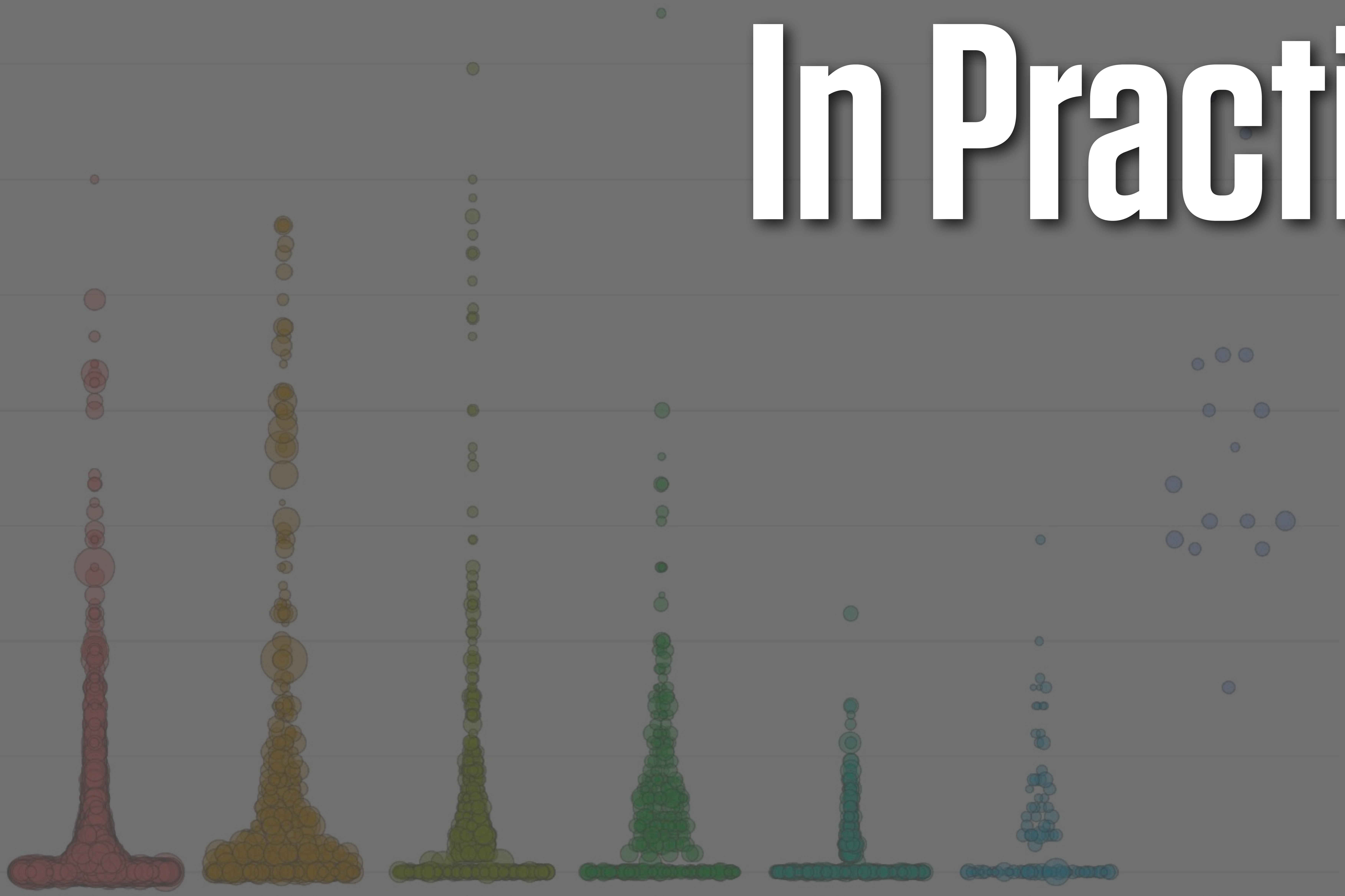
In Practice



Tidying Data

Table A-1. Years of School Completed by People 25 Years and Over, by Age and Sex: Selected Years 1940 to 2016

(Numbers in thousands. Noninstitutionalized population except where otherwise specified.)

Age, sex, and years	Total	Years of School Completed						
		Elementary		High school		College		Median
		0 to 4 years	5 to 8 years	1 to 3 years	4 years	1 to 3 years	4 years or more	
25 YEARS AND OLDER								
Male								
2016	103,372	1,183	3,513	7,144	30,780	26,468	34,283	(NA)
2015	101,887	1,243	3,669	7,278	30,997	25,778	32,923	(NA)
2014	100,592	1,184	3,761	7,403	30,718	25,430	32,095	(NA)
2013	99,305	1,127	3,836	7,314	30,014	25,283	31,731	(NA)
2012	98,119	1,237	3,879	7,388	30,216	24,632	30,766	(NA)
2011	97,220	1,234	3,883	7,443	30,370	24,319	29,971	(NA)
2010	96,325	1,279	3,931	7,705	30,682	23,570	29,158	(NA)
2009	95,518	1,372	4,027	7,754	30,025	23,634	28,706	(NA)
2008	94,470	1,310	4,136	7,853	29,491	23,247	28,433	(NA)
2007	93,421	1,458	4,249	8,294	29,604	22,219	27,596	(NA)
2006	92,233	1,472	4,395	7,940	29,380	22,136	26,910	(NA)
2005	90,899	1,505	4,402	7,787	29,151	21,794	26,259	(NA)

readxl part of the tidyverse

```
library(readxl)
```

```
edu
#> # A tibble: 366 x 11
#>    age   sex    year total elem4 elem8   hs3   hs4 coll3 coll4 median
#>    <chr> <chr> <int> <int> <int> <int> <dbl> <dbl> <dbl> <dbl>  <dbl>
#>  1 25-34 Male   2016 21845   116   468  1427  6386  6015  7432     NA
#>  2 25-34 Male   2015 21427   166   488  1584  6198  5920  7071     NA
#>  3 25-34 Male   2014 21217   151   512  1611  6323  5910  6710     NA
#>  4 25-34 Male   2013 20816   161   582  1747  6058  5749  6519     NA
#>  5 25-34 Male   2012 20464   161   579  1707  6127  5619  6270     NA
#>  6 25-34 Male   2011 20985   190   657  1791  6444  5750  6151     NA
#>  7 25-34 Male   2010 20689   186   641  1866  6458  5587  5951     NA
#>  8 25-34 Male   2009 20440   184   695  1806  6495  5508  5752     NA
#>  9 25-34 Male   2008 20210   172   714  1874  6356  5277  5816     NA
#> 10 25-34 Male   2007 20024   246   757  1930  6361  5137  5593     NA
#> # … with 356 more rows
```

```r
edu_t <- pivot_longer(data = edu,
                      cols = elem4:coll4,
                      names_to = "school",
                      values_to = "freq")
```

```r
head(edu_t)

#> # A tibble: 6 x 7
#>   age   sex    year total median school  freq
#>   <chr> <chr> <int> <int>  <dbl> <chr>  <dbl>
#> 1 25-34 Male   2016 21845     NA elem4    116
#> 2 25-34 Male   2016 21845     NA elem8    468
#> 3 25-34 Male   2016 21845     NA hs3     1427
#> 4 25-34 Male   2016 21845     NA hs4     6386
#> 5 25-34 Male   2016 21845     NA coll3   6015
#> 6 25-34 Male   2016 21845     NA coll4   7432
```

```r
tail(edu_t)

#> # A tibble: 6 x 7
#>   age   sex     year total median school  freq
#>   <chr> <chr>  <int> <int>  <dbl> <chr>  <dbl>
#> 1 55>   Female  1940  9777    8.3 elem4   1886
#> 2 55>   Female  1940  9777    8.3 elem8   5217
#> 3 55>   Female  1940  9777    8.3 hs3      932
#> 4 55>   Female  1940  9777    8.3 hs4      973
#> 5 55>   Female  1940  9777    8.3 coll3    372
#> 6 55>   Female  1940  9777    8.3 coll4    219
```

Date Formats

```r
head(bad_date)
```

```
## # A tibble: 6 x 2
##   date        N
##   <chr>   <int>
## 1 9/1/11  44426
## 2 9/2/11  55112
## 3 9/3/11  19263
## 4 9/4/11  12330
## 5 9/5/11   8534
## 6 9/6/11  59490
```

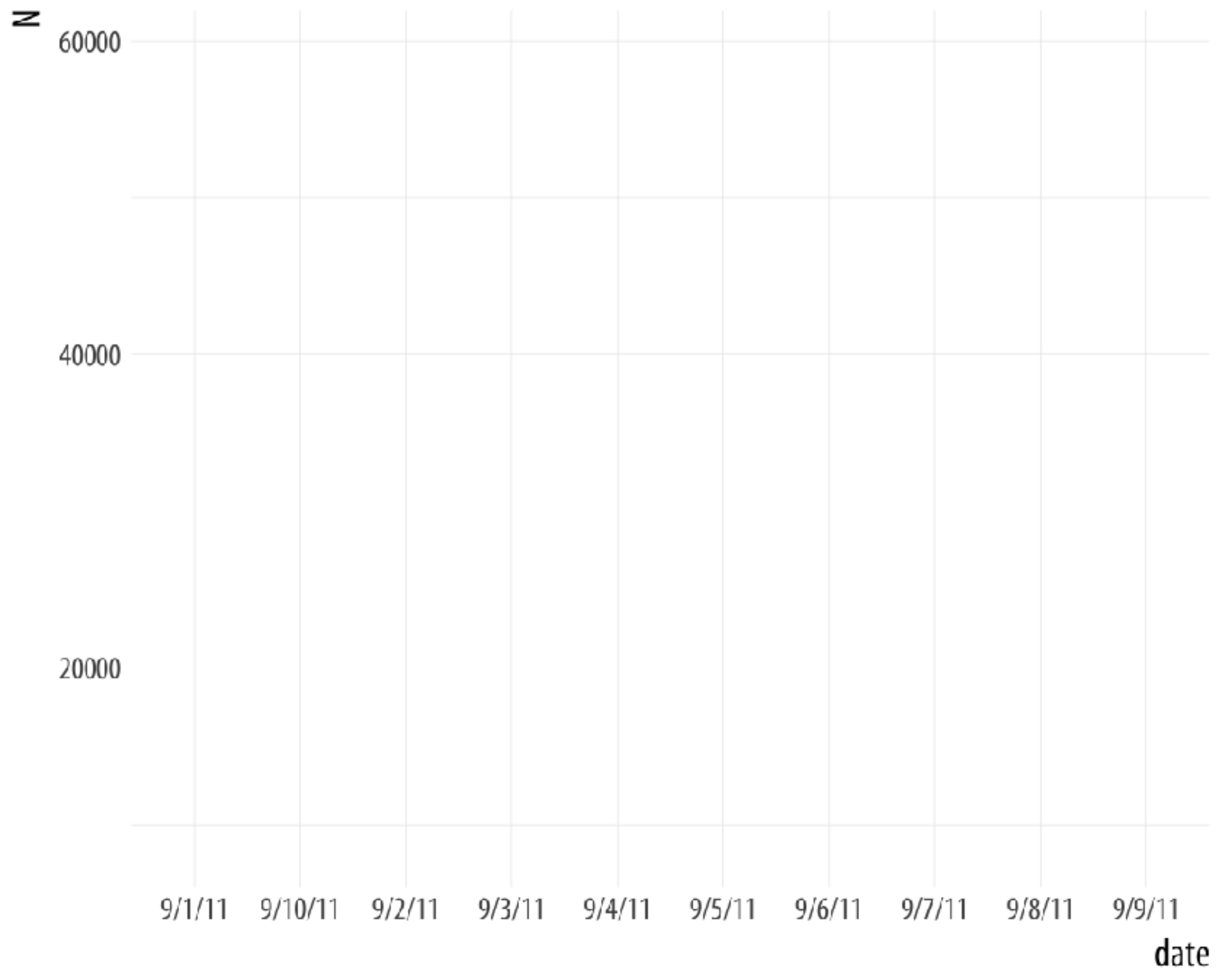
```r
head(bad_date)
```

```
## # A tibble: 6 x 2
##   date       N
##   <chr>  <int>
## 1 9/1/11 44426
## 2 9/2/11 55112
## 3 9/3/11 19263
## 4 9/4/11 12330
## 5 9/5/11  8534
## 6 9/6/11 59490
```

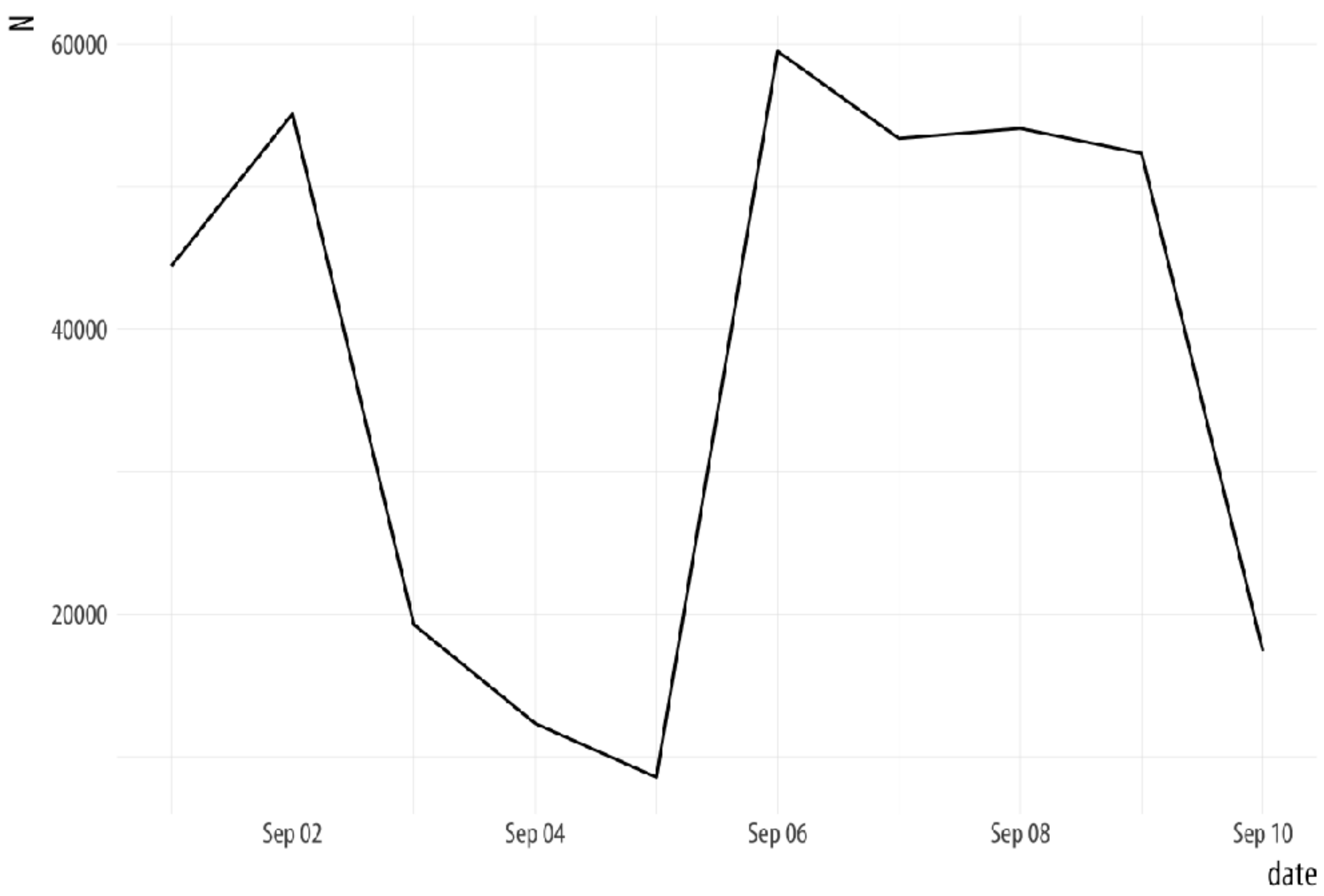
```r
p <- ggplot(data = bad_date, aes(x = date, y = N))
p + geom_line()
```

```
## geom_path: Each group consists of only one observation.
## Do you need to adjust the group aesthetic?
```

```r
bad_date2 <- rbind(bad_date, bad_date)

p <- ggplot(data = bad_date2, aes(x = date, y = N))
p + geom_line()
```



```r
# install.packages("lubridate")
library(lubridate)

bad_date$date <- mdy(bad_date$date)
head(bad_date)

## # A tibble: 6 x 2
##   date           N
##   <date>     <int>
## 1 2011-09-01 44426
## 2 2011-09-02 55112
## 3 2011-09-03 19263
## 4 2011-09-04 12330
## 5 2011-09-05  8534
## 6 2011-09-06 59490

p <- ggplot(data = bad_date, aes(x = date, y = N))
p + geom_line()
```



```r
bad_year <- read_csv("data/organdonation")
bad_year %>% select(1:3) %>% sample_n(10)
```

```
## # A tibble: 10 x 3
##    country        year donors
##    <chr>         <int>  <dbl>
##  1 United States  1994  19.4
##  2 Australia      1999   8.67
##  3 Canada         2001  13.5
##  4 Australia      1994  10.2
##  5 Sweden         1993  15.2
##  6 Ireland        1992  19.5
##  7 Switzerland    1997  14.3
##  8 Ireland        2000  17.6
##  9 Switzerland    1998  15.4
## 10 Norway           NA  NA
```

```r
p <- ggplot(data = bad_year,
            mapping = aes(x = year,
                          y = donors))
p + geom_point()
```

```r
bad_year$year <- int_to_year(bad_year$year)
bad_year %>% select(1:3)
```

```
## # A tibble: 238 x 3
##    country   year       donors
##    <chr>     <date>      <dbl>
##  1 Australia NA          NA
##  2 Australia 1991-01-01  12.1
##  3 Australia 1992-01-01  12.4
##  4 Australia 1993-01-01  12.5
##  5 Australia 1994-01-01  10.2
##  6 Australia 1995-01-01  10.2
##  7 Australia 1996-01-01  10.6
##  8 Australia 1997-01-01  10.3
##  9 Australia 1998-01-01  10.5
## 10 Australia 1999-01-01   8.67
## # ... with 228 more rows
```

