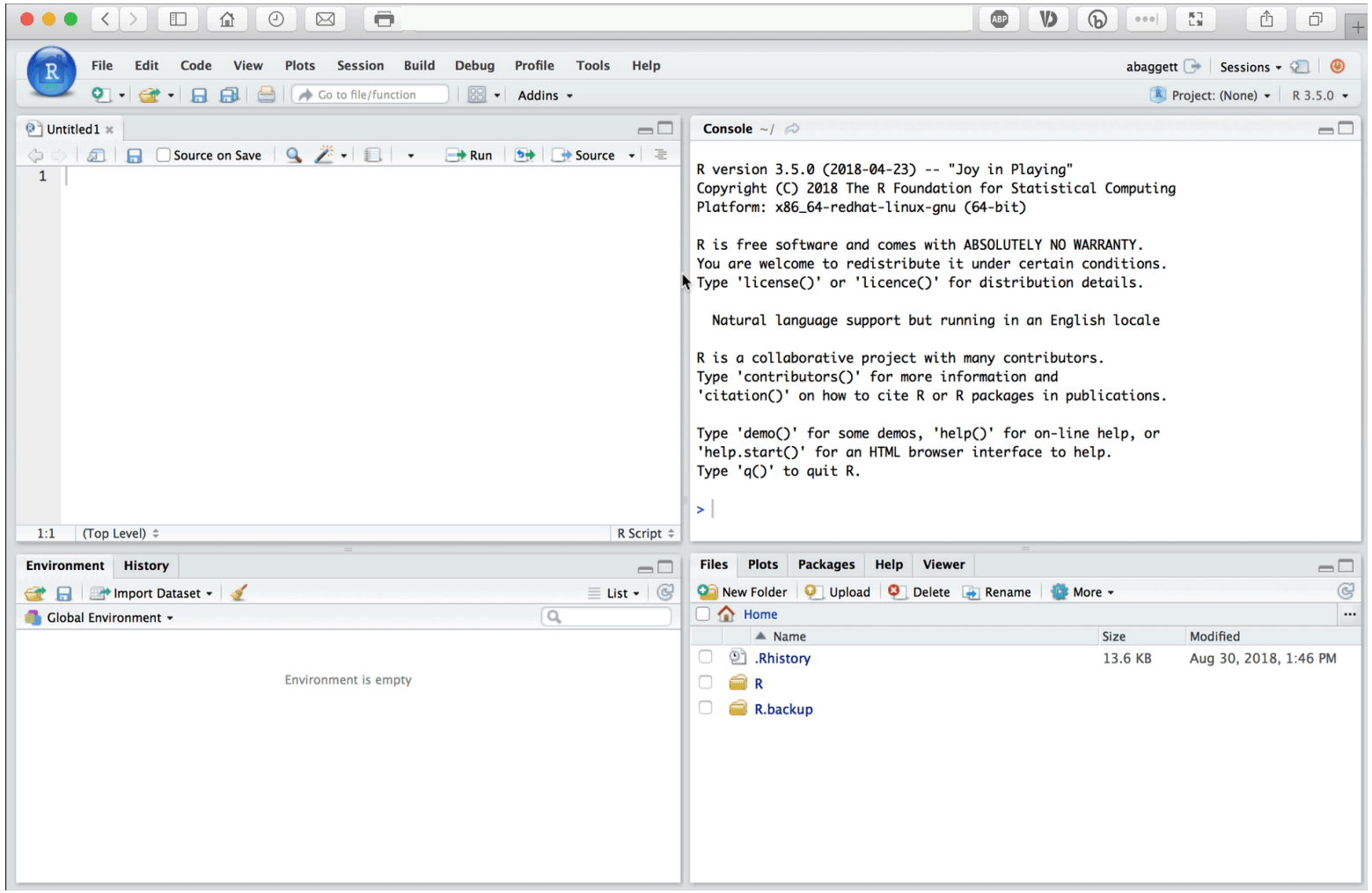
WELCOME!

