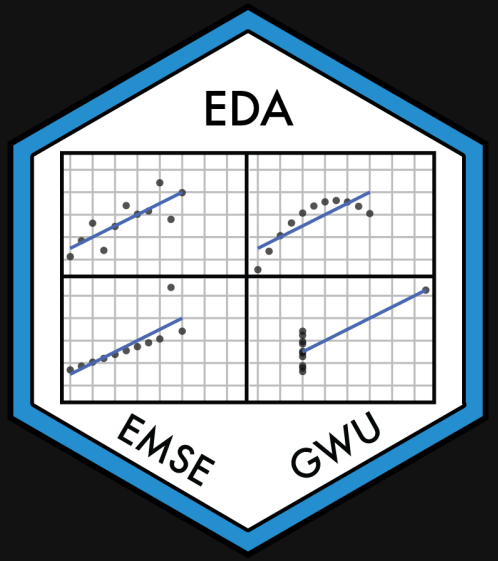


Week 6: *Amounts & Proportions*

EMSE 4575: Exploratory Data Analysis

John Paul Helveston

February 17, 2021

Tip of the week

The `fcuk` package

The `fcuk` package

Error message **without** the `fcuk` package:

```
maen(c(1, 2, 3, 4, 5))
```

```
Error in maen(c(1, 2, 3, 4, 5)) : could not find function "maen"
```

The `fcuk` package

Error message **without** the `fcuk` package:

```
maen(c(1, 2, 3, 4, 5))
```

```
Error in maen(c(1, 2, 3, 4, 5)) : could not find function "maen"
```

Error message **with** the `fcuk` package:

```
library(fcuk)

maen(c(1, 2, 3, 4, 5))
```

```
Error in maen(c(1, 2, 3, 4, 5)) : could not find function "maen"

Did you mean : mean or rename ?
```

The `fcuk` package

Install:

```
install.packages("fcuk")
```

Automatically load:

```
fcuk::add_fcuk_to_rprofile()
```

Tidy data review

Tidy data

Tidy data follows the following three rules:

- Each **variable** has its own **column**
- Each **observation** has its own **row**
- Each **value** has its own **cell**

Next projects due:

- Mini project 2: Redesign (Due 03/09)
- Project proposal (Due 03/12)

Today's data

```
avengers          <- read_csv(here('data', 'avengers.csv'))
bears             <- read_csv(here('data', 'north_america_bear_killings.csv'))
federal_spending <- read_csv(here('data', 'fed_spend_long.csv'))
gapminder         <- read_csv(here('data', 'gapminder.csv'))
lotr_words        <- read_csv(here('data', 'lotr_words.csv'))
milk_production   <- read_csv(here('data', 'milk_production.csv'))
wildlife_impacts <- read_csv(here('data', 'wildlife_impacts.csv'))
```

New packages

```
install.packages("waffle")
```

Week 6: *Amounts & Proportions*

1. Manipulating factors
2. Graphing amounts

BREAK

3. Graphing proportions

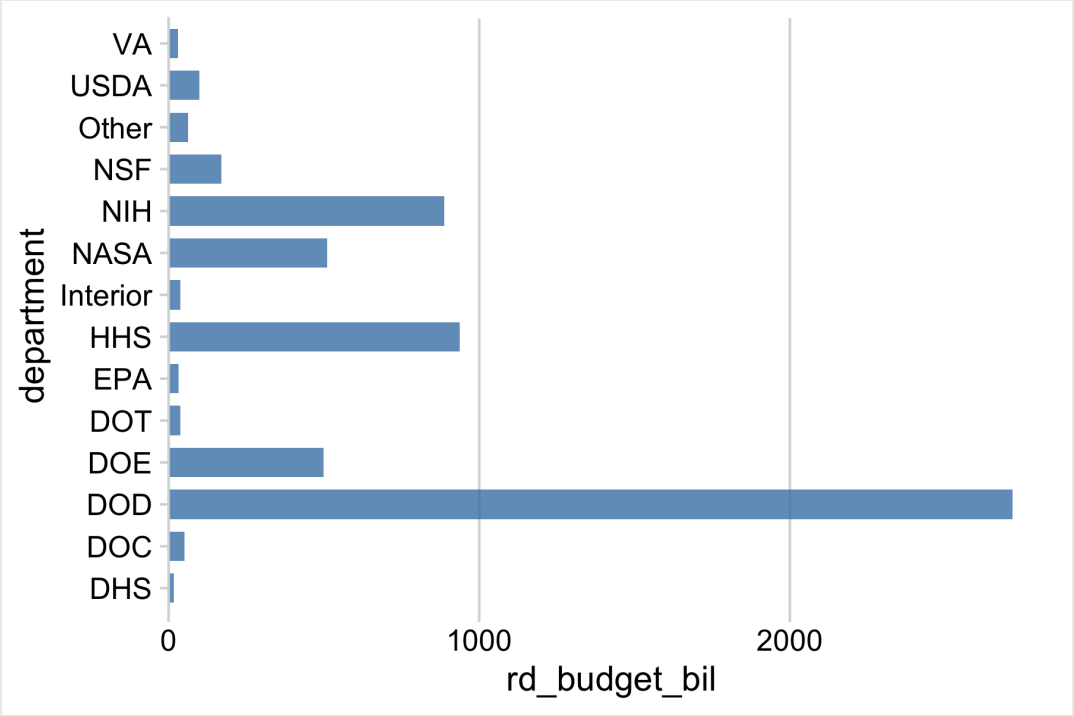
Week 6: *Amounts & Proportions*

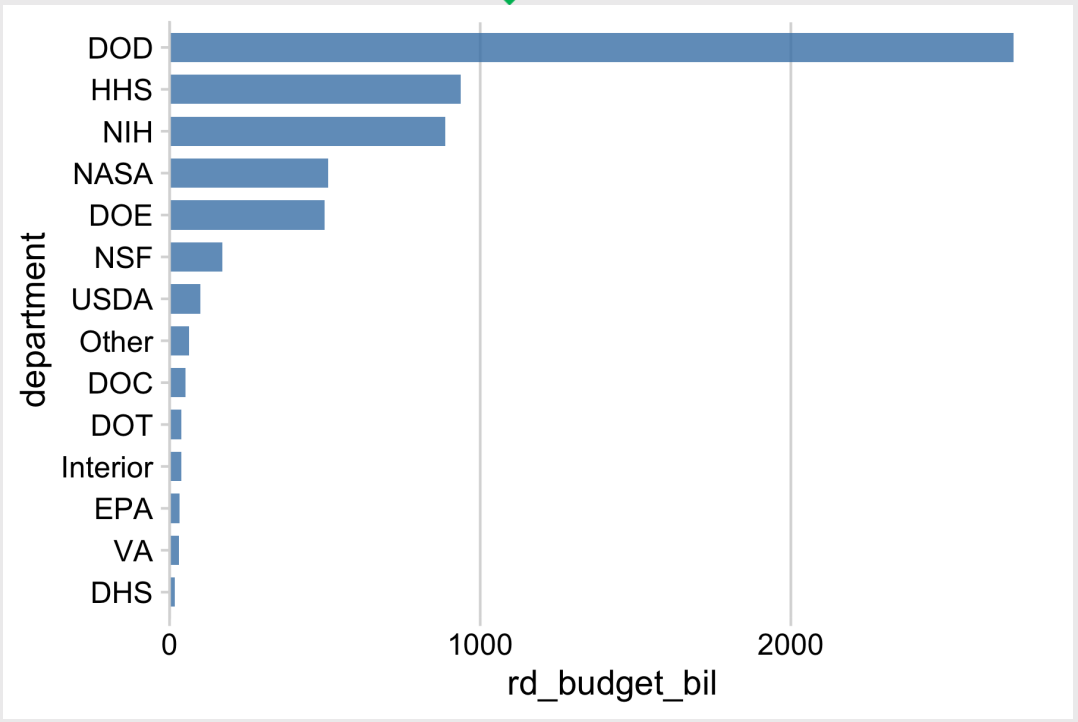
1. Manipulating factors
2. Graphing amounts

BREAK

3. Graphing proportions

Sorting in ggplot is done by reordering factors

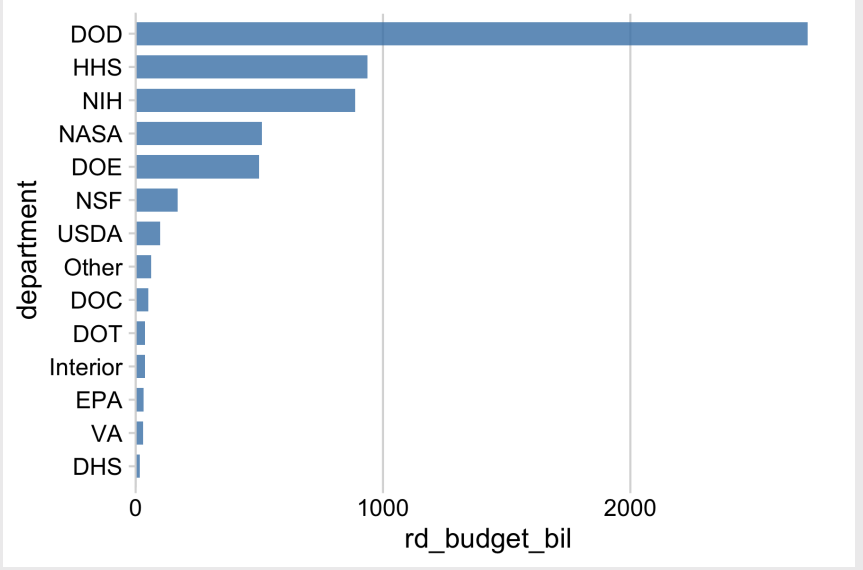




Two ways to sort

Method 1: Use `reorder()` inside aesthetic mapping

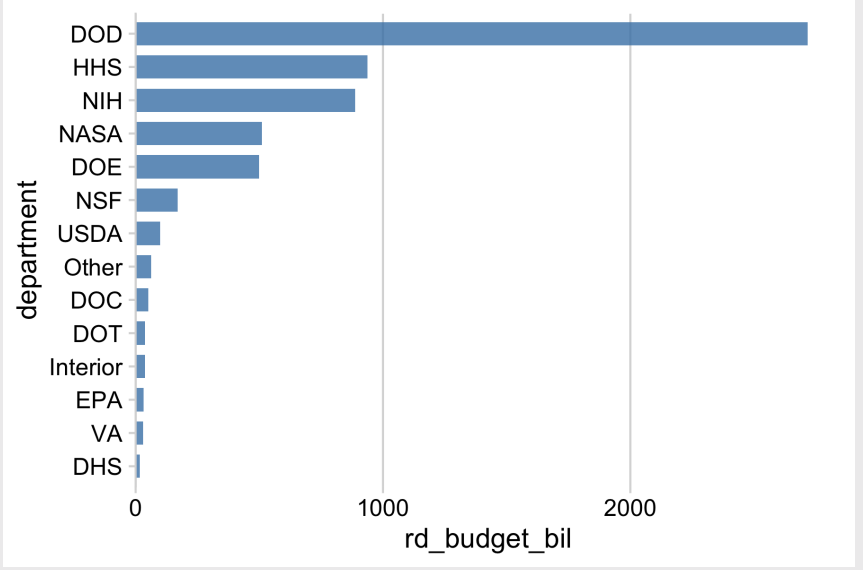
```
# Format the data frame
federal_spending %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil) / 10^3) %>

# Make the chart
  ggplot() +
  geom_col(aes(x = rd_budget_bil,
               y = reorder(department, rd_budget_bil)),
           width = 0.7, alpha = 0.8,
           fill = "steelblue") +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



Two ways to sort

Method 2: Use `fct_reorder()` when formatting the data frame

```
# Format the data frame
federal_spending %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil) / 10^3) %>
  mutate(
    department = fct_reorder(department, rd_budget_bil))

# Make the chart
  ggplot() +
  geom_col(aes(x = rd_budget_bil,
               y = department),
           width = 0.7, alpha = 0.8,
           fill = "steelblue") +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



Reorder & modify factors with the **forcats** library

Loaded with `library(tidyverse)`

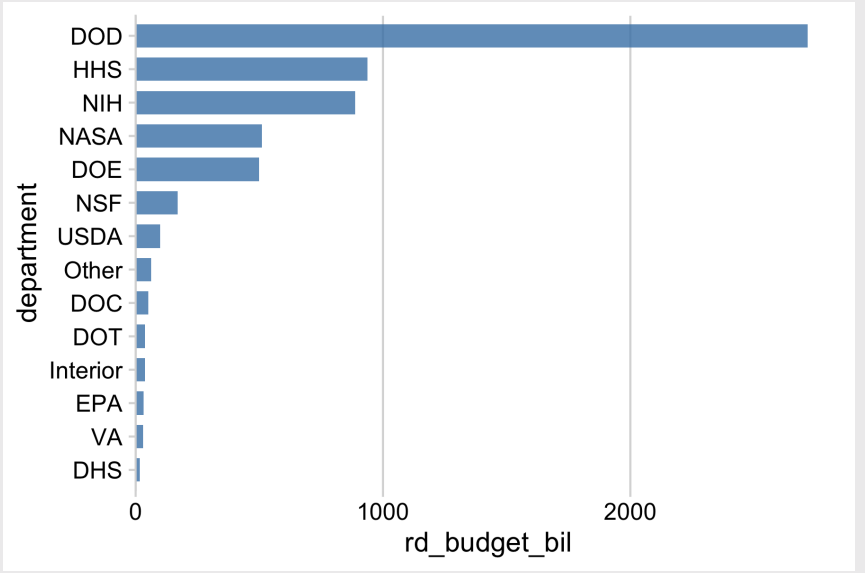
Common situations for modifying / reording factors:

1. Reorder factors based on another numerical variable
2. Reorder factors manually
3. Modify factors manually
4. What if there are too many factor levels?