Visualizing Missing Data

congress

Representatives and Senators since 1945

```r
install.packages("drat")
drat::addRepo("kjhealy")
install.packages("congress")
library(congress)
```

```
> congress
# A tibble: 21,009 x 38
   congress last  first middle suffix nickname born       death      sex   position party state district start      end   religion race 
      <dbl> <chr> <chr> <chr>  <chr>  <chr>    <date>     <date>     <chr> <chr>    <chr> <chr> <chr>    <date>     <chr> <chr>    <chr>
 1       79 Aber… Thom… Gerst… NA     NA       1903-05-16 1953-01-23 M     U.S. Re… Demo… MS    4        1945-01-03 01/0… Methodi… White
 2       79 Adams Sher… NA     NA     NA       1899-01-08 1986-10-27 M     U.S. Re… Repu… NH    2        1945-01-03 01/0… Not spe… White
 3       79 Aiken Geor… David  NA     NA       1892-08-20 1984-11-19 M     U.S. Se… Repu… VT    NA       1945-01-03 01/0… Protest… White
 4       79 Allen Asa   Leona… NA     NA       1891-01-05 1969-01-05 M     U.S. Re… Demo… LA    8        1945-01-03 01/0… Not spe… White
 5       79 Allen Leo   Elwood NA     NA       1898-10-05 1973-01-19 M     U.S. Re… Repu… IL    13       1945-01-03 01/0… Presbyt… White
 6       79 Almo… J.    Linds… Jr.    NA       1898-06-15 1986-04-14 M     U.S. Re… Demo… VA    6        1946-02-04 04/1… Lutheran White
 7       79 Ande… Herm… Carl   NA     NA       1897-01-27 1978-07-26 M     U.S. Re… Repu… MN    7        1945-01-03 01/0… Lutheran White
 8       79 Ande… Clin… Presba NA     NA       1895-10-23 1975-11-11 M     U.S. Re… Demo… NM    AL       1941-01-03 06/3… Presbyt… White
 9       79 Ande… John  Zuing… NA     NA       1904-03-22 1981-02-09 M     U.S. Re… Repu… CA    8        1945-01-03 01/0… Not spe… White
10       79 Andr… Augu… Herman NA     NA       1890-10-11 1958-01-14 M     U.S. Re… Repu… MN    1        1945-01-03 01/1… Not spe… White
# … with 20,999 more rows, and 21 more variables: educational_attainment <chr>, job_type_1 <chr>, job_type_2 <chr>, job_type_3 <chr>,
#   job_type_4 <chr>, job_type_5 <chr>, mil_1 <chr>, mil_2 <chr>, mil_3 <chr>, start_year <date>, end_year <date>, name_dob <chr>,
#   pid <dbl>, start_age <int>, poc <chr>, days_old <dbl>, months_old <int>, full_name <chr>, end_career <date>, entry_age <int>,
#   yr_fac <fct>
> 
```

```
library(naniar)
library(visdat)

vis_dat(congress)
```

naniar 0.4.2.9000 Getting Started Gallery Articles Reference News

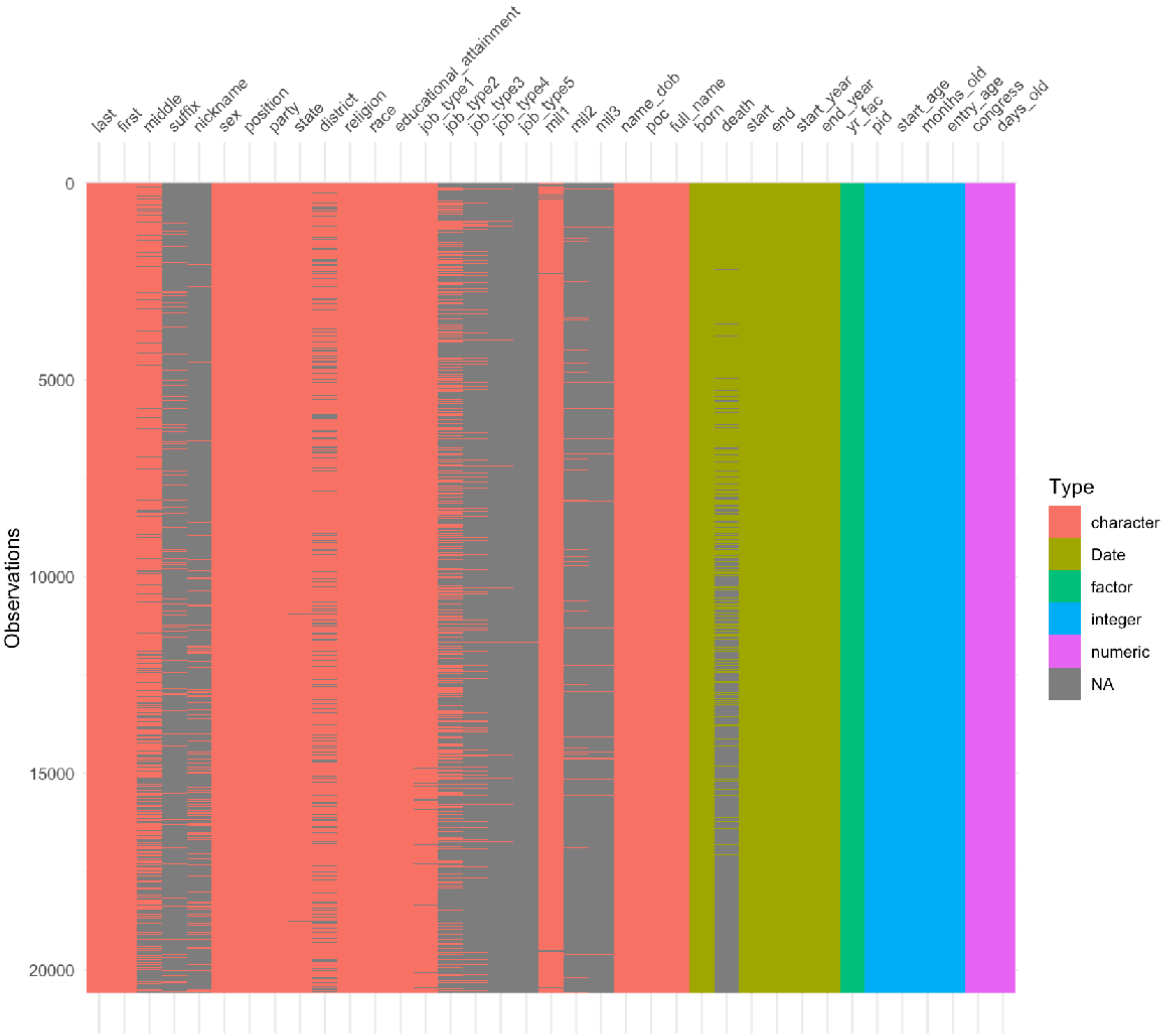
naniar

`naniar` provides principled, tidy ways to summarise, visualise, and manipulate missing data with minimal deviations from the workflows in ggplot2 and tidy data. It does this by providing:

- Shadow matrices, a tidy data structure for missing data:
  - `bind_shadow()` and `nabular()`
- Shorthand summaries for missing data:
  - `n_miss()` and `n_complete()`
  - `pct_miss()` and `pct_complete()`
- Numerical summaries of missing data in variables and cases:
  - `miss_var_summary()` and `miss_var_table()`
  - `miss_case_summary()`, `miss_case_table()`
- Visualisation for missing data:
  - `geom_miss_point()`
  - `gg_miss_var()`
  - `gg_miss_case()`
  - `gg_miss_fct()`

For more details on the workflow and theory underpinning naniar, read the vignette Getting started with naniar.

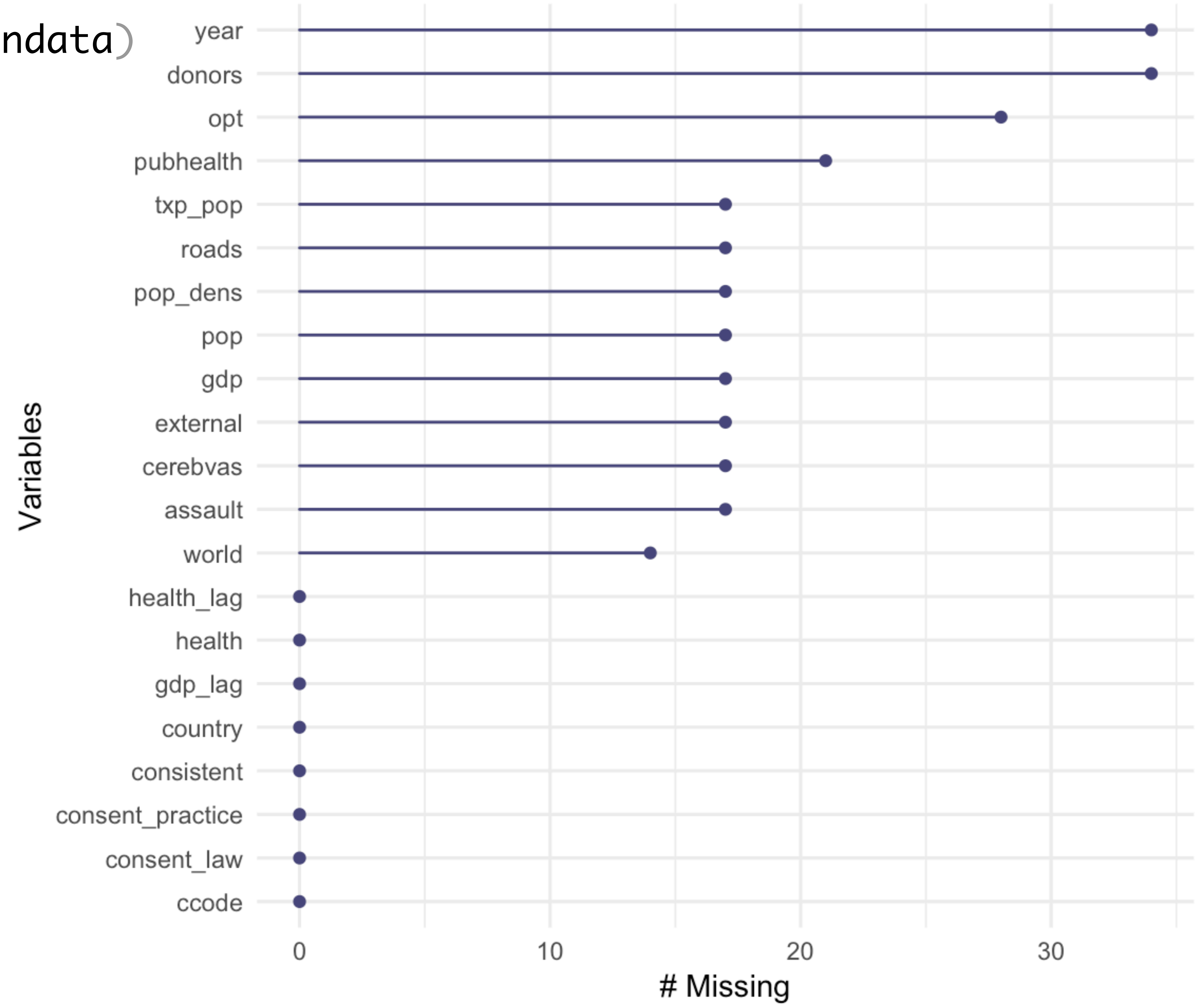
For a short primer on the data visualisation available in naniar, read the vignette Gallery of Missing Data Visualisations.


last
first
middle
suffix
nickname
sex
position
party
state
district
religion
race
educational_attainment
job_type1
job_type2
job_type3
job_type4
job_type5
mil1
mil2
mil3
name_dob
poc
full_name
born
death
start
end
start_year
end_year
yr_fac
pid
start_age
months_old
entry_age
congress
days_old
0
5000
10000
15000
20000
Observations
Type
character
Date
factor
integer
numeric
NA

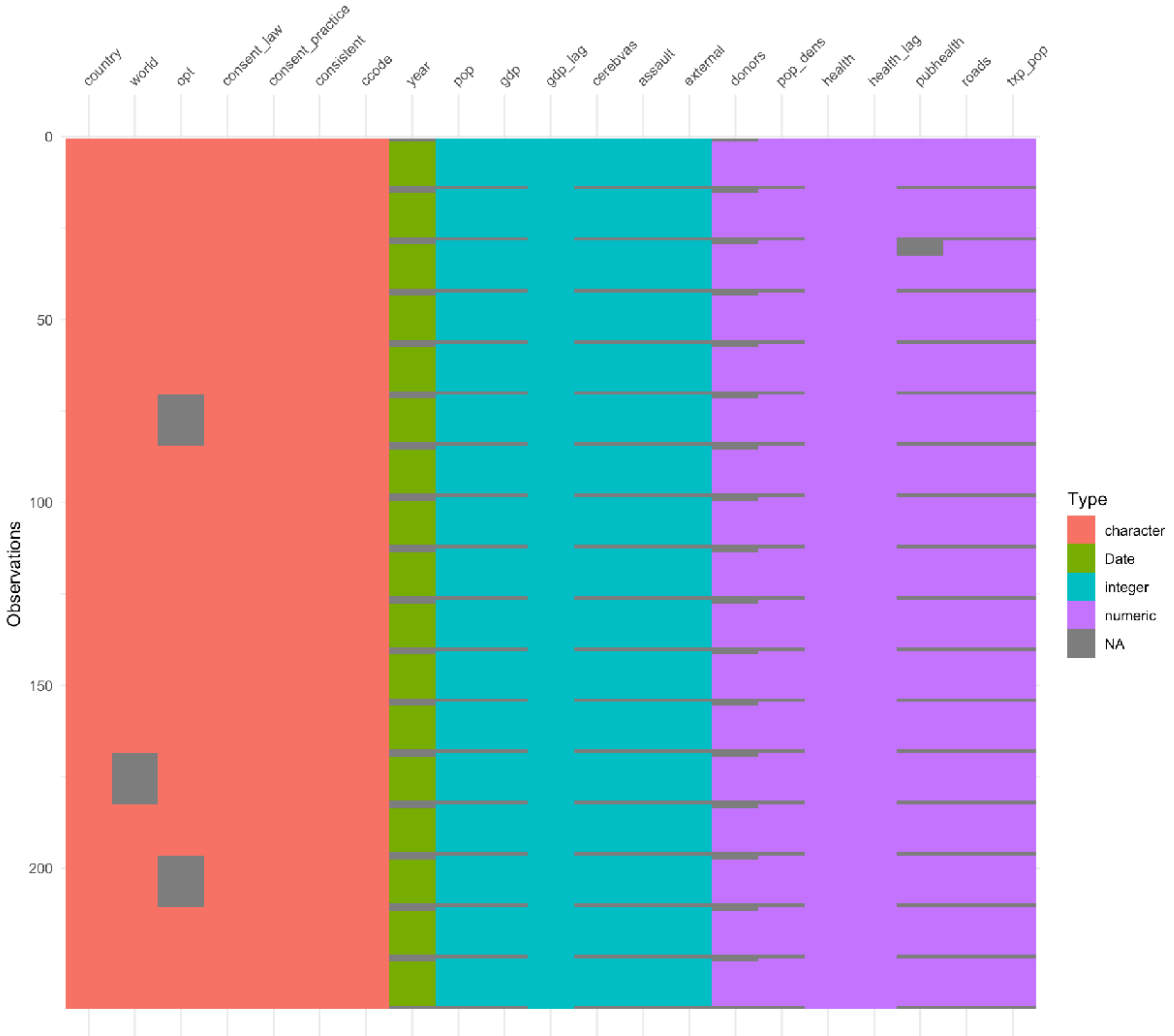
```r
library(socviz)
organdata
```

```
# A tibble: 238 x 21
   country year       donors   pop pop_dens   gdp gdp_lag health
   <chr>   <date>      <dbl> <int>    <dbl> <int>   <int>  <dbl>
 1 Austra… NA          NA    17065    0.220 16774   16591   1300
 2 Austra… 1991-01-01  12.1  17284    0.223 17171   16774   1379
 3 Austra… 1992-01-01  12.4  17495    0.226 17914   17171   1455
 4 Austra… 1993-01-01  12.5  17667    0.228 18883   17914   1540
 5 Austra… 1994-01-01  10.2  17855    0.231 19849   18883   1626
 6 Austra… 1995-01-01  10.2  18072    0.233 21079   19849   1737
 7 Austra… 1996-01-01  10.6  18311    0.237 21923   21079   1846
 8 Austra… 1997-01-01  10.3  18518    0.239 22961   21923   1948
 9 Austra… 1998-01-01  10.5  18711    0.242 24148   22961   2077
10 Austra… 1999-01-01   8.67 18926    0.244 25445   24148   2231
# … with 228 more rows, and 13 more variables: health_lag <dbl>,
#   pubhealth <dbl>, roads <dbl>, cerebvas <int>, assault <int>,
#   external <int>, txp_pop <dbl>, world <chr>, opt <chr>,
#   consent_law <chr>, consent_practice <chr>, consistent <chr>,
#   ccode <chr>
```

```
gg_miss_var(organdata)
```



```
vis_dat(organdata)
```



