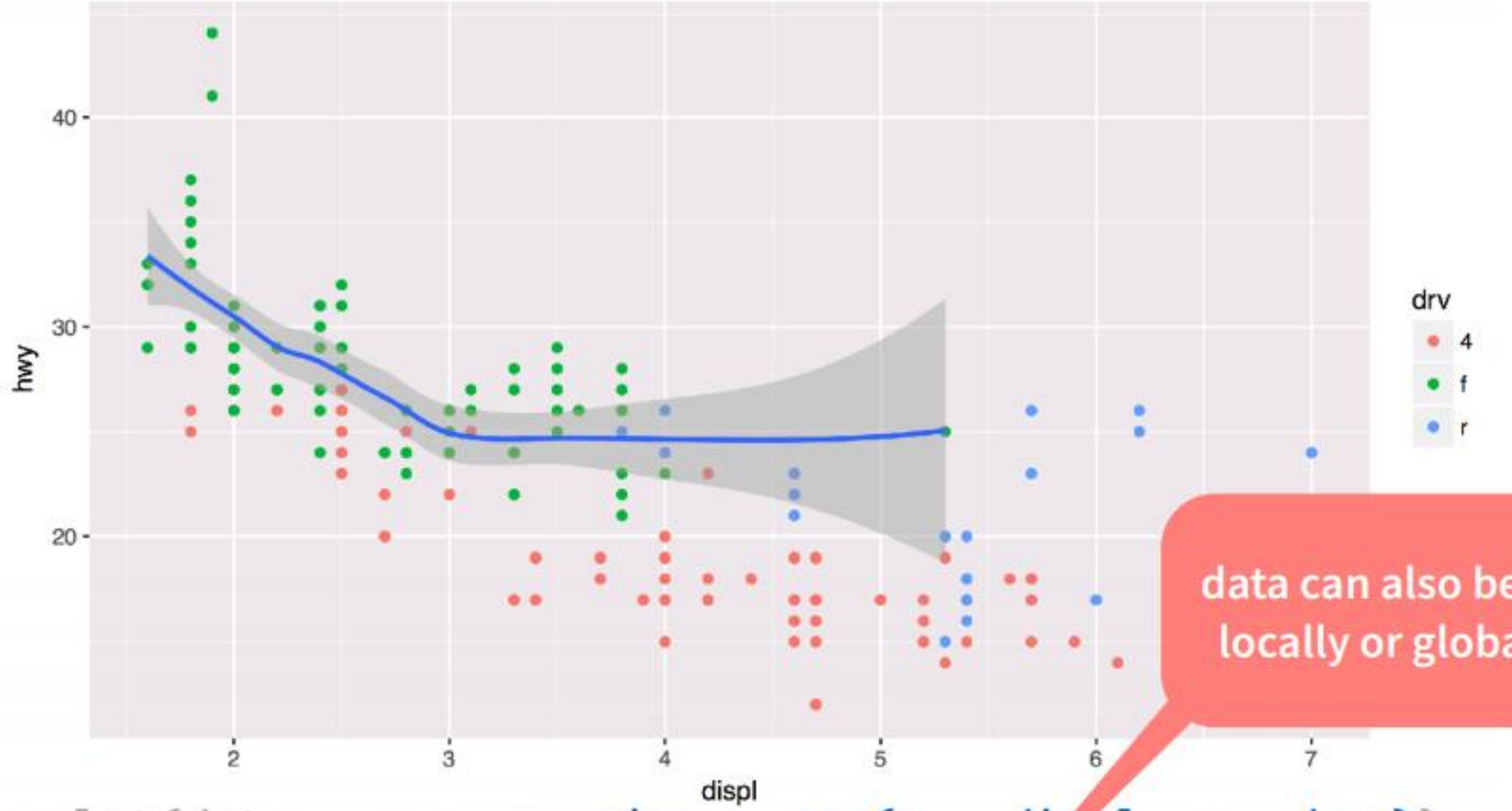


data can also be set locally or globally

```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy)) +
  geom_point(mapping = aes(color = drv)) +
  geom_smooth(data = filter(mpg, drv == "f"))
```

RStudio®

A ggplot2 template

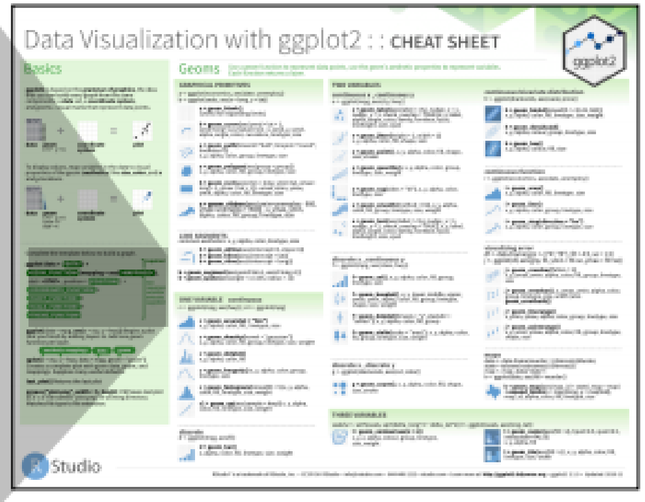
Make any plot by filling in the parameters of this template

Complete the template below to build a graph.

```
ggplot (data = <DATA>) +
<GEOM_FUNCTION>(mapping = aes(<MAPPINGS>),
 stat = <STAT>, position = <POSITION> ) +
<COORDINATE_FUNCTION> +
<FACET_FUNCTION> +
<SCALE_FUNCTION> +
<THEME_FUNCTION>
```

