Case Study

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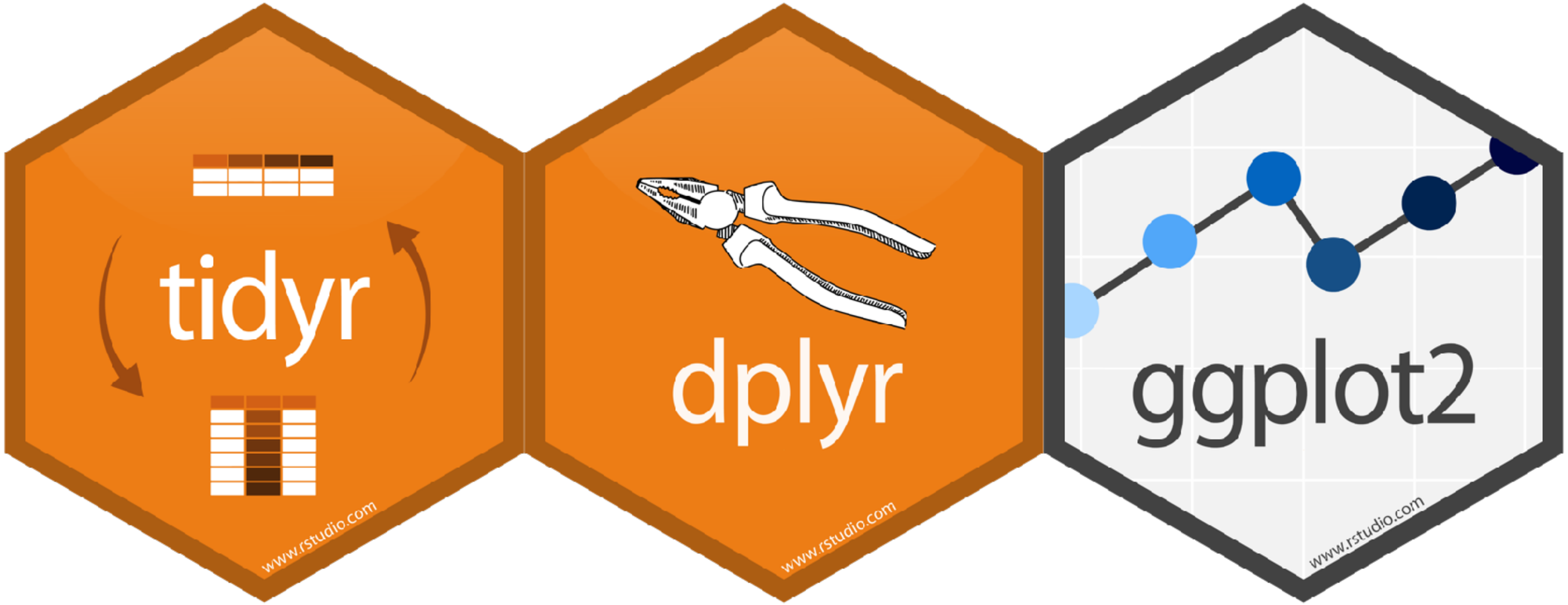
ATLAS
Accessible Teaching, Learning, and Assessment Systems