- **Before we get started:**
  1. Login to r.umhb.edu
  2. File > New File > R Script
  3. Make yours look like this



Slightly

A Deeper Dive into R

Introducing the Verbs of Data Manipulation

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FOLLOW ALONG

bit.ly/r_dive

WHAT IS R?

- R is:
  - A powerful, flexible statistics and data software program
  - Free and open source
  - Surging in adoption worldwide
    - Ranks 14th among 50 of the most used programming languages in the world[1]
  - Like a set of tools

[1] TIOBE Programming Index, http://bit.ly/2x4TQGh, March 2, 2019

R AS A COLLECTION OF TOOLS

VS.

*The **tidyverse** is a coherent system of packages for data manipulation, exploration, and visualization that share a common design philosophy.*

`tidyverse` Verbs

- Verbs of data manipulation
  1. Mutate
  2. Filter
  3. Select
  4. Summarize

LET’S GET STARTED!

NFL 2018 DATA

- Let's look at some data from the 2018 NFL season
  1. What was each team's winning percentage?
  2. What was the mean number of points scored per game over the course of the season, across all teams?
  3. To what extent are points scored and winning percentage associated?

NFL 2018 DATA

- Let's load the `tidyverse` package library and read in the NFL data

```
library(tidyverse)

load(url("http://bit.ly/nfl_18"))
```

NFL 2018 DATA

- Let's take a look at the NFL data

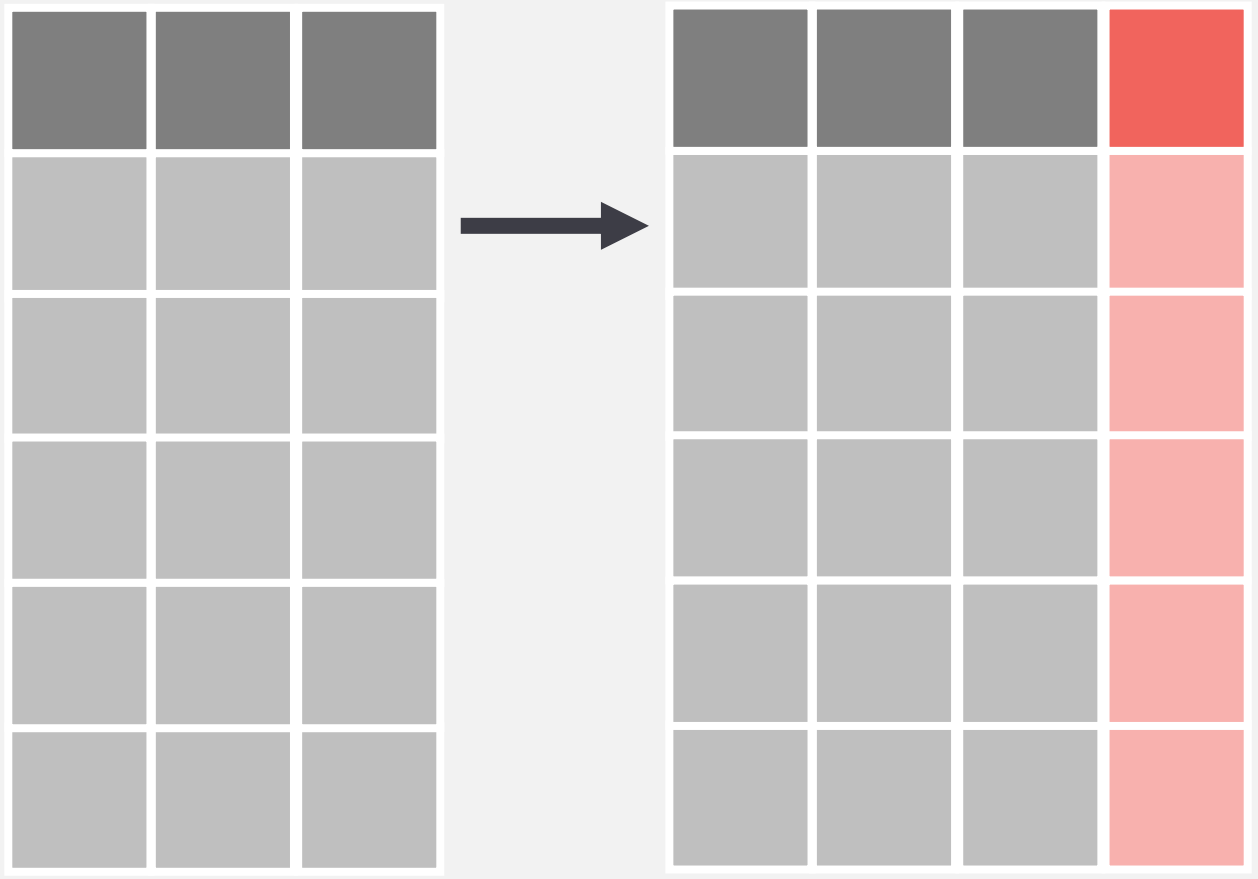
```
nfl

# A tibble: 32 x 12
   tm                    w     l     t    ps    pa    pd   mov   sos   srs  osrs  dsrs
   <chr>             <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>
 1 New Orleans Saints    13     3     0   504   353   151   9.4   0.6  10.1   7.9   2.2
 2 Los Angeles Rams      13     3     0   527   384   143   8.9  -0.4   8.5   9.5  -1.1
 3 Kansas City Chiefs    12     4     0   565   421   144   9    -0.1   8.9  12.6  -3.8
 4 Los Angeles Chargers  12     4     0   428   329    99   6.2  -0.2   6     3     2.9
 5 Chicago Bears         12     4     0   421   283   138   8.6  -2.3   6.3   1.5   4.8
 6 New England Patriots  11     5     0   436   325   111   6.9  -1.8   5.2   3.1   2.1
 7 Houston Texans        11     5     0   402   316    86   5.4  -1.5   3.8   2.4   1.4
 8 Baltimore Ravens      10     6     0   389   287   102   6.4   0.6   7     0.6   6.4
 9 Indianapolis Colts    10     6     0   433   344    89   5.6  -2.2   3.4   3.9  -0.6
10 Dallas Cowboys        10     6     0   339   324    15   0.9   0.2   1.1  -1.9   2.9
# … with 22 more rows
```

