What is tidy data?

RESHAPING DATA WITH TIDYR

Jeroen Boeye
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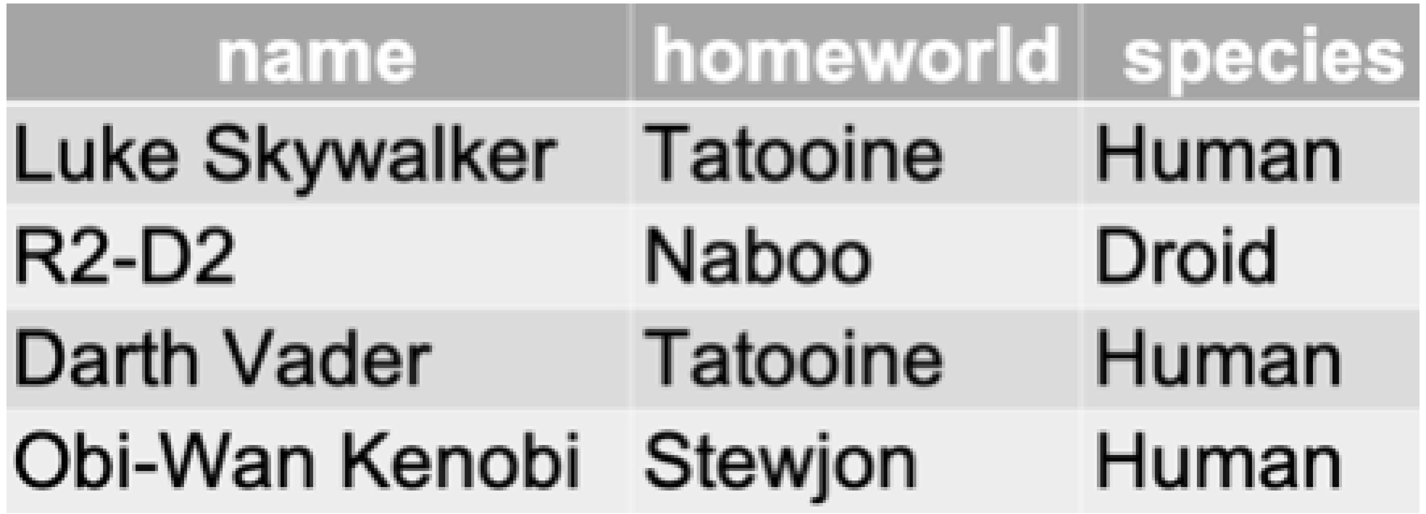
> *Happy families are all alike, but every unhappy family is unhappy in its own way.*
>
> **Leo Tolstoy**

> *Tidy datasets are all alike, but every messy dataset is messy in its own way.*
>
> **Hadley Wickham**

Rectangular data

Structure

- Columns
- Rows
- Cells

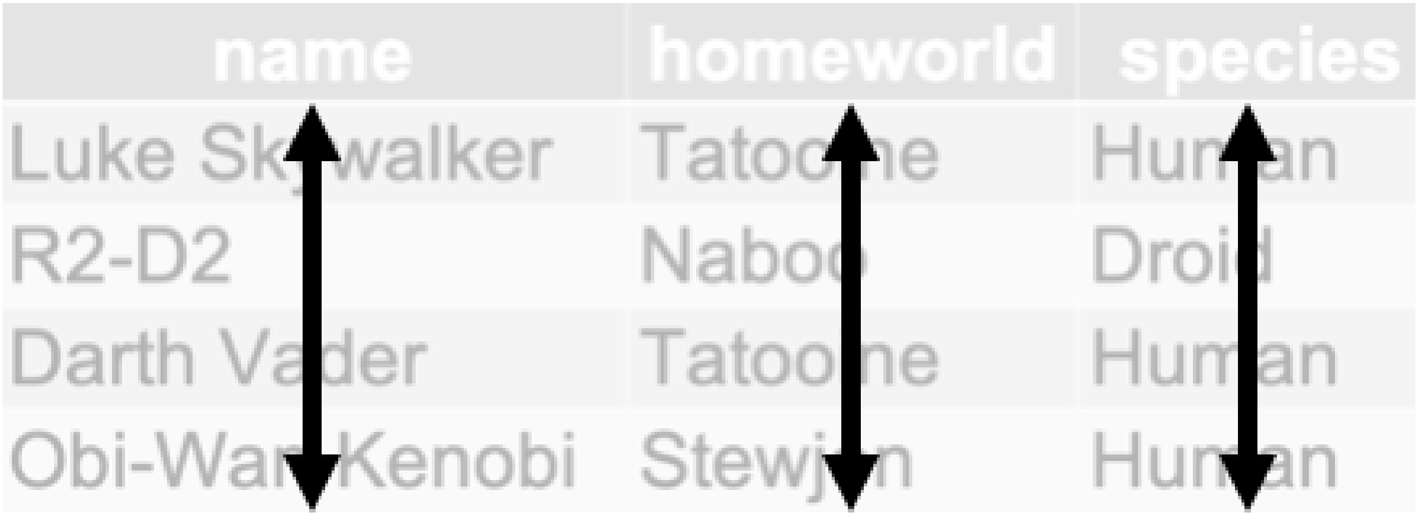


name	homeworld	species
Luke Skywalker	Tatooine	Human
R2-D2	Naboo	Droid
Darth Vader	Tatooine	Human
Obi-Wan Kenobi	Stewjon	Human

