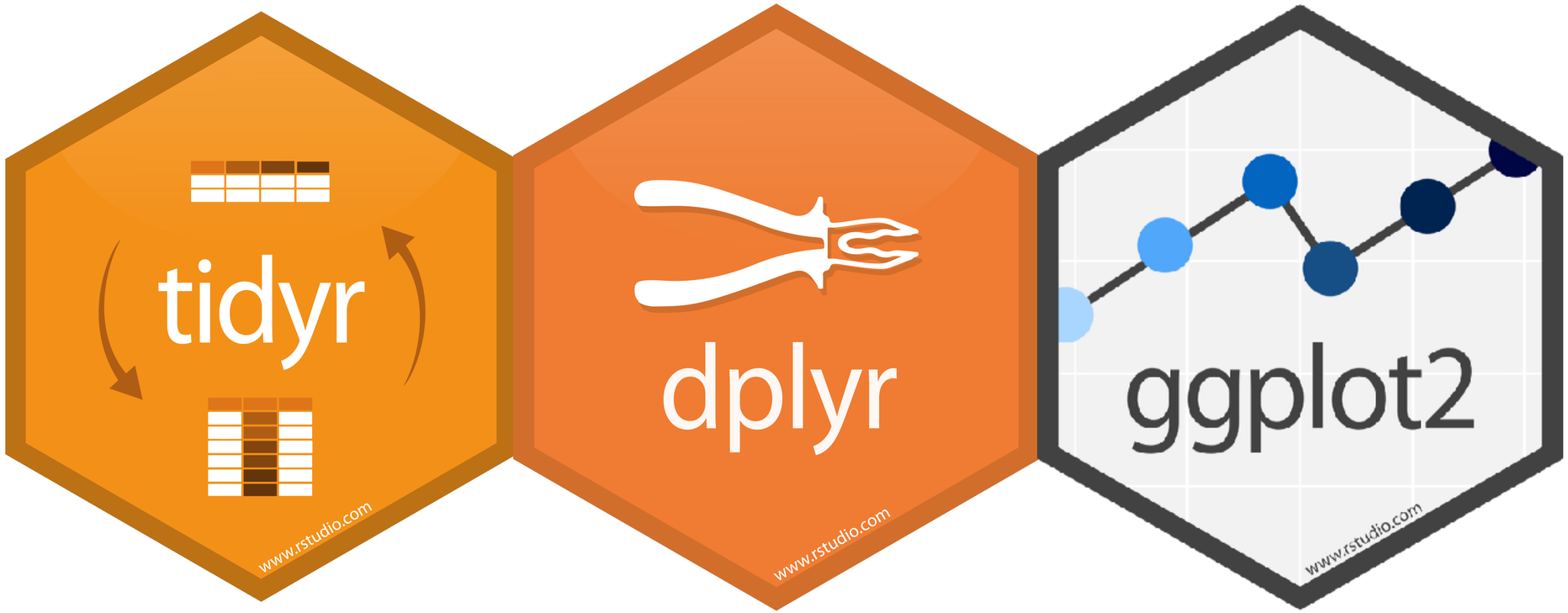
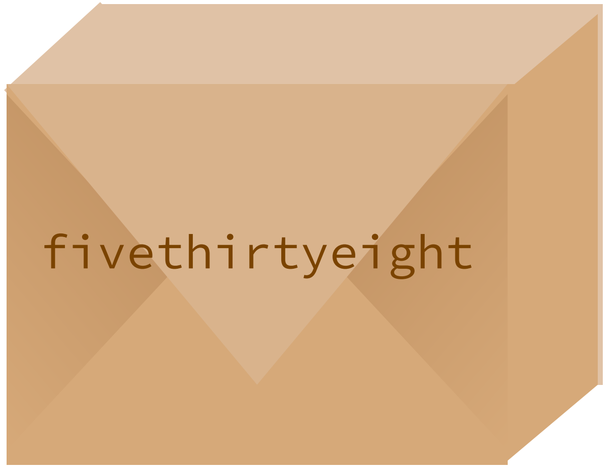
Case Study

