Week 11: *Programming with Data*

EMSE 4571 / 6571: Intro to Programming for Analytics

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Quiz 9

10:00

Write your name on the quiz!

Rules:

- Work alone; no outside help of any kind is allowed.
- No calculators, no notes, no books, no computers, no phones.

Week 11: *Programming with Data*

1. Writing functions for data frames

2. Writing custom plot functions

BREAK

3. Iteration with purrr

Week 11: *Programming with Data*

1. Writing functions for data frames

2. Writing custom plot functions

BREAK

3. Iteration with purrr

Motivation

I want a summary of a variable in a data frame:

```
head(diamonds)
```

```
#> # A tibble: 6 × 10
#>   carat cut       color clarity depth table price     x     y     z
#>   <dbl> <ord>     <ord> <ord>   <dbl> <dbl> <int> <dbl> <dbl> <dbl>
#> 1  0.23 Ideal     E     SI2      61.5    55   326  3.95  3.98  2.43
#> 2  0.21 Premium   E     SI1      59.8    61   326  3.89  3.84  2.31
#> 3  0.23 Good      E     VS1      56.9    65   327  4.05  4.07  2.31
#> 4  0.29 Premium   I     VS2      62.4    58   334  4.2   4.23  2.63
#> 5  0.31 Good      J     SI2      63.3    58   335  4.34  4.35  2.75
#> 6  0.24 Very Good J     VVS2     62.8    57   336  3.94  3.96  2.48
```

Motivation

I want a summary of a variable in a data frame:

```
length(diamonds$price)
```

```
#> [1] 53940
```

```
mean(diamonds$price)
```

```
#> [1] 3932.8
```

```
sd(diamonds$price)
```

```
#> [1] 3989.44
```

Motivation

I want a summary of a variable in a data frame:

```
diamonds %>%
  summarise(
    n = n(),
    mean = mean(price),
    sd = sd(price)
  )
```

```
#> # A tibble: 1 × 3
#>       n  mean    sd
#>   <int> <dbl> <dbl>
#> 1 53940 3933. 3989.
```

Motivation

I can get **grouped** summaries really easily now:

```
diamonds %>%
  group_by(cut) %>%
  summarise(
    n = n(),
    mean = mean(price),
    sd = sd(price)
  )
```

```
#> # A tibble: 5 × 4
#>   cut           n  mean    sd
#>   <ord>     <int> <dbl> <dbl>
#> 1 Fair       1610 4359. 3560.
#> 2 Good       4906 3929. 3682.
#> 3 Very Good 12082 3982. 3936.
#> 4 Premium   13791 4584. 4349.
#> 5 Ideal     21551 3458. 3808.
```

```
diamonds %>%
  group_by(color) %>%
  summarise(
    n = n(),
    mean = mean(price),
    sd = sd(price)
  )
```

```
#> # A tibble: 7 × 4
#>   color     n  mean    sd
#>   <ord> <int> <dbl> <dbl>
#> 1 D      6775 3170. 3357.
#> 2 E      9797 3077. 3344.
#> 3 F      9542 3725. 3785.
#> 4 G     11292 3999. 4051.
#> 5 H      8304 4487. 4216.
#> 6 I      5422 5092. 4722.
#> 7 J      2808 5324. 4438.
```

Convert this to a function

```
diamonds %>%
  group_by(color) %>%
  summarise(
    n = n(),
    mean = mean(price),
    sd = sd(price)
  )
```

```
#> # A tibble: 7 × 4
#>   color     n  mean    sd
#>   <ord> <int> <dbl> <dbl>
#> 1 D      6775 3170. 3357.
#> 2 E      9797 3077. 3344.
#> 3 F      9542 3725. 3785.
#> 4 G     11292 3999. 4051.
#> 5 H      8304 4487. 4216.
#> 6 I      5422 5092. 4722.
#> 7 J      2808 5324. 4438.
```

```
my_summary <- function(df, var) {
  df %>%
    group_by(var) %>%
    summarise(
      n = n(),
      mean = mean(price),
      sd = sd(price)
    )
}
```

...but this doesn't work

```
my_summary <- function(df, var) {
  df %>%
    group_by(var) %>%
    summarise(
      n = n(),
      mean = mean(price),
      sd = sd(price)
    )
}

my_summary(diamonds, color)
```

```
#> Error in `group_by()`:
#> ! Must group by variables found in `.data`.
#> ✖ Column `var` is not found.
```

Solution: "embrace" your variables 🤗

```
my_summary <- function(df, var) {
  df %>%
    group_by({{ var }}) %>%
    summarise(
      n = n(),
      mean = mean(price),
      sd = sd(price)
    )
}
```

```
my_summary(diamonds, cut)
```

```
#> # A tibble: 5 × 4
#>   cut           n  mean    sd
#>   <ord>     <int> <dbl> <dbl>
#> 1 Fair       1610 4359. 3560.
#> 2 Good       4906 3929. 3682.
#> 3 Very Good 12082 3982. 3936.
#> 4 Premium   13791 4584. 4349.
#> 5 Ideal     21551 3458. 3808.
```

```
my_summary(diamonds, color)
```

```
#> # A tibble: 7 × 4
#>   color     n  mean    sd
#>   <ord> <int> <dbl> <dbl>
#> 1 D      6775 3170. 3357.
#> 2 E      9797 3077. 3344.
#> 3 F      9542 3725. 3785.
#> 4 G     11292 3999. 4051.
```

Make it even more general!

```
my_summary <- function(df, group, var) {
  df %>%
    group_by({{ group }}) %>%
    summarise(
      n = n(),
      mean = mean({{ var }}),
      sd = sd({{ var }})
    )
}
```

```
my_summary(diamonds, group = cut, var = price)
```

```
#> # A tibble: 5 × 4
#>   cut           n  mean    sd
#>   <ord>     <int> <dbl> <dbl>
#> 1 Fair       1610 4359. 3560.
#> 2 Good       4906 3929. 3682.
#> 3 Very Good 12082 3982. 3936.
#> 4 Premium   13791 4584. 4349.
#> 5 Ideal     21551 3458. 3808.
```

Make it even more general!

```
my_summary <- function(df, group, var) {
  df %>%
    group_by({{ group }}) %>%
    summarise(
      n = n(),
      mean = mean({{ var }}),
      sd = sd({{ var }})
    )
}
```

```
my_summary(diamonds, group = color, var = carat)
```

```
#> # A tibble: 7 × 4
#>   color     n  mean    sd
#>   <ord> <int> <dbl> <dbl>
#> 1 D      6775 0.658 0.360
#> 2 E      9797 0.658 0.369
#> 3 F      9542 0.737 0.398
#> 4 G     11292 0.771 0.441
#> 5 H      8304 0.912 0.521
#> 6 I      5422 1.03  0.579
#> 7 J      2808 1.16  0.596
```

Use it on a different data frame!

```
library(palmerpenguins)

glimpse(penguins)
```

```
#> Rows: 344
#> Columns: 8
#> $ species           <fct> Adelie, Adelie,
#> $ island            <fct> Torgersen, Torg
#> $ bill_length_mm    <dbl> 39.1, 39.5, 40.
#> $ bill_depth_mm     <dbl> 18.7, 17.4, 18.
#> $ flipper_length_mm <int> 181, 186, 195,
#> $ body_mass_g       <int> 3750, 3800, 325
#> $ sex               <fct> male, female, f
#> $ year              <int> 2007, 2007, 200
```

```
my_summary(penguins, sex, body_mass_g)
```

```
#> # A tibble: 3 × 4
#>   sex        n  mean    sd
#>   <fct>  <int> <dbl> <dbl>
#> 1 female   165 3862.  666.
#> 2 male     168 4546.  788.
#> 3 <NA>      11   NA    NA
```

```
my_summary(penguins, species, bill_length_mm
```

```
#> # A tibble: 3 × 4
#>   species       n  mean    sd
#>   <fct>     <int> <dbl> <dbl>
#> 1 Adelie      152  NA   NA
#> 2 Chinstrap    68  48.8  3.34
#> 3 Gentoo      124  NA   NA
```

Defining a filter condition

```
filter_summary <- function(df, condition, var) {
  df %>%
    filter({{ condition }}) %>%
    summarise(
      n = n(),
      mean = mean({{ var }}, na.rm = TRUE),
      sd = sd({{ var }}, na.rm = TRUE)
    )
}
```

```
filter_summary(penguins, species == 'Adelie', bill_length_mm)
```

```
#> # A tibble: 1 × 3
#>       n  mean    sd
#>   <int> <dbl> <dbl>
#> 1   152  38.8  2.66
```

Your turn - write the following functions

15:00

```
my_subset <- function(df, condition, cols)
```

Returns a subset of `df` by filtering the rows based on `condition` and only includes the select `cols`. Example:

```
nycflights13::flights %>%
  my_subset(month == 12, c("carrier", "fligh
```

```
#> # A tibble: 5 × 2
#>   carrier flight
#>   <chr>    <int>
#> 1 B6         745
#> 2 B6         839
#> 3 US        1895
#> 4 UA        1487
#> 5 AA        2243
```

```
count_p <- function(df, group)
```