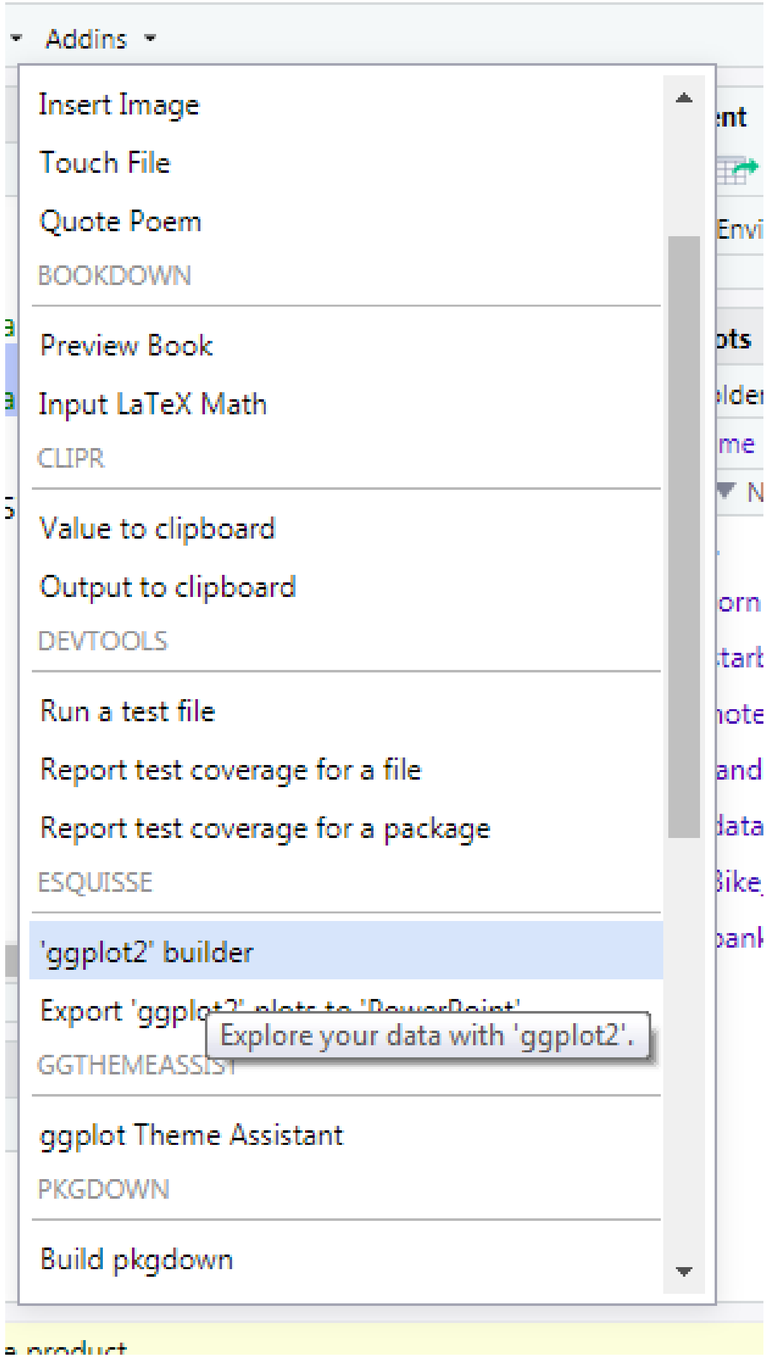
required

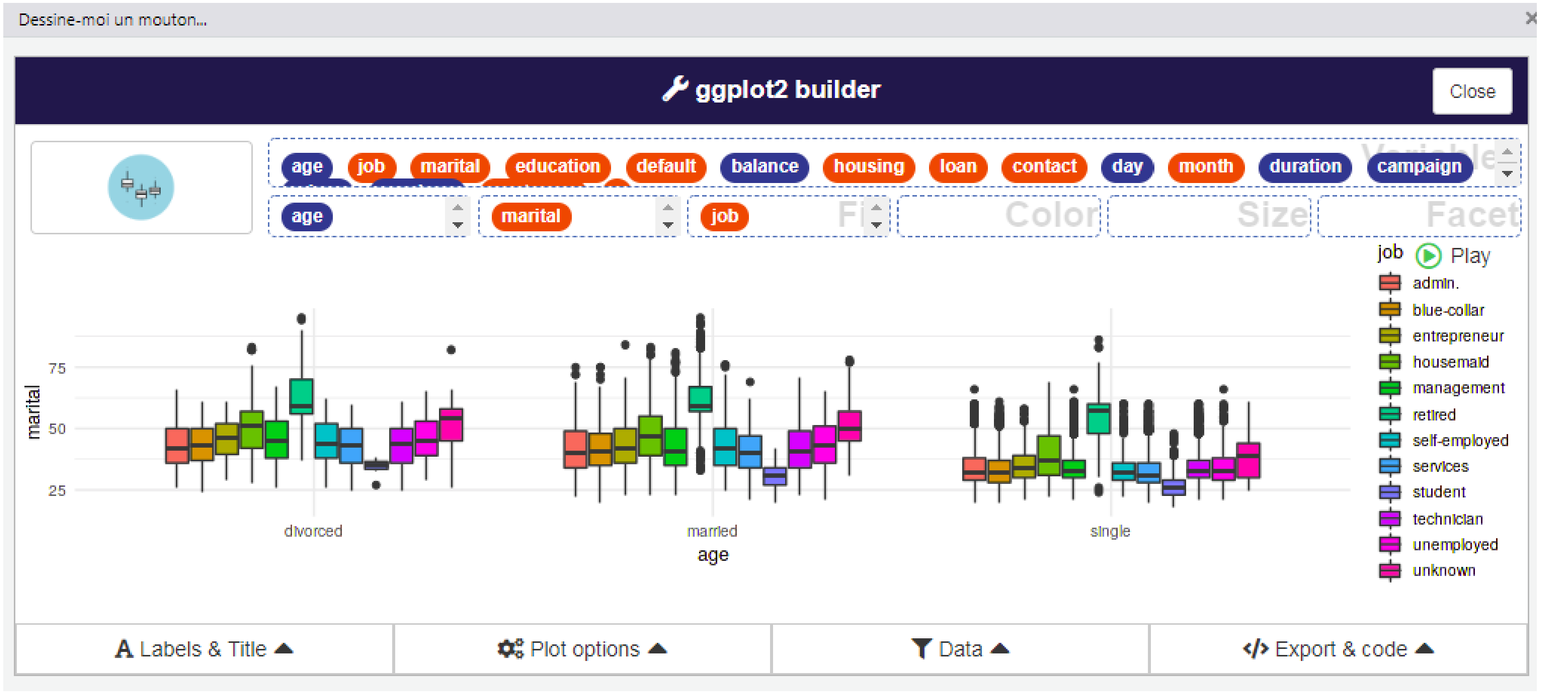
Not required, sensible defaults supplied



ggplot2

RStudio


Addins
Insert Image
Touch File
Quote Poem
BOOKDOWN
Preview Book
Input LaTeX Math
CLIPR
Value to clipboard
Output to clipboard
DEVTOOLS
Run a test file
Report test coverage for a file
Report test coverage for a package
ESQUISSE
'ggplot2' builder
Export 'ggplot2' plots to 'PowerPoint'
Explore your data with 'ggplot2'.
GGTHEMEASSIST
ggplot Theme Assistant
PKGDOWN
Build pkgdown


Dessine-moi un mouton...
ggplot2 builder
Close
age
job
marital
education
default
balance
housing
loan
contact
day
month
duration
campaign
Color
Size
Facet
job
Play
admin.
blue-collar
entrepreneur
housemaid
management
retired
self-employed
services
student
technician
unemployed
unknown
marital
75
50
25
divorced
married
single
age
Labels & Title
Plot options
Data
Export & code

RStudio

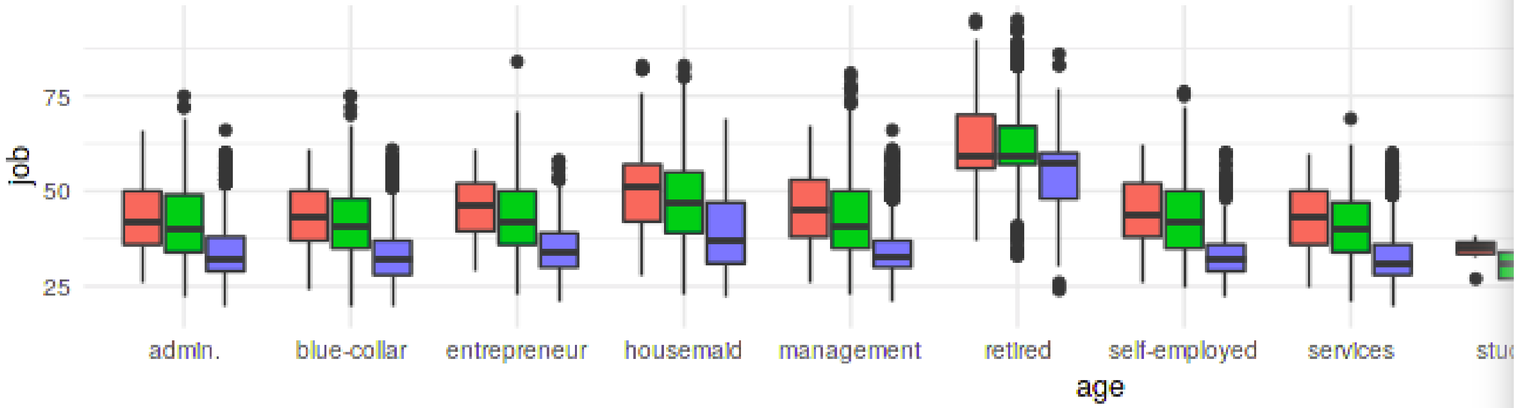
Dessine-moi un mouton...

ggplot2 builder

Close

age job marital education default balance housing loan contact day month duration campaign

age job marital



Copy to clipboard

Play

Code:

```
ggplot(data = bankData) +
  aes(x = job, y = age, fill = marital)
+
  geom_boxplot() +
  theme_minimal()
```

Insert code in script

Export:

PNG PowerPoint

Labels & Title ▲ | Plot options ▲ | Data ▲ | Export & code ▲

RStudio

EXERCISE 7MINS:

- Import some data and build some visualizations using esquisse…Take your data import code and visualization code and insert it into a notebook. Pick any dataset below to work on.
- landdata-states.csv
- starbucks.csv
- adae.csv
- dm.csv
- bank-full.csv
- ad_treatment.xlsx
- dmae.sas7bdat

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htmlwidgets

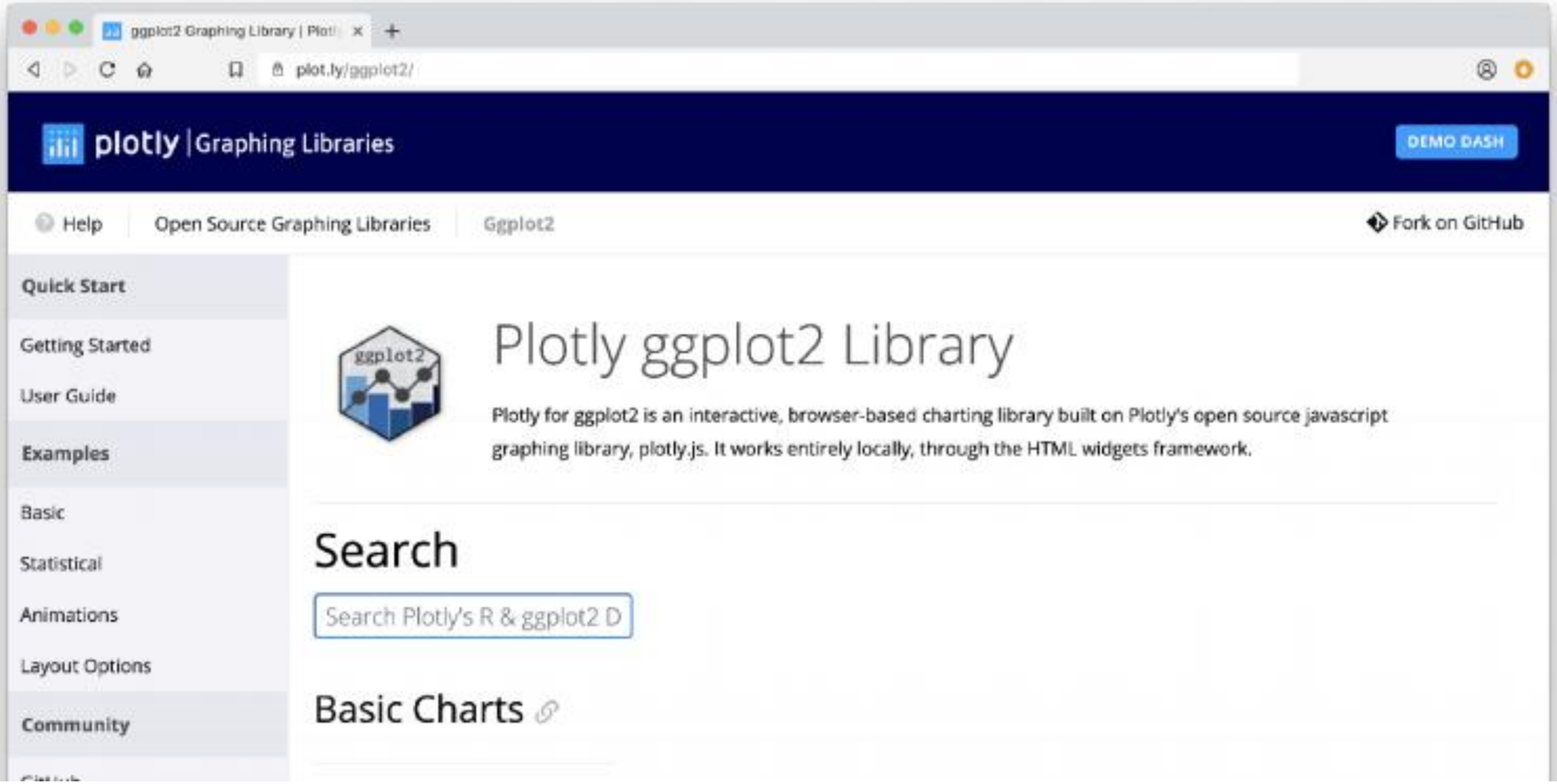
http://www.wthr.com/article/watch-video-shows-tornado-destroying-kokomo-starbucks