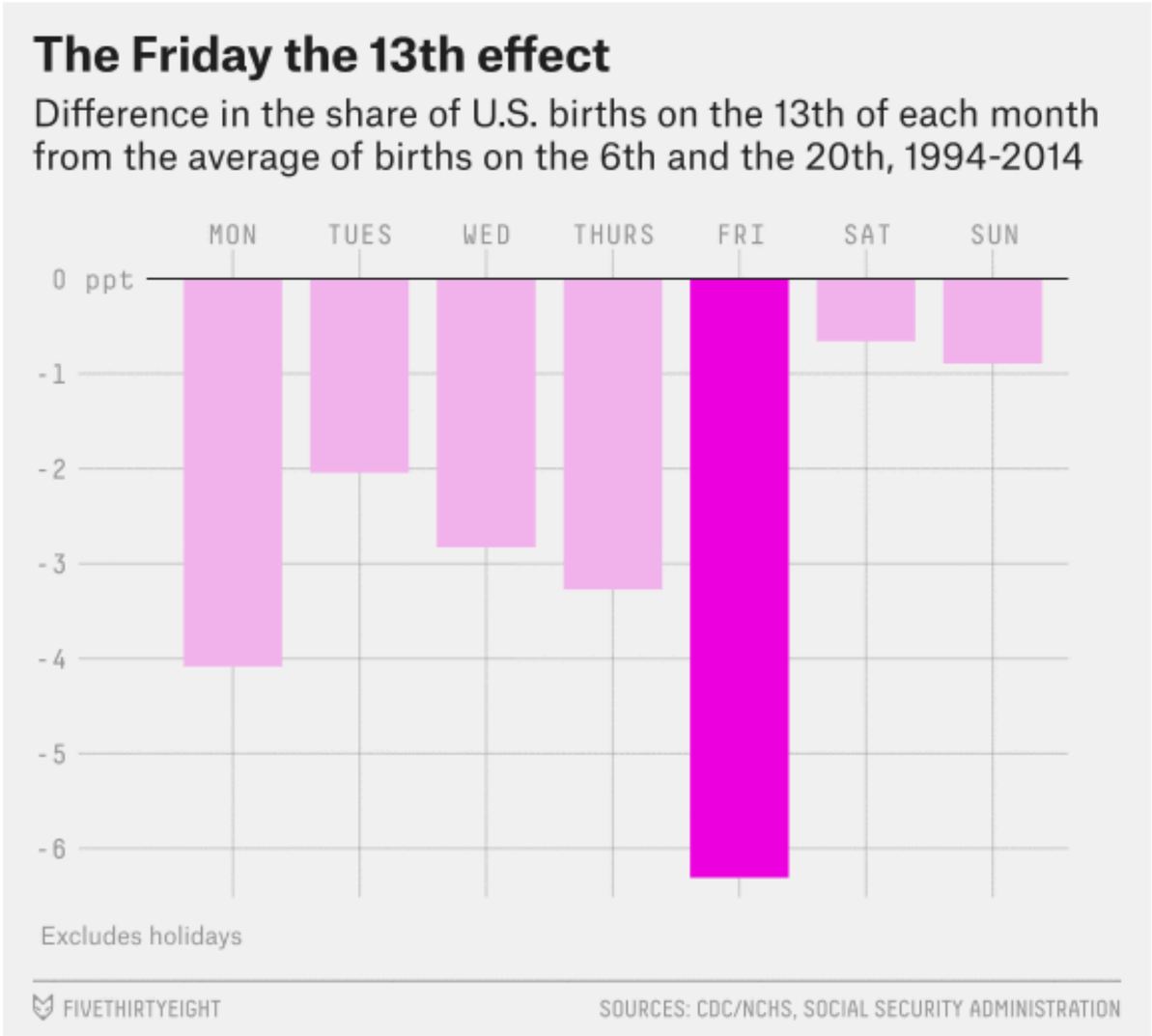


fivethirtyeight



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

```
# install.packages("fivethirtyeight")
library(fivethiryeight)
```



