Finishing up with tidy data

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Week 7, Class 2

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Agenda

- Discuss `gather` and `spread` more

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Learning objectives for today

- Get more comfortable with moving from wide to long
- Understand when you may need to "overgather", an how to best approach this


What questions do you have?

Revisiting *git*

Talk with neighbor. What do these terms mean?

- clone
- pull
- stage
- commit
- push
- repo
- remote

Reasons to prefer tidy data

- More efficient storage and retrieval
- More scalable
- The *tidyverse* of tools will work much more efficiently

Read in the hiv data

Note, you'll need to add `header = TRUE` to `import` to get it to treat the first row as column names instead of data.

- Make some manipulations (just {dplyr} variety) to make the data look like the below.
- Are these data tidy?
- How would you add a new variable - say, percent aids?
- Discuss how you would transform these data, if at all.

```
## # A tibble: 3 x 5
##   country             `1979` `1989` `1999` `2009`
##   <chr>                <dbl> <lgl>   <dbl>  <dbl>
## 1 France              NA     NA        0.3    0.4
## 2 South Africa        NA     NA       14.8   17.2
## 3 United States  0.03176408 NA        0.5    0.6
```

How do we tidy these data?

- Use the `gather()` function from *tidyr*

```
hiv_tidy <- hiv %>%
    gather(year, percentage, -1)
head(hiv_tidy)
```

```
## # A tibble: 6 x 3
##   country       year   percentage
##   <chr>         <chr>       <dbl>
## 1 France        1979  NA
## 2 South Africa  1979  NA
## 3 United States 1979   0.03176408
## 4 France        1989  NA
## 5 South Africa  1989  NA
## 6 United States 1989  NA
```

How do we tidy these data?

- Use the `gather()` function from *tidyr*

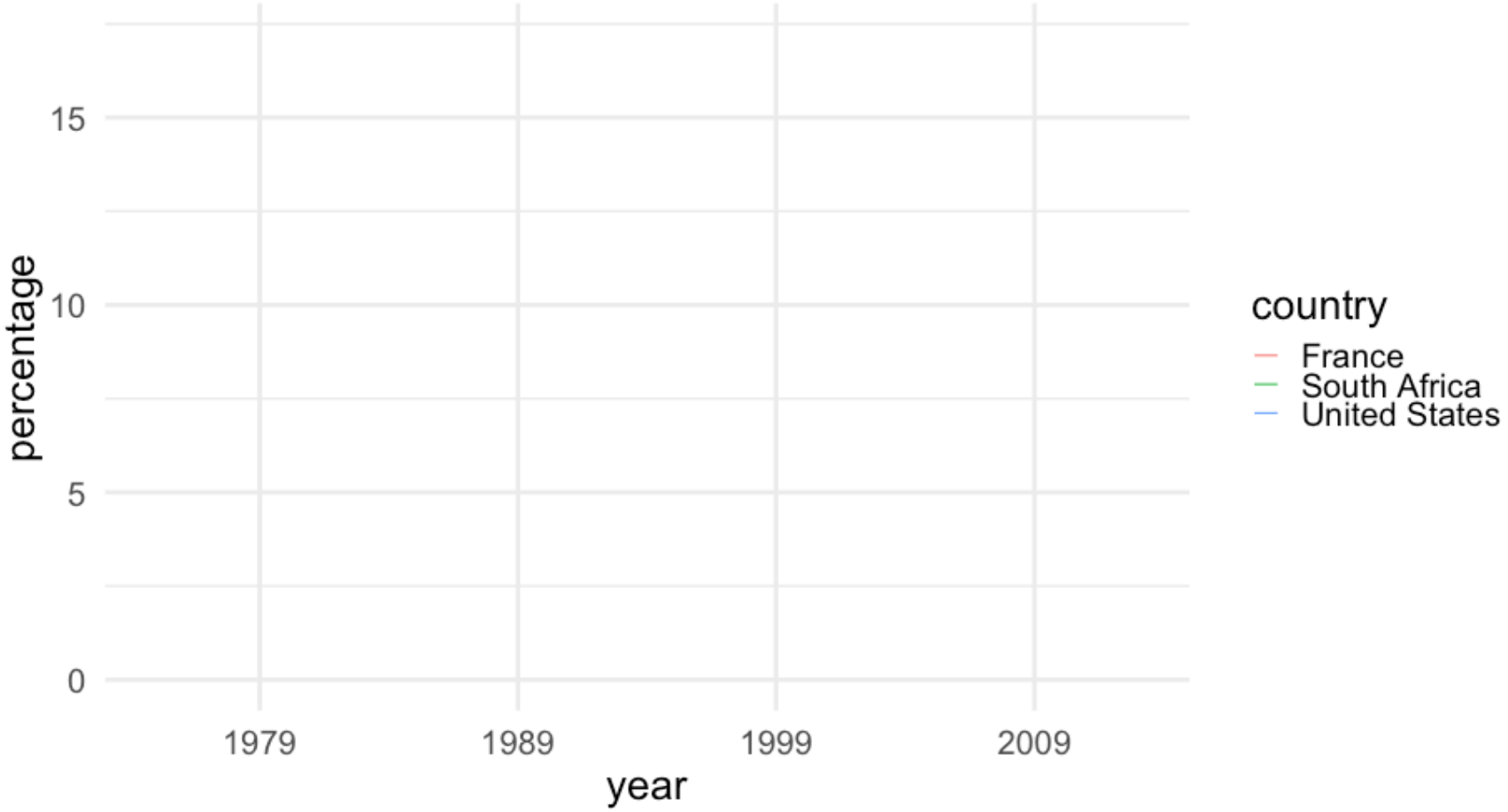
```
hiv_tidy <- hiv %>%
    gather(year, percentage, -1)
head(hiv_tidy)
```

```
## # A tibble: 6 x 3
##   country       year   percentage
##   <chr>         <chr>       <dbl>
## 1 France        1979  NA
## 2 South Africa  1979  NA
## 3 United States 1979   0.03176408
## 4 France        1989  NA
## 5 South Africa  1989  NA
## 6 United States 1989  NA
```