Tidy data, variables

Structure

- **Columns hold variables**
- Rows
- Cells

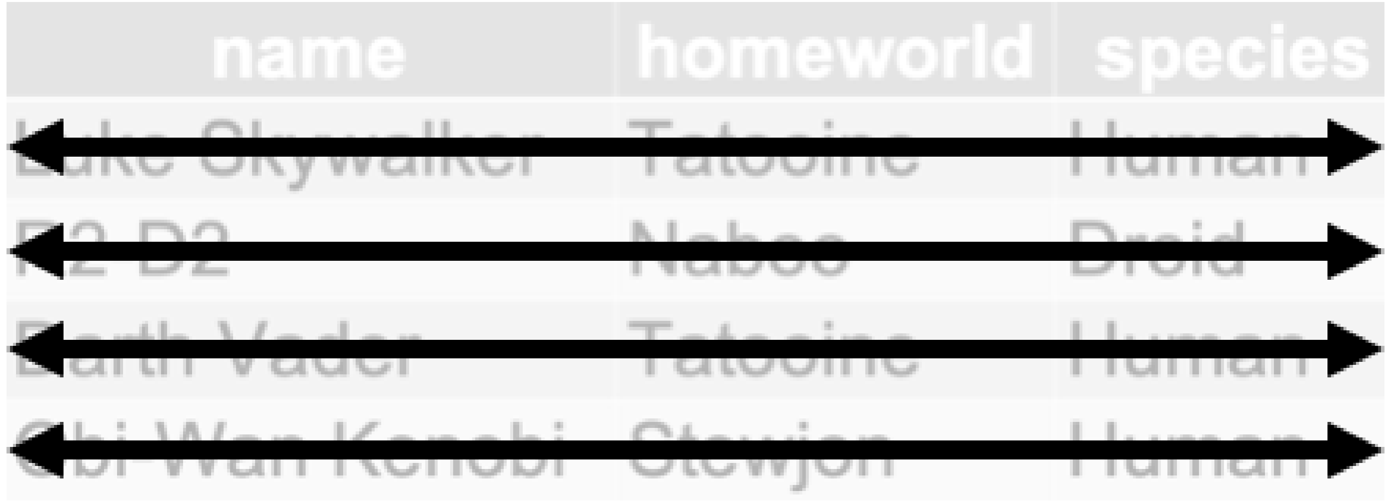


name	homeworld	species
Luke Skywalker	Tatooine	Human
R2-D2	Naboo	Droid
Darth Vader	Tatooine	Human
Obi-Wan Kenobi	Stewjon	Human

Tidy data, observations

Structure

- Columns hold variables
- **Rows hold observations**
- Cells

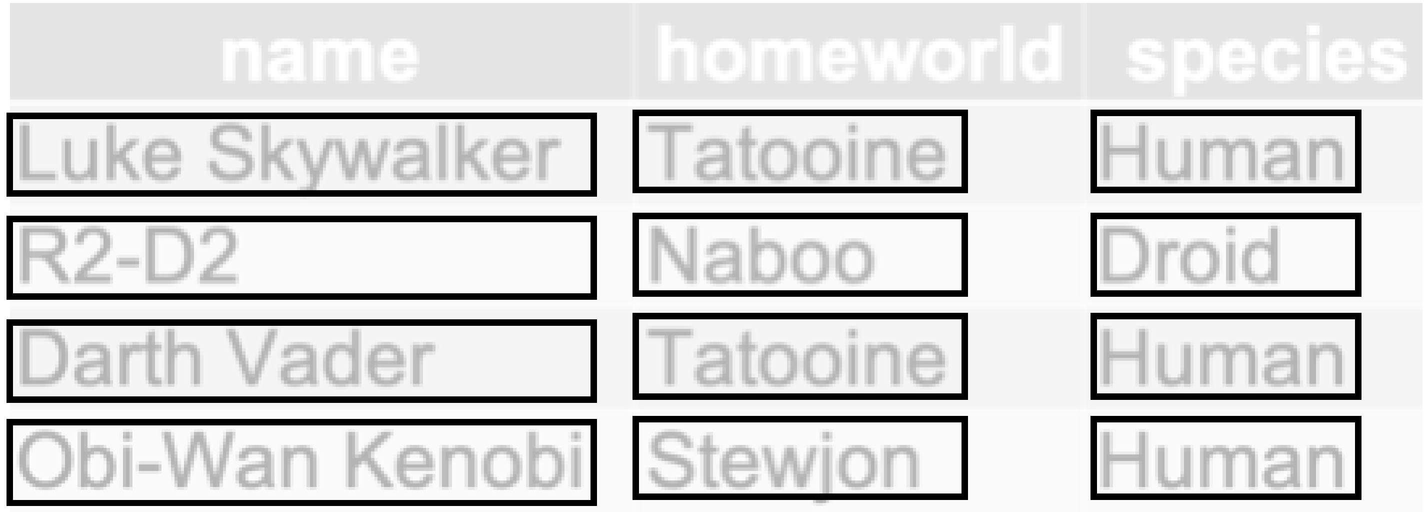


name	homeworld	species
Luke Skywalker	Tatooine	Human
R2-D2	Naboo	Droid
Darth Vader	Tatooine	Human
Obi-Wan Kenobi	Stewjon	Human