1. Mutate

Compute new column(s)

1. Mutate



1. Mutate

- Let's create a new column for teams' winning percentage

```
nfl
```

```
##    tm                      w     l
##  1 New Orleans Saints      13     3
##  2 Los Angeles Rams        13     3
##  3 Kansas City Chiefs      12     4
##  4 Los Angeles Chargers    12     4
##  5 Chicago Bears           12     4
##  . ...                      .     .
## 32 Arizona Cardinals        3    13
```

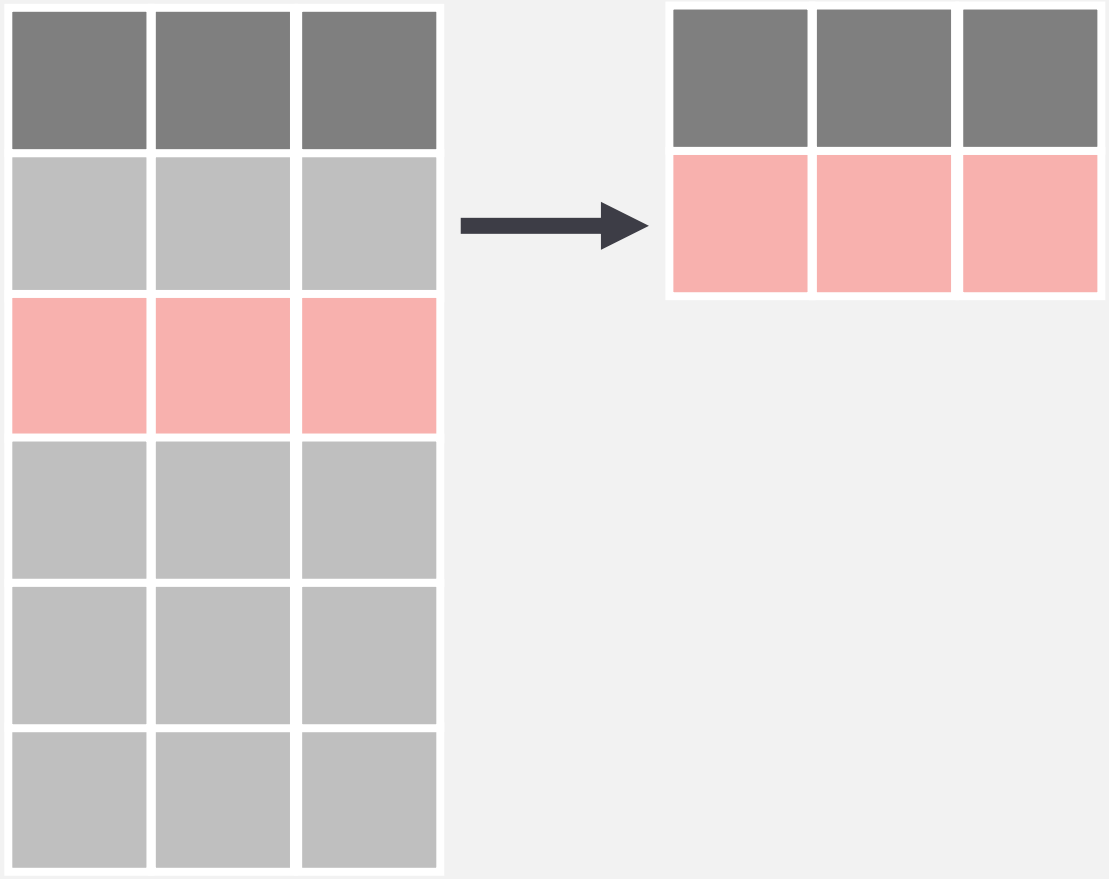
```
nfl <- nfl %>%
  mutate(wlpct = w / (w + l))
```

```
##    tm                      w     l wlpct
##  1 New Orleans Saints      13     3 0.812
##  2 Los Angeles Rams        13     3 0.812
##  3 Kansas City Chiefs      12     4 0.750
##  4 Los Angeles Chargers    12     4 0.750
##  5 Chicago Bears           12     4 0.750
##  . ...                      .     .     .
## 32 Arizona Cardinals        3    13 0.188
```

2. Filter

Extract rows that meet logical criteria

2. Filter



2. Filter

- Let's filter out and keep only teams with winning percentages above 0.800

```
nfl
```

```
##    tm                      w     l wlpct
##  1 New Orleans Saints      13     3 0.812
##  2 Los Angeles Rams        13     3 0.812
##  3 Kansas City Chiefs      12     4 0.750
##  4 Los Angeles Chargers    12     4 0.750
##  5 Chicago Bears           12     4 0.750
##  . ...                      .     .     .
## 32 Arizona Cardinals        3    13 0.188
```

