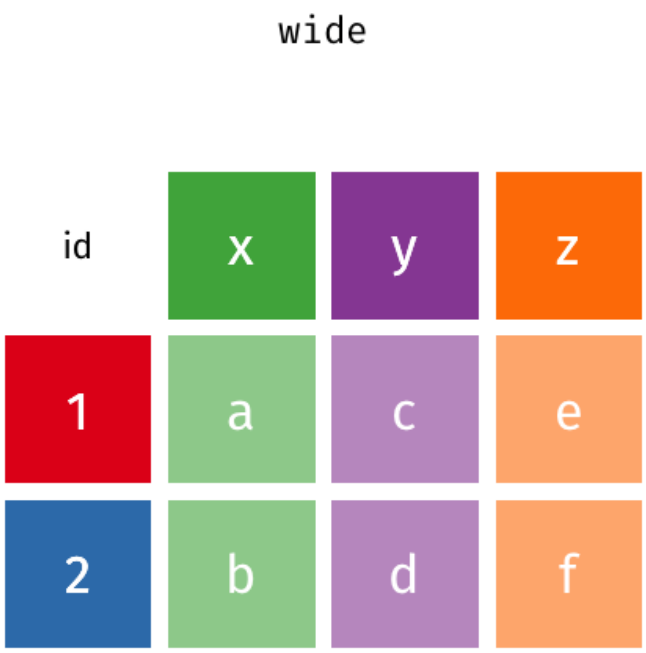
Data Reshaping

Data Wrangling in R

Reshaping: wide vs. long data

https://github.com/gadenbuie/tidyexplain/blob/main/images/tidyr-pivoting.gif



What is wide/long data?

Data is stored *differently* in the tibble.

Wide: has many columns

```
# A tibble: 1 × 4
  State   June_vacc_rate May_vacc_rate April_vacc_rate
  <chr>   <chr>          <chr>         <chr>
1 Alabama 37.2%          36.0%         32.4%
```

Long: column names become data

```
# A tibble: 3 × 3
  State   name            value
  <chr>   <chr>           <chr>
1 Alabama June_vacc_rate  37.2%
2 Alabama May_vacc_rate   36.0%
3 Alabama April_vacc_rate 32.4%
```

What is wide/long data?

Wide: multiple columns per individual, values spread across multiple columns

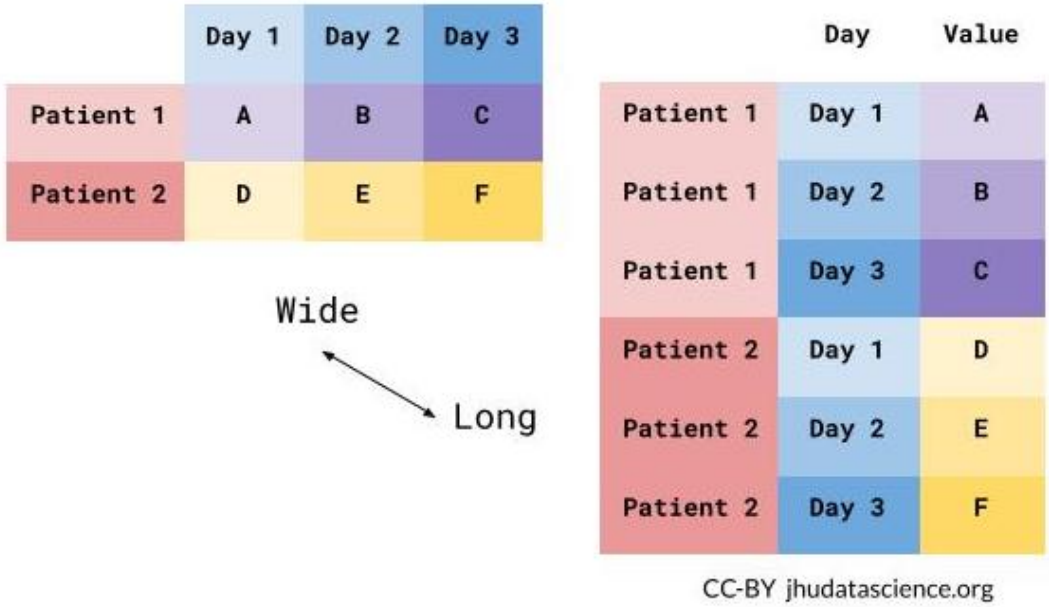
```
# A tibble: 2 × 4
  State   June_vacc_rate May_vacc_rate April_vacc_rate
  <chr>   <chr>          <chr>         <chr>
1 Alabama 37.2%          36.0%         32.4%
2 Alaska  47.5%          46.2%         41.7%
```