1. Reorder factors based on another numerical variable

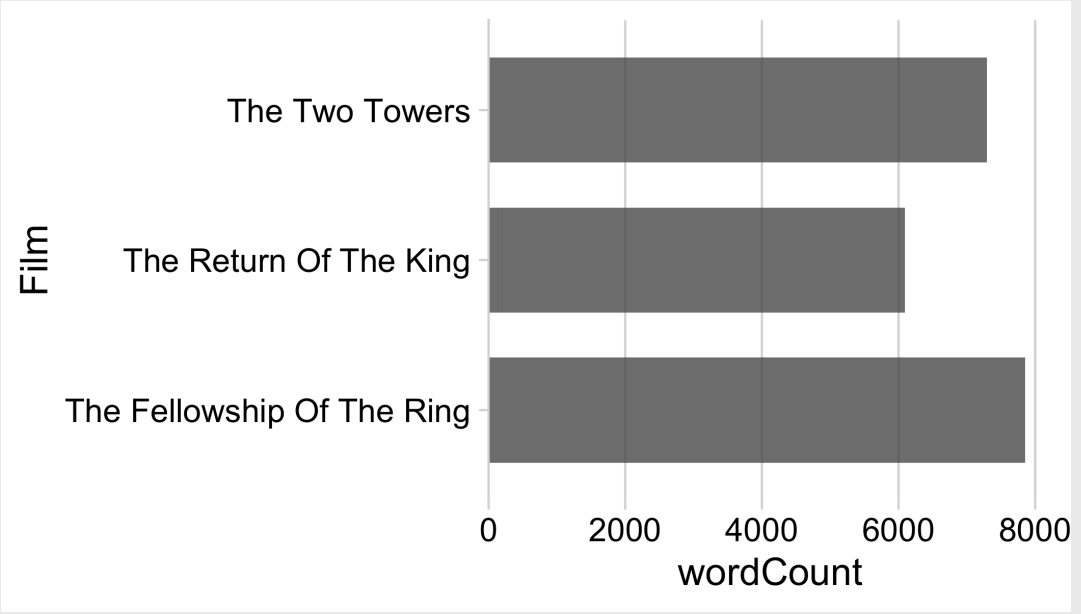
Use `fct_reorder()`

```
# Format the data frame
federal_spending %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil) / 10^3) %>
  mutate(
    department = fct_reorder(department, rd_budget_bil))

# Make the chart
  ggplot() +
  geom_col(aes(x = rd_budget_bil,
               y = department),
           width = 0.7, alpha = 0.8,
           fill = "steelblue") +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



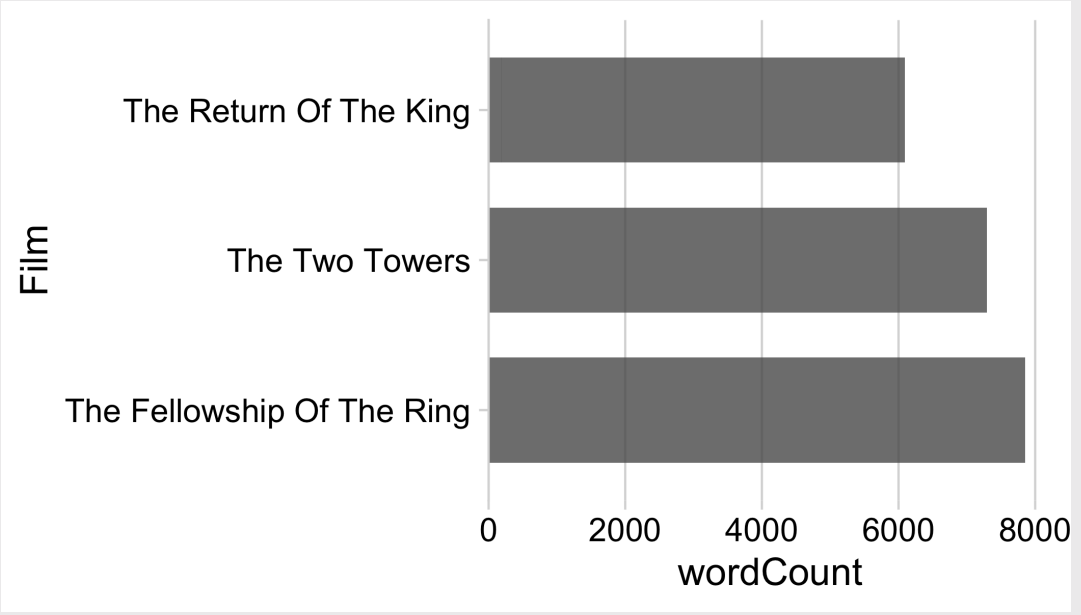
2. Reorder factors manually

```
# Format the data frame
lotr_words %>%
  gather(key = 'gender', value = 'wordCount',
         Female:Male) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = wordCount, y = Film),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



2. Reorder factors manually with `fct_relevel()`

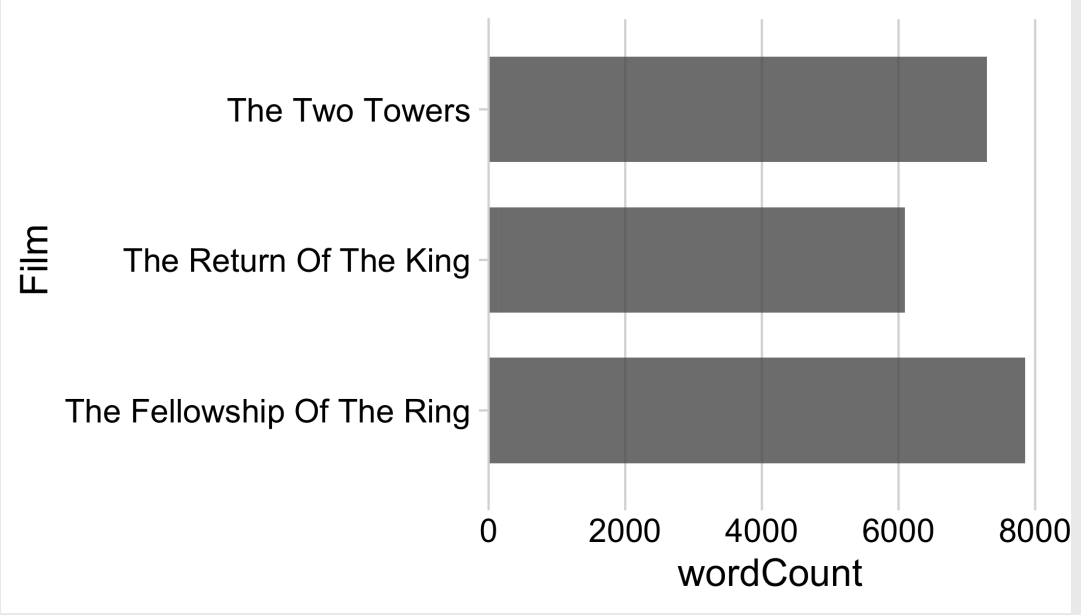
```
# Format the data frame
lotr_words %>%
  gather(key = 'gender', value = 'wordCount',
         Female:Male) %>%
  mutate(
    Film = fct_relevel(Film, levels = c(
      'The Fellowship Of The Ring',
      'The Two Towers',
      'The Return Of The King'))) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = wordCount, y = Film),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



3. Modify factors manually

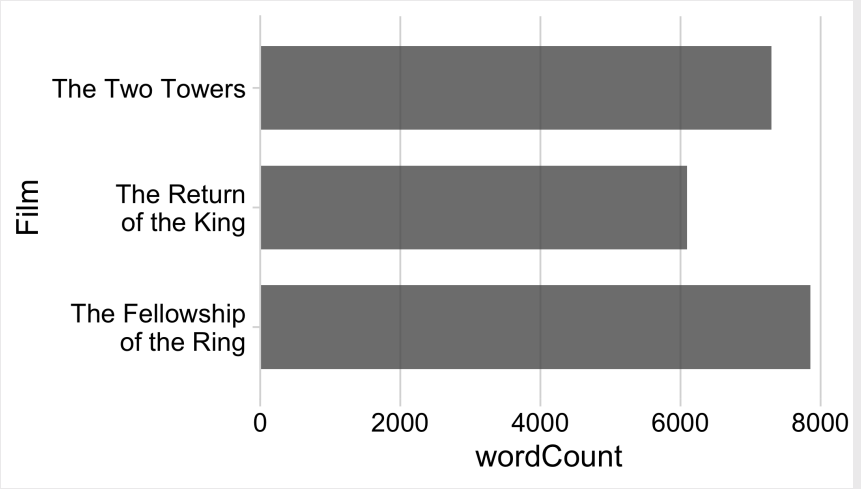
```
# Format the data frame
lotr_words %>%
  gather(key = 'gender', value = 'wordCount',
         Female:Male) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = wordCount, y = Film),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```

The film names here are too long



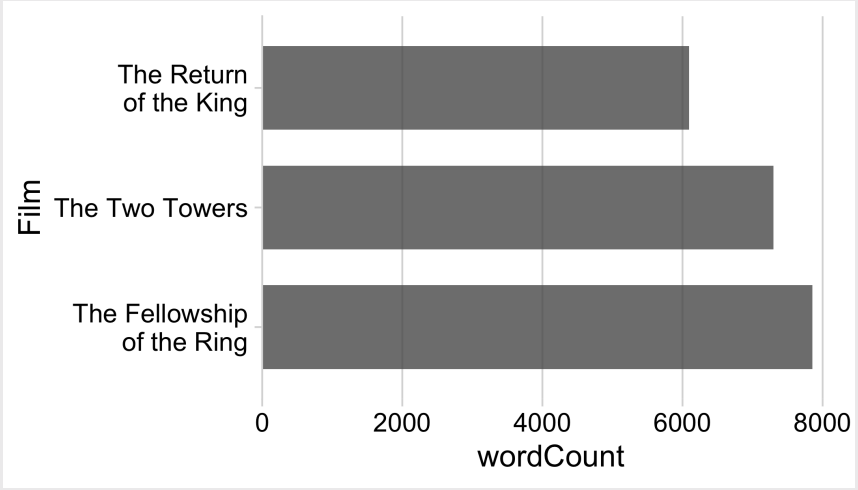
3. Modify factors manually with `fct_recode()`

```
# Format the data frame
lotr_words %>%
  gather(key = 'gender', value = 'wordCount',
         Female:Male) %>%
  mutate(
    Film = fct_recode(Film,
      'The Fellowship\nof the Ring' = 'The Fellowship Of
      'The Return\nof the King' = 'The Return Of The Kin

# Make the chart
  ggplot() +
  geom_col(aes(x = wordCount, y = Film),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



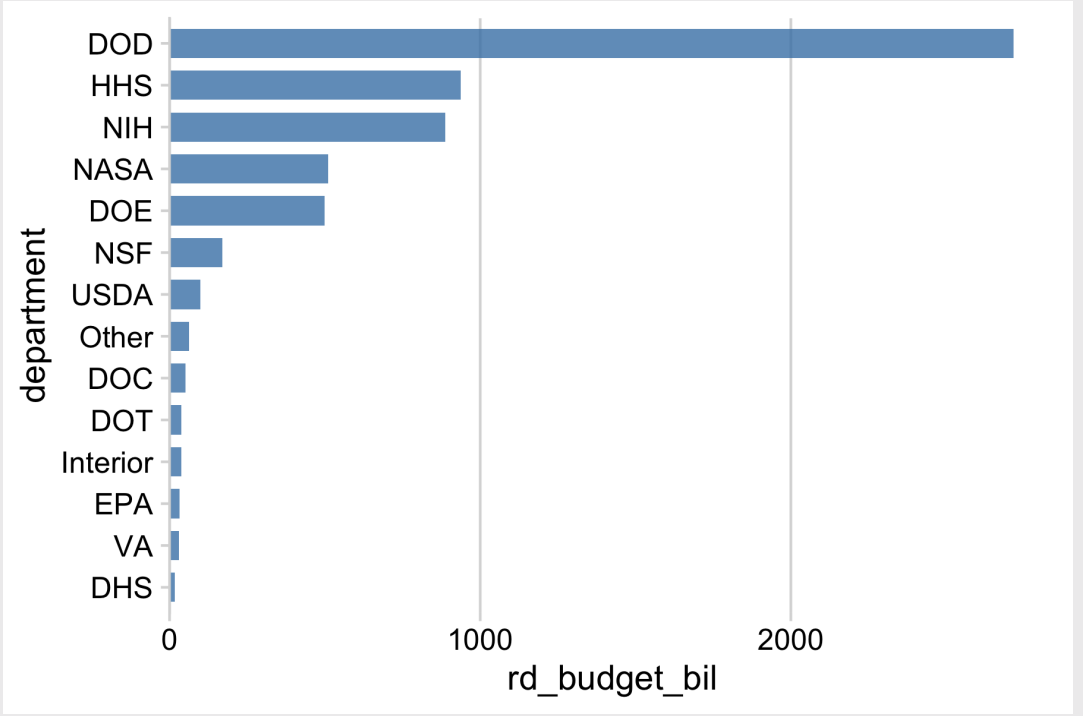
2 & 3. Modify and reorder factors manually

```
# Format the data frame
lotr_words %>%
  gather(key = 'gender', value = 'wordCount',
         Female:Male) %>%
  mutate(
    Film = fct_relevel(Film, levels = c(
      'The Fellowship Of The Ring',
      'The Two Towers',
      'The Return Of The King')),
    Film = fct_recode(Film,
      'The Fellowship\nof the Ring' = 'The Fellowship Of
      'The Return\nof the King' = 'The Return Of The Kin

# Make the chart
  ggplot() +
  geom_col(aes(x = wordCount, y = Film),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



4. What if there are too many factor levels?

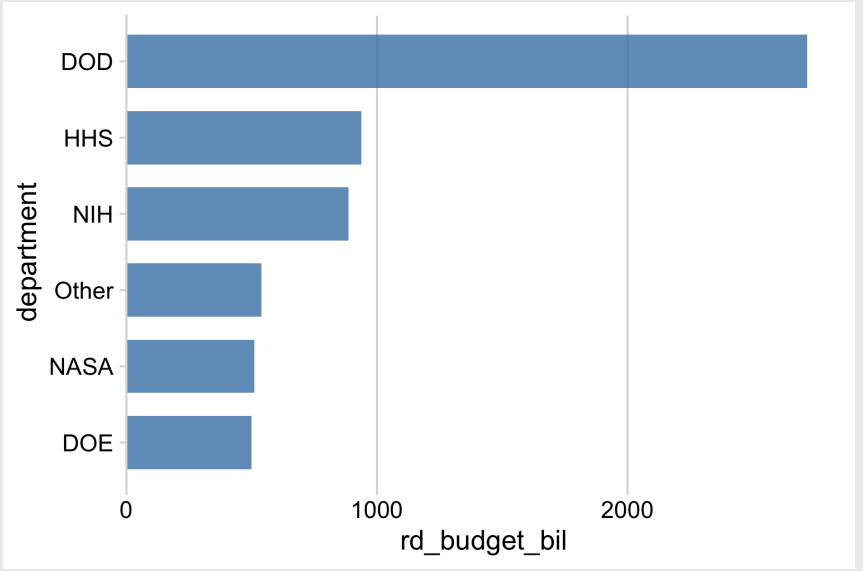
```
# Format the data frame
federal_spending %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil)
  mutate(
    department = fct_reorder(department, rd_buc

# Make the chart
  ggplot() +
  geom_col(aes(x = rd_budget_bil,
               y = department),
           width = 0.7, alpha = 0.8,
           fill = "steelblue") +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



4. What if there are too many factor levels?

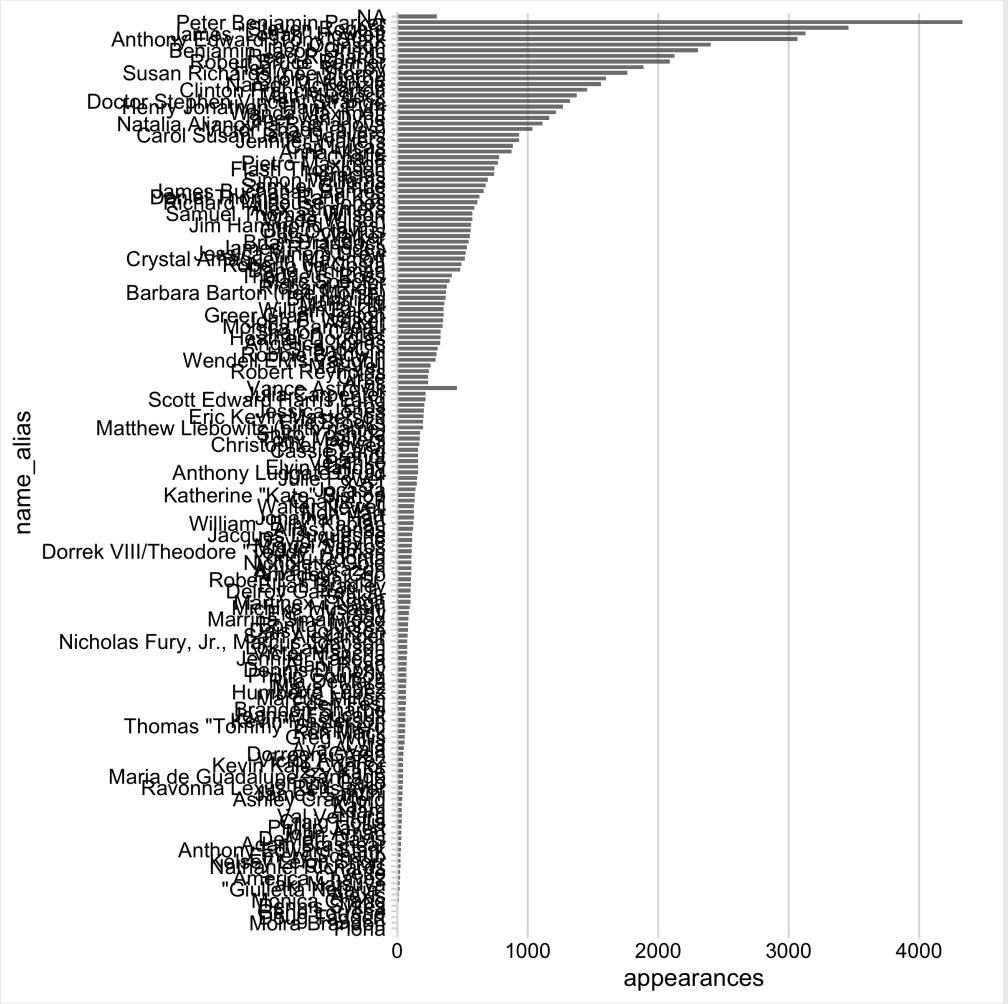
Strategy: Merge smaller factors into "Other" with `fct_other()`