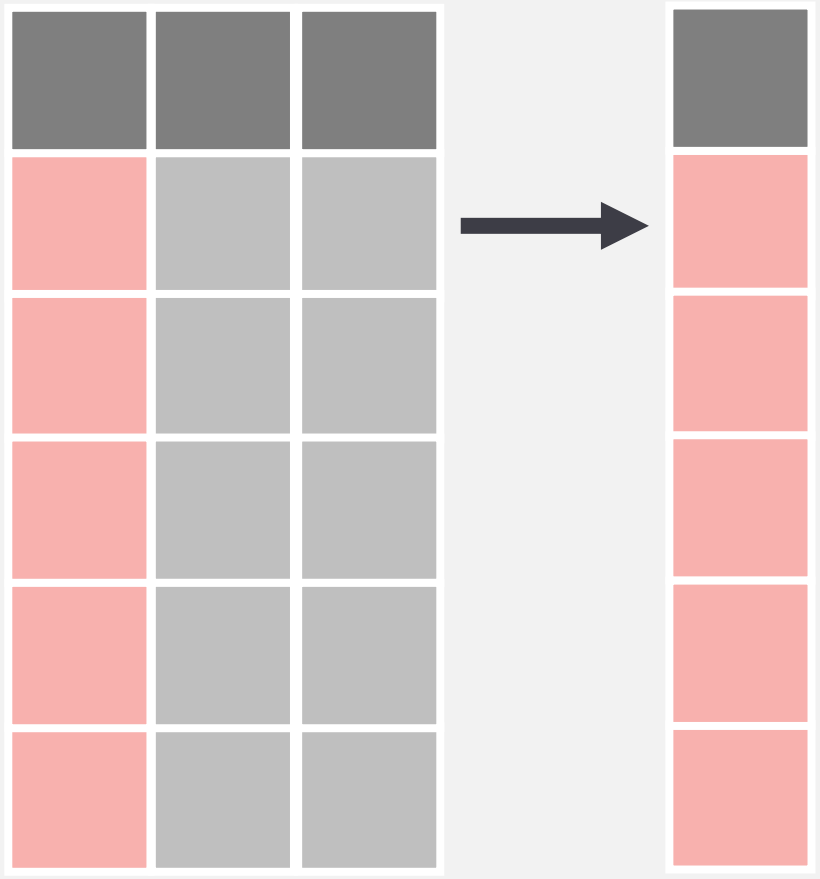
```
nfl %>%
  filter(wlpct > 0.8))
```

```
##    tm                      w     l wlpct
##  1 New Orleans Saints      13     3 0.812
##  2 Los Angeles Rams        13     3 0.812
```

3. Select

Extract columns as a table

3. Select



3. Select

- Let's get rid of `w` and `l`, keeping only `wlpct`

```
nfl
```

```
##    tm                      w     l wlpct
##  1 New Orleans Saints      13     3 0.812
##  2 Los Angeles Rams        13     3 0.812
##  3 Kansas City Chiefs      12     4 0.750
##  4 Los Angeles Chargers    12     4 0.750
##  5 Chicago Bears           12     4 0.750
##  . ...                      .     .     .
## 32 Arizona Cardinals        3    13 0.188
```