Long: multiple rows per observation, a single column contains the values

```
# A tibble: 6 × 3
  State   name            value
  <chr>   <chr>           <chr>
1 Alabama June_vacc_rate  37.2%
2 Alabama May_vacc_rate   36.0%
3 Alabama April_vacc_rate 32.4%
4 Alaska  June_vacc_rate  47.5%
5 Alaska  May_vacc_rate   46.2%
6 Alaska  April_vacc_rate 41.7%
```

What is wide/long data?

Data is wide or long **with respect** to certain variables.



Why do we need to switch between wide/long data?

Wide: **Easier for humans to read**

```
# A tibble: 2 × 4
  State   June_vacc_rate May_vacc_rate April_vacc_rate
  <chr>   <chr>          <chr>         <chr>
1 Alabama 37.2%          36.0%         32.4%
2 Alaska  47.5%          46.2%         41.7%
```

Long: **Easier for R to make plots & do analysis**

```
# A tibble: 6 × 3
  State   name            value
  <chr>   <chr>           <chr>
1 Alabama June_vacc_rate  37.2%
2 Alabama May_vacc_rate   36.0%
3 Alabama April_vacc_rate 32.4%
4 Alaska  June_vacc_rate  47.5%
5 Alaska  May_vacc_rate   46.2%
6 Alaska  April_vacc_rate 41.7%
```

Pivoting using `tidyr` package

`tidyr` allows you to "tidy" your data. We will be talking about:

- `pivot_longer` - make multiple columns into variables, (wide to long)
- `pivot_wider` - make a variable into multiple columns, (long to wide)
- `separate` - string into multiple columns

The `reshape` command exists. It is a **confusing** function. Don't use it.

You might see old functions `gather` and `spread` when googling. These are the old names for `pivot_longer` and `pivot_wider`, respectively.

`pivot_longer`...

Reshaping data from **wide to long**

`pivot_longer()` - puts column data into rows (`tidyr` package)

- First describe which columns we want to “pivot_longer”

```
{long_data} <- {wide_data} %>% pivot_longer(cols = {columns to pivot})
```

Reshaping data from **wide to long**

```
wide_data
```

```
# A tibble: 1 × 3
  June_vacc_rate May_vacc_rate April_vacc_rate
  <chr>          <chr>         <chr>
1 37.2%          36.0%         32.4%
```

```
long_data <- wide_data %>% pivot_longer(cols = everything())
long_data
```

```
# A tibble: 3 × 2
  name             value
  <chr>            <chr>
1 June_vacc_rate   37.2%
2 May_vacc_rate    36.0%
3 April_vacc_rate  32.4%
```

Reshaping data from **wide to long**

`pivot_longer()` - puts column data into rows (`tidyr` package)

- First describe which columns we want to “pivot_longer”
- `names_to` = gives a new name to the pivoted columns
- `values_to` = gives a new name to the values that used to be in those columns

```
{long_data} <- {wide_data} %>% pivot_longer(cols = {columns to pivot},
                                            names_to = {New column name: contains old column names},
                                            values_to = {New column name: contains cell values})
```

Reshaping data from **wide to long**

```
wide_data
```

```
# A tibble: 1 × 3
  June_vacc_rate May_vacc_rate April_vacc_rate
  <chr>          <chr>         <chr>
1 37.2%          36.0%         32.4%
```

```
long_data <- wide_data %>% pivot_longer(cols = everything(),
                                        names_to = "Month",
                                        values_to = "Rate")
long_data
```

```
# A tibble: 3 × 2
  Month           Rate
  <chr>           <chr>
1 June_vacc_rate  37.2%
2 May_vacc_rate   36.0%
3 April_vacc_rate 32.4%
```