We still have a problem here... What is it?

Trying to plot

```
ggplot(hiv_tidy, aes(year, percentage, color = country)) +
  geom_line()
```



Redefine year as numeric

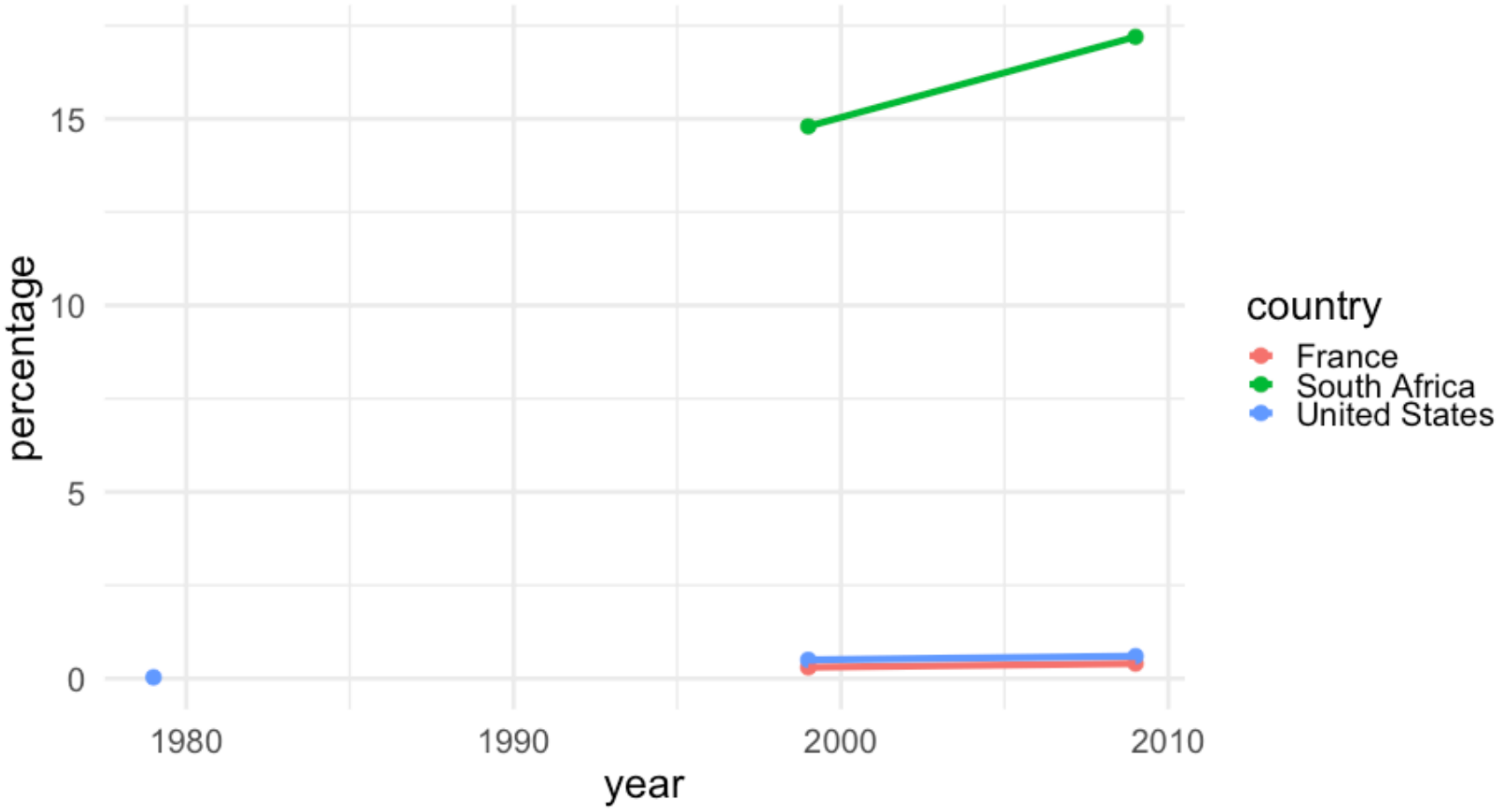
```
library(magrittr)
hiv_tidy %<>%
  mutate(year = parse_number(year))

head(hiv_tidy)
```

```
## # A tibble: 6 x 3
##   country        year  percentage
##   <chr>         <dbl>       <dbl>
## 1 France         1979 NA
## 2 South Africa   1979 NA
## 3 United States  1979  0.03176408
## 4 France         1989 NA
## 5 South Africa   1989 NA
## 6 United States  1989 NA
```