Tidy data, values

Structure

- Columns hold variables
- Rows hold observations
- **Cells hold values**



name	homeworld	species
Luke Skywalker	Tatooine	Human
R2-D2	Naboo	Droid
Darth Vader	Tatooine	Human
Obi-Wan Kenobi	Stewjon	Human

dplyr recap

```
character_df
```

```
# A tibble: 4 x 3
  name           homeworld species
  <chr>          <chr>     <chr>
1 Luke Skywalker Tatooine  Human
2 R2-D2          Naboo     Droid
3 Darth Vader    Tatooine  Human
4 Obi-Wan Kenobi Stewjon   Human
```

dplyr recap: select()

```
character_df %>%
  select(name, homeworld)
```

```
# A tibble: 4 x 2
  name           homeworld
  <chr>          <chr>
1 Luke Skywalker Tatooine
2 R2-D2          Naboo
3 Darth Vader    Tatooine
4 Obi-Wan Kenobi Stewjon
```

dplyr recap: filter()

```
character_df %>%
  filter(homeworld == "Tatooine")
```

```
# A tibble: 2 x 3
  name           homeworld species
  <chr>          <chr>     <chr>
1 Luke Skywalker Tatooine  Human
2 Darth Vader    Tatooine  Human
```

dplyr recap: mutate()

```
character_df %>%
  mutate(is_human = species == "Human")
```

```
# A tibble: 4 x 4
  name           homeworld species is_human
  <chr>          <chr>     <chr>   <lgl>
1 Luke Skywalker Tatooine  Human   TRUE
2 R2-D2          Naboo     Droid   FALSE
3 Darth Vader    Tatooine  Human   TRUE
4 Obi-Wan Kenobi Stewjon   Human   TRUE
```

dplyr recap: group_by() and summarize()

```
character_df %>%
  group_by(homeworld) %>%
  summarize(n = n())
```

```
# A tibble: 3 x 2
  homeworld     n
  <chr>     <int>
1 Naboo         1
2 Stewjon       1
3 Tatooine      2
```

[1] magrittr.tidyverse.org

[1] www.tidyverse.org

Multiple variables in a single column

```
population_df
```

```
# A tibble: 4 x 2
  country                 population
  <chr>                        <dbl>
1 Brazil, South America        210. 
2 Nepal, Asia                   28.1
3 Senegal, Africa               15.8
4 Australia, Oceania            25.0
```

Separating variables over two columns

```r
population_df %>%
  separate(country, into = c("country", "continent"), sep = ", ")
```

```
# A tibble: 4 x 3
  country   continent     population
  <chr>     <chr>              <dbl>
1 Brazil    South America      210. 
2 Nepal     Asia                28.1
3 Senegal   Africa              15.8
4 Australia Oceania             25.0
```

Let's practice!

RESHAPING DATA WITH TIDYR

Columns with multiple values

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Two variables in a single column

```
netflix_df
```

```
# A tibble: 637 x 3
   title                     type    duration
   <chr>                     <chr>   <chr>
 1 Article 15                Movie   125 min
 2 Kill Me If You Dare       Movie   100 min
 3 The Spy                   TV Show 1 Seasons
 4 The World We Make         Movie   108 min
 5 Watchman                  Movie   93 min
```

Converting separated columns' data types

```r
netflix_df %>%
  separate(duration, into = c("value", "unit"), convert = TRUE)
```

