R Ladies Amsterdam

Introduction to (Data Wrangling with) Tidyverse

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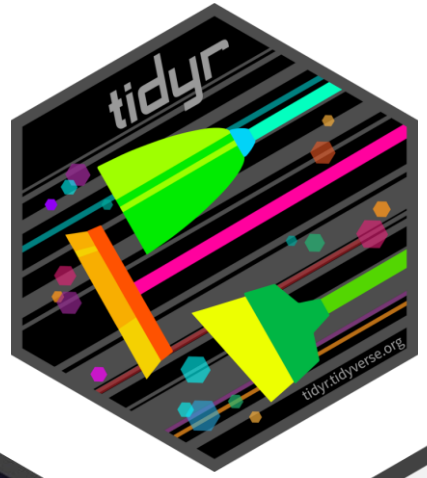
24-03-2021

Tidyverse

- **Ecosystem of packages**
- **Shared design philosophy and use intuition**
- **Creates seamless data analysis workflow**
- **Easily readable and reproducible code**

https://www.tidyverse.org/

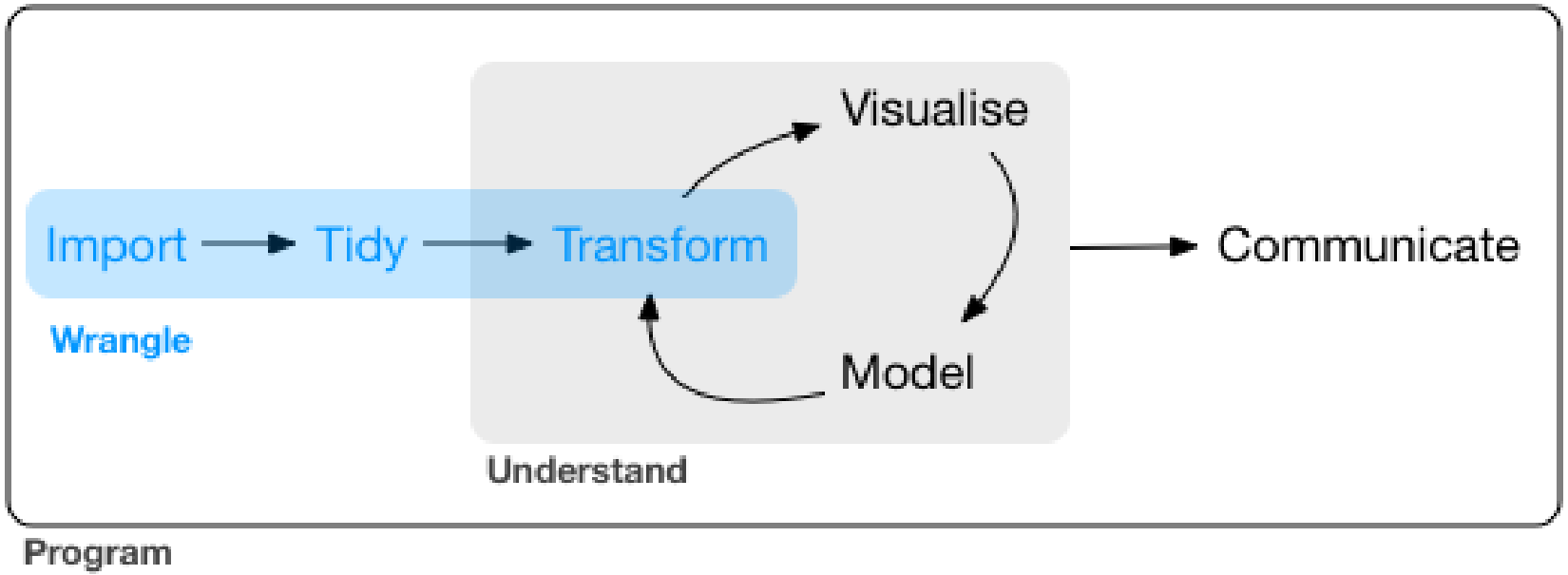
Tidyverse



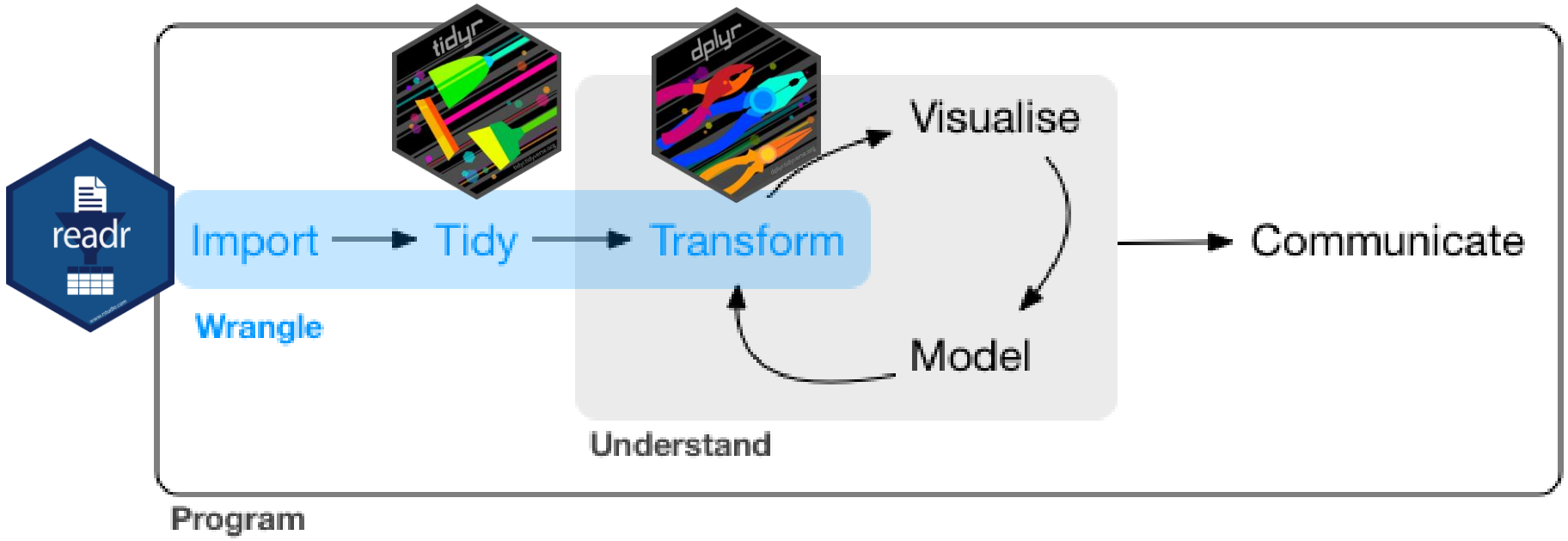
https://www.tidyverse.org/

@RLadiesAMS
#RLadies #rstats

Main Workflow

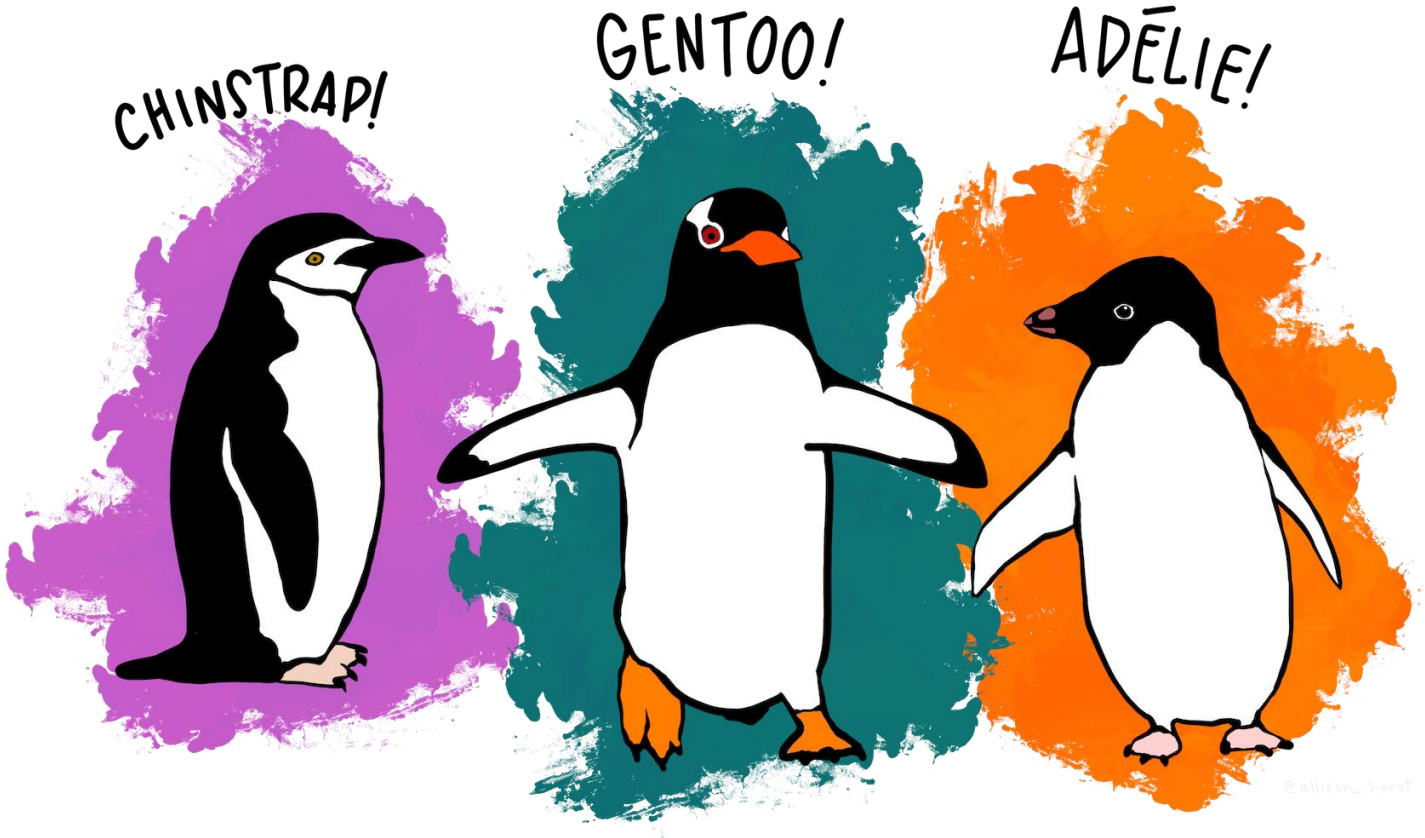


Packages we're going to use today



Introducing Data - Palmer Penguins

```
library(palmerpenguins)
```



The Palmer Archipelago penguins. Artwork by @allison_horst

Import Data

```
library(tidyverse) OR library(readr)
read_csv(file, col_names = TRUE, col_types = NULL,
          na = c("", "NA"))
```

```
penguin_data = read_csv("dataset/penguins_data.csv")
```

First Overview of the Data

```
glimpse(penguin_data)
```

```
## Rows: 1,376
## Columns: 8
## $ species      <chr> "Adelie", "Adelie", "Adelie", "Adelie", "Adelie", "Ade...
## $ island       <chr> "Torgersen", "Torgersen", "Torgersen", "Torgersen", "T...
## $ sex          <chr> "male", "male", "male", "male", "female", "female", "f...
## $ year         <dbl> 2007, 2007, 2007, 2007, 2007, 2007, 2007, 2007, 2007, ...
## $ date         <date> 2007-11-11, 2007-11-11, 2007-11-11, 2007-11-11, 2007-...
## $ id           <chr> "N1A1", "N1A1", "N1A1", "N1A1", "N1A2", "N1A2", "N1A2"...
## $ measurements <chr> "bill_length_mm", "bill_depth_mm", "flipper_length_mm"...
## $ values       <dbl> 39.1, 18.7, 181.0, 3750.0, 39.5, 17.4, 186.0, 3800.0, ...
```