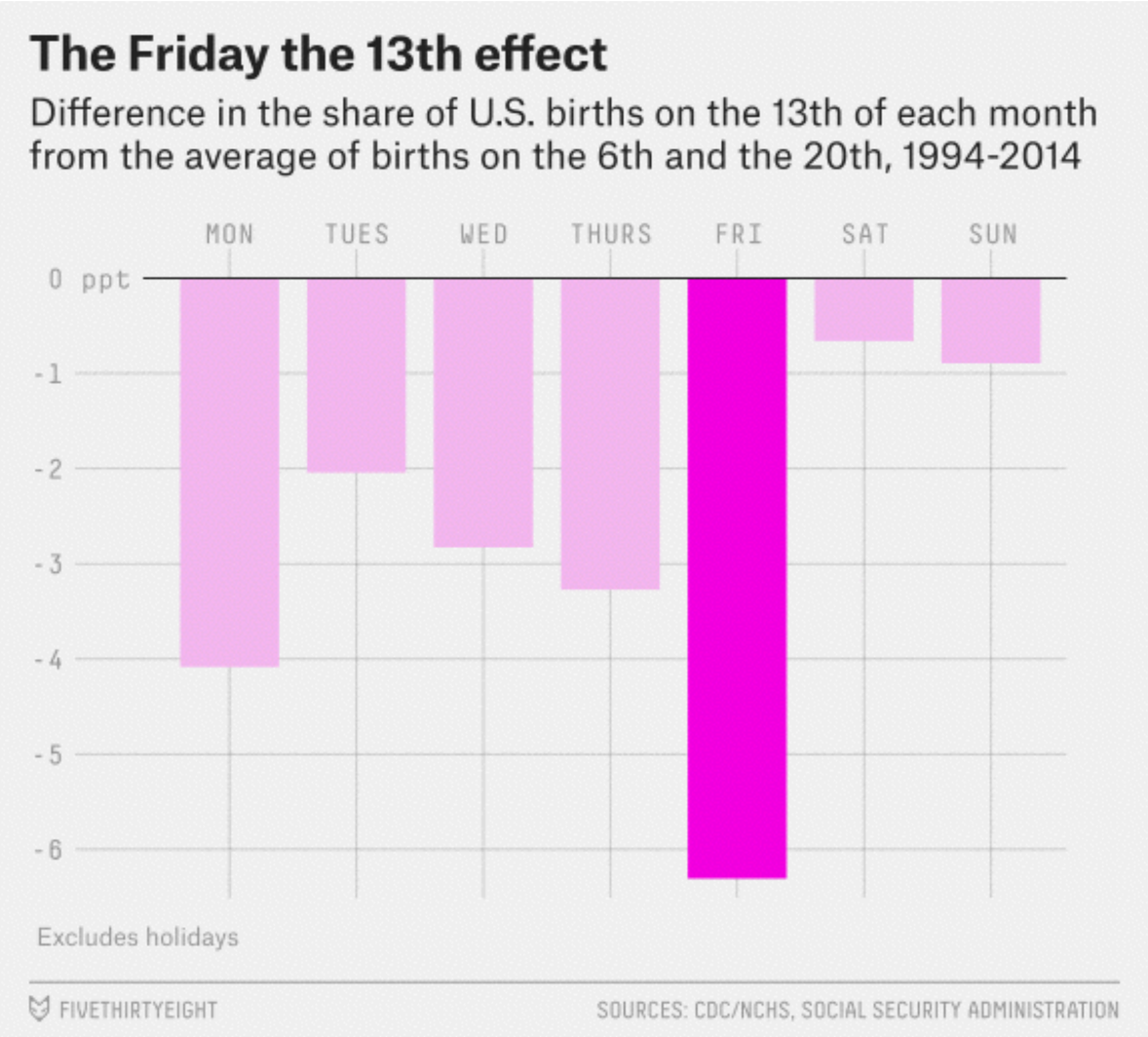
Your Turn 0

- Open **06-Case-Study-1.Rmd**
- Run the setup chunk

fivethirtyeight

Data sets and code from the fivethirtyeight website.
(Not officially published by 'FiveThirtyEight').

```
library(fivethirtyeight)
```