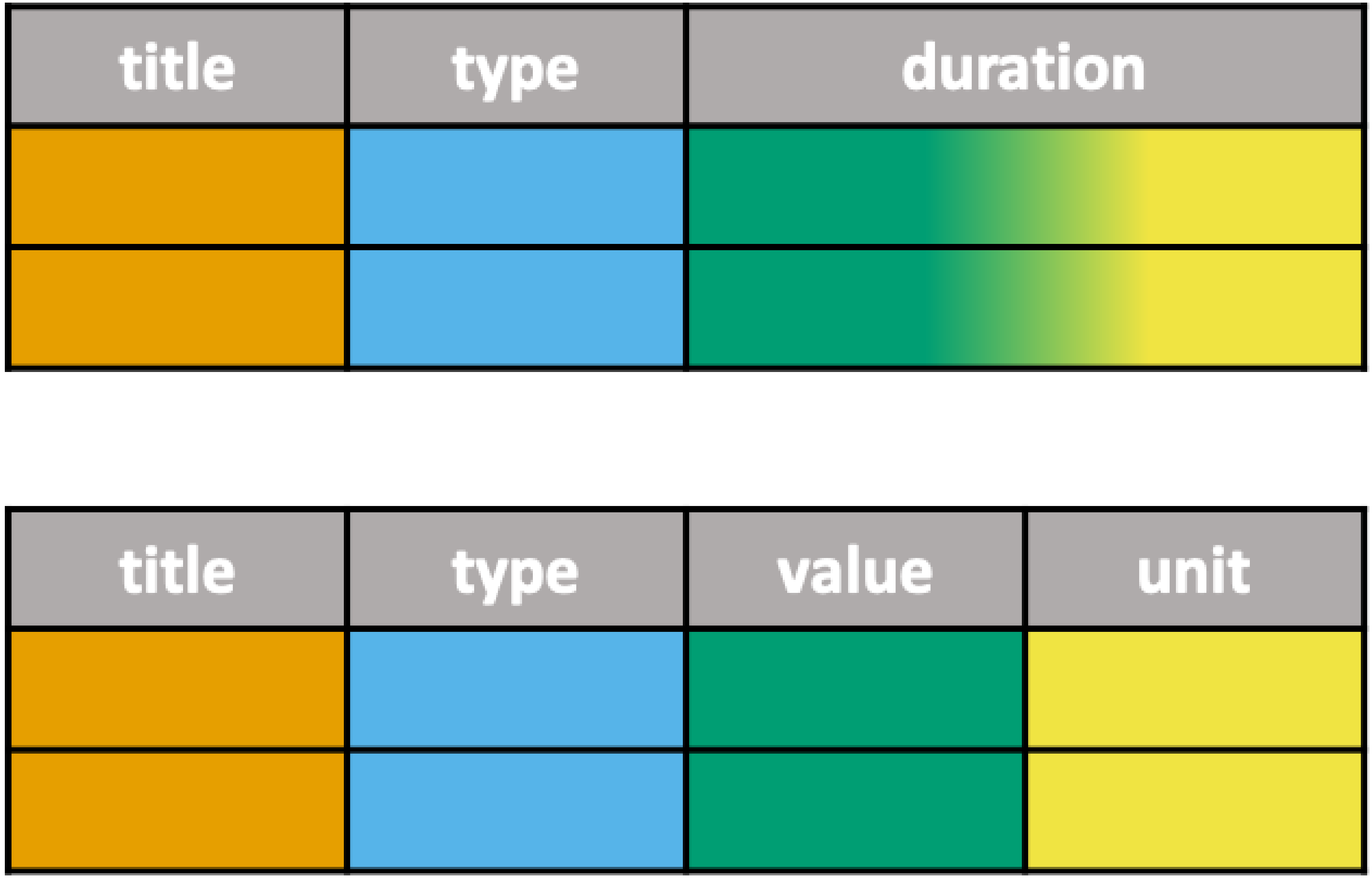
```
# A tibble: 5 x 4
  title               type    value unit
  <chr>               <chr>   <int> <chr>
1 Article 15          Movie     125 min
2 Kill Me If You Dare Movie     100 min
3 The Spy             TV Show     1 Seasons
4 The World We Make   Movie     108 min
5 Watchman            Movie      93 min
```

dplyr aggregation recap

```
netflix_df %>%
  separate(duration, into = c("value", "unit"), convert = TRUE) %>%
  group_by(type, unit) %>%
  summarize(mean_duration = mean(value))
```

```
# A tibble: 2 x 3
# Groups:   type [2]
  type     unit     mean_duration
  <chr>    <chr>            <dbl>
1 Movie    min              98.6
2 TV Show  Seasons           1.85
```

Separating variables over columns



title	type	duration
🟧	🟦	🟩🟨
🟧	🟦	🟩🟨

title	type	value	unit
🟧	🟦	🟩	🟨
🟧	🟦	🟩	🟨

Combining multiple columns into one

```
star_wars_df
```

```
# A tibble: 4 x 2
  given_name family_name
  <chr>      <chr>
1 Luke       Skywalker
2 Han        Solo
3 Leia       Organa
4 R2         D2
```

Combining multiple columns into one

```r
star_wars_df %>%
  unite("name", given_name, family_name)
```

```
# A tibble: 4 x 1
  name
  <chr>
1 Luke_Skywalker
2 Han_Solo
3 Leia_Organa
4 R2_D2
```

Combining multiple columns into one

```r
star_wars_df %>%
  unite("name", given_name, family_name, sep = " ")
```

```
# A tibble: 4 x 1
  name
  <chr>
1 Luke Skywalker
2 Han Solo
3 Leia Organa
4 R2 D2
```