Returns a summary data frame of the count of rows in `df` by `group` as well as the percentage of those counts.

```
nycflights13::flights %>%
  count_p(carrier)
```

```
#> # A tibble: 6 × 3
#>   carrier     n      p
#>   <chr>   <int>  <dbl>
#> 1 UA      58665 0.174
#> 2 B6      54635 0.162
#> 3 EV      54173 0.161
#> 4 DL      48110 0.143
#> 5 AA      32729 0.0972
#> 6 MQ      26397 0.0784
```

Testing data frame functions

Function:

```
my_summary <- function(df, group, var) {
  df %>%
    group_by({{ group }}) %>%
    summarise(
      n = n(),
      mean = mean({{ var }}),
      sd = sd({{ var }})
    )
}
```

Make two data frames and compare them

```
test_my_summary <- function() {

  cat("Testing my_summary()...")

  df1 <- diamonds %>%
    my_summary(cut, price)

  df2 <- diamonds %>%
    group_by(cut) %>%
    summarise(
      n = n(),
      mean = mean(price),
      sd = sd(price)
    )

  stopifnot(identical(df1, df2))

  cat("passed!")
}

test_my_summary()
```

```
#> Testing my_summary()...passed!
```

Week 11: *Programming with Data*

1. Writing functions for data frames
2. Writing custom plot functions

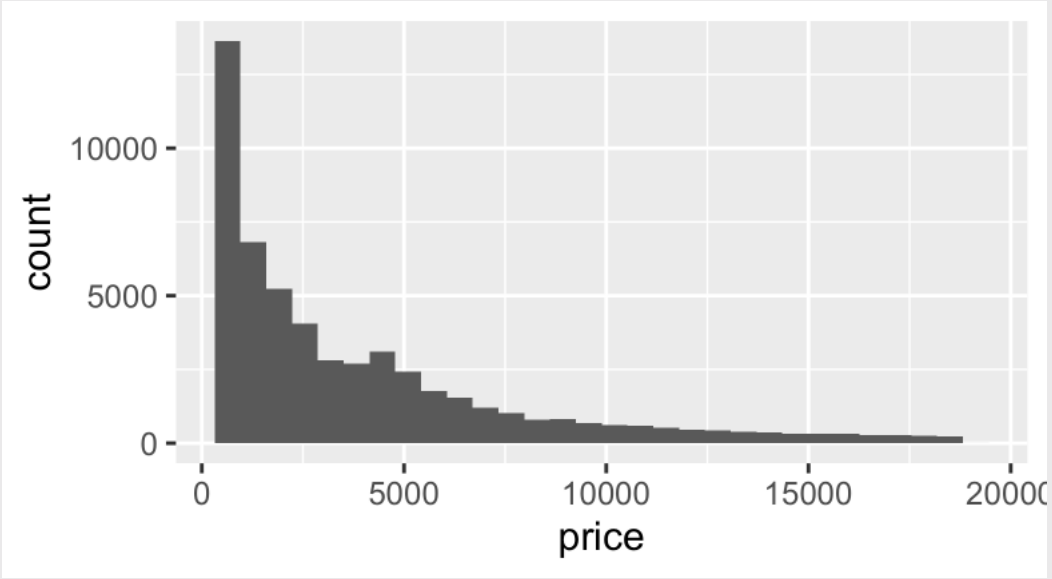
BREAK

3. Iteration with purrr

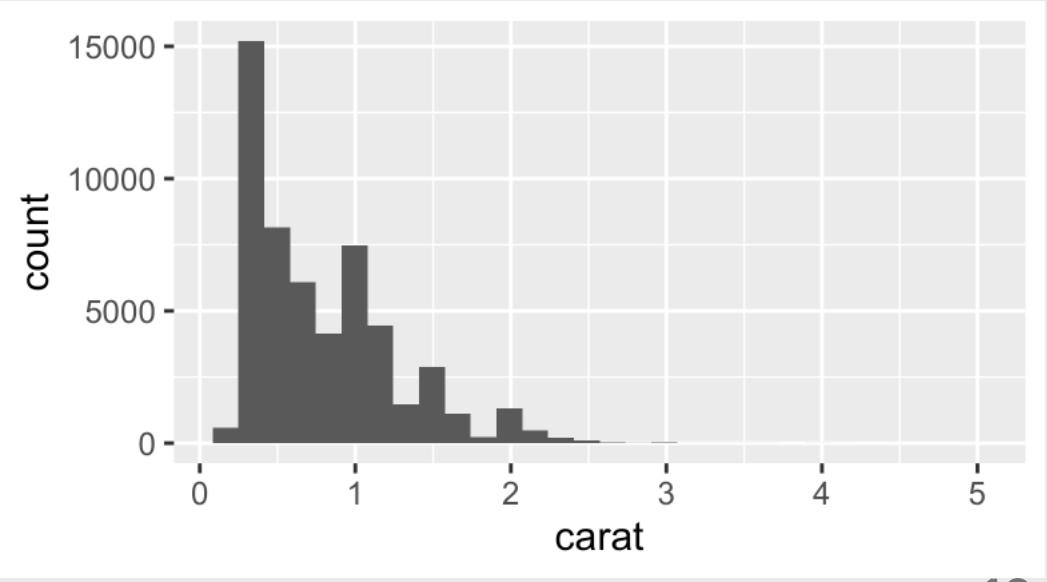
Motivation

I want to see a histogram of multiple variables

```
diamonds %>%
  ggplot() +
  geom_histogram((aes(x = price)))
```



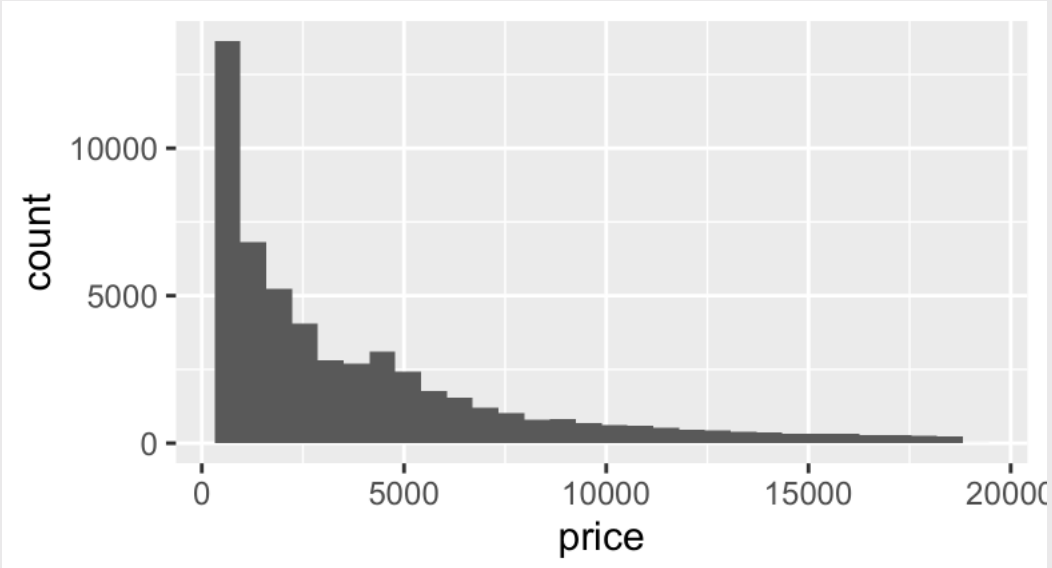

```
diamonds %>%
  ggplot() +
  geom_histogram((aes(x = carat)))
```



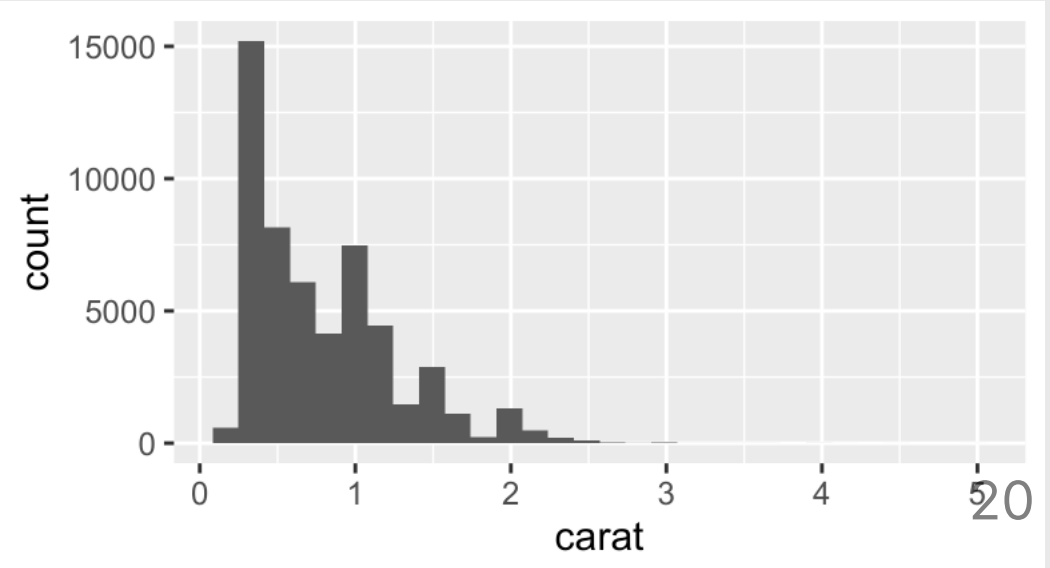
Convert this to a function

```
my_hist <- function(df, var) {
  df %>%
    ggplot() +
    geom_histogram((aes(x = {{ var }}))) # <<
}
```

```
my_hist(diamonds, price)
```