First Overview of the Data

```
slice_head (penguin_data, n = 5)
```

```
## # A tibble: 5 x 8
##   species island    sex     year date       id    measurements      values
##   <chr>   <chr>     <chr>  <dbl> <date>     <chr> <chr>               <dbl>
## 1 Adelie  Torgersen male    2007 2007-11-11 N1A1  bill_length_mm       39.1
## 2 Adelie  Torgersen male    2007 2007-11-11 N1A1  bill_depth_mm        18.7
## 3 Adelie  Torgersen male    2007 2007-11-11 N1A1  flipper_length_mm   181
## 4 Adelie  Torgersen male    2007 2007-11-11 N1A1  body_mass_g        3750
## 5 Adelie  Torgersen female  2007 2007-11-11 N1A2  bill_length_mm       39.5
```

slice_tail and slice_sample

Exercises Part 1

Solutions Part 1

```
slice_tail(penguin_data, n = 3)
```

```
> slice_tail(penguin_data, n = 3)
# A tibble: 3 x 8
  species   island sex     year date       id     measurements      values
  <chr>     <chr>  <chr>  <dbl> <date>     <chr>  <chr>               <dbl>
1 Chinstrap Dream  female  2009 2009-11-21 N100A2 bill_depth_mm        18.7
2 Chinstrap Dream  female  2009 2009-11-21 N100A2 flipper_length_mm   198
3 Chinstrap Dream  female  2009 2009-11-21 N100A2 body_mass_g         3775
```

Solutions Part 1

```
slice_sample(penguin_data, n = 10)
```

```
> slice_sample(penguin_data, n = 10)
# A tibble: 10 x 8
   species   island    sex     year date       id    measurements      values
   <chr>     <chr>     <chr>  <dbl> <date>     <chr> <chr>              <dbl>
 1 Chinstrap Dream     male    2008 2008-11-24 N65A2 flipper_length_mm   203
 2 Chinstrap Dream     female  2007 2007-11-26 N69A1 body_mass_g        3700
 3 Adelie    Torgersen female  2007 2007-11-16 N10A1 body_mass_g        3325
 4 Adelie    Torgersen male    2008 2008-11-11 N32A2 body_mass_g        4450
 5 Gentoo    Biscoe    female  2008 2008-11-04 N14A1 bill_length_mm      45.1
 6 Adelie    Biscoe    female  2008 2008-11-15 N25A1 body_mass_g        2850
 7 Gentoo    Biscoe    female  2009 2009-11-18 N1A1  body_mass_g        4625
 8 Adelie    Torgersen male    2009 2009-11-17 N66A2 flipper_length_mm   198
 9 Gentoo    Biscoe    male    2009 2009-11-18 N21A2 flipper_length_mm   225
10 Adelie    Biscoe    male    2009 2009-11-09 N47A2 body_mass_g        4725
```

Converting Variable Types

`map()` from **`purrr`**

```
penguin_data[, c( "species", "island", "sex“ )] =

purrr::map( penguin_data[, c( "species", "island",

"sex“)], factor)
```

Converting Variable Types

```
# display data structure

str(penguin_data, give.attr = F)
```

```
## tibble [1,376 x 8] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
##  $ species     : Factor w/ 3 levels "Adelie","Chinstrap",..: 1 1 1 1 1 1 1 1 1 1 ...
##  $ island      : Factor w/ 3 levels "Biscoe","Dream",..: 3 3 3 3 3 3 3 3 3 3 ...
##  $ sex         : Factor w/ 2 levels "female","male": 2 2 2 2 1 1 1 1 1 1 ...
##  $ year        : num [1:1376] 2007 2007 2007 2007 2007 ...
##  $ date        : Date[1:1376], format: "2007-11-11" "2007-11-11" ...
##  $ id          : chr [1:1376] "N1A1" "N1A1" "N1A1" "N1A1" ...
##  $ measurements: chr [1:1376] "bill_length_mm" "bill_depth_mm" "flipper_length_mm" "body_mass_g" ...
##  $ values      : num [1:1376] 39.1 18.7 181 3750 39.5 17.4 186 3800 40.3 18 ...
```

Converting Variable Types

col_types

```
penguin_data02 = read_csv( "dataset/penguins_data.csv“,
         col_types = cols(species = col_factor( c ( "Adelie",
"Gentoo",  "Chinstrap“ )),
              #skip the date column while reading the file
              date =  col_skip()))
```

Converting Variable Types

`col_types`

```
## # A tibble: 1,376 x 7
##    species island    sex     year id    measurements      values
##    <fct>   <chr>     <chr>  <dbl> <chr> <chr>              <dbl>
##  1 Adelie  Torgersen male    2007 N1A1  bill_length_mm      39.1
##  2 Adelie  Torgersen male    2007 N1A1  bill_depth_mm       18.7
##  3 Adelie  Torgersen male    2007 N1A1  flipper_length_mm  181
##  4 Adelie  Torgersen male    2007 N1A1  body_mass_g        3750
##  5 Adelie  Torgersen female  2007 N1A2  bill_length_mm      39.5
##  6 Adelie  Torgersen female  2007 N1A2  bill_depth_mm       17.4
##  7 Adelie  Torgersen female  2007 N1A2  flipper_length_mm  186
##  8 Adelie  Torgersen female  2007 N1A2  body_mass_g        3800
##  9 Adelie  Torgersen female  2007 N2A1  bill_length_mm      40.3
## 10 Adelie  Torgersen female  2007 N2A1  bill_depth_mm       18
## # ... with 1,366 more rows
```

The functions for converting variables

```
col_double()
col_character()
col_date (format = "")
```

```
col_factor()
col_logical()
col_numeric()
```