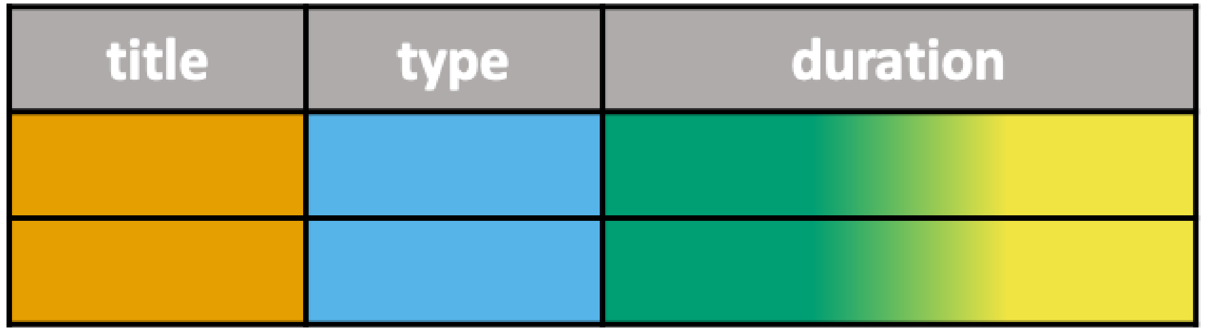
Multiple values in a single cell

```
drink_df
```

```
# A tibble: 2 x 2
  drink          ingredients
  <chr>          <chr>
1 Chocolate milk milk, chocolate, sugar
2 Orange juice   oranges, sugar
```

