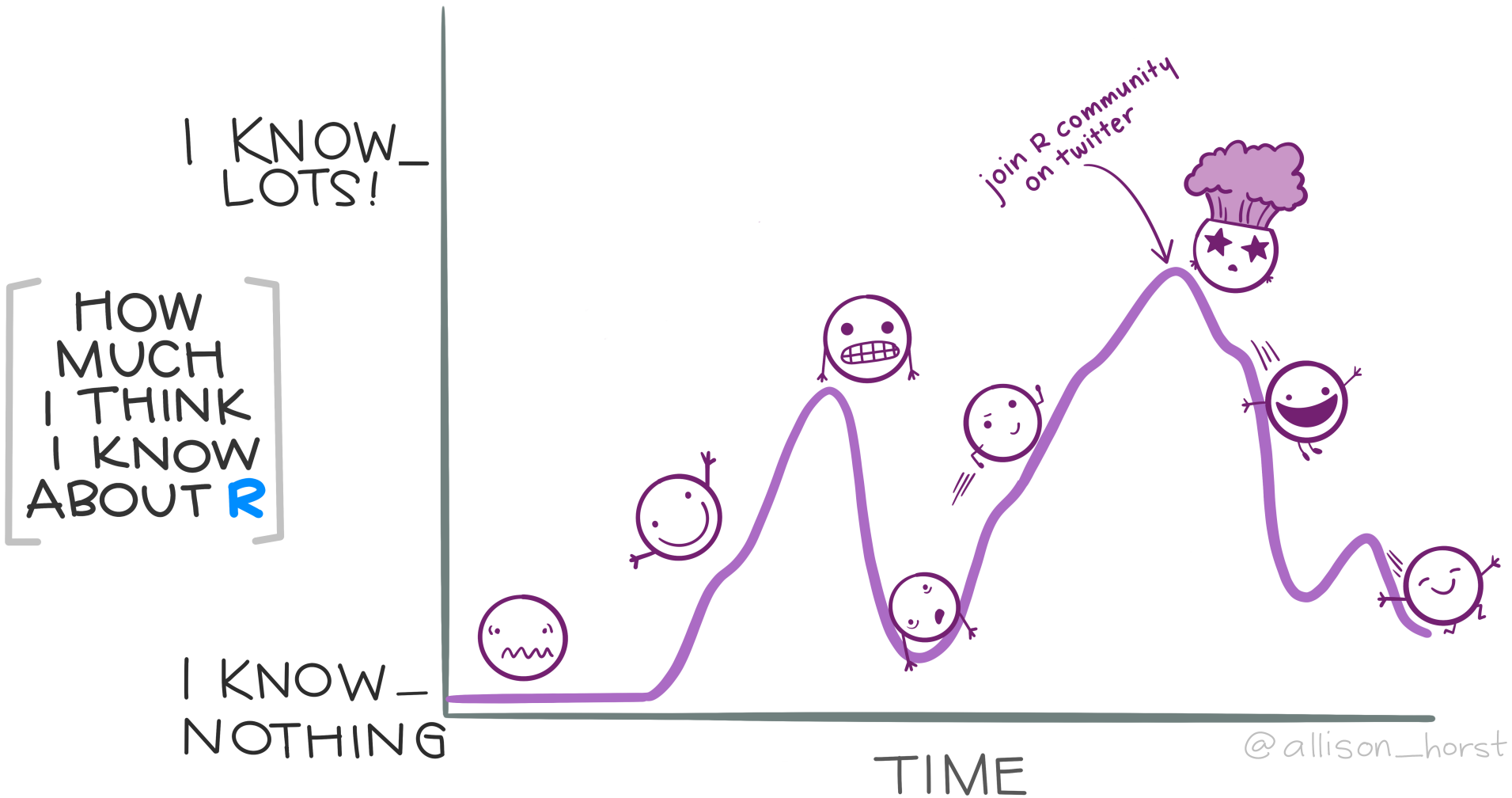
Daten transformieren mit `{dplyr}`

Unit 3

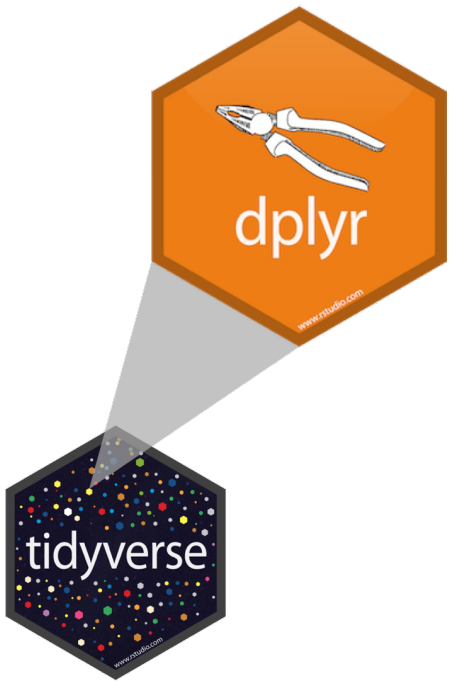
BASEL LANDSCHAFT
FINANZ- UND KIRCHENDIREKTION
AMT FÜR DATEN UND STATISTIK


I KNOW_ LOTS!
HOW MUCH I THINK I KNOW ABOUT R
I KNOW_ NOTHING
join R community on twitter
TIME
@allison_horst