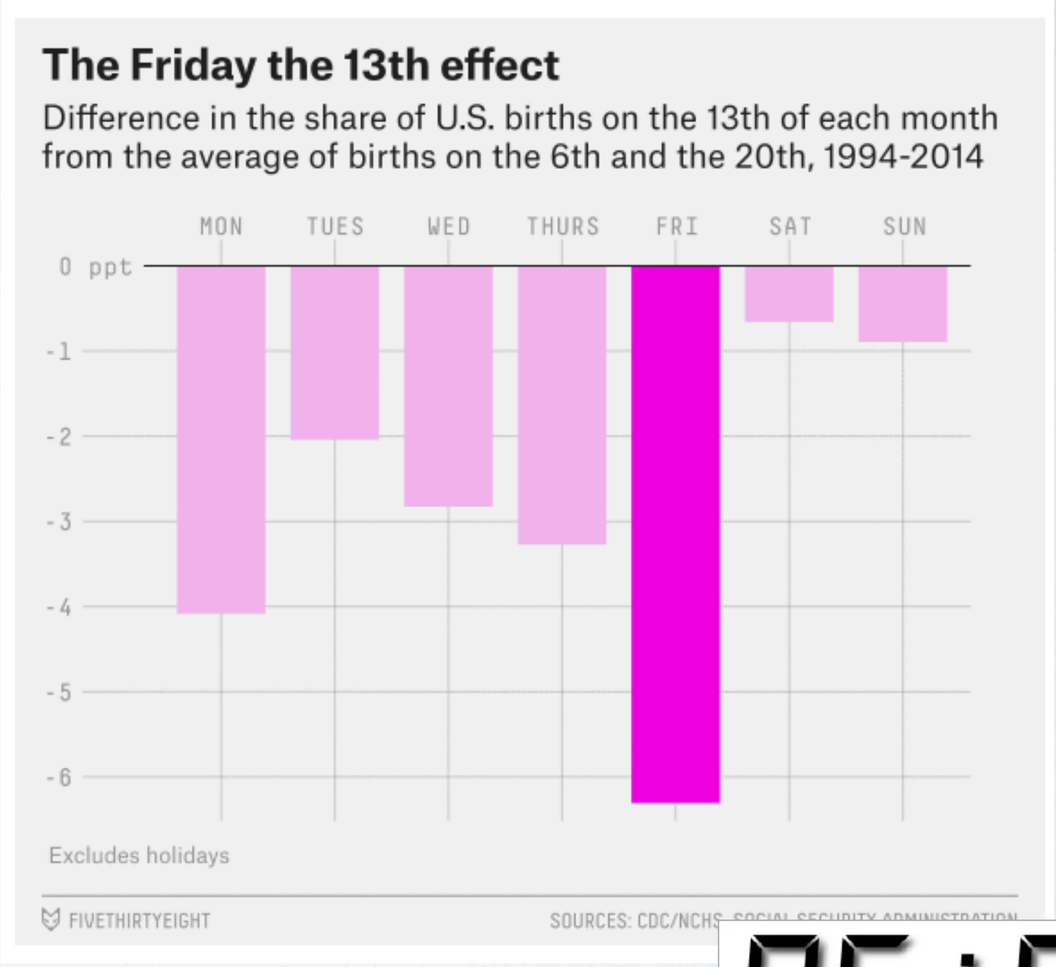
https://fivethirtyeight.com/features/some-people-are-too-superstitious-to-have-a-baby-on-friday-the-13th/

Can we replicate this plot?