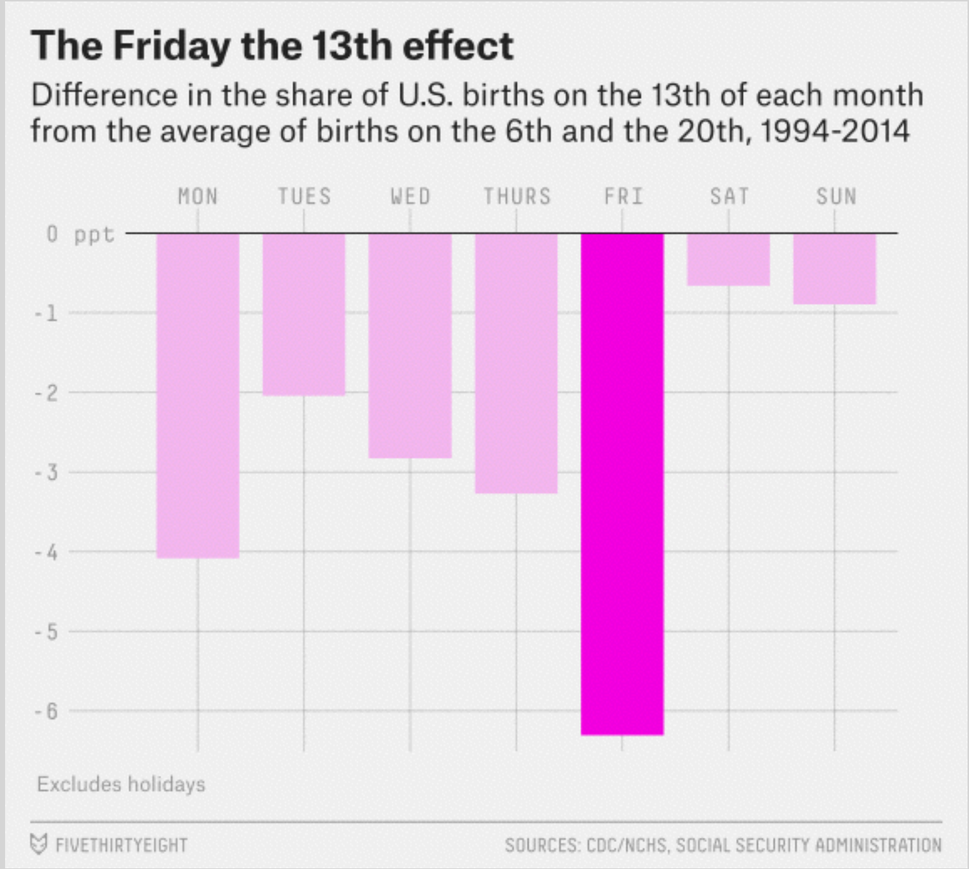


https://fivethirtyeight.com/features/some-people-are-too-superstitious-to-have-a-baby-on-friday-the-13th/

Can we replicate this plot?

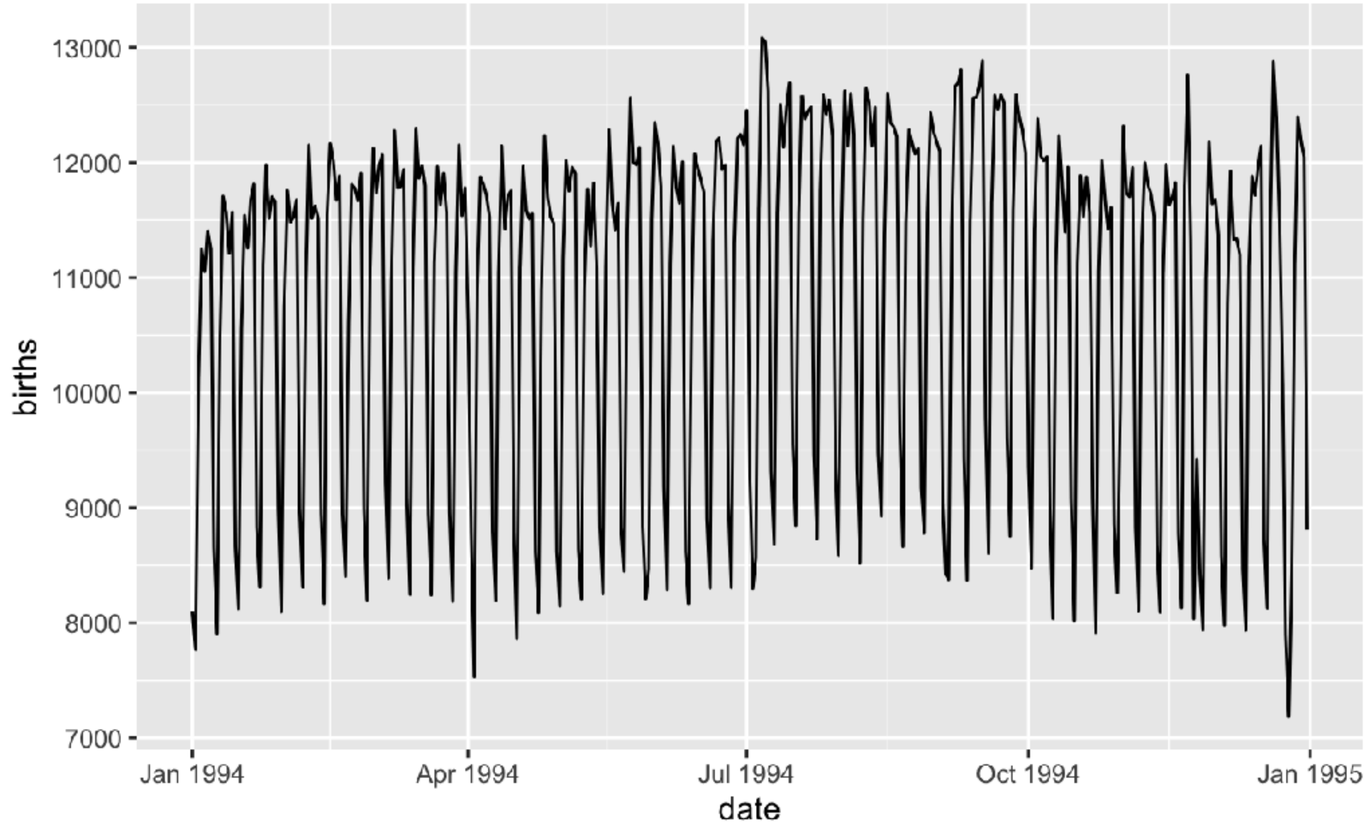
Your Turn 1

- Take a look at **US_births_1994_2003**
- With your neighbor, brainstorm the steps needed to get the data in a form ready to make the plot.