```
# Format the data frame
federal_spending %>%
  mutate(
    department = fct_other(department,
      keep = c('DOD', 'HHS', 'NIH', 'NASA', 'DOE'))) %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil) / 10^3) %
  mutate(department = fct_reorder(department, rd_budget_

# Make the chart
  ggplot() +
  geom_col(aes(x = rd_budget_bil,
               y = department),
           width = 0.7, alpha = 0.8,
           fill = "steelblue") +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



4. What if there are *really* too many factor levels?

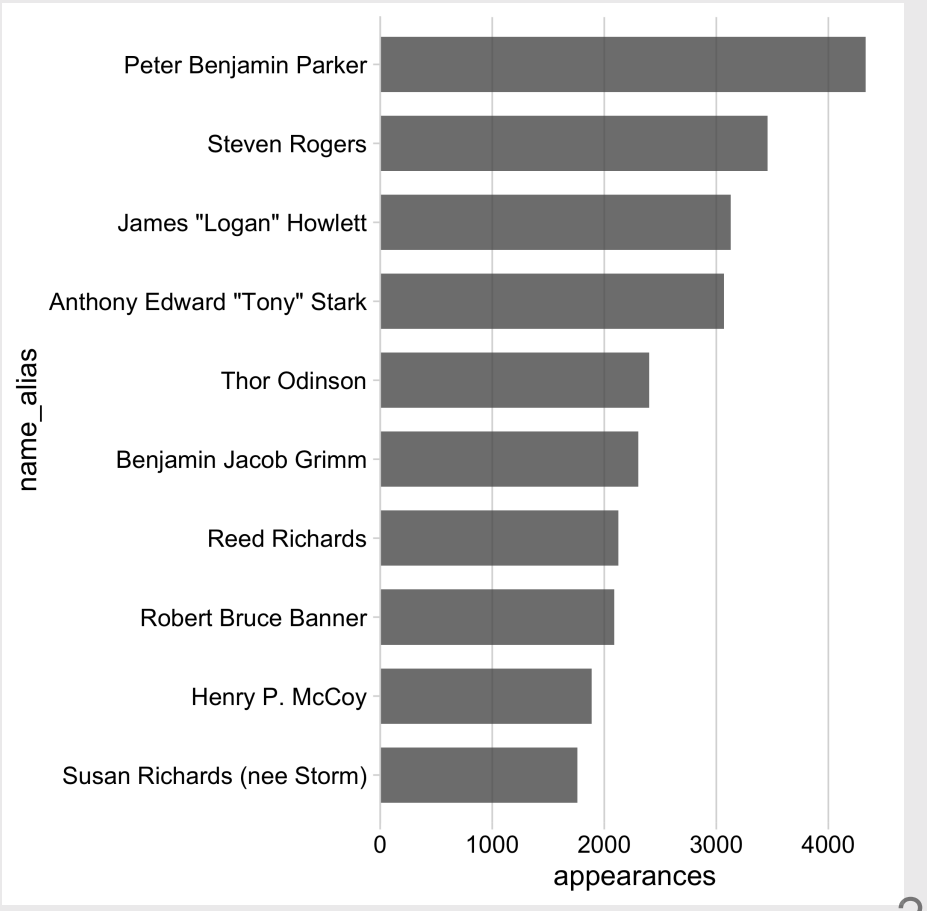
```
# Format the data frame
avengers %>%
  mutate(
    name_alias = fct_reorder(name_alias, appear

# Make the chart
  ggplot() +
  geom_col(aes(x = appearances,
               y = name_alias),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



4. What if there are *really* too many factor levels?

Strategy: Keep top N, drop the rest

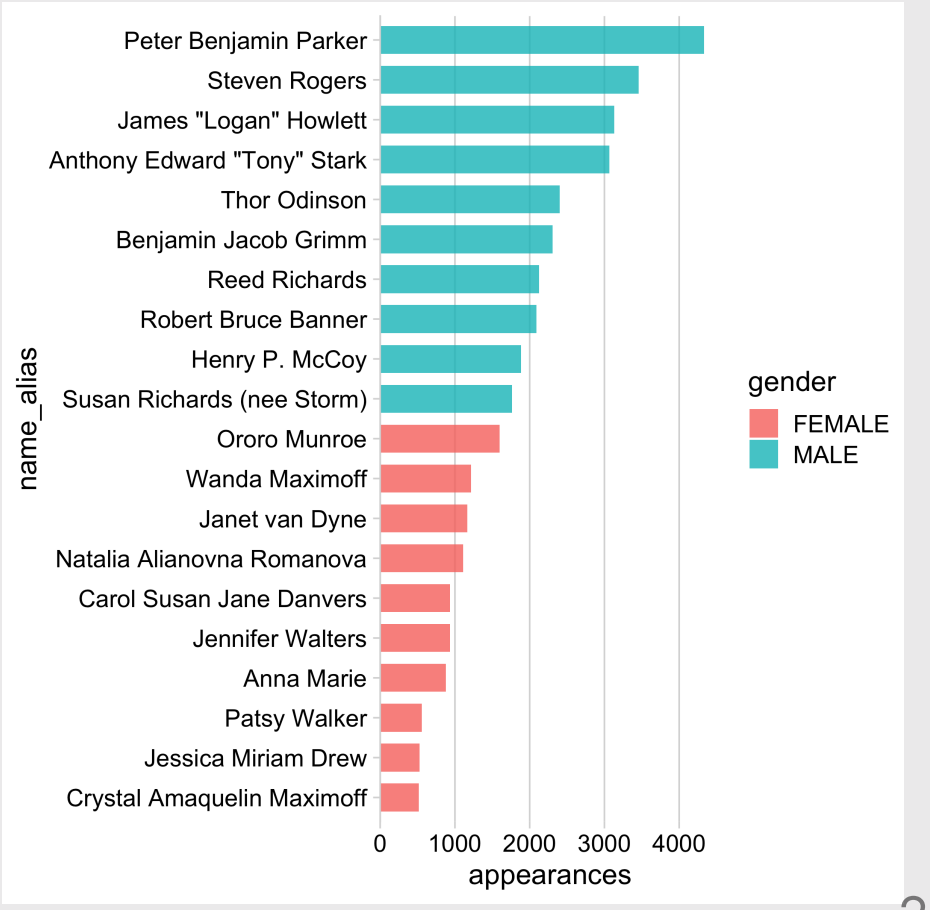
```
# Format the data frame
avengers %>%
  mutate(
    name_alias = fct_reorder(name_alias, appear
  arrange(desc(appearances)) %>%
  slice(1:10) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = appearances,
               y = name_alias),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



4. What if there are *really* too many factor levels?

`slice()` works with grouping too!