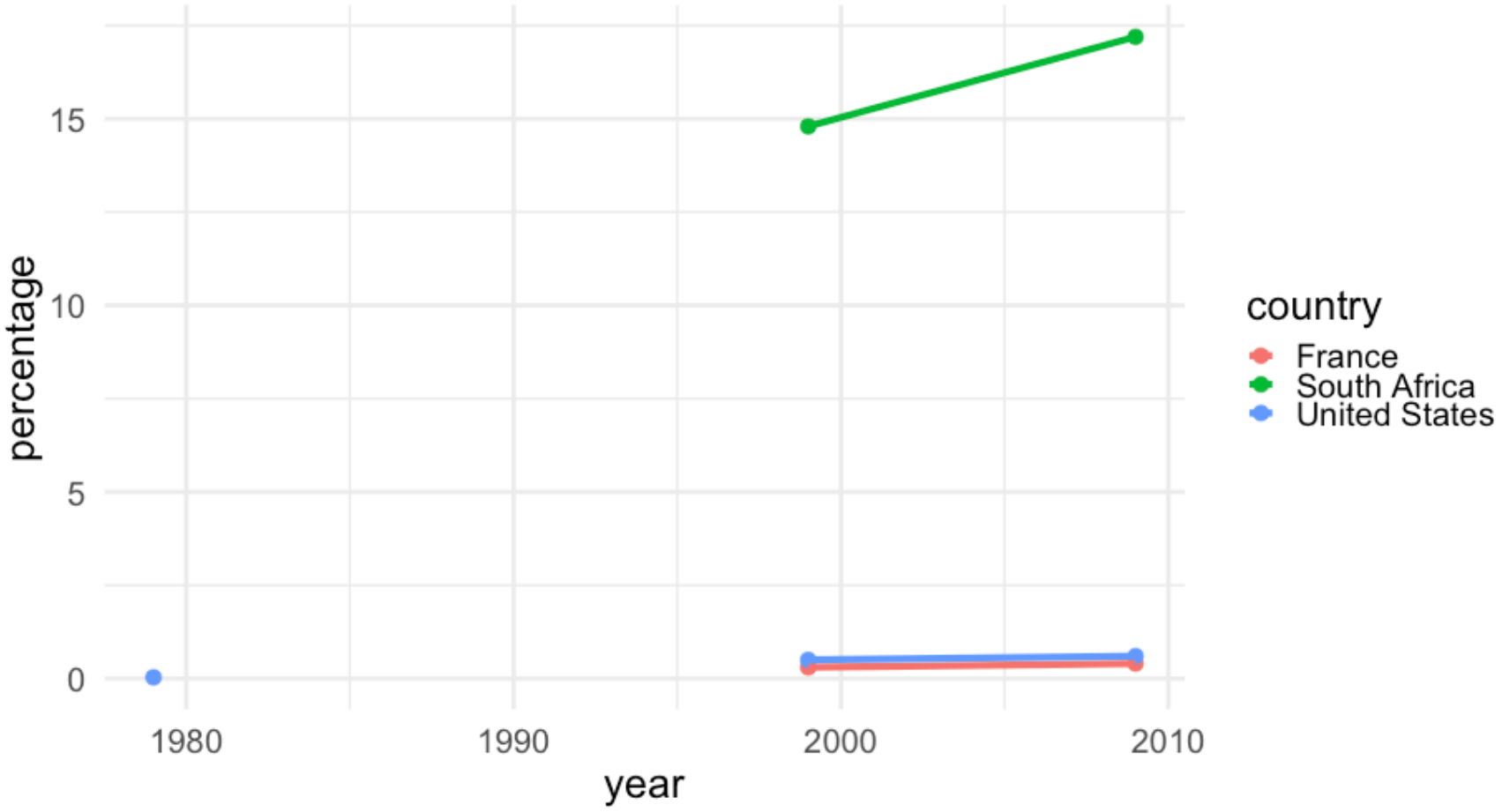
Trying to plot again

```
ggplot(hiv_tidy, aes(year, percentage, color = country)) +
  geom_point(size = 4) +
  geom_line(size = 2)
```



