

Week 3: *RMarkdown & Plotting*

☰ EMSE 6035: Marketing Analytics for Design Decisions

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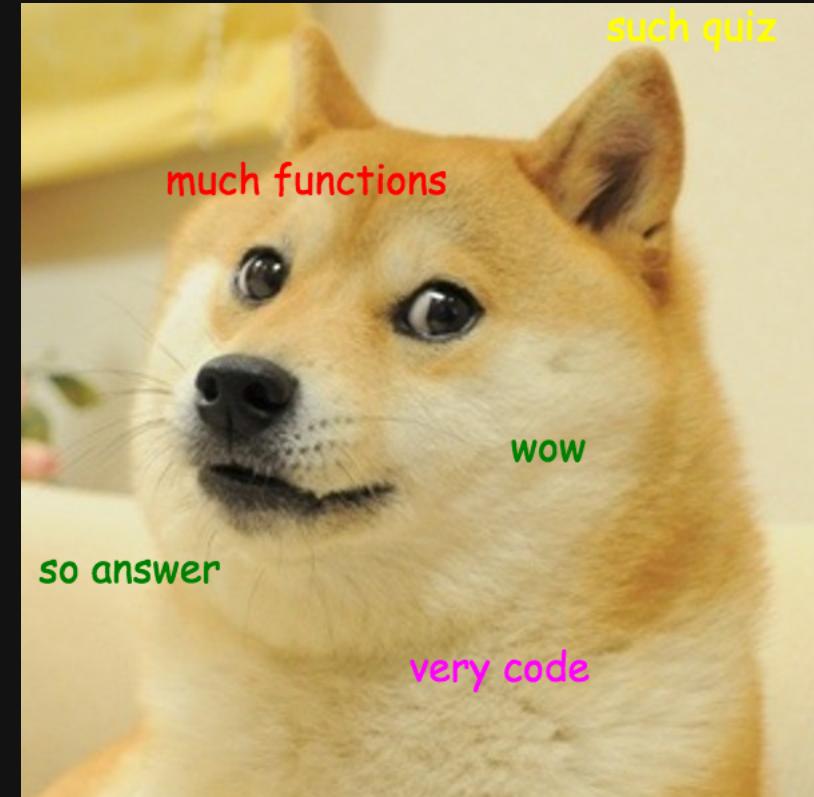
📅 September 15, 2021

Quiz 1

Link is on the [schedule](#)

Make sure to download the zip file
on the first page!

10 : 00



Week 3: RMarkdown & Plotting

1. Intro to RMarkdown
2. Intro to ggplot2
3. Project attributes & levels

BREAK

Week 3: RMarkdown & Plotting

1. Intro to RMarkdown
2. Intro to ggplot2
3. Project attributes & levels

BREAK

"Literate programming"

Treat programs as a
"literature" understandable
to **human beings**



Donald E. Knuth

Rmarkdown

TEXT. CODE. OUTPUT.
(GET IT TOGETHER, PEOPLE.)



RECIPE

1. ADD TEXT
2. ADD CODE
3. KNIT
4. (magic)
5. CELEBRATE PERCEIVED WIZARDRY



Art by Allison Horst

Anatomy of a .Rmd file

YAML (Yet Another Markdown Language)

Markdown text

R code

Quick demo

Open `rmd_demo.Rmd`, then click "knit"

Define overall document options in YAML

Basic html page

```
---
```

```
title: Your title here
author: Your name here
output: html_document
---
```

Add table of contents, change theme

```
---
```

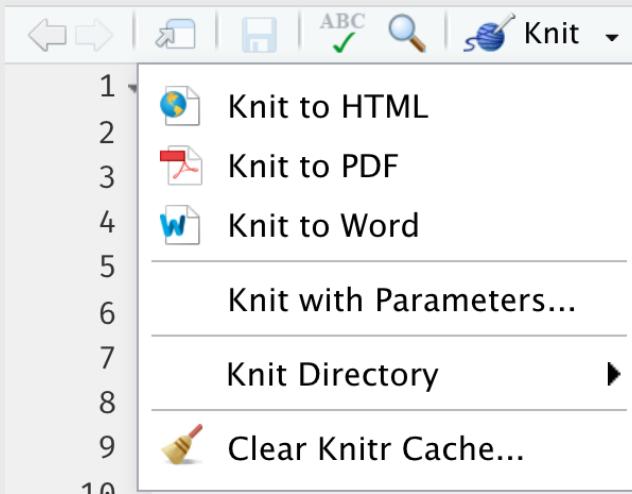
```
title: Your title here
author: Your name here
output:
  html_document:
    toc: true
    toc_float: true
    theme: flatly
---
```

Other themes at <https://bootswatch.com/>



Knit to multiple outputs

```
rmarkdown::render("rmd_demo.Rmd", output_format = "all")
```



```
---
```

```
title: Your title here
author: Your name here
output:
  html_document:
    toc: true
    toc_float: true
    theme: flatly
  word_document: default
  pdf_document: default
---
```

Anatomy of a .Rmd file

~~YAML (Yet Another Markdown Language)~~

Markdown text

R code

Right now, bookmark this! 

<https://commonmark.org/help/>

(When you have 10 minutes, do this! 

<https://commonmark.org/help/tutorial/>

Headers

```
# HEADER 1  
## HEADER 2  
### HEADER 3  
#### HEADER 4  
##### HEADER 5  
##### HEADER 6
```

HEADER 1

HEADER 2

HEADER 3

HEADER 4

HEADER 5

HEADER 6

Basic Text Formatting

Type this...