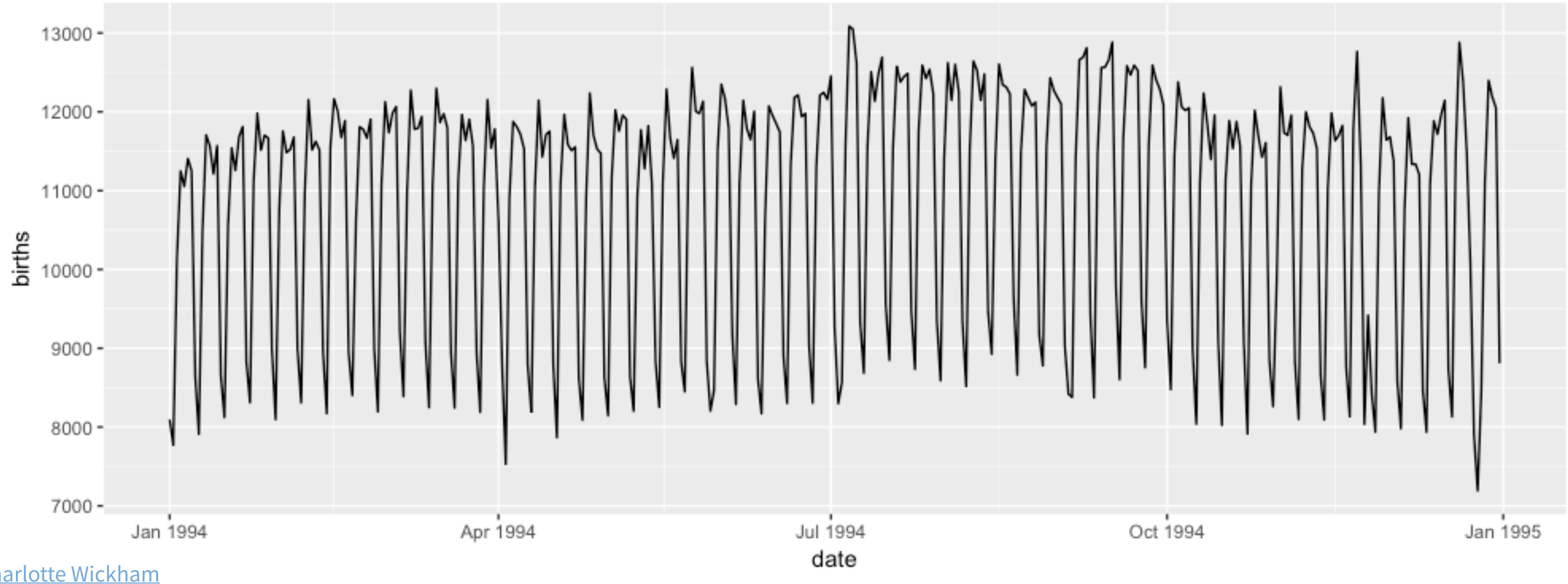
Your Turn 1

Take a look at
`US_births_1994_2003`

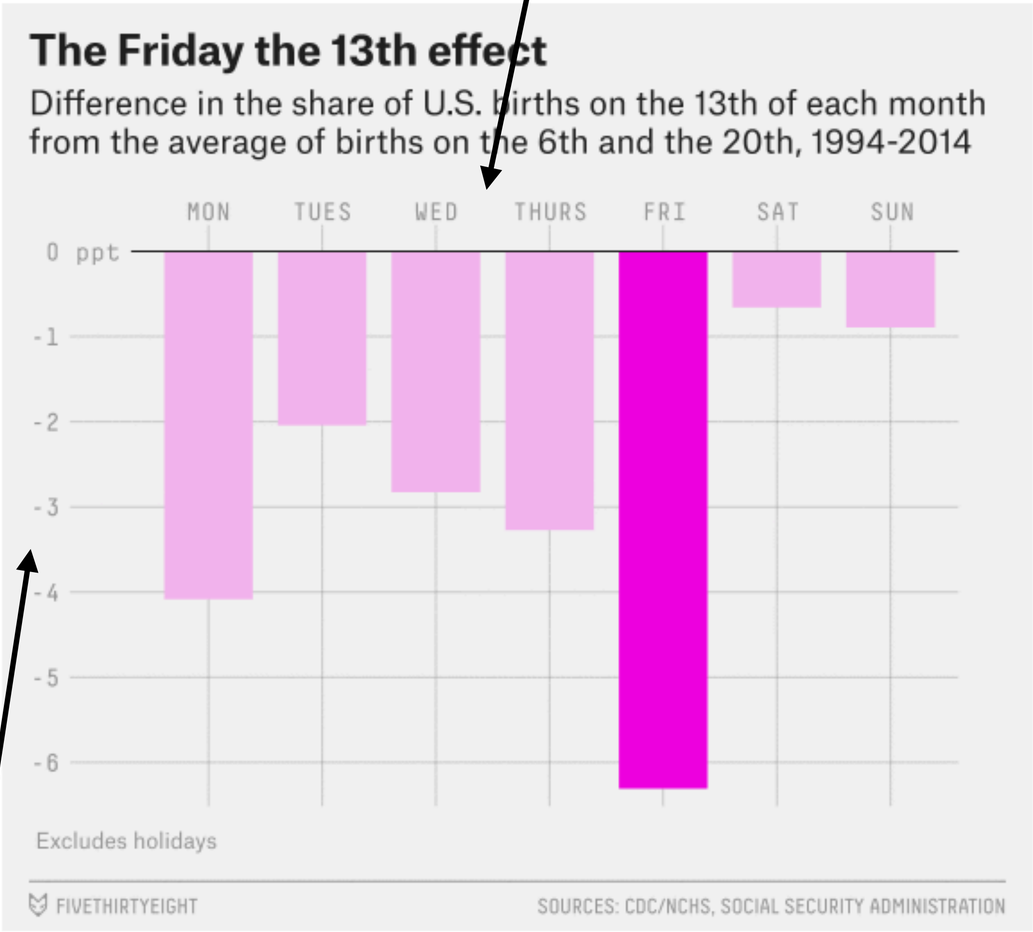
With your neighbour, brainstorm the steps needed to get the data in a form ready to make the plot.