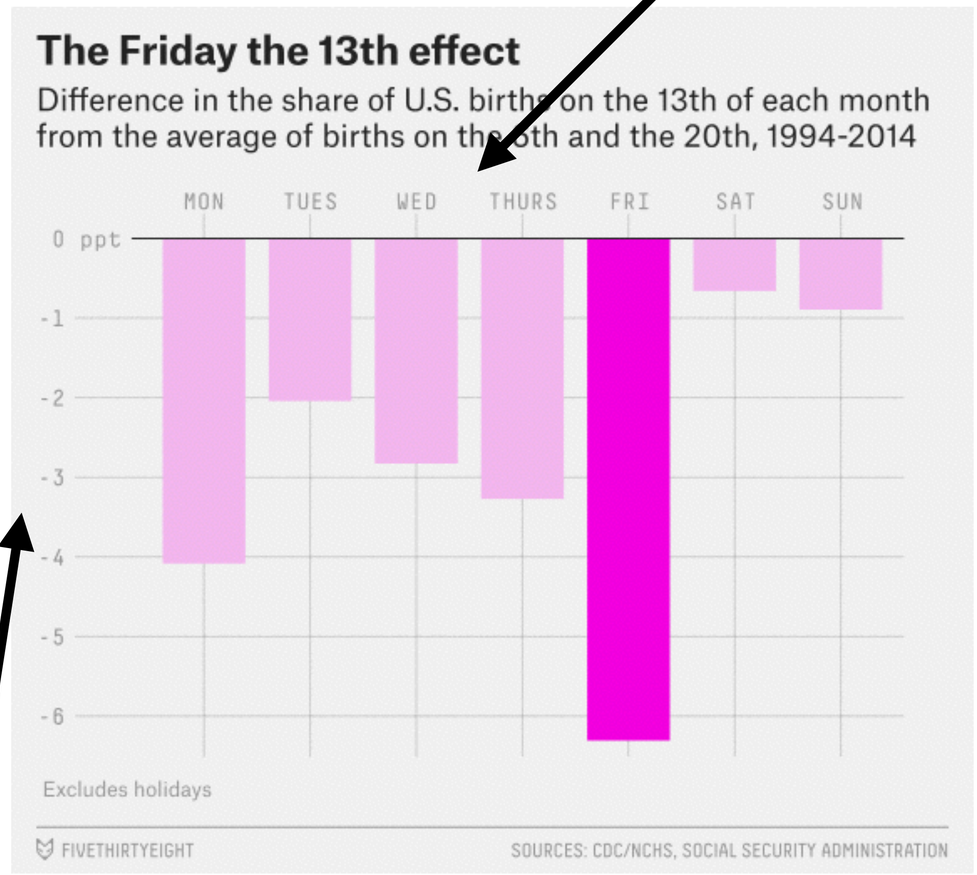


05 : 00

```
US_births_1994_2003 %>%
  filter(year == 1994) %>%
  ggplot(mapping = aes(x = date, y = births)) +
    geom_line()
```



day_of_week



some calculated value

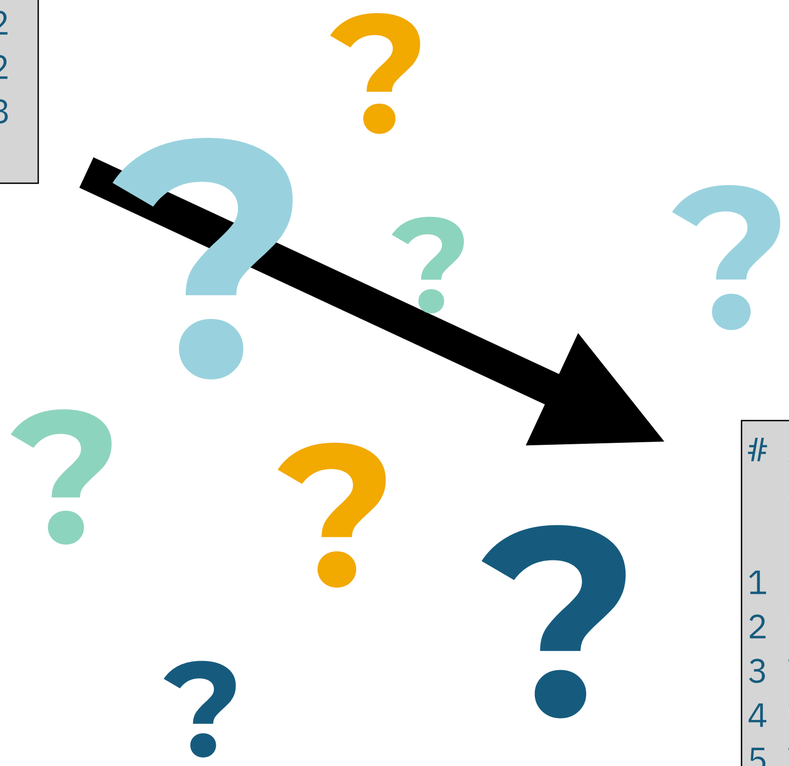
Data required to make the plot

day_of_week	avg_diff_13
Mon	-2.69
Tue	-1.38
Wed	-3.27
...	...