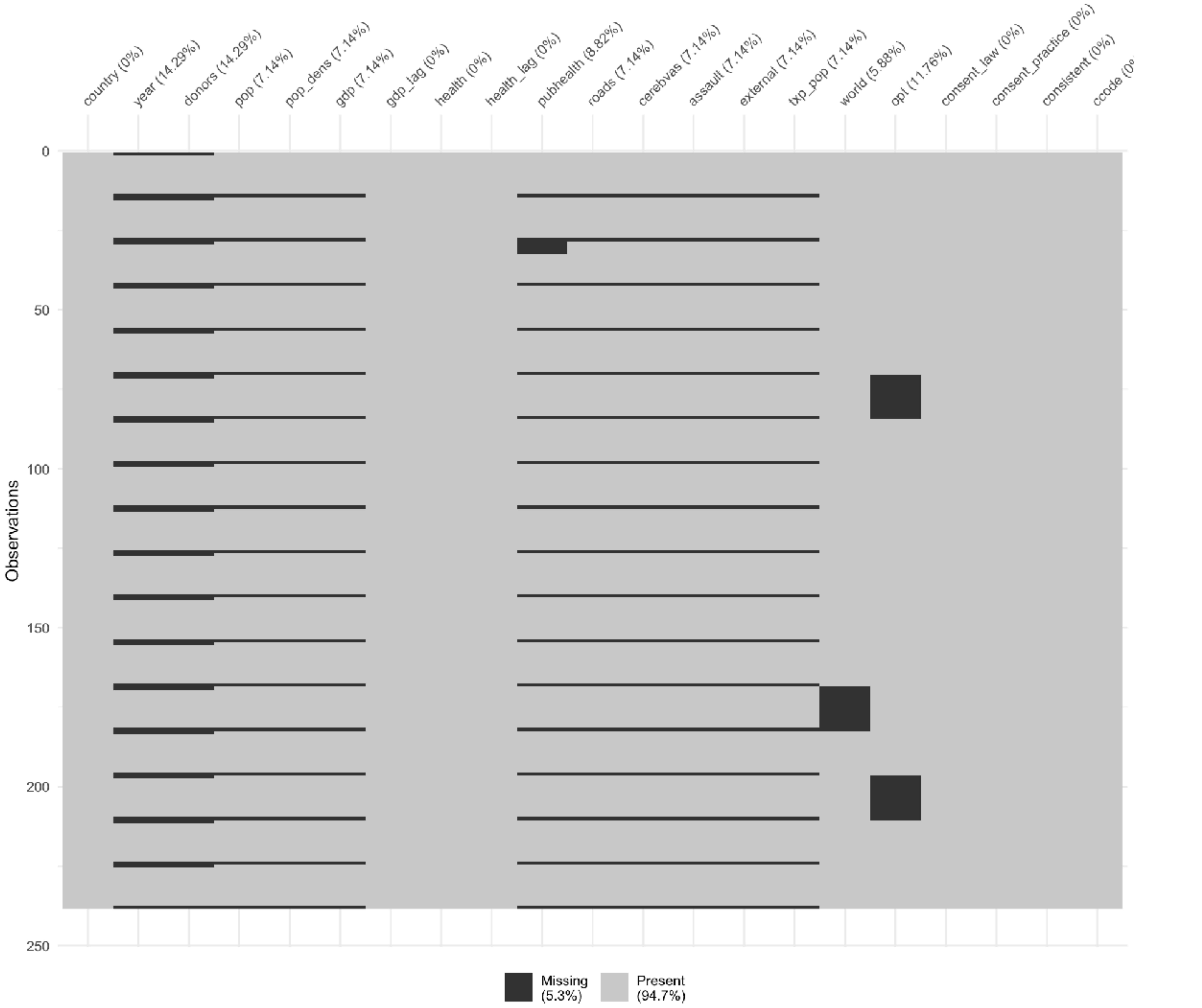
```
miss_var_summary(organdata)

A tibble: 21 x 3
   variable  n_miss pct_miss
   <chr>      <int>    <dbl>
 1 year          34    14.3
 2 donors        34    14.3
 3 opt           28    11.8
 4 pubhealth     21     8.82
 5 pop           17     7.14
 6 pop_dens      17     7.14
 7 gdp           17     7.14
 8 roads         17     7.14
 9 cerebvas      17     7.14
10 assault       17     7.14
# … with 11 more rows
```

```
miss_case_summary(organdata)

A tibble: 238 x 3
    case n_miss pct_miss
   <int>  <int>    <dbl>
 1    84     12     57.1
 2   182     12     57.1
 3   210     12     57.1
 4    14     11     52.4
 5    28     11     52.4
 6    42     11     52.4
 7    56     11     52.4
 8    70     11     52.4
 9    98     11     52.4
10   112     11     52.4
# … with 228 more rows
```

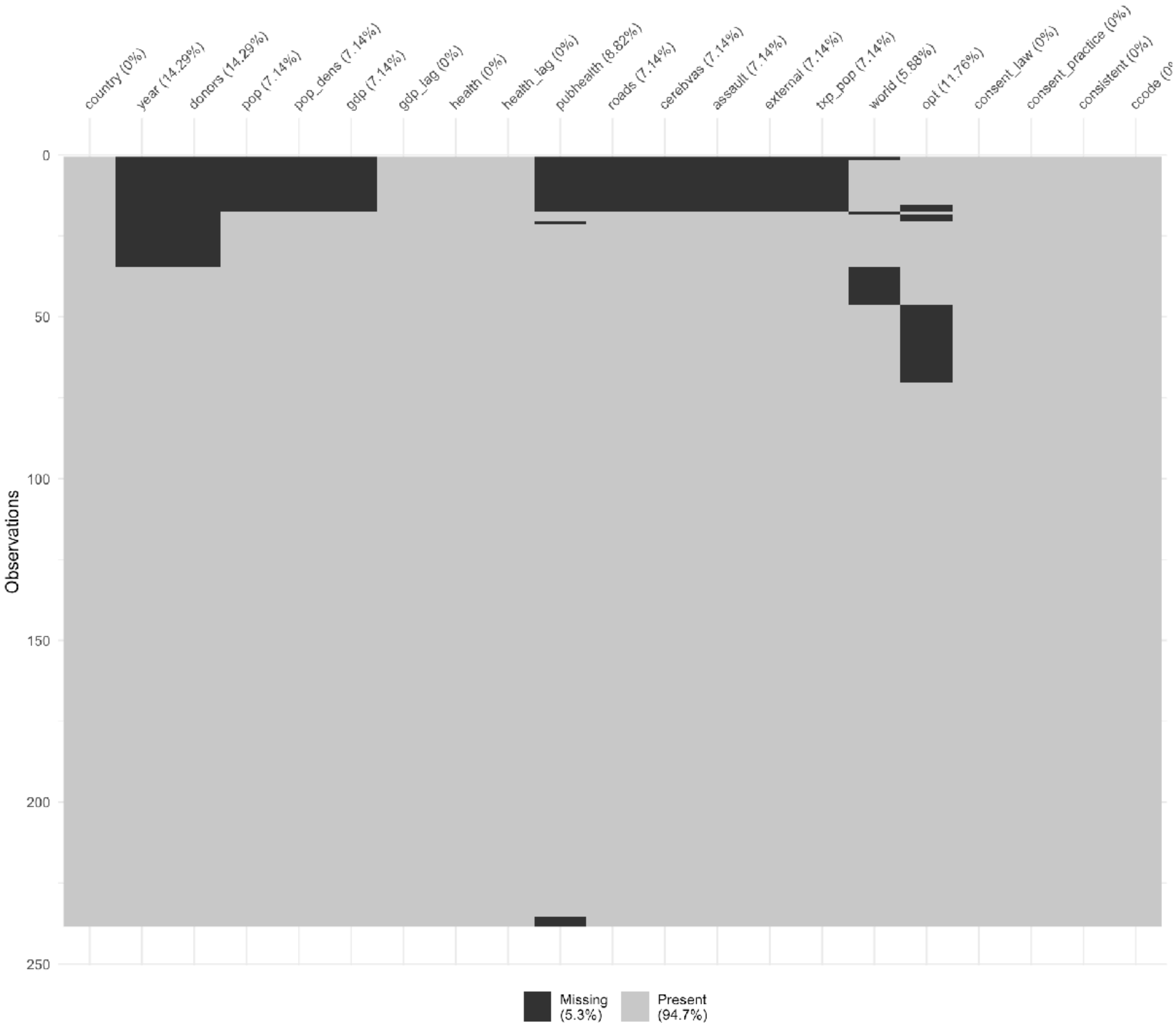
```r
organdata %>%
  select(consent_law, year, pubhealth, roads) %>%
  group_by(consent_law) %>%
  miss_var_summary()
```

```
A tibble: 6 x 4
  consent_law variable  n_miss pct_miss
  <chr>       <chr>      <int>    <dbl>
1 Informed    year          16    14.3
2 Informed    pubhealth      8     7.14
3 Informed    roads          8     7.14
4 Presumed    year          18    14.3
5 Presumed    pubhealth     13    10.3
6 Presumed    roads          9     7.14
```

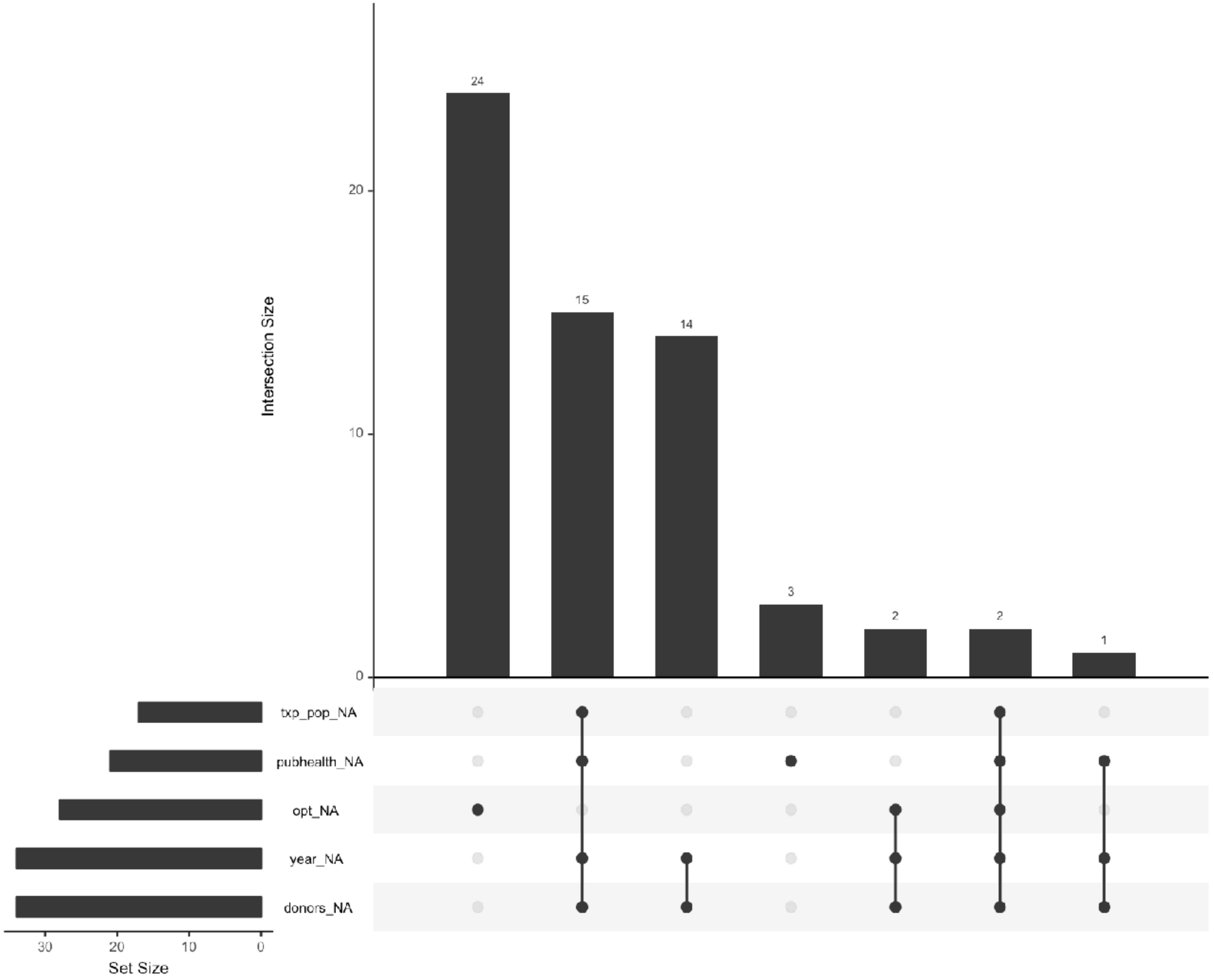
```
vis_miss(organdata)
```



```r
vis_miss(organdata,
         cluster = TRUE)
```

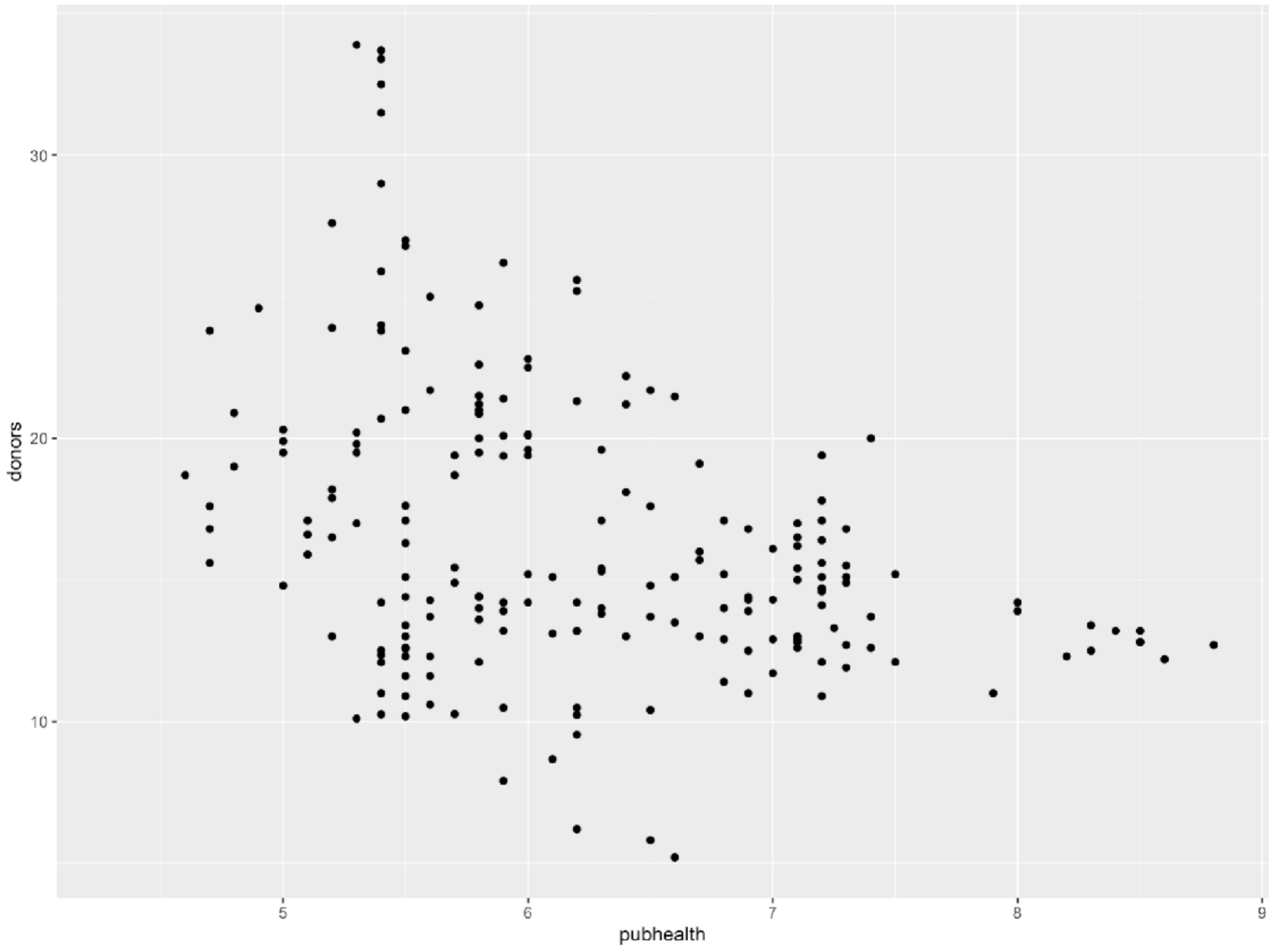


```
gg_miss_upset(organdata)
```

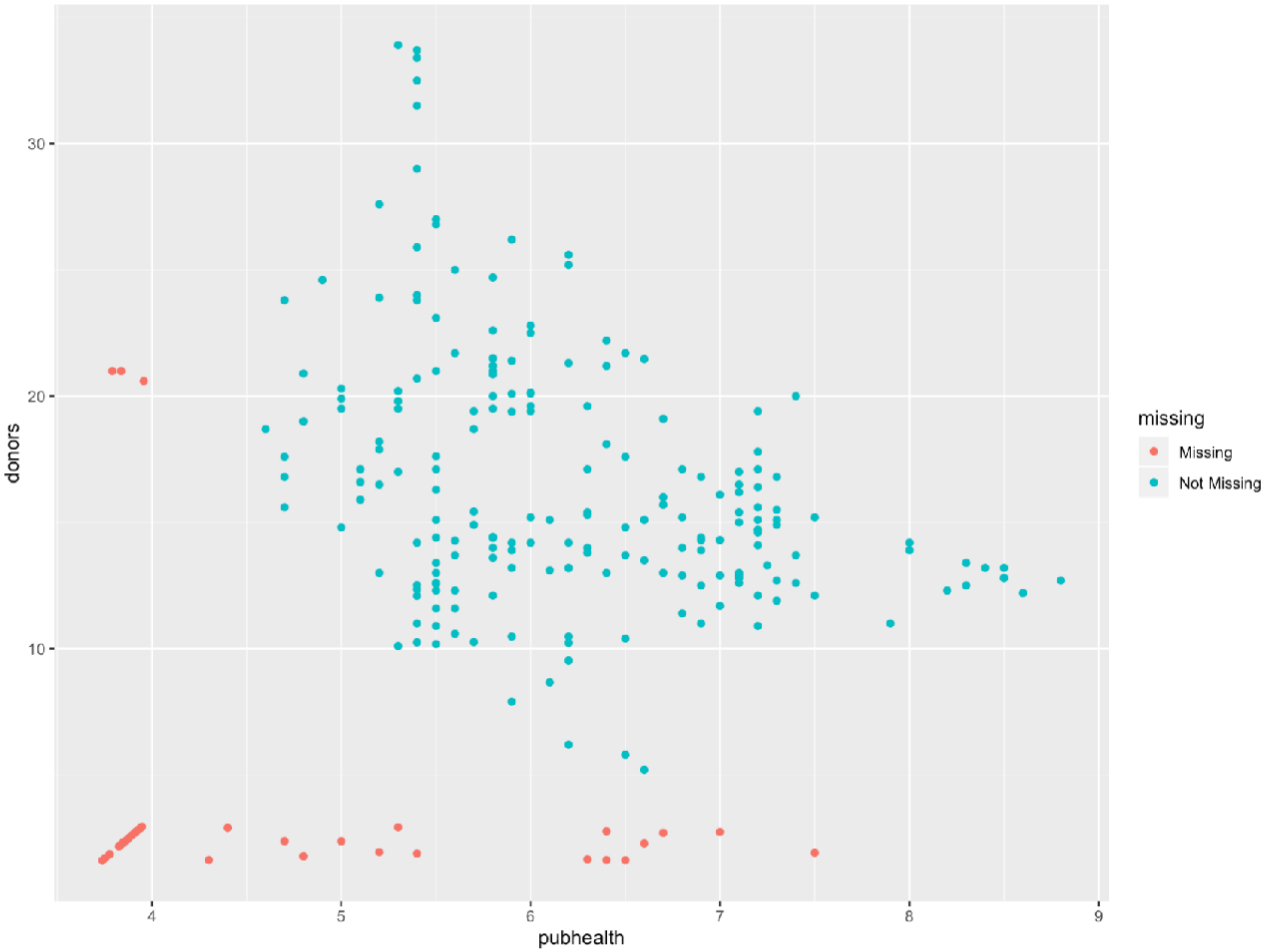


```r
ggplot(data = organdata, mapping = aes(x = pubhealth, y = donors)) +
geom_point()
```