Exercises Part 2

Solutions Part 2

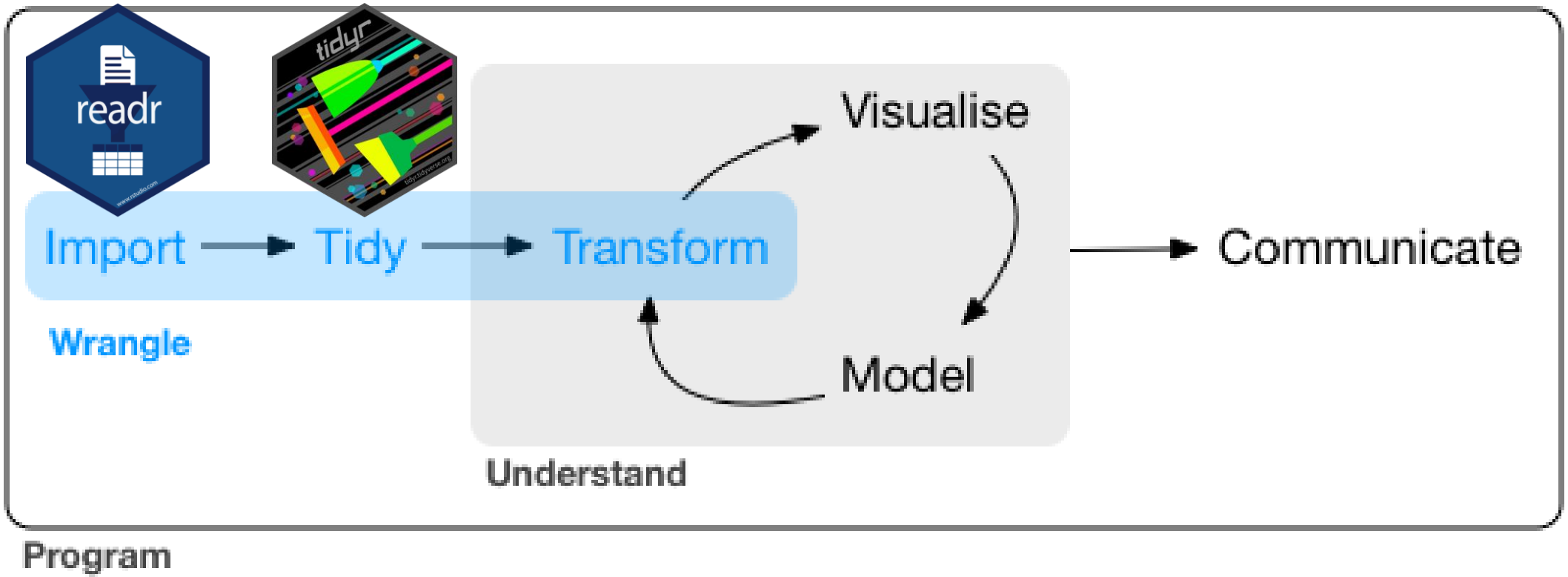
```
penguin_data02 = read_csv(str_c(file_path,"penguins_data.csv"),
                          col_types = cols(species =
col_factor(c("Adelie",  "Gentoo",  "Chinstrap")),
island = col_factor(c("Torgersen","Biscoe", "Dream")),
sex = col_factor(c( "female", "male" )),
# skip the date column while reading the file
date =  col_skip() ))
```

Solutions Part 2

```
str(penguin_data02, give.attr = FALSE)
```

```
> str(penguin_data02, give.attr = FALSE)
spec_tbl_df [1,376 x 7] (S3: spec_tbl_df/tbl_df/tbl/data.frame)
 $ species     : Factor w/ 3 levels "Adelie","Gentoo",..: 1 1 1 1 1 1 1 1 1 1 ...
 $ island      : Factor w/ 3 levels "Torgersen","Biscoe",..: 1 1 1 1 1 1 1 1 1 1 ...
 $ sex         : Factor w/ 2 levels "female","male": 2 2 2 2 1 1 1 1 1 1 ...
 $ year        : num [1:1376] 2007 2007 2007 2007 2007 ...
 $ id          : chr [1:1376] "N1A1" "N1A1" "N1A1" "N1A1" ...
 $ measurements: chr [1:1376] "bill_length_mm" "bill_depth_mm" "flipper_length_mm" "body_mass_g" ...
 $ values      : num [1:1376] 39.1 18.7 181 3750 39.5 17.4 186 3800 40.3 18 ...
```

Main Workflow



Pipe Operator


```
function(data, arguments)
```

Same as

```
data %>% function(arguments)
```

And

```
function_2( function_1 (A) )
```

Is equivalent of

```
A %>%
 function_1() %>%
 function_2()
```

Pipe Operator

Can be read as ***“then”***

```
pasta %>%
 boil_water() %>%
 put_pasta(type = “penne”) %>%
 add_souce (type = “marinara”)
```

Tidy Data

- **Each variable is a column**
- **Each observation is a raw**
- **Each cell contains only one value**

Tidy Data

Name	Spring	Winter	Summer
Ana	52kg	45kg	45.5kg
Mary	65kg	67kg	NA
Sandro	72kg	NA	74.5kg

Name	Season	Weight
Ana	Spring	52kg
Ana	Winter	45kg
Ana	Summer	45.5kg
Mary	Spring	65kg
Mary	Winter	67kg
Mary	Summer	NA
Sandro	Spring	72kg
Sandro	Winter	NA
Sandro	Summer	74.5kg

Tidy Data

```
#reshape into longer format
weight_df_long = weight_df %>% pivot_longer(cols = c( "Spring" ,
"Winter", "Summer" ),
                names_to = "Season",
                values_to = "Weight",
                values_drop_na = FALSE )
```

```
## # A tibble: 3 x 4
##   Name   Spring Winter Summer
##   <chr>  <chr>  <chr>  <chr>
## 1 Ana    52kg   45kg   45.5kg
## 2 Mary   65kg   67kg   NA
## 3 Sandro 72kg   NA     74.5kg
```

```
## # A tibble: 9 x 3
##   Name   Season Weight
##   <chr>  <chr>  <chr>
## 1 Ana    Spring 52kg
## 2 Ana    Winter 45kg
## 3 Ana    Summer 45.5kg
## 4 Mary   Spring 65kg
## 5 Mary   Winter 67kg
## 6 Mary   Summer NA
## 7 Sandro Spring 72kg
## 8 Sandro Winter NA
## 9 Sandro Summer 74.5kg
```