Demo Example

- 1_htmlwidgets_tornadoes.R
- Compare R script vs Notebook – what are the differences?

Plotly

Tools for making interactive plots. plot.ly/ggplot2/



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htmlwidgets

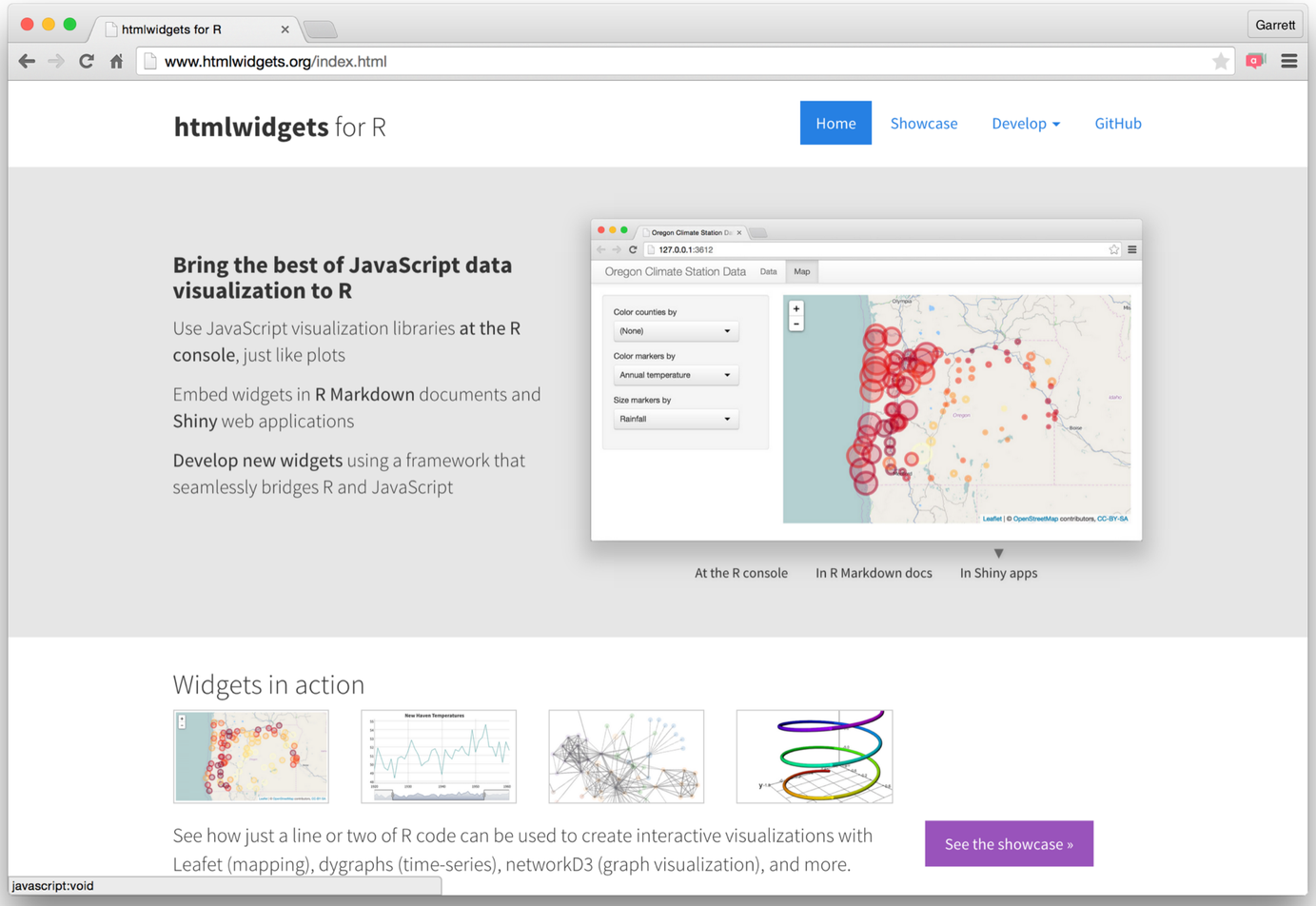
htmlwidgets for R:

- R bindings to JavaScript libraries
- Used to create interactive visualizations
- A line or two of R code is all it takes to produce an example

Use htmlwidgets in:

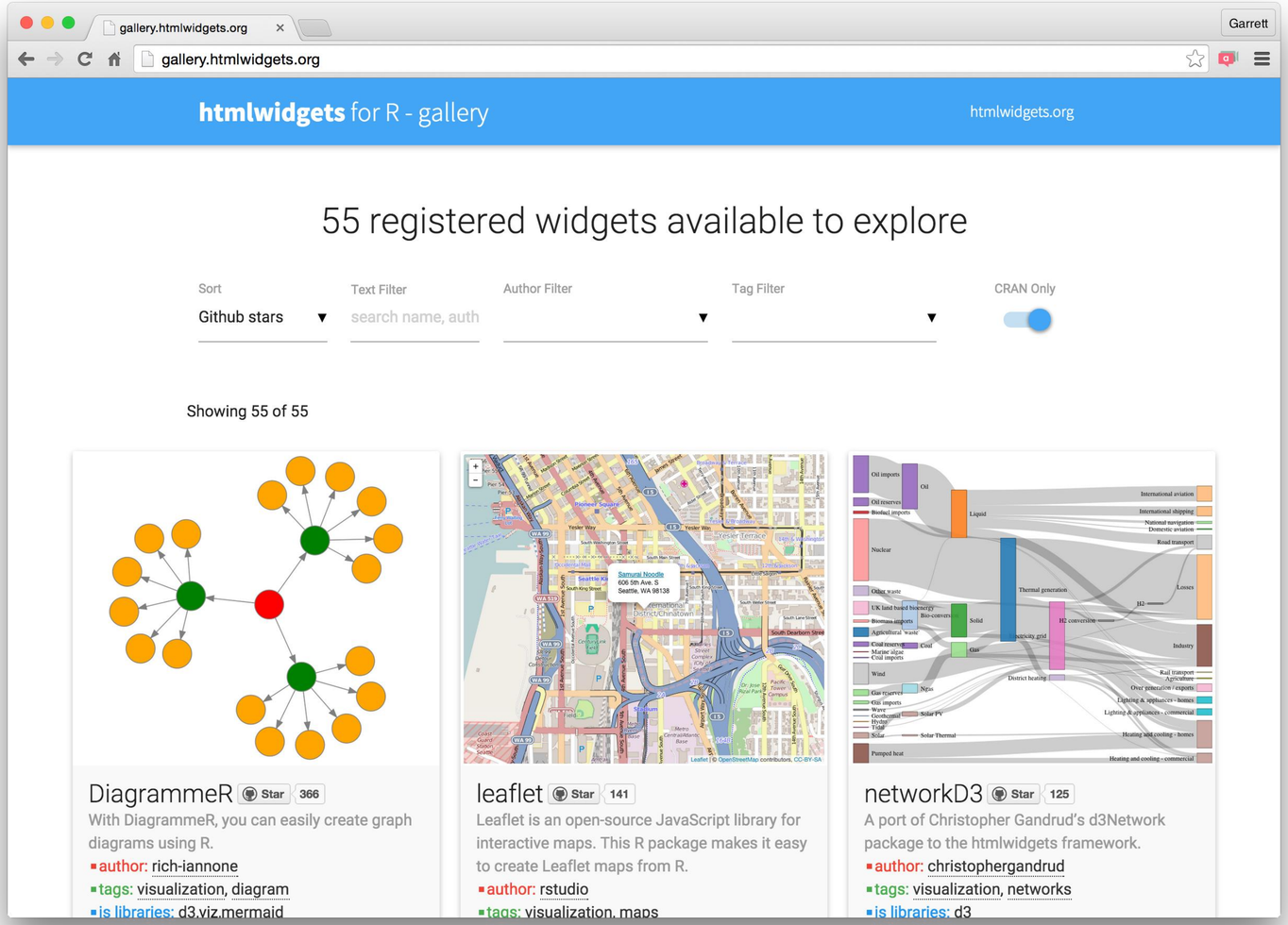
- RStudio viewer pane
- R Markdown files
- Shiny Apps

www.htmlwidgets.org



htmlwidgets gallery

http://gallery.htmlwidgets.org/



EXERCISE 10MINS:

- 02-Visualize-Exercises.Rmd Beginner
- Run through the chunks
- 2_r4ds_ggplot2_tidyverse.Rmd More Advanced

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Break Time

- Fun Video

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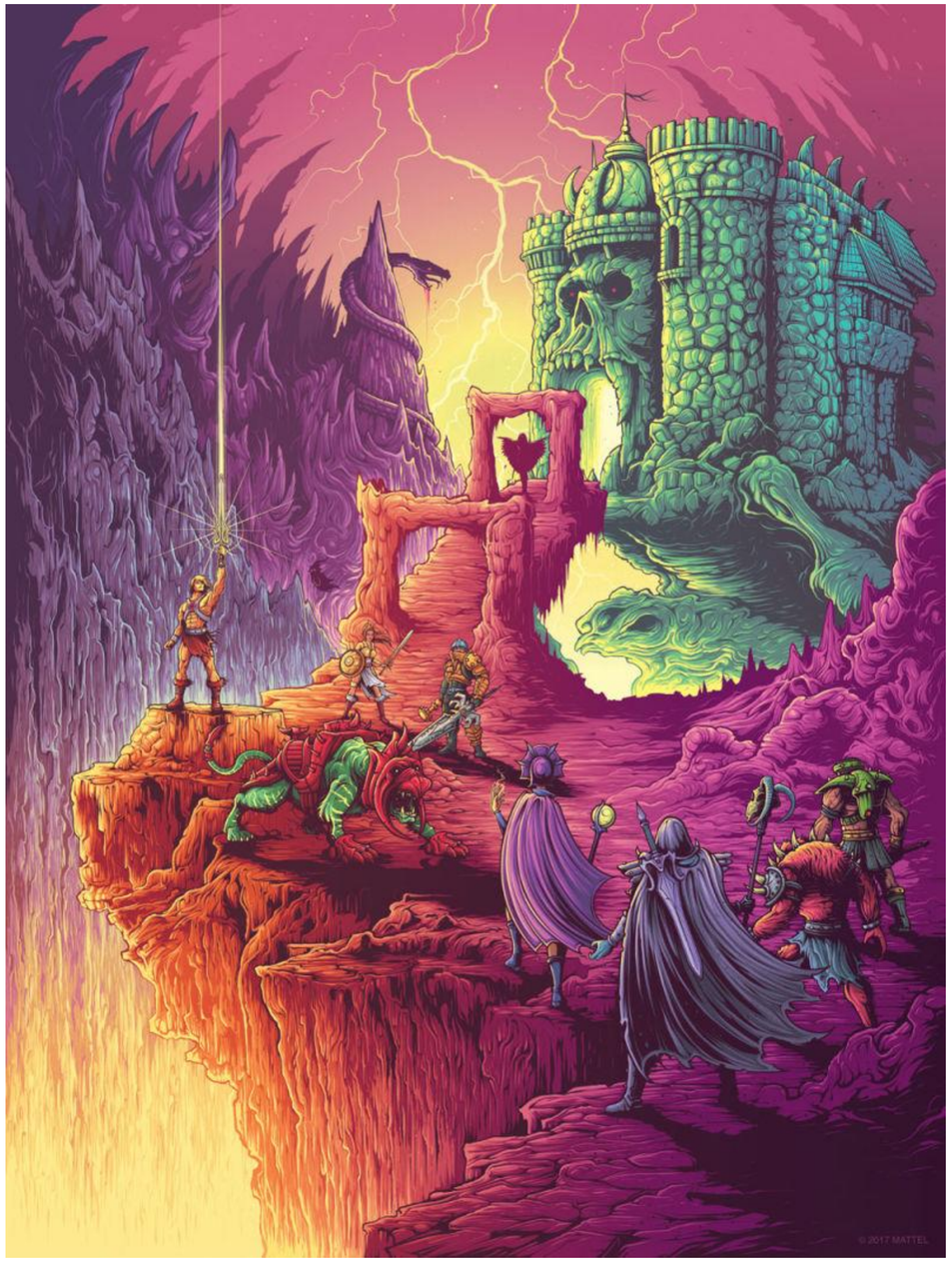
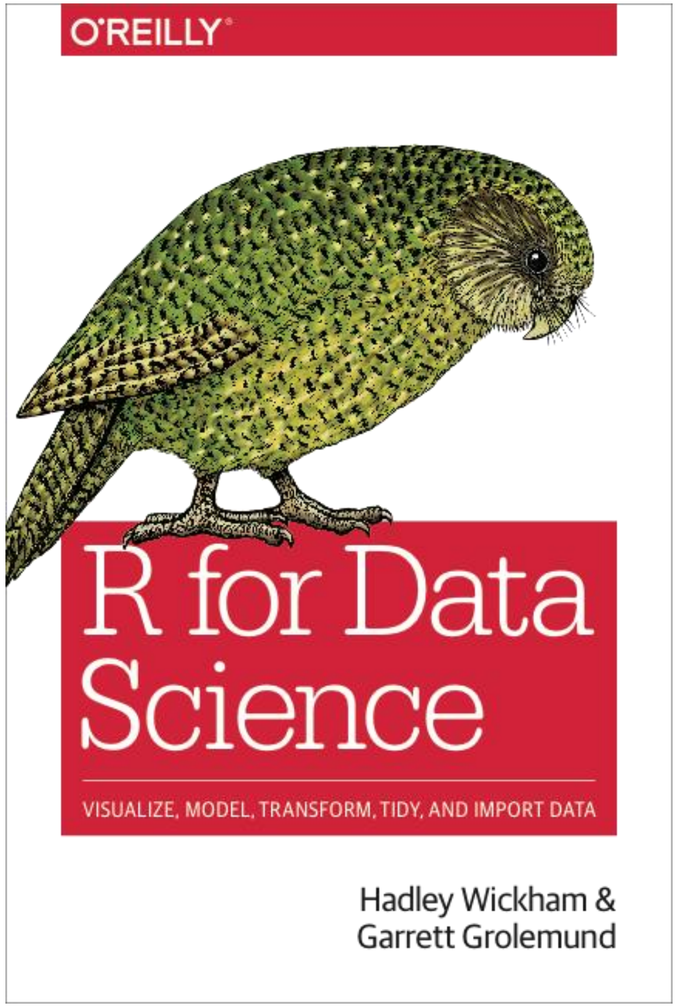
tidyverse
www.rstudio.com

Masters of the Tidyverse



Art by Dan Mumford



https://github.com/rstudio/RStartHere

RStudio

The Tidyverse Works With Tibbles

I said Tibbles,
not Tribbles

...Darn
Quadrotriticale!

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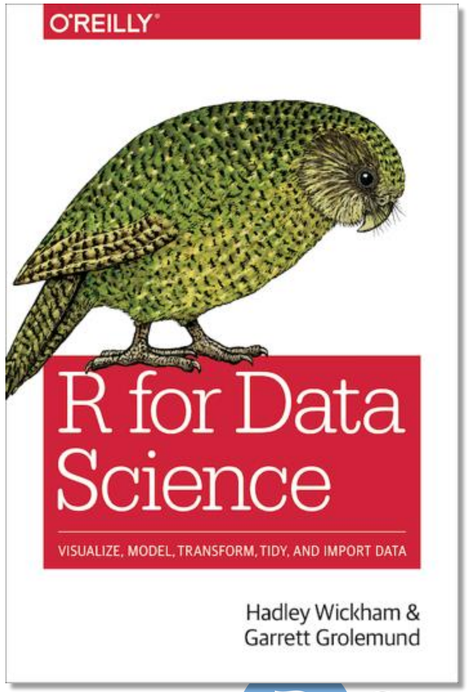
Tidyverse

A collection of R packages that share common philosophies and are designed to work together.

tidyverse.org

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



RStudio

Data Types

- R has a wide variety of data types…
- Vectors
- Lists
- **Matrix**
- **Factors**
- **Data frame**
- **Tibble**
- **Is** ToothGrowth a Tibble? Hint: class(ToothGrowth)

Toy data

```
storms <- tribble(
    ~storm, ~wind, ~pressure,       ~date,
  "Alberto",   110,     1007, "2000-08-12",
    "Alex",    45,     1009, "1998-07-30",
  "Allison",    65,     1005, "1995-06-04",
     "Ana",    40,     1013, "1997-07-01",
   "Arlene",    50,     1010, "1999-06-13",
   "Arthur",    45,     1010, "1996-06-21"
)
```

storms

storm	wind	pressure	date
Alberto	110	1007	2000-08-12
Alex	45	1009	1998-07-30
Allison	65	1005	1995-06-04
Ana	40	1013	1997-07-01
Arlene	50	1010	1999-06-13
Arthur	45	1010	1996-06-21