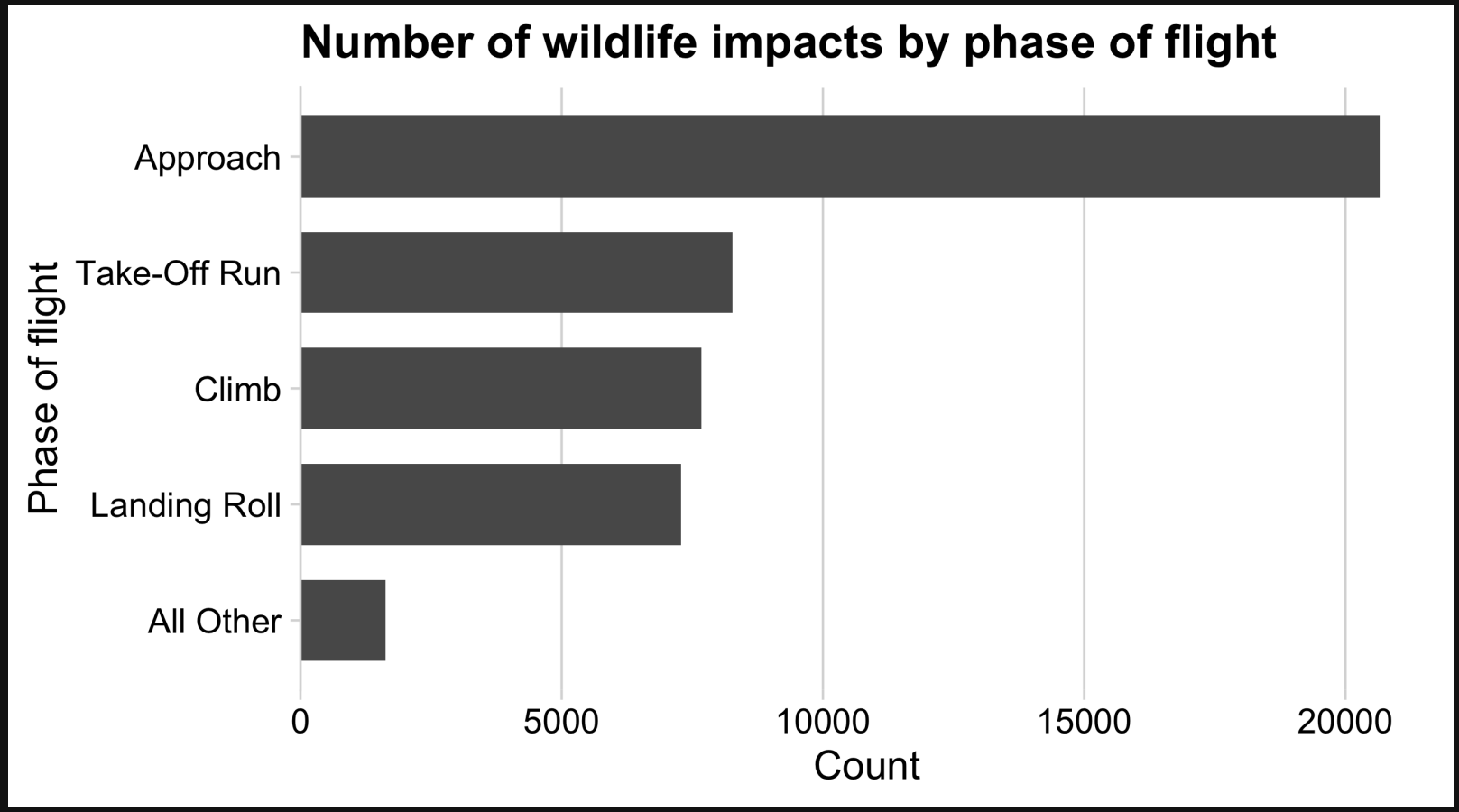
```
# Format the data frame
avengers %>%
  mutate(
    name_alias = fct_reorder(name_alias, appear
  arrange(desc(appearances)) %>%
  group_by(gender) %>%
  slice(1:10) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = appearances,
               y = name_alias,
               fill = gender),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



Your turn - practice manipulating factors

20:00

Use the `wildlife_impacts` data to create the following plot



Week 6: *Amounts & Proportions*

1. Manipulating factors
2. Graphing amounts

BREAK

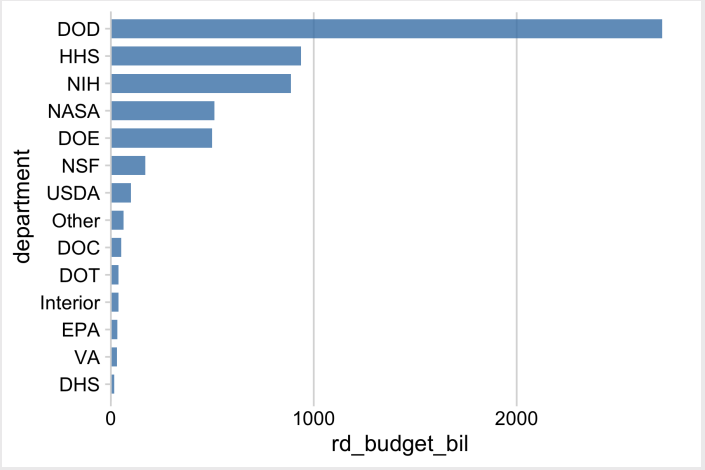
3. Graphing proportions

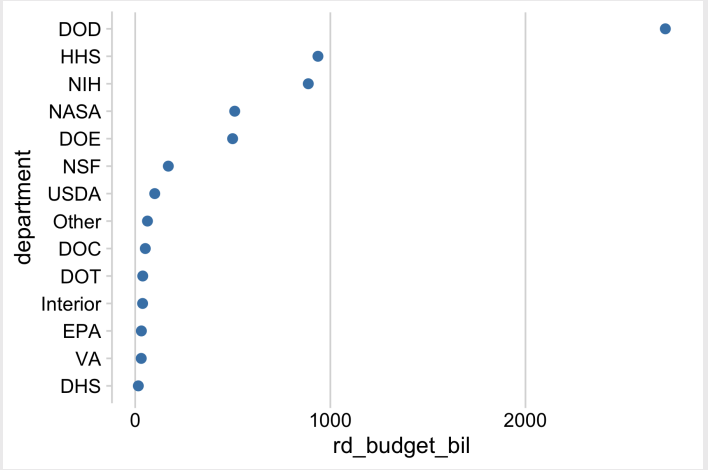
Show amounts with:

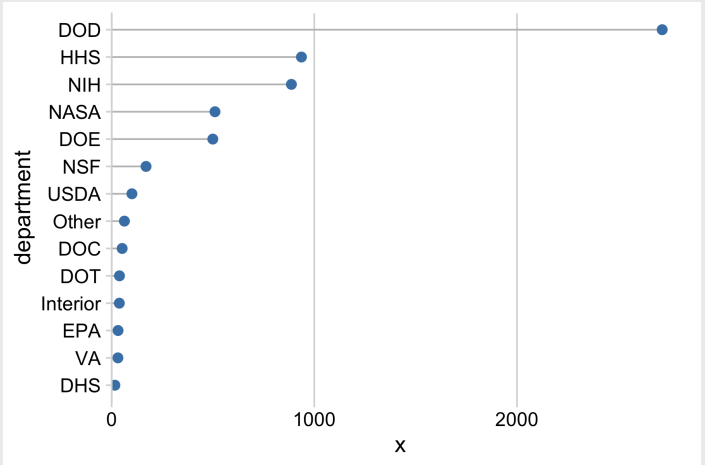
Bar chart

Dot chart

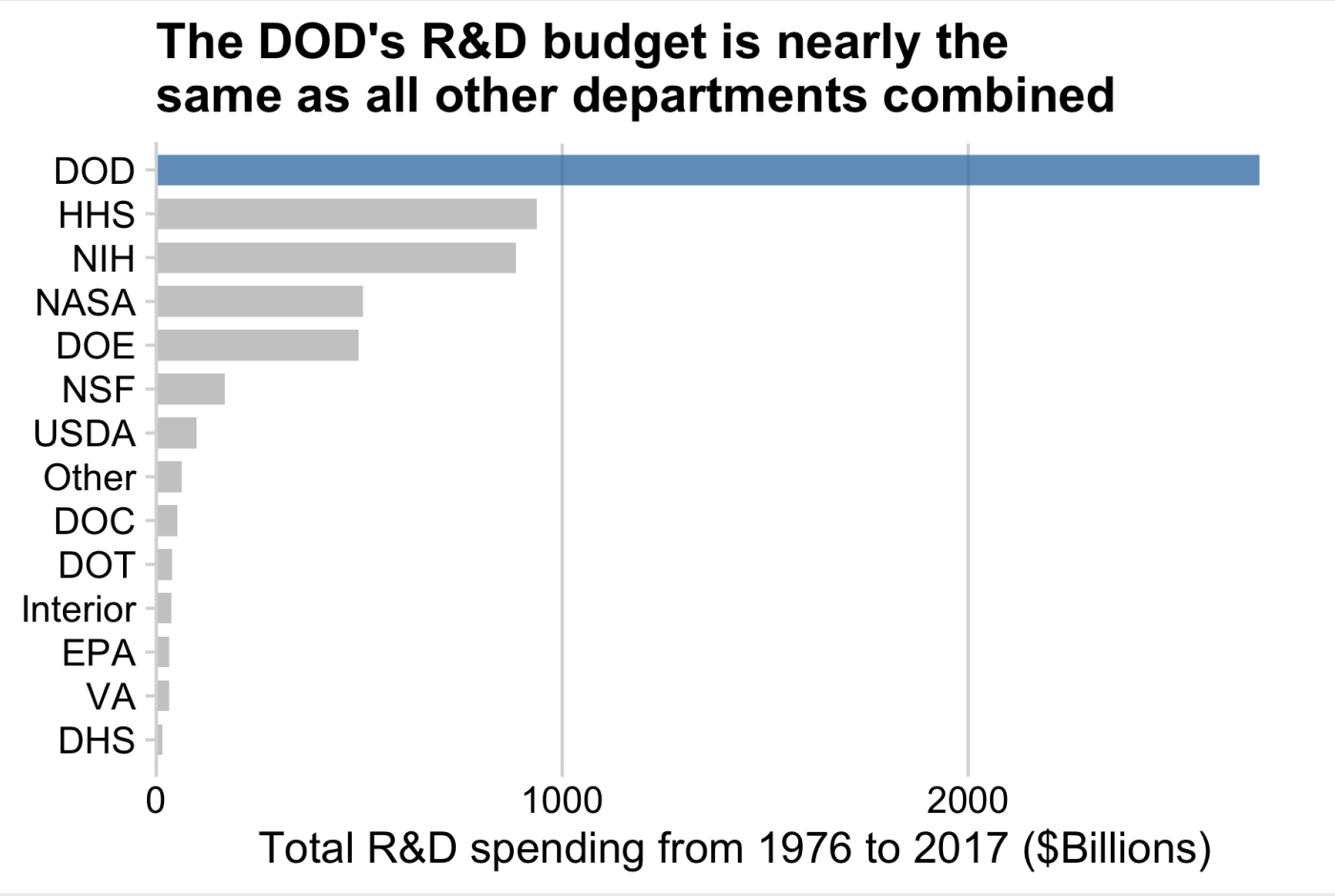
Lollipop chart





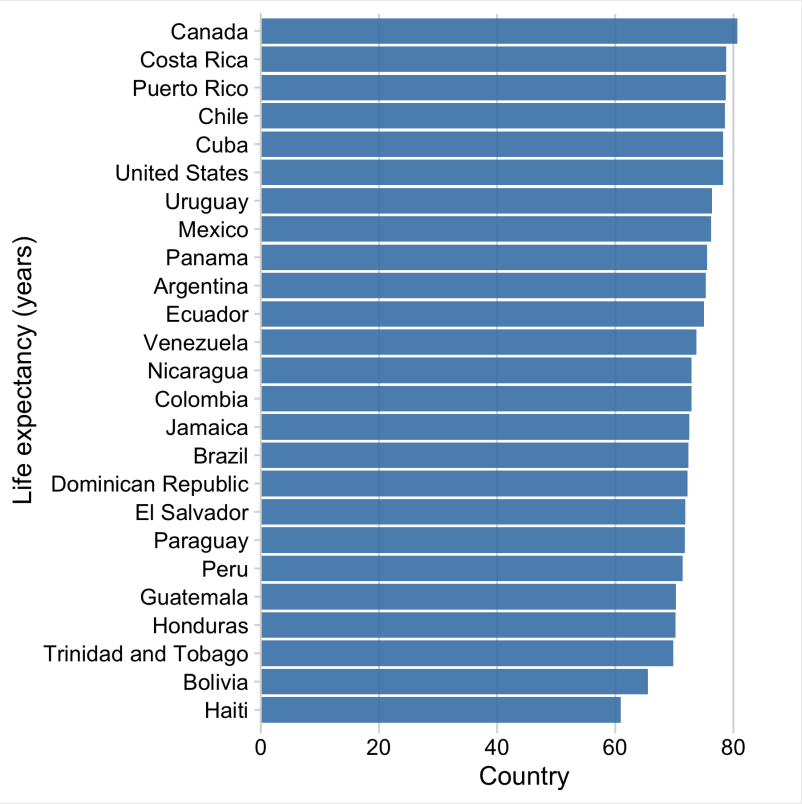


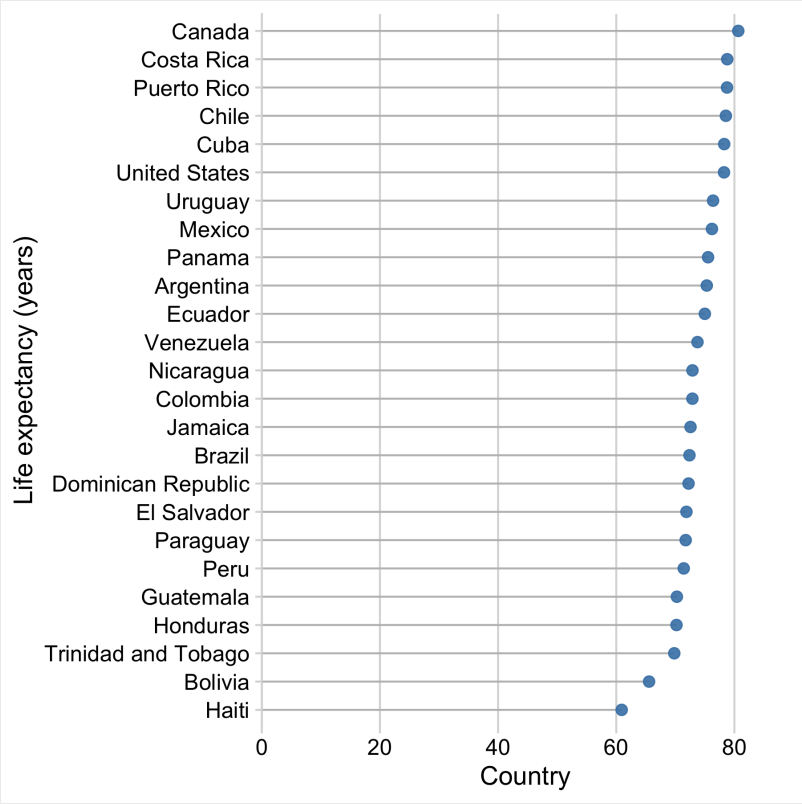
Bars are good for highlighting categories w/color



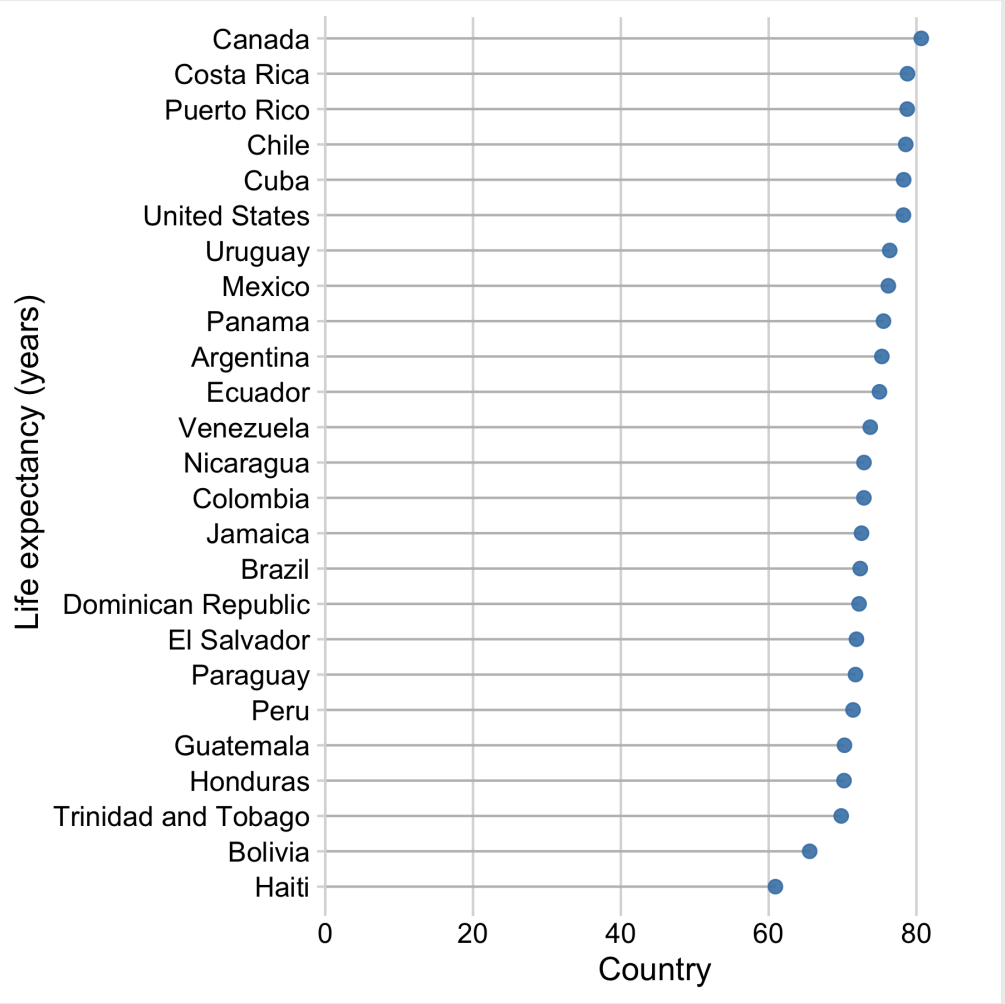
Use lollipops when:

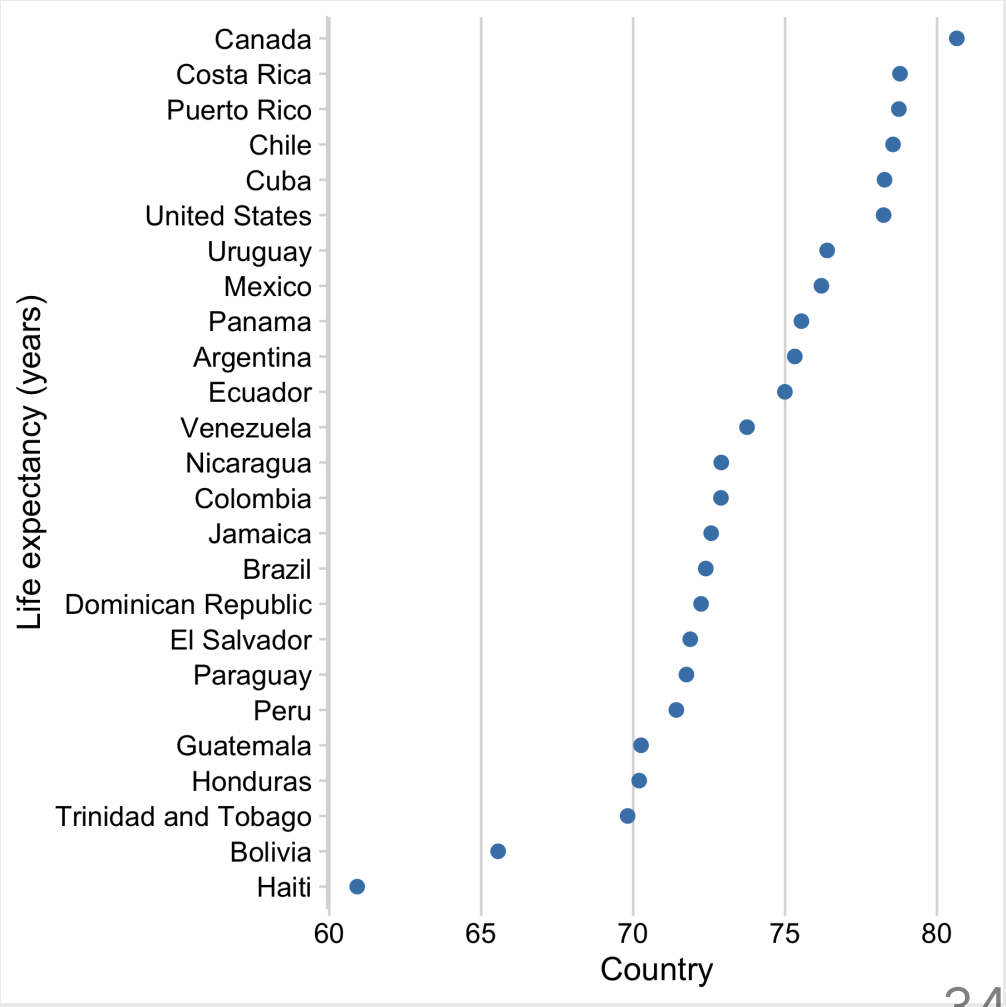
- The bars are overwhelming
- You're not highlighting categories





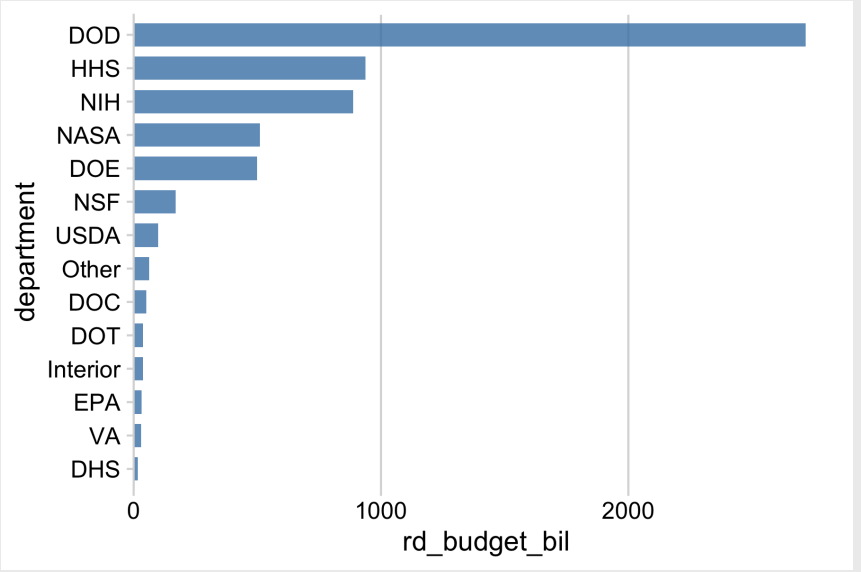
Or use dots and don't set axis to 0





How to make a **Bar chart**

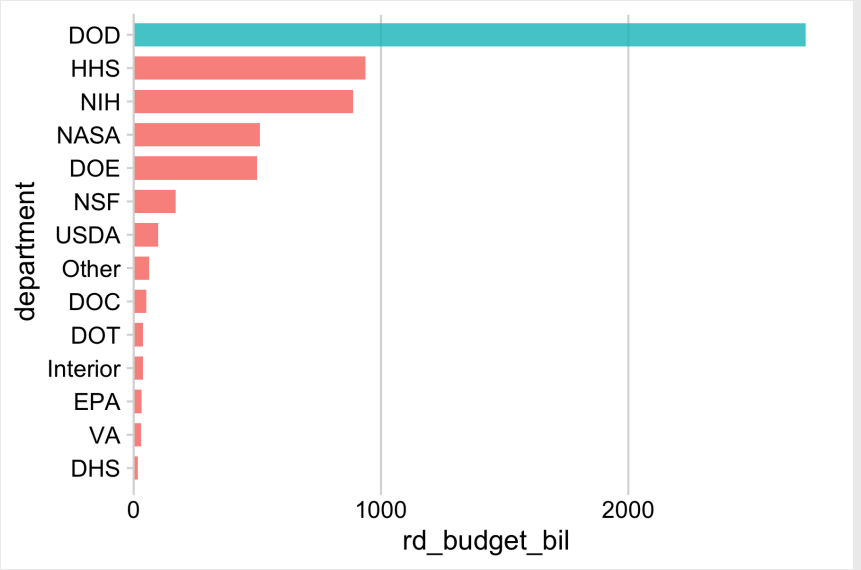
```
# Summarize the data
federal_spending %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil) / 10^3) %
  mutate(department = fct_reorder(department, rd_budget_