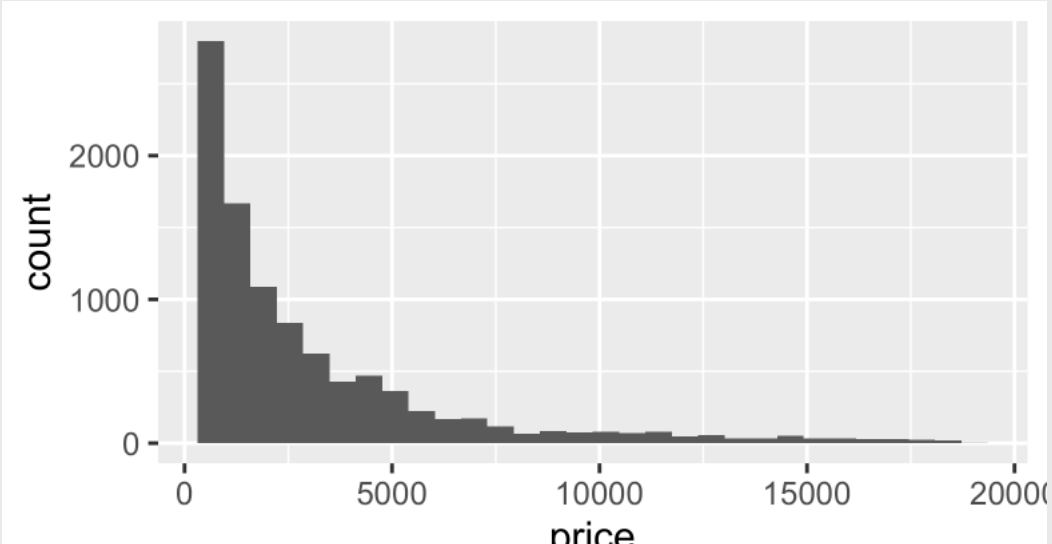

```
my_hist(diamonds, carat)
```



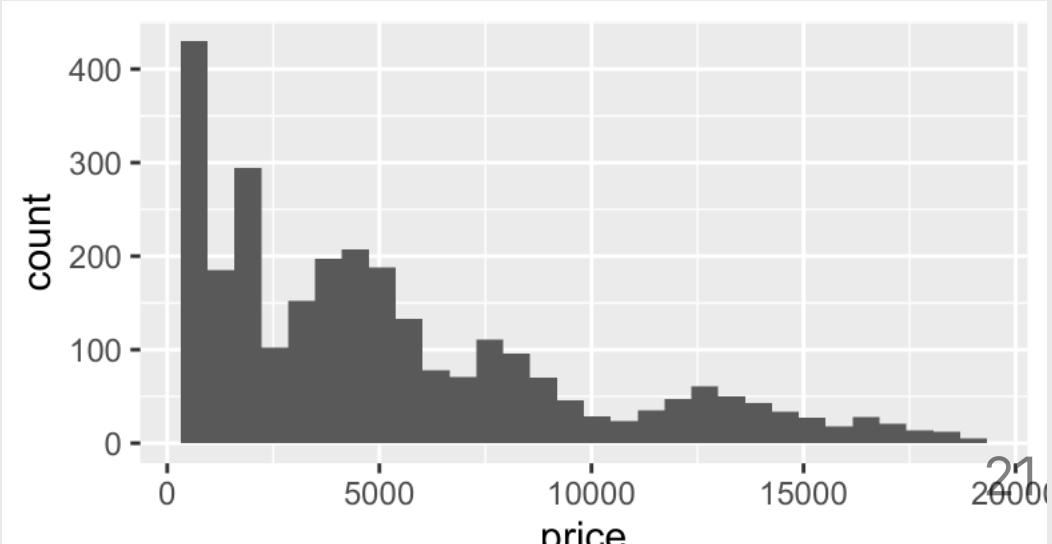
Combine with other functions

```
filtered_hist <- function(df, condition, var) {
  df %>%
    filter({{ condition }}) %>%
    ggplot() +
    geom_histogram((aes(x = {{ var }})))
}
```

```
filtered_hist(diamonds, color == "E", price)
```




```
filtered_hist(diamonds, color == "J", price)
```



Your turn

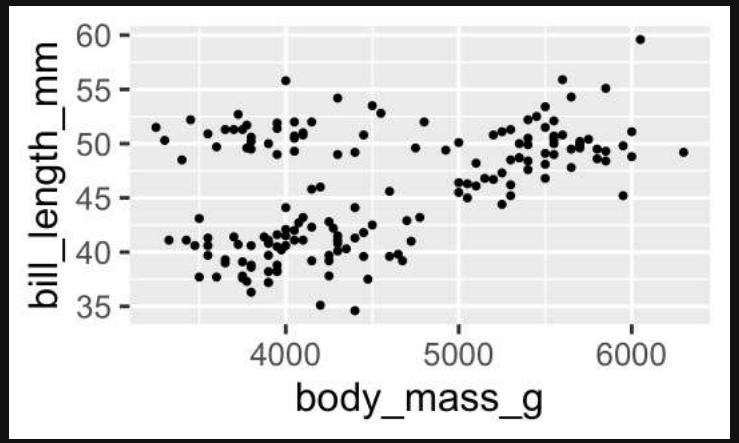
10:00

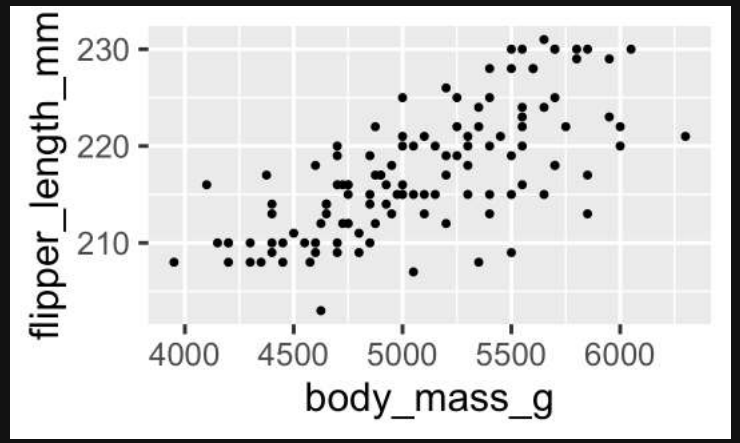
Write the function `filtered_scatter` which plots a scatterplot based on a condition, then use it for the two examples below.

```
filtered_scatter <- function(df, condition, x, y)
```

```
filtered_scatter(
  penguins, sex == "male",
  x = body_mass_g, y = bill_length_mm)
```

```
filtered_scatter(
  penguins, species == "Gentoo",
  x = body_mass_g, y = flipper_length_mm)
```



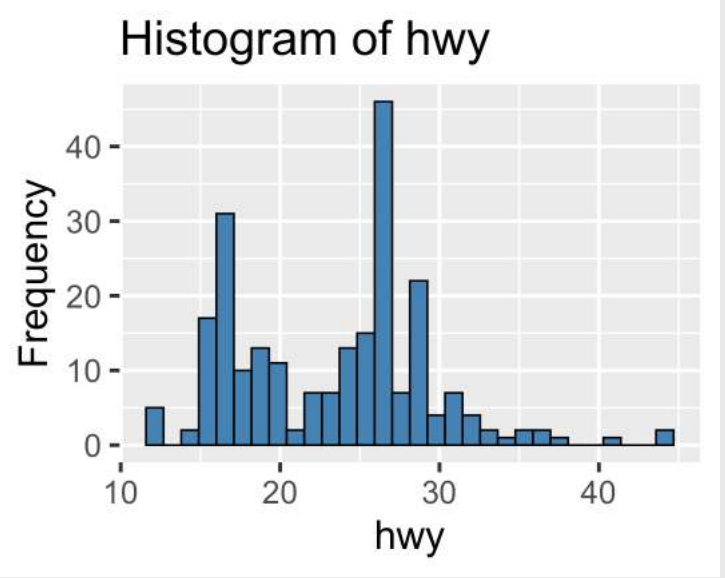


Can't use {{ var }} for plot labels

Solution:

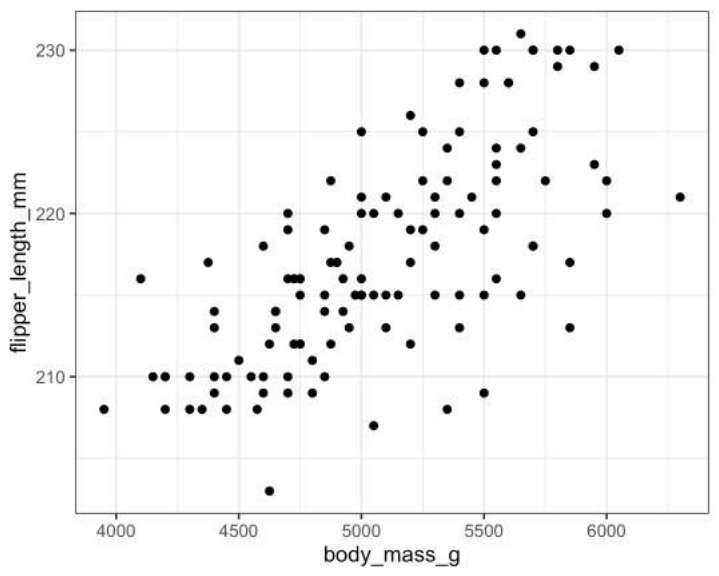
```
var_hist(mpg, hwy)
```

```r
var_hist <- function(df, var, bins = 30) {

  # Extract variable name as text
  var_name <- rlang::quo_text(enquo(var))

  histogram <- ggplot(df) +
    geom_histogram(
     aes(x = {{ var }}),
     bins = bins,
     fill = "steelblue", color = "black"
    ) +
    labs(
      title = paste("Histogram of", var_name),
      x = var_name,
      y = "Frequency"
    )

  return(histogram)
}
```



You can add layers to your custom plot functions

```
filtered_scatter(
  penguins, species == "Gentoo",
  x = body_mass_g, y = flipper_length_mm) +
  theme_bw()
```



Break

05:00

Week 11: *Programming with Data*

1. Writing functions for data frames

2. Writing custom plot functions

BREAK

3. Iteration with purrr

Much of this content is adapted from Shannon Pileggi's workshop at https://github.com/shannonpileggi/iterating-well-with-purrr

Iterating *without* purrr

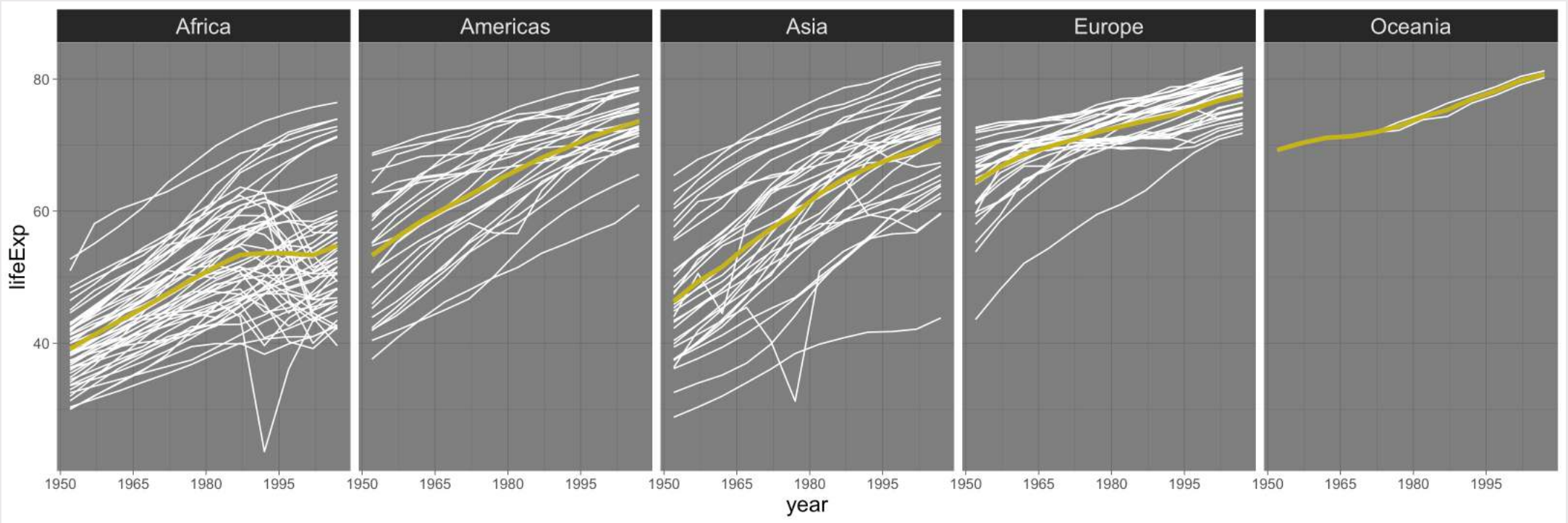
Gapminder example

```
library(gapminder)
library(tidyverse)

head(gapminder)
```

```
#> # A tibble: 6 × 6
#>   country     continent  year lifeExp      pop gdpPercap
#>   <fct>       <fct>     <int>   <dbl>    <int>     <dbl>
#> 1 Afghanistan Asia       1952    28.8  8425333      779.
#> 2 Afghanistan Asia       1957    30.3  9240934      821.
#> 3 Afghanistan Asia       1962    32.0 10267083      853.
#> 4 Afghanistan Asia       1967    34.0 11537966      836.
#> 5 Afghanistan Asia       1972    36.1 13079460      740.
#> 6 Afghanistan Asia       1977    38.4 14880372      786.
```

Hans Rosling discusses Gapminder data https://youtu.be/hVimVzgtD6w

Gapminder life expectancy



What am I doing here? Are there mistakes?

01:00

```
africa <- gapminder[gapminder$continent == "Africa", ]
africa_mm <- max(africa$lifeExp) - min(africa$lifeExp)

americas <- gapminder[gapminder$continent == "Americas", ]
americas_mm <- max(americas$lifeExp) - min(americas$lifeExp)

asia <- gapminder[gapminder$continent == "Asia", ]
asia_mm <- max(asia$lifeExp) - min(africa$lifeExp)

europe <- gapminder[gapminder$continent == "Europe", ]
europe_mm <- max(europe$lifeExp) - min(europe$lifeExp)

oceania <- gapminder[gapminder$continent == "Oceania", ]
oceania_mm <- max(europe$lifeExp) - min(oceania$lifeExp)

cbind(
  continent = c("Africa", "Asias", "Europe", "Oceania"),
  max_minus_min = c(africa_mm, americas_mm, asia_mm, europe_mm, oceania_mm)
)
```

1. What are the drawbacks of this code?

2. How would you do it instead?

```
africa <- gapminder[gapminder$continent == "Africa", ]
africa_mm <- max(africa$lifeExp) - min(africa$lifeExp)

americas <- gapminder[gapminder$continent == "Americas", ]
americas_mm <- max(americas$lifeExp) - min(americas$lifeExp)

asia <- gapminder[gapminder$continent == "Asia", ]
asia_mm <- max(asia$lifeExp) - min(africa$lifeExp)

europe <- gapminder[gapminder$continent == "Europe", ]
europe_mm <- max(europe$lifeExp) - min(europe$lifeExp)

oceania <- gapminder[gapminder$continent == "Oceania", ]
oceania_mm <- max(europe$lifeExp) - min(oceania$lifeExp)

cbind(
  continent = c("Africa", "Asias", "Europe", "Oceania"),
  max_minus_min = c(africa_mm, americas_mm, asia_mm, europe_mm, oceania_mm)
)
```

An alternative solution

```
gapminder %>%
 group_by(continent) %>%
 summarize(max_minus_min = max(lifeExp) - min(lifeExp))
```

`group_by` approach

```
#> # A tibble: 5 × 2
#>   continent max_minus_min
#>   <fct>              <dbl>
#> 1 Africa              52.8
#> 2 Americas            43.1
#> 3 Asia                53.8
#> 4 Europe              38.2
#> 5 Oceania             12.1
```

previous approach

```
#>      continent max_minus_min
#> [1,] "Africa"  "52.843"
#> [2,] "Asias"   "43.074"
#> [3,] "Europe"  "59.004"
#> [4,] "Oceania" "38.172"
#> [5,] "Africa"  "12.637"
```

More iteration

```
year <- 2017:2021
location <- c("Orlando", "San Diego", "Austin", "San Francisco", "remote")

conf <- rep("", length(year))
for (i in 1:length(conf)) {
 conf[i] <- paste0("The ", year[i], " RStudio Conference was in ", location[i], ".")
}
conf
```

```
#> [1] "The 2017 RStudio Conference was in Orlando."
#> [2] "The 2018 RStudio Conference was in San Diego."
#> [3] "The 2019 RStudio Conference was in Austin."
#> [4] "The 2020 RStudio Conference was in San Francisco."
#> [5] "The 2021 RStudio Conference was in remote."
```

Can you think of other ways to do this?