Data used: Charm City Circulator

http://jhudatascience.org/intro_to_r/data/Charm_City_Circulator_Ridership.csv

```
circ <-
  read_csv("http://jhudatascience.org/intro_to_r/data/Charm_City_Circulator_Ridership.csv")
head(circ, 5)
```

```
# A tibble: 5 × 15
  day       date       orangeBoardings orangeAlightings orangeAverage purpleBoardings purpleAlightings purpleAverage
  <chr>     <chr>                <dbl>            <dbl>        <dbl>           <dbl>             <dbl>         <dbl>
1 Monday    01/11/2010             877             1027          952              NA                NA            NA
2 Tuesday   01/12/2010             777              815          796              NA                NA            NA
3 Wednesday 01/13/2010            1203             1220         1212.             NA                NA            NA
4 Thursday  01/14/2010            1194             1233         1214.             NA                NA            NA
5 Friday    01/15/2010            1645             1643         1644              NA                NA            NA
# … with 7 more variables: greenBoardings <dbl>, greenAlightings <dbl>, greenAverage <dbl>, bannerBoardings <dbl>,
#   bannerAlightings <dbl>, bannerAverage <dbl>, daily <dbl>
```

Reshaping data from **wide to long**

```
long <- circ %>%
  pivot_longer(starts_with(c("orange","purple","green","banner")))
long
```

```
# A tibble: 13,752 × 5
   day    date       daily name              value
   <chr>  <chr>      <dbl> <chr>             <dbl>
 1 Monday 01/11/2010   952 orangeBoardings     877
 2 Monday 01/11/2010   952 orangeAlightings   1027
 3 Monday 01/11/2010   952 orangeAverage       952
 4 Monday 01/11/2010   952 purpleBoardings      NA
 5 Monday 01/11/2010   952 purpleAlightings     NA
 6 Monday 01/11/2010   952 purpleAverage        NA
 7 Monday 01/11/2010   952 greenBoardings       NA
 8 Monday 01/11/2010   952 greenAlightings      NA
 9 Monday 01/11/2010   952 greenAverage         NA
10 Monday 01/11/2010   952 bannerBoardings      NA
# … with 13,742 more rows
```

Reshaping data from **wide to long**

There are many ways to select the columns we want. Use `?tidyr_tidy_select` to look at more column selection options.

```
long <- circ %>%
  pivot_longer( !c(day, date, daily))
long
```

```
# A tibble: 13,752 × 5
   day    date       daily name              value
   <chr>  <chr>      <dbl> <chr>             <dbl>
 1 Monday 01/11/2010   952 orangeBoardings     877
 2 Monday 01/11/2010   952 orangeAlightings   1027
 3 Monday 01/11/2010   952 orangeAverage       952
 4 Monday 01/11/2010   952 purpleBoardings      NA
 5 Monday 01/11/2010   952 purpleAlightings     NA
 6 Monday 01/11/2010   952 purpleAverage        NA
 7 Monday 01/11/2010   952 greenBoardings       NA
 8 Monday 01/11/2010   952 greenAlightings      NA
 9 Monday 01/11/2010   952 greenAverage         NA
10 Monday 01/11/2010   952 bannerBoardings      NA
# … with 13,742 more rows
```

Cleaning up long data

We will use `str_replace` from the `stringr` package to put _ in the names

```
long <- long %>% mutate(
  name = str_replace(name, "Board", "_Board"),
  name = str_replace(name, "Alight", "_Alight"),
  name = str_replace(name, "Average", "_Average")
)
long
```

```
# A tibble: 13,752 × 5
   day    date       daily name              value
   <chr>  <chr>      <dbl> <chr>             <dbl>
 1 Monday 01/11/2010   952 orange_Boardings    877
 2 Monday 01/11/2010   952 orange_Alightings  1027
 3 Monday 01/11/2010   952 orange_Average      952
 4 Monday 01/11/2010   952 purple_Boardings     NA
 5 Monday 01/11/2010   952 purple_Alightings    NA
 6 Monday 01/11/2010   952 purple_Average       NA
 7 Monday 01/11/2010   952 green_Boardings      NA
 8 Monday 01/11/2010   952 green_Alightings     NA
 9 Monday 01/11/2010   952 green_Average        NA
10 Monday 01/11/2010   952 banner_Boardings     NA
# … with 13,742 more rows
```