# Make chart
  ggplot() +
  geom_col(aes(x = rd_budget_bil,
               y = department),
           width = 0.7, alpha = 0.8,
           fill = 'steelblue') +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid()
```



Filling the bars with color

```
# Summarize the data
federal_spending %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil) / 10^3) %
  mutate(
    department = fct_reorder(department, rd_budget_bil),
    is_dod = if_else(
      department == 'DOD', TRUE, FALSE)) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = rd_budget_bil,
               y = department,
               fill = is_dod),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid() +
  theme(legend.position = 'none')
```

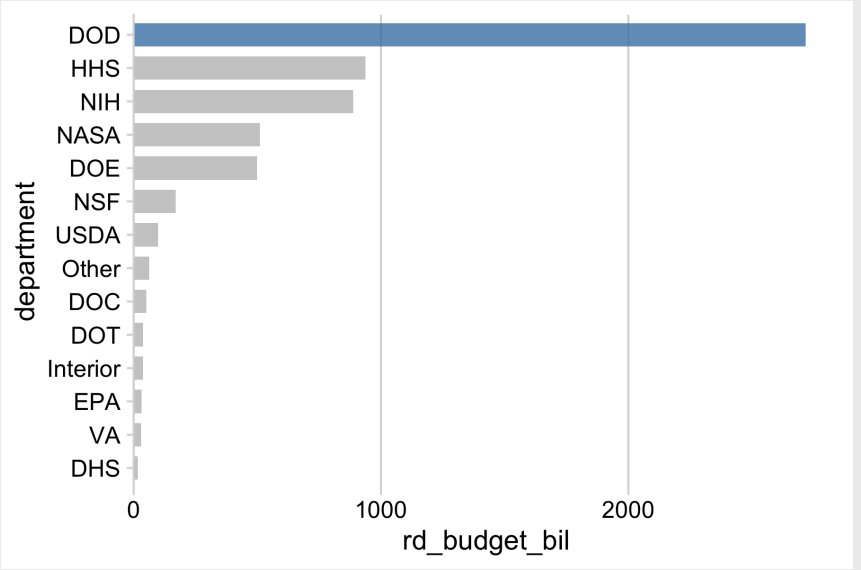
The DOD's R&D budget is nearly the same as all other departments combined



Filling the bars with color

```
# Summarize the data
federal_spending %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil) / 10^3) %
  mutate(
    department = fct_reorder(department, rd_budget_bil),
    is_dod = if_else(
      department == 'DOD', TRUE, FALSE)) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = rd_budget_bil,
               y = department,
               fill = is_dod),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  scale_fill_manual(values = c('grey', 'steelblue')) +
  theme_minimal_vgrid() +
  theme(legend.position = 'none')
```

The DOD's R&D budget is nearly the same as all other departments combined

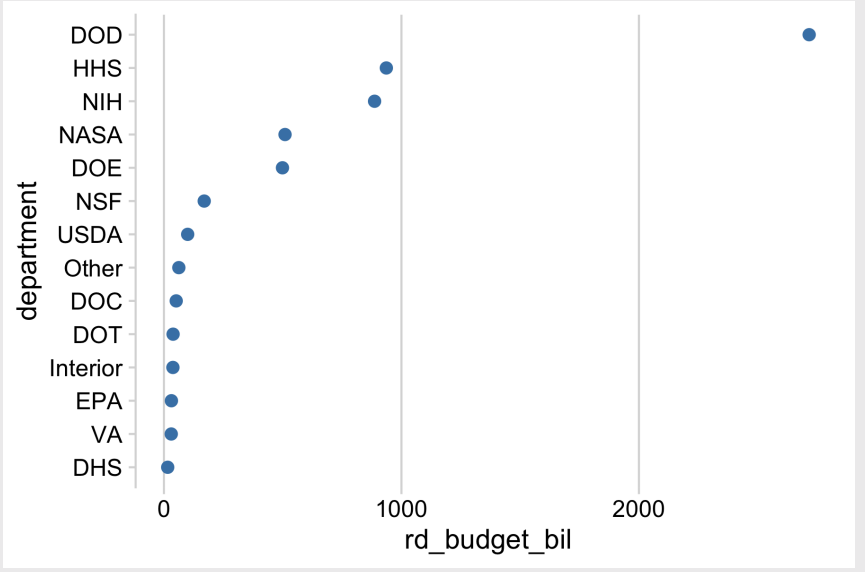


How to make a **Dot chart**

Summarize data frame:

```
# Summarize the data
federal_spending %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil) / 10^3) %
  mutate(department = fct_reorder(department, rd_budget_

# Make the chart
  ggplot() +
  geom_point(aes(x = rd_budget_bil,
                 y = department),
             size = 2.5, color = 'steelblue') +
  theme_minimal_vgrid()
```

Dot chart of federal R&D spending by department

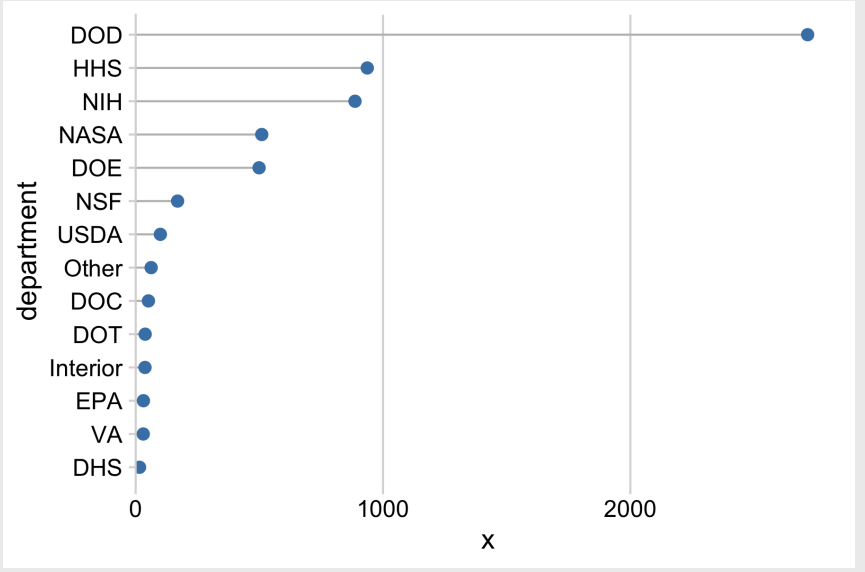


How to make a **Lollipop chart**

Summarize data frame:

```
# Summarize the data
federal_spending %>%
  group_by(department) %>%
  summarise(rd_budget_bil = sum(rd_budget_mil) / 10^3) %
  mutate(department = fct_reorder(department, rd_budget_

# Make the chart
  ggplot() +
  geom_segment(aes(x    = 0,
                   xend = rd_budget_bil,
                   y    = department,
                   yend = department),
               color = 'grey') +
  geom_point(aes(x = rd_budget_bil,
                 y = department),
             size = 2.5, color = 'steelblue') +
  theme_minimal_vgrid()
```

Lollipop chart of federal R&D spending by department



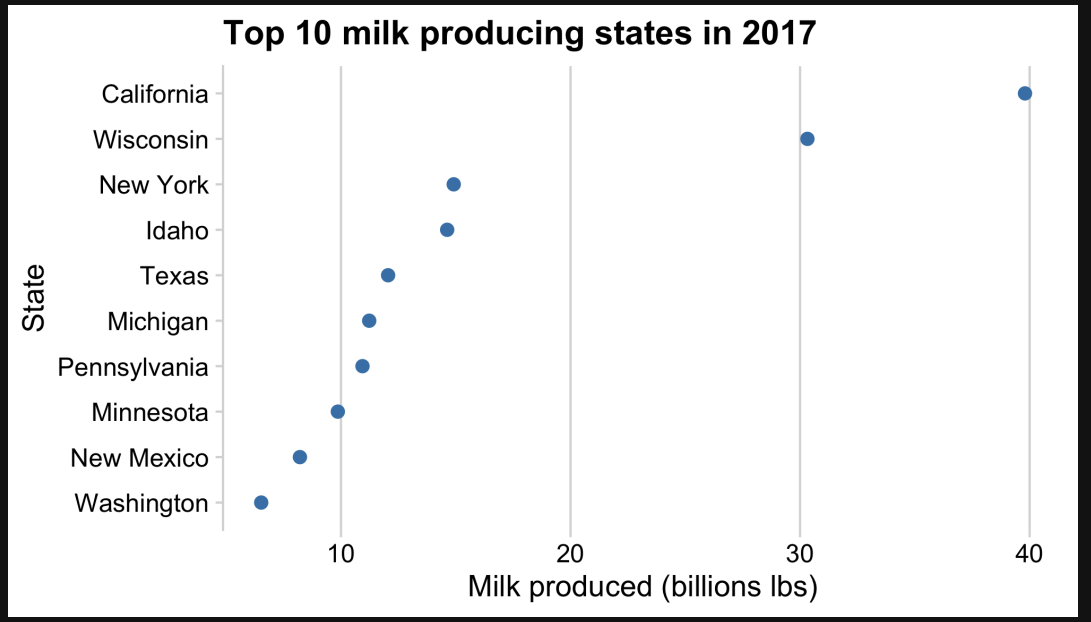
Your turn - practice plotting amounts

20:00

Create the following charts:

Data: `bears`

Data: `milk_production`



Break!

Stand up, Move around, Stretch!

05:00

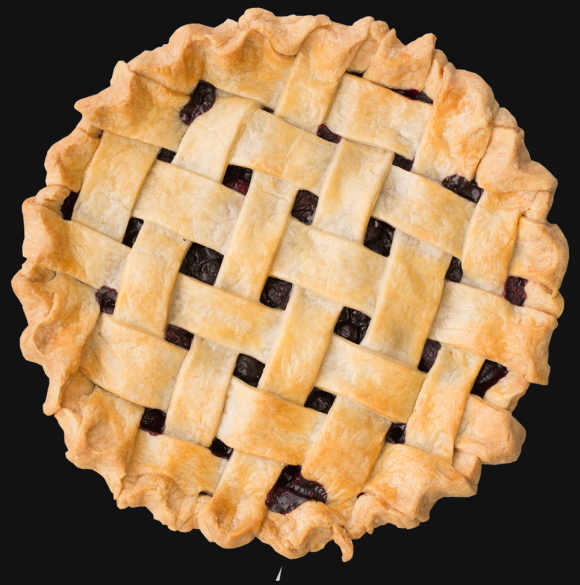
Week 6: *Amounts & Proportions*

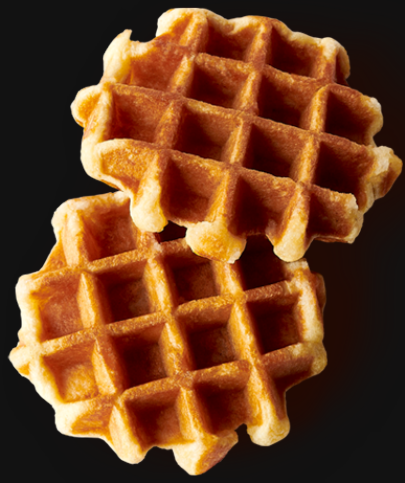
1. Manipulating factors
2. Graphing amounts

BREAK

3. Graphing proportions

Show proportions with:

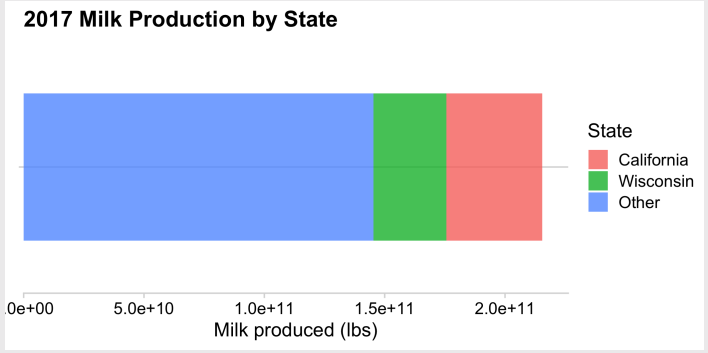


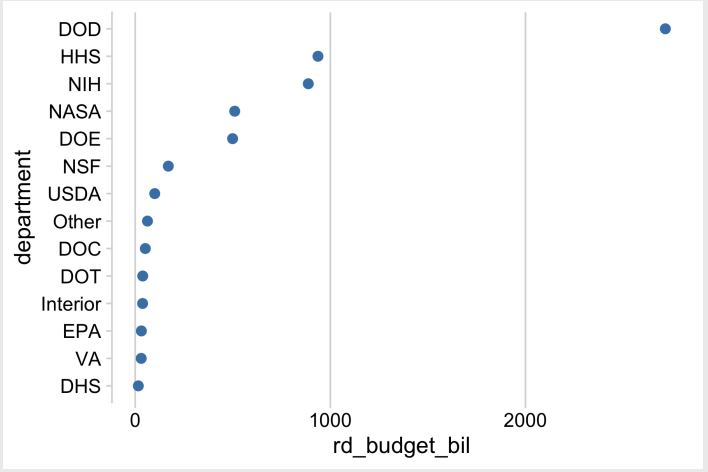


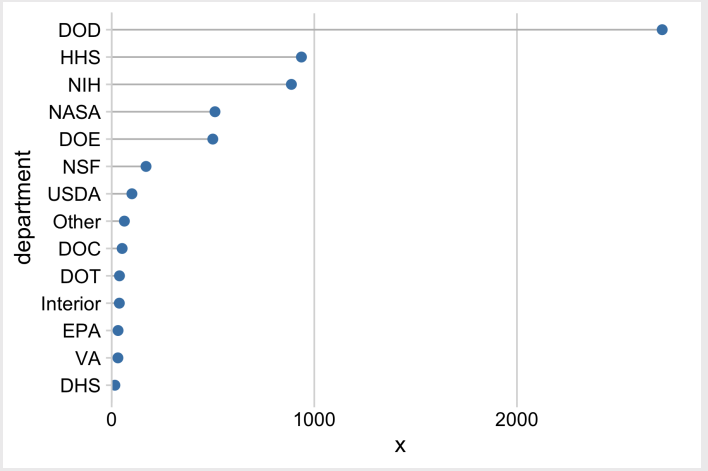
Bar charts

Pie charts

Waffle charts

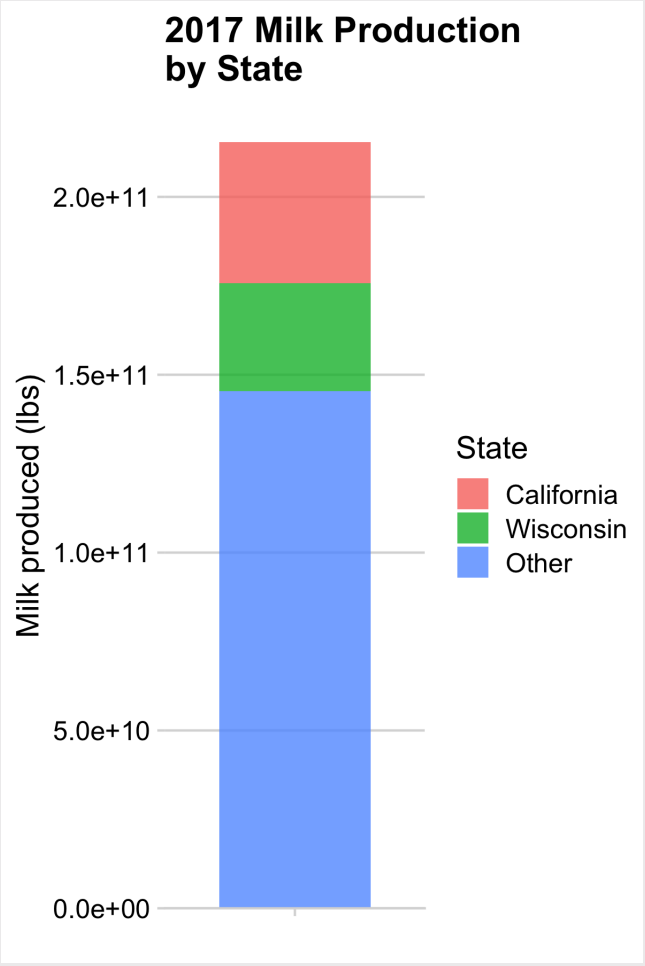






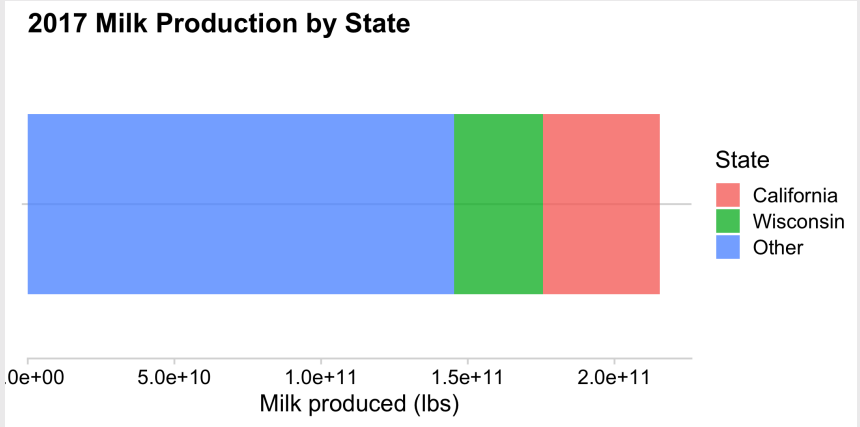
Stacked bars