Ziele für heute

1. Befehle zur Transformation von Spalten identifizieren und anwenden
2. Befehle zur Gruppierung, Zusammenfassung und zum Zählen von Daten identifizieren und anwenden
3. erläutern, wie man mehrere Befehle kombiniert

Daten-Transformation mit `{dplyr}`



Zeilen: filtern, anordnen

Spalten: auswählen, anordnen, umbenennen, erstellen

Gruppen: zusammenfassen, zählen

Tabellen: zusammenfügen

Spalten transformieren

`select()`, `relocate()`, `rename()`, `mutate()`


STAR WARS
STAR WARS
freevector.com

Daten

```
1  library(tidyverse)
2  glimpse(starwars)
```

```
1  Rows: 87
2  Columns: 14
3  $ name       <chr> "Luke Skywalker", "C-3PO", "R2-D2", "Darth Vader", "Leia Or…
4  $ height     <int> 172, 167, 96, 202, 150, 178, 165, 97, 183, 182, 188, 180, 2…
5  $ mass       <dbl> 77.0, 75.0, 32.0, 136.0, 49.0, 120.0, 75.0, 32.0, 84.0, 77.…
6  $ hair_color <chr> "blond", NA, NA, "none", "brown", "brown, grey", "brown", N…
7  $ skin_color <chr> "fair", "gold", "white, blue", "white", "light", "light", "…
8  $ eye_color  <chr> "blue", "yellow", "red", "yellow", "brown", "blue", "blue",…
9  $ birth_year <dbl> 19.0, 112.0, 33.0, 41.9, 19.0, 52.0, 47.0, NA, 24.0, 57.0, …
10 $ sex        <chr> "male", "none", "none", "male", "female", "male", "female",…
11 $ gender     <chr> "masculine", "masculine", "masculine", "masculine", "femini…
12 $ homeworld  <chr> "Tatooine", "Tatooine", "Naboo", "Tatooine", "Alderaan", "T…
13 $ species    <chr> "Human", "Droid", "Droid", "Human", "Human", "Human", "Huma…
14 $ films      <list> <"A New Hope", "The Empire Strikes Back", "Return of the J…
15 $ vehicles   <list> <"Snowspeeder", "Imperial Speeder Bike">, <>, <>, <>, "Imp…
16 $ starships  <list> <"X-wing", "Imperial shuttle">, <>, <>, "TIE Advanced x1",…
```

Spalten auswählen

```
select(Datensatz, Spalten)
```

Spalten auswählen

```
1 select(starwars, name, mass)
```

```
1  # A tibble: 87 × 2
2     name                mass
3     <chr>              <dbl>
4   1 Luke Skywalker        77
5   2 C-3PO                 75
6   3 R2-D2                 32
7   4 Darth Vader          136
8   5 Leia Organa           49
9   6 Owen Lars            120
10  7 Beru Whitesun Lars    75
11  8 R5-D4                 32
12  9 Biggs Darklighter     84
13 10 Obi-Wan Kenobi        77
14 # ℹ 77 more rows
```

Spalten auswählen

```
select(starwars, -height)
```

```
# A tibble: 87 × 13
   name   mass hair_color skin_color eye_color birth_year sex   gender homeworld
   <chr> <dbl> <chr>      <chr>      <chr>           <dbl> <chr> <chr>  <chr>
 1 Luke…    77 blond      fair       blue             19   male  mascu… Tatooine
 2 C-3PO    75 <NA>       gold       yellow          112   none  mascu… Tatooine
 3 R2-D2    32 <NA>       white, bl… red              33   none  mascu… Naboo
 4 Dart…   136 none       white      yellow           41.9 male  mascu… Tatooine
 5 Leia…    49 brown      light      brown            19   fema… femin… Alderaan
 6 Owen…   120 brown, gr… light      blue             52   male  mascu… Tatooine
 7 Beru…    75 brown      light      blue             47   fema… femin… Tatooine
 8 R5-D4    32 <NA>       white, red red              NA   none  mascu… Tatooine
 9 Bigg…    84 black      light      brown            24   male  mascu… Tatooine
10 Obi-…    77 auburn, w… fair       blue-gray        57   male  mascu… Stewjon
# ℹ 77 more rows
# ℹ 4 more variables: species <chr>, films <list>, vehicles <list>,
#   starships <list>
```