More iteration, cont.

```
year <- 2017:2021
location <- c("Orlando", "San Diego", "Austin", "San Francisco", "remote")
```

```
paste0("The ", year, " RStudio Conference was in ", location, ".")
```

```
#> [1] "The 2017 RStudio Conference was in Orlando."
#> [2] "The 2018 RStudio Conference was in San Diego."
#> [3] "The 2019 RStudio Conference was in Austin."
#> [4] "The 2020 RStudio Conference was in San Francisco."
#> [5] "The 2021 RStudio Conference was in remote."
```

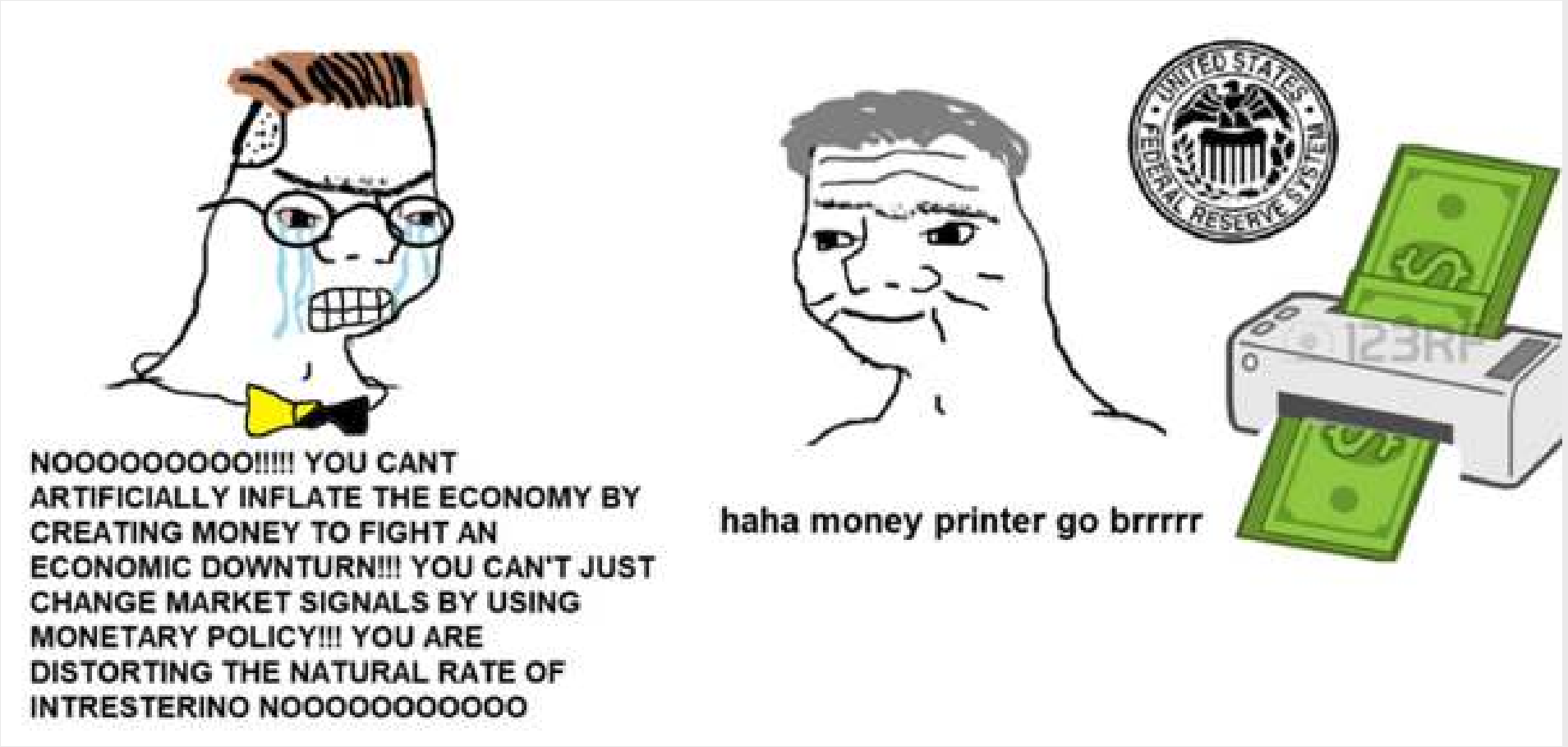
```
glue::glue("The {year} RStudio Conference was in {location}.")
```

```
#> The 2017 RStudio Conference was in Orlando.
#> The 2018 RStudio Conference was in San Diego.
#> The 2019 RStudio Conference was in Austin.
#> The 2020 RStudio Conference was in San Francisco.
#> The 2021 RStudio Conference was in remote.
```

Introducing `purrr`

Loaded automatically with `library(tidyverse)`

Why "purrr"?


NOOOOOOOOO!!!!! YOU CANT ARTIFICIALLY INFLATE THE ECONOMY BY CREATING MONEY TO FIGHT AN ECONOMIC DOWNTURN!!! YOU CAN'T JUST CHANGE MARKET SIGNALS BY USING MONETARY POLICY!!! YOU ARE DISTORTING THE NATURAL RATE OF INTRESTERINO NOOOOOOOOOOO
haha money printer go brrrrr
UNITED STATES
FEDERAL RESERVE SYSTEM

Why "`purrr`"?

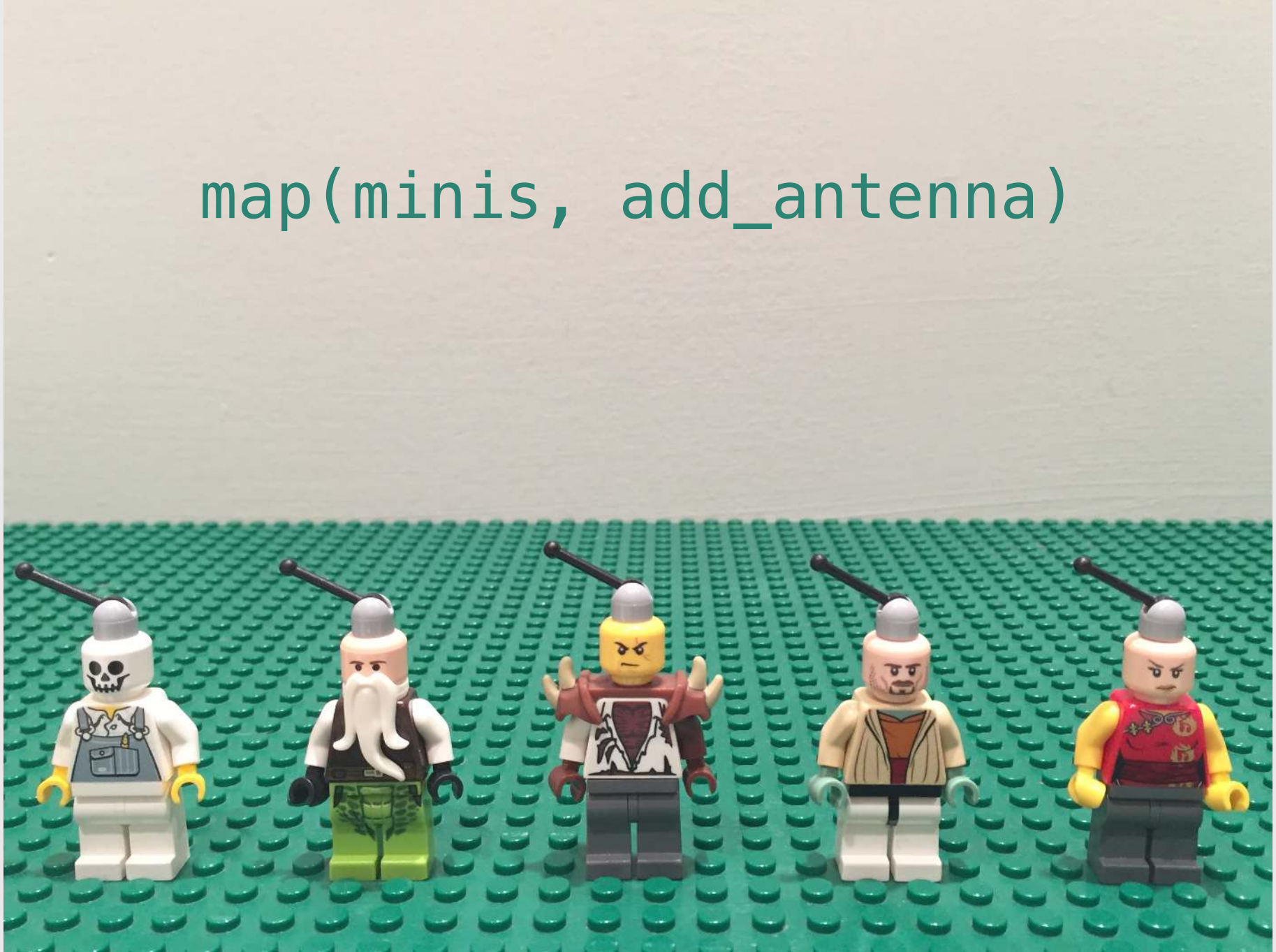
"Make your **pure** functions **purr** with **purrr**"
- Hadley Wickham

```
purrr::map(x, f, ...)
```