```
# Format the data
milk_production %>%
  filter(year == 2017) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = "", y = milk_produced, fill = state),
           width = 0.7, alpha = 0.8) +
  scale_y_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_hgrid() +
  labs(x = NULL,
       y = 'Milk produced (lbs)',
       fill = 'State',
       title = '2017 Milk Production\nby State')
```



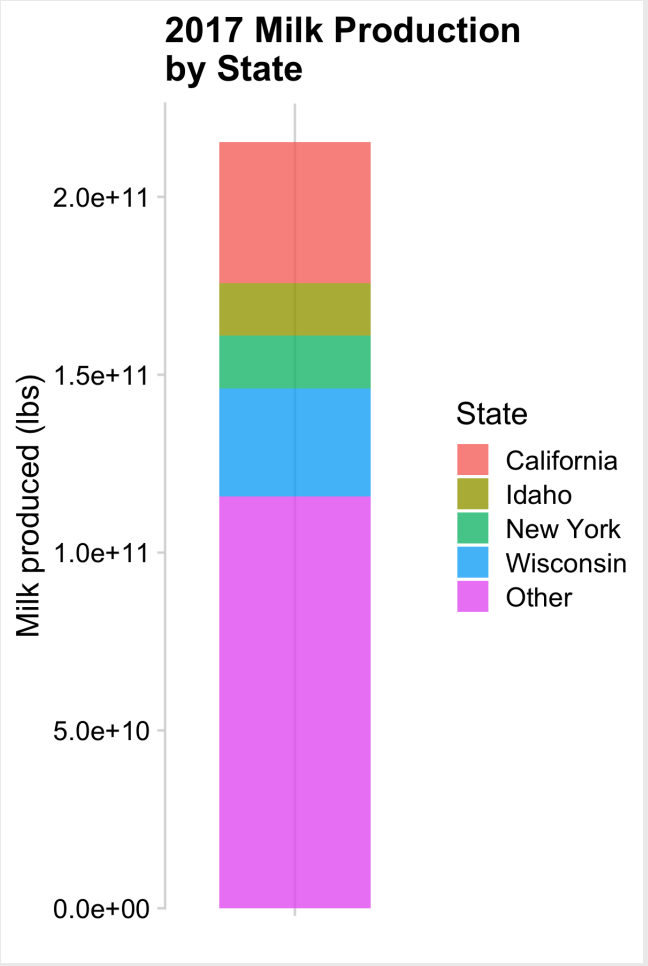
Stacked bars - Rotated also looks good

```
# Format the data
milk_production %>%
  filter(year == 2017) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = milk_produced, y = "", fill = state),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_hgrid() +
  labs(y = NULL,
       x = 'Milk produced (lbs)',
       fill = 'State',
       title = '2017 Milk Production by State')
```



Stacked bars - not great for more than a few categories

```r
# Format the data
milk_production %>%
  filter(year == 2017) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin',
             'New York', 'Idaho'))) %>%
  group_by(state) %>%
  summarise(milk_produced = sum(milk_produced))

# Make the chart
  ggplot() +
  geom_col(aes(x = "", y = milk_produced, fill = state),
           width = 0.7, alpha = 0.8) +
  coord_flip() +
  scale_y_continuous(
    expand = expand_scale(mult = c(0, 0.05))) +
  theme_minimal_vgrid() +
  labs(x = NULL,
       y = 'Milk produced (lbs)',
       fill = 'State',
       title = '2017 Milk Production by State')
```

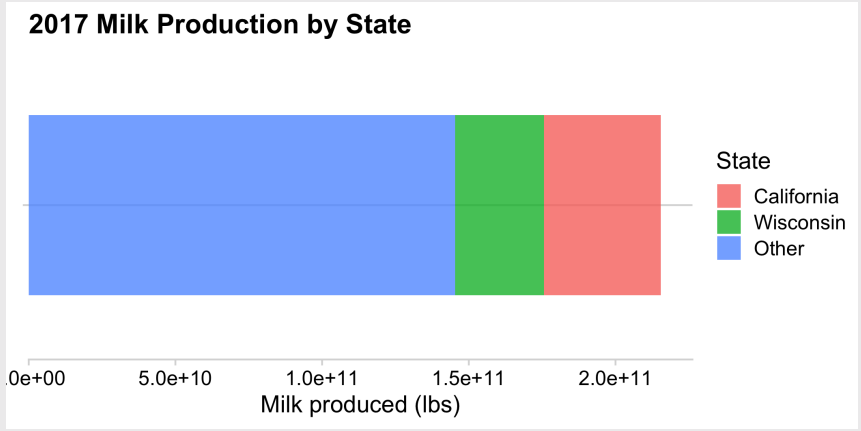


Dodged bars

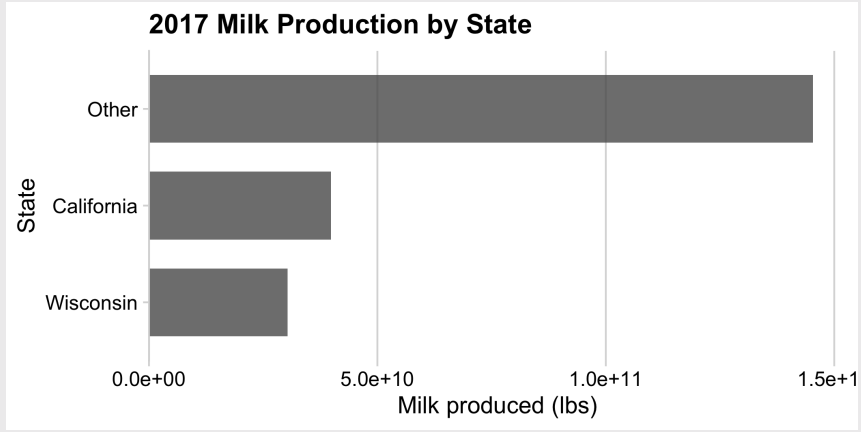
Better for **part-to-whole comparison**