* using slightly different data

Start

```
# A tibble: 3,652 x 6
    year month date_of_month date       day_of_week births
   <int> <int>         <int> <date>     <ord>         <int>
 1  1994     1             1 1994-01-01 Sat            8096
 2  1994     1             2 1994-01-02 Sun            7772
 3  1994     1             3 1994-01-03 Mon           10142
 4  1994     1             4 1994-01-04 Tues          11248
    ...
```



```
# A tibble: 7 x 2
  day_of_week avg_diff_13
  <ord>              <dbl>
1 Sun               -0.303
2 Mon               -2.69
3 Tues              -1.38
4 Wed               -3.27
5 Thurs             -3.01
6 Fri               -6.81
7 Sat               -0.738
```

One such process

- Get just the data for the 6th, 13th, and 20th
- Calculate variable of interest
  - (For each month/year):
    - Find average births on 6th and 20th
    - Find *percentage difference* between births on 13th and average births on 6th and 20th
  - Average *percent difference* by day of the week
- Create plot

Your Turn 2

- Extract just the 6th, 13th, and 20th of each month.

(`select(-date)` is removing the date column, because it gets in the way later and is redundant).

02 : 00

```
US_births_1994_2003 %>%
  select(-date) %>%
  filter(date_of_month %in% c(6, 13, 20))
# A tibble: 360 x 5
    year month date_of_month day_of_week births
   <int> <int>         <int> <ord>         <int>
 1  1994     1             6 Thurs         11406
 2  1994     1            13 Thurs         11212
 3  1994     1            20 Thurs         11682
 4  1994     2             6 Sun            8309
 5  1994     2            13 Sun            8171
 6  1994     2            20 Sun            8402
 7  1994     3             6 Sun            8389
 8  1994     3            13 Sun            8248
 9  1994     3            20 Sun            8243
10  1994     4             6 Wed           11811
# … with 350 more rows
```

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One month

Two options for arranging the data

Which one is tidy?

Option 1
days in rows

year <int>	month <int>	date_of_month <int>	day_of_week <ord>	births <int>
1994	1	6	Thurs	11406
1994	1	13	Thurs	11212
1994	1	20	Thurs	11682

Option 2
days in cols

year <int>	month <int>	day_of_week <ord>	6 <int>	13 <int>	20 <int>
1994	1	Thurs	11406	11212	11682

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Your Turn 3

Which arrangement is tidy?

(**Hint:** think about our next step *"Find the percent difference between the 13th and the average of the 6th and 20th."* In which layout will this be easier using our tidy tools?)

02 : 00

Option 1

days in rows

year <int>	month <int>	date_of_month <int>	day_of_week <ord>	births <int>
1994	1	6	Thurs	11406
1994	1	13	Thurs	11212
1994	1	20	Thurs	11682

Next step, we'd have to write a custom function to summarize these three rows, relying on order, or subsetting to reference dates. NOT TIDY.

Option 2

days in cols

year <int>	month <int>	day_of_week <ord>	6 <int>	13 <int>	20 <int>
1994	1	Thurs	11406	11212	11682

Next step, we can mutate directly referring to columns for days. TIDY!

Your Turn 4

Tidy the filtered data to have the days in columns.

E.g.

year <int>	month <int>	day_of_week <ord>	6 <int>	13 <int>	20 <int>
1994	1	Thurs	11406	11212	11682
1994	2	Sun	8309	8171	8402
1994	3	Sun	8389	8248	8243
1994	4	Wed	11811	11428	11585
1994	5	Fri	11904	11085	11645
1994	6	Mon	11130	10692	11337
1994	7	Wed	13086	12134	12378
1994	8	Sat	9336	9474	9646
1994	9	Tues	11448	12560	12584
1994	10	Thurs	12017	11398	11876