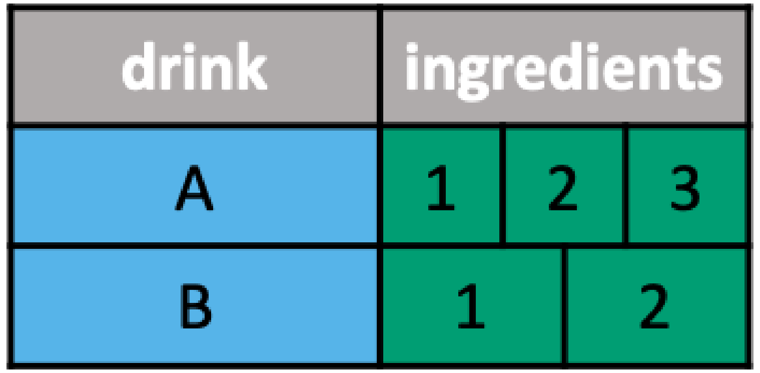
Multiple values in a single cell

Netflix data



title	type	duration

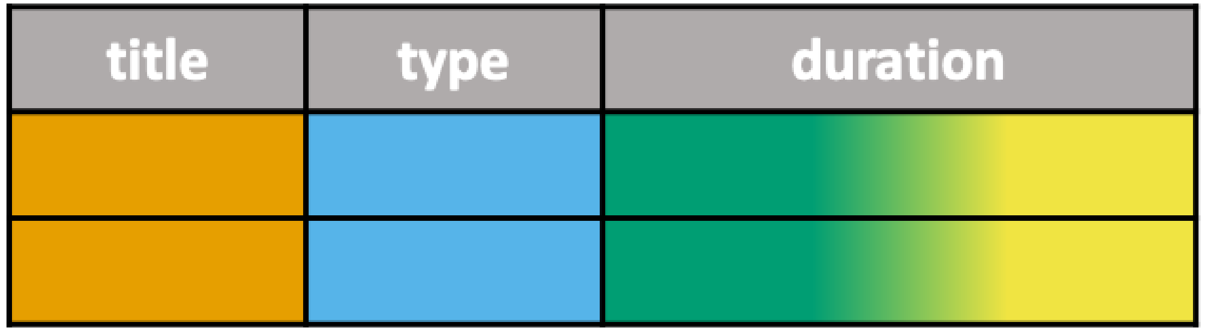
Drinks data



drink	ingredients
A	1 2 3
B	1 2

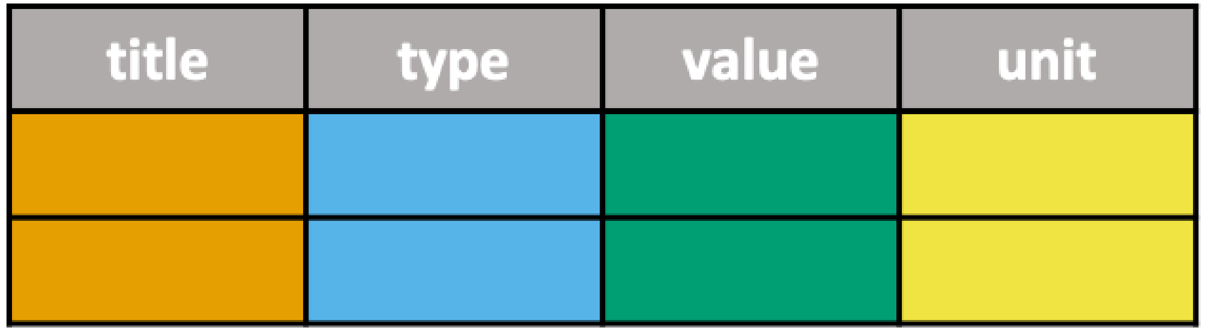
Multiple values in a single cell

Netflix data



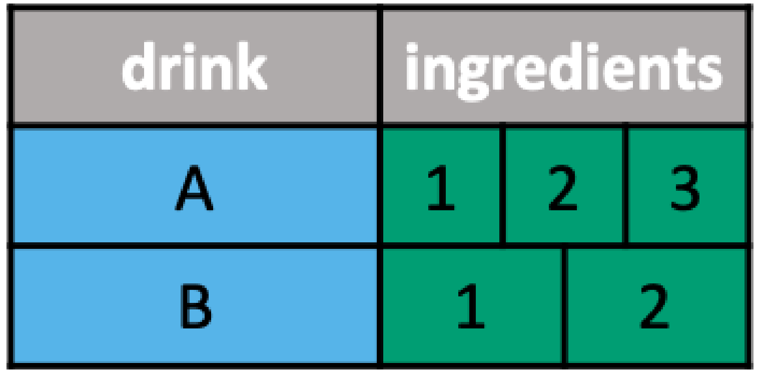
title	type	duration
🟧	🟦	🟩🟨
🟧	🟦	🟩🟨

Values to variables



title	type	value	unit
🟧	🟦	🟩	🟨
🟧	🟦	🟩	🟨

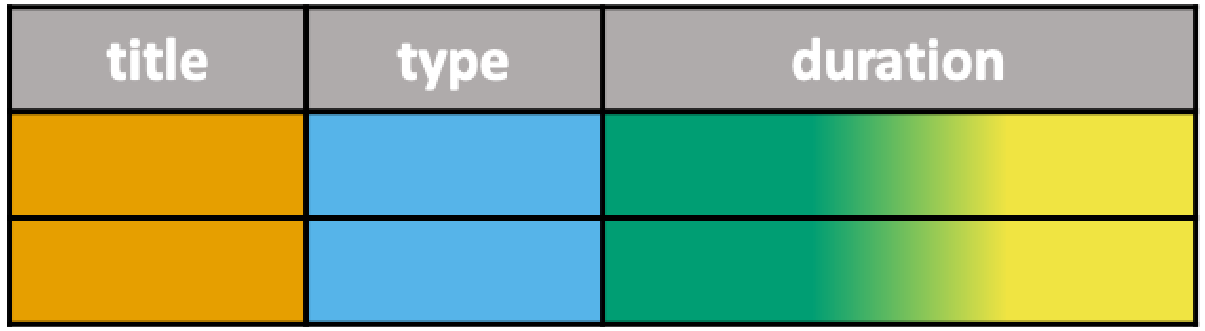
Drinks data



drink	ingredients		
A	1	2	3
B	1	2	

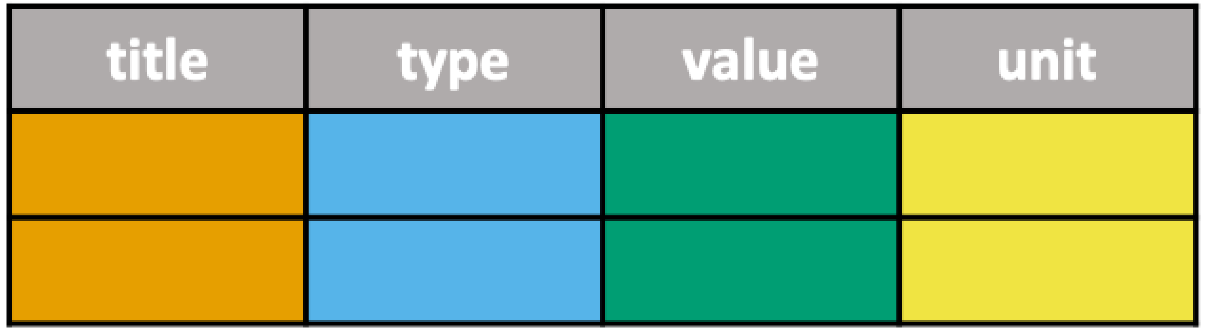
Multiple values in a single cell

Netflix data



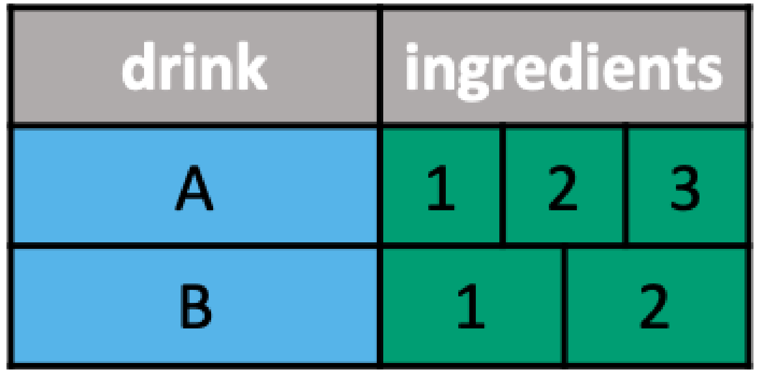
title	type	duration
🟧	🟦	🟩🟨
🟧	🟦	🟩🟨

Values to variables



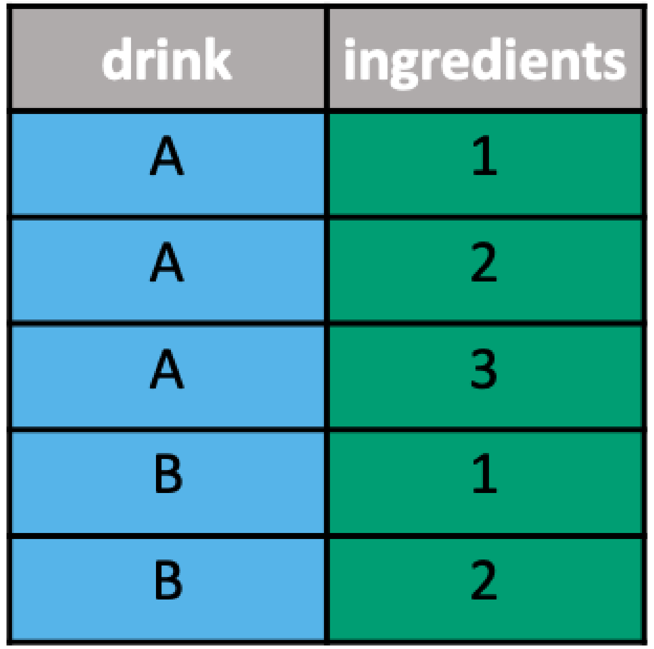
title	type	value	unit
🟧	🟦	🟩	🟨
🟧	🟦	🟩	🟨

Drinks data



drink	ingredients
A	1 2 3
B	1 2