```
# Format the data
milk_production %>%
  filter(year == 2017) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%
  mutate(state = fct_reorder(state, milk_produced)) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = milk_produced, state),
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid() +
  labs(x = 'Milk produced (lbs)',
       y = 'State',
       title = '2017 Milk Production by State')
```

Okay:



Better:

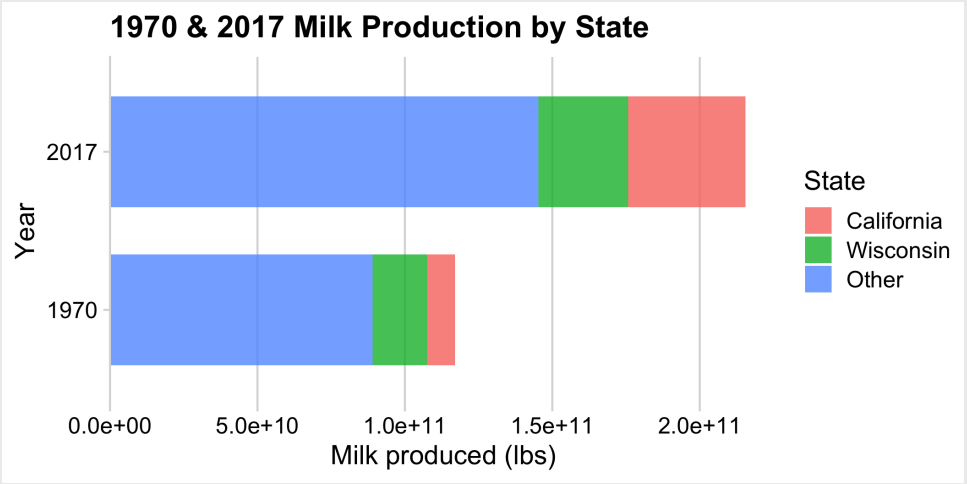


Dodged bars

Better for **comparing individual components**

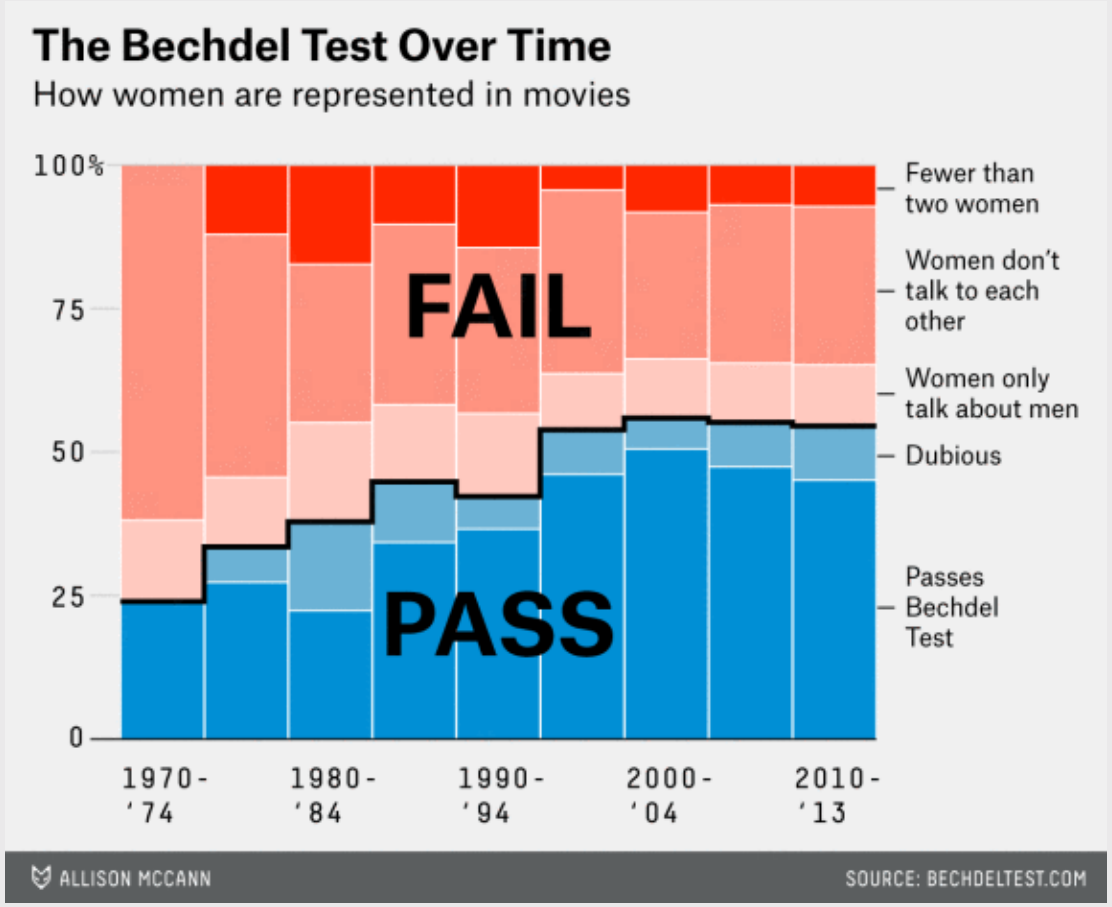
```
milk_production %>%
  filter(year %in% c(1970, 2017)) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(year, state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = milk_produced,
               y = as.factor(year),
               fill = state),
           position = 'dodge',
           width = 0.7, alpha = 0.8) +
  scale_x_continuous(
    expand = expansion(mult = c(0, 0.05))) +
  theme_minimal_vgrid() +
  labs(x = 'Milk produced (lbs)',
       y = 'Year',
       fill = 'State',
       title = '1970 & 2017 Milk Production by State
```

Better for comparing *total*:



Better for comparing *parts*:

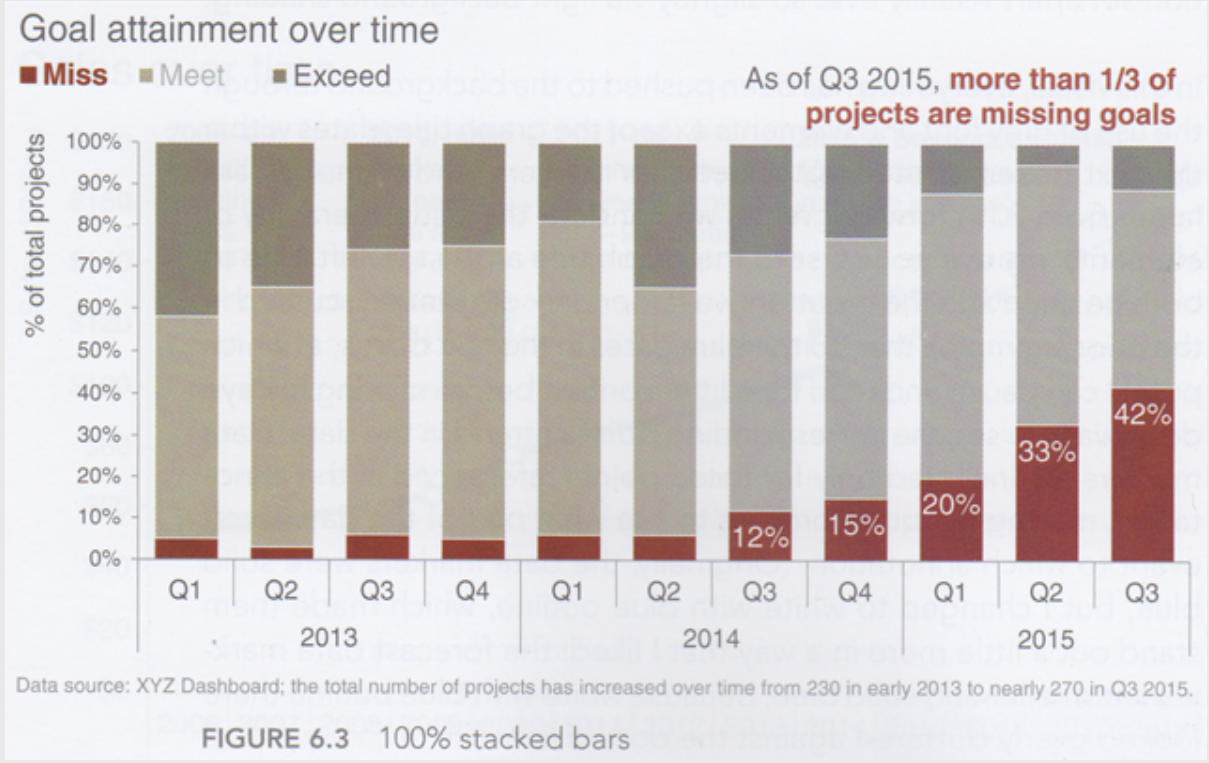
Where stacking is useful



- **2 to 3 groups**
- Proportions over time

https://fivethirtyeight.com/features/the-dollar-and-cents-case-against-hollywoods-exclusion-of-women/

Where stacking is useful



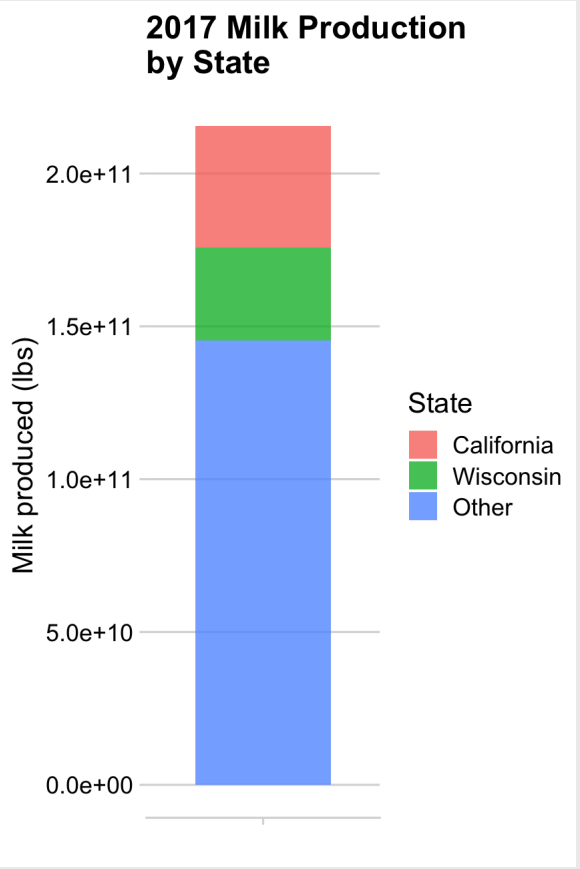
https://www.perceptualedge.com/blog/?p=2239

- 2 to 3 groups
- **Proportions over time**

The Notorious P-I-E

Start with a bar chart

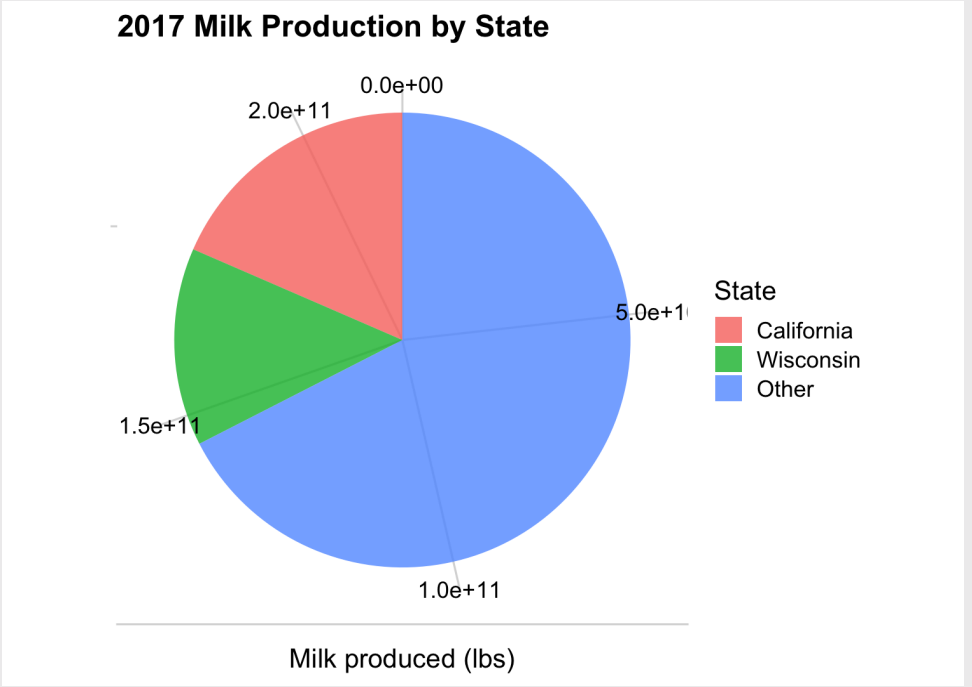
```
# Format the data
milk_production %>%
  filter(year == 2017) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = "",
               y = milk_produced,
               fill = state),
           width = 0.7, alpha = 0.8) +
  theme_minimal_hgrid() +
  labs(x = NULL,
       y = 'Milk produced (lbs)',
       fill = 'State',
       title = '2017 Milk Production\nby State')
```



The Notorious P-I-E

Convert bar to pie with `coord_polar()`

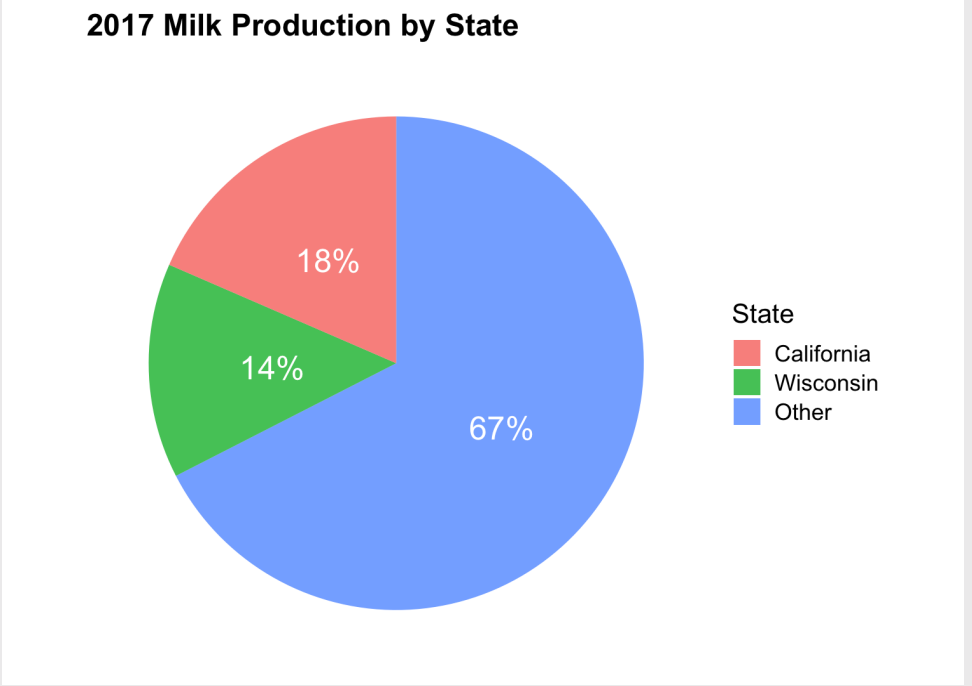
```
# Format the data
milk_production %>%
  filter(year == 2017) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = "",
               y = milk_produced,
               fill = state),
           width = 0.7, alpha = 0.8) +
  coord_polar(theta = "y") +
  theme_minimal_hgrid() +
  labs(x = NULL,
       y = 'Milk produced (lbs)',
       fill = 'State',
       title = '2017 Milk Production by State')
```



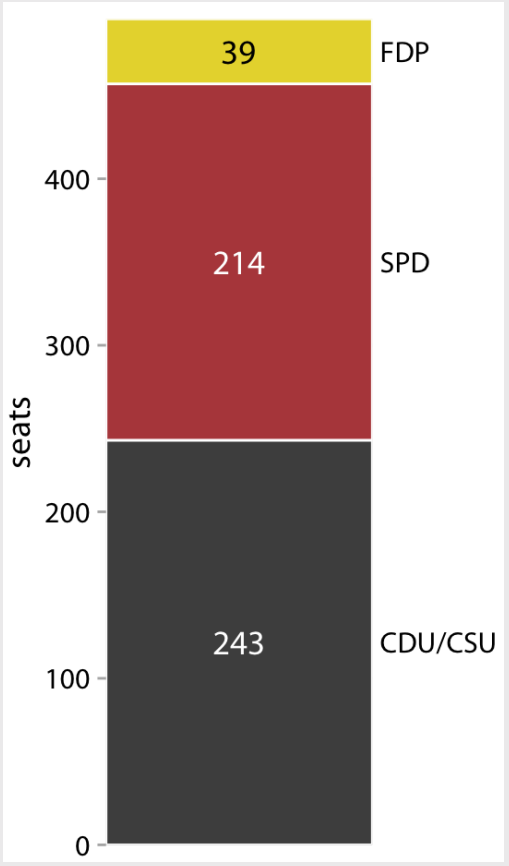
```r
# Format the data
milk_production %>%
  filter(year == 2017) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%
  arrange(desc(state)) %>%
  mutate(p = 100*(milk_produced / sum(milk_produced)
         label = str_c(round(p), '%')) %>%