Tibbles – Quick Intro

- as_tibble()
- as_tibble(ToothGrowth)
- This will work for reasonable inputs that are already data.frames, lists, matrices, or tables.
- There are two main differences in the usage of a tibble vs. a classic data.frame: printing and subsetting
- Tibbles show only the first 10 rows
- Each column reports its type, a nice feature borrowed from str()
- package?tibble

Tibbles – What to Know

- tibble() does much less than data.frame():
- A. it never changes the type of the inputs (e.g. it never converts strings to factors!)
- B. it never changes the names of variables, and it never creates row names
- Cdata.frame() vs. modern data_frame():
- Base R has a burning desire to turn character information into factor...via read.table() & data.frame() and other functions are also eager
- To shut this down, use stringsAsFactors = FALSE in read.table() and data.frame() or – even better – use the tidyverse!
- readr::read_csv(), readr::read_tsv(), etc. For data frame creation, use tibble::tibble()

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

does the equivalent of

```
install.packages("ggplot2")
install.packages("dplyr")
install.packages("tidyr")
install.packages("readr")
install.packages("purrr")
install.packages("tibble")
install.packages("hms")
install.packages("stringr")
install.packages("lubridate")
install.packages("forcats")
install.packages("DBI")
install.packages("haven")
install.packages("httr")
install.packages("jsonlite")
install.packages("readxl")
install.packages("rvest")
install.packages("xml2")
install.packages("modelr")
install.packages("broom")
```

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

does the equivalent of

```
install.packages("ggplot2")
install.packages("dplyr")
install.packages("tidyr")
install.packages("readr")
install.packages("purrr")
install.packages("tibble")
install.packages("hms")
install.packages("stringr")
install.packages("lubridate")
install.packages("forcats")
install.packages("DBI")
install.packages("haven")
install.packages("httr")
install.packages("jsonlite")
install.packages("readxl")
install.packages("rvest")
install.packages("xml2")
install.packages("modelr")
install.packages("broom")
```

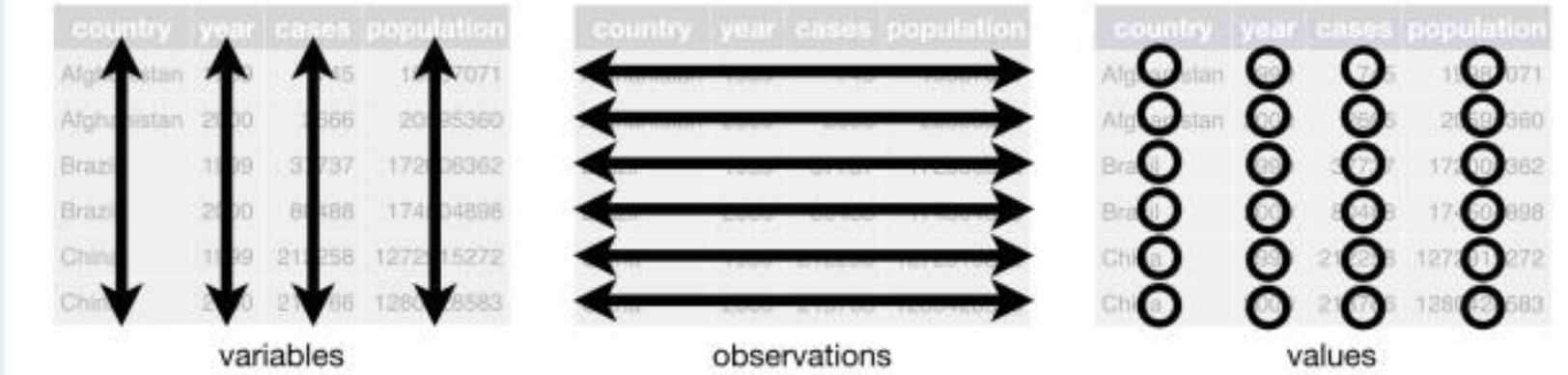
```
library("tidyverse")
```

does the equivalent of

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

tidyverse Core Principles

- Built around `data` - usually as a `data.frame` or `tibble`
- Built around `tidy` data
  - Each `variable` in its own `column`
  - Each `observation` or `case` in its own `row`
  - Each type of observational units forms a table



babynames

Names of male and female babies born in the US from 1880 to 2008. 1.8M rows.

```
# install.packages("babynames")
library(babynames)
```

View(babynames)

	year	sex	name	n	prop
1	1880	F	Mary	7065	0.0723835869
2	1880	F	Anna	2604	0.0266789611
3	1880	F	Emma	2003	0.0205214897
4	1880	F	Elizabeth	1939	0.0198657856
5	1880	F	Minnie	1746	0.0178884278
6	1880	F	Margaret	1578	0.0161672045
7	1880	F	Ida	1472	0.0150811946
8	1880	F	Alice	1414	0.0144869628
9	1880	F	Bertha	1320	0.0135238973
10	1880	F	Sarah	1288	0.0131960453
11	1880	F	Annie	1258	0.0128886840

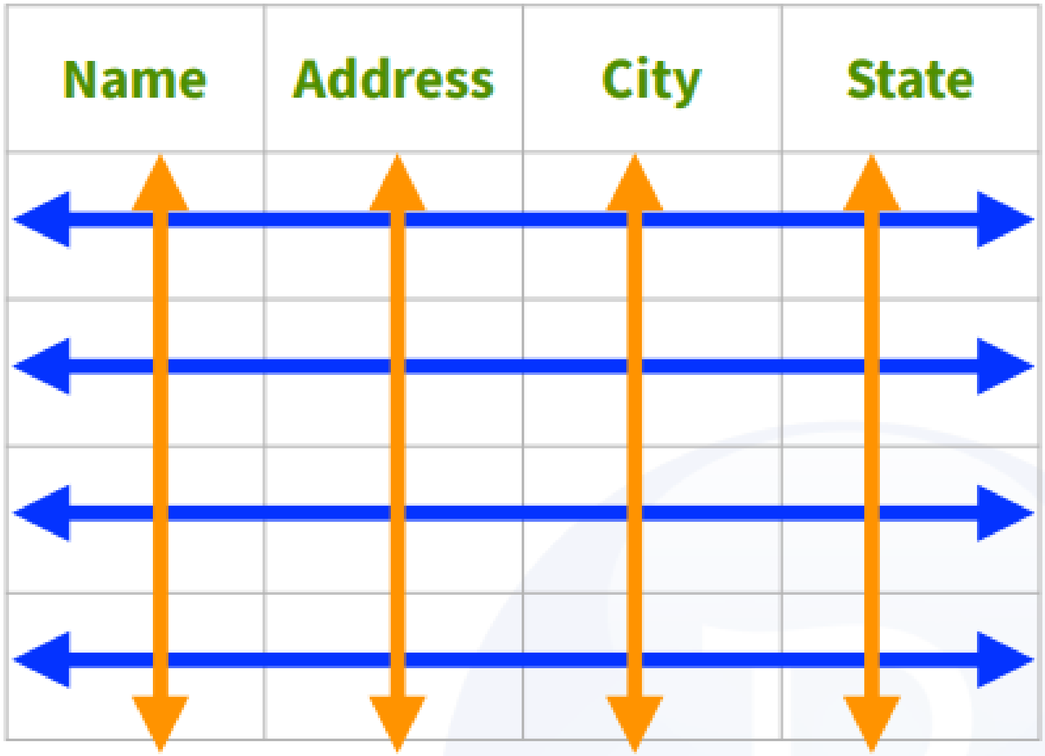
We Call This Data **Tidy**

Data are organized in **rows** and **columns**

Each **variable** has its own column

Each **observation** or record has its own row

Every cell has only one value in it



Untidy data

```
untidy_df
```

```
## # A tibble: 5 x 7
##   age_group male_2016 female_2016 male_2017 female_2017 male_2018
##   <chr>          <dbl>       <dbl>     <dbl>       <dbl>     <dbl>
## 1 < 18           22000       20000     22000       20000     22000
## 2 18-30          36000       35000     36000       35000     36000
## 3 31-50          50000       40000     50000       40000     50000
## 4 51-60          62000       60000     62000       60000     62000
## 5 > 60           75000       72000     75000       72000     75000
## # … with 1 more variable: female_2018 <dbl>
```

Tidy data

```
tidy_df
```

```
## # A tibble: 30 x 4
##    age_group gender year  income
##    <chr>     <chr>  <chr>  <dbl>
##  1 < 18      male   2016   22000
##  2 18-30     male   2016   36000
##  3 31-50     male   2016   50000
##  4 51-60     male   2016   62000
##  5 > 60      male   2016   75000
##  6 < 18      female 2016   20000
##  7 18-30     female 2016   35000
##  8 31-50     female 2016   40000
##  9 51-60     female 2016   60000
## 10 > 60      female 2016   72000
## # … with 20 more rows
```

Break Time

- Fun Video

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Transforming Data & Data Visualization