Trying to plot again

```
ggplot(hiv_tidy, aes(year, percentage, color = country)) +
  geom_point(size = 4) +
  geom_line(size = 2)
```



Missing data

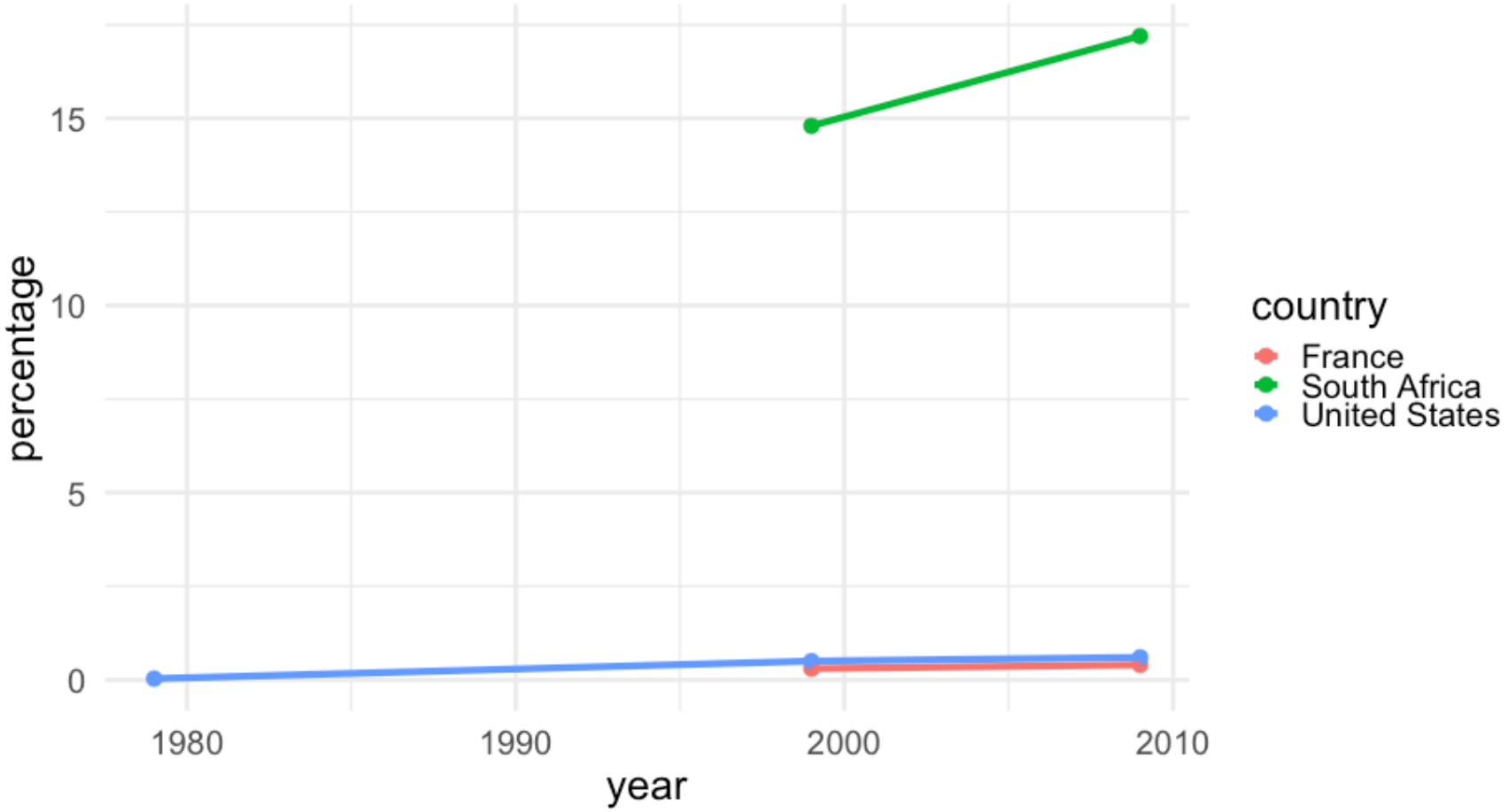
```
hiv_tidy
```

```
## # A tibble: 12 x 3
##    country        year  percentage
##    <chr>         <dbl>       <dbl>
##  1 France         1979 NA
##  2 South Africa   1979 NA
##  3 United States  1979  0.03176408
##  4 France         1989 NA
##  5 South Africa   1989 NA
##  6 United States  1989 NA
##  7 France         1999  0.3
##  8 South Africa   1999 14.8
##  9 United States  1999  0.5
## 10 France         2009  0.4
## 11 South Africa   2009 17.2
## 12 United States  2009  0.6
```

```
hiv_tidy %>%
  filter(!is.na(percentage))
```

```
## # A tibble: 7 x 3
##   country        year  percentage
##   <chr>         <dbl>       <dbl>
## 1 United States  1979  0.03176408
## 2 France         1999  0.3
## 3 South Africa   1999 14.8
## 4 United States  1999  0.5
## 5 France         2009  0.4
## 6 South Africa   2009 17.2
## 7 United States  2009  0.6
```

```
hiv_tidy %>%
  filter(!is.na(percentage)) %>%
  ggplot(aes(year, percentage, color = country)) +
  geom_point(size = 4) +
  geom_line(size = 2)
```



