Getting Started with R

David Keyes // R for the Rest of Us

Installation

Install R

The first thing you need to do is download the R software. Go to the Comprehensive R Archive Network (aka “CRAN”) website and download the software for your operating system (Windows, Mac, or Linux).

Working Directly in R

Working Directly in R

1. Enter: 2 + 2
2. Hit return
3. View result

Your Turn

1. Download and Install R
2. Open R
3. Use any mathematical operators (+, -, /, and *) to create an expression and make sure it works as expected

RStudio

R: Engine	RStudio: Dashboard
	

Courtesy Modern Dive

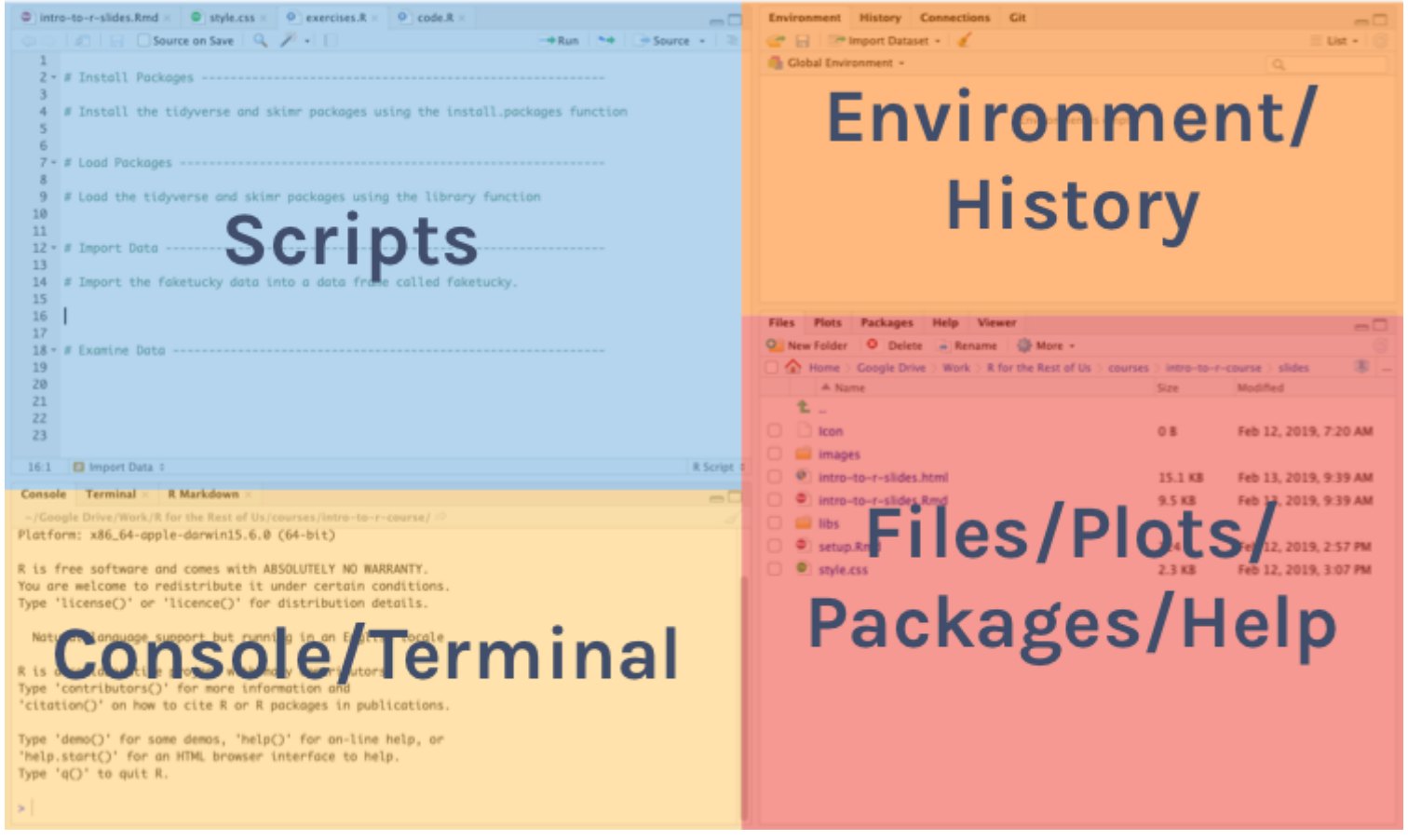
RStudio

If you use RStudio, you'll have a graphical user interface, the ability to see all of your stored information, and much more.