Art by Lou Pimentel

dplyr

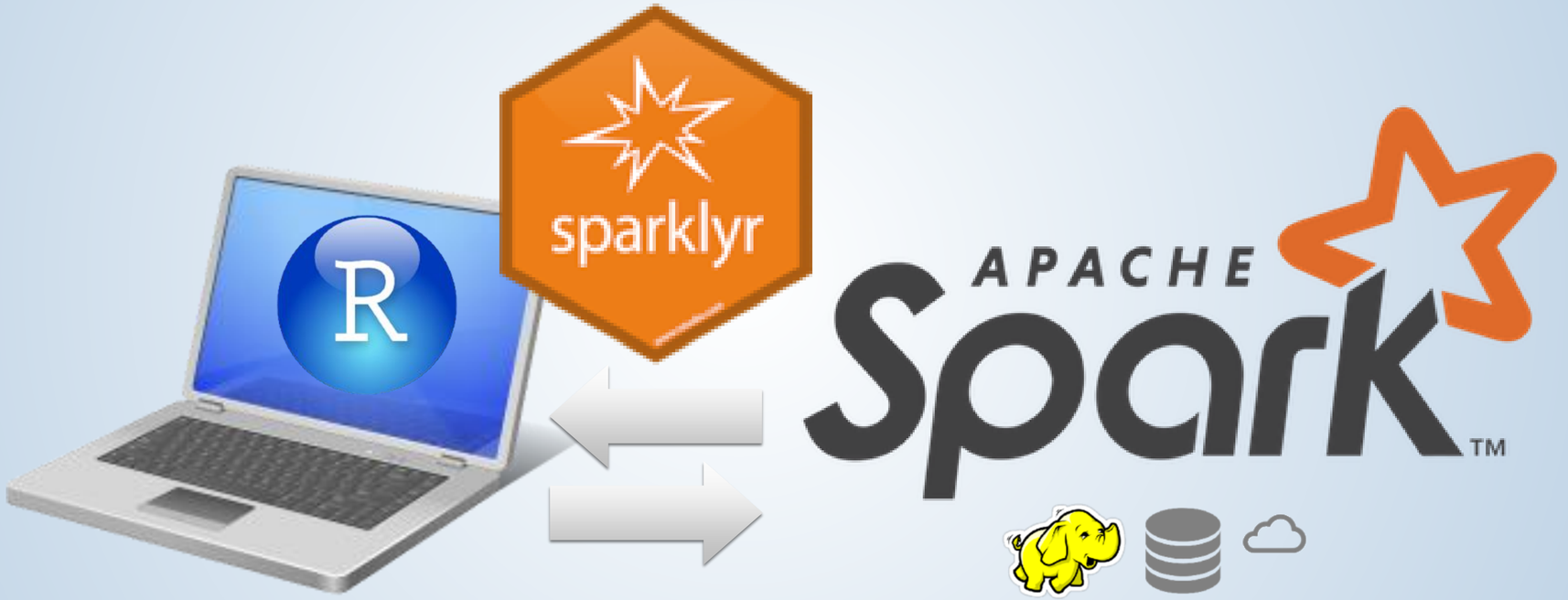
A package that transforms data.

dplyr implements a *grammar* for transforming tabular data.

Data transformation toolbox

Sparklyr

Makes it easy to use R with Spark



Spark with AWS EMR

Spark and the data lake

dplyr

6 Main verbs

- filter()
- arrange()
- select()
- mutate()
- group_by()
- summarise()

Simple use

- pull()
- n()/count()
- glimpse()

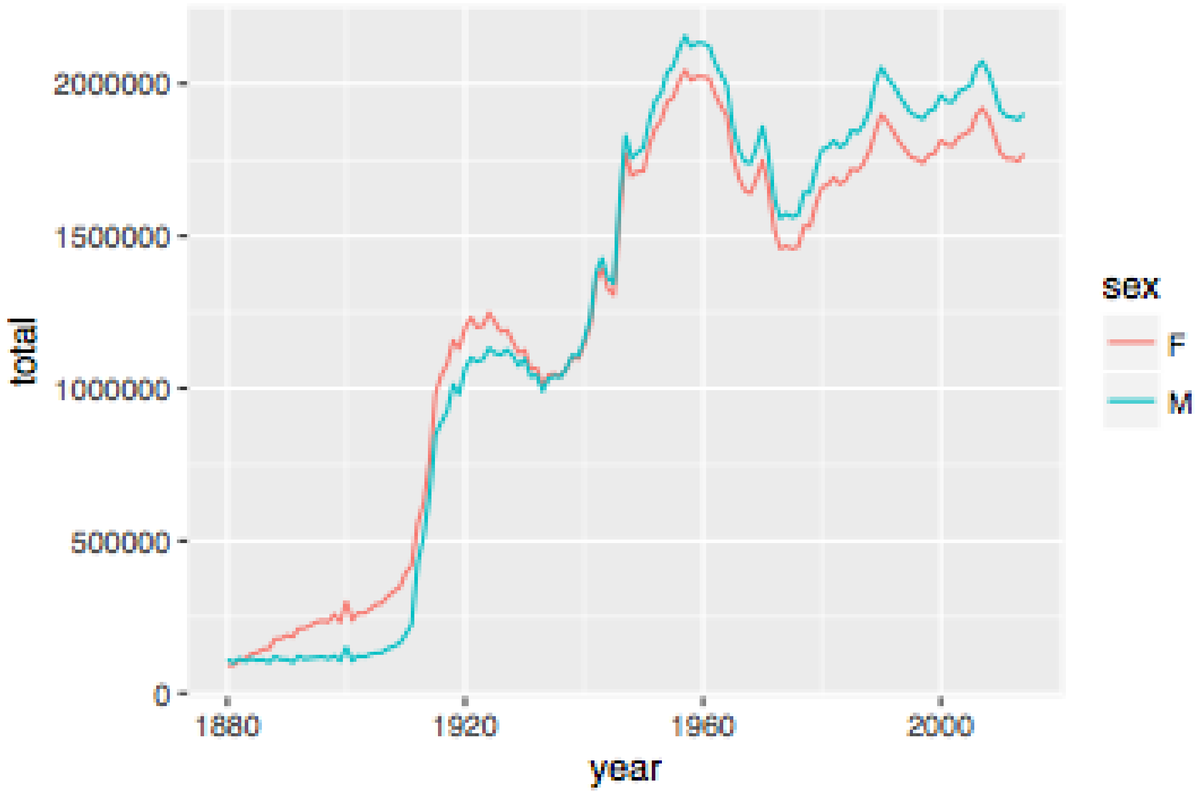
Advanced iterations

- summarize_at()
- mutate_at()

More info

- dplyr.tidyverse.org
- R for Data Science

```
babynames %>%
  group_by(year, sex) %>%
  summarise(total = sum(n)) %>%
  ggplot(aes(x = year, y = total, color = sex)) +
    geom_line()
```



%>% Is Called the Pipe Operator

- Connects the output of one operation to the input of the next.
- Allows us to see the flow of data from left to right

```
employees %>%
 filter(Department == "Engineering") %>%
 count()

# A tibble: 1 x 1
      n
  <int>
1    71
```

The %>% == and then

Rather than multiple assignment or nesting functions

```
did_something <- do_something(data)

did_another_thing <- do_another_thing(did_something)

final_thing <- do_last_thing(did_another_thing)
```

```
final_thing <- do_last_thing(
  do_another_thing(
    do_something(
      data
      )
    )
  )
```

```
final_thing <- data %>%
      do_something() %>%
      do_another_thing() %>%
      do_last_thing()
```

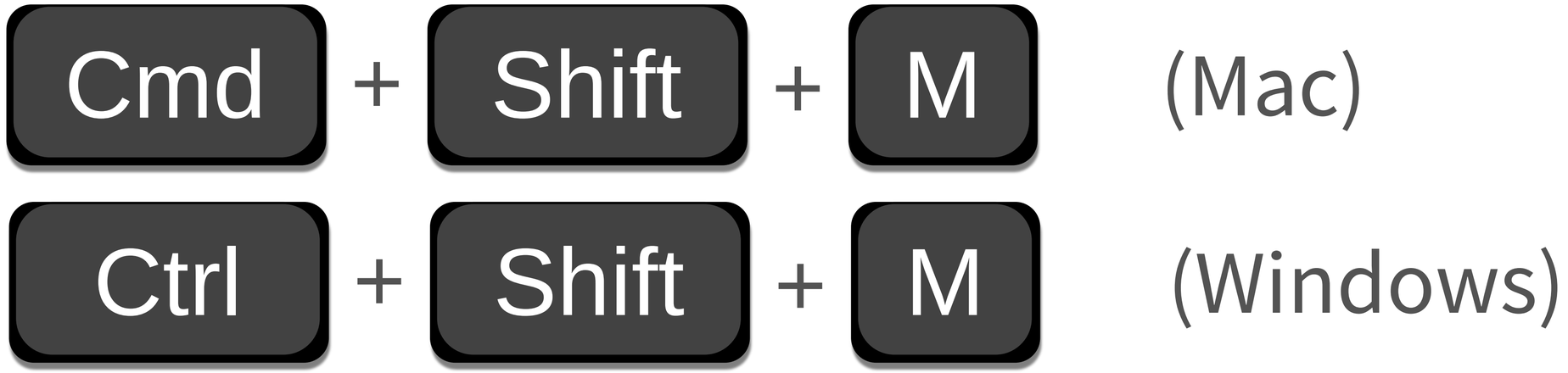
```
Phil <- filter(babynames, name == "Phil", sex == "M")
summarise(Phil, min = min(prop), mean = mean(prop),
  max = max(prop))
```

```
filter(babynames, name == "Phil", sex == "M") %>%
  summarise(min = min(prop), mean = mean(prop),
    max = max(prop))
```

```
Phil <- filter(babynames, name == "Phil", sex == "M")
summarise(Phil, min = min(prop), mean = mean(prop),
  max = max(prop))
```

```
babynames %>%
  filter(name == "Phil", sex == "M") %>%
  summarise(min = min(prop), mean = mean(prop),
    max = max(prop))
```