Spalten auswählen

```
select(starwars, name:mass)
```

```
# A tibble: 87 × 3
   name               height  mass
   <chr>               <int> <dbl>
 1 Luke Skywalker        172    77
 2 C-3PO                 167    75
 3 R2-D2                  96    32
 4 Darth Vader           202   136
 5 Leia Organa           150    49
 6 Owen Lars             178   120
 7 Beru Whitesun Lars    165    75
 8 R5-D4                  97    32
 9 Biggs Darklighter     183    84
10 Obi-Wan Kenobi        182    77
# ℹ 77 more rows
```

Spalten auswählen

```
select(starwars, starts_with("h"))
```

```
# A tibble: 87 × 3
   height hair_color    homeworld
    <int> <chr>         <chr>
 1    172 blond         Tatooine
 2    167 <NA>          Tatooine
 3     96 <NA>          Naboo
 4    202 none          Tatooine
 5    150 brown         Alderaan
 6    178 brown, grey   Tatooine
 7    165 brown         Tatooine
 8     97 <NA>          Tatooine
 9    183 black         Tatooine
10    182 auburn, white Stewjon
# ℹ 77 more rows
```

Spalten auswählen

```
select(starwars, ends_with("color"))
```

```
# A tibble: 87 × 3
   hair_color    skin_color  eye_color
   <chr>         <chr>       <chr>
 1 blond         fair        blue
 2 <NA>          gold        yellow
 3 <NA>          white, blue red
 4 none          white       yellow
 5 brown         light       brown
 6 brown, grey   light       blue
 7 brown         light       blue
 8 <NA>          white, red  red
 9 black         light       brown
10 auburn, white fair        blue-gray
# ℹ 77 more rows
```

Selection helpers: `contains("s")`, `where(is.numeric)`, `everything()`

Eine Spalte verschieben

```
relocate(Datensatz, Spalten_zu_verschieben)
```

Eine Spalte verschieben

```
starwars
```

```
# A tibble: 87 × 14
   name      height  mass hair_color sk
   <chr>      <int> <dbl> <chr>      <c
 1 Luke Sk…     172    77 blond      fa
 2 C-3PO        167    75 <NA>       go
 3 R2-D2         96    32 <NA>       wh
 4 Darth V…     202   136 none       wh
 5 Leia Or…     150    49 brown      li
 6 Owen La…     178   120 brown, gr… li
 7 Beru Wh…     165    75 brown      li
 8 R5-D4         97    32 <NA>       wh
 9 Biggs D…     183    84 black      li
10 Obi-Wan…     182    77 auburn, w… fa
# ℹ 77 more rows
# ℹ 5 more variables: homeworld <chr>,
#   vehicles <list>, starships <list>
```

```
relocate(starwars, mass)
```

```
# A tibble: 87 × 14
    mass name      height hair_color sk
   <dbl> <chr>      <int> <chr>      <c
 1    77 Luke Sk…     172 blond      fa
 2    75 C-3PO        167 <NA>       go
 3    32 R2-D2         96 <NA>       wh
 4   136 Darth V…     202 none       wh
 5    49 Leia Or…     150 brown      li
 6   120 Owen La…     178 brown, gr… li
 7    75 Beru Wh…     165 brown      li
 8    32 R5-D4         97 <NA>       wh
 9    84 Biggs D…     183 black      li
10    77 Obi-Wan…     182 auburn, w… fa
# ℹ 77 more rows
# ℹ 5 more variables: homeworld <chr>,
#   vehicles <list>, starships <list>
```

Eine Spalte verschieben

```
relocate(starwars, mass, .before = height)
```

```
# A tibble: 87 × 14
   name      mass height hair_color skin_color eye_color birth_year sex   gender
   <chr>    <dbl>  <int> <chr>      <chr>      <chr>           <dbl> <chr> <chr>
 1 Luke Sk…    77    172 blond      fair       blue             19   male  mascu…
 2 C-3PO       75    167 <NA>       gold       yellow          112   none  mascu…
 3 R2-D2       32     96 <NA>       white, bl… red              33   none  mascu…
 4 Darth V…   136    202 none       white      yellow           41.9 male  mascu…
 5 Leia Or…    49    150 brown      light      brown            19   fema… femin…
 6 Owen La…   120    178 brown, gr… light      blue             52   male  mascu…
 7 Beru Wh…    75    165 brown      light      blue             47   fema… femin…
 8 R5-D4       32     97 <NA>       white, red red              NA   none  mascu…
 9 Biggs D…    84    183 black      light      brown            24   male  mascu…
10 Obi-Wan…    77    182 auburn, w… fair       blue-gray        57   male  mascu…
# ℹ 77 more rows
# ℹ 5 more variables: homeworld <chr>, species <chr>, films <list>,
#   vehicles <list>, starships <list>
```