1–10 of 120 rows Previous 1 2 3 4 5 6 ... 12 Next

03 : 00

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```
US_births_1994_2003 %>%
  select(-date) %>%
  filter(date_of_month %in% c(6, 13, 20)) %>%
  pivot_wider(names_from = date_of_month, values_from = births)
# A tibble: 120 x 6
    year month day_of_week   `6`  `13`  `20`
   <int> <int> <ord>       <int> <int> <int>
 1  1994     1 Thurs       11406 11212 11682
 2  1994     2 Sun          8309  8171  8402
 3  1994     3 Sun          8389  8248  8243
 4  1994     4 Wed         11811 11428 11585
 5  1994     5 Fri         11904 11085 11645
 6  1994     6 Mon         11130 10692 11337
 7  1994     7 Wed         13086 12134 12378
 8  1994     8 Sat          9336  9474  9646
 9  1994     9 Tues        11448 12560 12584
10  1994    10 Thurs       12017 11398 11876
# … with 110 more rows
```

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Your Turn 5

Now use **mutate()** to add columns for:

- The average of the births onto 6th and 20th
- The percentage difference between the number of births on the 13th and the average of the 6th and 20th

(Hint: You need to use backpacks ` around the days, e.g., `6`, `13`, and `20` to specify the column names)

03:00

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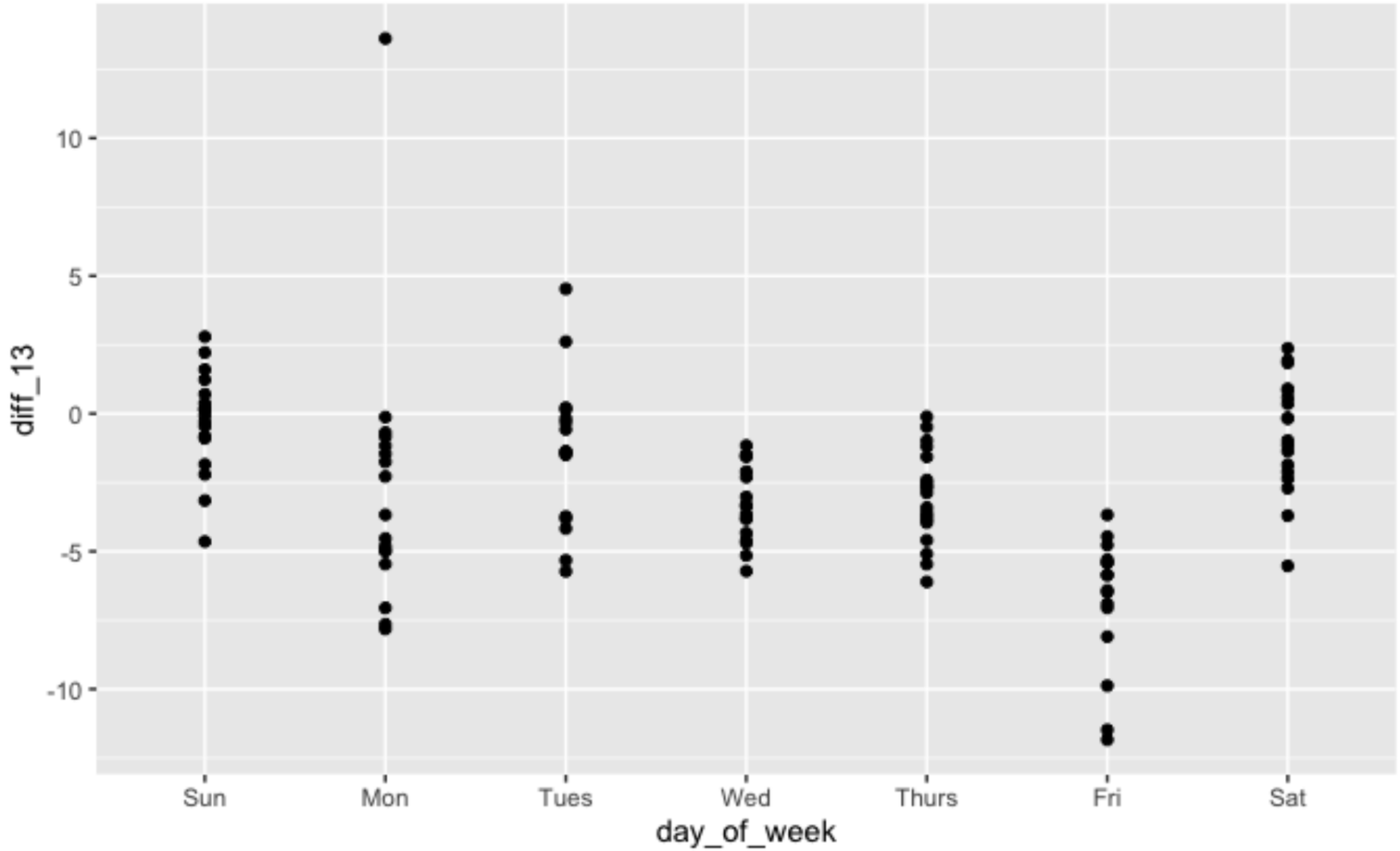
```
births_diff_13 <- US_births_1994_2003 %>%
  select(-date) %>%
  filter(date_of_month %in% c(6, 13, 20)) %>%
  pivot_wider(names_from = date_of_month, values_from = births) %>%
  mutate(avg_6_20 = (`6` + `20`) / 2,
         diff_13 = (`13` - avg_6_20) / avg_6_20 * 100)
# A tibble: 120 x 8
    year month day_of_week   `6`  `13`  `20` avg_6_20 diff_13
   <int> <int> <ord>       <int> <int> <int>    <dbl>   <dbl>
 1  1994     1 Thurs       11406 11212 11682   11544   -2.88
 2  1994     2 Sun          8309  8171  8402    8356.  -2.21
 3  1994     3 Sun          8389  8248  8243    8316   -0.818
 4  1994     4 Wed         11811 11428 11585   11698   -2.31
 5  1994     5 Fri         11904 11085 11645   11774.  -5.86
 6  1994     6 Mon         11130 10692 11337   11234.  -4.82
 7  1994     7 Wed         13086 12134 12378   12732   -4.70
```