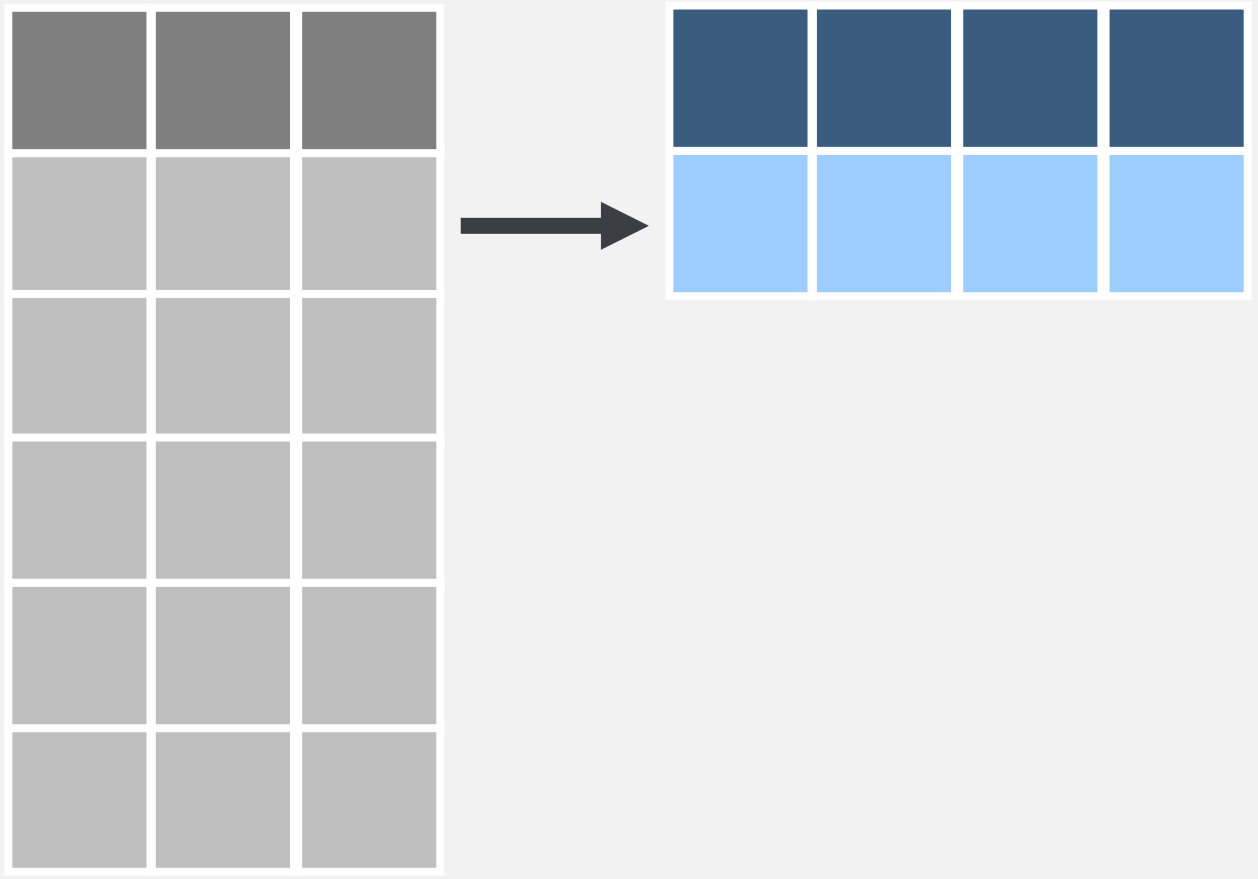
```
nfl %>%
  select(wlpct)
```

```
##    tm                    wlpct
##  1 New Orleans Saints    0.812
##  2 Los Angeles Rams      0.812
##  3 Kansas City Chiefs    0.750
##  4 Los Angeles Chargers  0.750
##  5 Chicago Bears         0.750
##  . ...                     .
## 32 Arizona Cardinals     0.188
```

4. Summarize

Compute table of summaries

4. Summarize



4. Summarize

- Let's calculate the mean number of points scored per game, over the course of the season, across all teams

```
nfl
```

```
##    tm                       w     l    ps
##  1 New Orleans Saints      13     3   504
##  2 Los Angeles Rams        13     3   527
##  3 Kansas City Chiefs      12     4   565
##  4 Los Angeles Chargers    12     4   428
##  5 Chicago Bears           12     4   421
##  . ...                      .     .     .
## 32 Arizona Cardinals        3    13   225
```

```
nfl %>%
 summarize(ppg = mean(ps) / 16)
```

```
## # A tibble: 1 x 1
##     ppg
## 1  23.3
```

