Data tidying

From wide-to-long and long-to-wide with `tidyr`

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2024-05-14

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Learning objectives

Today we will...

- learn how to re-structure our data with the `tidyr` package
- use `pivot_longer()` to make data longer
- use `pivot_wider()` to make data wider

Set-up

Load the `tidyverse` package

```
library(tidyverse)
```

Load a subset of the `tidy_data_lifetime_pilot.csv` data. For demonstration purposes, we'll only look at two trials from a single participant.

```
df_lifetime <- readr::read_csv(here::here("data/tidy_data_lifetime_pilot.csv"),
                               # for special characters
                               locale = readr::locale(encoding = "latin1")
                               ) |>
  filter(type=="critical", px=="px5", trial %in% c(3,8)) |>
  select(px,trial,region,ff,fp,rpd,tt)
```

Inspect data

- we'll be changing the shape of our data, so let's first see how it looks as-is

```
df_lifetime
```

```
# A tibble: 10 x 7
   px    trial region    ff    fp   rpd    tt
   <chr> <dbl> <chr>  <dbl> <dbl> <dbl> <dbl>
 1 px5       3 verb-1   190   190   190   190
 2 px5       3 verb     175   175   175   321
 3 px5       3 verb+1   154   154  1258  1723
 4 px5       3 verb+2   160   283   283   672
 5 px5       3 verb+3   156   575  1940   575
 6 px5       8 verb-1   246   246   246   246
 7 px5       8 verb     228   960   960  1892
 8 px5       8 verb+1   176   573   573   967
 9 px5       8 verb+2   151   151   151   450
10 px5       8 verb+3   216   981  2852   981
```

- of importance, we have the following variables:
  - `region`: contains info on which sentence region the row's reading times correspond to
  - `ff`: first fixation time, an eye-tracking reading measure

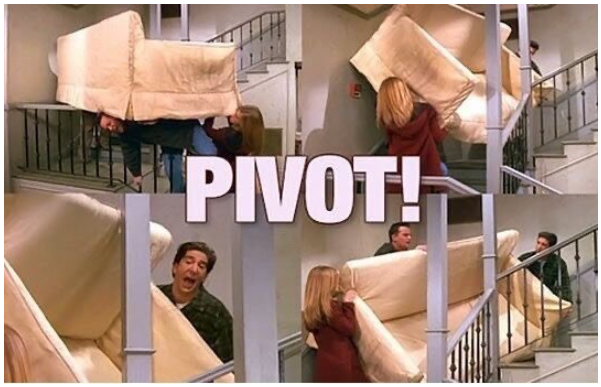
  - `fp`: first-pass reading time, an eye-tracking reading measure
  - `rpd`: regression path duration, an eye-tracking reading measure
  - `tt`: total reading time, an eye-tracking reading measure
- we see that we have 10 rows x 4 reading time measures = 40 reading time measures

Reshape data

- this is the major step of data tidying
  - make each column a variable
  - make each row an observation
  - make each cell a data point
- what variable and observation mean will depend on what you want to do, and will change at different steps of your analyses
- you typically want *long* data
  - but our dataset isn't as long as it could be
- the `tidyr` package from the `tidyverse` has some useful functions to faciliate this: `pivot_longer()` and `pivot_wider()`

Pivot with `tidyr`

- to pivot (verb): *to turn or rotate on a point, like a hinge. Or a basketball player pivoting back and forth on one foot to protect the ball.* (vocabulary.com)
- a pivot (noun): *a fixed point supporting something that turns or balances* (dictonary.Cambridge.org)



Wide-to-long: `pivot_longer()`

- `pivot_longer()` takes wide data and makes it longer
  - converts headers of columns into values of a new column
  - combines the values of those columns into a new condensed column
- takes a few arguments:
  - `cols`: which columns do we want to combine into a single column?
  - `names_to`: what should we call the new column containing the previous column names?
  - `values_to`: what should we call the new column containing the values from the previous columns?
- let's take our four reading time measures and list them in a single variable that we'll call `measure`, and put their values in a second variable called `time`

```
df_longer <-
  df_lifetime |>
  pivot_longer(
  cols = c(ff,fp,rpd,tt), # columns to make long
  names_to = "measure", # new column name for headers
  values_to = "time" # new column name for values
)
```

```
df_longer
```

```
# A tibble: 40 x 5
   px    trial region measure  time
   <chr> <dbl> <chr>  <chr>   <dbl>
 1 px5       3 verb-1 ff        190
 2 px5       3 verb-1 fp        190
 3 px5       3 verb-1 rpd       190
 4 px5       3 verb-1 tt        190
 5 px5       3 verb   ff        175
 6 px5       3 verb   fp        175
 7 px5       3 verb   rpd       175
 8 px5       3 verb   tt        321
 9 px5       3 verb+1 ff        154
10 px5       3 verb+1 fp        154
# i 30 more rows
```