```
births_diff_13 %>%
  ggplot(mapping = aes(x = day_of_week, y = diff_13)) +
    geom_point()
```



```
births_diff_13 %>%
  filter(day_of_week == "Mon", diff_13 > 10)
# A tibble: 1 x 8
   year month day_of_week   `6`   `13`   `20` avg_6_20 diff_13
  <int> <int> <ord>       <int> <int> <int>    <dbl>   <dbl>
1  1999     9 Mon          8249 11481 11961    10105    13.6
```

Your Turn 6

Summarize each day of the week to have mean of **diff_13**.

The recreate the fivethirtyeight plot. (**Hint:** if you specify a y aesthetic with **geom_bar()** you'll need to add **stat = "identity"** as an argument.)

(**Extra challenge:** use a different summary, and/or another way of visualizing the data)

05 : 00

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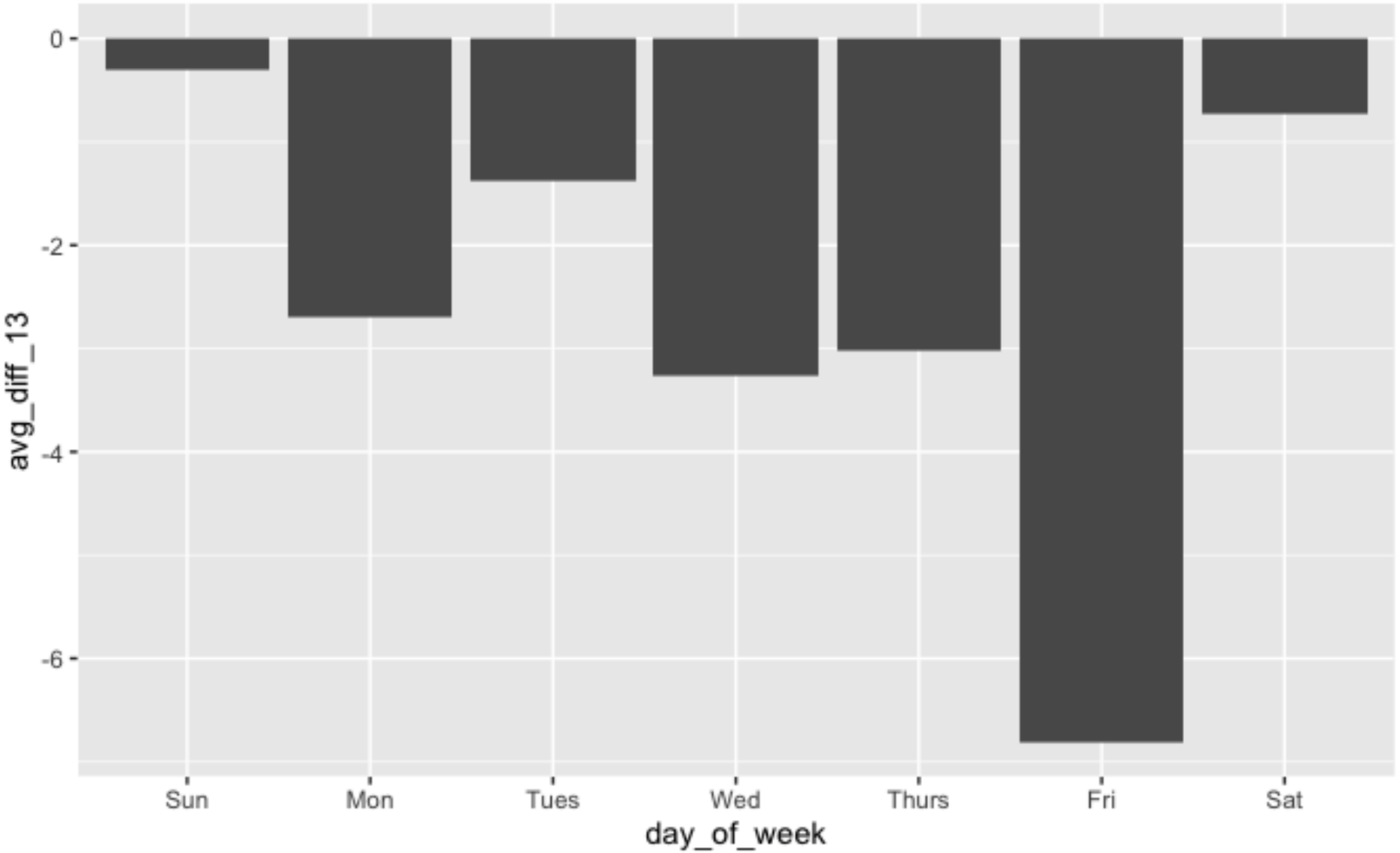
```
births_13_sum <- US_births_1994_2003 %>%
  select(-date) %>%
  filter(date_of_month %in% c(6, 13, 20)) %>%
  spread(date_of_month, births) %>%
  mutate(avg_6_20 = (`6` + `20`)/2,
         diff_13 = (`13` - avg_6_20) / avg_6_20 * 100) %>%
  group_by(day_of_week) %>%
  summarize(avg_diff_13 = mean(diff_13))
# A tibble: 7 x 2
  day_of_week avg_diff_13
  <ord>             <dbl>
1 Sun              -0.303
2 Mon              -2.69
3 Tues             -1.38
4 Wed              -3.27
5 Thurs            -3.01
6 Fri              -6.81
7 Sat              -0.738
```