How does `gather` *work?*

arg 3
Columns to Gather

```
# A tibble: 3 x 5
        Country `1979` `1989` `1999` `2009`
          <chr>  <dbl>  <lgl>  <dbl>  <dbl>
1          France     NA     NA    0.3    0.4
2    South Africa     NA     NA   14.8   17.2
3   United States 0.0318     NA    0.5    0.6
```

gather(**year**, **percentage**, **-1**)

arg 1 arg 2

```
# A tibble: 12 x 3
        Country year  percentage
          <chr> <chr>      <dbl>
1          France 1979       NA
2    South Africa 1979       NA
3   United States 1979   0.0318
4          France 1989       NA
5    South Africa 1989       NA
6   United States 1989       NA
7          France 1999   0.3000
8    South Africa 1999  14.8000
9   United States 1999   0.5000
10         France 2009   0.4000
11   South Africa 2009  17.2000
12  United States 2009   0.6000
```

Pop quiz

- What would have happened if I didn't use `-1` to define the columns to gather?

Country is part of the gather

```
hiv %>%
    gather(year, percentage)
```

```
## # A tibble: 15 x 2
##    year    percentage
##    <chr>   <chr>
##  1 country France
##  2 country South Africa
##  3 country United States
##  4 1979    <NA>
##  5 1979    <NA>
##  6 1979    0.031764078
##  7 1989    <NA>
##  8 1989    <NA>
##  9 1989    <NA>
## 10 1999    0.3
## 11 1999    14.8
## 12 1999    0.5
## 13 2009    0.4
## 14 2009    17.2
## 15 2009    0.6
```