Download RStudio

Download RStudio at the RStudio website. Ignore the various versions listed there. All you need is the latest version of RStudio Desktop.

Tour of RStudio



Your Turn

1. Download and Install RStudio
2. Open RStudio
3. Working in the console pane, use any mathematical operators (+, -, /, and *) to create an expression and make sure it works as expected

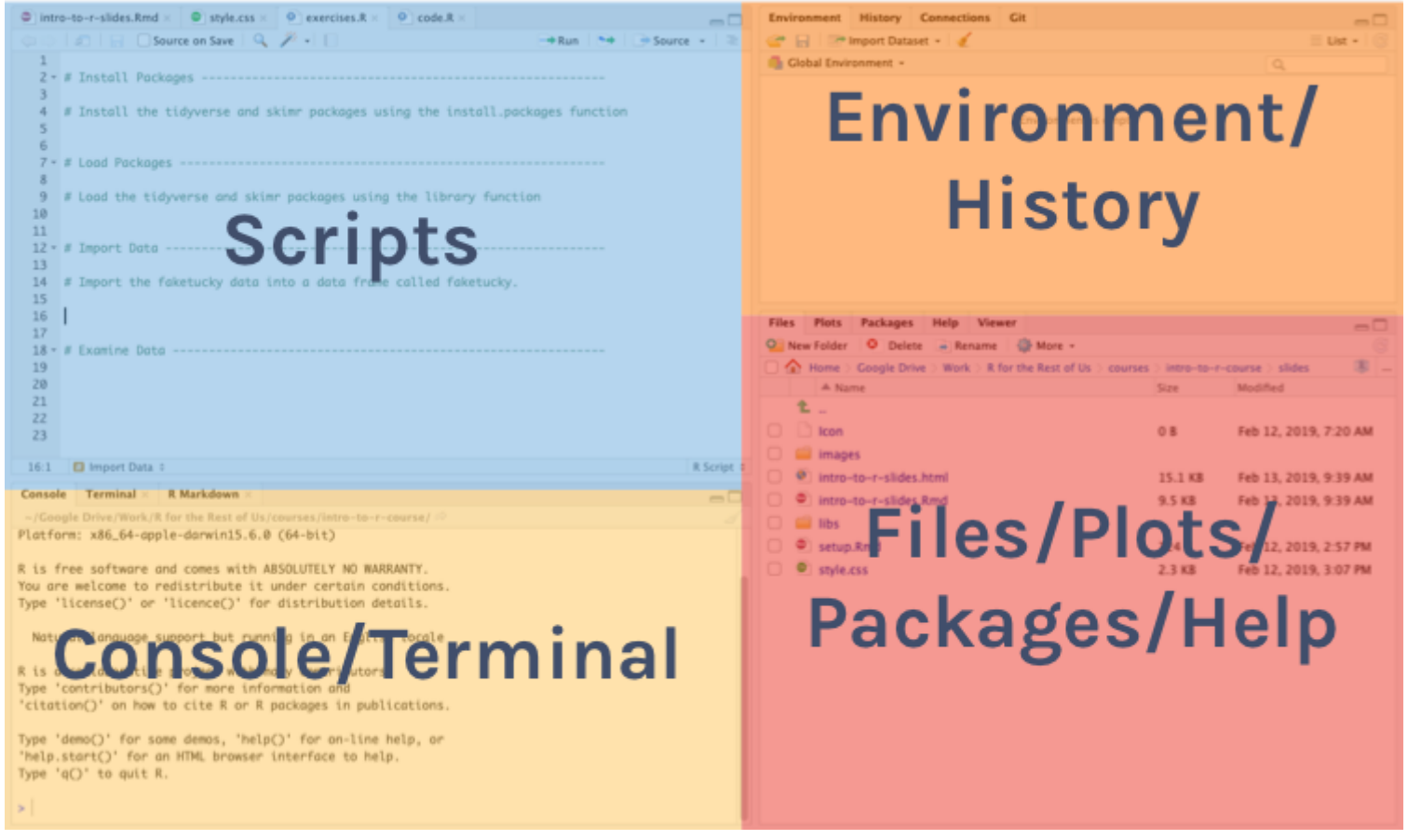
Projects

Projects

Projects allow you to keep a collection of files all together, including:

- R scripts
- RMarkdown files (more on those soon)
- Data files
- And much more!