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



day_of_week



some calculated variable

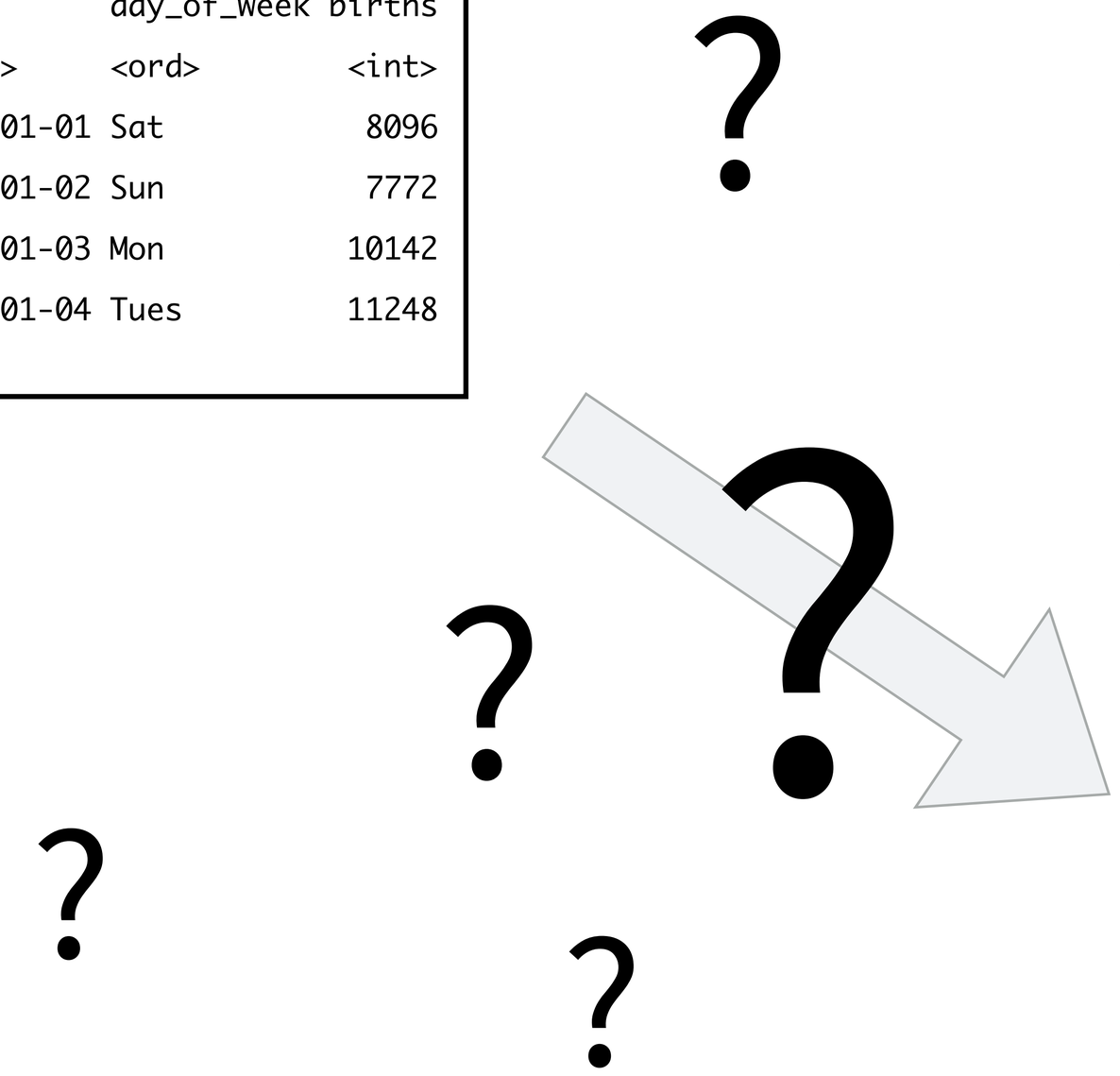
Data required to make the plot

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
    ...
```



End

```
# 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).

```
US_births_1994_2003 %>%
  select(-date) %>%
  filter(date_of_month %in% c(6, 13, 20))
```