Declaring columns to gather

- I could have declared the columns to gather other ways. The important part is just being clear which columns should be part of the gather. All of the below are equivalent

```
hiv %>%
    gather(year, percentage, -1)
```

```
hiv %>%
    gather(year, percentage, `1979`, `1989`, `1999`, `2009`)
```

```
hiv %>%
    gather(year, percentage, `1979`:`2009`)
```

```
hiv %>%
    gather(year, percentage, -country)
```

A few more examples (follow along)

- Load the *votes_repub.csv* dataset.

```
votes <- import(here("data", "votes_repub.csv"),
                setclass = "tbl_df")
head(votes)
```

```
## # A tibble: 6 x 32
##   V1      X1856 X1860 X1864 X1868 X1872 X1876    X1880 X1884 X1888   X1892
##   <chr>   <dbl> <dbl> <dbl> <dbl> <dbl> <dbl>    <dbl> <dbl> <dbl>   <dbl>
## 1 Alabama NA    NA    NA    51.44 53.19 40.02 36.98000 38.44 32.28  3.95
## 2 Alaska  NA    NA    NA    NA    NA    NA    NA       NA    NA    NA
## 3 Arizona NA    NA    NA    NA    NA    NA    NA       NA    NA    NA
## 4 Arkans… NA    NA    NA    53.73 52.17 39.88 39.550   40.5  38.07 32.0100
## 5 Califo… 18.77 32.96 58.63 50.24 56.38 50.88 48.92    52.08 49.95 43.76
## 6 Colora… NA    NA    NA    NA    NA    NA    51.28    54.39 55.31 41.13
## # ... with 21 more variables: X1896 <dbl>, X1900 <dbl>, X1904 <dbl>,
## #   X1908 <dbl>, X1912 <dbl>, X1916 <dbl>, X1920 <dbl>, X1924 <dbl>,
## #   X1928 <dbl>, X1932 <dbl>, X1936 <dbl>, X1940 <dbl>, X1944 <dbl>,
## #   X1948 <dbl>, X1952 <dbl>, X1956 <dbl>, X1960 <dbl>, X1964 <dbl>,
## #   X1968 <dbl>, X1972 <dbl>, X1976 <dbl>
```

Discuss with neighbor

- What's the first step to tidy these data?
- Second?

Step 1: Name state

- dplyr syntax

```
votes <- votes %>%
  rename(state = V1)
```

Step 2: `gather()`

```
votes %>%
    gather(year, approval_rating, -1)
```

```
## # A tibble: 1,550 x 3
##    state       year  approval_rating
##    <chr>       <chr>           <dbl>
##  1 Alabama     X1856              NA
##  2 Alaska      X1856              NA
##  3 Arizona     X1856              NA
##  4 Arkansas    X1856              NA
##  5 California  X1856              18.77
##  6 Colorado    X1856              NA
##  7 Connecticut X1856              53.18
##  8 Delaware    X1856               2.11
##  9 Florida     X1856              NA
## 10 Georgia     X1856              NA
## # ... with 1,540 more rows
```

Clean up some

```
votes_tidy <- votes %>%
    gather(year, approval_rating, -1) %>%
    mutate(year = parse_number(year))
votes_tidy
```

```
## # A tibble: 1,550 x 3
##    state        year approval_rating
##    <chr>       <dbl>           <dbl>
##  1 Alabama      1856              NA
##  2 Alaska       1856              NA
##  3 Arizona      1856              NA
##  4 Arkansas     1856              NA
##  5 California   1856           18.77
##  6 Colorado     1856              NA
##  7 Connecticut  1856           53.18
##  8 Delaware     1856            2.11
##  9 Florida      1856              NA
## 10 Georgia      1856              NA
## # ... with 1,540 more rows
```