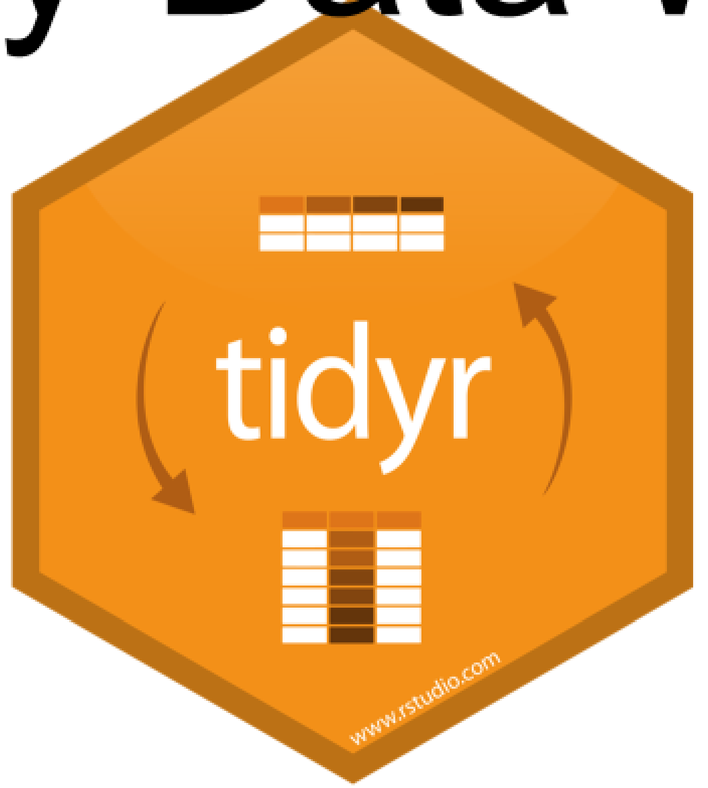
Shortcut to type %>%



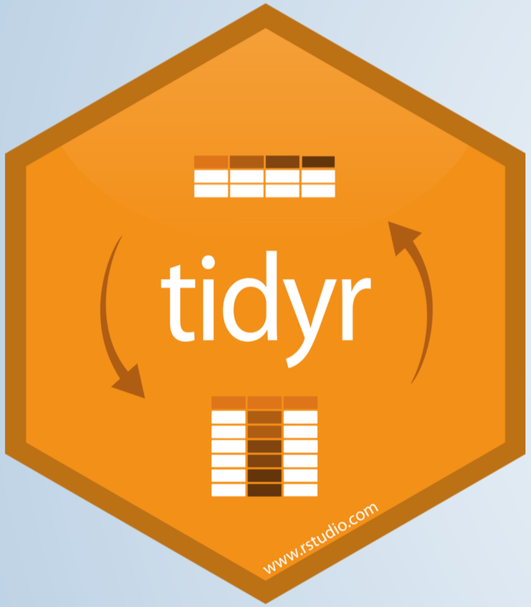
Your Turn – Pick One of Interest: 10min

- 03-Transform-Exercises.Rmd Beginner
- 1_dplyr_tidyr_r4ds_tidyverse.Rmd Advanced
- In folder RMD_Clinical_Tidyverse, A gentle guide to Tidy statistics in R.rmd Clinical

Tidy Data with



tidyr



A package that reshapes the layout of tabular data.

tidyr

The goal of tidyr is to help you create tidy data. Tidy data is data where:

- Each variable is in a column.
- Each observation is a row.
- Each value is a cell.

Make Taller and Make Wider

- `gather()` - takes multiple columns, and gathers them into key-value pairs: it makes “wide” data longer.
- `spread()` - takes two columns (key & value), and spreads into multiple columns: it makes “long” data wider.

Separate and unite columns

- `separate()` - Separate one column into multiple columns.
- `unite()` - Unite multiple columns into one.

Your Turn: 3min

- 1_dplyr_tidyr_r4ds_tidyverse.Rmd
- At Bottom

Break Time

- Fun Video

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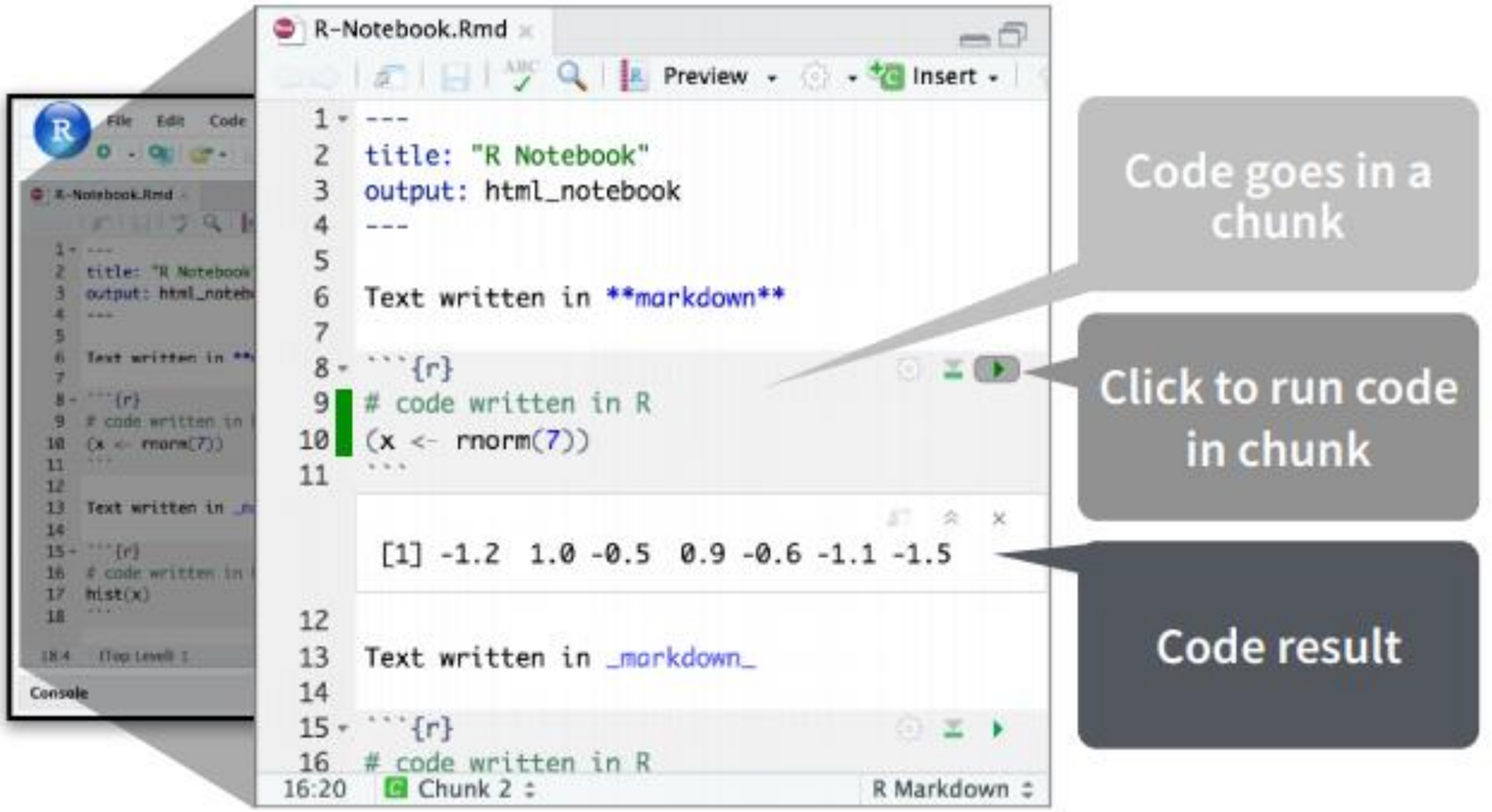
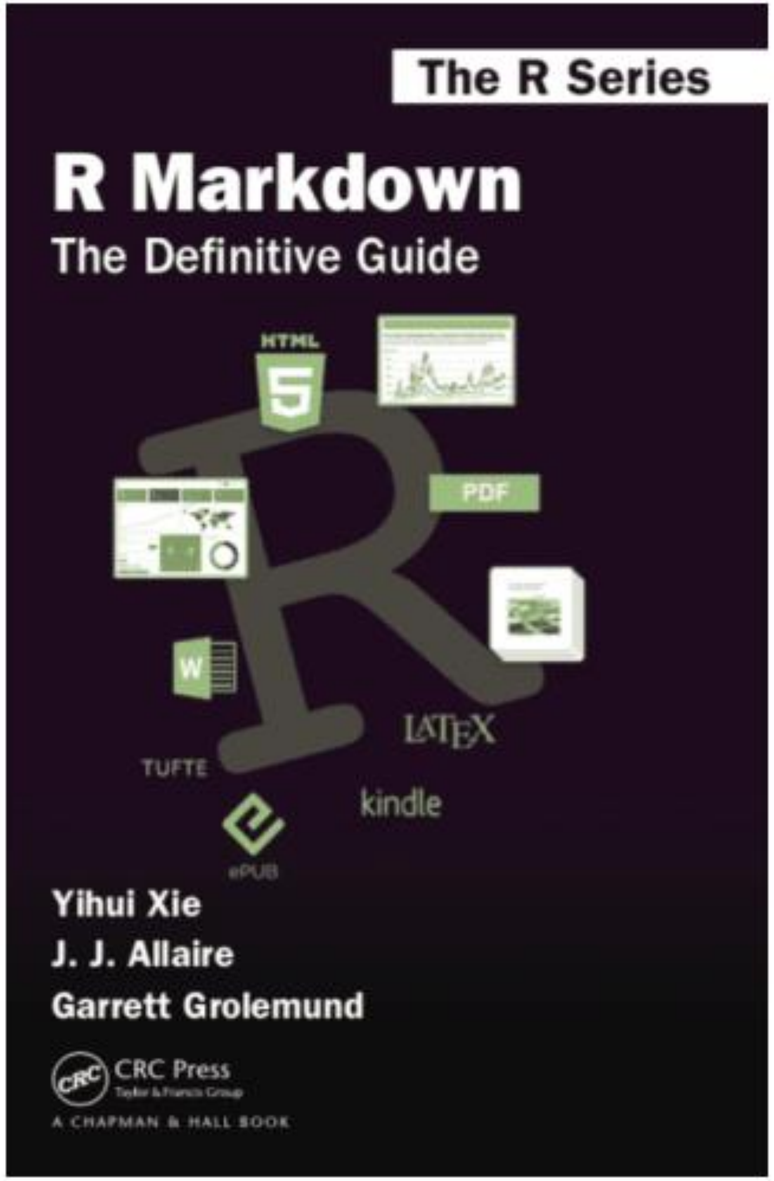
R Markdown

