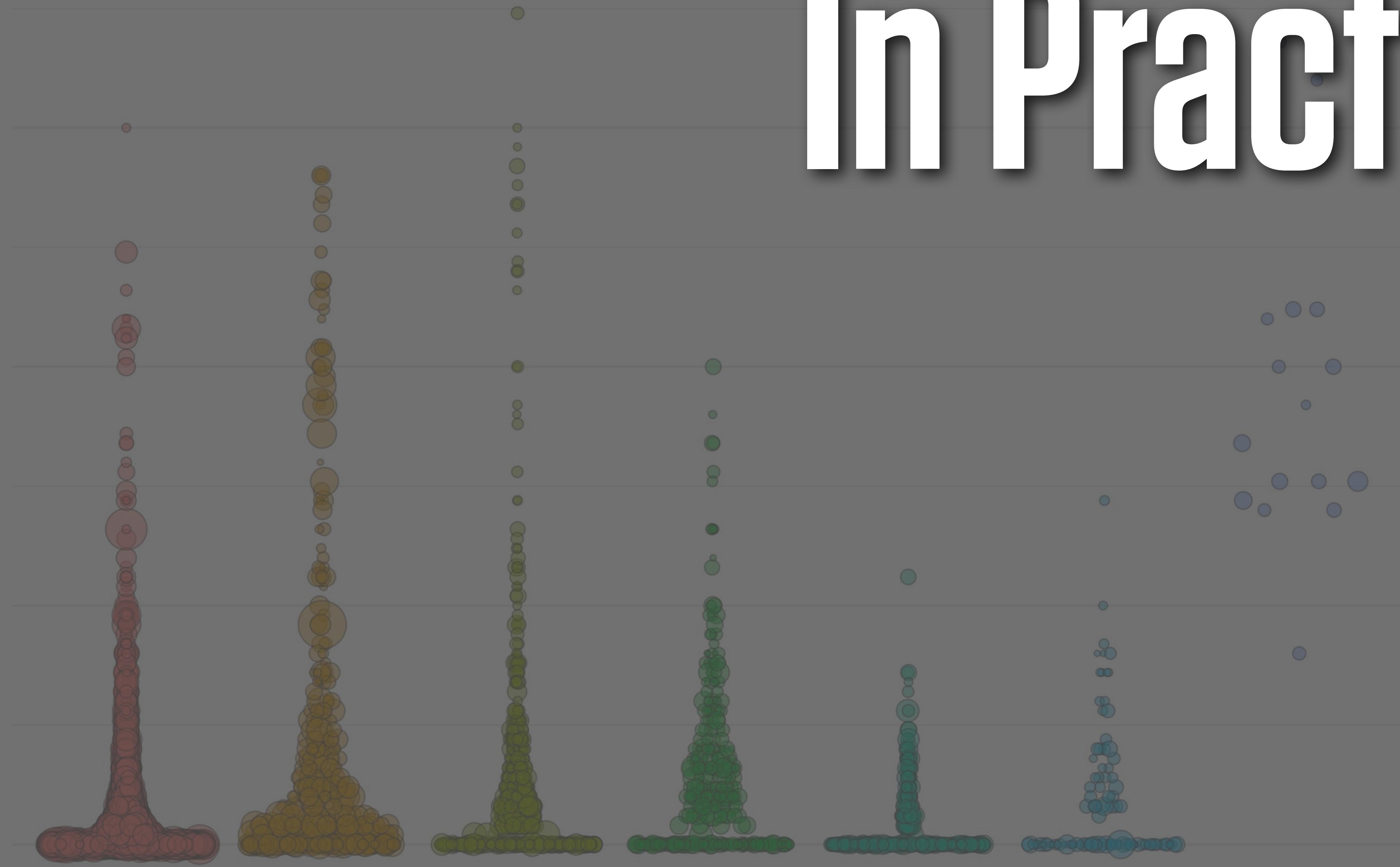


In Practice



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 coll13 coll14 median
#>   <chr> <chr> <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
```

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

```
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
```

```
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

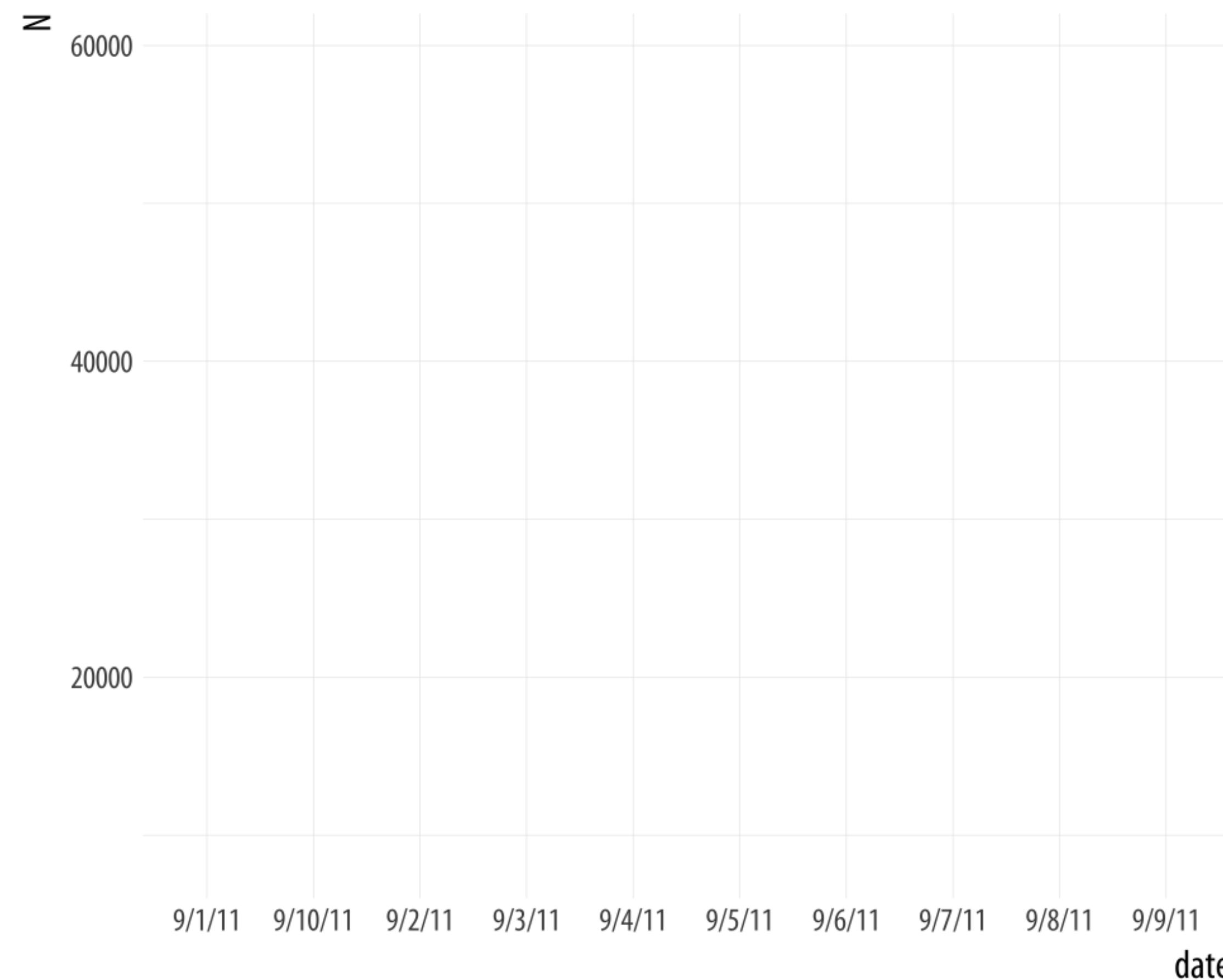
```
head(bad_date)
```

```
## # 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
```

```
head(bad_date)          p <- ggplot(data = bad_date, aes(x = date, y = N))  
                        p + geom_line()  
  
## # A tibble: 6 x 2  
##   date      N  
##   <chr>  <int>  
## 1 9/1/11  44426    ## geom_path: Each group consists of only one observation.  
## 2 9/2/11  55112    ## Do you need to adjust the group aesthetic?  
## 3 9/3/11  19263  
## 4 9/4/11  12330  
## 5 9/5/11  8534  
## 6 9/6/11  59490
```

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

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

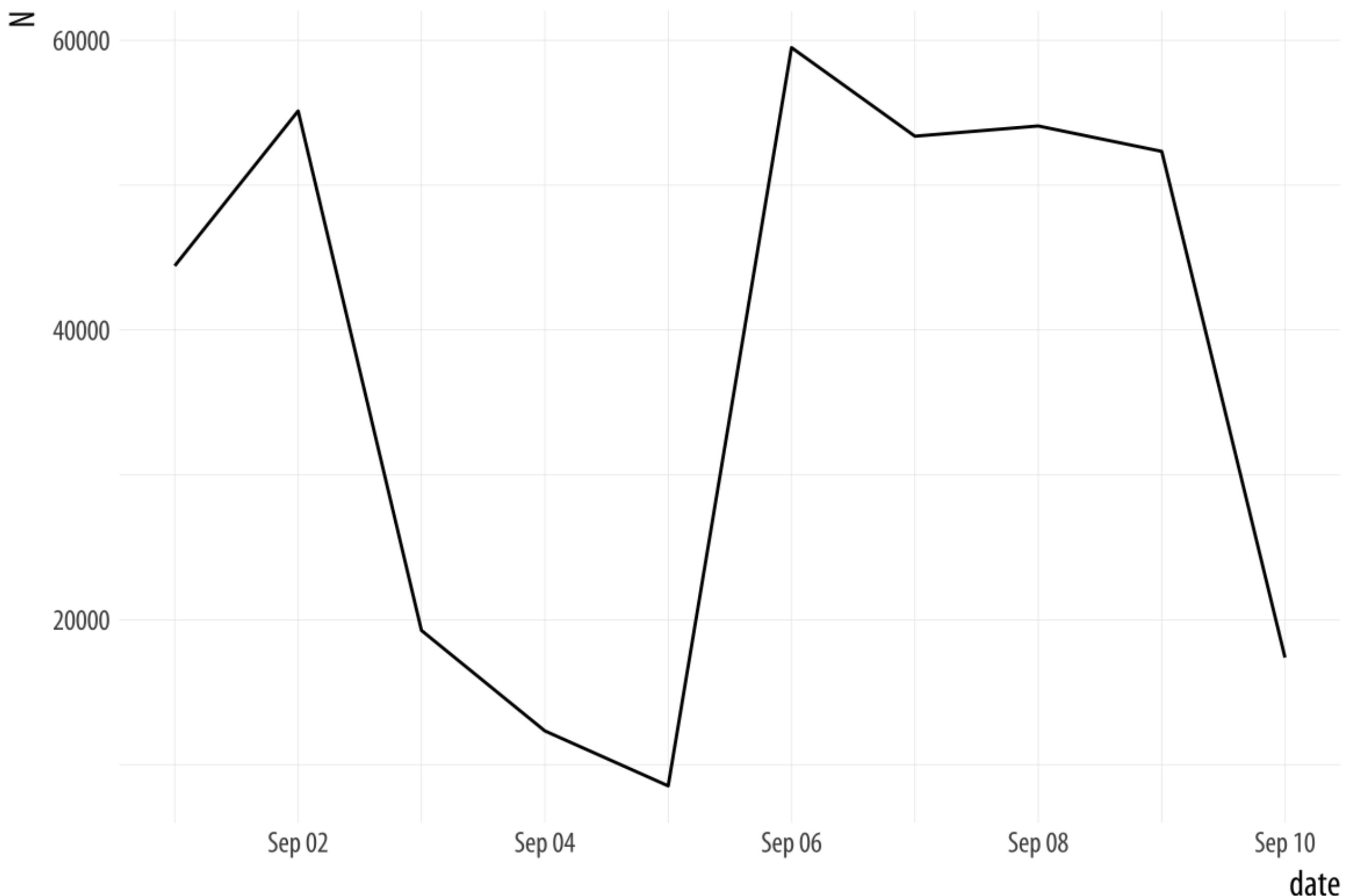


```
# install.packages("lubridate")
library(lubridate)

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

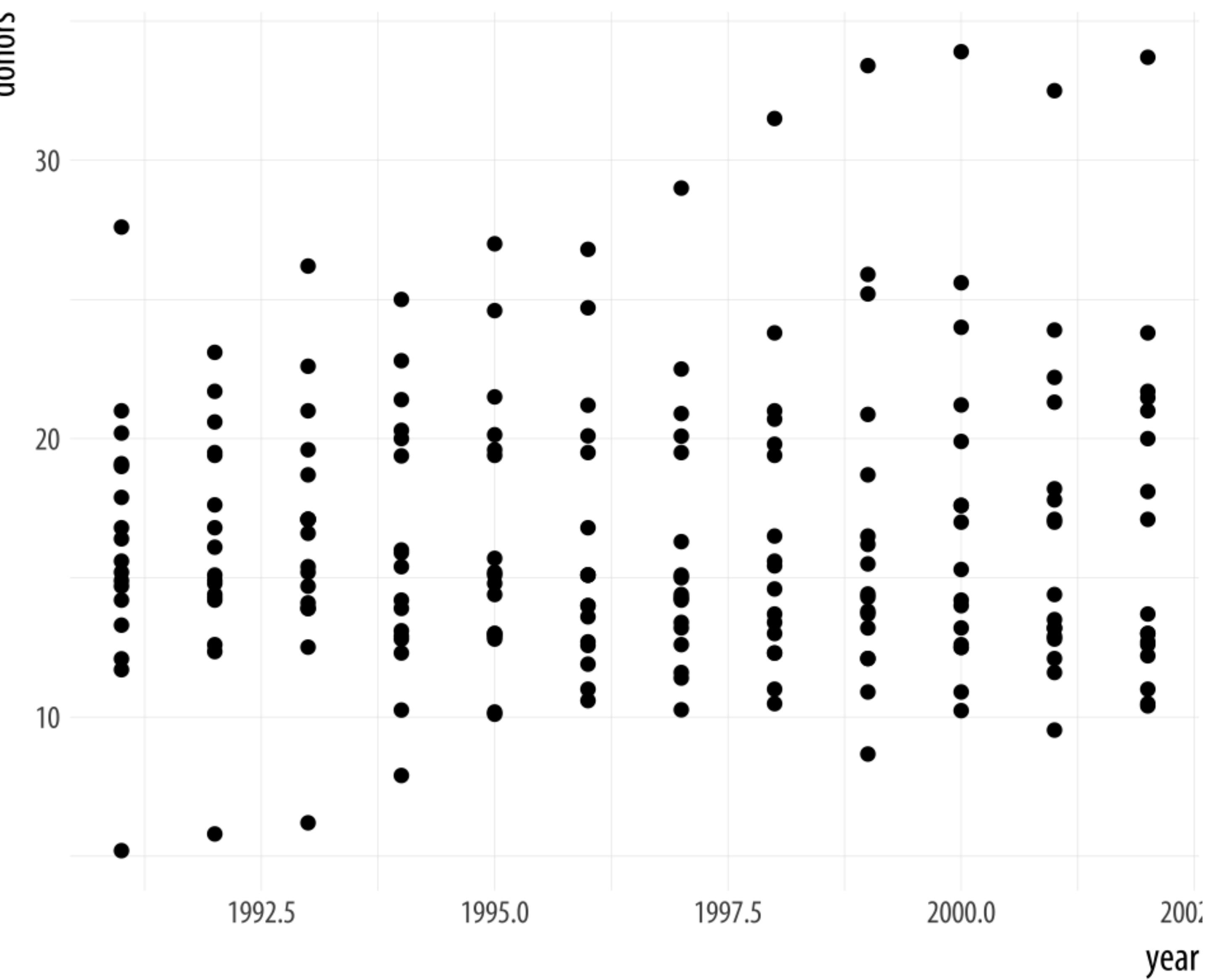
p <- ggplot(data = bad_date, aes(x = date, y = N))
p + geom_line()
```



```
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
```