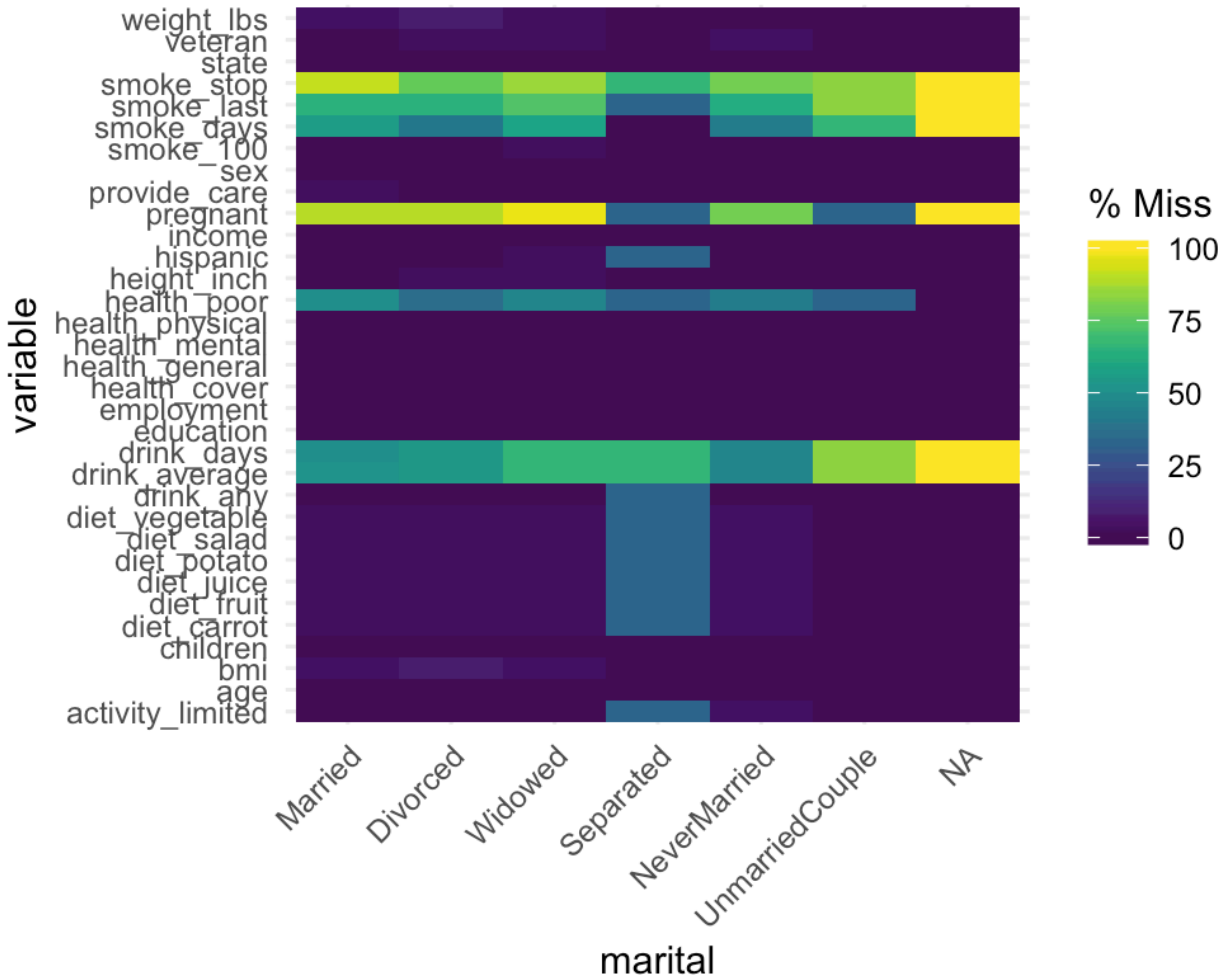
```
## Warning message:
## Removed 37 rows containing missing values (geom_point).
```



```
ggplot(data = organdata, mapping = aes(x = pubhealth, y = donors)) +
geom_miss_point()
```



```r
gg_miss_fct(x = riskfactors, fct = marital)
```



Zero Counts in dplyr

https://github.com/kjhealy/fc_sample

```r
library(tidyverse)

## Hex colors for sex
sex_colors <- c("#E69F00", "#993300")

## Hex color codes for Dem Blue and Rep Red
party_colors <- c("#2E74C0", "#CB454A")

## Group labels
mf_labs <- tibble(M = "Men", F = "Women")

theme_set(theme_minimal())
```

```r
## Character vectors only, by default
df <- read_csv("data/fc_sample.csv")
```

```r
df
```

```
#> > df
#> # A tibble: 280 x 4
#>       pid start_year party      sex
#>     <int> <date>     <chr>      <chr>
#>  1  3160 2013-01-03 Republican M
#>  2  3161 2013-01-03 Democrat   F
#>  3  3162 2013-01-03 Democrat   M
#>  4  3163 2013-01-03 Republican M
#>  5  3164 2013-01-03 Democrat   M
#>  6  3165 2013-01-03 Republican M
#>  7  3166 2013-01-03 Republican M
#>  8  3167 2013-01-03 Democrat   F
#>  9  3168 2013-01-03 Republican M
#> 10  3169 2013-01-03 Democrat   M
#> # ... with 270 more rows
```

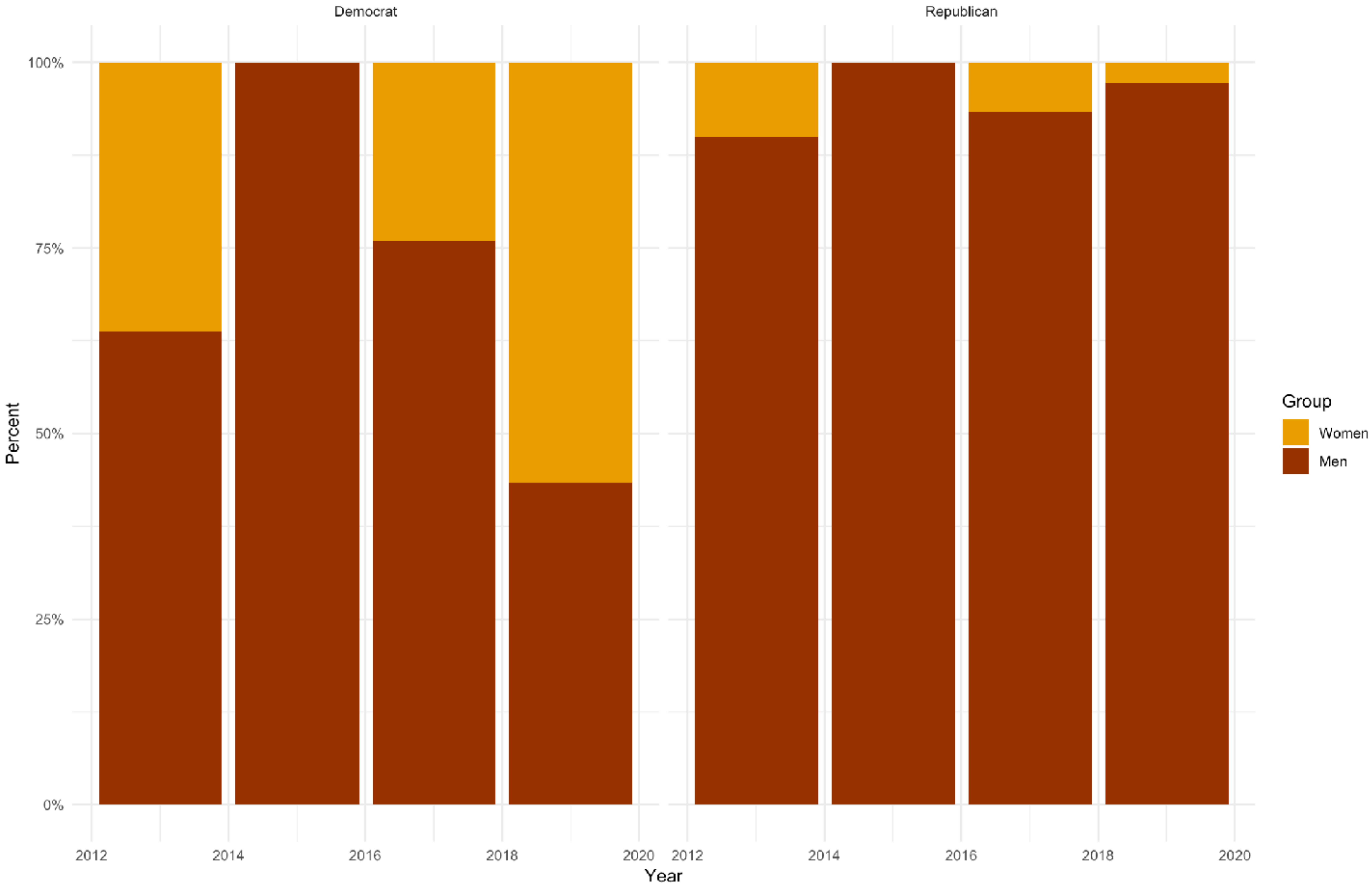
```r
df %>%
    group_by(start_year, party, sex) %>%
    summarize(N = n()) %>%
    mutate(freq = N / sum(N))
```

```
#> # A tibble: 14 x 5
#> # Groups:   start_year, party [8]
#>    start_year party      sex       N   freq
#>    <date>     <chr>      <chr> <int>  <dbl>
#>  1 2013-01-03 Democrat   F        21 0.362
#>  2 2013-01-03 Democrat   M        37 0.638
#>  3 2013-01-03 Republican F         8 0.101
#>  4 2013-01-03 Republican M        71 0.899
#>  5 2015-01-03 Democrat   M         1 1
#>  6 2015-01-03 Republican M         5 1
#>  7 2017-01-03 Democrat   F         6 0.24
#>  8 2017-01-03 Democrat   M        19 0.76
#>  9 2017-01-03 Republican F         2 0.0667
#> 10 2017-01-03 Republican M        28 0.933
#> 11 2019-01-03 Democrat   F        33 0.647
#> 12 2019-01-03 Democrat   M        18 0.353
#> 13 2019-01-03 Republican F         1 0.0323
#> 14 2019-01-03 Republican M        30 0.968
```

Not in the table

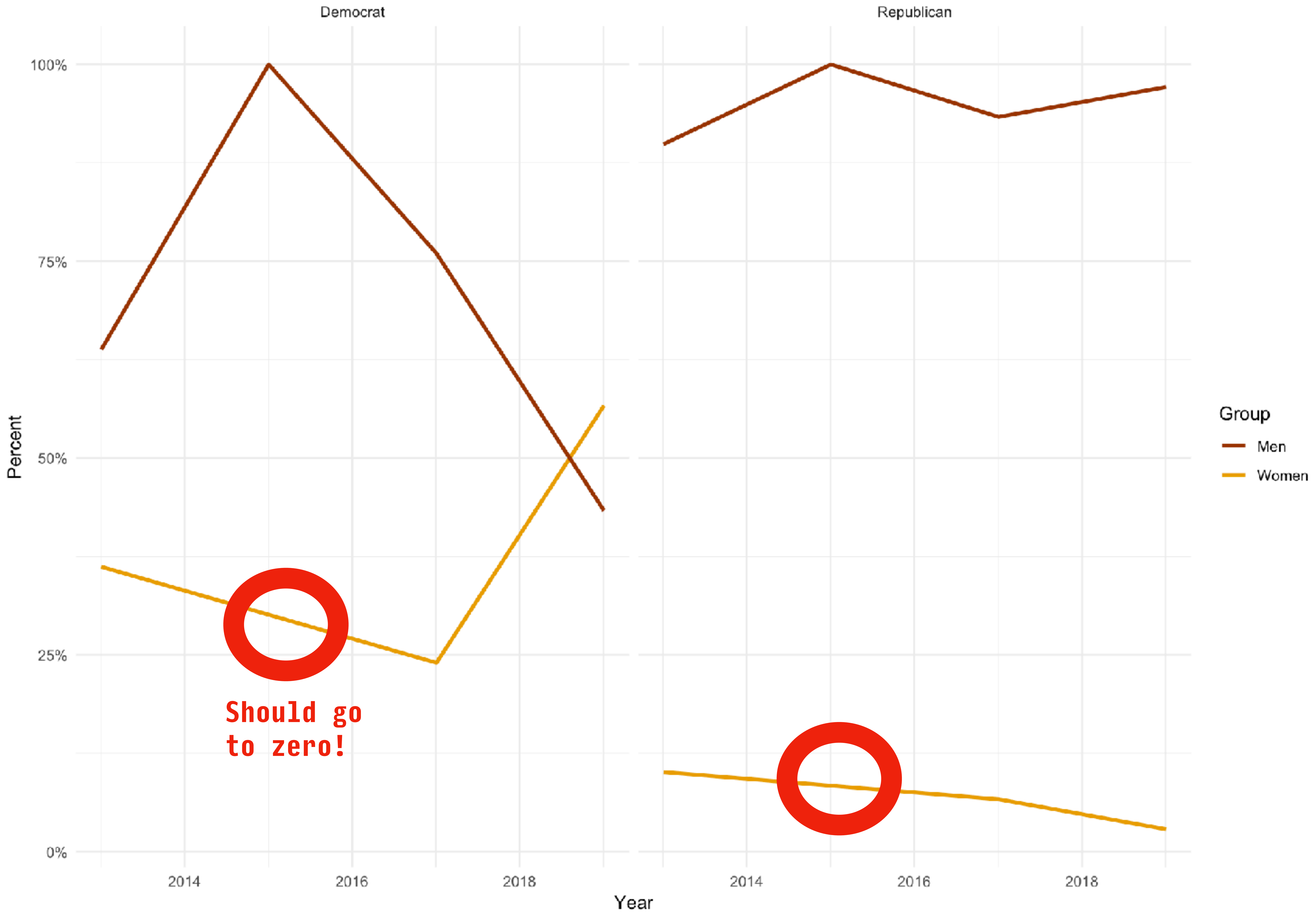
```
#>      start_year party      sex       N freq
#>   5' 2015-01-03 Democrat   F         0 0
#>   6' 2015-01-03 Republican F         0 0
```

```r
df %>%
    group_by(start_year, party, sex) %>%
    summarize(N = n()) %>%
    mutate(freq = N / sum(N)) %>%
    ggplot(aes(x = start_year,
               y = freq,
               fill = sex)) +
    geom_col() +
    scale_y_continuous(labels = scales::percent) +
    scale_fill_manual(values = sex_colors,
                      labels = c("Women", "Men")) +
    labs(x = "Year", y = "Percent", fill = "Group") +
    facet_wrap(~ party)
```



Democrat
Republican
100%
75%
50%
25%
0%
Percent
2012
2014
2016
2018
2020
Year
Group
Women
Men

```r
df %>%
    group_by(start_year, party, sex) %>%
    summarize(N = n()) %>%
    mutate(freq = N / sum(N)) %>%
    ggplot(aes(x = start_year,
               y = freq,
               color = sex)) +
    geom_line(size = 1.1) +
    scale_y_continuous(labels = scales::percent) +
    scale_color_manual(values = sex_colors,
                       labels = c("Women", "Men")) +
    guides(color = guide_legend(reverse = TRUE)) +
    labs(x = "Year", y = "Percent", color = "Group") +
    facet_wrap(~ party)
```


Democrat
Republican
100%
75%
50%
25%
0%
Percent
2014
2016
2018
Year
Group
Men
Women
Should go
to zero!

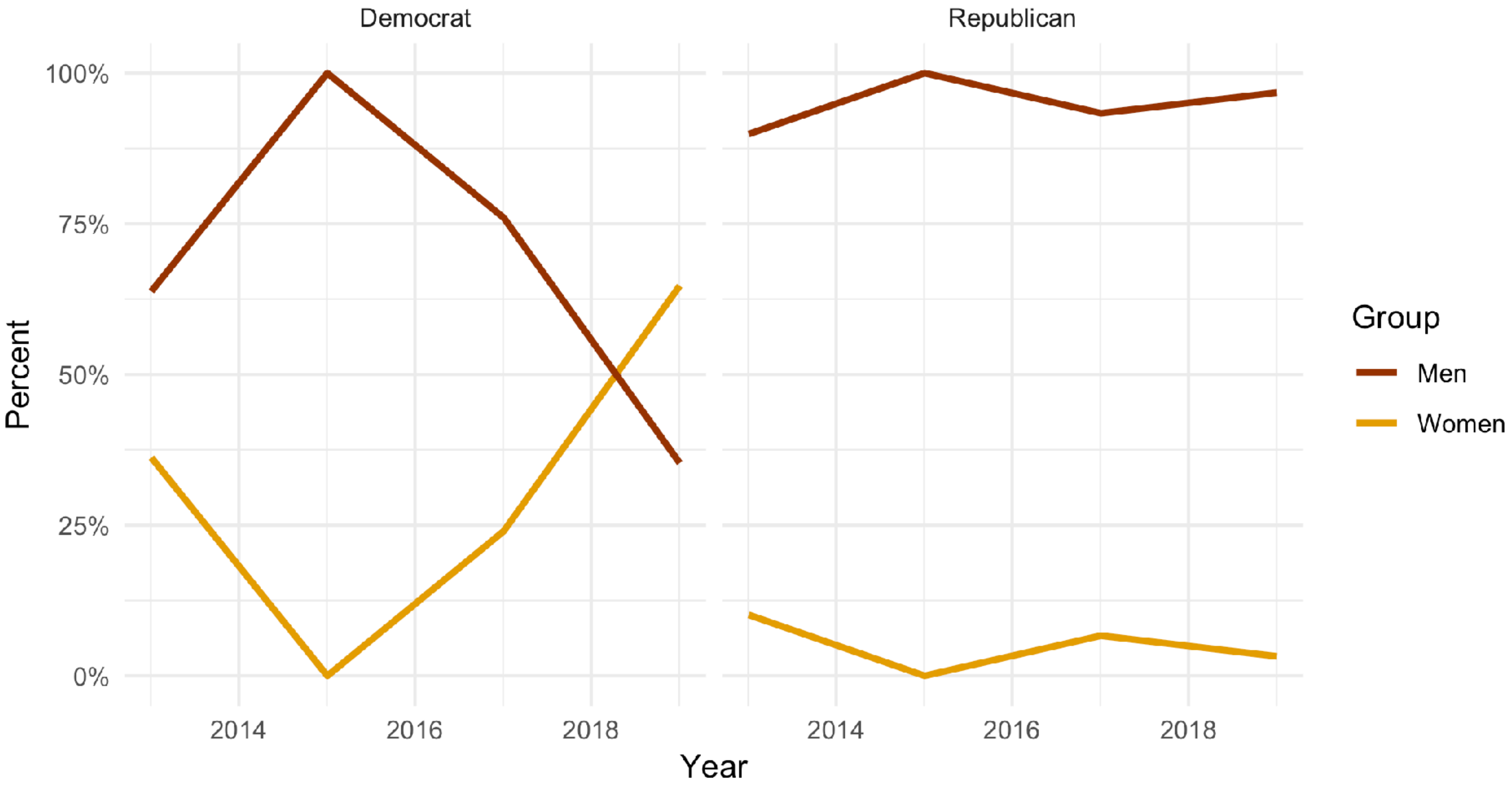
```r
df_f <- df %>% modify_if(is.character, as.factor)

df_f %>%
    group_by(start_year, party, sex) %>%
    tally()

#> # A tibble: 16 x 4
#> # Groups:   start_year, party [8]
#>    start_year party      sex       n
#>    <date>     <fct>      <fct> <int>
#>  1 2013-01-03 Democrat   F        21
#>  2 2013-01-03 Democrat   M        37
#>  3 2013-01-03 Republican F         8
#>  4 2013-01-03 Republican M        71
#>  5 2015-01-03 Democrat   F         0
#>  6 2015-01-03 Democrat   M         1
#>  7 2015-01-03 Republican F         0
#>  8 2015-01-03 Republican M         5
```