Sample Project



How to Create a Project

1. File → New Project

2. Quit RStudio, Double-click .Rproj file to reopen project

Your Turn

1. Create a new project (doesn't matter if it's in a new or existing directory)

2. Quit RStudio, double-click the .Rproj file and reopen your project

Download Course Project

Your Turn

Enter the following into the RStudio console pane:

```
install.packages("usethis")
library(usethis)
use_course("https://github.com/rladiesstl/intro-meetup1-oct-2021/archive/refs/heads/main.zi
```

Files in R

File Types

There are **two main file types** that you'll work with:

R scripts (.R)

Text is assumed to be executable R code unless you comment it (more on this soon)

```
# This is a comment

data <- read_csv("data.csv")
```

RMarkdown files (.Rmd)

Text is assumed to be text unless you put it in a code chunk (more on this soon)

R Scripts

Create new script file: File → New File → R Script

How to Run Code

Run the code: control + enter on Windows, command + enter on Mac keystrokes or use Run button

Comments

Do them for others, and for your future self.

```
# This is a comment

head(data, n = 5)
```

Packages

Packages

Packages add functionality that is not present in base R.

They're where much of the power of R is found.

R: A new phone	R Packages: Apps you can download
	

Packages We'll Use

`tidyverse`

The `tidyverse` is a collection of packages.

We'll use `readr` to import data.

Packages We'll Use

`skimr`

`skimr` provides easy summary statistics.

Install Packages

The syntax to install packages is as follows.

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

The package name must be in quotes.

> Packages should be installed **once per computer** (i.e. once you've installed a package, you don't need to do it again on the same computer).

Load Packages

To load packages, use the following syntax:

```
library(tidyverse)
library(skimr)
```

Package names don't need to be quoted here (though they can be).

> Packages should be loaded **once per session** (i.e. every time you start working in R, you need to load any packages you want to use).

Your Turn

1. Open the project you downloaded before (it should be on your desktop)

2. Open the exercises.R file

3. Install the `tidyverse` and `skimr` packages using the `install.packages()` function

4. Load the `tidyverse` and `skimr` packages using the `library()` function


Import Data

Import Data

Let's read data from a CSV file.

```
faketucky <- read_csv("data/faketucky.csv")
```

We now have a data frame/tibble called `faketucky` that we can work with in R.

R is Case Sensitive

R is **case sensitive** so choose one of the following for all objects and **be consistent**.

Option	Example
snake_case	student_data
camelCase	studentData
periods.in.names	student.data

Directories

If the data file is in the working directory, you only need to specify its name.

```
faketucky <- read_csv("faketucky.csv")
```

If the data file is not in the working directory, you need to specify full path name.

When specifying the path name use the forward slash (“/”) not backslash (“\”).

```
faketucky <- read_csv("data/faketucky.csv")
```

Where Does our Data Live?

Data we have imported is available in the environment/history pane.

Your Turn

1. Open the exercises.R file

2. Import the faketucky data into a data frame called `faketucky`.

3. Make sure you see `faketucky` in your environment/history pane.

Objects and Functions

Objects and Functions

> To understand computations in R, two slogans are helpful:
>
> Everything that exists is an **object**, and
>
> Everything that happens is a **function** call.

John Chambers, quoted in Hadley Wickham's Advanced R.

```
grants_data <- read_csv("data/grants-data.csv")
```

everything that exists is an

OBJECT

everything that happens is a

FUNCTION

Assignment Operator

```
grants_data <- read_csv("data/grants-data.csv")
```

ASSIGNMENT OPERATOR

We assign the result of the `read_csv()` **function** to the `faketucky` **object**

Examine Our Data

Examine Our Data

There are many ways to look at our data. We'll talk about a few.

faketucky

If you type the name of your data frame (i.e. `faketucky`), R will output the following:

```
faketucky
```

```
## # A tibble: 57,855 × 12
##    student_id first_high_school_attended school_district  male race_ethnicity
##         <dbl> <chr>                      <chr>            <dbl> <chr>
##  1       1622 Jackson                    Jackson              1 Multiple/Native …
##  2       1877 Jackson                    Jackson              1 White
##  3       1941 Jackson                    Jackson              1 White
##  4       3442 Jackson                    Jackson              0 White
##  5       4623 Jackson                    Jackson              1 White
##  6       4913 Jackson                    Jackson              1 White
##  7       5754 Jackson                    Jackson              1 White
##  8       6293 Jackson                    Jackson              0 White
##  9       7010 Jackson                    Jackson              1 White
## 10       8343 Jackson                    Jackson              1 White
## #  with 57,845 more rows, and 7 more variables: free and reduced lunch <dbl>
```