- now instead of having the four reading time values in a single row across four columns called `ff`, `fp`, `rpd`, and `tt`, we have two columns (`measure` and `time`) which contain the reading time measure names and corresponding reading times
- we again still have 40 reading time values: 40 rows x 1 column containing reading time values (`time`)

Long-to-wide: `pivot_wider()`

- `pivot_wider()` takes long data and makes it wider
- takes a few arguments:
  - `id_cols`: identifying columns
  - `names_from`: what should we call the new column containing the previous column names?
  - `names_prefix`:
  - `values_from`: new column values
- let's now take our `region` column in `df_longer` and widen it
  - we'll do this only for `tt` (total reading time) the resultfour reading time measures and list them in a single variable that we'll call `measure`, and put their values in a second variable called `time`

```
df_longer_wider <-
  df_longer |>
  pivot_wider(
  id_cols = c(px,trial,measure), # columns to make long
  names_from = region, # new column name for headers
  names_prefix = "reg_", # new column name for values (optional)
  values_from = time
)
```

```
df_longer_wider
```

```
# A tibble: 8 x 8
  px    trial measure `reg_verb-1` reg_verb `reg_verb+1` `reg_verb+2`
  <chr> <dbl> <chr>          <dbl>    <dbl>        <dbl>        <dbl>
1 px5       3 ff               190      175          154          160
2 px5       3 fp               190      175          154          283
3 px5       3 rpd              190      175         1258          283
4 px5       3 tt               190      321         1723          672
5 px5       8 ff               246      228          176          151
```

```
6 px5       8 fp               246      960          573          151
7 px5       8 rpd              246      960          573          151
8 px5       8 tt               246     1892          967          450
# i 1 more variable: `reg_verb+3` <dbl>
```

- again, we have 40 reading time values: 8 rows x 5 variables containing reading time values per region

Re-structuring, not changing

- in `df_lifetime`, `df_longer`, and `df_longer_wider`, we have 40 reading time values
  - we have the exact same information in all three versions
  - we have not removed or changed our data
  - we have only changed the *structure* of the data
- this might not always be the case, based on what you're trying to achieve
  - but it's important to understand that you can find the same information in long versus wide data
  - the way you structure your data should reflect/facilitate what you're trying to say about your data
- look at the three versions of the data below, and ask yourself: what does each one more easily communicate?

```
df_longer
```

```
# A tibble: 40 x 5
   px    trial region measure  time
   <chr> <dbl> <chr>  <chr>   <dbl>
 1 px5       3 verb-1 ff        190
 2 px5       3 verb-1 fp        190
 3 px5       3 verb-1 rpd       190
 4 px5       3 verb-1 tt        190
 5 px5       3 verb   ff        175
 6 px5       3 verb   fp        175
 7 px5       3 verb   rpd       175
 8 px5       3 verb   tt        321
 9 px5       3 verb+1 ff        154
10 px5       3 verb+1 fp        154
# i 30 more rows
```

```r
# only first 15 rows
df_longer |> head(15)
```

```
# A tibble: 15 x 5
   px    trial region measure  time
   <chr> <dbl> <chr>  <chr>   <dbl>
 1 px5       3 verb-1 ff        190
 2 px5       3 verb-1 fp        190
 3 px5       3 verb-1 rpd       190
 4 px5       3 verb-1 tt        190
 5 px5       3 verb   ff        175
 6 px5       3 verb   fp        175
 7 px5       3 verb   rpd       175
 8 px5       3 verb   tt        321
 9 px5       3 verb+1 ff        154
10 px5       3 verb+1 fp        154
11 px5       3 verb+1 rpd      1258
12 px5       3 verb+1 tt       1723
13 px5       3 verb+2 ff        160
14 px5       3 verb+2 fp        283
15 px5       3 verb+2 rpd       283
```

```r
df_longer_wider
```

```
# A tibble: 8 x 8
  px    trial measure `reg_verb-1` reg_verb `reg_verb+1` `reg_verb+2`
  <chr> <dbl> <chr>          <dbl>    <dbl>        <dbl>        <dbl>
1 px5       3 ff               190      175          154          160
2 px5       3 fp               190      175          154          283
3 px5       3 rpd              190      175         1258          283
4 px5       3 tt               190      321         1723          672
5 px5       8 ff               246      228          176          151
6 px5       8 fp               246      960          573          151
7 px5       8 rpd              246      960          573          151
8 px5       8 tt               246     1892          967          450
# i 1 more variable: `reg_verb+3` <dbl>
```

More reading: PsyTeachR

Learning objectives

Today we...

- learned how to re-structure our data with the `tidyr` package
- used `pivot_longer()` to make data longer
- used `pivot_wider()` to make data wider