Eine Spalte umbenennen

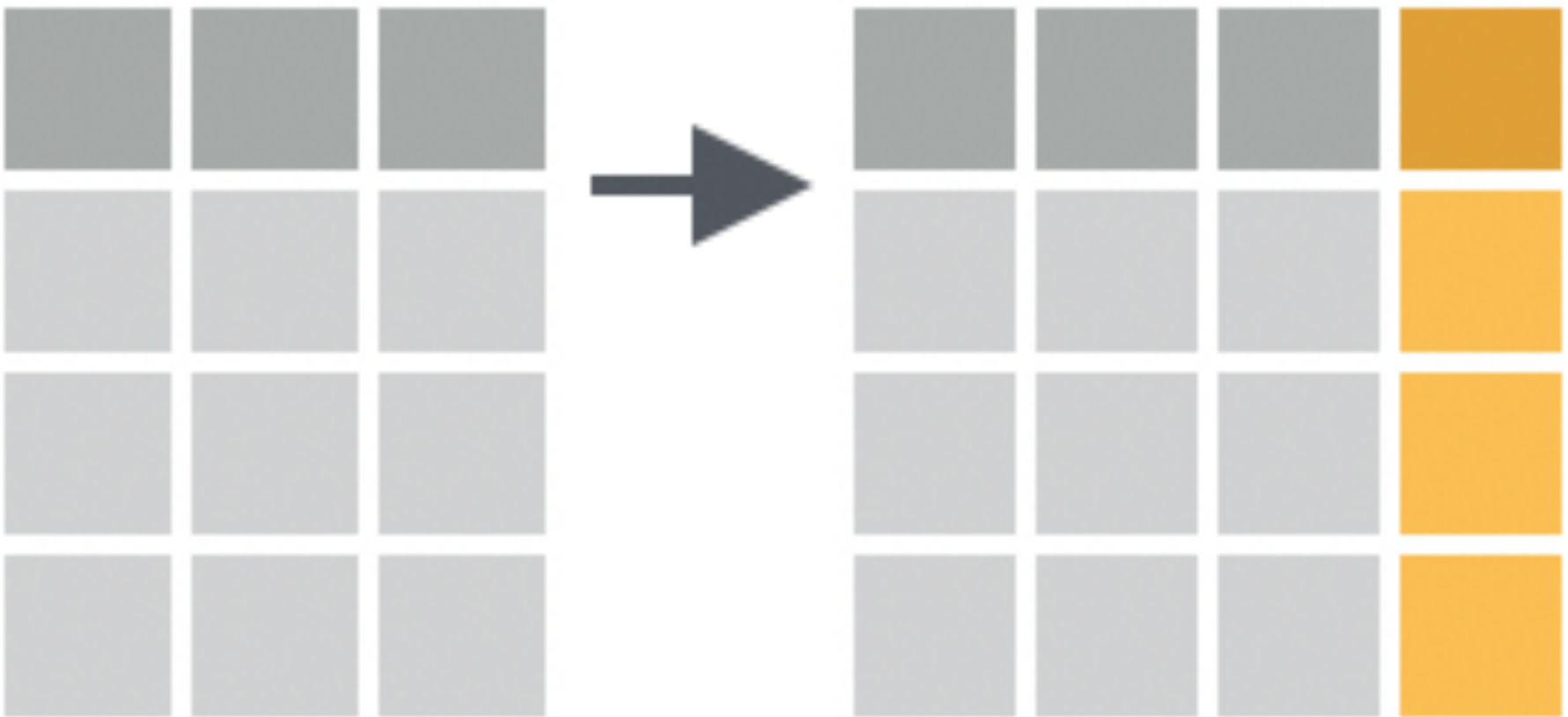
```
rename(Datensatz, neuer_name = alter_name)
```

Eine Spalte umbenennen

```
rename(starwars, gewicht = mass)
```

```
# A tibble: 87 × 14
   name   height gewicht hair_color skin_color eye_color birth_year sex   gender
   <chr>   <int>   <dbl> <chr>      <chr>      <chr>           <dbl> <chr> <chr>
 1 Luke …    172      77 blond      fair       blue             19   male  mascu…
 2 C-3PO     167      75 <NA>       gold       yellow          112   none  mascu…
 3 R2-D2      96      32 <NA>       white, bl… red              33   none  mascu…
 4 Darth…    202     136 none       white      yellow           41.9 male  mascu…
 5 Leia …    150      49 brown      light      brown            19   fema… femin…
 6 Owen …    178     120 brown, gr… light      blue             52   male  mascu…
 7 Beru …    165      75 brown      light      blue             47   fema… femin…
 8 R5-D4      97      32 <NA>       white, red red              NA   none  mascu…
 9 Biggs…    183      84 black      light      brown            24   male  mascu…
10 Obi-W…    182      77 auburn, w… fair       blue-gray        57   male  mascu…
# ℹ 77 more rows
# ℹ 5 more variables: homeworld <chr>, species <chr>, films <list>,
#   vehicles <list>, starships <list>
```

Eine neue Spalte erstellen



```
mutate(Datensatz, neue_spalte = Wert_neuer_spalte)
```