Option 1: Convert to Factor

```r
df %>%
    group_by(start_year, party, sex) %>%
    summarize(N = n()) %>%
    mutate(freq = N / sum(N)) %>%
    ungroup() %>%
    complete(start_year, party, sex,
             fill = list(N = 0, freq = 0))

#> # A tibble: 16 x 5
#>    start_year party      sex       N  freq
#>    <date>     <chr>      <chr> <dbl> <dbl>
#>  1 2013-01-03 Democrat   F        21 0.362
#>  2 2013-01-03 Democrat   M        37 0.638
#>  3 2013-01-03 Republican F         8 0.101
#>  4 2013-01-03 Republican M        71 0.899
#>  5 2015-01-03 Democrat   F         0 0
#>  6 2015-01-03 Democrat   M         1 1
#>  7 2015-01-03 Republican F         0 0
#>  8 2015-01-03 Republican M         5 1
```

Option 2: ungroup() & complete()

```r
df_f %>%
    group_by(start_year, party, sex) %>%
    summarize(N = n()) %>%
    mutate(freq = N / sum(N)) %>%
    ggplot(aes(x = start_year,
               y = freq,
               color = sex)) +
    geom_line(size = 1.1) +
    scale_y_continuous(labels = scales::percent) +
    scale_color_manual(values = sex_colors,
                       labels = c("Women", "Men")) +
    guides(color = guide_legend(reverse = TRUE)) +
    labs(x = "Year", y = "Percent", color = "Group") +
    facet_wrap(~ party)
```


Democrat
Republican
100%
75%
50%
25%
0%
Percent
2014
2016
2018
2014
2016
2018
Year
Group
Men
Women

Functions

```r
add_xy(x = 1, y = 7)
```

```
## [1] 8
```

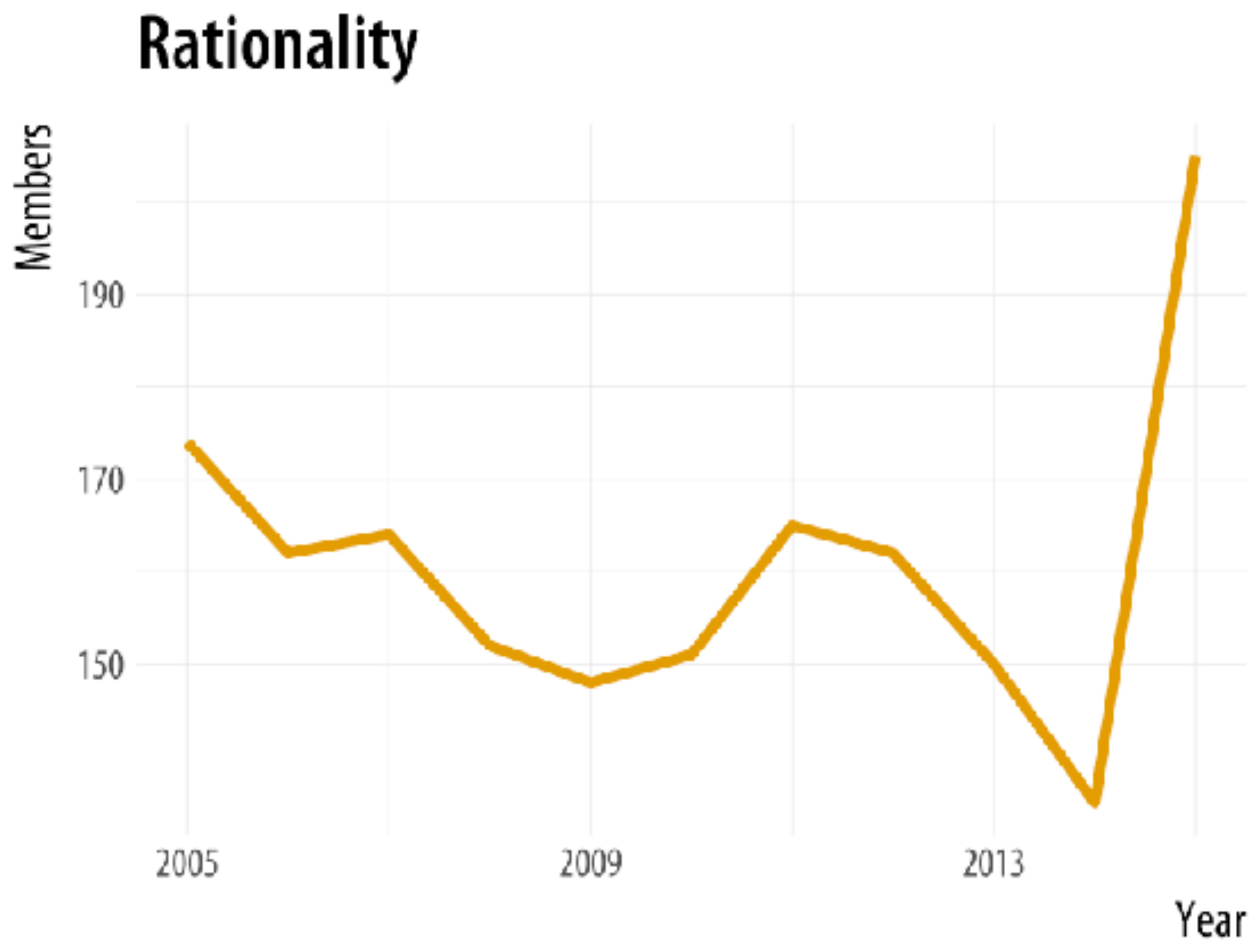
```r
add_xy <- function(x, y) {
    x + y
}
```

```r
add_xy(x = 5, y = 2)
```

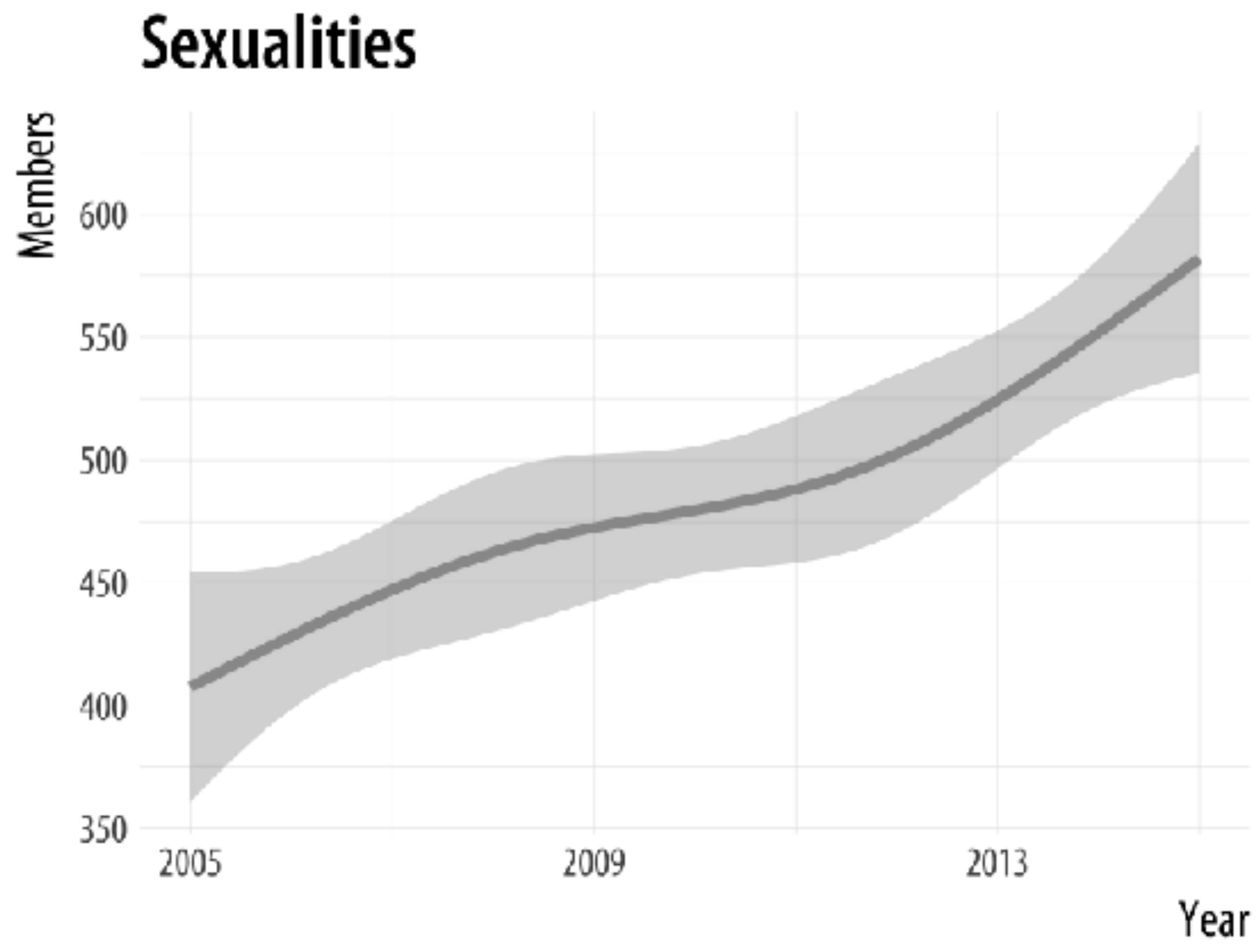
```
## [1] 7
```

```r
plot_section <- function(section="Culture", x = "Year",
                         y = "Members", data = asasec,
                         smooth=FALSE){
    require(ggplot2)
    require(splines)
    # Note use of aes_string() rather than aes()
    p <- ggplot(subset(data, Sname==section),
            mapping = aes_string(x=x, y=y))

    if(smooth == TRUE) {
        p0 <- p + geom_smooth(color = "#999999",
                             size = 1.2, method = "lm",
                             formula = y ~ ns(x, 3)) +
            scale_x_continuous(breaks = c(seq(2005, 2015, 4))) +
            labs(title = section)
    } else {
    p0 <- p + geom_line(color= "#E69F00", size=1.2) +
        scale_x_continuous(breaks = c(seq(2005, 2015, 4))) +
        labs(title = section)
    }

    print(p0)
}
```

```r
plot_section("Rationality")
```




```r
plot_section("Sexualities", smooth = TRUE)
```



Tiles and Labels

CLASS I.

Institutions whose graduates would ordinarily be able to take the master's degree at any of the large graduate schools in one year after receiving the bachelor's degree, without necessarily doing more than the amount of work regularly prescribed for such higher degree.

```
> data_allu
# A tibble: 206 x 13
    Rank School Babcock PubPriv Tuition Enrollment Acceptance Retention Graduation Type  Dummy sname
   <dbl> <fct>  <chr>   <chr>     <dbl>      <dbl>      <dbl>     <dbl>      <dbl> <chr> <dbl> <chr>
 1   152 Adelp… Class 2 Private   30800       7859       66.5        81         66 Univ…     1 Adel…
 2    75 Ameri… Not Ra… Private   40649      12904       44.2        90         77 Univ…     1 Amer…
 3   181 Andre… Not Ra… Private   25470       3551       37.5        79         59 Univ…     1 Andr…
 4   142 Arizo… Not Ra… Public    10002      73378       87.9        82         57 Univ…     1 Ariz…
 5    91 Aubur… Not Ra… Public     9852      25134       77.2        88         68 Univ…     1 Aubu…
 6   173 Azusa… Not Ra… Private   32256      10184       52.3        85         63 Univ…     1 Azus…
 7   181 Ball … Not Ra… Public     9250      21053       61.2        79         57 Univ…     1 Ball…
 8    75 Baylo… Class 2 Private   35972      15364       60.7        85         75 Univ…     1 Bayl…
 9    97 Bingh… Not Ra… Public     8144      15308       42.9        91         79 Univ…     1 Bing…
10   177 Biola… Not Ra… Private   32142       6302       74.7        85         65 Univ…     1 Biola
# … with 196 more rows, and 1 more variable: usnwr_grp <fct>
```

CLASS IV.

Institutions whose bachelor's degree would be approximately two years short of equivalency with the standard bachelor's degree of a standard college as described above. It should be said in connection with this class that the information upon which to base judgment of individual institutions is less sufficient and satisfactory, and in larger proportion drawn from catalogues, than is the case for the other classes, since a relatively smaller proportion of the graduates of institutions in this class appears in the registration in graduate and professional schools. Presumably a much larger number of institutions will

```
> data_allu
# A tibble: 206 x 13
    Rank School Babcock PubPriv Tuition Enrollment Acceptance Retention Graduation Type  Dummy sname
   <dbl> <fct>  <chr>   <chr>     <dbl>      <dbl>      <dbl>     <dbl>      <dbl> <chr> <dbl> <chr>
 1   152 Adelp… Class 2 Private   30800       7859       66.5        81         66 Univ…     1 Adel…
 2    75 Ameri… Not Ra… Private   40649      12904       44.2        90         77 Univ…     1 Amer…
 3   181 Andre… Not Ra… Private   25470       3551       37.5        79         59 Univ…     1 Andr…
 4   142 Arizo… Not Ra… Public    10002      73378       87.9        82         57 Univ…     1 Ariz…
 5    91 Aubur… Not Ra… Public     9852      25134       77.2        88         68 Univ…     1 Aubu…
 6   173 Azusa… Not Ra… Private   32256      10184       52.3        85         63 Univ…     1 Azus…
 7   181 Ball … Not Ra… Public     9250      21053       61.2        79         57 Univ…     1 Ball…
 8    75 Baylo… Class 2 Private   35972      15364       60.7        85         75 Univ…     1 Bayl…
 9    97 Bingh… Not Ra… Public     8144      15308       42.9        91         79 Univ…     1 Bing…
10   177 Biola… Not Ra… Private   32142       6302       74.7        85         65 Univ…     1 Biola
# … with 196 more rows, and 1 more variable: usnwr_grp <fct>
```

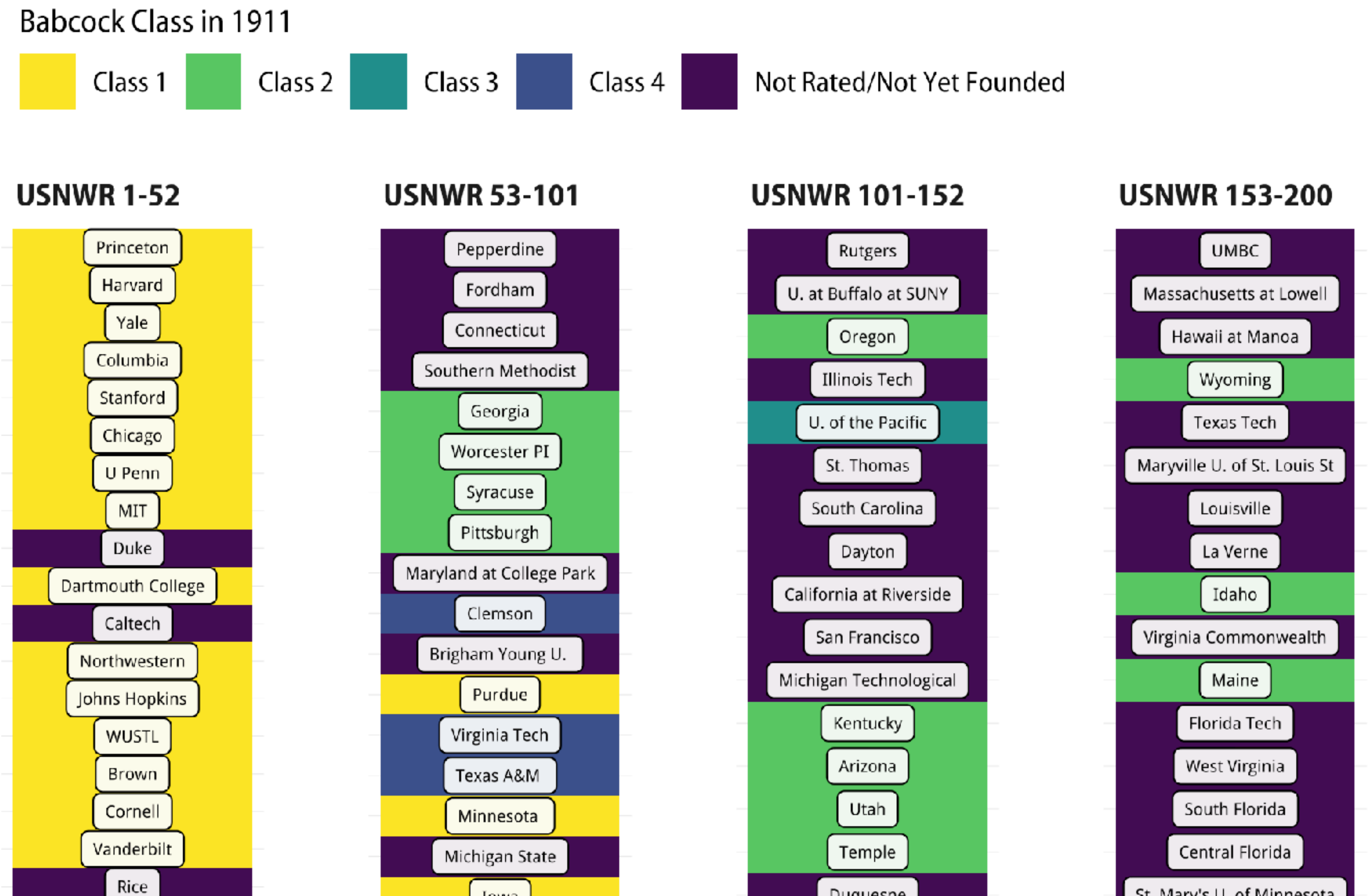
```r
p <- ggplot(mapping = data_allu, aes(x = Dummy, y = reorder(sname, -Rank),
                           fill = Babcock,
                           label = sname))

p + geom_tile() +
  facet_wrap( ~ usnwr_grp, nrow = 1, scales = "free_y") +
    geom_label(fill = "#FFFFFF", alpha = 0.9, size = rel(1.8)) +
    scale_fill_viridis_d(option = "D", direction = -1) +
    guides(fill = guide_legend(title="Babcock Class in 1911",
                               title.position = "top")) +
    labs(x = NULL, y = NULL,
         title = "The Persistence of the Old Regime",
         subtitle = "1911 Babcock Classification and 2014 US News Rankings",
         caption = "Kieran Healy. http://kieranhealy.org") +
   theme(strip.text.x = element_text(size = rel(0.8), face = "bold"),
          axis.ticks=element_blank(),
          axis.text.x = element_blank(),
          axis.text.y = element_blank(),
          legend.title = element_text(size = rel(0.9)),
          panel.grid.major.x = element_blank(),
          panel.grid.minor.x = element_blank(),
          legend.position = "top",
          legend.justification = "left")
```