R Markdown

An authoring format for Data Science.





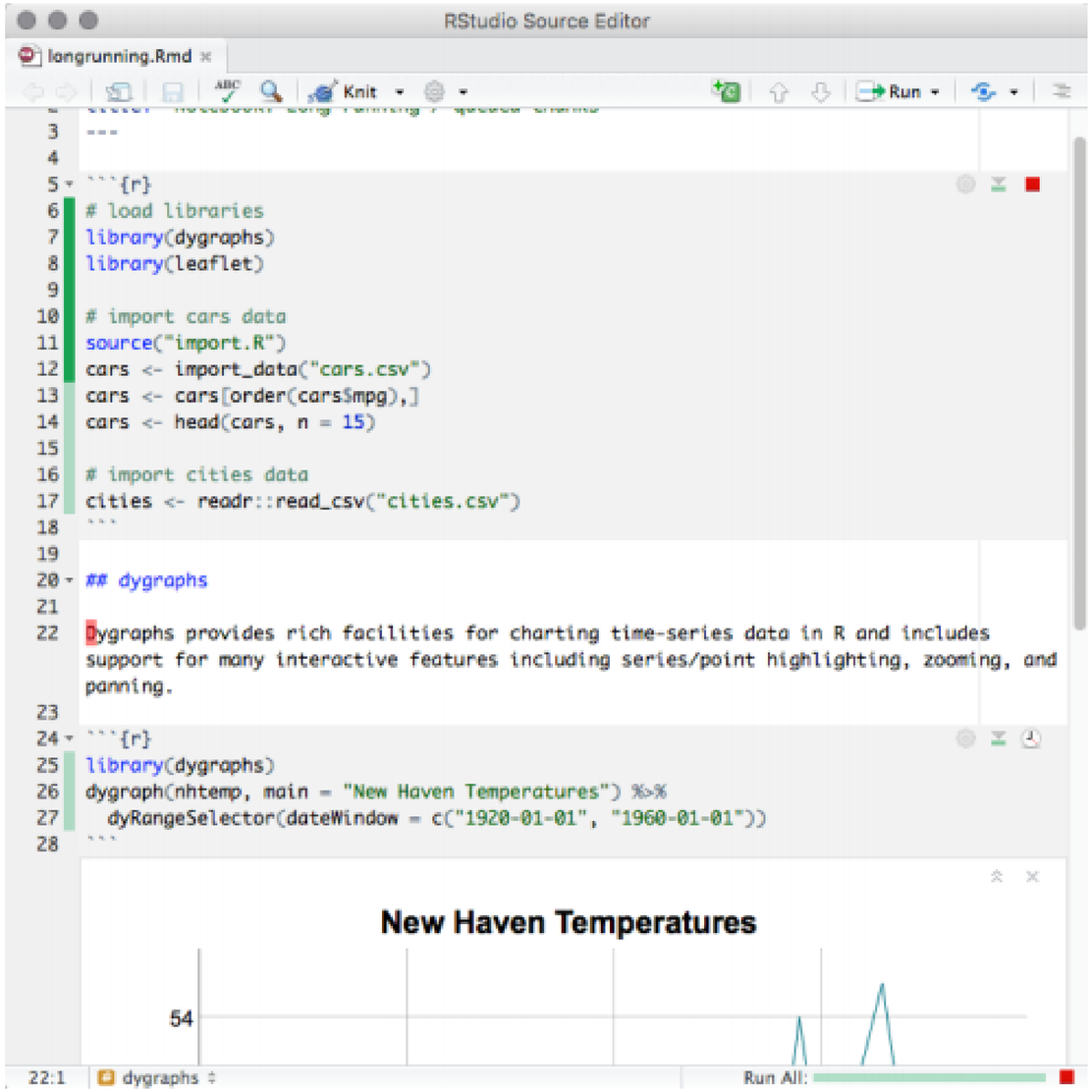
bookdown.org/yihui/rmarkdown/

ONLINE, FREE

rmarkdown

- Starts as a notebook style interface
  - Mixes code with **prose**
- **Knits** to dozens of different formats
  - HTML
  - PDF
  - Handouts
  - Books
  - Reports
  - dashboards
  - Interactive shiny apps
  - Articles
  - Websites

Example



Your Turn: 3mins

- Go to 3_Report.
- Open 01-RMarkdown-Exercises.Rmd.
- Read through the file and do everything it tells you to do.

KNITR IS MULTI-LINGUAL!

- [x] SAS
- [x] PYTHON
- [x] MORE

Your Turn

- demo-notebook.Rmd in python folder
- Which section is changing the language engine via knitr?

Parameters

A list of values that you can call in R code chunks

params list

elements and values

```
---
title: "Untitled"
output: html_document
params:
  filename: "data.csv"
  symbol: "GOOG"
---
```

Access as `params$filename` and `params$symbol`

Your Turn: 5mins

- Part 1 - Easy
- 1_RMD_Stocks.Rmd
- Pick a new stock and generate a new report
- Now Make it a PDF

- Part 2 - Harder
- Go to 05-Report-Exercise.Rmd
- See if you can make it parameterized for your name

R Markdown Render Function

rmarkdown::**render**

Render at the command line with YAML options

```
> render("doc.Rmd")
```

Render at the command line, override output format.

```
> render("doc.Rmd", "html_document")
```

Render at the command line to multiple formats.

```
> render("doc.Rmd", c("html_document", "pdf_document"))
```

rmarkdown::**render**

Render at the command line with YAML options

```
> render("doc.Rmd")
```

Render at the command line, set parameters.

```
> render("doc.Rmd", params = list(
      filename = "other_data.csv",
      symbol = "AAPL")
```

Your Turn: 2mins

- 3_RMD_stock_Flex_CSS
- Render the report programatically using the render function.
- Now do it manually using the “Knit with Parameters” button

What about many reports?

Say Hi to purrr

Demo Example

- 6_RMD_Report_Versions
- **Don't forget to set the WD**
- Review the airplane-report.Rmd
- Notice how it is connecting to a DB?
- build_airplane_report, run this function as well as the list above it
- Then run the purr command at the bottom
- See how the reports generate dynamically?
- **How would you automate this? Ask your neighbor**

What if I Start to Have a Collection of RMDs or If I Want a Website?

Other R Markdown Output Types

- Blogdown
- RMD Websites - Example
- Bookdown
- Presentations
- Package Documentation

Your Turn: 5mins

- Go to the 11_RMD_IL_Home_Prices and knit the portfolio.Rmd
- Now go t 12_RMD_Stocks_RMarkdown_Website
- Knit the Index.RMD file…
- How is this different than what we have done so far? How are they similar?
- Now Knit index.Rmd in 8_RMD_Immunogenicity_RMarkdown_Distill
- How is this different? What about Blogdown and Bookdown? Same or different?

But all of my data are in DBs?

DB - Three ways to write queries

1. DBI code
2. dplyr syntax
3. R Notebook SQL language engine

Your Turn

- 1_DB_Examples
- quick_db_demo.Rmd

- Review 5_RMD_Flex_Database to see a report built on data in a DB

Q/A. . .