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
1994	2	6	Sun	8309
1994	2	13	Sun	8171
1994	2	20	Sun	8402
1994	3	6	Sun	8389
1994	3	13	Sun	8248
1994	3	20	Sun	8243
1994	4	6	Wed	11811

1-10 of 360 rows Previous 1 2 3 4 5 6 ... 36 Next

One month

Two options for arranging the data

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

Which one is tidy?

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 12th"*. In which layout will this be easier using our tidy tools?)

Option 1

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

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

Next step, we can use 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>
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

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

```
US_births_1994_2003 %>%
  select(-date) %>%
  filter(date_of_month %in% c(6, 13, 20)) %>%
  spread(date_of_month, births)
```

	year <int>	month <int>	day_of_week <ord>	6 <int>	13 <int>	20 <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

1-10 of 120 rows

Previous 1 2 3 4 5 6 ... 12 Next

Your Turn 5

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

- The average of the births on the 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 backticks ` around the days, e.g. `` `6` ``, `` `13` `` and `` `20` `` to specify the column names)

```
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
  )
```

year <int>	month <int>	day_of_week <ord>	6 <int>	13 <int>	20 <int>	avg_6_20 <dbl>	diff_13 <dbl>
1994	1	Thurs	11406	11212	11682	11544.0	-2.87595288
1994	2	Sun	8309	8171	8402	8355.5	-2.20812638
1994	3	Sun	8389	8248	8243	8316.0	-0.81770082
1994	4	Wed	11811	11428	11585	11698.0	-2.30808685
1994	5	Fri	11904	11085	11645	11774.5	-5.85587498
1994	6	Mon	11130	10692	11337	11233.5	-4.82040326
1994	7	Wed	13086	12134	12378	12732.0	-4.69682689
1994	8	Sat	9336	9474	9646	9491.0	-0.17911706
1994	9	Tues	11448	12560	12584	12016.0	4.52729694
1994	10	Thurs	12017	11398	11876	11946.5	-4.59130289

1-10 of 120 rows

Previous 1 2 3 4 5 6 ... 12 Next

```r
births_diff_13 <- 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
  )
```