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



```
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

```
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     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     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

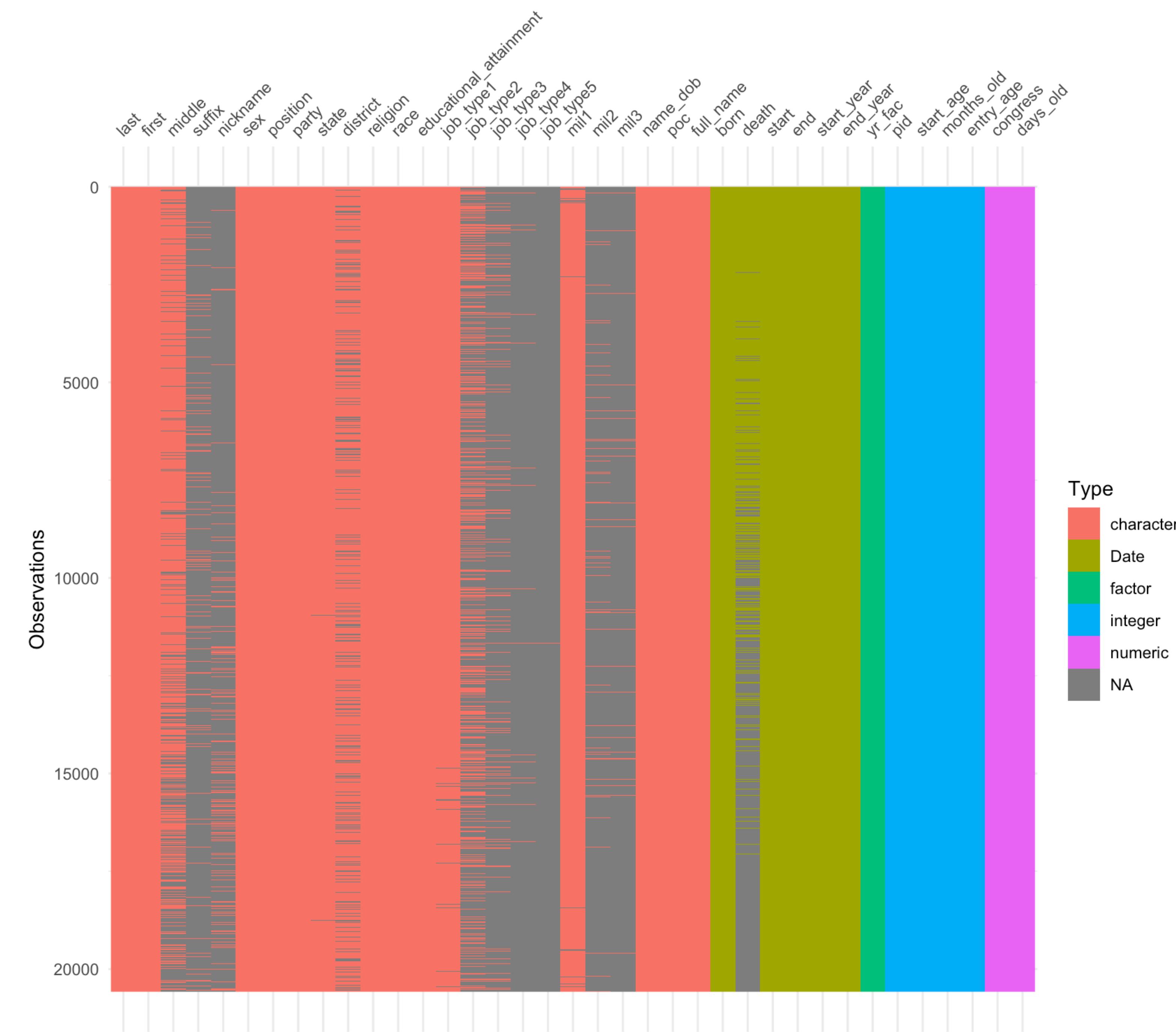
`naniar` provides principled, tidy ways to summarise, visualise, and manipulate missing data with minimal deviations from the workflows in `ggplot2` and tidy data. It does this by providing:

- 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](#).

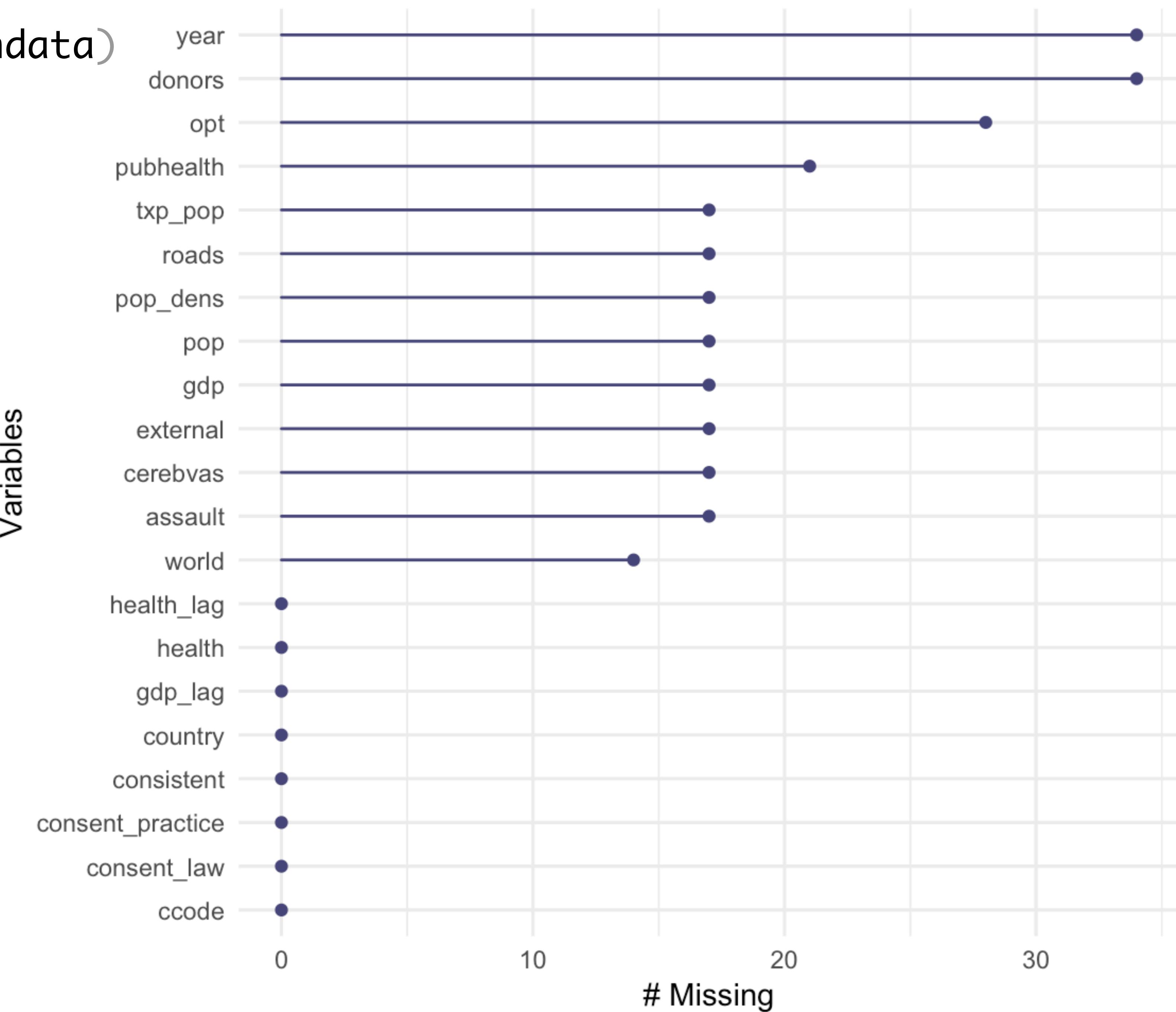
For a short primer on the data visualisation available in naniar, read the vignette [Gallery of Missing Data Visualisations](#).



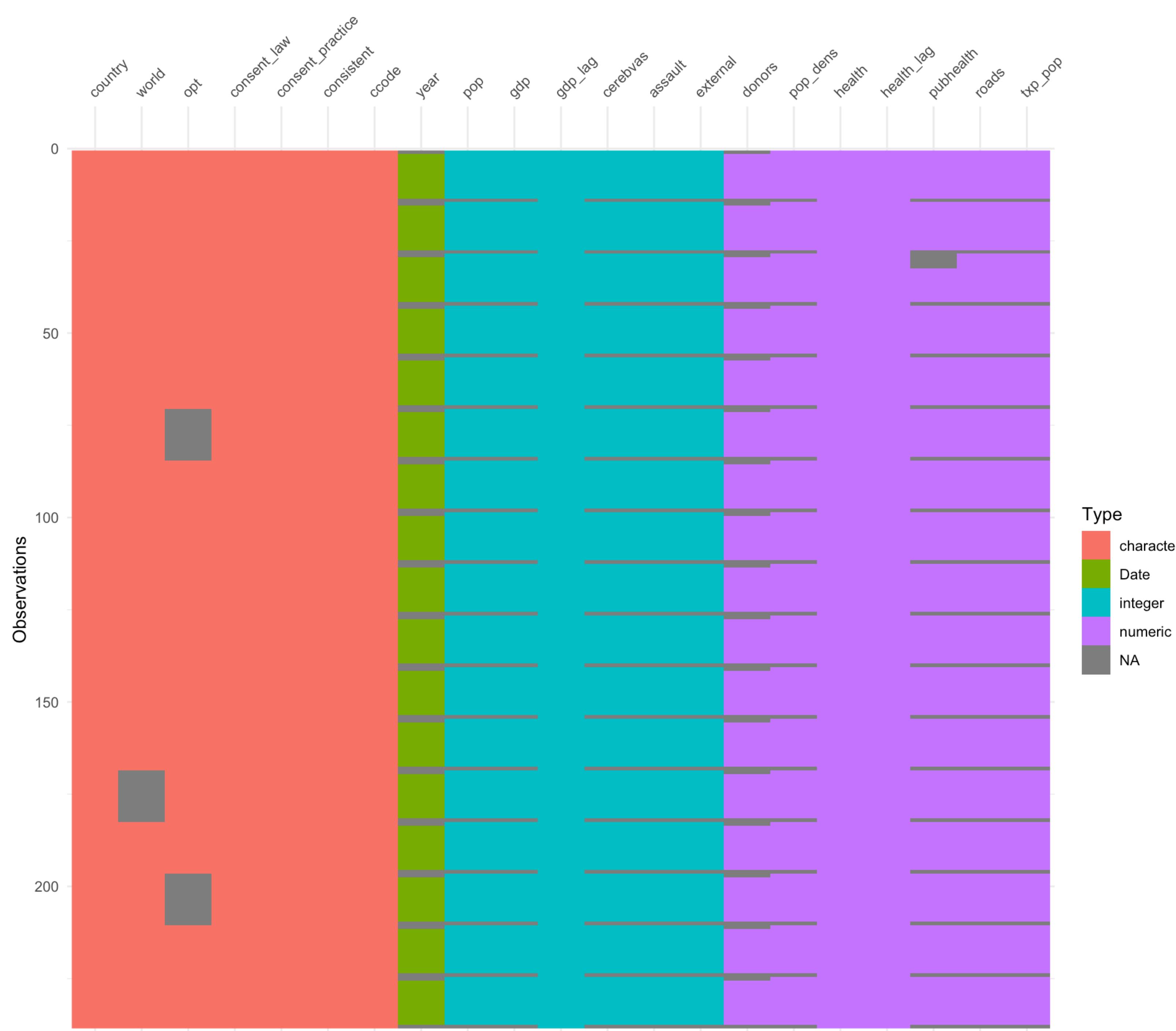
```
library(socviz)
organdata

# 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(organadata)



```
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

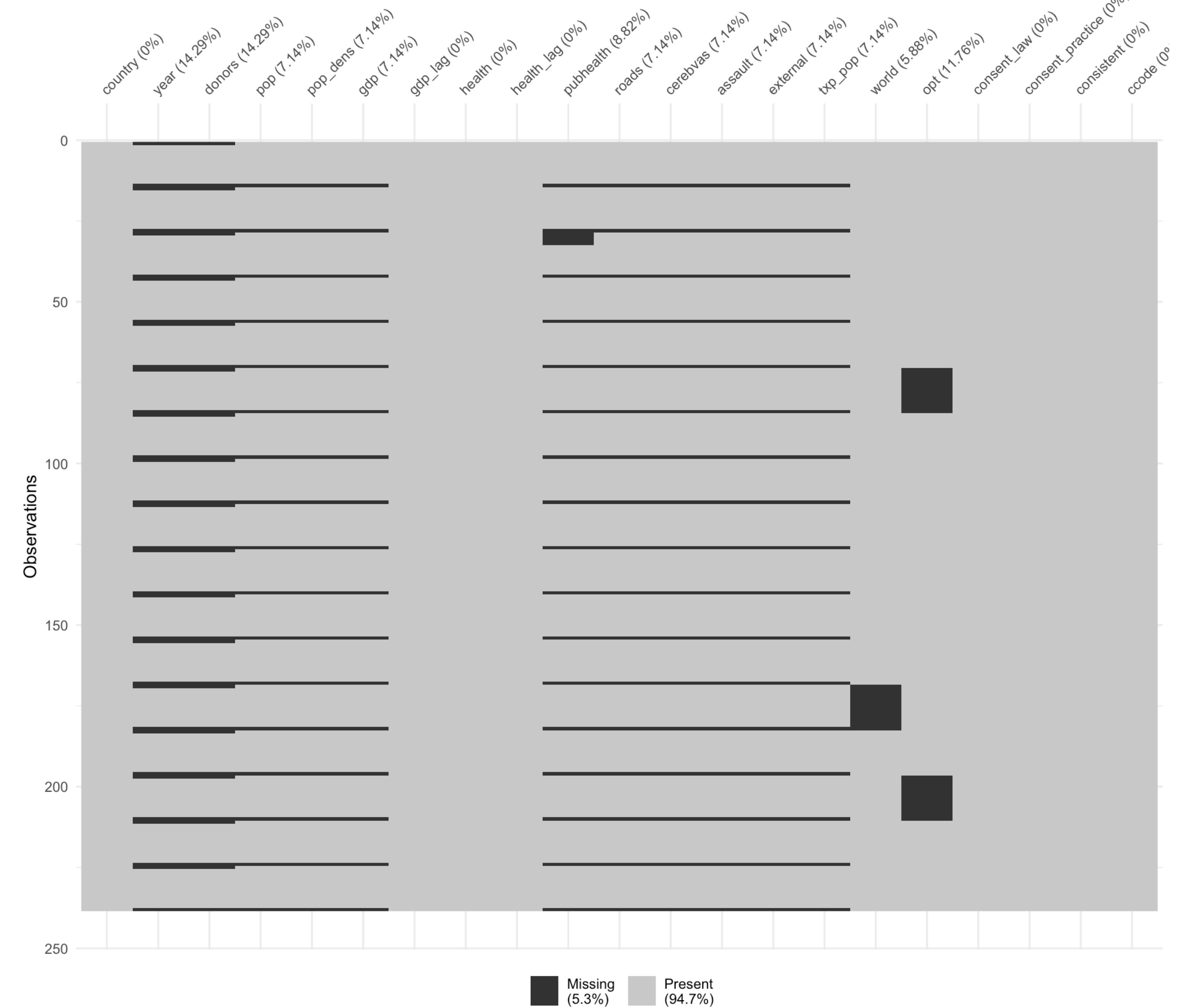
	case	n_miss	pct_miss
	<int>	<int>	<dbl>
1	84	12	57.1
2	182	12	57.1
3	210	12	57.1
4	14	11	52.4
5	28	11	52.4
6	42	11	52.4
7	56	11	52.4
8	70	11	52.4
9	98	11	52.4
10	112	11	52.4
# ... with 228 more rows			