Tidy Data

```
pivot_wider (weight_df_long,
             names_from = Season,
             values_from = Weight)
```

```
## # A tibble: 3 x 4
##   Name   Spring Winter Summer
##   <chr>  <chr>  <chr>  <chr>
## 1 Ana    52kg   45kg   45.5kg
## 2 Mary   65kg   67kg   NA
## 3 Sandro 72kg   NA     74.5kg
```

```
## # A tibble: 9 x 3
##   Name   Season Weight
##   <chr>  <chr>  <chr>
## 1 Ana    Spring 52kg
## 2 Ana    Winter 45kg
## 3 Ana    Summer 45.5kg
## 4 Mary   Spring 65kg
## 5 Mary   Winter 67kg
## 6 Mary   Summer NA
## 7 Sandro Spring 72kg
## 8 Sandro Winter NA
## 9 Sandro Summer 74.5kg
```

Exercises Part 3

Solutions Part 3

```
penguin_data02 %>% summary()
```

```
> penguin_data02 %>% summary()
      species          island       sex            year          id                measurements       values
 Adelie   :608   Torgersen:208   female:660   Min.   :2007   Length:1376        Length:1376        Min.   :  13.10
 Gentoo   :496   Biscoe   :672   male  :672   1st Qu.:2007   Class :character   Class :character   1st Qu.:  29.45
 Chinstrap:272   Dream    :496   NA's  : 44   Median :2008   Mode  :character   Mode  :character   Median : 115.80
                                             Mean   :2008                                         Mean   :1115.94
                                             3rd Qu.:2009                                         3rd Qu.: 848.25
                                             Max.   :2009                                         Max.   :6300.00
                                                                                                  NA's   :8
```

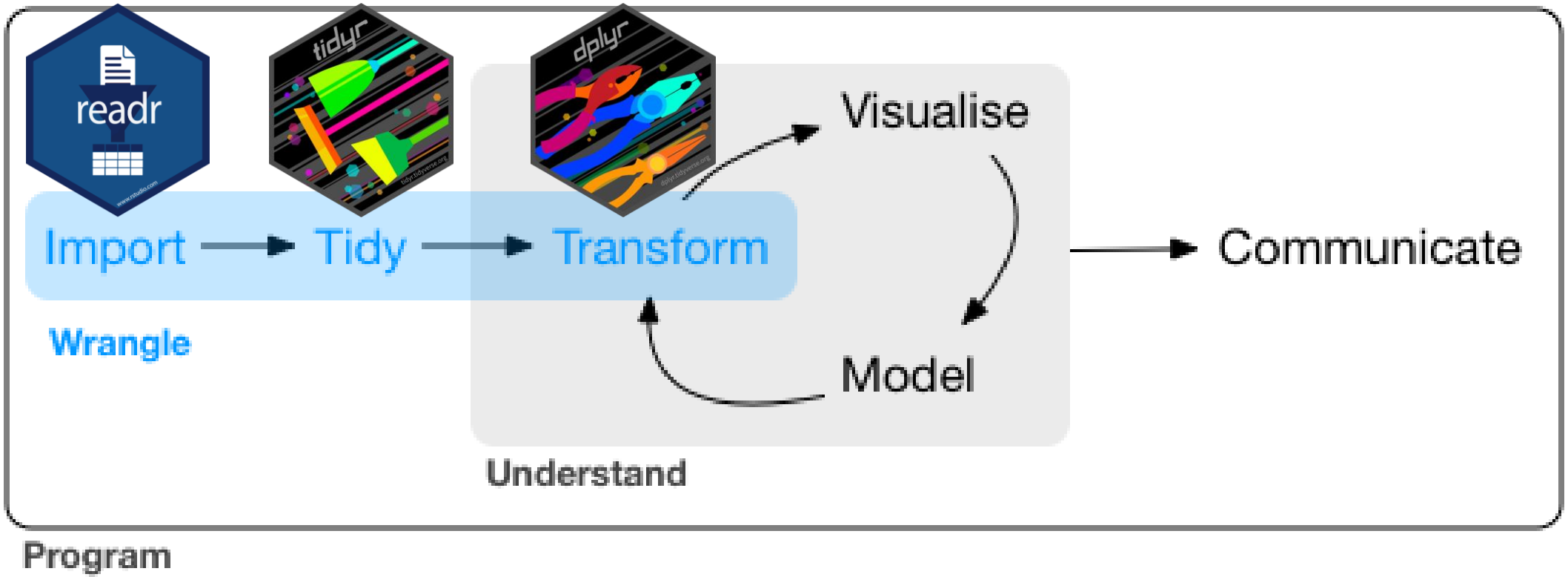
```
penguin_df_wide = penguin_data02 %>%
  pivot_wider(names_from = measurements,
              values_from = values)
```

Solutions Part 3

```
slice_head(penguin_df_wide, n = 8)
```

```
> slice_head(penguin_df_wide, n = 8)
# A tibble: 8 x 9
  species island    sex     year id    bill_length_mm bill_depth_mm flipper_length_mm body_mass_g
  <fct>   <fct>     <fct>  <dbl> <chr>          <dbl>         <dbl>             <dbl>       <dbl>
1 Adelie  Torgersen male    2007 N1A1            39.1          18.7               181        3750
2 Adelie  Torgersen female  2007 N1A2            39.5          17.4               186        3800
3 Adelie  Torgersen female  2007 N2A1            40.3          18                 195        3250
4 Adelie  Torgersen NA      2007 N2A2            NA            NA                  NA          NA
5 Adelie  Torgersen female  2007 N3A1            36.7          19.3               193        3450
6 Adelie  Torgersen male    2007 N3A2            39.3          20.6               190        3650
7 Adelie  Torgersen female  2007 N4A1            38.9          17.8               181        3625
8 Adelie  Torgersen male    2007 N4A2            39.2          19.6               195        4675
```