4. Visualize

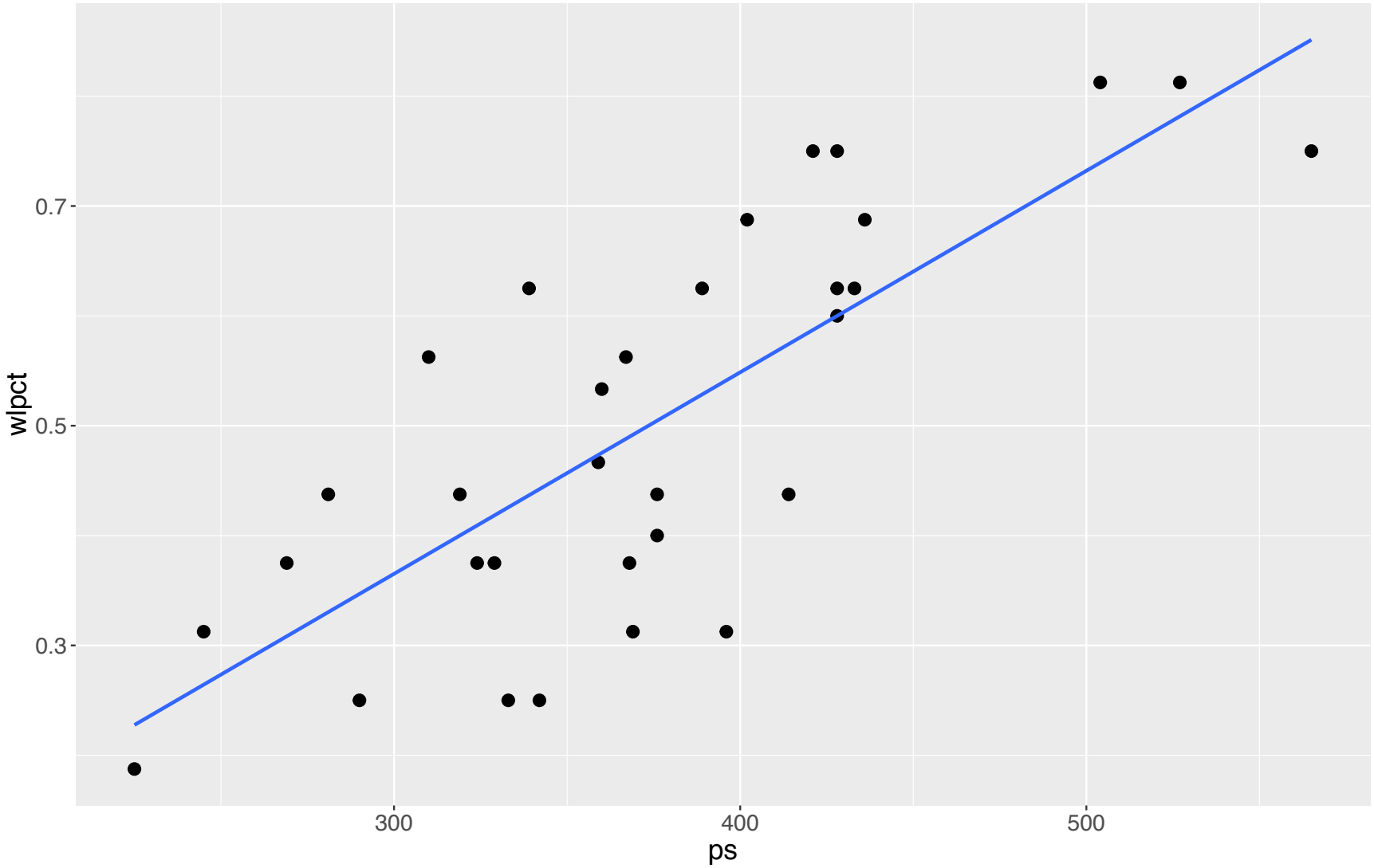
Plot distributions, relationships, and factors

5. Visualize

- Let's visualize the association between winning percentage and points scored over the season

```
ggplot(data = nfl,
  aes(x = ps, y = wlpct)) +
  geom_point() +
  geom_smooth(method = "lm", se = FALSE)
```

5. Visualize



RECAP

RECAP

- Data analysis often involves “tidying” the data before visualizing and modeling
- The verbs of the `tidyverse` are modern tools
- Applicable to any data analysis workflow

QUESTIONS?