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

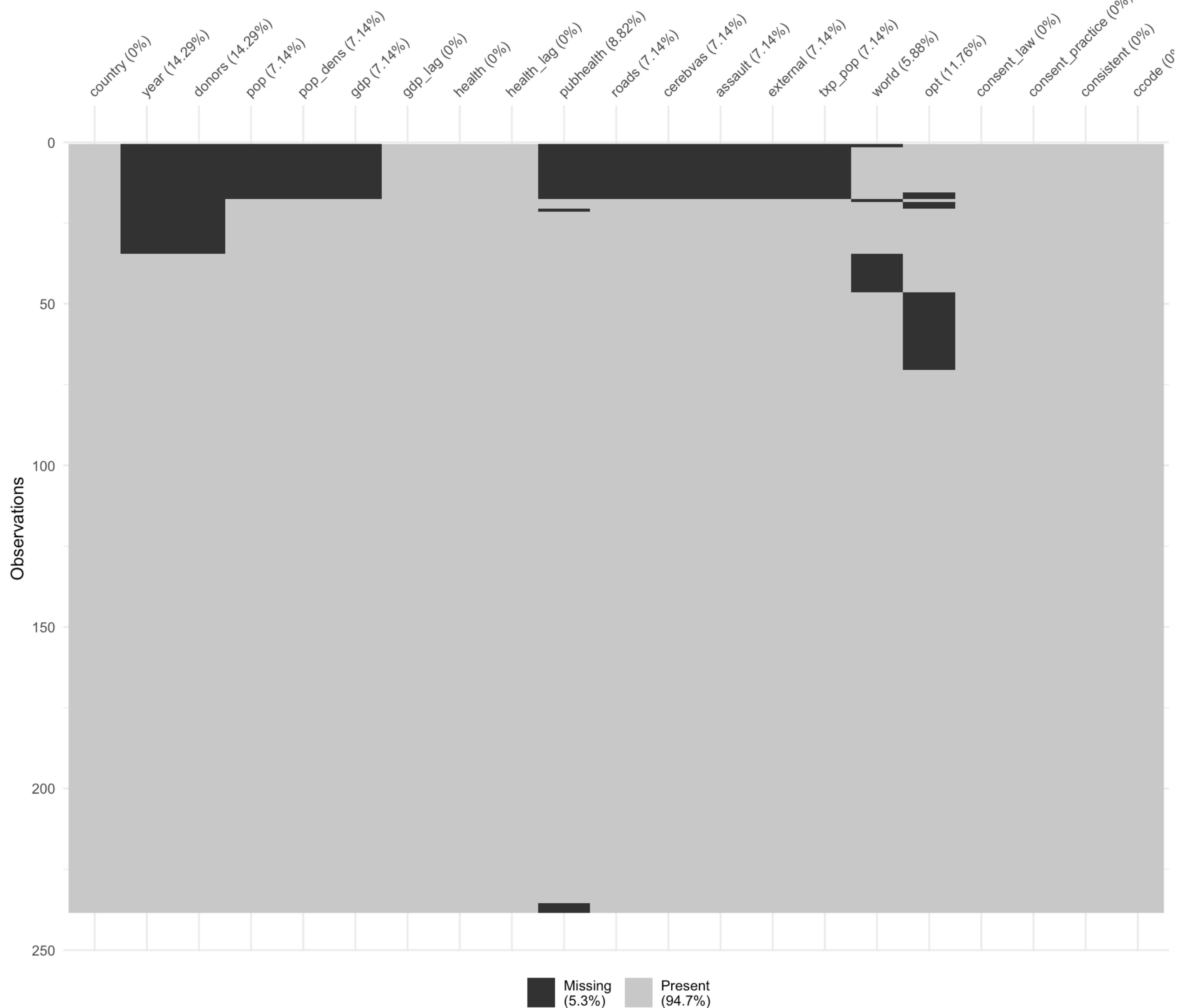
A tibble: 6 x 4

	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

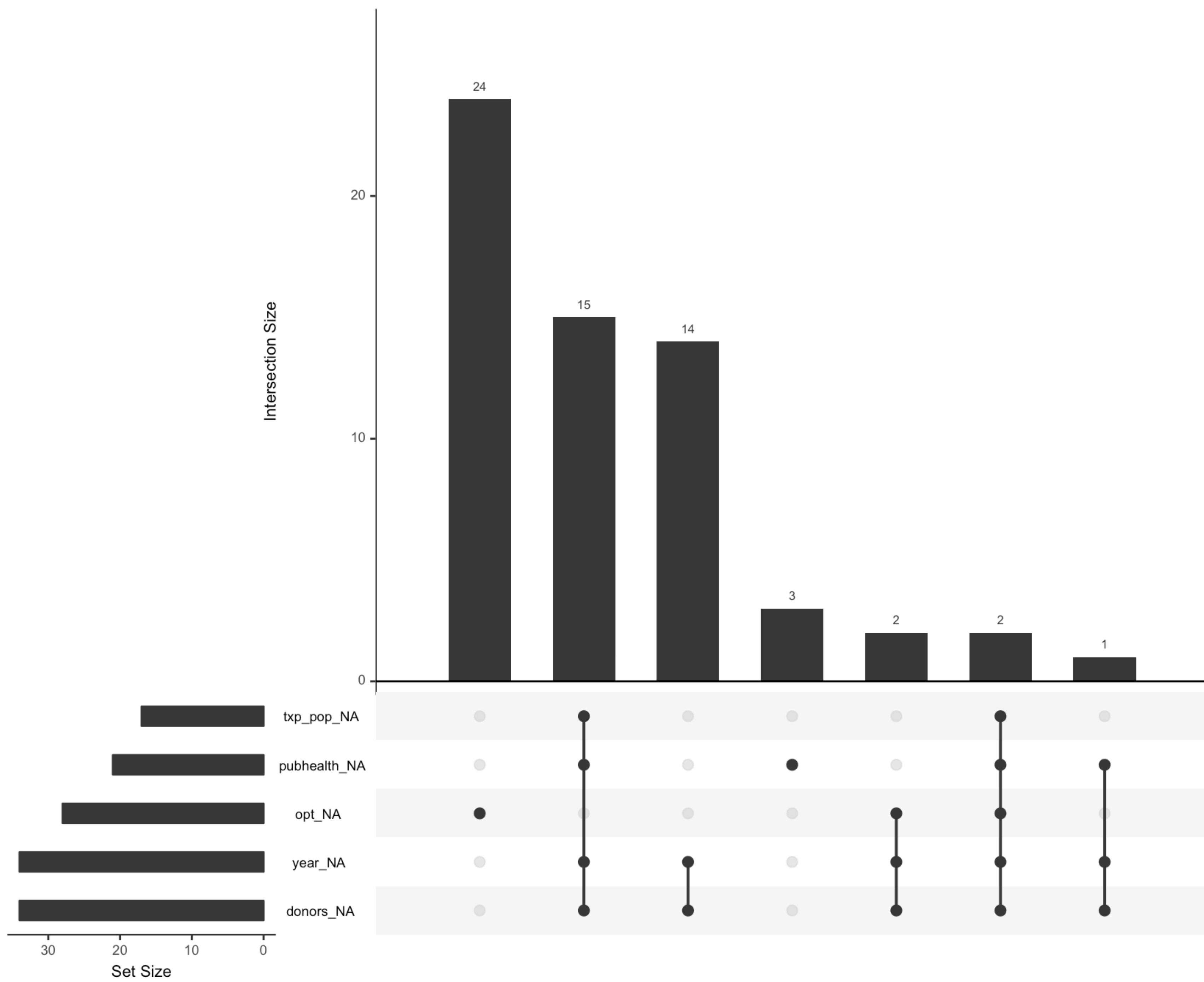
vis_miss(organdata)



vis_miss(organdata,
cluster = TRUE)

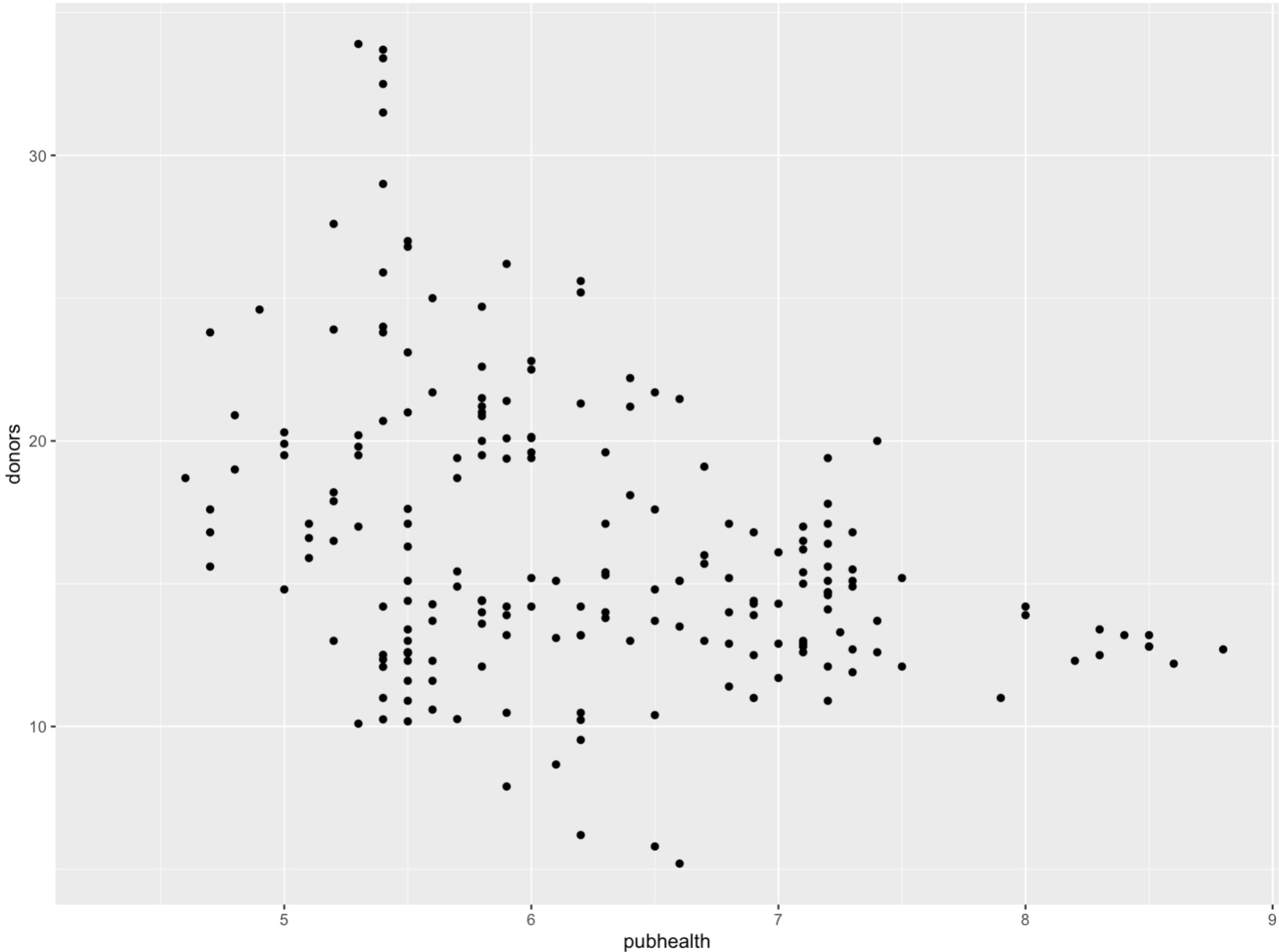


gg_miss_upset(organdata)