Main Workflow



Data Transformation

`Select ()`

Selects columns by their name and returns a tibble

```
penguin_df_wide %>%
  select(id,
         species:year) %>%
  slice_sample(n = 5)
```

```
## # A tibble: 5 x 5
##   id    species   island    sex     year
##   <chr> <fct>     <fct>     <fct>  <dbl>
## 1 N63A2 Chinstrap Dream     male    2008
## 2 N62A2 Chinstrap Dream     female  2007
## 3 N84A2 Adelie    Dream     male    2009
## 4 N67A1 Adelie    Torgersen female  2009
## 5 N66A2 Chinstrap Dream     male    2007
```

Deleting columns using `select`

```
penguin_df_wide %>%
      select( -(year:id) ) %>%
      slice_sample(n = 5)
```

```
## # A tibble: 5 x 7
##   species island sex   bill_length_mm bill_depth_mm flipper_length_~ body_mass_g
##   <fct>   <fct>  <fct>          <dbl>         <dbl>             <dbl>       <dbl>
## 1 Chinst~ Dream  fema~           40.9          16.6               187        3200
## 2 Adelie  Dream  fema~           36.6          18.4               184        3475
## 3 Adelie  Torge~ fema~           40.2          17                 176        3450
## 4 Gentoo  Biscoe fema~           46.2          14.5               209        4800
## 5 Chinst~ Dream  male            51.3          19.2               193        3650
```

"Helper" verbs for `select`

- `starts_with()`
- `ends_with()`

- `contains()`
- `everything()`
- `where()`

"Helper" verbs

```
penguin_df_wide %>%
  select( starts_with ("bill") ) %>%
  slice_sample(n = 3)
```

bill_length_mm <dbl>	bill_depth_mm <dbl>
48.2	15.6
39.6	18.8
39.6	17.2

Renaming

```
penguin_df_wide %>%
  select(individual_id = id,
         date = year,
         location = island ) %>%
  slice_sample (n = 5)
```

```
## # A tibble: 5 x 3
##   individual_id  date location
##   <chr>         <dbl> <fct>
## 1 N28A1          2009 Biscoe
## 2 N11A1          2007 Biscoe
## 3 N76A2          2009 Dream
## 4 N55A2          2008 Biscoe
## 5 N63A1          2009 Torgersen
```

Rearranging columns

```
penguin_df_wide %>%
   select(id, sex,
          everything()) %>%
# drop the missing values from every row
  drop_na()
```

Rearranging columns

id <chr>	sex <fctr>	species <fctr>	island <fctr>	year <dbl>	bill_length_mm <dbl>	bill_depth_mm <dbl>	flipper_length_mm <dbl>	body_mass_g <dbl>
N1A1	male	Adelie	Torgersen	2007	39.1	18.7	181	3750
N1A2	female	Adelie	Torgersen	2007	39.5	17.4	186	3800
N2A1	female	Adelie	Torgersen	2007	40.3	18.0	195	3250
N3A1	female	Adelie	Torgersen	2007	36.7	19.3	193	3450
N3A2	male	Adelie	Torgersen	2007	39.3	20.6	190	3650
N4A1	female	Adelie	Torgersen	2007	38.9	17.8	181	3625

Relocate

```
relocate(.data, ..., .before = NULL, .after = NULL)
```

```
penguin_df_wide %>%

  relocate( year:id, .after = last_col()) %>%

  slice_sample(n = 5)
```

Relocate

```
relocate(.data, ..., .before = NULL, .after = NULL)
```

species <fctr>	island <fctr>	sex <fctr>	bill_length_mm <dbl>	bill_depth_mm <dbl>	flipper_length_mm <dbl>	body_mass_g <dbl>	year <dbl>	id <chr>
Chinstrap	Dream	female	46.5	17.9	192	3500	2007	N61A1
Chinstrap	Dream	male	52.7	19.8	197	3725	2007	N64A1
Gentoo	Biscoe	male	45.0	15.4	220	5050	2008	N15A2
Chinstrap	Dream	male	50.5	19.6	201	4050	2007	N70A2
Gentoo	Biscoe	female	47.7	15.0	216	4750	2008	N54A1

Select based on a condition

`where()` selects a column *where* the condition is **`TRUE`**

```
## # A tibble: 5 x 5
##    year bill_length_mm bill_depth_mm flipper_length_mm body_mass_g
##   <dbl>          <dbl>         <dbl>             <dbl>       <dbl>
## 1  2008           45.8          18.9               197        4150
## 2  2009           40.2          20.1               200        3975
## 3  2008           41.8          19.4               198        4450
## 4  2007           50            19.5               196        3900
## 5  2007           46.6          17.8               193        3800
```

Exercises Part 4

Solutions Part 4

```
df1 = penguin_df_wide %>%
select(species:year)


df2 = df1 %>% select(- year)
```

```
penguin_df_wide %>%
  select(individual_id = id,
         date = year,
         location = island )
```

```
penguin_df_wide %>%
  rename(individual_id = id,
         date = year,
         location = island )
```

Solutions Part 4

```
penguin_df_wide %>%
  rename(individual_id = id,
         date = year,
         location = island )
```

	species	location	sex	date	individual_id	bill_length_mm	bill_depth_mm	flipper_length_mm	body_mass_g
	<fct>	<fct>	<fct>	<dbl>	<chr>	<dbl>	<dbl>	<dbl>	<dbl>
1	Adelie	Torgersen	male	2007	N1A1	39.1	18.7	181	3750
2	Adelie	Torgersen	female	2007	N1A2	39.5	17.4	186	3800
3	Adelie	Torgersen	female	2007	N2A1	40.3	18	195	3250
4	Adelie	Torgersen	NA	2007	N2A2	NA	NA	NA	NA
5	Adelie	Torgersen	female	2007	N3A1	36.7	19.3	193	3450
6	Adelie	Torgersen	male	2007	N3A2	39.3	20.6	190	3650
7	Adelie	Torgersen	female	2007	N4A1	38.9	17.8	181	3625
8	Adelie	Torgersen	male	2007	N4A2	39.2	19.6	195	4675
9	Adelie	Torgersen	NA	2007	N5A1	34.1	18.1	193	3475
10	Adelie	Torgersen	NA	2007	N5A2	42	20.2	190	4250