```
ggplot(data = births_13_sum, aes(x = day_of_week, y = avg_diff_13)) +
  geom_col()
```



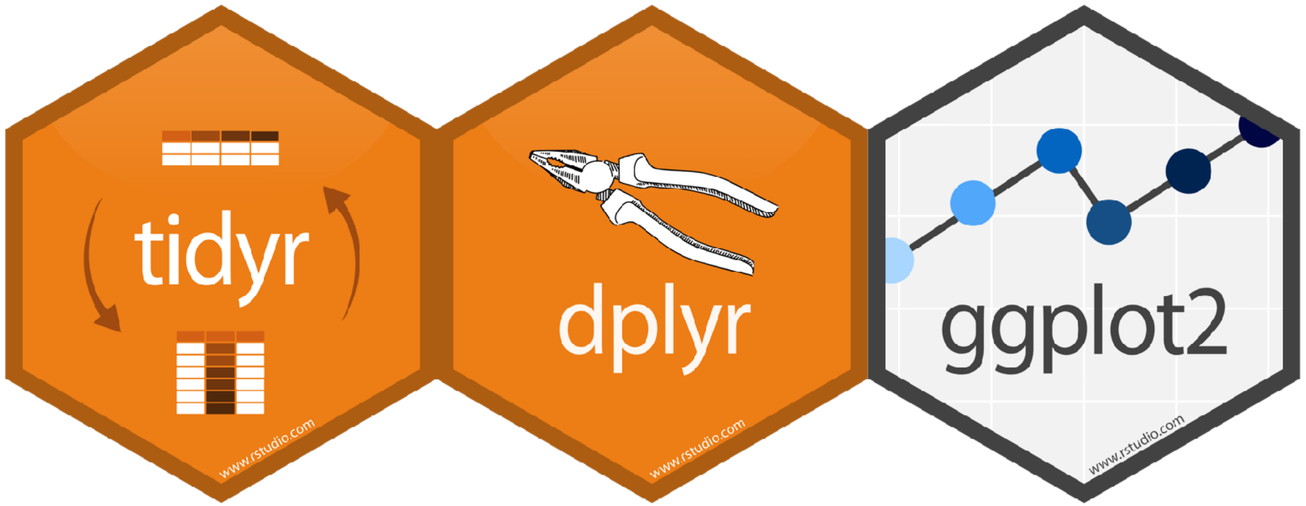
Extra Challenges

If you wanted to use the **US_births_2000_2014** data instead, what would you need to change in the pipeline? How about using both **US_births_1994_2003** and **US_births_2000_2014**?

Try not removing the date column. At what point in the pipeline does it cause problems? Why?

05 : 00

Case Study



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