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

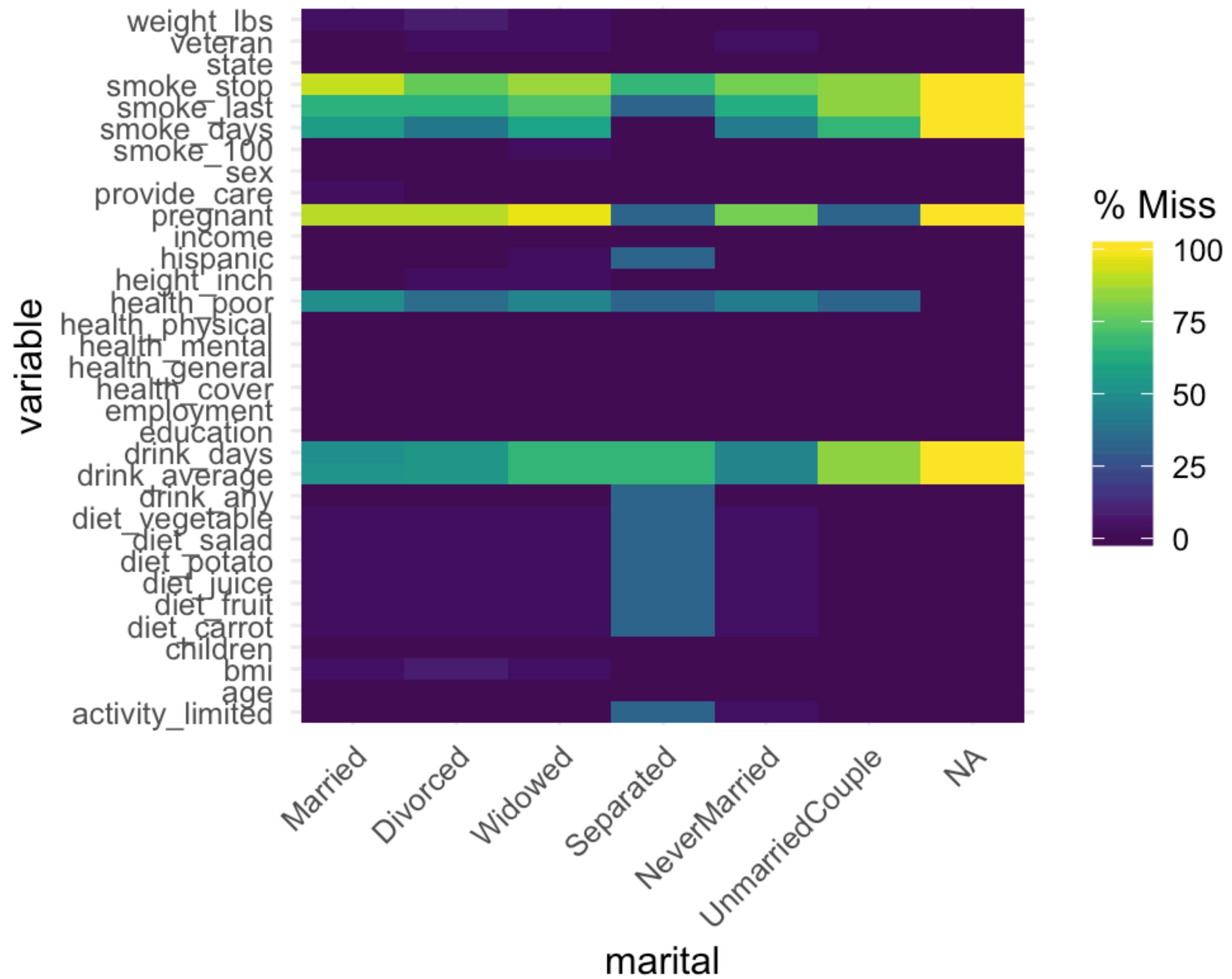
```
## Warning message:  
## Removed 37 rows containing missing values (geom_point).
```



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



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



Zero Counts in dplyr

https://github.com/kjhealy/fc_sample

```
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())
```

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

```
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
```

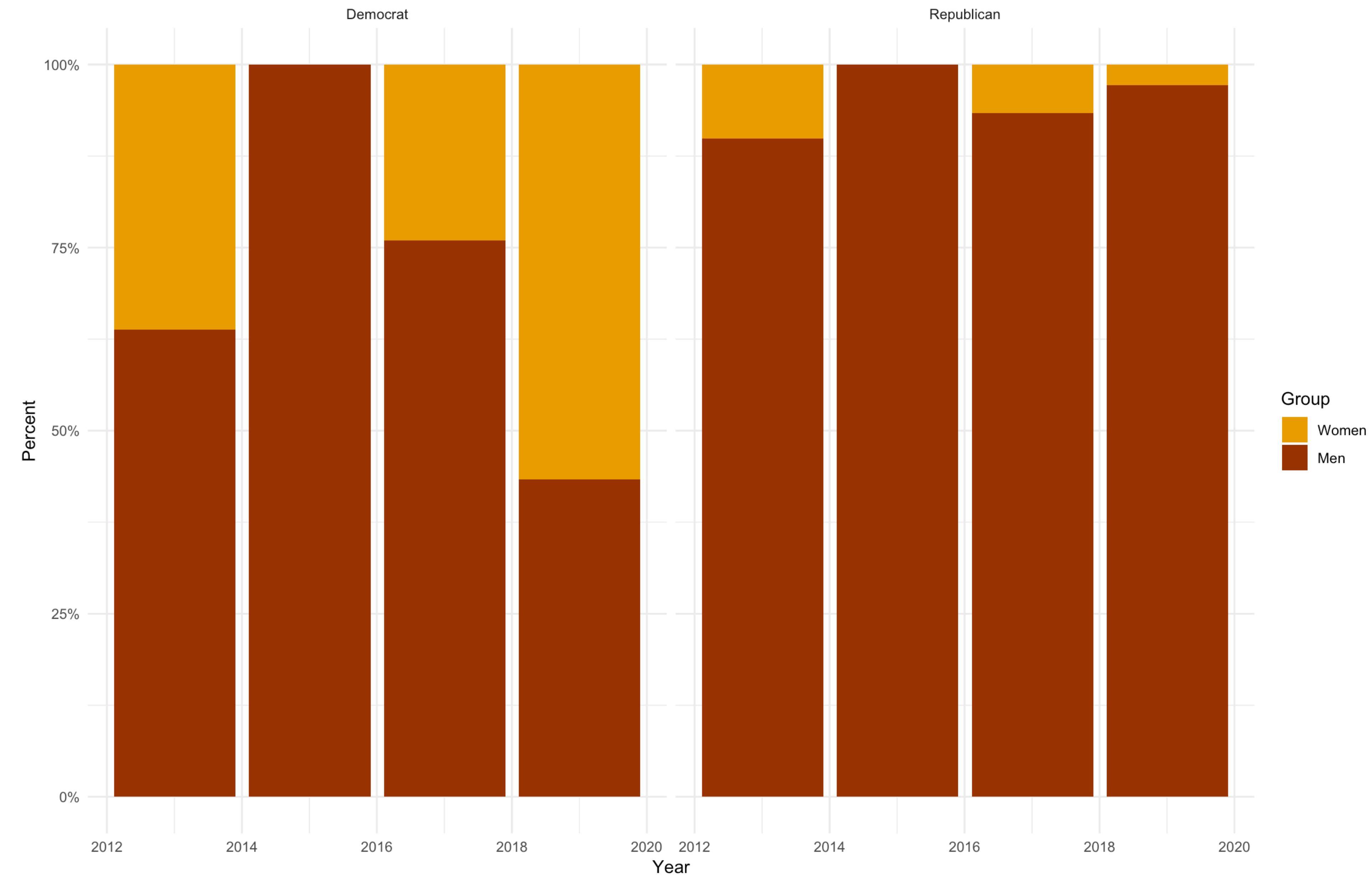
```
df %>%
  group_by(start_year, party, sex) %>%
  summarize(N = n()) %>%
  mutate(freq = N / sum(N))

#> # 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
```

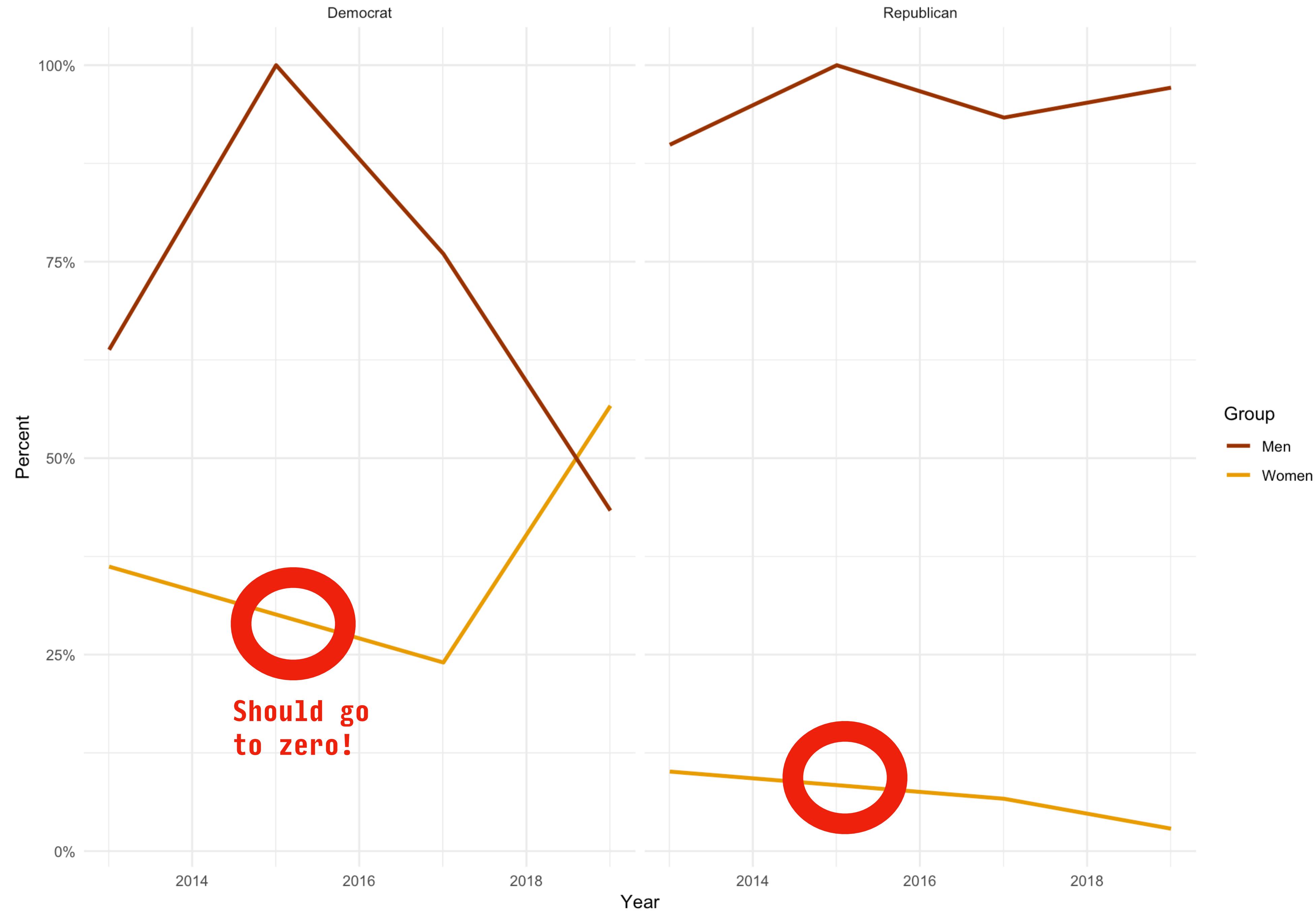
Not in the table

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

```
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)
```



```
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)
```



```
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
```



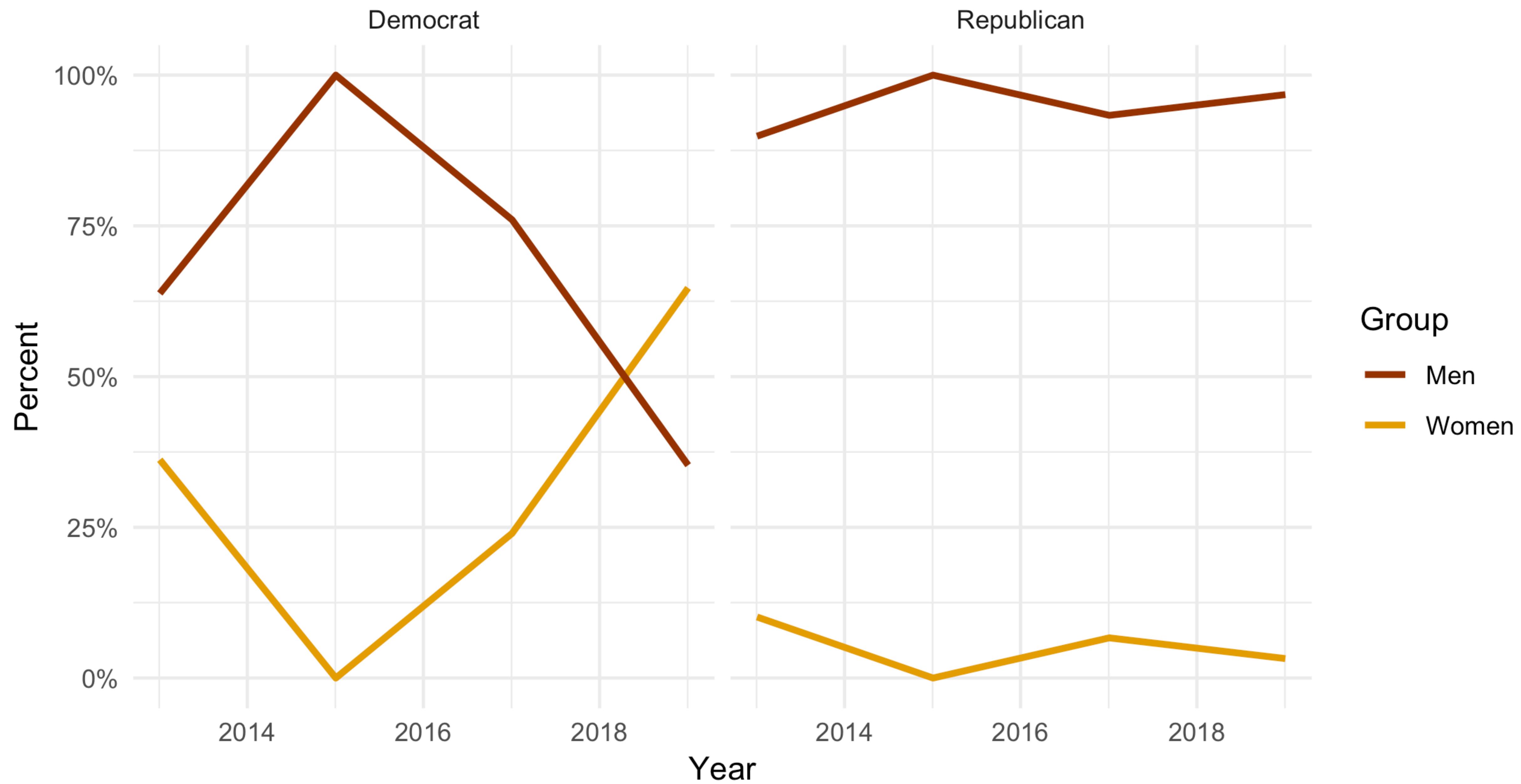
Option 1: Convert to Factor

```
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()`

```
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)
```



Functions

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

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

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

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

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

```
plot_section <- function(section="Culture", x = "Year",
                        y = "Members", data = asasec,
                        smooth=FALSE){