... with 334 more rows

Solutions Part 4 (Bonus)

```
#5. Select only the columns that end with "g" and contain word "length"
penguin_df_wide %>% select( contains ( "length" ),
                            ends_with( "g" ) )
```

```
# A tibble: 344 x 3
   bill_length_mm flipper_length_mm body_mass_g
            <dbl>              <dbl>       <dbl>
 1           39.1                181        3750
 2           39.5                186        3800
 3           40.3                195        3250
 4             NA                 NA          NA
 5           36.7                193        3450
 6           39.3                190        3650
 7           38.9                181        3625
 8           39.2                195        4675
 9           34.1                193        3475
10           42                  190        4250
# ... with 334 more rows
```

Solutions Part 4 (Bonus)

```
penguin_df_wide %>%
rename(individual_id = id,
         date = year,
         location = island ) %>%
  # Rearrange columns
select(individual_id, sex,
         everything()) %>%
  # drop missing values
  drop_na() %>%
  # print the summary of the resulted data set
  summary()
```

Solutions Part 4 (Bonus)

```
#7. Relocate id to be the first column
penguin_df_wide %>%
  relocate(id, .before = species) %>%
  # print random 5 rows
  slice_sample(n = 5)


#8. select only the categorical columns
penguin_df_wide %>%
  select(where (is.factor)) %>%
  # print random 5 rows
  slice_sample(n = 5)
```

Forming new columns with `mutate`

```
penguin_df_wide %>%
   select(contains("mm")) %>%
   mutate(bill_length_cm = bill_length_mm / 10,
          bill_depth_cm =  bill_length_mm / 10,
          flipper_length_cm = flipper_length_mm / 10)
```

Forming new columns with `mutate`

```
## # A tibble: 344 x 6
##    bill_length_mm bill_depth_mm flipper_length_~ bill_length_cm bill_depth_cm
##             <dbl>         <dbl>            <dbl>          <dbl>         <dbl>
##  1           39.1          18.7              181           3.91          3.91
##  2           39.5          17.4              186           3.95          3.95
##  3           40.3          18                195           4.03          4.03
##  4           NA            NA                 NA          NA            NA
##  5           36.7          19.3              193           3.67          3.67
##  6           39.3          20.6              190           3.93          3.93
```

across

Takes 2 arguments - columns to transform & a function to apply

```
penguin_df_wide %>%
  # select every column that contains "mm"in name
  select(contains("mm")) %>%
  # remove missing values
  drop_na() %>%
  # divide every column by 10
  mutate(across (everything(), ~.x / 10 ) )
```

across

Takes 2 arguments - columns to transform & a function to apply

```
## # A tibble: 342 x 3
##    bill_length_mm bill_depth_mm flipper_length_mm
##             <dbl>         <dbl>             <dbl>
##  1           3.91          1.87              18.1
##  2           3.95          1.74              18.6
##  3           4.03          1.8               19.5
##  4           3.67          1.93              19.3
##  5           3.93          2.06              19
##  6           3.89          1.78              18.1
```

if_else(condition, true, false)

Let's divide penguins into small and large

```
# calculate median body mass of all penguins
median_mass = median(penguin_df_wide$body_mass_g, na.rm = T)


penguin_df_wide %>%
  select(sex, body_mass_g) %>%
#create a new column to categorize penguins based on their mass
  mutate(size = if_else(body_mass_g  >= median_mass,
"large_penguin", "small_penguin"))
```

```
if_else(condition, true, false)
```

```
##     sex    body_mass_g size
##     <fct>        <dbl> <chr>
##  1 male           3725 small_penguin
##  2 male           3950 small_penguin
##  3 female         3950 small_penguin
##  4 female         3700 small_penguin
##  5 female         3525 small_penguin
##  6 female         4500 large_penguin
```

Exercises Part 5

Solutions Part 5

```
#1. Use mutate() and calculate the bill depth to length ratio
penguin_df_wide %>%
  mutate (bill_depth_length_ratio =  bill_depth_mm /
bill_length_mm )


#2. Now write the same code using transmute()
# Look at the difference
penguin_df_wide %>%
  transmute (bill_depth_length_ratio =  bill_depth_mm /
bill_length_mm )
```

Solutions Part 5 (Bonus)

```
#3.
penguin_df_wide %>%
  # select every column that contains "mm" in name
  select(contains("mm")) %>%
  # remove missing values
  drop_na() %>%
  # round every value in these columns
  mutate(across (everything(),
                 round ))
```

Solutions Part 5 (Bonus)

```
#4.
median_flipper_length = median(penguin_df_wide$flipper_length_mm,
na.rm = T)
penguin_df_wide %>%
  #remove missing values
  drop_na() %>%
  #create a new column to categorize penguins based on their mass
  mutate(length = if_else(flipper_length_mm  >= median_flipper_length,
"long_flipper", "short_flipper")) %>%
  slice_sample(n = 10)
```

Solutions Part 5 (Bonus)

```
# A tibble: 10 x 10
   species   island sex     year id    bill_length_mm bill_depth_mm flipper_length_mm body_mass_g length
   <fct>     <fct>  <fct>  <dbl> <chr>           <dbl>         <dbl>             <dbl>       <dbl> <chr>
 1 Gentoo    Biscoe male    2007 N40A2            48.7          15.1               222        5350 long_flipper
 2 Chinstrap Dream  female  2007 N73A1            42.4          17.3               181        3600 short_flipper
 3 Adelie    Biscoe male    2007 N18A2            40.5          18.9               180        3950 short_flipper
 4 Adelie    Biscoe male    2008 N29A2            41.6          18                 192        3950 short_flipper
 5 Gentoo    Biscoe male    2009 N1A2             52.5          15.6               221        5450 long_flipper
 6 Gentoo    Biscoe female  2009 N15A1            47.5          15                 218        4950 long_flipper
 7 Adelie    Dream  female  2007 N21A1            39.5          16.7               178        3250 short_flipper
 8 Adelie    Biscoe female  2008 N23A1            34.5          18.1               187        2900 short_flipper
 9 Chinstrap Dream  female  2009 N87A1            50.1          17.9               190        3400 short_flipper
10 Adelie    Biscoe male    2007 N12A2            38.2          18.1               185        3950 short_flipper
```