head()

head() shows us the first X rows.

```
head(faketucky, 5)
```

```
## # A tibble: 5 × 12
##   student_id first_high_school_attended school_district  male race_ethnicity
##        <dbl> <chr>                      <chr>           <dbl> <chr>
## 1       1622 Jackson                    Jackson             1 Multiple/Native A…
## 2       1877 Jackson                    Jackson             1 White
## 3       1941 Jackson                    Jackson             1 White
## 4       3442 Jackson                    Jackson             0 White
## 5       4623 Jackson                    Jackson             1 White
## # … with 7 more variables: free_and_reduced_lunch <dbl>, percent_absent <dbl>,
## #   gpa <dbl>, act_reading_score <dbl>, act_math_score <dbl>,
## #   received_high_school_diploma <dbl>, enrolled_in_college <dbl>
```

head()

```
head(faketucky, 5)
```

`faketucky` and the number 5 here are **arguments**.

tail()

`tail` shows us the last X rows.

```
tail(faketucky, 5)
```

```
## # A tibble: 5 × 12
##   student_id first_high_school_attended school_district  male race_ethnicity
##        <dbl> <chr>                      <chr>           <dbl> <chr>
## 1      89364 Lookout Point              Lookout Point       1 Hispanic
## 2      94764 Lookout Point              Lookout Point       0 White
## 3      97538 Lookout Point              Lookout Point       1 White
## 4     101342 Lookout Point              Lookout Point       1 White
## 5     104903 Lookout Point              Lookout Point       1 Hispanic
## # … with 7 more variables: free_and_reduced_lunch <dbl>, percent_absent <dbl>,
## #   gpa <dbl>, act_reading_score <dbl>, act_math_score <dbl>,
## #   received_high_school_diploma <dbl>, enrolled_in_college <dbl>
```

`View()`

`View` (note capital V) opens the RStudio viewer (or click on a data frame in the environment pane).

```
View(faketucky)
```

skimr

The `skimr` package provides more detailed information about our data frame. It is also broken up by the type of variable.

```
# Install the package if necessary
install.packages("skimr")
```

```
skim(faketucky)
```

Your Turn

1. Open the file exercises.R

2. Follow the instructions to use the `head()`, `tail()`, `View()`, and `skim()` functions to examine your data.


We've Got Issues!

We've Got Issues!

Several variables have max values of 999. This seems suspicious!

```
> skim(faketucky)
Skim summary statistics
 n obs: 57855
 n variables: 12

── Variable type:character ─────────────────────────────────────────────────────────────────────────
                 variable missing complete     n min max empty n_unique
 first_high_school_attended       0    57855 57855   4  14     0      393
             race_ethnicity     794    57061 57855   5  24     0        5
            school_district       0    57855 57855   4  13     0      171

── Variable type:numeric ───────────────────────────────────────────────────────────────────────────
                  variable missing complete     n      mean       sd p0      p25      p50      p75 p100     hist
               act_math_score       0    57855 57855   257.85   420.77  1    16       20       33     999 ▇▁▁▁▁▁▁▁▂
             act_reading_score       0    57855 57855   258.78   420.65  2    16       22       34     999 ▇▁▁▁▁▁▁▁▂
           enrolled_in_college       0    57855 57855   255.74   435.54  0     0        1      999     999 ▇▁▁▁▁▁▁▁▃
       free_and_reduced_lunch       0    57855 57855    15.45   120.82  0     0        1        1     999 ▇▁▁▁▁▁▁▁▁
                         gpa       0    57855 57855    40.22   189.95  0     2.02     2.7      3.36  999 ▇▁▁▁▁▁▁▁▁
                        male       0    57855 57855     0.76    15.54  0     0        1        1     999 ▇▁▁▁▁▁▁▁▁
              percent_absent       0    57855 57855    10.68    46.19  0     3.27     6.28    11.35  3153 ▇▁▁▁▁▁▁▁▁
 received_high_school_diploma       0    57855 57855     0.74     0.44  0     0        1        1        1 ▂▁▁▁▁▁▁▁▇
                  student_id       0    57855 57855 55922.15 32332.71  1 27909.5  56070    83872.5  111990 ▇▇▇▇▇▇▇▇▇
```

We've Got Issues!