# Make the chart
  ggplot() +
  geom_col(aes(x = "",
               y = milk_produced,
               fill = state),
           width = 0.7, alpha = 0.8) +
  geom_text(aes(x = "", y = milk_produced, label =
            color = "white", size = 6,
            position = position_stack(vjust = 0.5))
  coord_polar(theta = "y") +
  theme_map() +
  labs(x = NULL,
       y = NULL,
       fill = 'State',
       title = '2017 Milk Production by State')
```

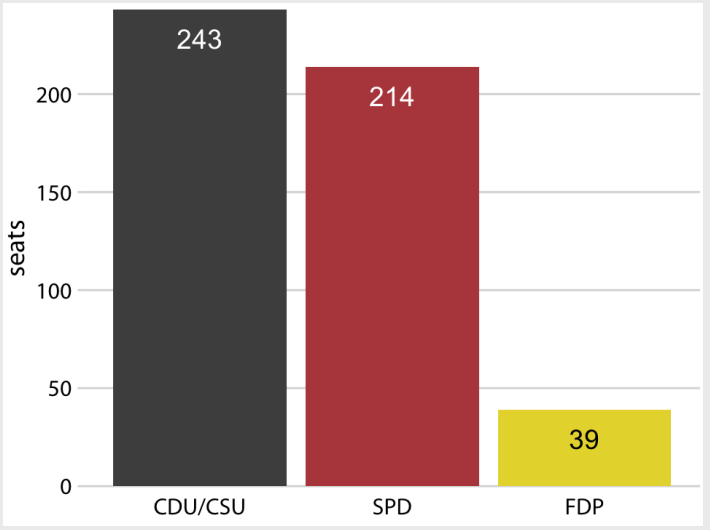
The Notorious P-I-E

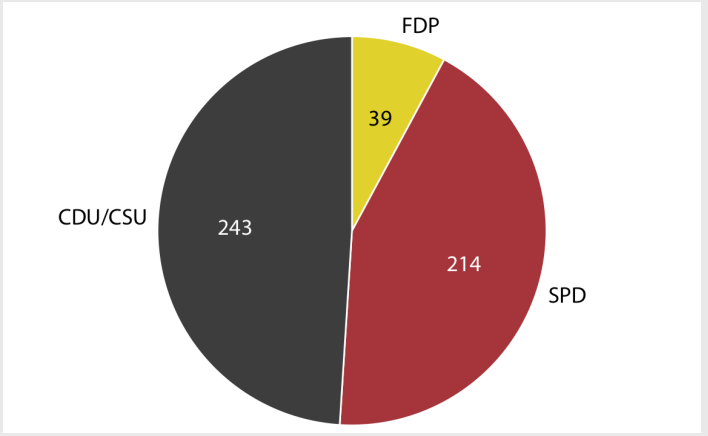
Final chart with labels & `theme_map()`



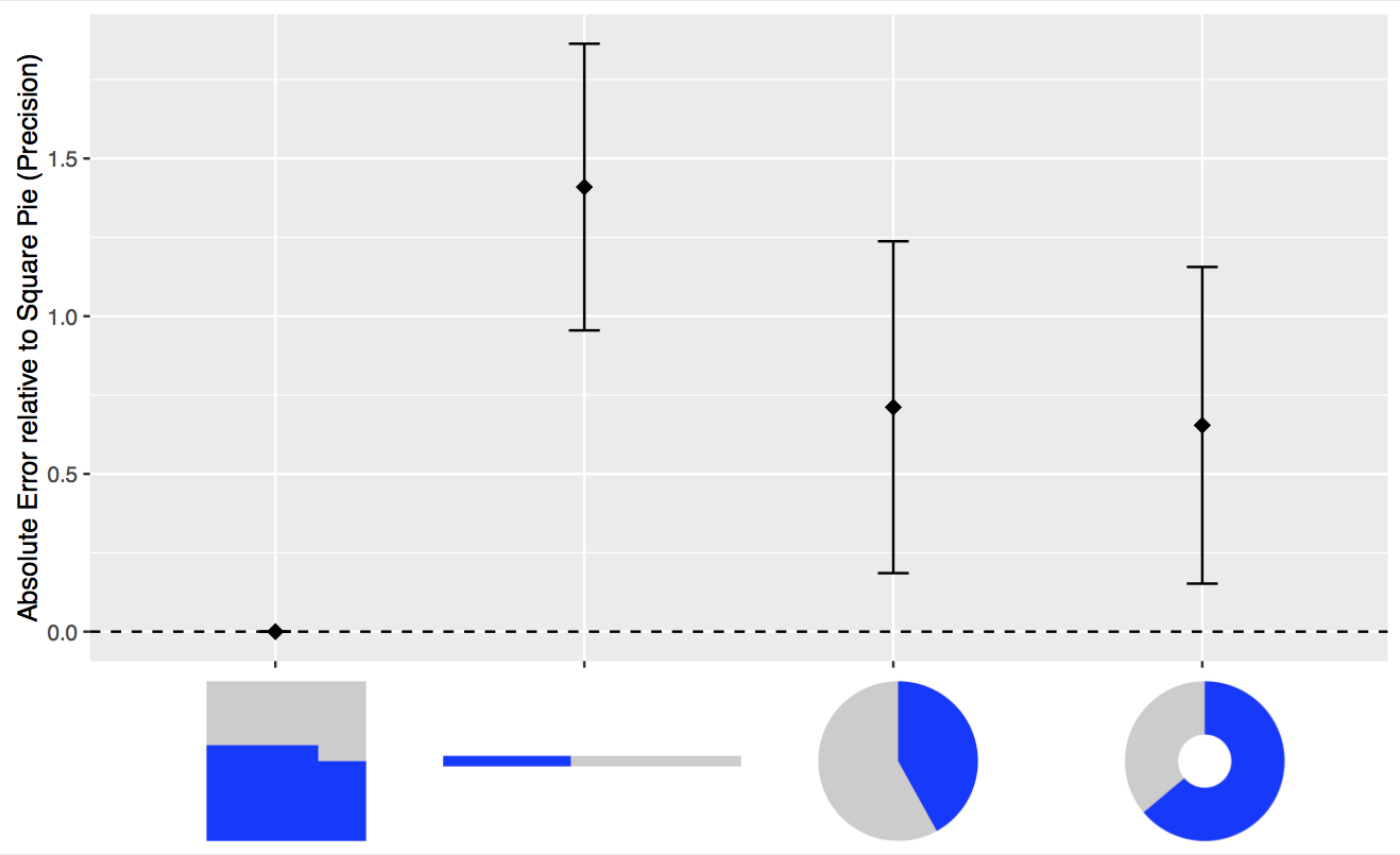
Pies are still useful if the sum of components matters







The best pies are **square pies**



https://eagereyes.org/blog/2016/a-reanalysis-of-a-study-about-square-pie-charts-from-2009

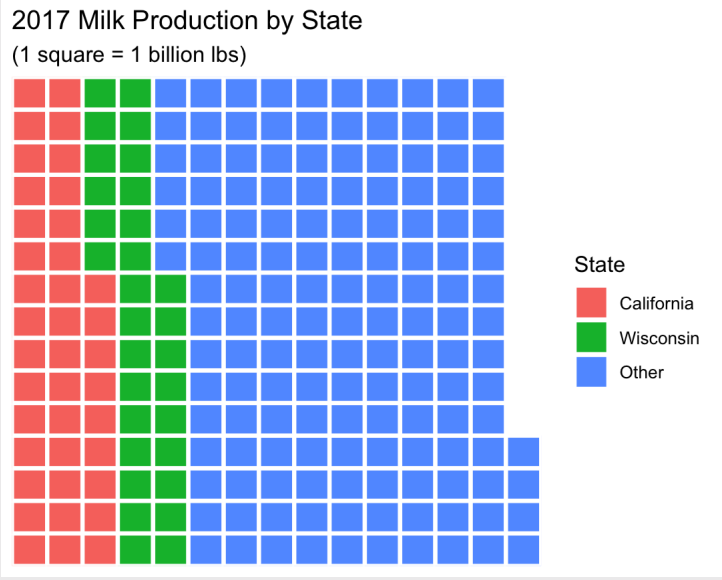
Waffle plots

```
library(waffle)

# Format the data
milk_production %>%
  filter(year == 2017) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%
  mutate(milk_produced = milk_produced / 10^9) %>%

# Make the chart
  ggplot() +
  geom_waffle(aes(fill = state,
                  values = milk_produced),
              color = "white", size = 1, n_rows = 15
  scale_x_discrete(expand = c(0, 0)) +
  scale_y_discrete(expand = c(0, 0)) +
  theme_minimal() +
  labs(fill = 'State',
       x = NULL,
       y = NULL,
       title = '2017 Milk Production by State',
       subtitle = '(1 square = 1 billion lbs)')
```

Use values between 100 - 1,000

(You don't want 1,000,000,000 boxes!)

```
#> # A tibble: 3 x 2
#>   state      milk_produced
#>   <fct>              <dbl>
#> 1 California          39.8
#> 2 Wisconsin           30.3
#> 3 Other              145.
```



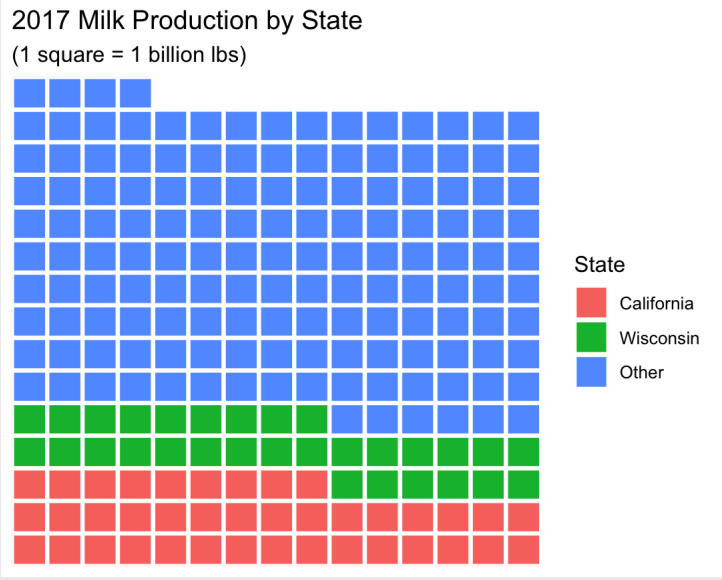
Waffle plots

```
library(waffle)

# Format the data
milk_production %>%
  filter(year == 2017) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%
  mutate(milk_produced = milk_produced / 10^9) %>%

# Make the chart
  ggplot() +
  geom_waffle(aes(fill = state,
                  values = milk_produced),
              color = "white", size = 1, n_rows = 15
              flip = TRUE) +
  scale_x_discrete(expand = c(0, 0)) +
  scale_y_discrete(expand = c(0, 0)) +
  theme_minimal() +
  labs(fill = 'State',
       x = NULL,
       y = NULL,
       title = '2017 Milk Production by State',
       subtitle = '(1 square = 1 billion lbs)')
```

Use values between 100 - 1,000

(You don't want 1,000,000,000 boxes!)

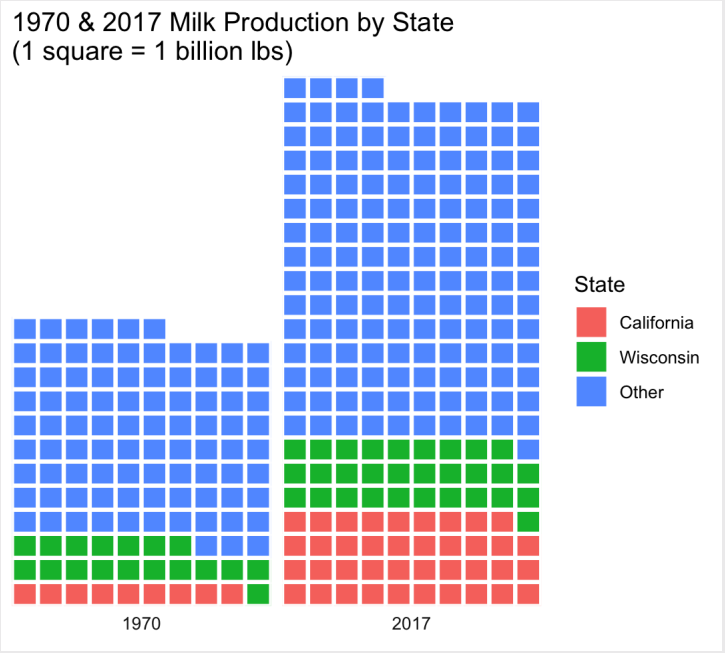
```
#> # A tibble: 3 x 2
#>   state      milk_produced
#>   <fct>              <dbl>
#> 1 California          39.8
#> 2 Wisconsin           30.3
#> 3 Other              145.
```



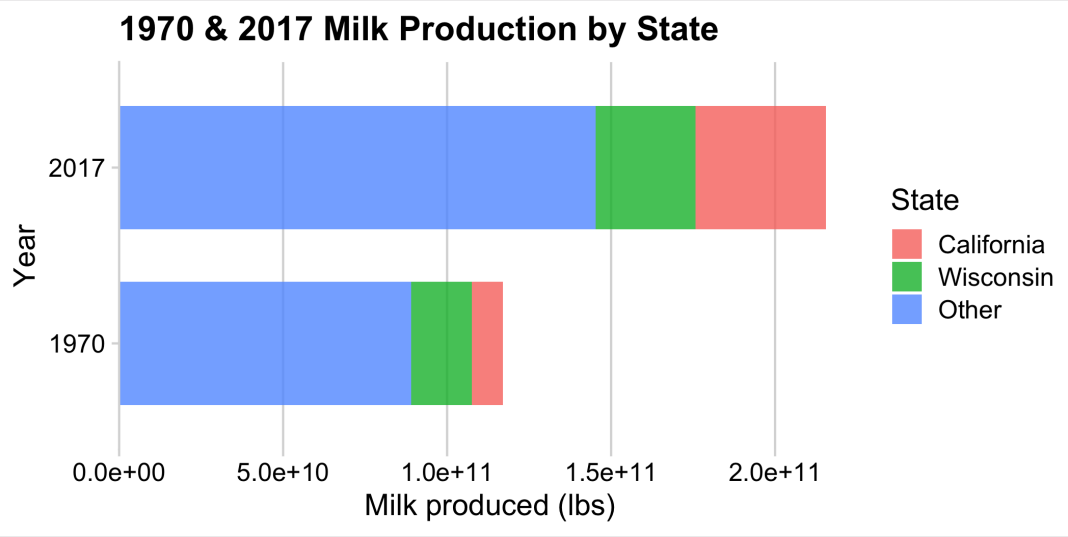
```r
library(waffle)

# Format the data
milk_production %>%
  filter(year %in% c(1970, 2017)) %>%
  mutate(state = fct_other(state,
    keep = c('California', 'Wisconsin'))) %>%
  group_by(year, state) %>%
  summarise(milk_produced = sum(milk_produced)) %>%
  mutate(milk_produced = milk_produced / 10^9) %>%

# Make the chart
  ggplot() +
  geom_waffle(aes(fill = state, values = milk_produc
              color = "white", size = 1, n_rows = 10
              flip = TRUE) +
  facet_wrap(~year, strip.position = 'bottom') +
  scale_x_discrete(expand = c(0, 0)) +
  scale_y_discrete(expand = c(0, 0)) +
  theme_minimal() +
  labels(fill = 'State',
       x = NULL,
       y = NULL,
       title = str_c('1970 & 2017 Milk Production by
                     '(1 square = 1 billion lbs)'))
```

Waffle comparison

```
#> # A tibble: 3 x 2
#>   state      milk_produced
#>   <fct>              <dbl>
#> 1 California          39.8
#> 2 Wisconsin           30.3
#> 3 Other              145.
```

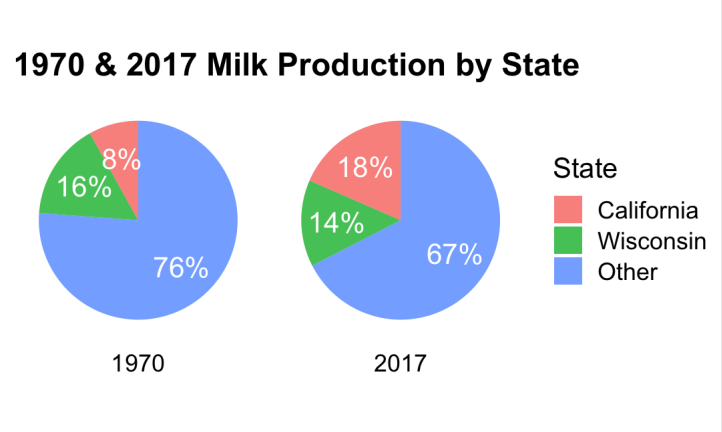


Stacked bars

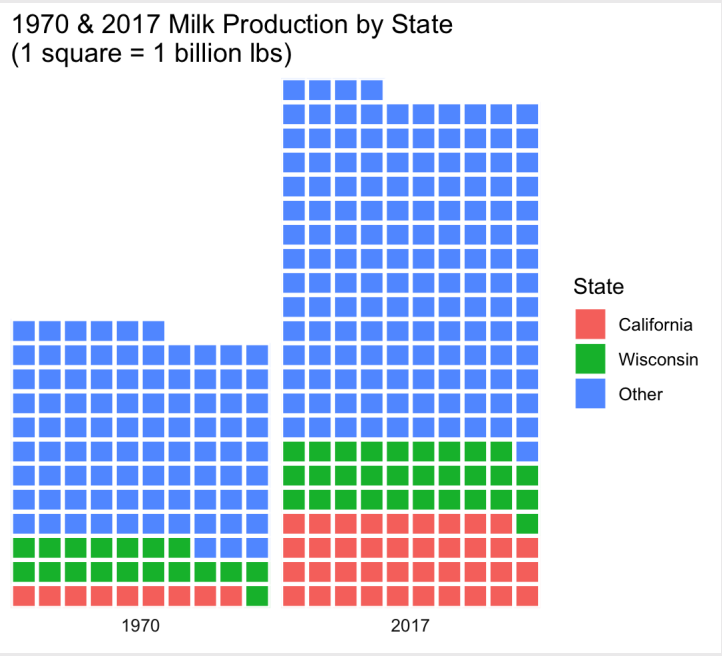


Dodged bars

Pie chart



Waffle chart



Your turn

20:00

Using the `wildlife_impacts` data, create plots that shows the proportion of incidents that occur at each different time of day.

For this exercise, you can remove `NA` values.

Try to create the following plots:

- Stacked bars
- Dodged bars
- Pie chart
- Waffle chart

To get started, you'll need to first summarize the data:

```
wildlife_summary <- wildlife_impacts %>%
  filter(!is.na(time_of_day)) %>%
  count(time_of_day)

wildlife_summary
```

```
#> # A tibble: 4 x 2
#>   time_of_day     n
#>   <chr>       <int>
#> 1 Dawn         1270
#> 2 Day         25123
#> 3 Dusk         1717
#> 4 Night       12735
```