Eine neue Spalte erstellen

```r
mutate(starwars, height_m = height / 100)
```

```
# A tibble: 87 × 15
   name      height  mass hair_color skin_color eye_color birth_year sex   gender
   <chr>      <int> <dbl> <chr>      <chr>      <chr>           <dbl> <chr> <chr>
 1 Luke Sk…    172    77 blond      fair       blue             19   male  mascu…
 2 C-3PO       167    75 <NA>       gold       yellow          112   none  mascu…
 3 R2-D2        96    32 <NA>       white, bl… red              33   none  mascu…
 4 Darth V…    202   136 none       white      yellow           41.9 male  mascu…
 5 Leia Or…    150    49 brown      light      brown            19   fema… femin…
 6 Owen La…    178   120 brown, gr… light      blue             52   male  mascu…
 7 Beru Wh…    165    75 brown      light      blue             47   fema… femin…
 8 R5-D4        97    32 <NA>       white, red red              NA   none  mascu…
 9 Biggs D…    183    84 black      light      brown            24   male  mascu…
10 Obi-Wan…    182    77 auburn, w… fair       blue-gray        57   male  mascu…
# ℹ 77 more rows
# ℹ 6 more variables: homeworld <chr>, species <chr>, films <list>,
#   vehicles <list>, starships <list>, height_m <dbl>
```

Eine neue Spalte erstellen

```r
mutate(
  starwars,
  height_m = height / 100,
  .after = height
)
```

```
# A tibble: 87 × 15
   name   height height_m  mass hair_color skin_color eye_color birth_year sex
   <chr>   <int>    <dbl> <dbl> <chr>      <chr>      <chr>           <dbl> <chr>
 1 Luke …    172     1.72    77 blond      fair       blue             19   male
 2 C-3PO     167     1.67    75 <NA>       gold       yellow          112   none
 3 R2-D2      96     0.96    32 <NA>       white, bl… red              33   none
 4 Darth…    202     2.02   136 none       white      yellow           41.9 male
 5 Leia …    150     1.5     49 brown      light      brown            19   fema…
 6 Owen …    178     1.78   120 brown, gr… light      blue             52   male
 7 Beru …    165     1.65    75 brown      light      blue             47   fema…
 8 R5-D4      97     0.97    32 <NA>       white, red red              NA   none
 9 Biggs…    183     1.83    84 black      light      brown            24   male
10 Obi-W…    182     1.82    77 auburn, w… fair       blue-gray        57   male
# ℹ 77 more rows
# ℹ 6 more variables: gender <chr>, homeworld <chr>, species <chr>,
#   films <list>, vehicles <list>, starships <list>
```

Mehrere Spalten erstellen

```r
mutate(
  starwars,
  height_m = height / 100,
  bmi = mass / height_m^2,
  .after = mass
)
```

```
# A tibble: 87 × 16
   name   height  mass height_m   bmi hair_color skin_color eye_color birth_year
   <chr>   <int> <dbl>    <dbl> <dbl> <chr>      <chr>      <chr>           <dbl>
 1 Luke …    172    77     1.72  26.0 blond      fair       blue             19
 2 C-3PO     167    75     1.67  26.9 <NA>       gold       yellow          112
 3 R2-D2      96    32     0.96  34.7 <NA>       white, bl… red              33
 4 Darth…    202   136     2.02  33.3 none       white      yellow           41.9
 5 Leia …    150    49     1.5   21.8 brown      light      brown            19
 6 Owen …    178   120     1.78  37.9 brown, gr… light      blue             52
 7 Beru …    165    75     1.65  27.5 brown      light      blue             47
 8 R5-D4      97    32     0.97  34.0 <NA>       white, red red              NA
 9 Biggs…    183    84     1.83  25.1 black      light      brown            24
10 Obi-W…    182    77     1.82  23.2 auburn, w… fair       blue-gray        57
# ℹ 77 more rows
# ℹ 7 more variables: sex <chr>, gender <chr>, homeworld <chr>, species <chr>,
#   films <list>, vehicles <list>, starships <list>
```

Praktikum: Spalten-Transformation mit `{dplyr}`

prak-03a-spalten-abstimmung.qmd

20:00

Break ☕ 🍵 🍜

10:00

The Pipe

The Pipe |>

1. `filter`: mass < 300
2. `mutate`: height_m, bmi
3. `select`: name, species, sex, bmi
4. `arrange`: desc(bmi)

```
arrange(select(mutate(filter(starwars, mass < 300), height_m = height / 100, bmi = mass / height_m^2), name, species, s
```

```
# A tibble: 58 × 4
   name              species        sex     bmi
   <chr>             <chr>          <chr> <dbl>
 1 Dud Bolt          Vulptereen     male   50.9
 2 Yoda              Yoda's species male   39.0
 3 Owen Lars         Human          male   37.9
 4 IG-88             Droid          none   35
 5 R2-D2             Droid          none   34.7
 6 Grievous          Kaleesh        male   34.1
 7 R5-D4             Droid          none   34.0
 8 Jek Tono Porkins  <NA>           <NA>   34.0
 9 Darth Vader       Human          male   33.3
10 Sebulba           Dug            male   31.9
# ℹ 48 more rows
```