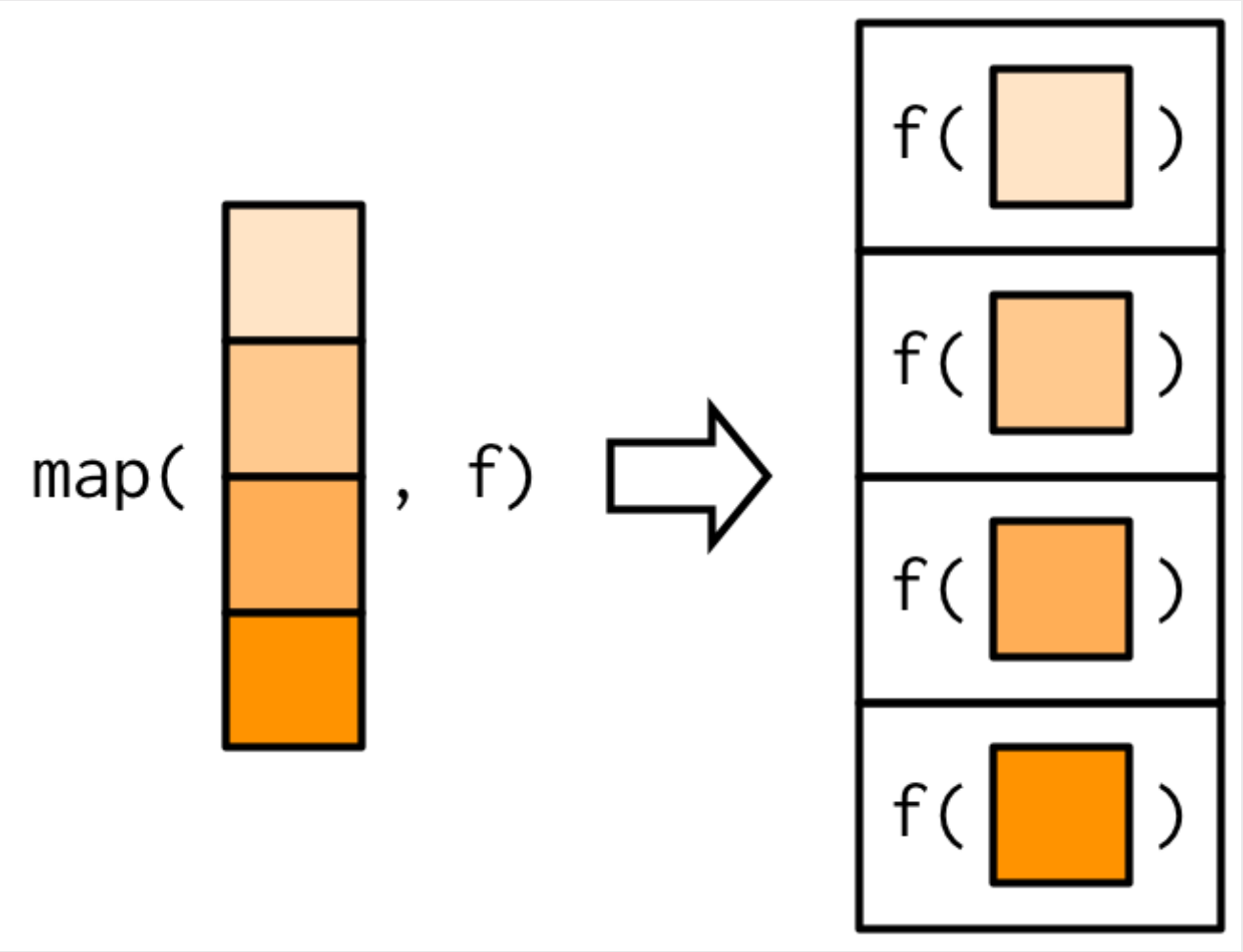
for every element of `x` do `f`

```
x = minis

f = add_antenna
```

```
map(minis, add_antenna)
```



for every element of x do f



`map()` returns a list

Vector example

```
addTen <- function(x) {
  return(x + 10)
}
```

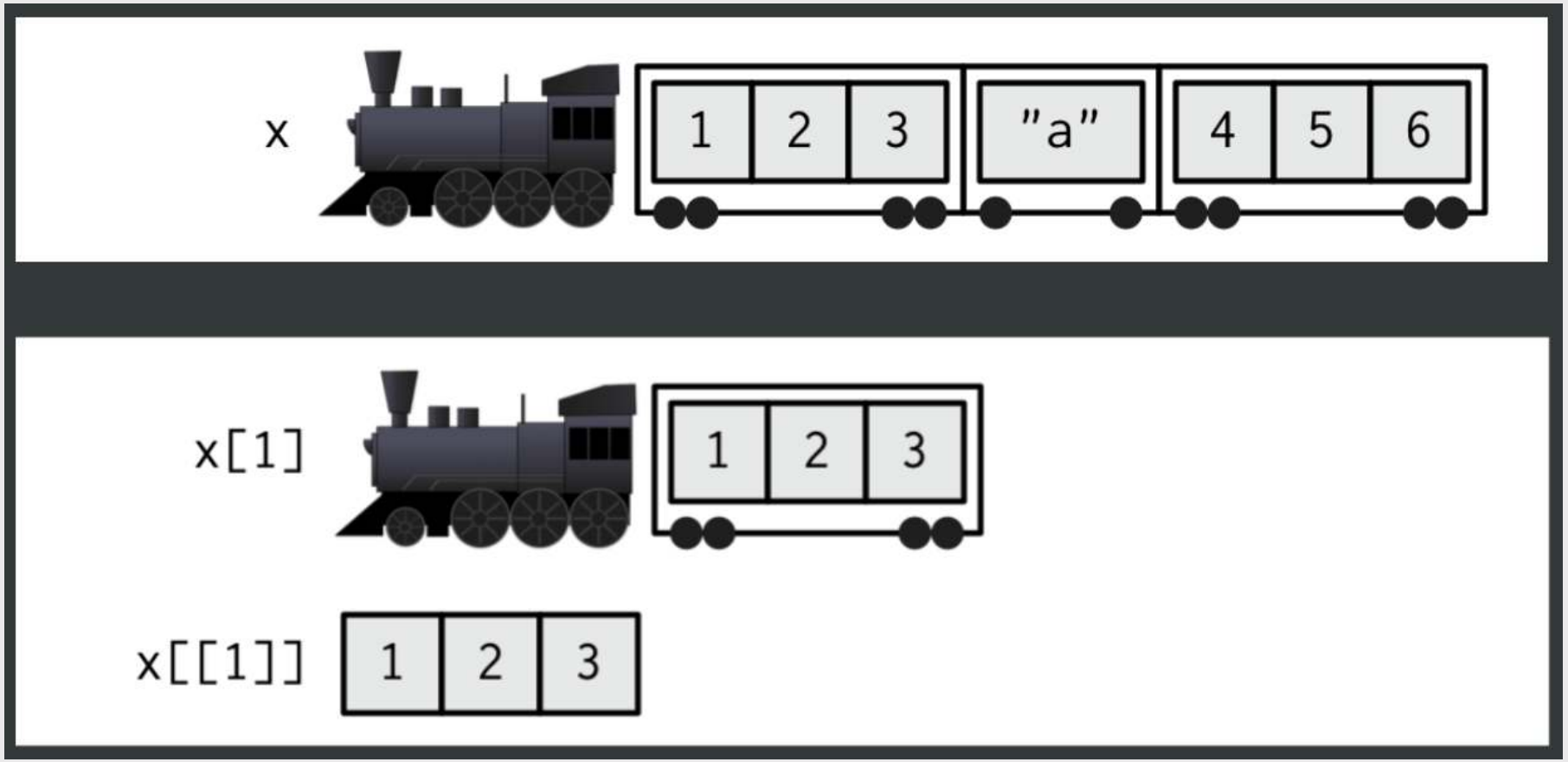
```
numbers <- c(1, 7, 13)
map(numbers, addTen)
```

```
#> [[1]]
#> [1] 11
#>
#> [[2]]
#> [1] 17
#>
#> [[3]]
#> [1] 23
```