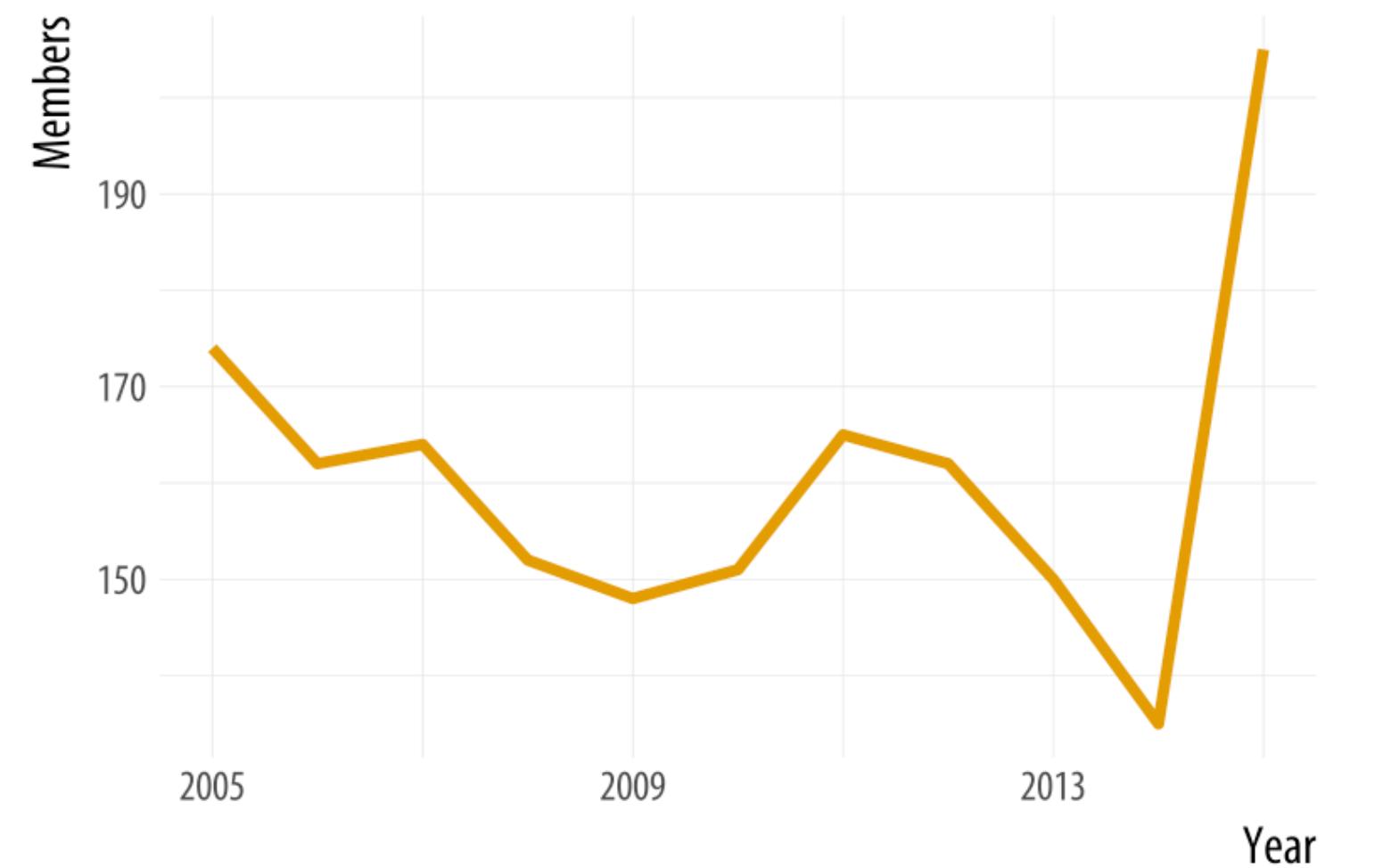
  require(ggplot2)
  require(splines)
  # Note use of aes_string() rather than aes()
  p <- ggplot(subset(data, Sname==section),
               mapping = aes_string(x=x, y=y))

  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)
}
```

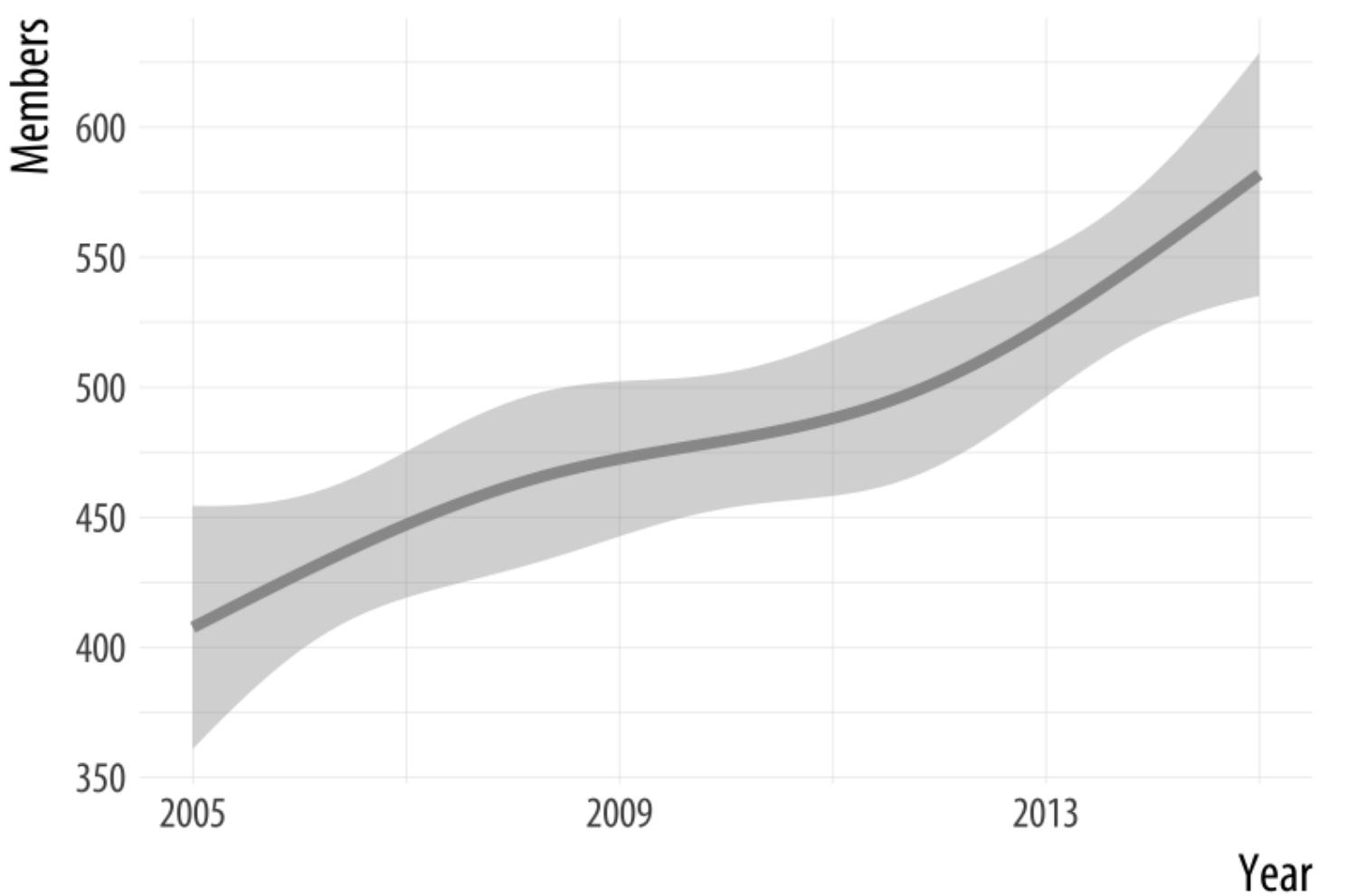
```
plot_section("Rationality")
```

Rationality



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

Sexualities



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>
```

```
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")
```