Cleaning up long data

Now each `var` is Boardings, Averages, or Alightings. We use "`into =`" to name the new columns and "`sep =`" to show where the separation should happen.

```
long <- long %>%
  separate(name, into = c("line", "type"), sep = "_")
long
```

```
# A tibble: 13,752 × 6
   day    date       daily line   type       value
   <chr>  <chr>      <dbl> <chr>  <chr>      <dbl>
 1 Monday 01/11/2010   952 orange Boardings    877
 2 Monday 01/11/2010   952 orange Alightings  1027
 3 Monday 01/11/2010   952 orange Average      952
 4 Monday 01/11/2010   952 purple Boardings     NA
 5 Monday 01/11/2010   952 purple Alightings    NA
 6 Monday 01/11/2010   952 purple Average      NA
 7 Monday 01/11/2010   952 green  Boardings     NA
 8 Monday 01/11/2010   952 green  Alightings    NA
 9 Monday 01/11/2010   952 green  Average      NA
10 Monday 01/11/2010   952 banner Boardings     NA
# … with 13,742 more rows
```

`pivot_wider...`

Reshaping data from **long to wide**

`pivot_wider()` - spreads row data into columns (`tidyr` package)

- `names_from` = the old column whose contents will be spread into multiple new column names.
- `values_from` = the old column whose contents will fill in the values of those new columns.

```
{wide_data} <- {long_data} %>%
  pivot_wider(names_from = {Old column name: contains new column names},
              values_from = {Old column name: contains new cell values})
```

Reshaping data from long to wide

```
long_data
```

```
# A tibble: 3 × 2
  Month            Rate
  <chr>            <chr>
1 June_vacc_rate   37.2%
2 May_vacc_rate    36.0%
3 April_vacc_rate  32.4%
```

```
wide_data <- long_data %>% pivot_wider(names_from = "Month",
                                       values_from = "Rate")
wide_data
```

```
# A tibble: 1 × 3
  June_vacc_rate May_vacc_rate April_vacc_rate
  <chr>          <chr>         <chr>
1 37.2%          36.0%         32.4%
```

Reshaping Charm City Circulator

```
long
```

```
# A tibble: 13,752 × 6
   day    date       daily line   type        value
   <chr>  <chr>      <dbl> <chr>  <chr>       <dbl>
 1 Monday 01/11/2010   952 orange Boardings     877
 2 Monday 01/11/2010   952 orange Alightings   1027
 3 Monday 01/11/2010   952 orange Average       952
 4 Monday 01/11/2010   952 purple Boardings      NA
 5 Monday 01/11/2010   952 purple Alightings     NA
 6 Monday 01/11/2010   952 purple Average       NA
 7 Monday 01/11/2010   952 green  Boardings      NA
 8 Monday 01/11/2010   952 green  Alightings     NA
 9 Monday 01/11/2010   952 green  Average       NA
10 Monday 01/11/2010   952 banner Boardings      NA
# … with 13,742 more rows
```

Reshaping Charm City Circulator

```
wide <- long %>% pivot_wider(names_from = "type",
                             values_from = "value")
wide
```

```
# A tibble: 4,584 × 7
   day       date       daily line   Boardings Alightings Average
   <chr>     <chr>      <dbl> <chr>      <dbl>      <dbl>   <dbl>
 1 Monday    01/11/2010  952  orange       877       1027    952
 2 Monday    01/11/2010  952  purple        NA         NA     NA
 3 Monday    01/11/2010  952  green         NA         NA     NA
 4 Monday    01/11/2010  952  banner        NA         NA     NA
 5 Tuesday   01/12/2010  796  orange       777        815    796
 6 Tuesday   01/12/2010  796  purple        NA         NA     NA
 7 Tuesday   01/12/2010  796  green         NA         NA     NA
 8 Tuesday   01/12/2010  796  banner        NA         NA     NA
 9 Wednesday 01/13/2010 1212. orange      1203       1220   1212.
10 Wednesday 01/13/2010 1212. purple        NA         NA     NA
# … with 4,574 more rows
```

Summary

- `tidyr` package helps us convert between wide and long data
- `pivot_longer()` goes from wide -> long
  - Specify columns you want to pivot
  - Specify `names_to =` and `values_to =` for custom naming
- `pivot_wider()` goes from long -> wide
  - Specify `names_from =` and `values_from =`