year <int>	month <int>	day_of_week <ord>	6 <int>	13 <int>	20 <int>	avg_6_20 <dbl>	diff_13 <dbl>
1994	1	Thurs	11406	11212	11682	11544.0	-2.87595288
1994	2	Sun	8309	8171	8402	8355.5	-2.20812638
1994	3	Sun	8389	8248	8243	8316.0	-0.81770082
1994	4	Wed	11811	11428	11585	11698.0	-2.30808685
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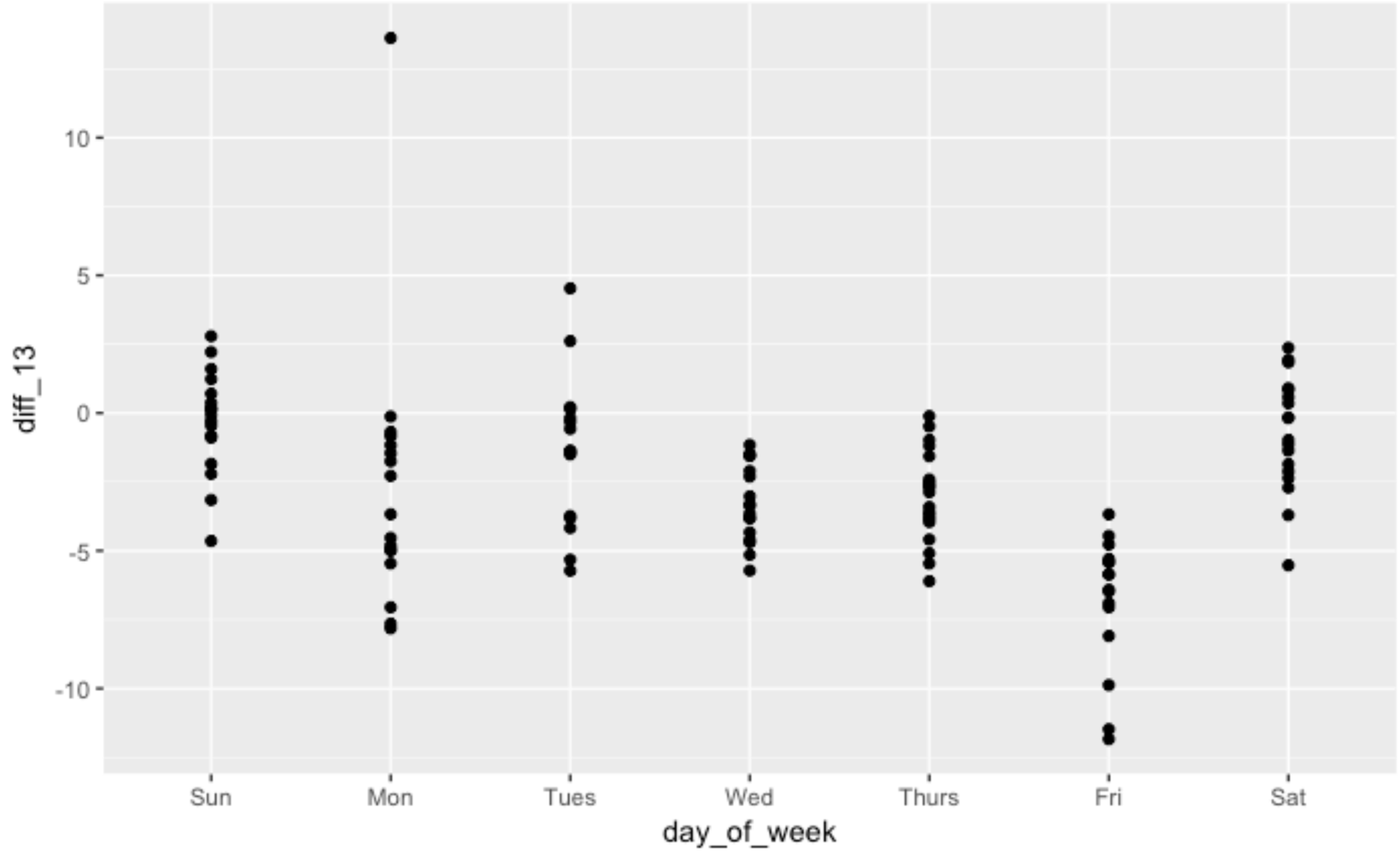
1994	7	Wed	13086	12134	12378	12732.0	-4.69682689
1994	8	Sat	9336	9474	9646	9491.0	-0.17911706
1994	9	Tues	11448	12560	12584	12016.0	4.52729694
1994	10	Thurs	12017	11398	11876	11946.5	-4.59130289

1-10 of 120 rows

Previous 1 2 3 4 5 6 ... 12 Next

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



```
births_diff_13 %>%
  filter(day_of_week == "Mon", diff_13 > 10)
```

year <int>	month <int>	day_of_week <ord>	6 <int>	13 <int>	20 <int>	avg_6_20 <dbl>	diff_13 <dbl>
1999	9	Mon	8249	11481	11961	10105	13.61702

1 row

Your Turn 6

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

Then, 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)