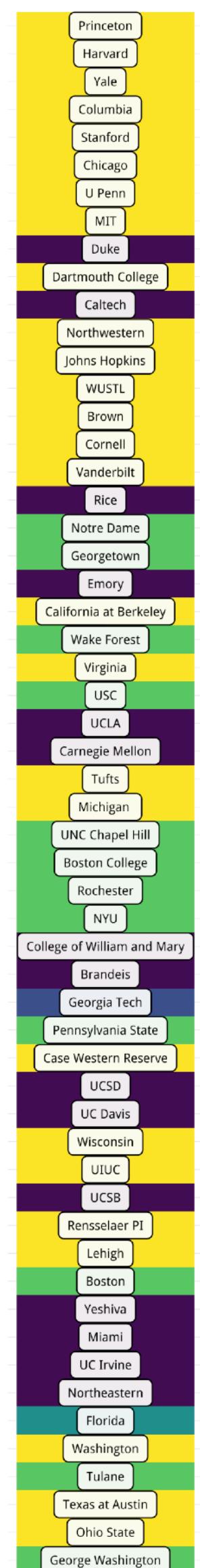
The Persistence of the Old Regime

1911 Babcock Classification and 2014 US News Rankings

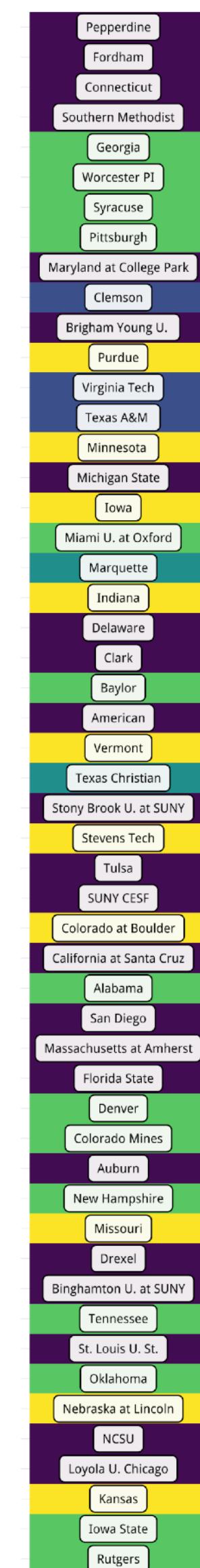
Babcock Class in 1911

Class 1 Class 2 Class 3 Class 4 Not Rated/Not Yet Founded

USNWR 1-52



USNWR 53-101



USNWR 101-152
USNWR 153-200



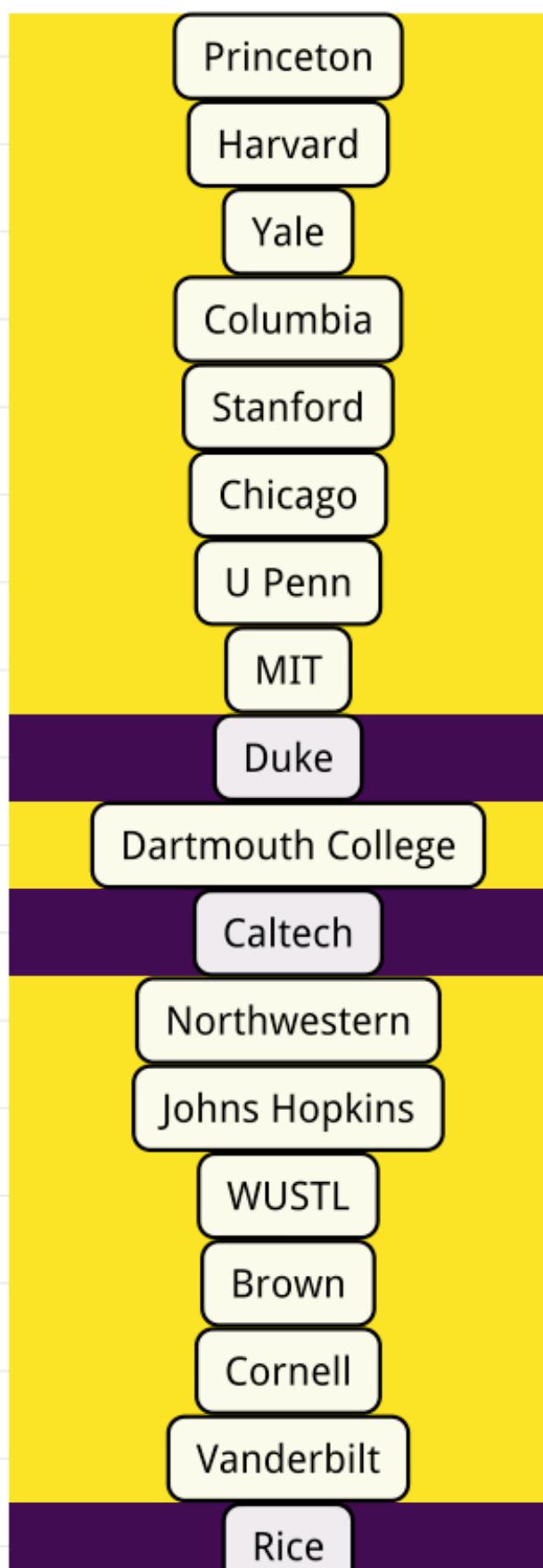
The Persistence of the Old Regime

1911 Babcock Classification and 2014 US News Rankings

Babcock Class in 1911



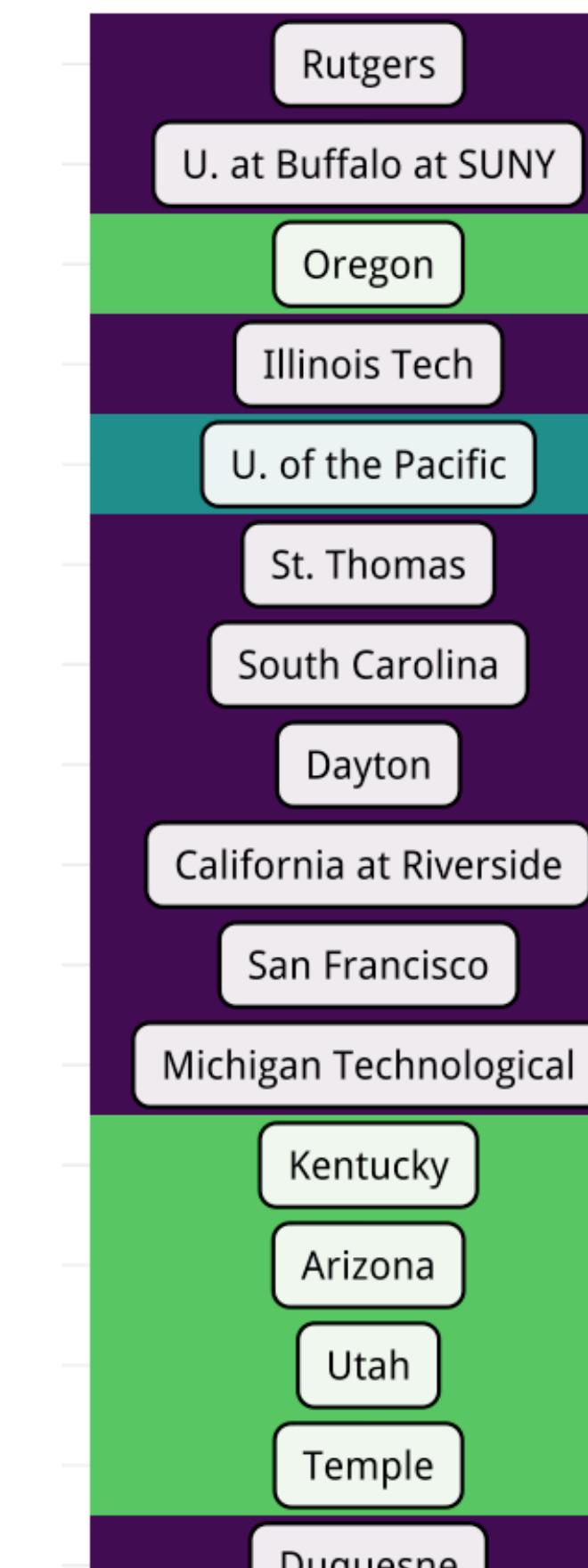
USNWR 1-52



USNWR 53-101



USNWR 101-152



USNWR 153-200



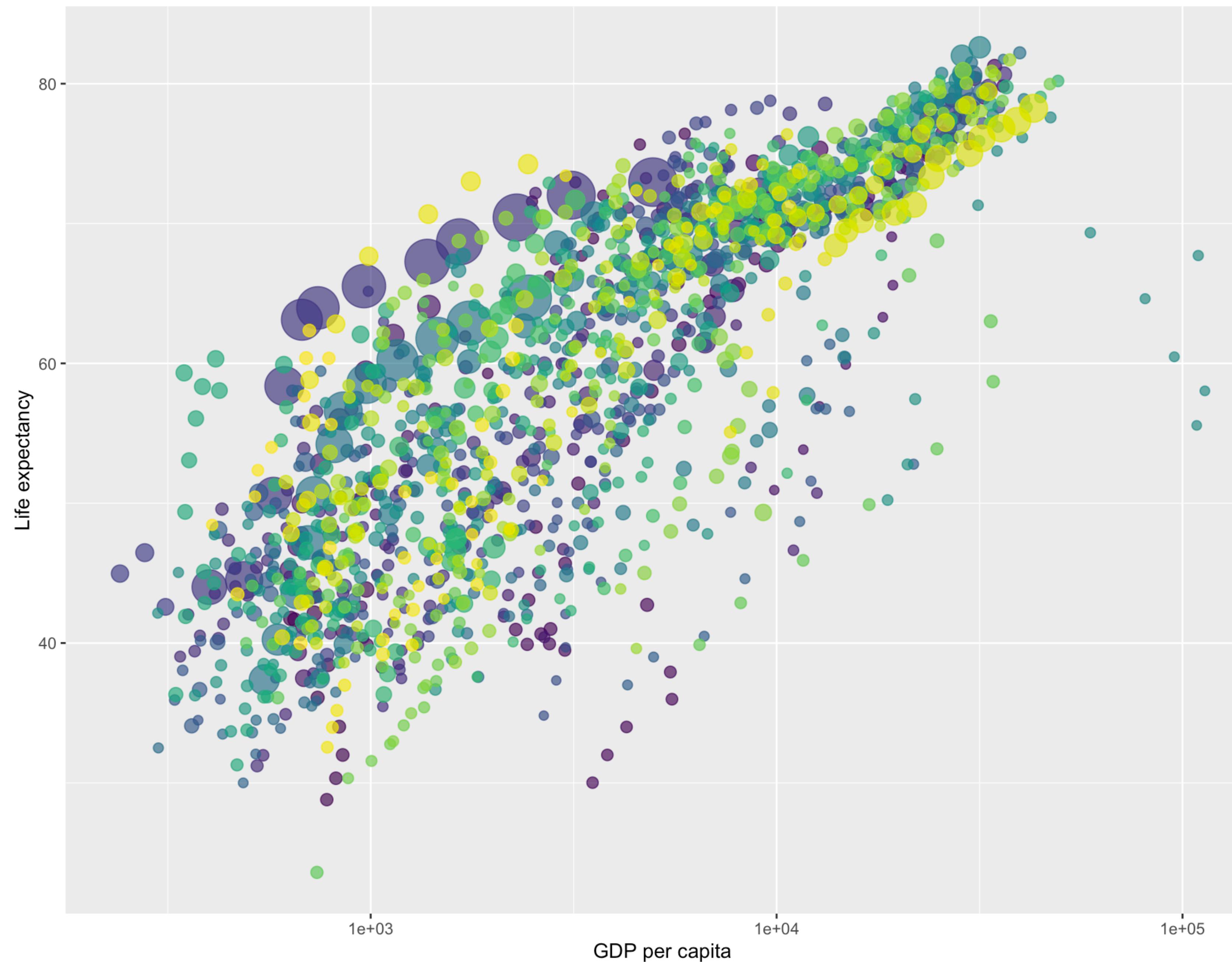
Animation

Introductory

```
install.packages("gifski")
install.packages("pngpackage")
library(gganimate)
library(gapminder)

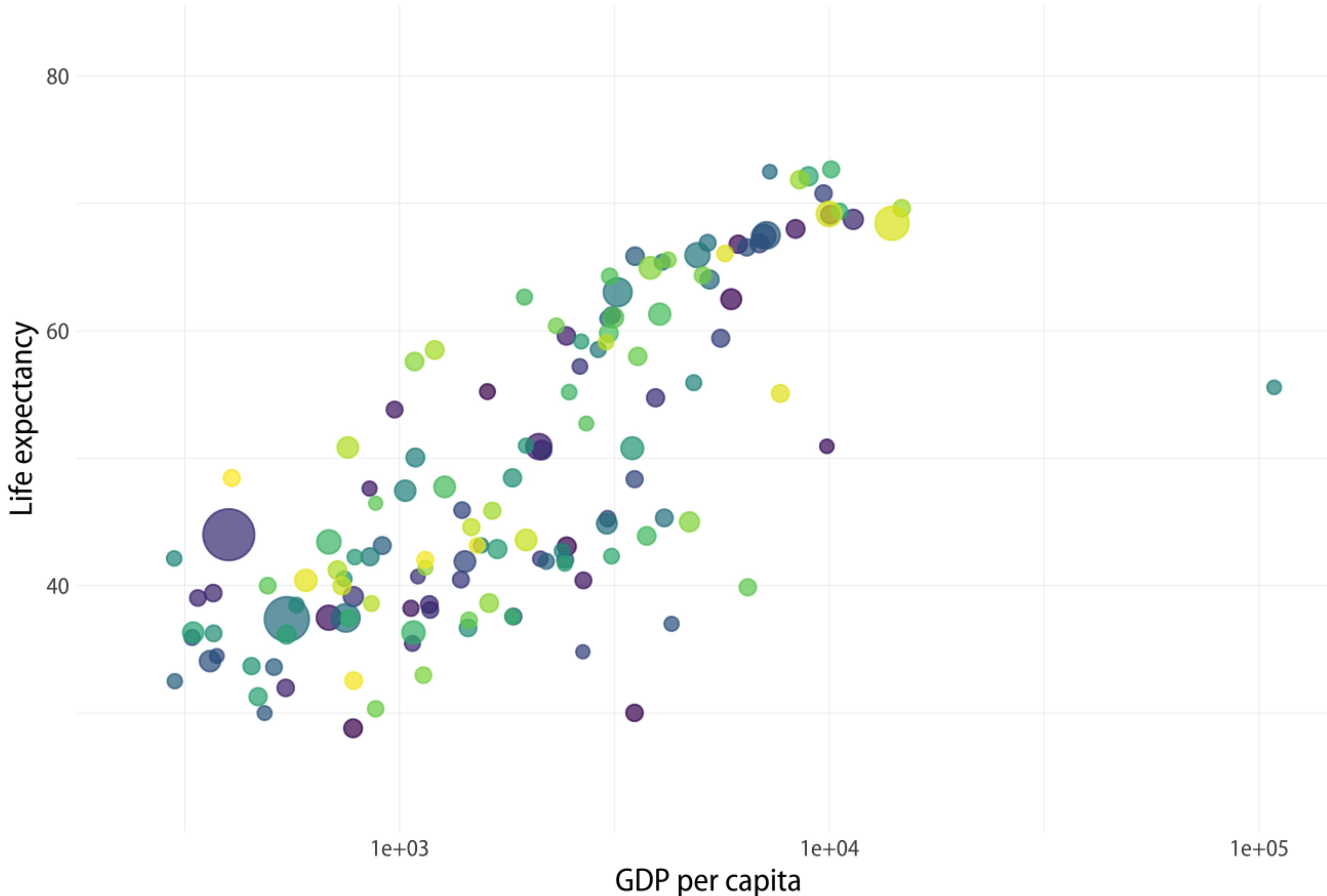
p <- ggplot(data = gapminder,
             mapping = aes(x = gdpPercap, y=lifeExp,
                           size = pop, color = country)) +
  geom_point(show.legend = FALSE, alpha = 0.7) +
  scale_color_viridis_d() +
  scale_size(range = c(2, 12)) +
  scale_x_log10() +
  labs(x = "GDP per capita",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

p



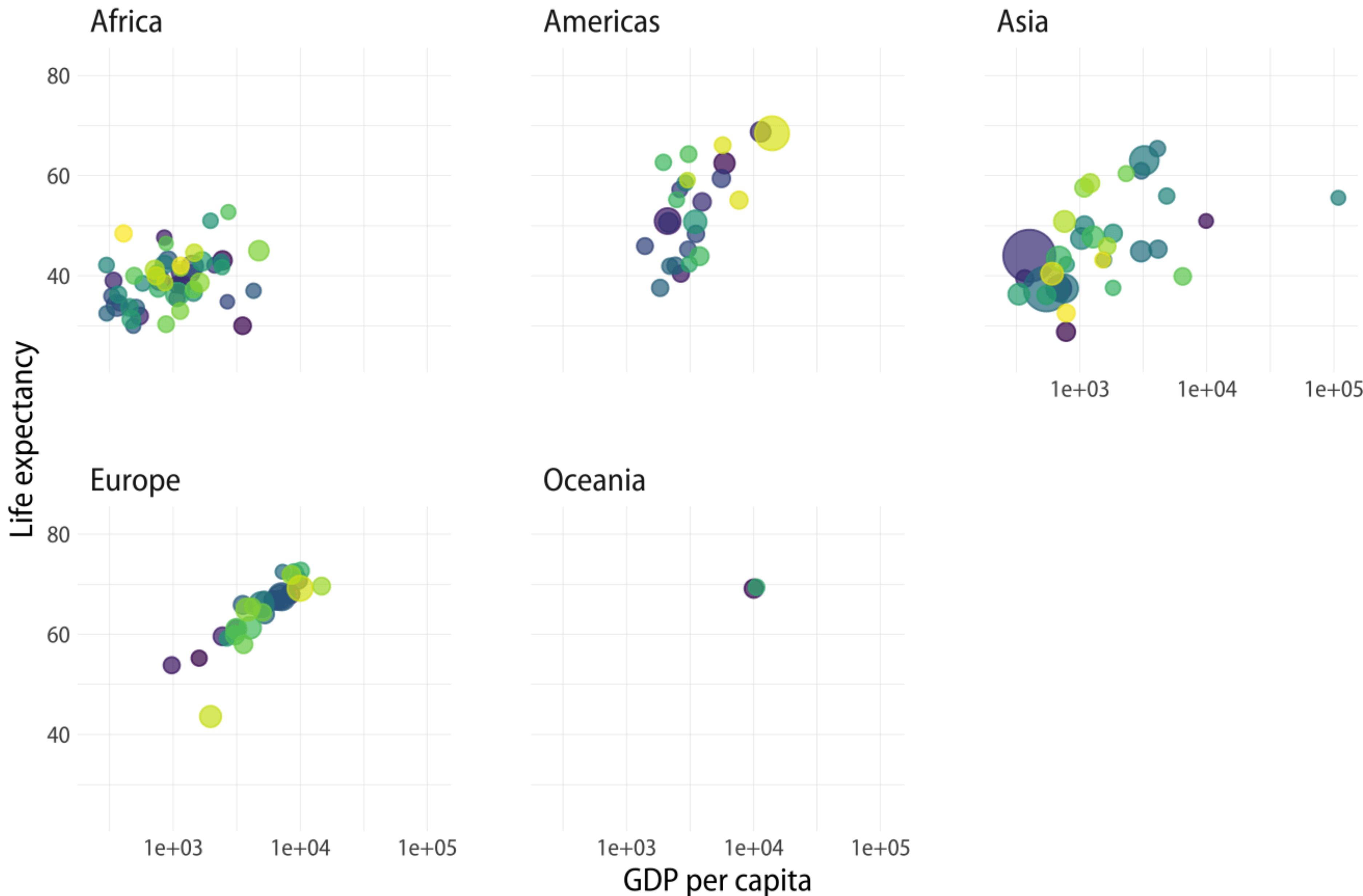
```
p + transition_time(year) +  
  labs(title = "Year: {frame_time}")
```

Year: 1952



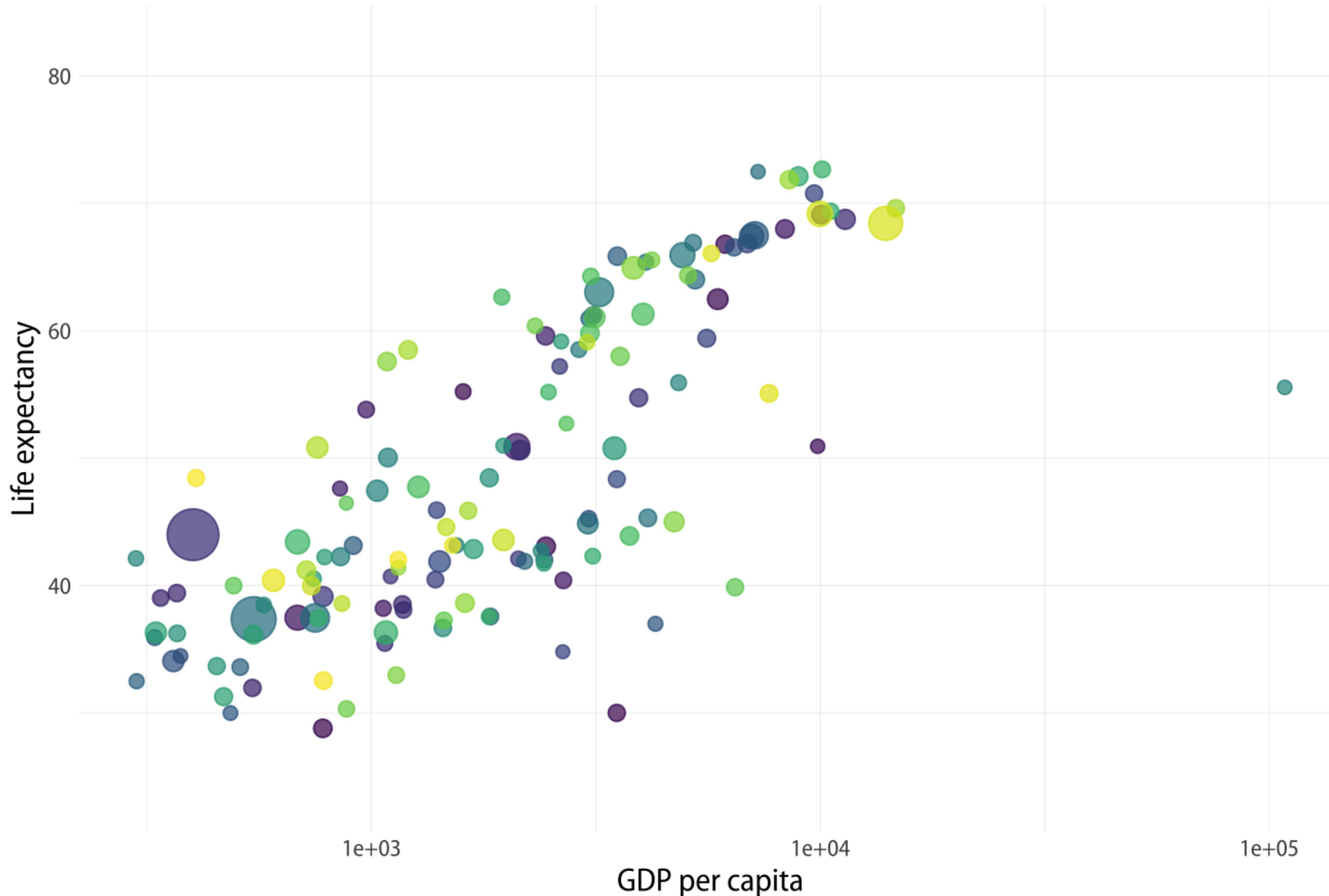
```
p + facet_wrap(~continent) +
transition_time(year) +
labs(title = "Year: {frame_time}")
```

Year: 1952



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

Year: 1952



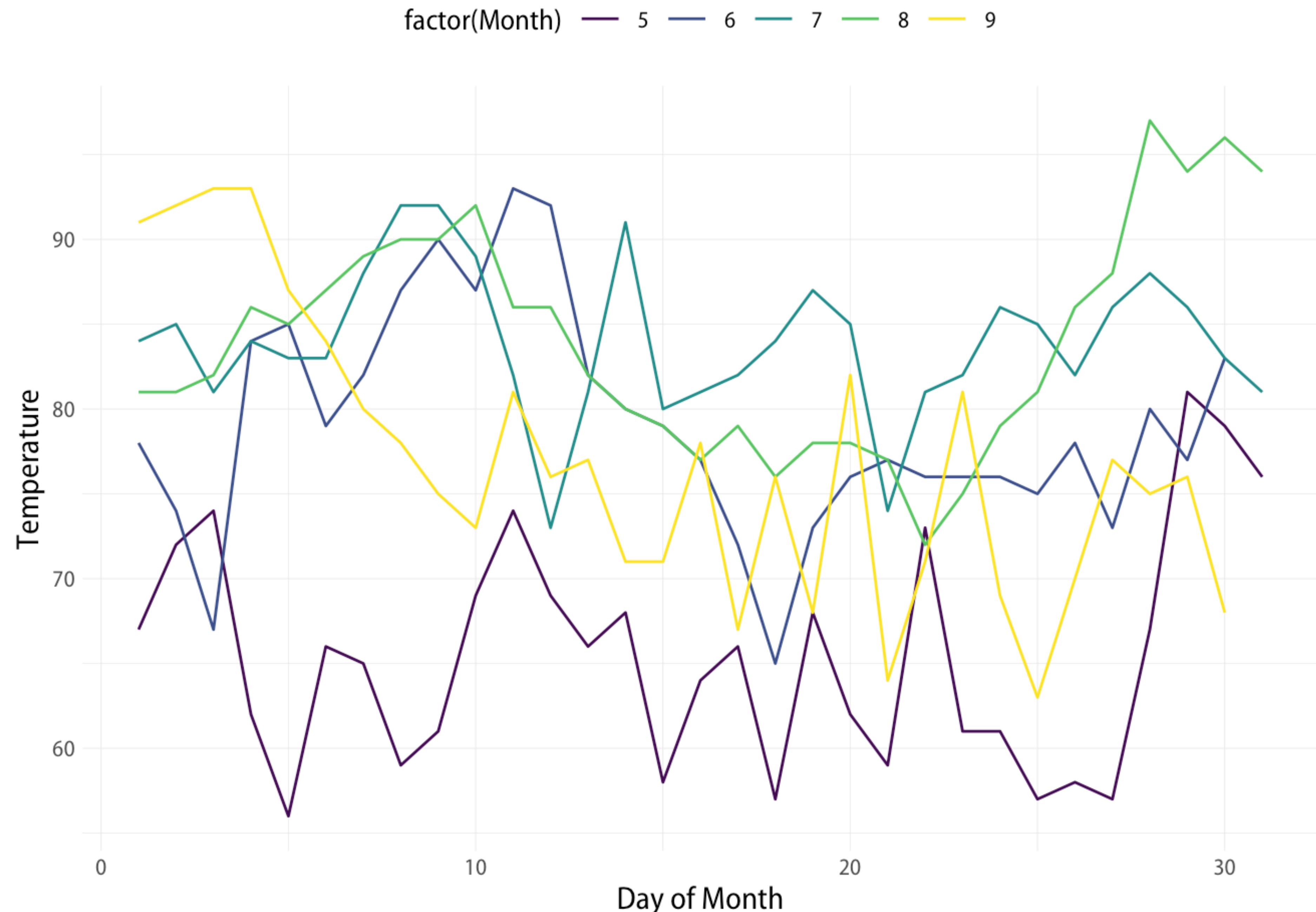
```
p + transition_time(year) +  
  labs(title = "Year: {frame_time}") +  
  shadow_wake(wake_length = 0.1, alpha = FALSE)
```

Year: 1952

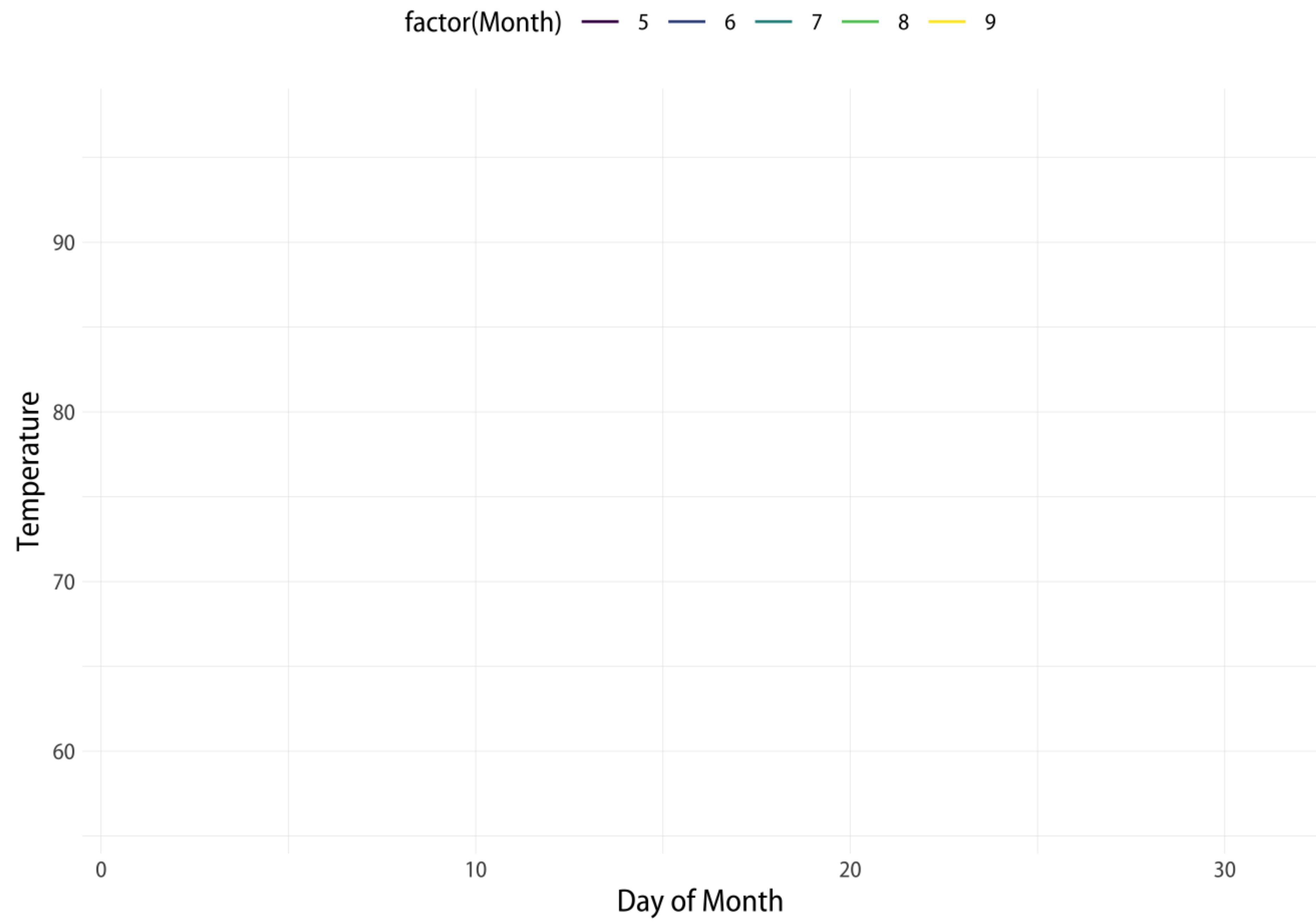