Values to observations



drink	ingredients
A	1
A	2
A	3
B	1
B	2

Separating values over rows

```r
drink_df %>%
  separate_rows(ingredients, sep = ", ")
```

```
# A tibble: 5 x 2
  drink          ingredients
  <chr>          <chr>
1 Chocolate milk milk
2 Chocolate milk chocolate
3 Chocolate milk sugar
4 Orange juice   oranges
5 Orange juice   sugar
```

Counting ingredients

```
drink_df %>%
  separate_rows(ingredients, sep = ", ") %>%
  count(drink)
```

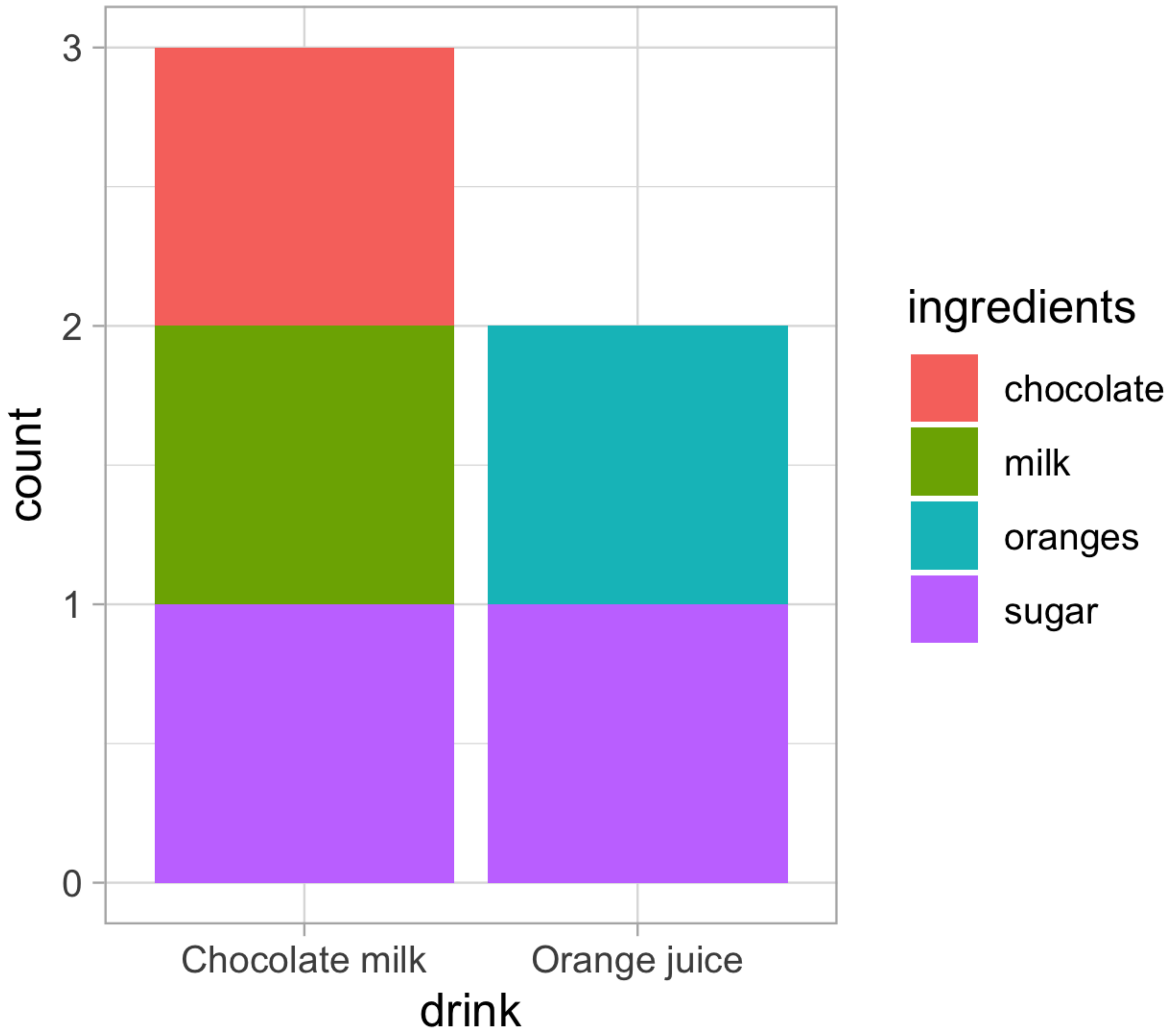
```
# A tibble: 2 x 2
  drink             n
  <chr>         <int>
1 Chocolate milk     3
2 Orange juice       2
```

```
drink_df %>%
  separate_rows(ingredients, sep = ", ") %>%
  count(ingredients)
```

```
# A tibble: 4 x 2
  ingredients     n
  <chr>       <int>
1 chocolate       1
2 milk            1
3 oranges         1
4 sugar           2
```