The Pipe |>

1. `filter`: mass < 300
2. `mutate`: height_m, bmi
3. `select`: name, species, sex, bmi
4. `arrange`: desc(bmi)

```
arrange(
  select(
    mutate(
      filter(starwars, mass < 300),
      height_m = height / 100,
      bmi = mass / height_m^2
    ),
    name, species, sex, bmi
  ),
  desc(bmi)
)
```

The Pipe |>

```r
df1 <- filter(starwars, mass < 300)
df2 <- mutate(df1,
  height_m = height / 100,
  bmi = mass / height_m^2
)
df3 <- select(df2, name, species, sex, bmi)
arrange(df3, desc(bmi))
```

```r
starwars |>
  filter(mass < 300) |>
  mutate(
    height_m = height / 100,
    bmi = mass / height_m^2
  ) |>
  select(name, species, sex, bmi) |>
  arrange(desc(bmi))
```

The Pipe %>%

|> vs. %>%

Ctrl + ⇧ + M = |>

Options

- General
- Code
- Console
- Appearance
- Pane Layout
- Packages
- R Markdown
- Python
- Sweave
- Spelling
- Git/SVN
- Publishing
- Terminal
- Accessibility

Editing | Display | Saving | Completion | Diagnostics

General

- [x] Insert spaces for Tab
  - Tab width 2
- [ ] Auto-detect code indentation
- [x] Insert matching parens/quotes
- [x] Use native pipe operator, |> (requires R 4.1+)
- [x] Auto-indent code after paste
- [x] Vertically align arguments in auto-indent
- [ ] Soft-wrap R source files
- [ ] Continue comment when inserting new line
- [x] Enable hyperlink highlighting in editor

Surround selection on text insertion: Quotes & Brackets

Keybindings: Default | Modify Keyboard Shortcuts...

Execution

- [ ] Focus console after executing from source

Ctrl+Enter executes: Multi-line R statement

Snippets

- [x] Enable code snippets | Edit snippets... | ?

Pipe vs Layer

- `|>` in `{dplyr}` pipelines: die Ausgabe der vorherigen Codezeile als erste Eingabe der nächsten Codezeile

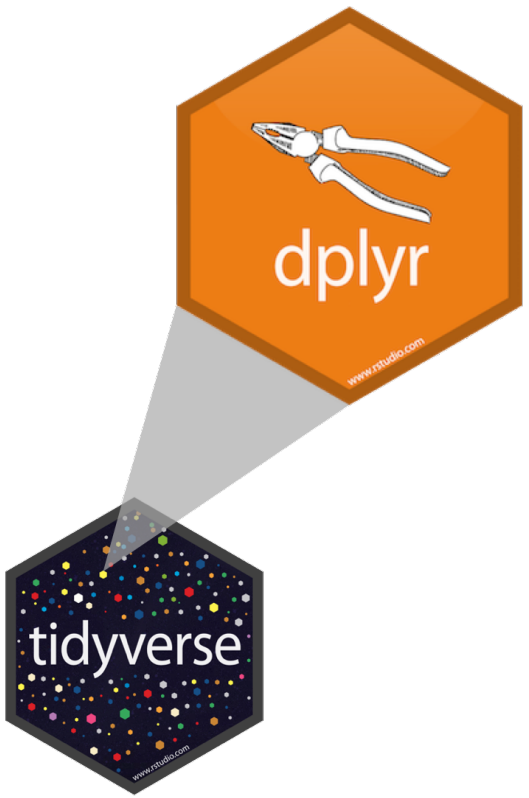
- `+` in `ggplot2` für Schichten: wir erstellen Schichten die durch `+` getrennt sind