```
p <- ggplot(data = airquality,
             mapping = aes(Day, Temp, group = Month,
                           color = factor(Month))) +
  geom_line() +
  scale_color_viridis_d() +
  labs(x = "Day of Month", y = "Temperature") +
  theme(legend.position = "top")
```

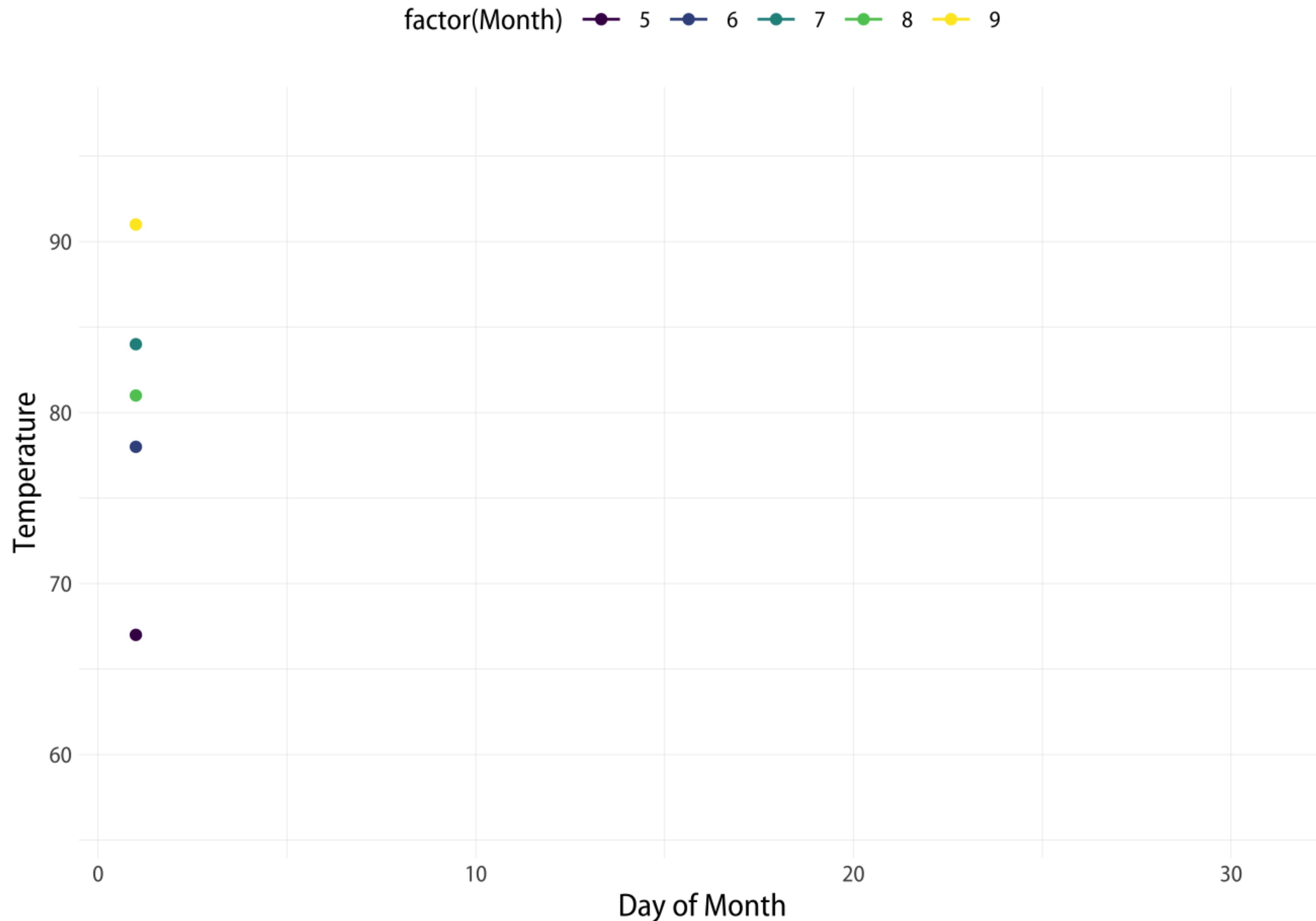
p



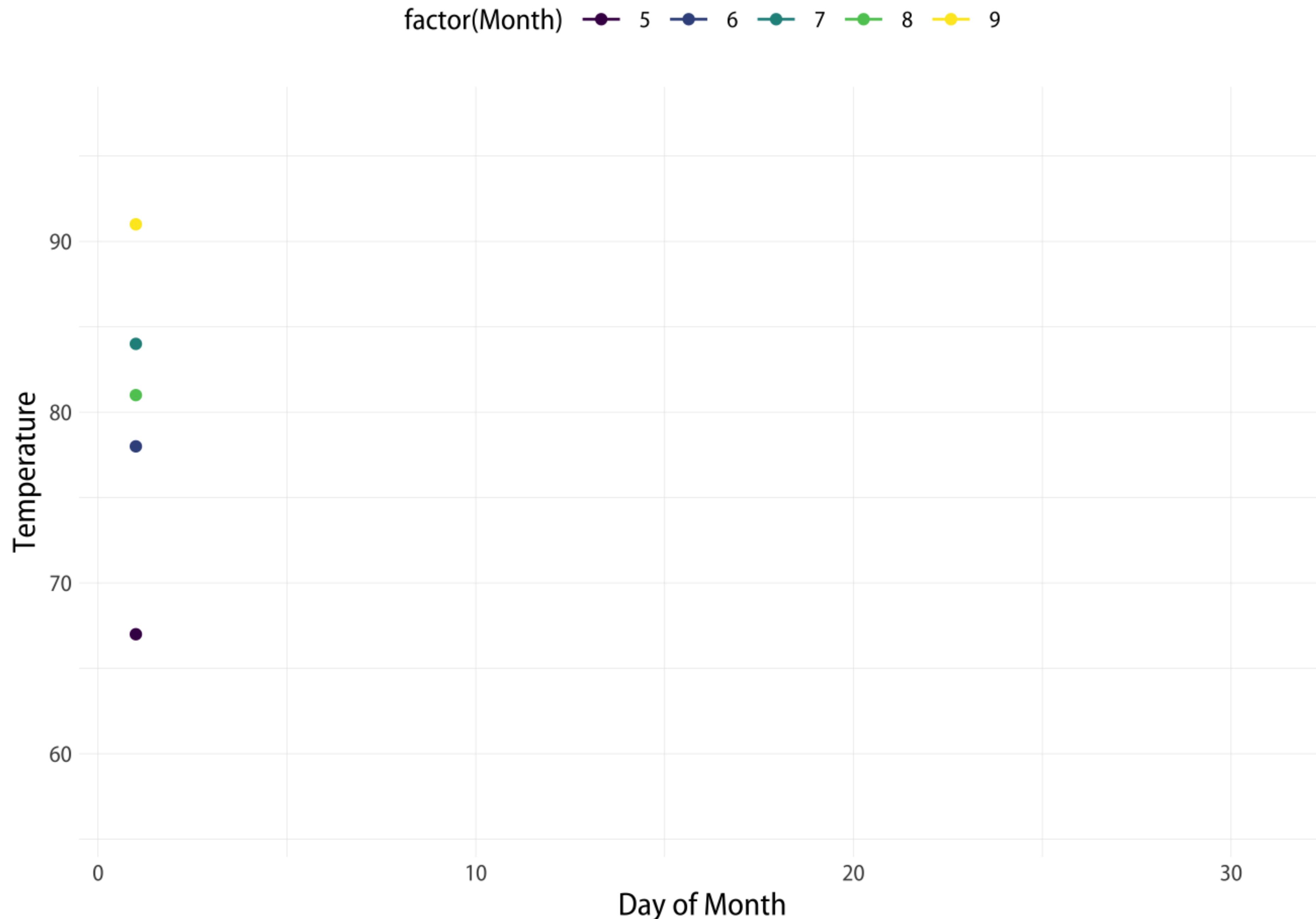
```
p + transition_reveal(Day)
```



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



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



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


Baby Names