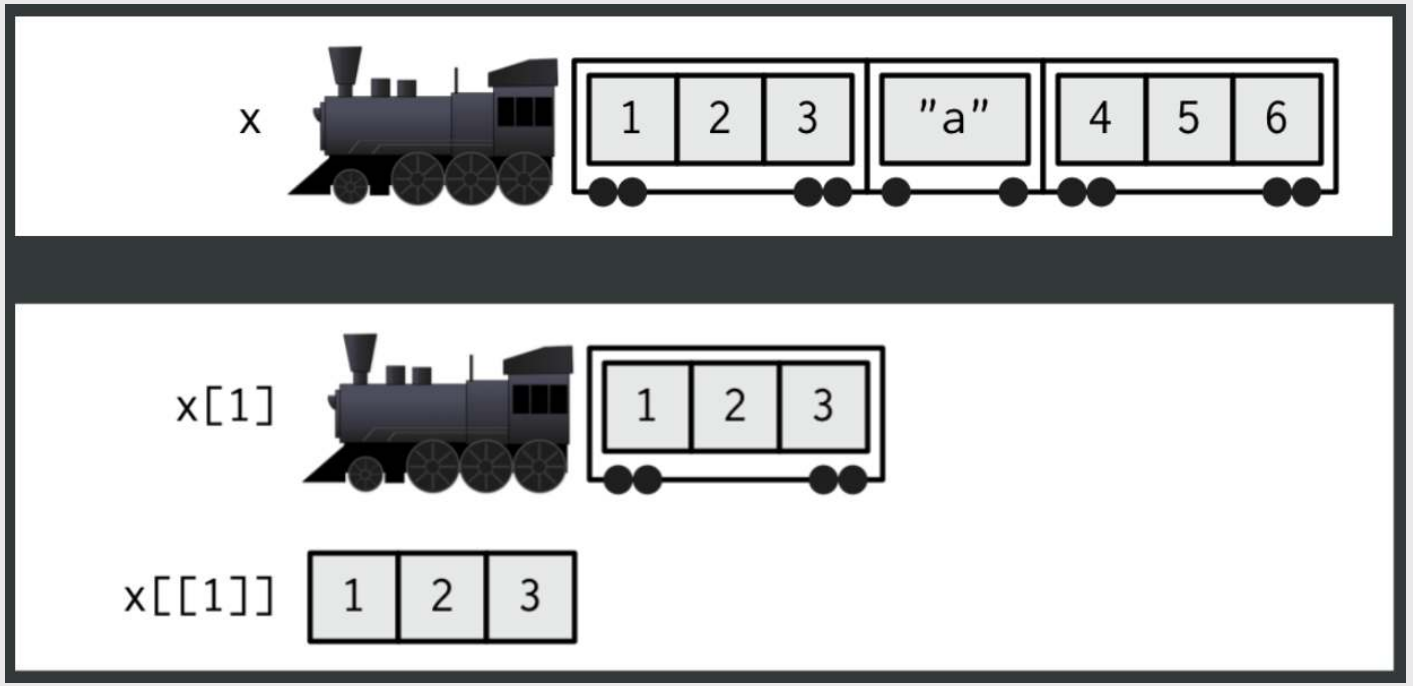
Working with lists feels like...

https://media.giphy.com/media/Bqn8Z7xdPCFy0/giphy.gif

Subsetting lists



source: https://shannonpileggi.github.io/iterating-well-with-purrr/#/subsetting-lists




```
x <- list(c(1, 2, 3), "a", c(4, 5, 6))
```

```
x[1]
```

```
#> [[1]]
#> [1] 1 2 3
```

```
x[[1]]
```

```
#> [1] 1 2 3
```

Example data: `sw_people`

```
library(repurrrsive)
```

```
sw_people
```

```
#> [[1]]
#> [[1]]$name
#> [1] "Luke Skywalker"
#>
#> [[1]]$height
#> [1] "172"
#>
#> [[1]]$mass
#> [1] "77"
#>
#> [[1]]$hair_color
#> [1] "blond"
#>
#> [[1]]$skin_color
#> [1] "fair"
#>
```

How many films was each Star Wars character in?

```
map(sw_people, f = 🤷)
```

Workflow:

1. Do it for one element.

2. Find the general recipe.

3. Drop into `map()` to do for all.

1. Do it for one element

```
x <- sw_people[[1]]
x
```

```
#> $name
#> [1] "Luke Skywalker"
#>
#> $height
#> [1] "172"
#>
#> $mass
#> [1] "77"
#>
#> $hair_color
#> [1] "blond"
#>
#> $skin_color
#> [1] "fair"
#>
#> $eye_color
#> [1] "blue"
#>
```

View the variables we have to work with:

```
names(x)
```

```
#>  [1] "name"       "height"     "mass"
#>  [6] "eye_color"  "birth_year" "gender"
#> [11] "species"    "vehicles"   "starships
#> [16] "url"
```

Extract the films

```
x$films
```

```
#> [1] "http://swapi.co/api/films/6/" "http:
#> [3] "http://swapi.co/api/films/2/" "http:
#> [5] "http://swapi.co/api/films/7/"
```

1. Do it for one element

How many films was each Star Wars character in?

Character 1:

```
x <- sw_people[[1]]
length(x$films)
```

```
#> [1] 5
```

Character 2:

```
x <- sw_people[[2]]
length(x$films)
```

```
#> [1] 6
```

2. Find the general recipe

How many films was each Star Wars character in?

```
x <- sw_people[[1]]
length(x$films)
```

```
#> [1] 5
```

Recipe:

```
x <- sw_people[[index]]

length(x$films)
```

3. Drop into `map()` to do for all items in list.

Recipe:

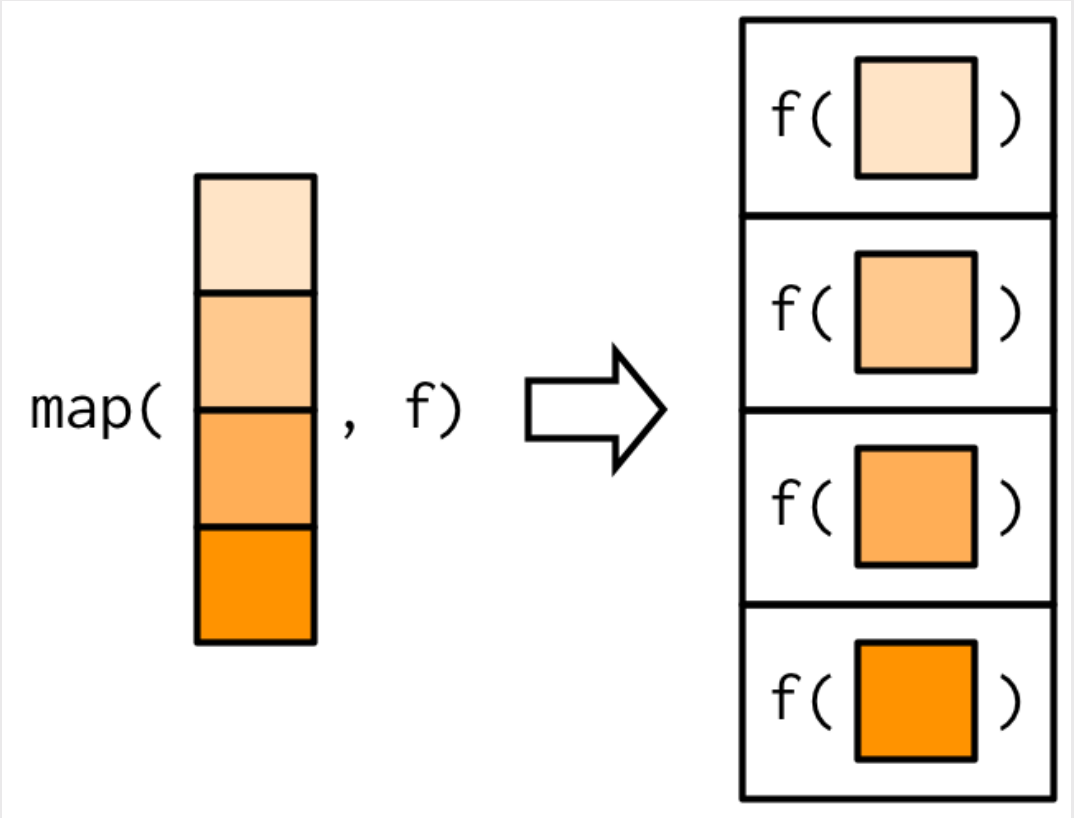
```
x <- sw_people[[index]]

length(x$films)
```