The Persistence of the Old Regime

1911 Babcock Classification and 2014 US News Rankings

The Persistence of the Old Regime

1911 Babcock Classification and 2014 US News Rankings



Animation

Introductory

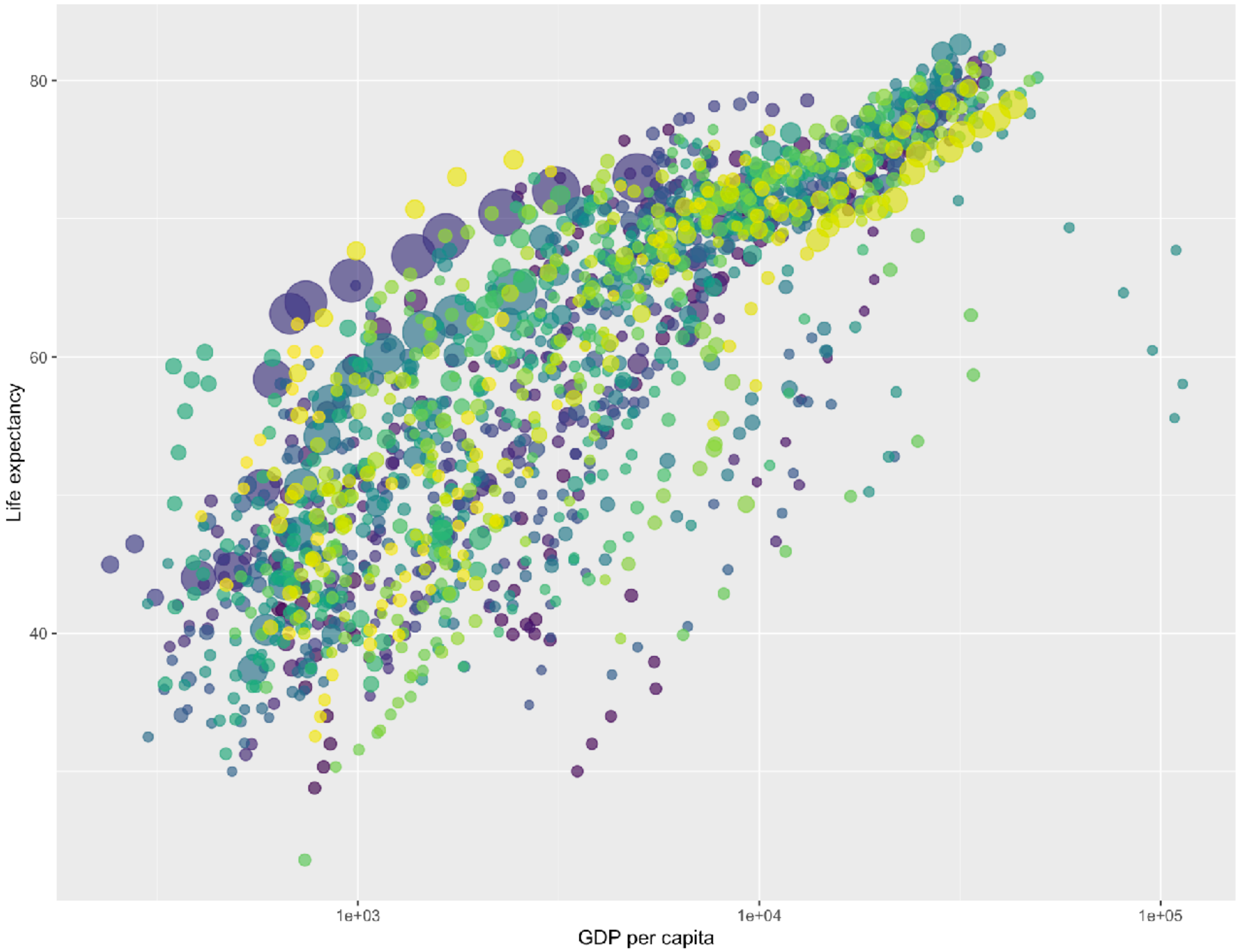
```
install.packages("gifski")
```

```
install.packages("pngpackage")
```

```
library(gganimate)
```

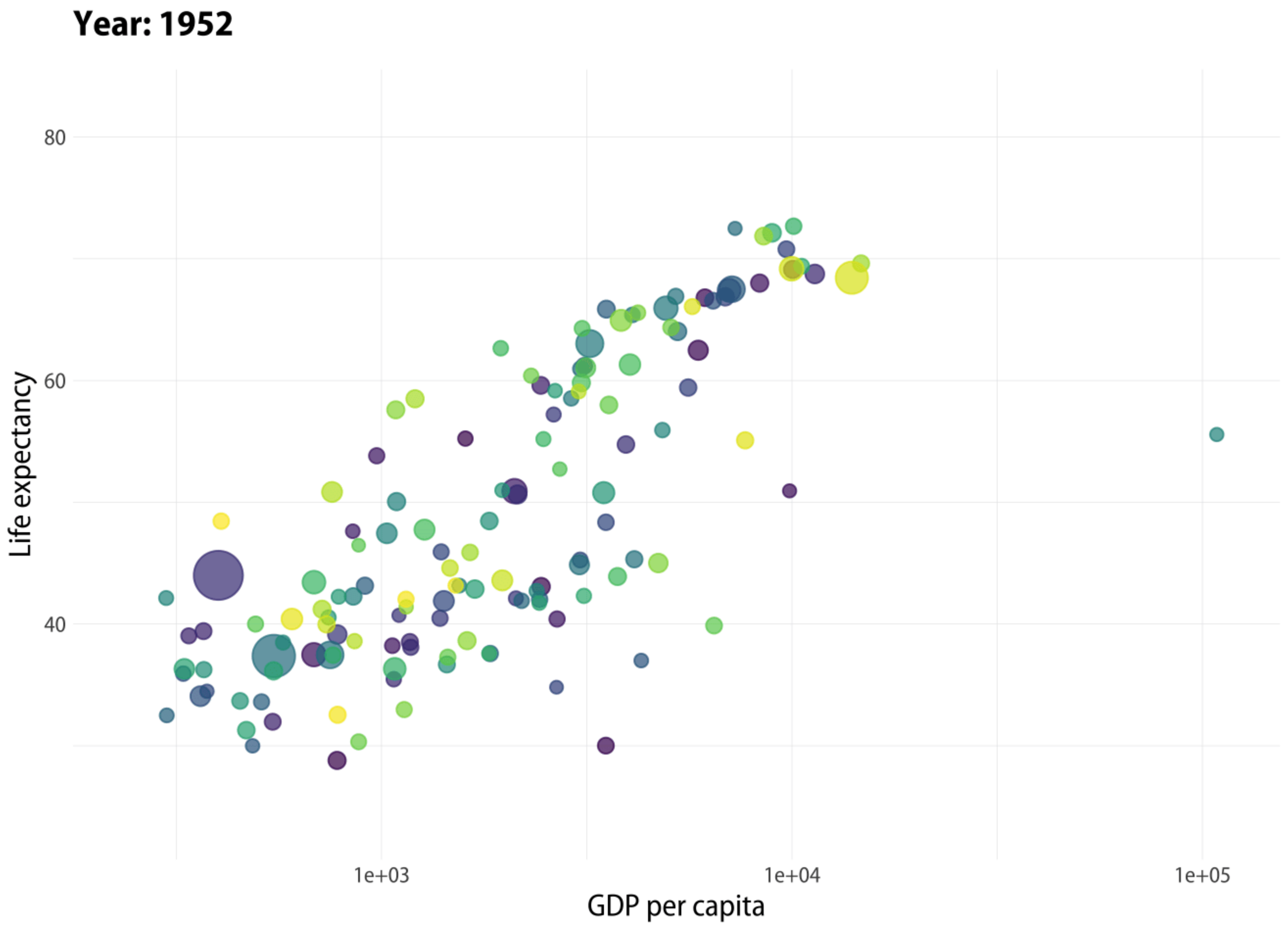
```
library(gapminder)
```

```
p <- ggplot(data = gapminder,
            mapping = aes(x = gdpPercap, y=lifeExp,
                          size = pop, color = country)) +
  geom_point(show.legend = FALSE, alpha = 0.7) +
  scale_color_viridis_d() +
  scale_size(range = c(2, 12)) +
  scale_x_log10() +
  labs(x = "GDP per capita", y = "Life expectancy")
p
```



80
60
40
Life expectancy
1e+03
1e+04
1e+05
GDP per capita

```r
p + transition_time(year) +
  labs(title = "Year: {frame_time}")
```

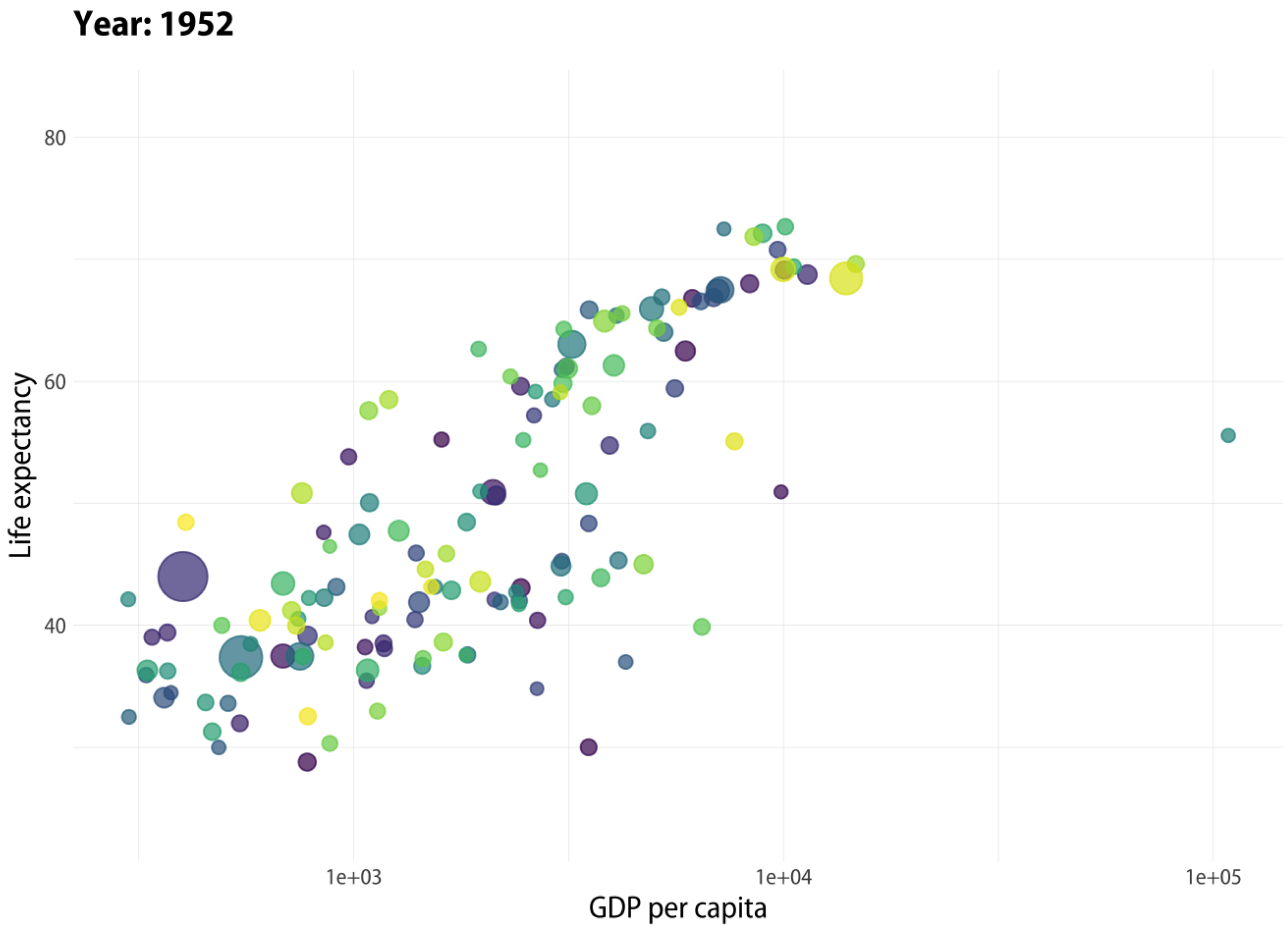


Year: 1952
80
60
40
Life expectancy
1e+03
1e+04
1e+05
GDP per capita

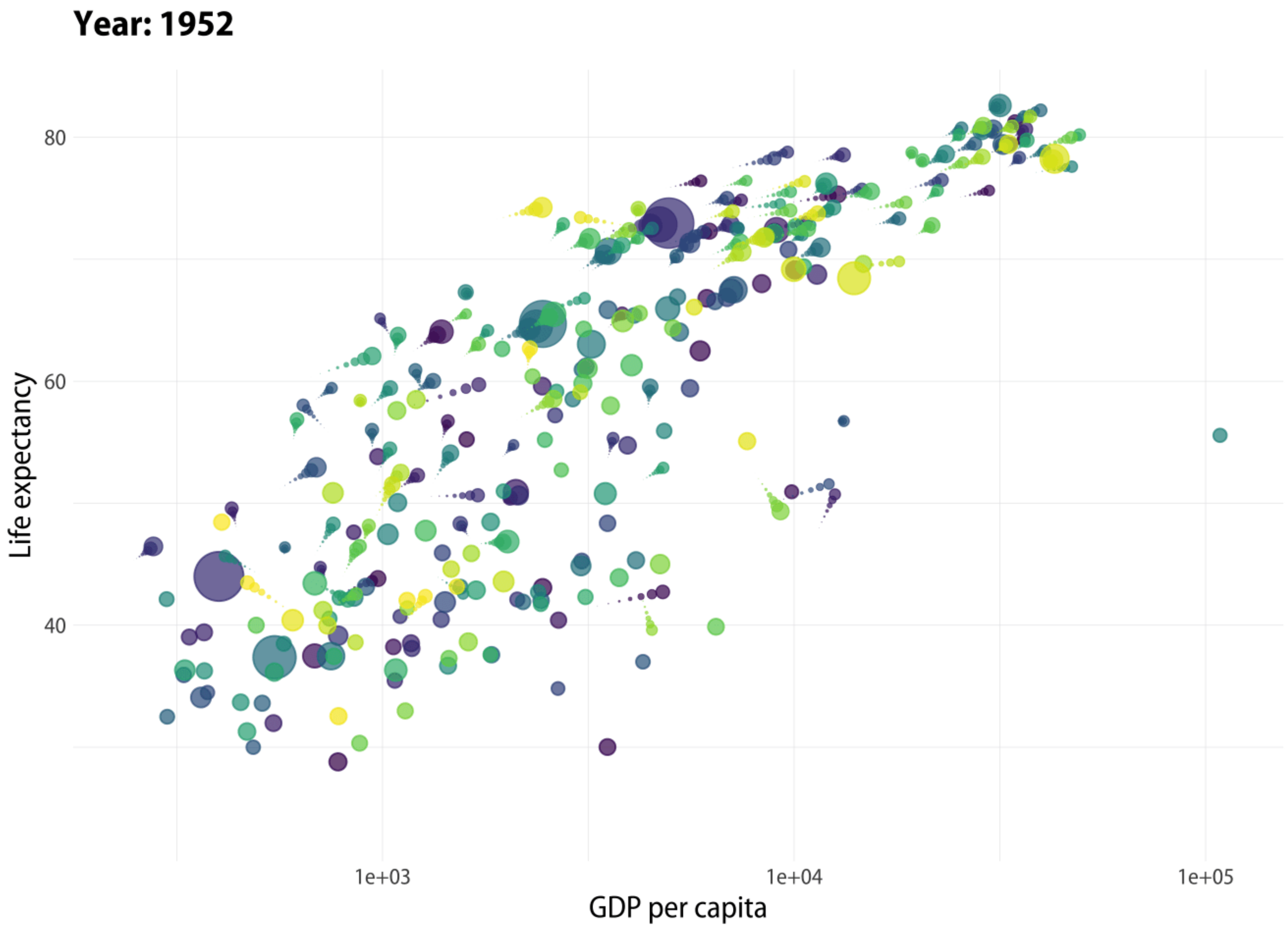
```r
p + facet_wrap(~continent) +
  transition_time(year) +
  labs(title = "Year: {frame_time}")
```

Year: 1952
Africa
Americas
Asia
Europe
Oceania
Life expectancy
GDP per capita
80
60
40
1e+03
1e+04
1e+05

```r
p + transition_time(year) +
  labs(title = "Year: {frame_time}") +
  view_follow(fixed_y = TRUE)
```