```
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
```

```
## 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

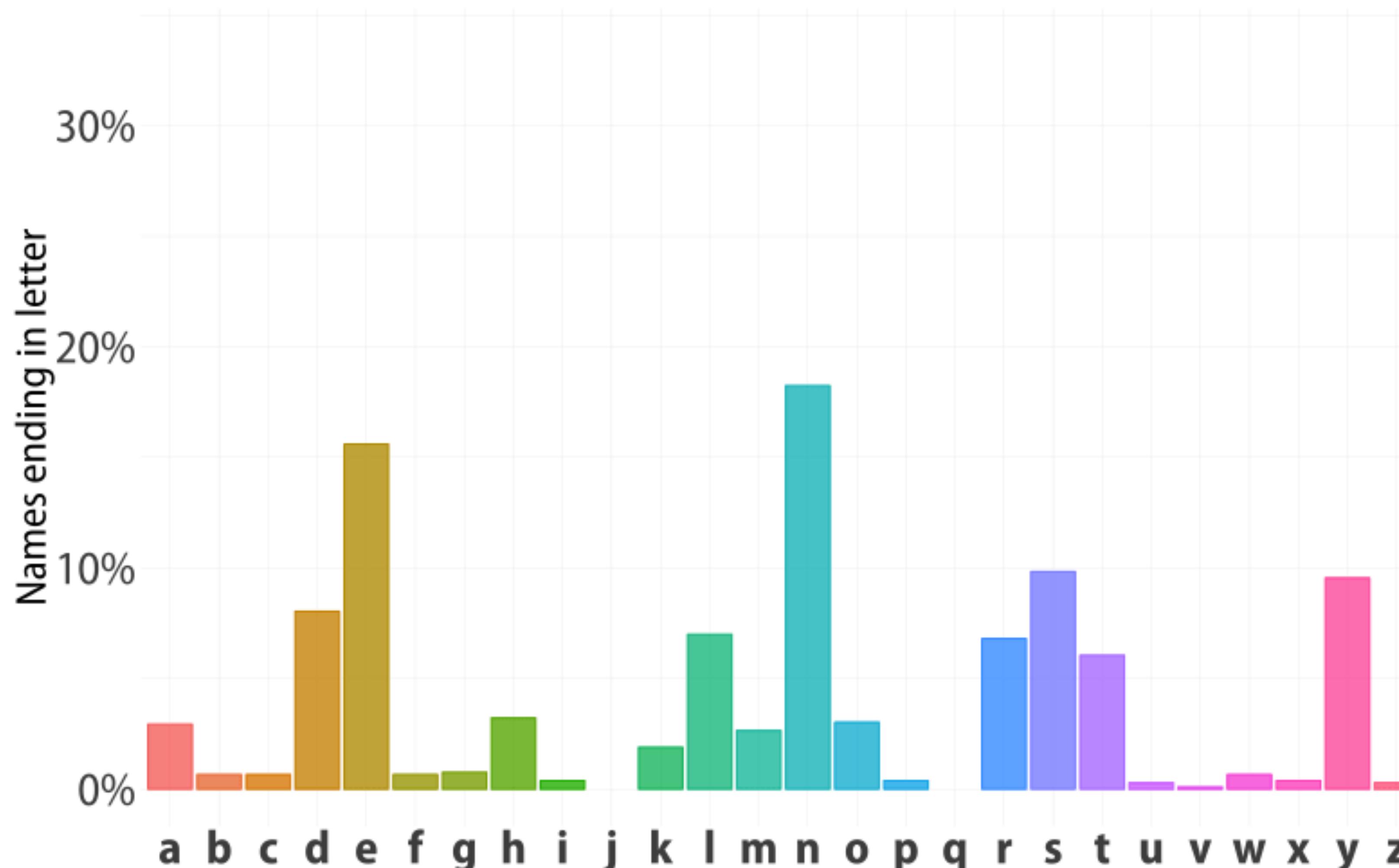
```
# ... with 3,414 more rows
```

```
## 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')
```

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

Distribution of Last Letters of U.S. Boys' Names over Time

1880



Data: US Social Security Administration. @kjhealy / socviz.co

Population Pyramids

```
## 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
```



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

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
```

```
uscenops %>%
  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")
```

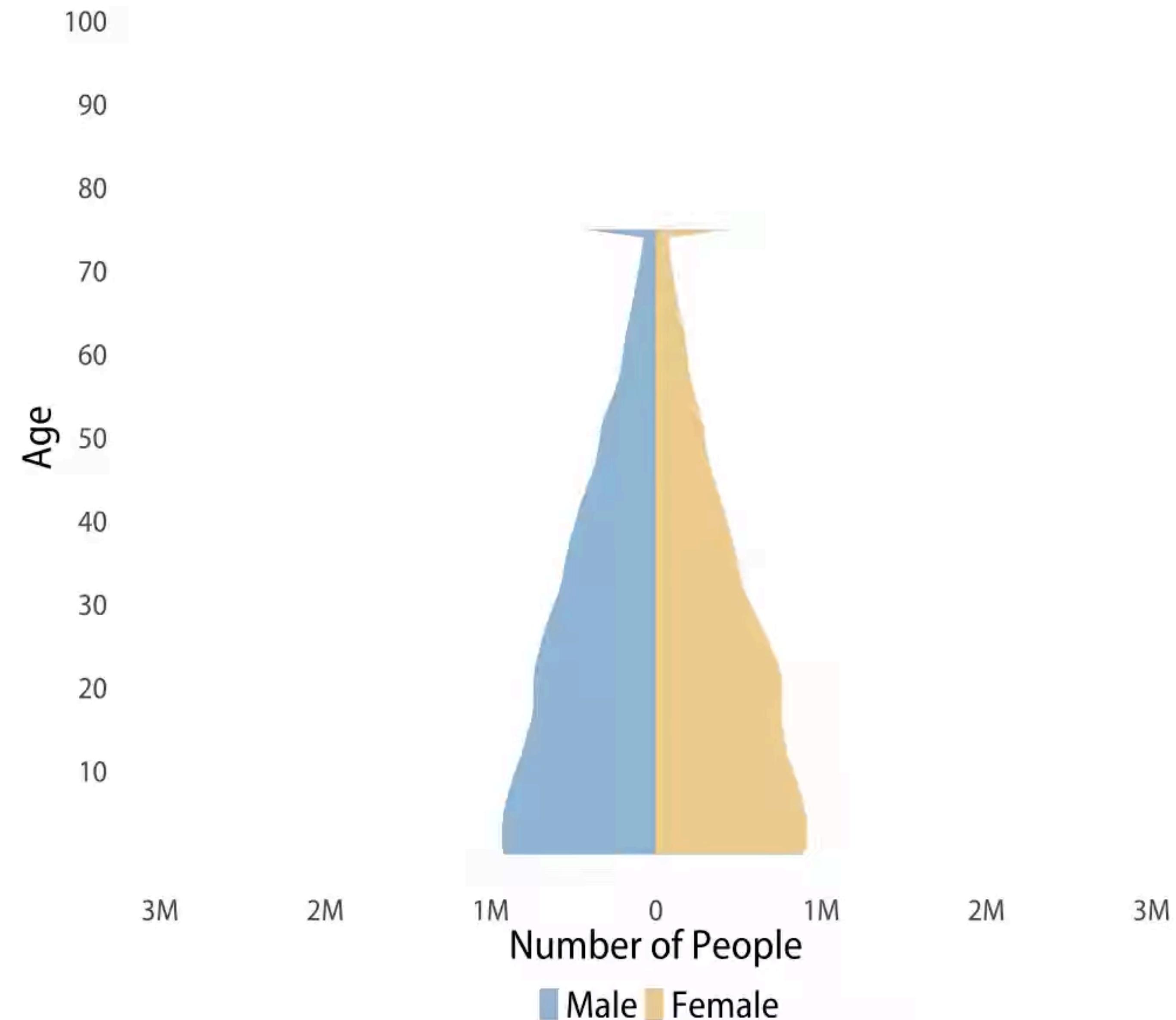
```
p <- ggplot(data = pop_pyr,
             mapping = aes(x = age, ymin = base,
                           ymax = count, fill = group))

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")
```

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

1900. Absolute Age Distribution of the U.S. Population by Sex

Age is top-coded at 75 until 1939, at 85 until 1979, and at 100 since 1980.



Networks

```
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          0
#> 2      Adams.Samuel        0          0          1          1          0          1          1
#> 3      Allen.Dr           0          0          1          0          0          0          0          0
#> 4 Appleton.Nathaniel     0          0          1          0          0          1          0          0
#> 5      Ash.Gilbert         1          0          0          0          0          0          0          0
#> 6      Austin.Benjamin     0          0          0          0          0          0          0          1
```

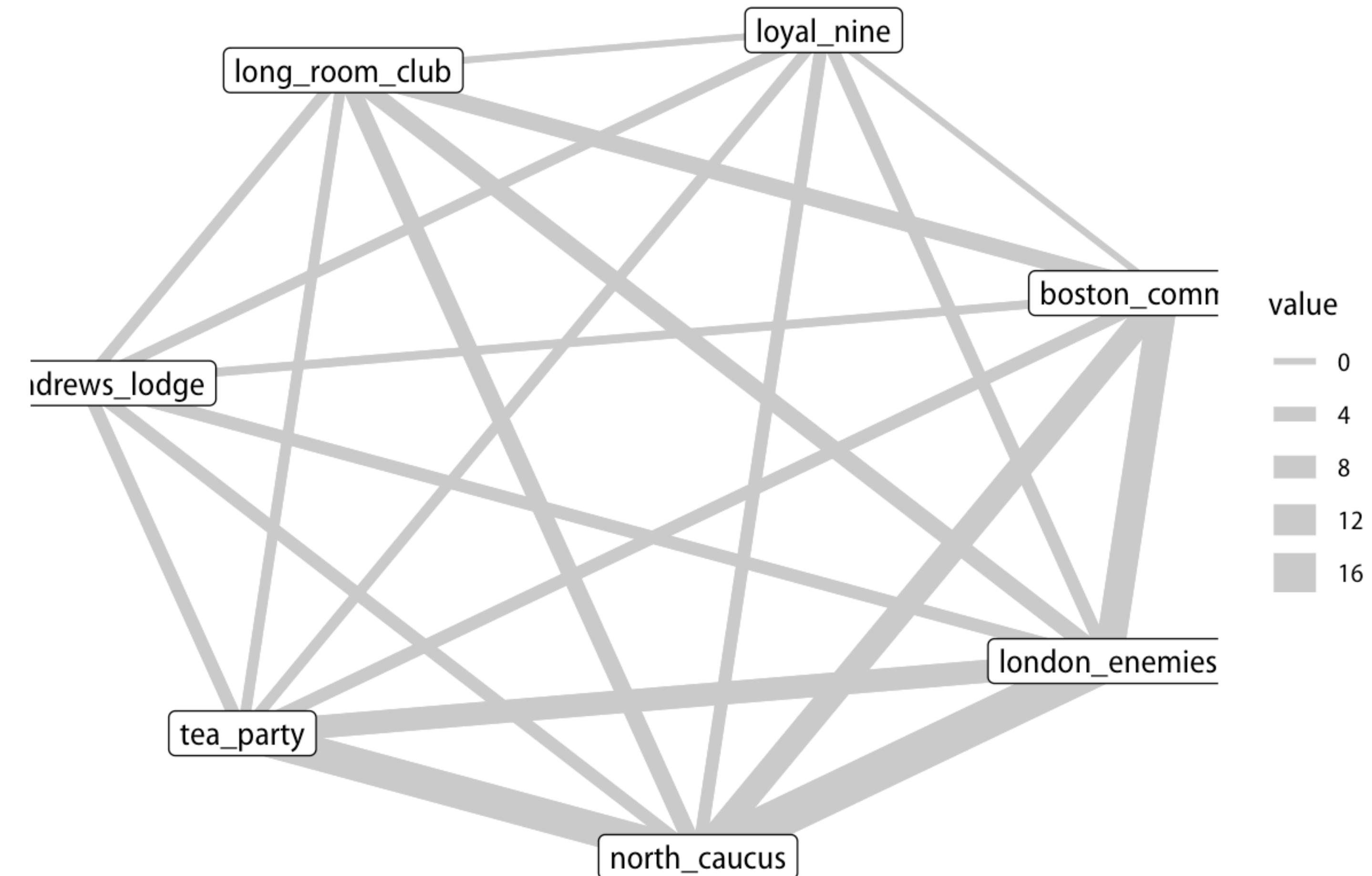
revere_groups

```
#> # 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
```

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
```

```
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))

```