GET IN TOUCH

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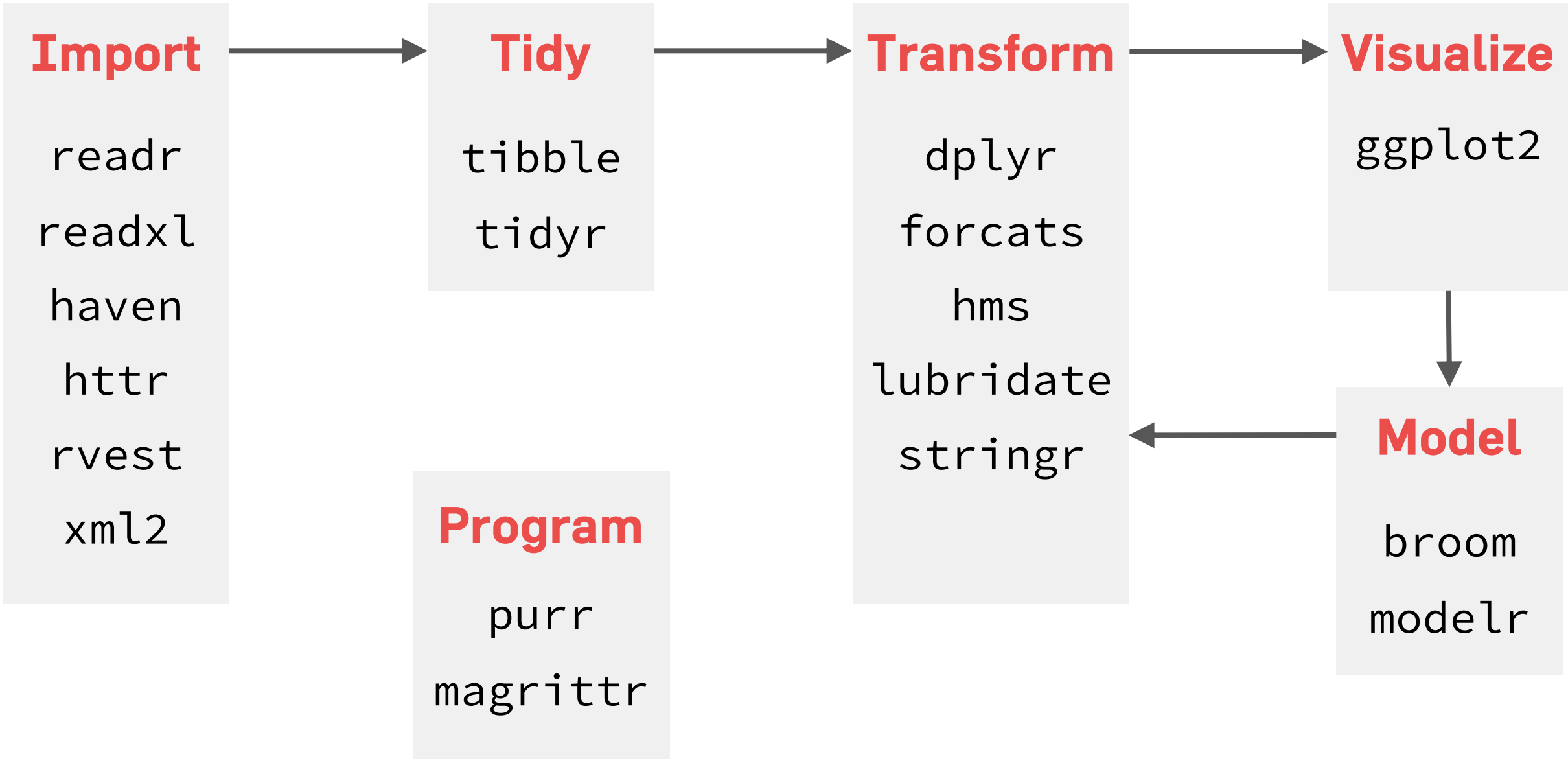
APPENDIX

DATA SCIENCE WORKFLOW

- The following slide contains a basic workflow for tackling data analysis projects
- For each step in the workflow, the corresponding tidyverse packages are listed
- For more information about the tidyverse see:

https://www.tidyverse.org/


Import
readr
readxl
haven
httr
rvest
xml2
Tidy
tibble
tidyr
Transform
dplyr
forcats
hms
lubridate
stringr
Visualize
ggplot2
Model
broom
modelr
Program
purr
magrittr