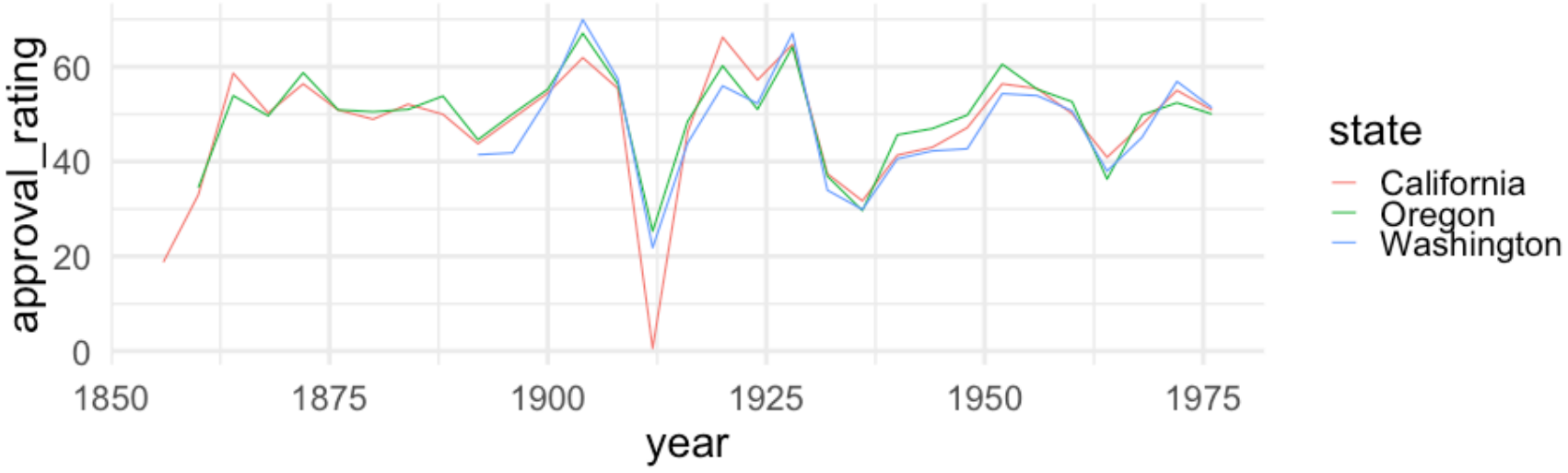
Exploratory plot

- Can you plot approval ratings by year for the west coast (California, Oregon, and Washington)?
- What do you observe?

Plot

```
pd <- votes_tidy %>%
  filter(state == "California" |
         state == "Oregon" |
         state == "Washington")

ggplot(pd, aes(year, approval_rating, color = state)) +
  geom_line()
```



More complex

- Load the affairs data
- Discuss with a partner/your table
  - What are the variables?
  - What needs to happen to make it tidy?

```
affairs <- import(here("data", "affairs.csv"),
                  setclass = "tbl_df")
head(affairs, n = 3)
```

```
## # A tibble: 3 x 19
##      V1 naffairs  kids vryunhap unhap avgmarr hapavg vryhap antirel notrel
##   <int>    <int> <int>    <int> <int>   <int>  <int>  <int>   <int>  <int>
## 1     1        0     0        0     0       0      1      0       0      0
## 2     2        0     0        0     0       0      1      0       0      0
## 3     3        3     0        0     0       0      1      0       0      0
## # ... with 9 more variables: slghtrel <int>, smerel <int>, vryrel <int>,
## #   yrsmarr1 <int>, yrsmarr2 <int>, yrsmarr3 <int>, yrsmarr4 <int>,
## #   yrsmarr5 <int>, yrsmarr6 <int>
```

Variables

- Number of affairs: *naffairs*
- Have kids or not: *kids*
- Marriage happiness: *vryunhap*:*vryhap*
- Religous: *antirel*:*vryrel*
- Years married: *yrsmarr1*:*yrsmarr6*

Lots of ways to do this

- One way: `rename`, `gather`, `separate`, `filter`, `spread` For renaming I'm using the base function and you can probably see why I prefer it in this case.

```
names(affairs)[1] <- "id"
names(affairs)[4:8] <- paste0("marhap_", names(affairs)[4:8])
names(affairs)[9:13] <- paste0("rel_", names(affairs)[9:13])
names(affairs)[14:19] <- paste0("yrs_", names(affairs)[14:19])
head(affairs, n = 3)
```

```
## # A tibble: 3 x 19
##      id naffairs  kids marhap_vryunhap marhap_unhap marhap_avgmarr
##   <int>    <int> <int>           <int>        <int>          <int>
## 1     1        0     0               0            0              0
## 2     2        0     0               0            0              0
## 3     3        3     0               0            0              0
## # ... with 13 more variables: marhap_hapavg <int>, marhap_vryhap <int>,
## #   rel_antirel <int>, rel_notrel <int>, rel_slghtrel <int>,
## #   rel_smerel <int>, rel_vryrel <int>, yrs_yrsmarr1 <int>,
## #   yrs_yrsmarr2 <int>, yrs_yrsmarr3 <int>, yrs_yrsmarr4 <int>,
## #   yrs_yrsmarr5 <int>, yrs_yrsmarr6 <int>
```