Do for all items in list:

```
get_film_length <- function(x) {
    return(length(x$films))
}

map(sw_people, get_film_length)
```

```
#> [[1]]
#> [1] 5
#>
#> [[2]]
#> [1] 6
#>
#> [[3]]
#> [1] 7
#>
#> [[4]]
```

for every element of x do f




```
get_film_length <- function(x) {
    return(length(x$films))
}

map(sw_people, get_film_length)
```

```
#> [[1]]
#> [1] 5
#>
#> [[2]]
#> [1] 6
#>
#> [[3]]
#> [1] 7
#>
#> [[4]]
#> [1] 4
#>
#> [[5]]
#> [1] 5
#>
```

Simplify it with "anonymous" functions

Version 1: **Custom function**

```
get_film_length <- function(x) {
    return(length(x$films))
}

map(sw_people, get_film_length)
```

```
#> [[1]]
#> [1] 5
#>
#> [[2]]
#> [1] 6
#>
#> [[3]]
#> [1] 7
#>
#> [[4]]
#> [1] 4
#>
```

Version 2: **Anonymous function**

```
map(sw_people, function(x) length(x$films))
```

```
#> [[1]]
#> [1] 5
#>
#> [[2]]
#> [1] 6
#>
#> [[3]]
#> [1] 7
#>
#> [[4]]
#> [1] 4
#>
#> [[5]]
#> [1] 5
#>
#> [[6]]
```

Anonymous functions

Three ways of specifying anonymous functions:

```
map(sw_people, function(x) length( x$films)) # supported in base R
map(sw_people,        \(x) length( x$films)) # supported R > 4.1.0
map(sw_people,           ~ length(.x$films)) # supported in purrr
```

Quick practice

03:00

- How many `vehicles` does each Star Wars character have?

(use the `sw_people` list)

- How many `titles` does each character in Game of Thrones have?

(use the `got_chars` list)

Type specific map variants

```
map_int(sw_people, \(x) length(x$films))
```

```
#>  [1] 5 6 7 4 5 3 3 1 1 6 3 2 5 4 1 3 3 1 5 5 3 1 1 2 1 2 1 1 1 1 1 3 1 2 1 1 1 2
#> [39] 1 1 2 1 1 3 1 1 1 3 3 3 2 2 2 1 3 2 1 1 1 2 2 1 1 2 2 1 1 1 1 1 1 1 2 1 1 2
#> [77] 1 1 2 2 1 1 1 1 1 1 3
```

`map_lgl()`: Returns a *logical* vector

`map_int()`: Returns a *integer* vector

`map_dbl()`: Returns a *double* vector

`map_chr()`: Returns a *character* vector

Quick practice

03:00

Replace `map()` with type-specific `map()`.

```
# What's each character's name?
map(got_chars, \(x) x$name)
map(sw_people, \(x) x$name)

# What color is each SW character's hair?
map(sw_people, \(x) x$hair_color)

# Is the GoT character alive?
map(got_chars, \(x) x$alive)

# Is the SW character female?
map(sw_people, \(x) x$gender == "female")

# How heavy is each SW character?
map(sw_people, \(x) x$mass)
```

How many films was each Star Wars character in?

```
map(sw_people, \(x) length(x$films))
```

```
#> [[1]]
#> [1] 5
#>
#> [[2]]
#> [1] 6
#>
#> [[3]]
#> [1] 7
#>
#> [[4]]
#> [1] 4
#>
#> [[5]]
#> [1] 5
#>
#> [[6]]
#> [1] 3
#>
#> [[7]]
```

Wait, which character?

Use a tibble to get the character name as well!

Returns a list of data frames:

```
map(sw_people, \(x) tibble(
    name = x$name,
    n_vehicles = length(x$films)
  )
)
```

```
#> [[1]]
#> # A tibble: 1 × 2
#>   name           n_vehicles
#>   <chr>               <int>
#> 1 Luke Skywalker          5
#>
#> [[2]]
#> # A tibble: 1 × 2
#>   name  n_vehicles
#>   <chr>      <int>
#> 1 C-3PO          6
#>
```

Use `map_df()` to merge the data frames

```
map_df(sw_people, \(x) tibble(
    name = x$name,
    n_vehicles = length(x$films)
  )
)
```

```
#> # A tibble: 87 × 2
#>    name               n_vehicles
#>    <chr>                   <int>
#>  1 Luke Skywalker              5
#>  2 C-3PO                       6
#>  3 R2-D2                       7
#>  4 Darth Vader                 4
#>  5 Leia Organa                 5
#>  6 Owen Lars                   3
#>  7 Beru Whitesun lars          3
#>  8 R5-D4                       1
#>  9 Biggs Darklighter           1
```

Your turn

15:00

Try to answer these questions:

1. Which SW film has the most characters? (use `sw_films`)
2. Which SW species has the highest average lifespan? (use `sw_species`)
3. Which GoT character(s) have been played by multiple actors? (use `got_chars`)

Sometimes you really need do something on each row

Use a `for` loop to iterate across each row in a data frame:

```
for (i in 1:nrow(df)) {
  row <- df[i,]
  # Do stuff with row
}
```

Example: tagging a new daily covid case record

```
covid_dc <- read_csv(here::here('data', 'us_covid.csv')) %>%
  filter(state == 'District of Columbia') %>%
  select(-state)

head(covid_dc)
```

```
#> # A tibble: 6 × 6
#>   date         day cases_daily deaths_daily cases_total deaths_total
#>   <date>     <dbl>       <dbl>        <dbl>       <dbl>        <dbl>
#> 1 2020-01-23     1           0            0           0            0
#> 2 2020-01-24     2           0            0           0            0
#> 3 2020-01-25     3           0            0           0            0
#> 4 2020-01-26     4           0            0           0            0
#> 5 2020-01-27     5           0            0           0            0
#> 6 2020-01-28     6           0            0           0            0
```

Example: tagging a new daily covid case record

Initialize new column

```
covid_dc$new_record <- FALSE

glimpse(covid_dc)
```

```
#> Rows: 403
#> Columns: 7
#> $ date         <date> 2020-01-23, 2020-01
#> $ day          <dbl> 1, 2, 3, 4, 5, 6, 7,
#> $ cases_daily  <dbl> 0, 0, 0, 0, 0, 0, 0,
#> $ deaths_daily <dbl> 0, 0, 0, 0, 0, 0, 0,
#> $ cases_total  <dbl> 0, 0, 0, 0, 0, 0, 0,
#> $ deaths_total <dbl> 0, 0, 0, 0, 0, 0, 0,
#> $ new_record   <lgl> FALSE, FALSE, FALSE,
```

Now loop through each row and check if a new record is met

```
record <- 0
for (i in 1:nrow(covid_dc)) {

  # Get the nubmer of cases on row i
  num_cases <- covid_dc[i,]$cases_daily

  # Check if new record is met
  if (num_cases > record) {

    # Update new record in covid_dc
    covid_dc[i, ]$new_record <- TRUE

    # Update new record
    record <- num_cases
  }
}
```

	date	day	state	cases_daily	deaths_daily	cases_total	deaths_total	new_record
58	2020-03-20	58	District of Columbia	31	1	71	1	TRUE
59	2020-03-21	59	District of Columbia	27	0	98	0	FALSE
60	2020-03-22	60	District of Columbia	4	2	102	2	FALSE
61	2020-03-23	61	District of Columbia	18	0	120	2	FALSE
62	2020-03-24	62	District of Columbia	21	0	141	2	FALSE
63	2020-03-25	63	District of Columbia	46	0	187	2	TRUE
64	2020-03-26	64	District of Columbia	44	1	231	3	FALSE
65	2020-03-27	65	District of Columbia	40	0	271	3	FALSE
66	2020-03-28	66	District of Columbia	33	1	304	4	FALSE
67	2020-03-29	67	District of Columbia	38	1	342	5	FALSE
68	2020-03-30	68	District of Columbia	59	4	401	9	TRUE
69	2020-03-31	69	District of Columbia	94	0	495	9	TRUE
70	2020-04-01	70	District of Columbia	91	0	586	9	FALSE
71	2020-04-02	71	District of Columbia	67	3	653	12	FALSE
72	2020-04-03	72	District of Columbia	104	3	757	15	TRUE
73	2020-04-04	73	District of Columbia	145	6	902	21	TRUE
74	2020-04-05	74	District of Columbia	100	1	1002	22	FALSE
75	2020-04-06	75	District of Columbia	95	2	1097	24	FALSE
76	2020-04-07	76	District of Columbia	114	0	1211	22	FALSE
77	2020-04-08	77	District of Columbia	229	5	1440	27	TRUE
78	2020-04-09	78	District of Columbia	83	5	1523	32	FALSE
79	2020-04-10	79	District of Columbia	137	6	1660	38	FALSE
80	2020-04-11	80	District of Columbia	118	9	1778	47	FALSE
81	2020-04-12	81	District of Columbia	97	3	1875	50	FALSE
82	2020-04-13	82	District of Columbia	80	2	1955	52	FALSE

Preview HW 11