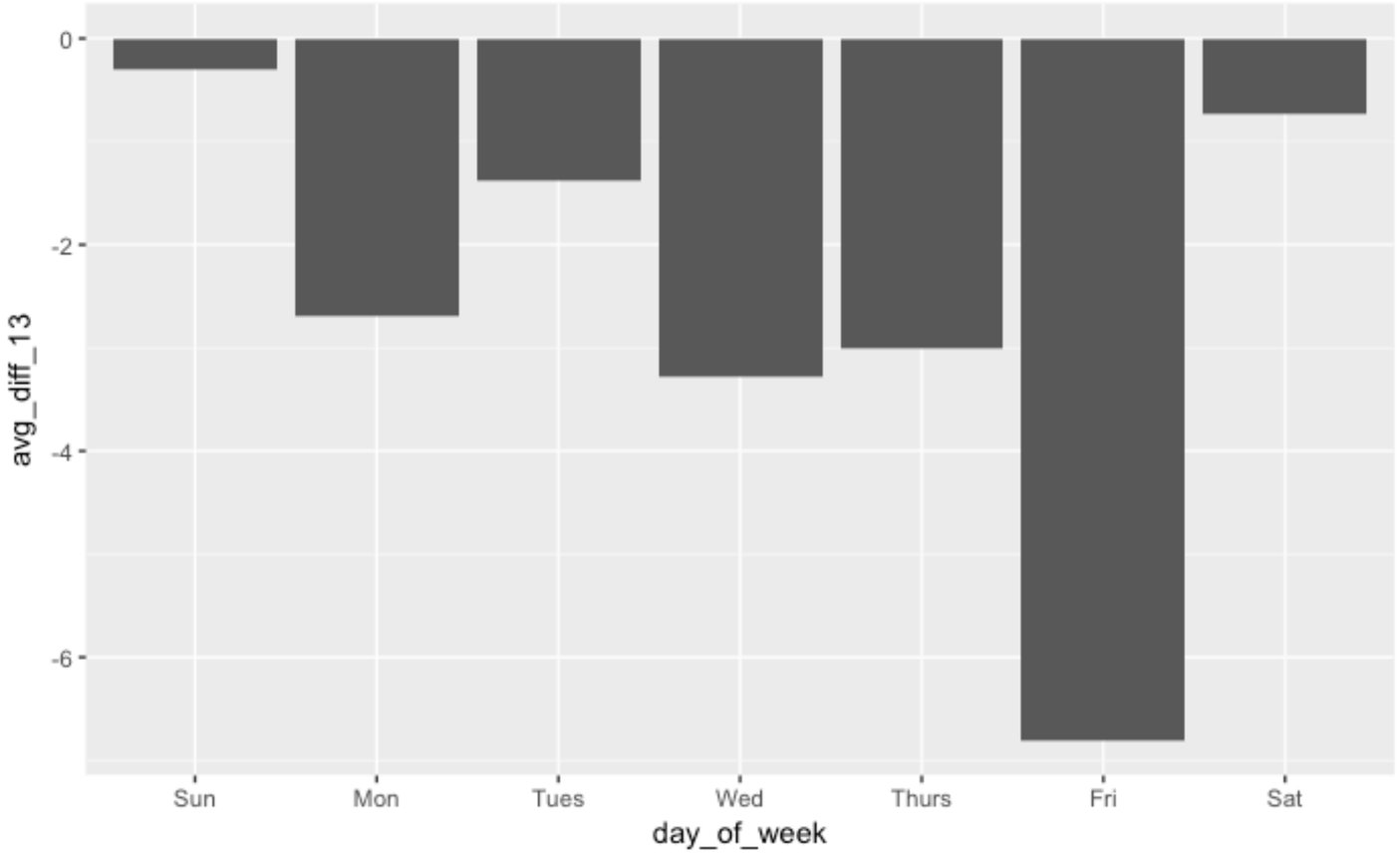
```
US_births_1994_2003 %>%
  select(-date) %>%
  filter(date_of_month %in% c(6, 13, 20)) %>%
  spread(date_of_month, births) %>%
  mutate(
    avg_6_20 = (`6` + `20`)/2,
    diff_13 = (`13` - avg_6_20) / avg_6_20 * 100
  ) %>%
  group_by(day_of_week) %>%
  summarise(avg_diff_13 = mean(diff_13))
```

day_of_week <ord>	avg_diff_13 <dbl>
Sun	-0.3026934
Mon	-2.6856859
Tues	-1.3776517
Wed	-3.2735133
Thurs	-3.0117652
Fri	-6.8057874
Sat	-0.7376400

```
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) %>%
  summarise(avg_diff_13 = mean(diff_13))
```

day_of_week <ord>	avg_diff_13 <dbl>
Sun	-0.3026934
Mon	-2.6856859
Tues	-1.3776517
Wed	-3.2735133
Thurs	-3.0117652
Fri	-6.8057874
Sat	-0.7376400

```
births_13_sum  %>%
  ggplot(aes(x = day_of_week, y = avg_diff_13)) +
    geom_bar(stat = "identity")
```



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?

Can you come up with an alternative way to investigate the Friday the 13th effect? Try it out!

Case Study