Several variables show up as numeric, but we know they're **not actually numeric**.

```
> skim(faketucky)
Skim summary statistics
 n obs: 57855
 n variables: 12

── Variable type:character ─────────────────────────────────────────────────────────────────────────
                variable missing complete     n min max empty n_unique
 first_high_school_attended       0    57855 57855   4  14     0      393
           race_ethnicity     794    57061 57855   5  24     0        5
          school_district       0    57855 57855   4  13     0      171

── Variable type:numeric ───────────────────────────────────────────────────────────────────────────
                variable missing complete     n     mean       sd p0     p25     p50     p75   p100     hist
           act_math_score       0    57855 57855   257.85   420.77  1   16      20      33      999 ▇▁▁▁▁▁▁▁▂
         act_reading_score      0    57855 57855   258.78   420.65  2   16      22      34      999 ▇▁▁▁▁▁▁▁▂
        enrolled_in_college     0    57855 57855   255.74   435.54  0    0       1     999      999 ▇▁▁▁▁▁▁▁▃
    free_and_reduced_lunch      0    57855 57855    15.45   120.82  0    0       1       1      999 ▇▁▁▁▁▁▁▁▁
                       gpa      0    57855 57855    40.22   189.95  0    2.02    2.7     3.36   999 ▇▁▁▁▁▁▁▁▁
                      male      0    57855 57855     0.76    15.54  0    0       1       1      999 ▇▁▁▁▁▁▁▁▁
           percent_absent       0    57855 57855    10.68    46.19  0    3.27    6.28   11.35  3153 ▇▁▁▁▁▁▁▁▁
 received_high_school_diploma   0    57855 57855     0.74     0.44  0    0       1       1       1 ▂▁▁▁▁▁▁▁▇
                student_id      0    57855 57855 55922.15 32332.71  1 27909.5  56070    83872.5 111990 ▇▇▇▇▇▇▇▇
```

Let's Import Our Data Again

We need to do two things:

1. Tell `read_csv()` how to handle **missing data**
2. Make sure `read_csv()` assigns the correct **data type** to each variable

Missing Data

Here's how we imported our data the first time:

```
faketucky <- read_csv("data/faketucky.csv")
```

To tell R which data is missing, simply add an argument to the `read_csv` function as follows:

```
faketucky <- read_csv("data/faketucky.csv",
                      na = "999")
```

Missing Data

If we skim our data again, we'll see that there are no longer 999 values.

```
skim(faketucky)
```

Data Types

When you run `read_csv` you'll see the following message, which tells you the data types that have been assigned to your data frame.

```
Parsed with column specification:
cols(
  student_id = col_double(),
  first_high_school_attended = col_character(),
  school_district = col_character(),
  male = col_double(),
  race_ethnicity = col_character(),
  free_and_reduced_lunch = col_double(),
  percent_absent = col_double(),
  gpa = col_double(),
  act_reading_score = col_double(),
  act_math_score = col_double(),
  received_high_school_diploma = col_double(),
  enrolled_in_college = col_double()
)
```

Data Types

- **Double/Numeric** (e.g. 2.5)
- **Character** (e.g. "Male")

There are many other data types in R that we won't discuss today.

Data Types

```
faketucky <- read_csv("data/faketucky.csv",
                      na = "999",
                      col_types = list(enrolled_in_college = "c",
                                       free_and_reduced_lunch = "c",
                                       male = "c",
                                       received_high_school_diploma = "c"))
```

Your Turn

1. Open the file exercises.R and change the code so that you correctly import the `faketucky` data frame, telling `read_csv` which data is missing and explictly defining column types where necessary.

2. After you make changes to how you import your data, rerun the code in the Examine Data section to make sure everything worked!