gather

```
affairs %>%
  gather(var, val, -id, -naffairs, -kids)
```

```
## # A tibble: 9,616 x 5
##       id naffairs  kids var                val
##    <int>    <int> <int> <chr>            <int>
##  1     1        0     0 marhap_vryunhap      0
##  2     2        0     0 marhap_vryunhap      0
##  3     3        3     0 marhap_vryunhap      0
##  4     4        0     1 marhap_vryunhap      0
##  5     5        3     1 marhap_vryunhap      0
##  6     6        0     1 marhap_vryunhap      0
##  7     7        0     0 marhap_vryunhap      0
##  8     8        0     0 marhap_vryunhap      0
##  9     9        7     1 marhap_vryunhap      0
## 10    10        0     0 marhap_vryunhap      0
## # ... with 9,606 more rows
```

separate

```
affairs %>%
  gather(var, val, -id, -naffairs, -kids) %>%
  separate(var, c("var", "char_val"))
```

```
## # A tibble: 9,616 x 6
##       id naffairs  kids var    char_val   val
##    <int>    <int> <int> <chr>  <chr>    <int>
##  1     1        0     0 marhap vryunhap     0
##  2     2        0     0 marhap vryunhap     0
##  3     3        3     0 marhap vryunhap     0
##  4     4        0     1 marhap vryunhap     0
##  5     5        3     1 marhap vryunhap     0
##  6     6        0     1 marhap vryunhap     0
##  7     7        0     0 marhap vryunhap     0
##  8     8        0     0 marhap vryunhap     0
##  9     9        7     1 marhap vryunhap     0
## 10    10        0     0 marhap vryunhap     0
## # ... with 9,606 more rows
```

Filter

```
affairs %>%
  gather(var, val, -id, -naffairs, -kids) %>%
  separate(var, c("var", "char_val")) %>%
  filter(val == 1)
```

```
## # A tibble: 1,803 x 6
##       id naffairs  kids var    char_val   val
##    <int>    <int> <int> <chr>  <chr>    <int>
##  1    49       12     1 marhap vryunhap     1
##  2    64        0     1 marhap vryunhap     1
##  3    82        0     1 marhap vryunhap     1
##  4   138        0     1 marhap vryunhap     1
##  5   150       12     1 marhap vryunhap     1
##  6   206        7     1 marhap vryunhap     1
##  7   215        0     1 marhap vryunhap     1
##  8   275        3     1 marhap vryunhap     1
##  9   358        0     1 marhap vryunhap     1
## 10   371        0     1 marhap vryunhap     1
## # ... with 1,793 more rows
```

Drop val, `spread`

```
affairs %>%
  gather(var, val, -id, -naffairs, -kids) %>%
  separate(var, c("var", "char_val")) %>%
  filter(val == 1) %>%
  select(-val) %>%
  spread(var, char_val) %>%
  head()
```

```
## # A tibble: 6 x 6
##      id naffairs  kids marhap rel      yrs
##   <int>    <int> <int> <chr>  <chr>    <chr>
## 1     1        0     0 hapavg slghtrel yrsmarr5
## 2     2        0     0 hapavg smerel   yrsmarr3
## 3     3        3     0 hapavg slghtrel yrsmarr2
## 4     4        0     1 hapavg antirel  yrsmarr6
## 5     5        3     1 vryhap slghtrel yrsmarr3
## 6     6        0     1 vryhap vryrel   yrsmarr6
```

Cleanup

```
affairs_tidy <- affairs %>%
  gather(var, val, -id, -naffairs, -kids) %>%
  separate(var, c("var", "char_val")) %>%
  filter(val == 1) %>%
  select(-val) %>%
  spread(var, char_val) %>%
  mutate(yrs = parse_number(yrs))

head(affairs_tidy)
```

```
## # A tibble: 6 x 6
##      id naffairs  kids marhap rel        yrs
##   <int>    <int> <int> <chr>  <chr>    <dbl>
## 1     1        0     0 hapavg slghtrel     5
## 2     2        0     0 hapavg smerel       3
## 3     3        3     0 hapavg slghtrel     2
## 4     4        0     1 hapavg antirel      6
## 5     5        3     1 vryhap slghtrel     3
## 6     6        0     1 vryhap vryrel       6
```

Notice what we've done?

- Essentially, in this case, we've removed the dummy-coding
  - One of the most common ways data are not tidy

Lab