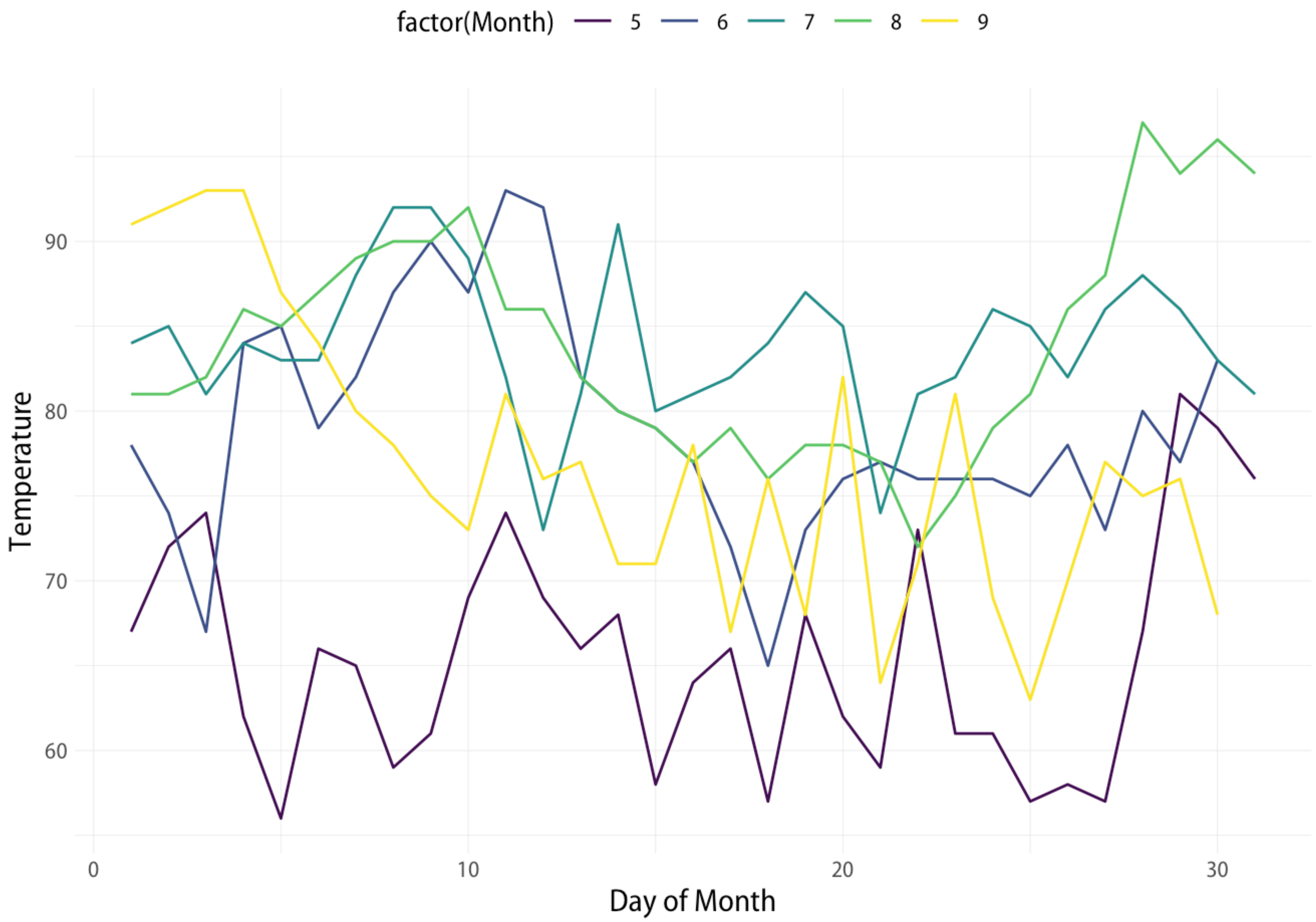

Year: 1952
80
60
40
Life expectancy
1e+03
1e+04
1e+05
GDP per capita

```r
p + transition_time(year) +
  labs(title = "Year: {frame_time}") +
  shadow_wake(wake_length = 0.1, alpha = FALSE)
```



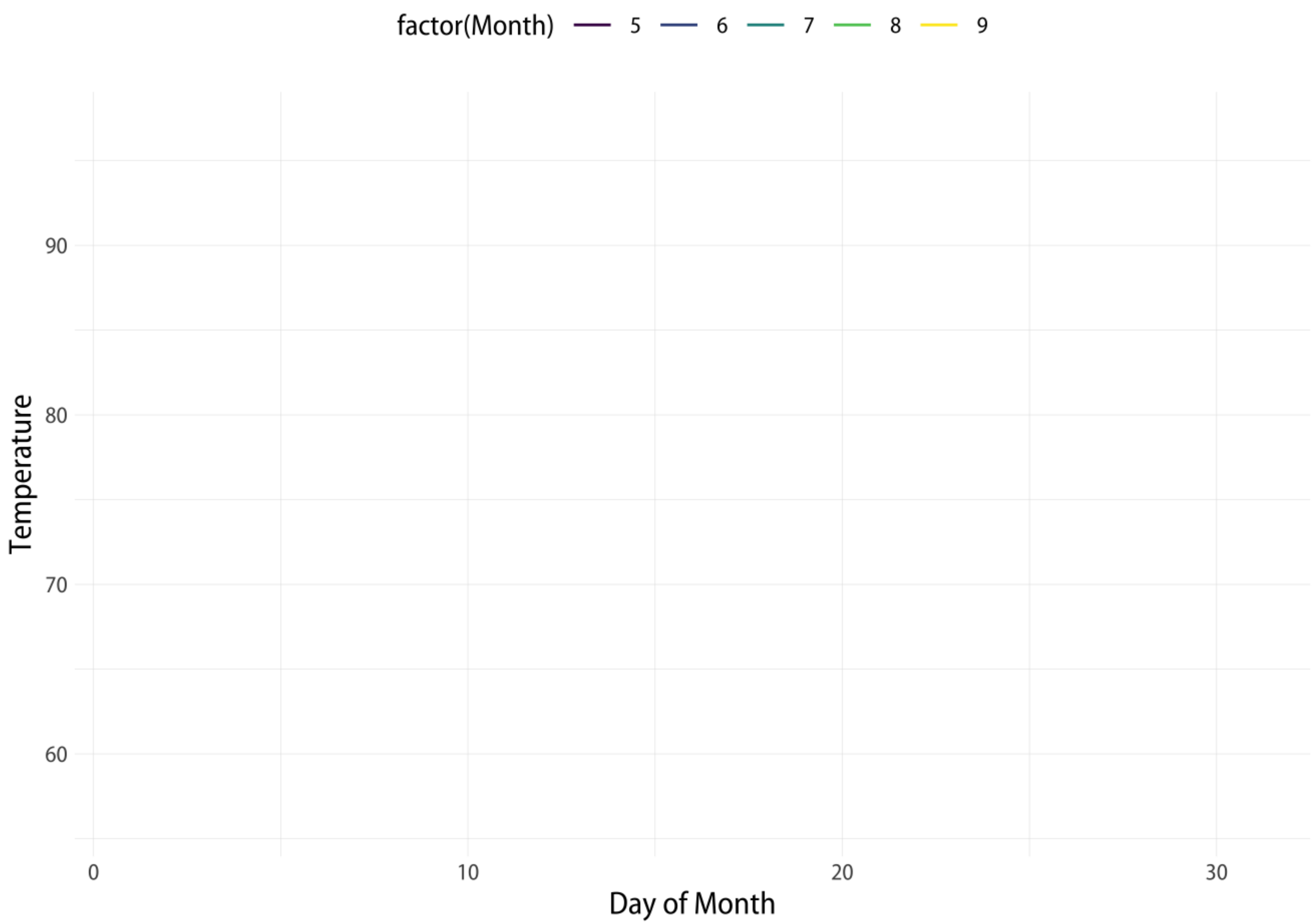
Year: 1952
80
60
40
Life expectancy
1e+03
1e+04
1e+05
GDP per capita

```r
p <- ggplot(data = airquality,
            mapping = aes(Day, Temp, group = Month,
                          color = factor(Month))) +
  geom_line() +
  scale_color_viridis_d() +
  labs(x = "Day of Month", y = "Temperature") +
  theme(legend.position = "top")
p
```



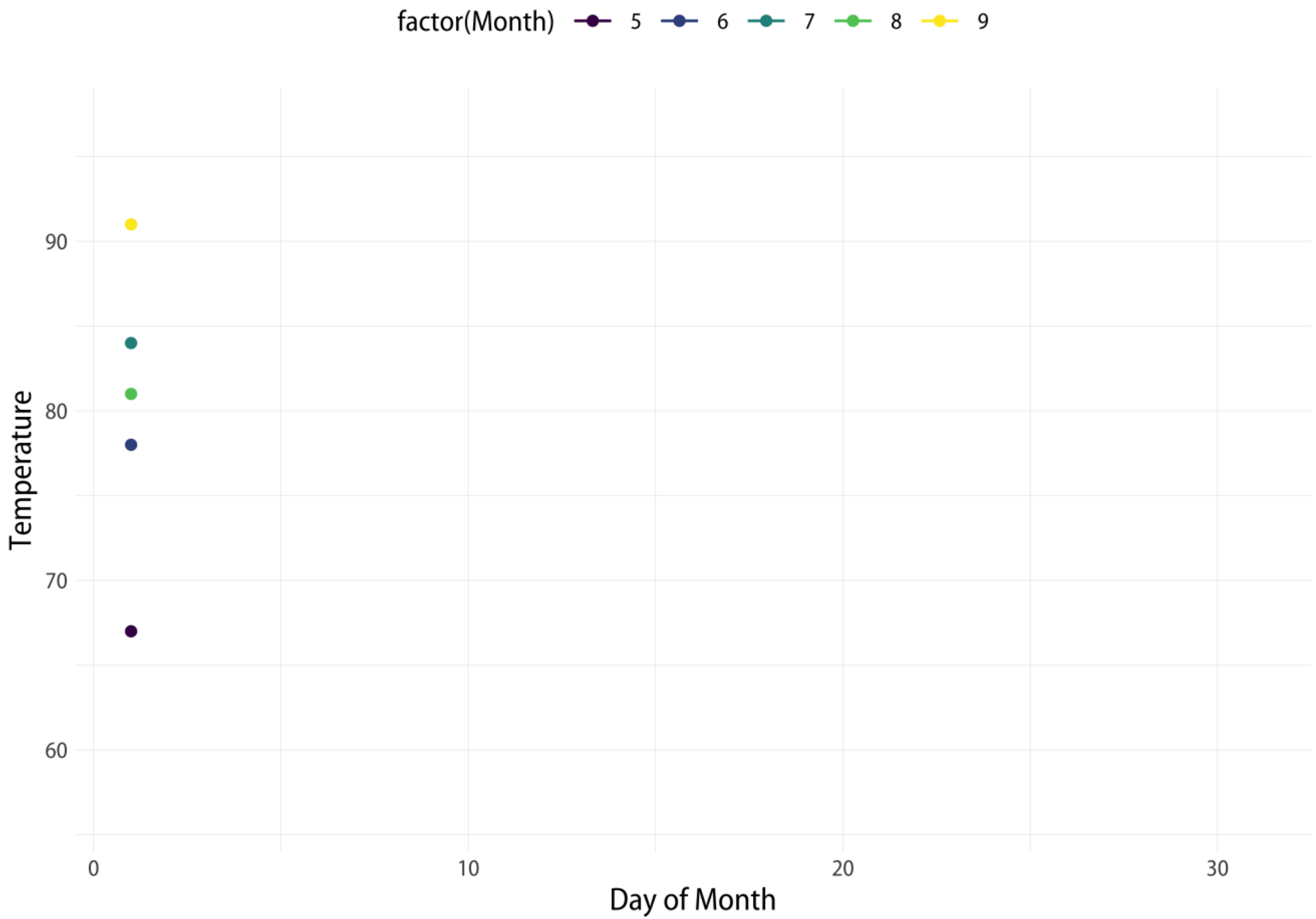
factor(Month)
5
6
7
8
9
Temperature
90
80
70
60
0
10
20
30
Day of Month

```
p + transition_reveal(Day)
```

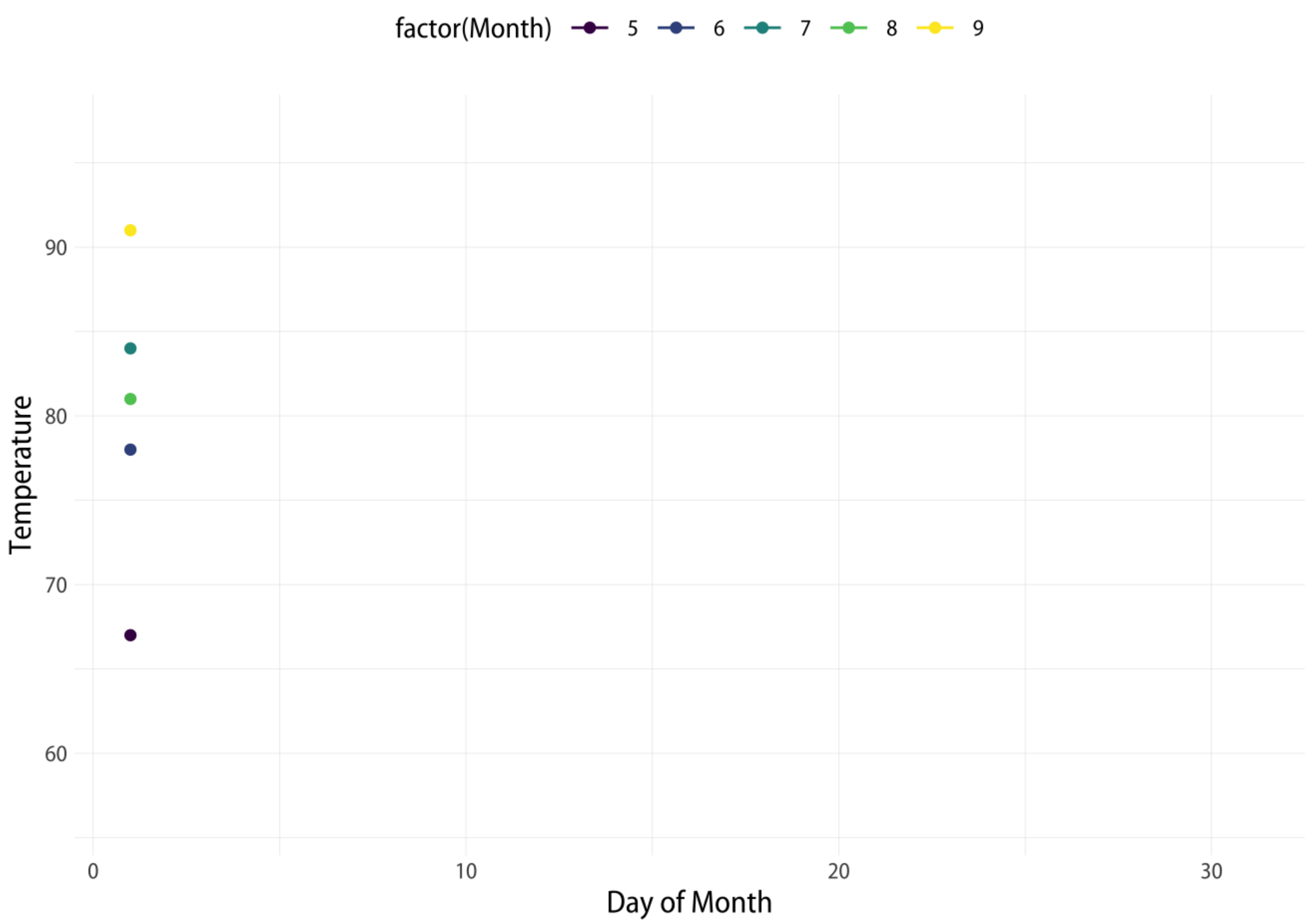


factor(Month)
5
6
7
8
9
Temperature
90
80
70
60
0
10
20
30
Day of Month

```r
p +
  geom_point() +
  transition_reveal(Day)
```


factor(Month)
5
6
7
8
9
Temperature
90
80
70
60
0
10
20
30
Day of Month

```r
p +
  geom_point(aes(group = seq_along(Day))) +
  transition_reveal(Day)
```



factor(Month)
5
6
7
8
9
Temperature
90
80
70
60
0
10
20
30
Day of Month

```r
p +
  geom_point(aes(group = seq_along(Day))) +
  transition_reveal(Day)
```