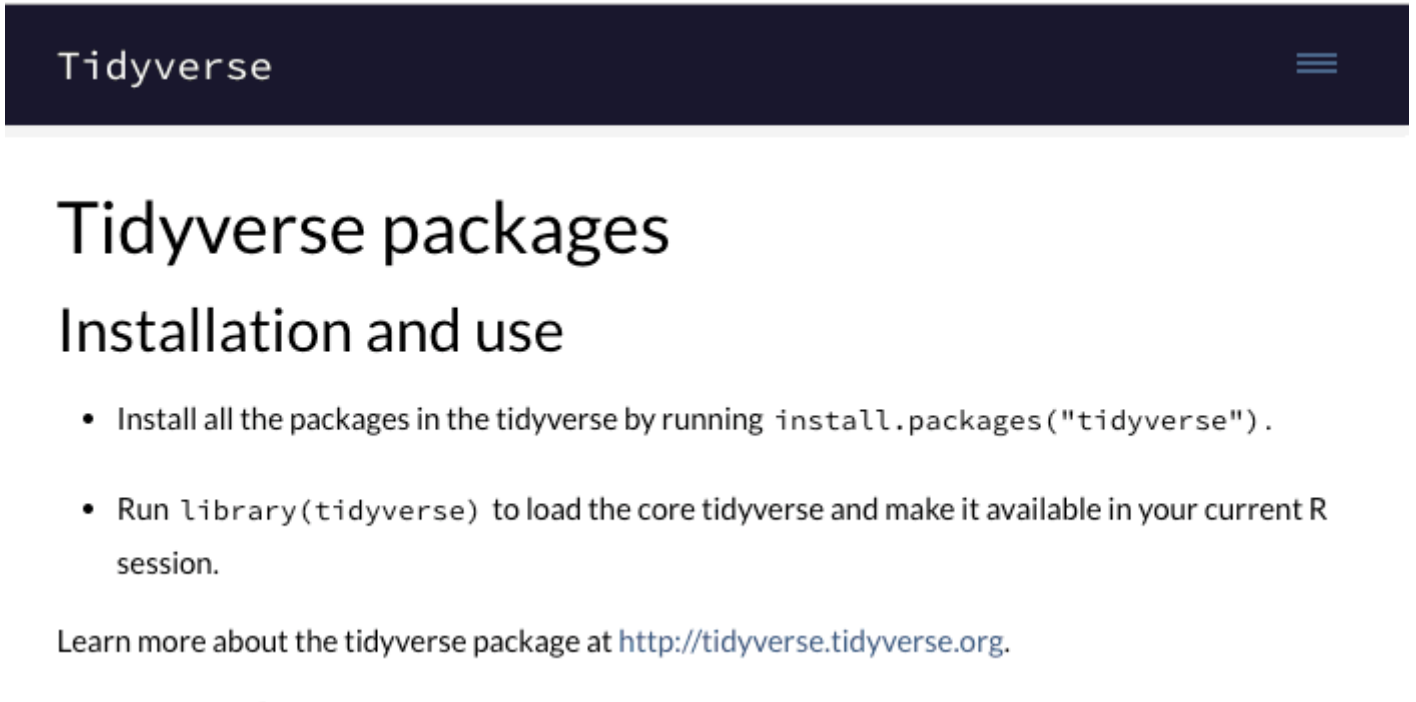
Getting Help

?function

Use the ? to get help about anything you're confused about

```
?read_csv
```

Tidyverse Website



Package Vignettes

Using Skimr

Elin Waring

2019-01-13

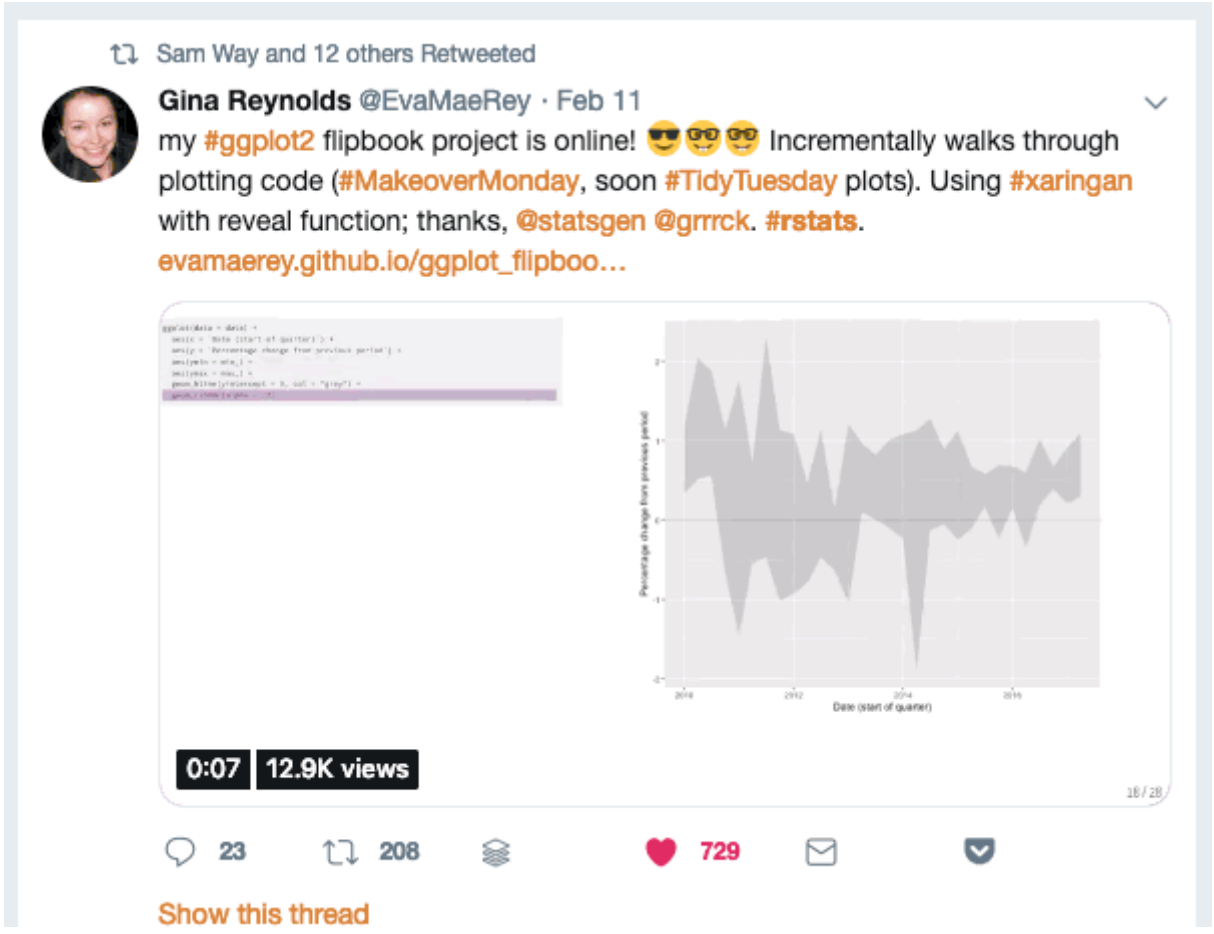
`skimr` is designed to provide summary statistics about variables. It is opinionated in its defaults, but easy to modify.