Visualizing ingredients

```
drink_df %>%
  separate_rows(ingredients, sep = ", ") %>%
  ggplot(aes(x=drink, fill=ingredients)) +
  geom_bar()
```



Let's practice!

RESHAPING DATA WITH TIDYR

Missing values

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Missing values in R

NA = Not Available

```
# A tibble: 5 x 4
  drink          ingredient quantity unit
  <chr>          <chr>         <int> <chr>
1 Chocolate milk milk              1 L
2 Chocolate milk chocolate       100 g
3 Chocolate milk sugar            20 g
4 Orange juice   oranges           3 NA
5 Orange juice   sugar            20 g
```

Imputing with a default value: replace_na()

```
moon_df
```

```
# A tibble: 4 x 2
   year people_on_moon
  <int>          <int>
1  1969              4
2  1970             NA
3  1971              4
4  1972              4
5  1973             NA
```

Imputing with a default value: replace_na()

```r
moon_df %>%
  replace_na(list(people_on_moon = 0L))
```

```
# A tibble: 4 x 2
   year people_on_moon
  <int>          <int>
1  1969              4
2  1970              0
3  1971              4
4  1972              4
5  1973              0
```

```r
typeof(0L)
```

```
[1] "integer"
```

```r
typeof(0)
```

```
[1] "double"
```

Imputing with the most recent value: fill()

```
cumul_moon_df
```

```
# A tibble: 5 x 3
   year people_on_moon total_people_on_moon
  <int>          <int>                <int>
1  1969              4                    4
2  1970             NA                   NA
3  1971              4                    8
4  1972              4                   12
5  1973             NA                   NA
```

Imputing with the most recent value: fill()

```
cumul_moon_df %>%
  fill(total_people_on_moon)
```

```
# A tibble: 5 x 3
   year people_on_moon total_people_on_moon
  <int>          <int>                <int>
1  1969              4                    4
2  1970             NA                    4
3  1971              4                    8
4  1972              4                   12
5  1973             NA                   12
```

fill() imputation options

```
cumul_moon_df %>%
  fill(total_people_on_moon, .direction = "down")
```

```
# A tibble: 5 x 3
   year people_on_moon total_people_on_moon
  <int>          <int>                <int>
1  1969              4                    4
2  1970             NA                    4
3  1971              4                    8
4  1972              4                   12
5  1973             NA                   12
```

fill() imputation options

```r
cumul_moon_df %>%
  fill(total_people_on_moon, .direction = "up")
```

```
# A tibble: 5 x 3
   year people_on_moon total_people_on_moon
  <int>          <int>                <int>
1  1969              4                    4
2  1970             NA                    8
3  1971              4                    8
4  1972              4                   12
5  1973             NA                   NA
```

Removing rows with missing values: drop_na()

```
moon_df %>%
  drop_na()
```

```
# A tibble: 3 x 2
   year people_on_moon
  <int>          <int>
1  1969              4
2  1971              4
3  1972              4
```

drop_na() caveats

```r
mars_df
```

```
# A tibble: 5 x 3
   year people_on_moon people_on_mars
  <int>          <int> <int>
1  1969              4 NA
2  1970             NA NA
3  1971              4 NA
4  1972              4 NA
5  1973             NA NA
```

drop_na() caveats

```
mars_df %>%
  drop_na()
```

```
# A tibble: 0 x 3
# ... with 3 variables: year <int>, people_on_moon <int>, people_on_mars <int>
```

drop_na() caveats

```
mars_df %>%
  drop_na(people_on_moon)
```

```
# A tibble: 3 x 3
   year people_on_moon people_on_mars
  <int>          <int> <int>
1  1969              4 NA
2  1971              4 NA
3  1972              4 NA
```

Let's practice!

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