Praktikum: `{dplyr}` und `|>`

prak-03a-spalten-abstimmung.qmd

10:00

Daten-Transformation mit `{dplyr}`



Zeilen: auswählen, anordnen

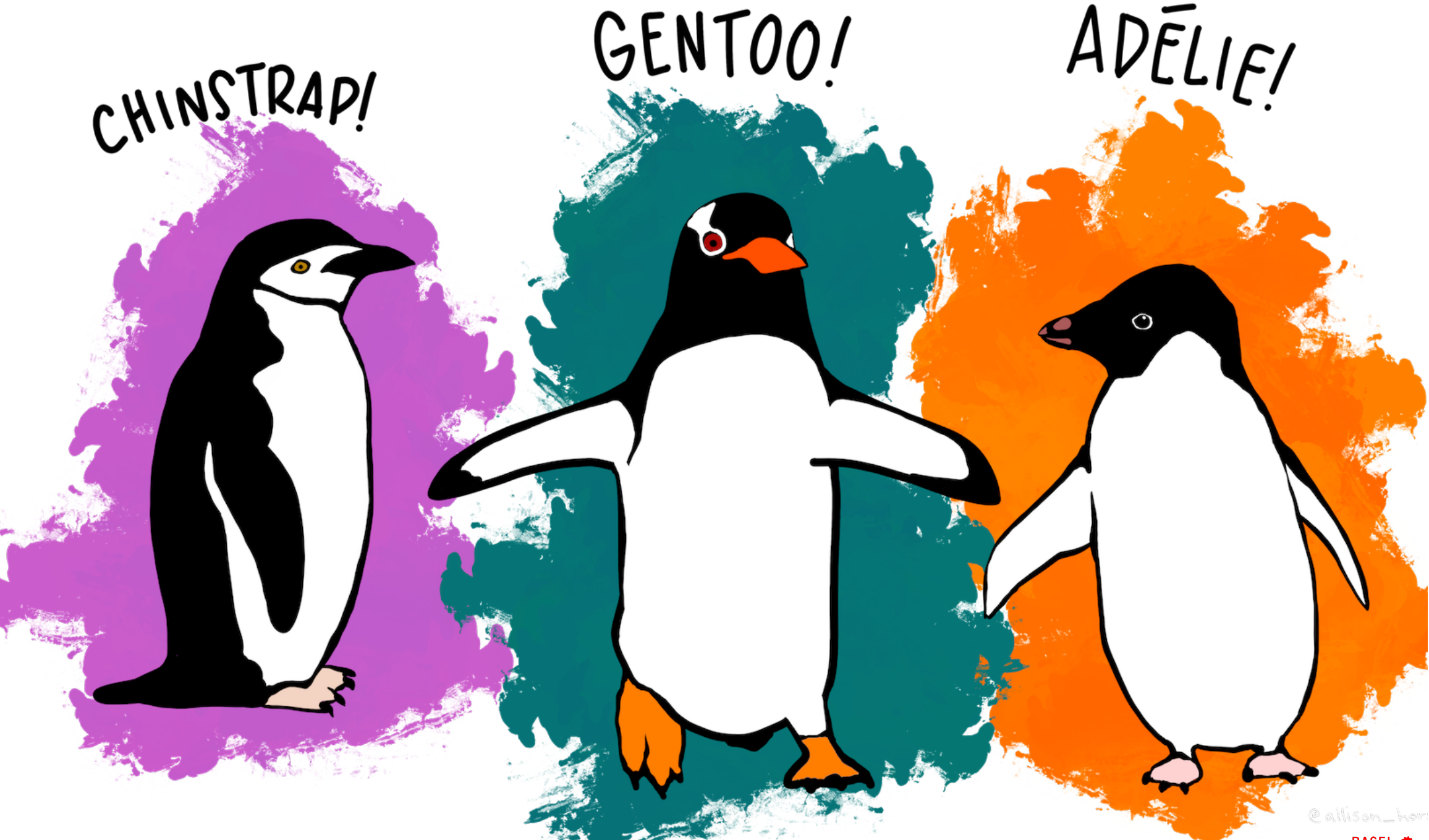
Spalten: auswählen, anordnen, umbenennen, erstellen

Gruppen: zusammenfassen, zählen

Tabellen: zusammenfügen.

Daten gruppieren mit `{dplyr}`

`group_by()`, `summarise()`, `count()`


CHINSTRAP!
GENTOO!
ADÉLIE!

Daten

```
glimpse(penguins)
```

```
Rows: 344
Columns: 8
$ species           <fct> Adelie, Adelie, Adelie, Adelie, Adelie, Adelie, Adel…
$ island            <fct> Torgersen, Torgersen, Torgersen, Torgersen, Torgerse…
$ bill_length_mm    <dbl> 39.1, 39.5, 40.3, NA, 36.7, 39.3, 38.9, 39.2, 34.1, …
$ bill_depth_mm     <dbl> 18.7, 17.4, 18.0, NA, 19.3, 20.6, 17.8, 19.6, 18.1, …
$ flipper_length_mm <int> 181, 186, 195, NA, 193, 190, 181, 195, 193, 190, 186…
$ body_mass_g       <int> 3750, 3800, 3250, NA, 3450, 3650, 3625, 4675, 3475, …
$ sex               <fct> male, female, female, NA, female, male, female, male…
$ year              <int> 2007, 2007, 2007, 2007, 2007, 2007, 2007, 2007, 2007…
```

Daten zusammenfassen

```
penguins |>
  summarise(
    average_weight = mean(body_mass_g, na.rm = TRUE)
  )
```

Daten zusammenfassen

```r
penguins |>
  summarise(
    average_weight = mean(body_mass_g, na.rm = TRUE)
  )
```

```
# A tibble: 1 × 1
  average_weight
           <dbl>
1          4202.
```