In base R, the most similar functions are `summary()` for vectors and data frames and `fivenum()` for numeric vectors:

```
summary(iris)
```

```
##   Sepal.Length    Sepal.Width     Petal.Length    Petal.Width
##  Min.   :4.300   Min.   :2.000   Min.   :1.000   Min.   :0.100
##  1st Qu.:5.100   1st Qu.:2.800   1st Qu.:1.600   1st Qu.:0.300
##  Median :5.800   Median :3.000   Median :4.350   Median :1.300
```

Twitter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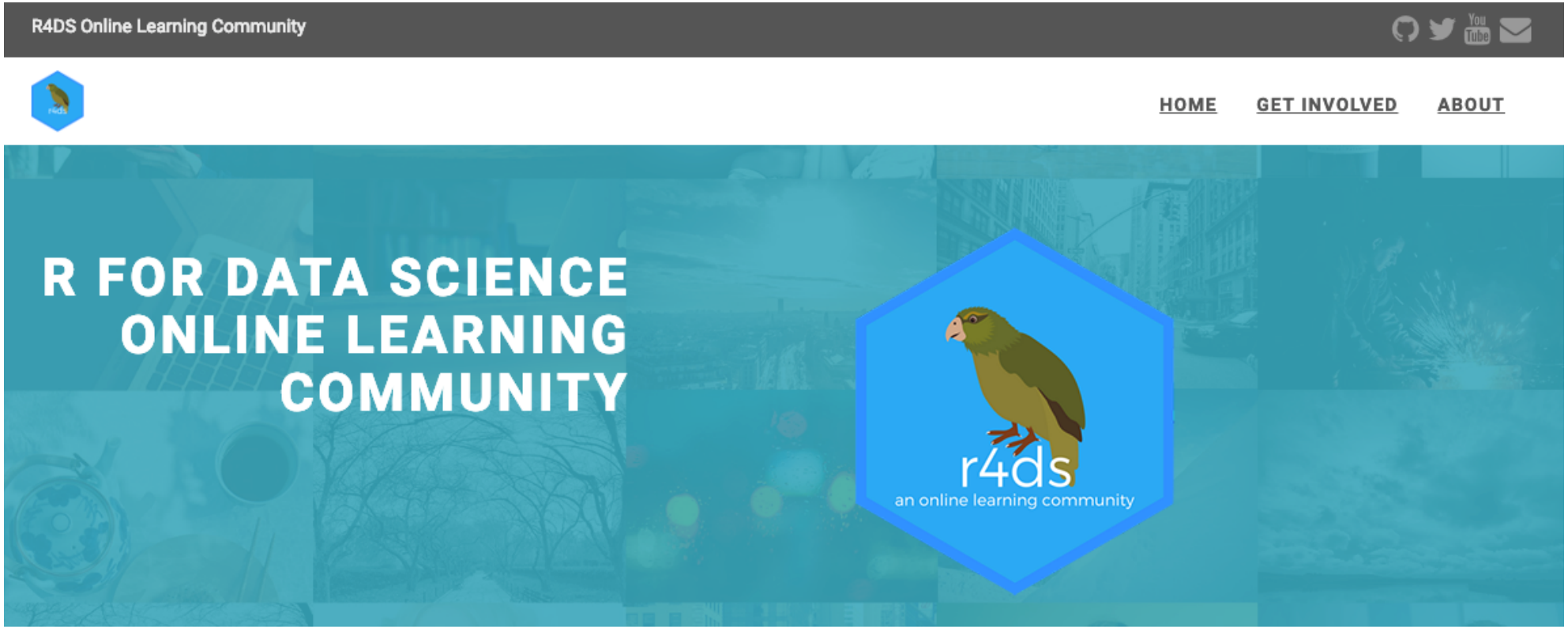