Baby Names

```r
library(babynames)
library(gganimate)
```

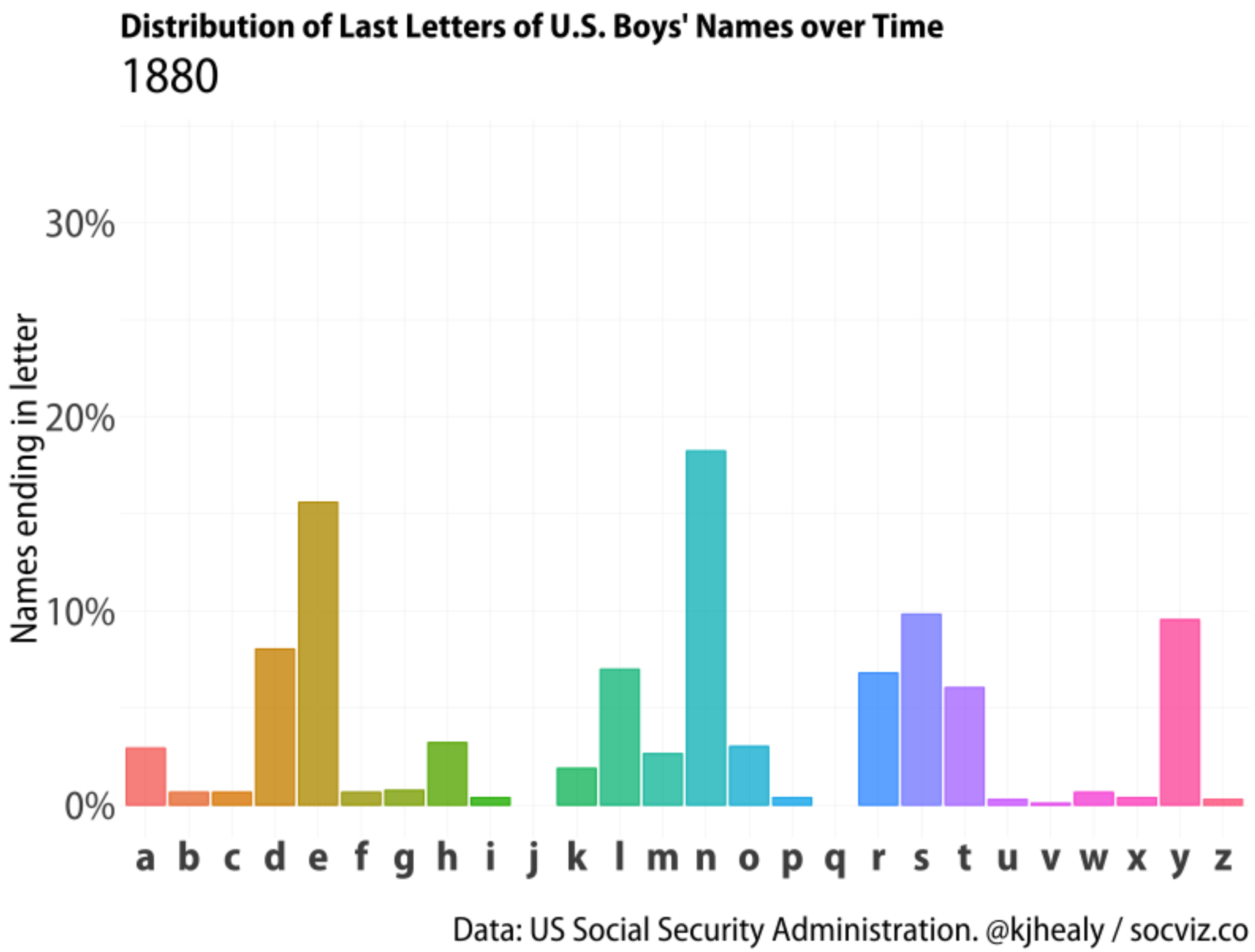
```
> babynames
# A tibble: 1,924,665 x 5
    year sex   name          n   prop
   <dbl> <chr> <chr>     <int>  <dbl>
 1  1880 F     Mary       7065 0.0724
 2  1880 F     Anna       2604 0.0267
 3  1880 F     Emma       2003 0.0205
 4  1880 F     Elizabeth  1939 0.0199
 5  1880 F     Minnie     1746 0.0179
 6  1880 F     Margaret   1578 0.0162
 7  1880 F     Ida        1472 0.0151
 8  1880 F     Alice      1414 0.0145
 9  1880 F     Bertha     1320 0.0135
10  1880 F     Sarah      1288 0.0132
# … with 1,924,655 more rows
```

```r
## Create the plot object
p <- babynames %>%
    filter(sex == "M") %>%
    mutate(endletter = stringr::str_sub(name, -1)) %>%
    group_by(year, endletter) %>%
    summarize(letter_count = n()) %>%
    mutate(letter_prop = letter_count / sum(letter_count),
           rank = min_rank(-letter_prop) * 1) %>%
    ungroup() %>%
    ggplot(aes(x = factor(endletter, levels = letters, ordered = TRUE),
               y = letter_prop,
               group = endletter,
               fill = factor(endletter),
               color = factor(endletter))) +
    geom_col(alpha = 0.8) +
    scale_y_continuous(labels = scales::percent_format(accuracy = 1)) +
    guides(color = FALSE, fill = FALSE) +
    labs(title = "Distribution of Last Letters of U.S. Girls' Names over Time",
         subtitle  = '{closest_state}',
         x = "", y = "Names ending in letter",
         caption = "Data: US Social Security Administration. @kjhealy / socviz.co") +
    theme(plot.title = element_text(size = rel(2)),
          plot.subtitle = element_text(size = rel(3)),
          plot.caption = element_text(size = rel(2)),
          axis.text.x = element_text(face = "bold", size = rel(3)),
          axis.text.y = element_text(size = rel(3)),
          axis.title.y = element_text(size = rel(2))) +
    transition_states(year, transition_length = 4, state_length = 1) +
    ease_aes('cubic-in-out')
```

```
# A tibble: 3,424 x 5
    year endletter letter_count letter_prop  rank
   <dbl> <chr>            <int>       <dbl> <dbl>
 1  1880 a                   31     0.0293     11
 2  1880 b                    7     0.00662    15
 3  1880 c                    7     0.00662    15
 4  1880 d                   85     0.0803      5
 5  1880 e                  165     0.156       2
 6  1880 f                    7     0.00662    15
 7  1880 g                    8     0.00756    14
 8  1880 h                   34     0.0321      9
 9  1880 i                    4     0.00378    19
10  1880 k                   20     0.0189     13
# … with 3,414 more rows
```

```r
## Create the plot object
p <- babynames %>%
    filter(sex == "M") %>%
    mutate(endletter = stringr::str_sub(name, -1)) %>%
    group_by(year, endletter) %>%
    summarize(letter_count = n()) %>%
    mutate(letter_prop = letter_count / sum(letter_count),
           rank = min_rank(-letter_prop) * 1) %>%
    ungroup() %>%
    ggplot(aes(x = factor(endletter, levels = letters, ordered = TRUE),
               y = letter_prop,
               group = endletter,
               fill = factor(endletter),
               color = factor(endletter))) +
    geom_col(alpha = 0.8) +
    scale_y_continuous(labels = scales::percent_format(accuracy = 1)) +
    guides(color = FALSE, fill = FALSE) +
    labs(title = "Distribution of Last Letters of U.S. Girls' Names over Time",
         subtitle  = '{closest_state}',
         x = "", y = "Names ending in letter",
         caption = "Data: US Social Security Administration. @kjhealy / socviz.co") +
    theme(plot.title = element_text(size = rel(2)),
          plot.subtitle = element_text(size = rel(3)),
          plot.caption = element_text(size = rel(2)),
          axis.text.x = element_text(face = "bold", size = rel(3)),
          axis.text.y = element_text(size = rel(3)),
          axis.title.y = element_text(size = rel(2))) +
    transition_states(year, transition_length = 4, state_length = 1) +
    ease_aes('cubic-in-out')
```

```r
animate(p, fps = 25, duration = 20, width = 800, height = 600,
        renderer = gifski_renderer("figures/name_endings_boys.gif"))
```



Population Pyramids

```r
## drat::addRepo("kjhealy")
## install.packages("uscenpops")

library(tidyverse)
library(uscenpops)

uscenpops
#> # A tibble: 10,520 x 5
#>     year   age     pop   male female
#>    <int> <dbl>   <dbl>  <dbl>  <dbl>
#>  1  1900     0 1811000 919000 892000
#>  2  1900     1 1835000 928000 907000
#>  3  1900     2 1846000 932000 914000
#>  4  1900     3 1848000 932000 916000
#>  5  1900     4 1841000 928000 913000
#>  6  1900     5 1827000 921000 906000
#>  7  1900     6 1806000 911000 895000
#>  8  1900     7 1780000 899000 881000
#>  9  1900     8 1750000 884000 866000
#> 10  1900     9 1717000 868000 849000
#> # … with 10,510 more rows
```

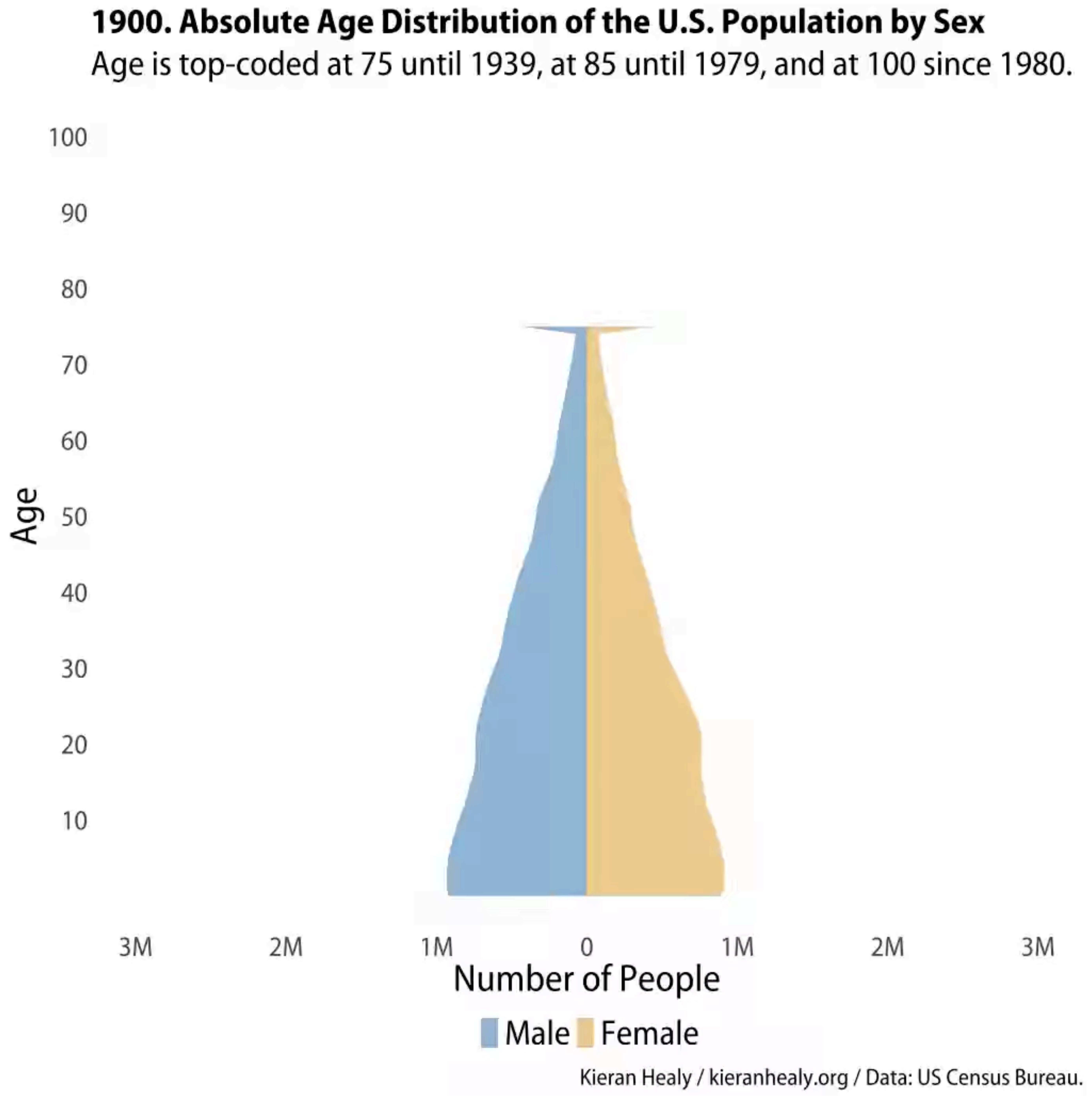
```r
library(tidyverse)
library(here)
library(janitor)
library(socviz)
library(gganimate)
library(transformr)
```

```r
pop_pyr <- uscenpops %>% select(year, age, male, female) %>%
  pivot_longer(male:female, names_to = "group", values_to = "count") %>%
  group_by(year, group) %>%
  mutate(total = sum(count), pct = (count/total)*100, base = 0)

pop_pyr
#> # A tibble: 21,040 x 7
#> # Groups:   year, group [240]
#>     year   age group   count    total   pct  base
#>    <int> <dbl> <chr>   <dbl>    <dbl> <dbl> <dbl>
#>  1  1900     0 male   919000 38867000  2.36     0
#>  2  1900     0 female 892000 37227000  2.40     0
#>  3  1900     1 male   928000 38867000  2.39     0
#>  4  1900     1 female 907000 37227000  2.44     0
#>  5  1900     2 male   932000 38867000  2.40     0
#>  6  1900     2 female 914000 37227000  2.46     0
#>  7  1900     3 male   932000 38867000  2.40     0
#>  8  1900     3 female 916000 37227000  2.46     0
#>  9  1900     4 male   928000 38867000  2.39     0
#> 10  1900     4 female 913000 37227000  2.45     0
#> # … with 21,030 more rows
```

```r
uscenpops %>%
  group_by(year) %>%
  summarize(max_age = max(age)) %>%
  group_by(max_age) %>%
  summarize(minyr = min(year),
            maxyr = max(year))

#> # A tibble: 3 x 3
#>   max_age minyr maxyr
#>     <dbl> <int> <int>
#> 1      75  1900  1939
#> 2      85  1940  1979
#> 3     100  1980  2019


## Make all the Male ages negative
pop_pyr$count[pop_pyr$group == "male"] <-
  -pop_pyr$count[pop_pyr$group == "male"]

mbreaks <- c("1M", "2M", "3M")
```

```r
p <- ggplot(data = pop_pyr,
            mapping = aes(x = age, ymin = base,
                          ymax = count, fill = group))

p_pyr_count <- p + geom_ribbon(alpha = 0.5) +
    scale_y_continuous(labels = c(rev(mbreaks), "0", mbreaks), breaks = seq(-3e6, 3e6, 1e6),
                       limits = c(-3e6, 3e6)) +
    scale_x_continuous(breaks = seq(10, 100, 10)) +
    scale_fill_manual(values = my.colors("bly"), labels = c("Female", "Male")) +
    guides(fill = guide_legend(reverse = TRUE)) +
    labs(x = "Age", y = "Number of People",
         title = "{frame_time}. Absolute Age Distribution of the U.S. Population by Sex",
         subtitle = "Age is top-coded at 75 until 1939, at 85 until 1979, and at 100 since 1980.",
         caption = "Kieran Healy / kieranhealy.org / Data: US Census Bureau.",
         fill = "") +
    theme(legend.position = "bottom",
          plot.title = element_text(size = rel(3), face = "bold"),
          plot.subtitle = element_text(size = rel(3)),
          plot.caption = element_text(size = rel(2)),
          axis.text.y = element_text(size = rel(3)),
          axis.text.x = element_text(size = rel(3)),
          axis.title.x = element_text(size = rel(3)),
          axis.title.y = element_text(size = rel(3)),
          legend.text = element_text(size = rel(3))) +
    coord_flip() +
    transition_time(as.integer(year)) +
    ease_aes("cubic-in-out")
```

```r
animate(p_pyr_count, fps = 25, duration = 60,
        width = 1024, height = 1024,
        renderer = ffmpeg_renderer())
```



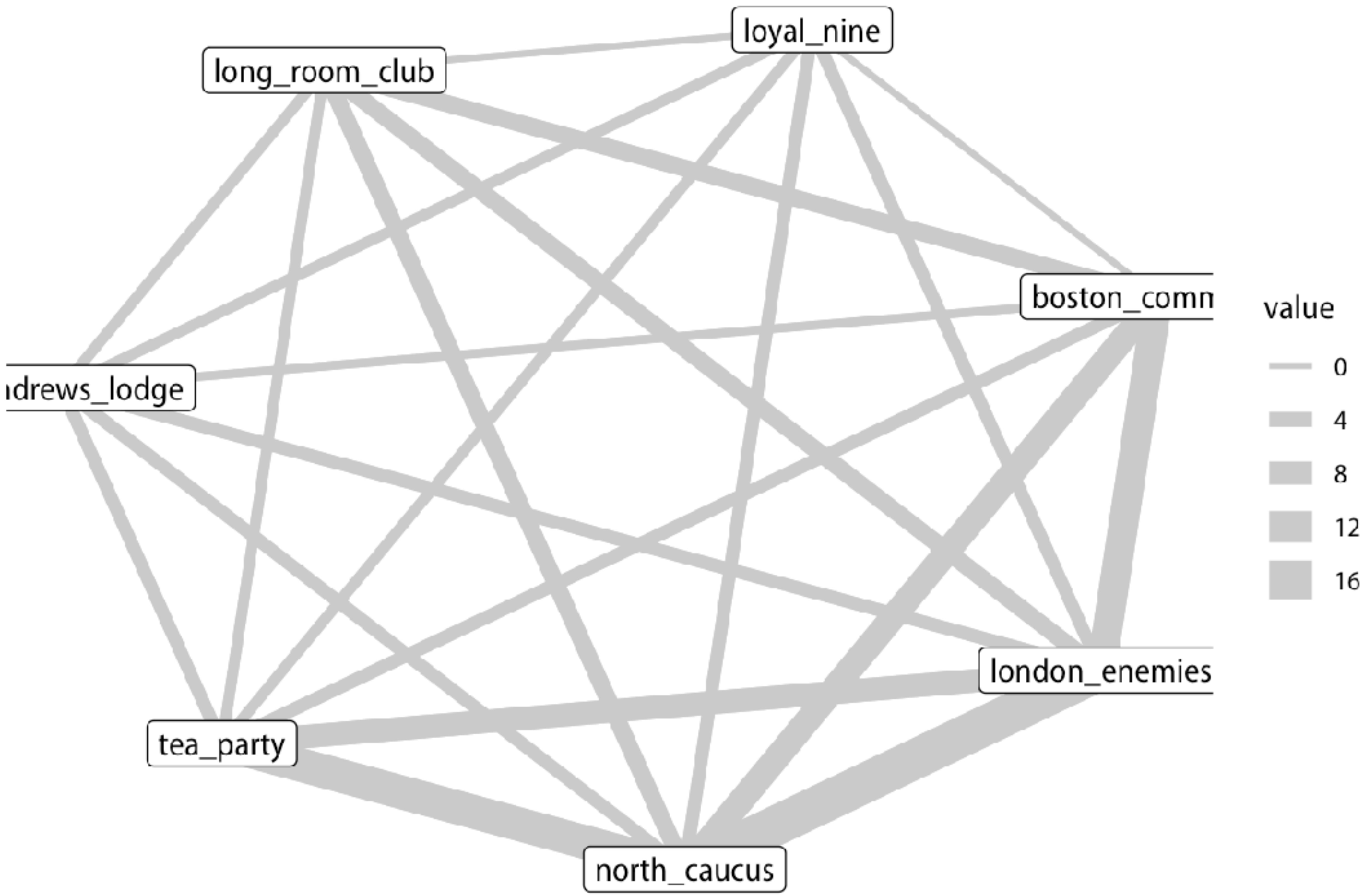
Networks

```r
library(ggraph)
library(tidygraph)
library(graphlayouts)
library(janitor)

drat::addRepo("kjhealy")
install.packages("kjhnet")

library(kjhnet)

head(revere)
#>               person st_andrews_lodge loyal_nine north_caucus long_room_club tea_party boston_committee london_enemies
#> 1         Adams.John                0          0            1              1         0                0              0
#> 2       Adams.Samuel                0          0            1              1         0                1              1
#> 3           Allen.Dr                0          0            1              0         0                0              0
#> 4 Appleton.Nathaniel                0          0            1              0         0                1              0
#> 5         Ash.Gilbert                1          0            0              0         0                0              0
#> 6    Austin.Benjamin                0          0            0              0         0                0              1
```

```r
revere_groups
#> # A tbl_graph: 7 nodes and 49 edges
#> #
#> # An undirected multigraph with 1 component
#> #
#> # Node Data: 7 x 2 (active)
#>      id name
#>   <int> <chr>
#> 1     1 st_andrews_lodge
#> 2     2 loyal_nine
#> 3     3 north_caucus
#> 4     4 long_room_club
#> 5     5 tea_party
#> 6     6 boston_committee
#> # … with 1 more row
#> #
#> # Edge Data: 49 x 3
#>    from    to value
#>   <int> <int> <dbl>
#> 1     1     1    53
#> 2     1     2     2
#> 3     1     3     3
#> # … with 46 more rows
```

```r
revere_persons
#> # A tbl_graph: 254 nodes and 19666 edges
#> #
#> # An undirected multigraph with 1 component
#> #
#> # Node Data: 254 x 2 (active)
#>      id name
#>   <int> <chr>
#> 1     1 John_Adams
#> 2     2 Samuel_Adams
#> 3     3 Dr_Allen
#> 4     4 Nathaniel_Appleton
#> 5     5 Gilbert_Ash
#> 6     6 Benjamin_Austin
#> # … with 248 more rows
#> #
#> # Edge Data: 19,666 x 3
#>    from    to value
#>   <int> <int> <dbl>
#> 1     1     1     2
#> 2     1     2     2
#> 3     1     3     1
#> # … with 19,663 more rows
```

```r
revere_groups %>%
  ggraph(layout = "kk") +
  geom_edge_link(aes(width = value), color = "gray80") +
  geom_node_label(aes(label = name))
```



```
revere_persons %>%
  mutate(centrality = centrality_eigen()) %>%
  ggraph(layout = "stress") +
  geom_edge_link0(mapping = aes(filter = value > 1,
                                width = value),
           color = "gray90") +
  geom_node_point() +
  geom_node_label(mapping = aes(filter = centrality > 0.9,
                               label = name),
                  size = rel(2.5))
```