Daten gruppieren

```
group_by(Datensatz, Gruppierungsvariablen)
```

Daten gruppieren

```
summary(penguins)
```

```
      species          island    bill_length_mm  bill_depth_mm
 Adelie   :152   Biscoe   :168   Min.   :32.10   Min.   :13.10
 Chinstrap: 68   Dream    :124   1st Qu.:39.23   1st Qu.:15.60
 Gentoo   :124   Torgersen: 52   Median :44.45   Median :17.30
                                 Mean   :43.92   Mean   :17.15
                                 3rd Qu.:48.50   3rd Qu.:18.70
                                 Max.   :59.60   Max.   :21.50
                                 NA's   :2       NA's   :2
 flipper_length_mm  body_mass_g       sex           year
 Min.   :172.0     Min.   :2700   female:165   Min.   :2007
 1st Qu.:190.0     1st Qu.:3550   male  :168   1st Qu.:2007
 Median :197.0     Median :4050   NA's  : 11   Median :2008
 Mean   :200.9     Mean   :4202                Mean   :2008
 3rd Qu.:213.0     3rd Qu.:4750                3rd Qu.:2009
 Max.   :231.0     Max.   :6300                Max.   :2009
 NA's   :2         NA's   :2
```

Daten gruppieren

```
penguins |>
  group_by(species)
```

```
# A tibble: 344 × 8
# Groups:   species [3]
   species island    bill_length_mm bill_depth_mm flipper_length_mm body_mass_g
   <fct>   <fct>              <dbl>         <dbl>             <int>       <int>
 1 Adelie  Torgersen           39.1          18.7               181        3750
 2 Adelie  Torgersen           39.5          17.4               186        3800
 3 Adelie  Torgersen           40.3          18                 195        3250
 4 Adelie  Torgersen           NA            NA                  NA          NA
 5 Adelie  Torgersen           36.7          19.3               193        3450
 6 Adelie  Torgersen           39.3          20.6               190        3650
 7 Adelie  Torgersen           38.9          17.8               181        3625
 8 Adelie  Torgersen           39.2          19.6               195        4675
 9 Adelie  Torgersen           34.1          18.1               193        3475
10 Adelie  Torgersen           42            20.2               190        4250
# ℹ 334 more rows
# ℹ 2 more variables: sex <fct>, year <int>
```

Eine Gruppe zusammenfassen

```r
penguins |>
  group_by(species) |>
  summarise(
    average_weight = mean(body_mass_g, na.rm = TRUE)
  )
```

```
# A tibble: 3 × 2
  species   average_weight
  <fct>              <dbl>
1 Adelie             3701.
2 Chinstrap          3733.
3 Gentoo             5076.
```

Eine Gruppe zusammenfassen

```r
penguins |>
  summarise(
    average_weight = mean(body_mass_g, na.rm = TRUE),
    .by = species
  )
```

```
# A tibble: 3 × 2
  species   average_weight
  <fct>              <dbl>
1 Adelie             3701.
2 Gentoo             5076.
3 Chinstrap          3733.
```

Eine Gruppe mehrfach zusammenfassen

```r
penguins |>
  group_by(species) |>
  summarise(
    average_weight = mean(body_mass_g, na.rm = TRUE),
    average_flipper_length = mean(flipper_length_mm, na.rm = TRUE)
  )
```

```
# A tibble: 3 × 3
  species   average_weight average_flipper_length
  <fct>              <dbl>                  <dbl>
1 Adelie             3701.                   190.
2 Chinstrap          3733.                   196.
3 Gentoo             5076.                   217.
```

Mehrere Gruppen zusammenfassen

```r
penguins |>
  group_by(species, island) |>
  summarise(average_weight = mean(body_mass_g, na.rm = TRUE))
```

```
# A tibble: 5 × 3
# Groups:   species [3]
  species   island    average_weight
  <fct>     <fct>              <dbl>
1 Adelie    Biscoe             3710.
2 Adelie    Dream              3688.
3 Adelie    Torgersen          3706.
4 Chinstrap Dream              3733.
5 Gentoo    Biscoe             5076.
```

Frequenzen

```
penguins |>
  group_by(species) |>
  summarise(n = n())
```

```
# A tibble: 3 × 2
  species       n
  <fct>     <int>
1 Adelie      152
2 Chinstrap    68
3 Gentoo      124
```

```
penguins |> count(species)
```

```
# A tibble: 3 × 2
  species       n
  <fct>     <int>
1 Adelie      152
2 Chinstrap    68
3 Gentoo      124
```

`group_by()` + `summarise()` + `n()` ↔ `count()`

> Most of data science is counting, and sometimes dividing.
>
> – *Hadley Wickham*

Praktikum 03b: Gruppen zusammenfassen

prak-3b-groups-penguins.qmd

20:00

Break ☕ 🍵 🍜

10:00

Praktikum 03c: Gebäude und Energiequelle

prak-03c-dplyr-gebaeude.qmd

20:00

Danke! 

Slides created via revealjs and Quarto.

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