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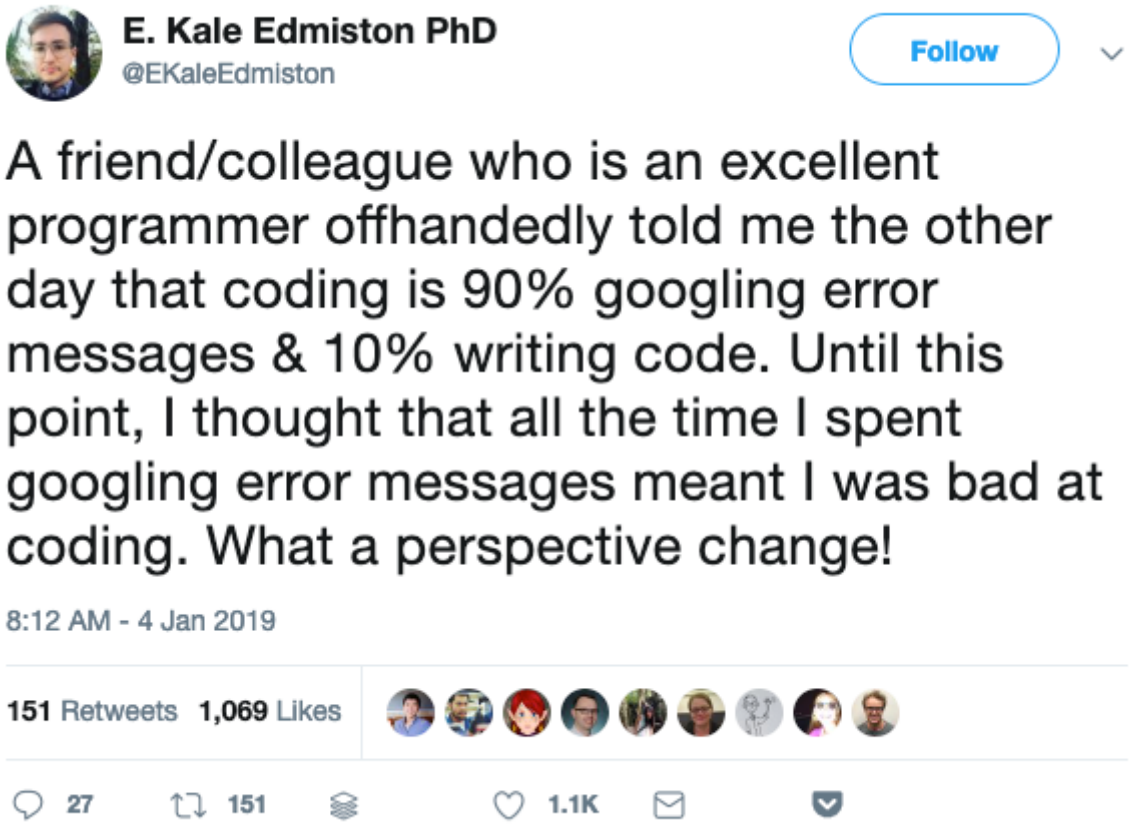
E. Kale Edmiston PhD
@EKaleEdmiston
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A friend/colleague who is an excellent programmer offhandedly told me the other day that coding is 90% googling error messages & 10% writing code. Until this point, I thought that all the time I spent googling error messages meant I was bad at coding. What a perspective change!
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