Filtering and changing the row order

```
# choose only the rows corresponding to year 2007
penguin_df_wide %>%
  filter(year == '2007' )%>%
# sort bill depth in descending order
  arrange (desc(bill_depth_mm))
```

Filtering and changing the row order

```
## # A tibble: 110 x 9
##    species   island    sex    year id    bill_length_mm bill_depth_mm
##    <fct>     <fct>     <fct> <dbl> <chr>           <dbl>         <dbl>
##  1 Adelie    Torgersen male   2007 N10A2            46            21.5
##  2 Adelie    Torgersen male   2007 N7A2             38.6          21.2
##  3 Adelie    Dream     male   2007 N30A2            42.3          21.2
##  4 Adelie    Torgersen male   2007 N8A1             34.6          21.1
##  5 Adelie    Dream     male   2007 N23A2            39.2          21.1
##  6 Adelie    Torgersen male   2007 N9A2             42.5          20.7
##  7 Adelie    Torgersen male   2007 N3A2             39.3          20.6
##  8 Chinstrap Dream     male   2007 N68A2            51.7          20.3
##  9 Adelie    Torgersen <NA>   2007 N5A2             42            20.2
## 10 Adelie    Dream     male   2007 N24A1            38.8          20
## # ... with 100 more rows, and 2 more variables: flipper_length_mm <dbl>,
## #   body_mass_g <dbl>
```

Filtering

```
# minimum body mass (kg) of female penguins from the Dream
# island in 2007
penguin_df_wide %>%
  filter(island == 'Dream', sex == 'female') %>%
  # calculate body mass in kg
  transmute(body_mass_kg = body_mass_g / 1000) %>%
  slice_min(body_mass_kg)
```

```
## # A tibble: 1 x 1
##   body_mass_kg
##          <dbl>
## 1          2.7
```

Group and Summarize Data

```
penguin_df_wide %>%
    # group for females and males
  group_by(sex) %>%
  # summarize number of penguins and average mass for each
group
summarise (total_number = n(),
           average_mass = mean(body_mass_g, na.rm = T))
```

Group and Summarize Data

```
## # A tibble: 2 x 3
##   sex    total_number average_mass
##   <fct>          <int>        <dbl>
## 1 female           165        3862.
## 2 male             168        4546.
```

Exercises Part 6

Solutions Part 6

```
#1. penguin_df_wide %>%
  filter(year == 2009,
         sex == "female") %>%

arrange(desc(flipper_length_mm))
```

```
#2.
penguin_df_wide %>%
  filter( island == "Biscoe", sex ==
"male“ ) %>%
mutate(body_mass_kg = body_mass_g /
1000) %>%
slice_max(body_mass_kg)
```

The rest of tidyverse

Visualization

Working on stings

Manipulating dates

Model

Newer, better data.frame

All about factors

Advanced programming

@RLadiesAMS
#RLadies #rstats

The rest of tidyverse

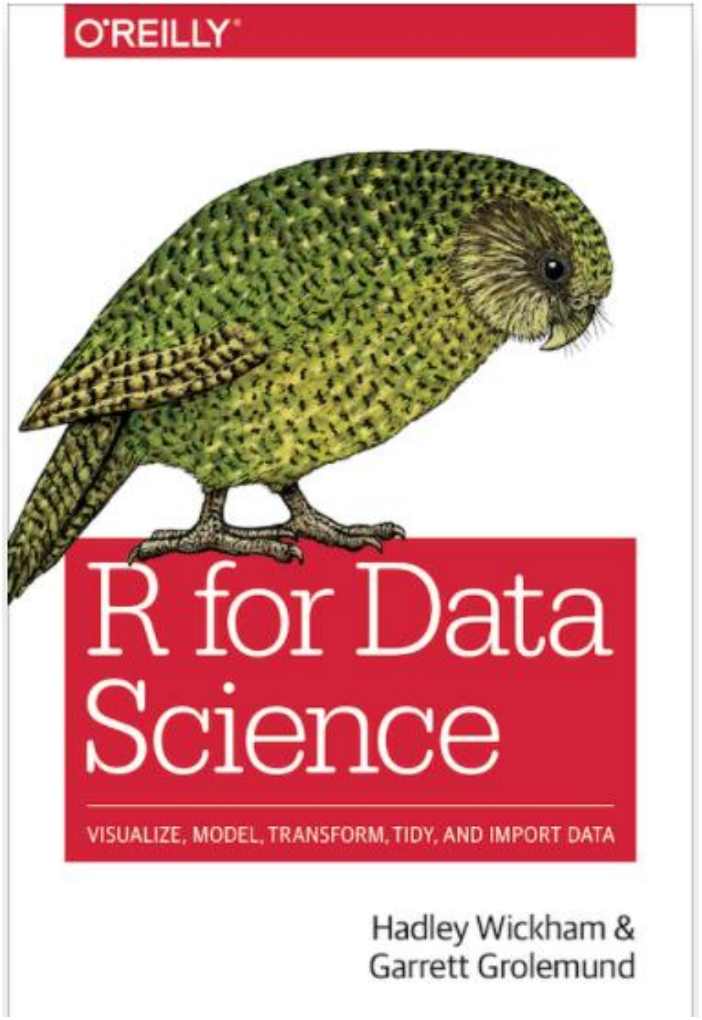
Beginners guide into tidyverse

https://r4ds.had.co.nz/

Books & Workshops

https://www.tidyverse.org/learn/

https://github.com/tidyverse/tidyverse



Thank you!

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