- normal text
- italic text
- *italic text*
- **bold text**
- ***bold italic text***
- ~~strikethrough~~
- `code text`

..to get this

- normal text
- *italic text*
- *italic text*
- **bold text**
- ***bold italic text***
- ~~strikethrough~~
- code text

Lists

Bullet list:

- first item
- second item
- third item

- first item
- second item
- third item

Numbered list:

1. first item
2. second item
3. third item

1. first item
2. second item
3. third item

Links

Simple **url link** to another site:

[Download R] (<http://www.r-project.org/>)

[Download R](#)

Back to [rmd_demo.Rmd](#)

Anatomy of a .Rmd file

~~YAML (Yet Another Markdown Language)~~

~~Markdown text~~

R code

R Code

Inline code

```
`r insert code here`
```

Code chunks

```
```{r}  
insert code here
insert more code here
```
```

Inline R code

```
The sum of 3 and 4 is `r 3 + 4`
```

Produces this:

The sum of 3 and 4 is 7

R Code chunks

This code chunk...

```
```{r}
bears %>%
 count(month)
```
```

...will produce this when compiled:

```
bears %>%
  count(month)
```

```
#> # A tibble: 12 × 2
#>   month     n
#>   <dbl> <int>
#> 1     1     3
#> 2     2     1
#> 3     3     1
#> 4     4     4
#> 5     5    18
#> 6     6    20
#> 7     7    27
#> 8     8    28
#> 9     9    25
#> 10    10   25
#> 11    11   12
```

Chunk options

Control what chunks output using options inside `{r}`:

Example: `{r, echo=FALSE, message=FALSE}`

| option | default | effect |
|------------|----------|---|
| eval | TRUE | Whether to evaluate the code and include its results |
| echo | TRUE | Whether to display code along with its results |
| warning | TRUE | Whether to display warnings |
| error | FALSE | Whether to display errors |
| message | TRUE | Whether to display messages |
| tidy | FALSE | Whether to reformat code in a tidy way when displaying it |
| results | "markup" | "markup", "asis", "hold", or "hide" |
| cache | FALSE | Whether to cache results for future renders |
| comment | "##" | Comment character to preface results with |
| fig.width | 7 | Width in inches for plots created in chunk |
| fig.height | 7 | Height in inches for plots created in chunk |

Chunk output options

By default, code chunks print **code + output**

```
```{r, echo=FALSE}  
cat('hello world!')
```
```

```
```{r, eval=FALSE}  
cat('hello world!')
```
```

```
```{r, include=FALSE}  
cat('hello world!')
```
```

Prints only **output**
(doesn't show code)

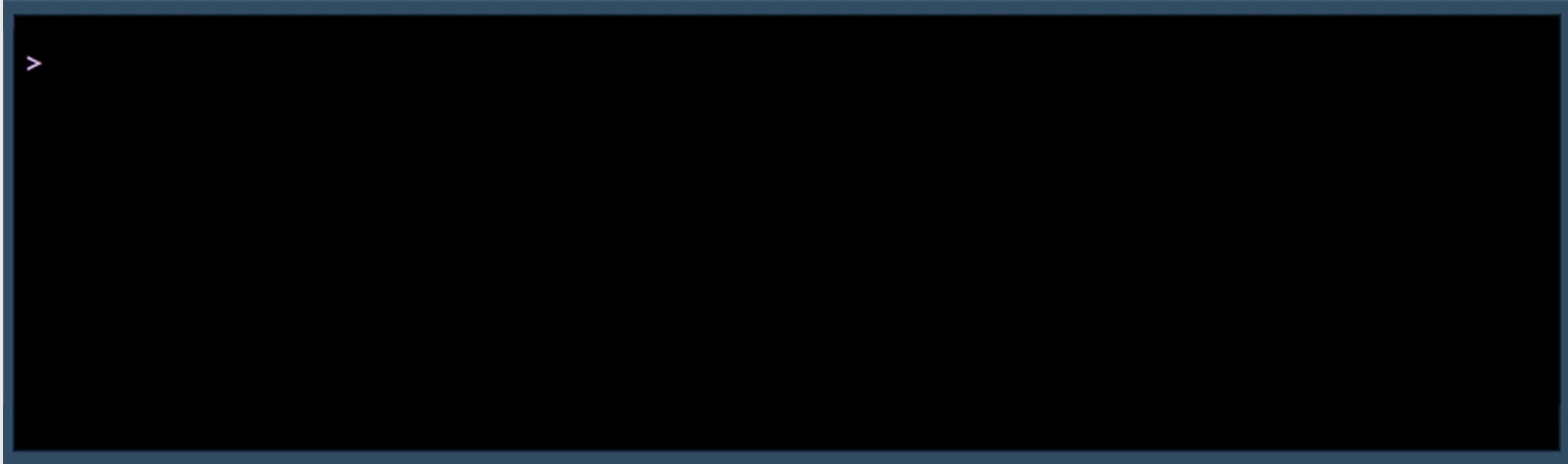
Prints only **code**
(doesn't run the code)

Runs, but doesn't print
anything

```
#> hello world!
```

```
cat('hello world!')
```

message / warning



message / warning

Drop messages and warnings in chunk settings

```
```{r, message=FALSE, warning=FALSE}
library(tidyverse)
```
```

A global setup chunk



One chunk to rule them all!

```
```{r setup, include = FALSE}
knitr::opts_chunk$set(
 warning = FALSE,
 message = FALSE,
 comment = "#>",
 fig.retina = 3,
 fig.path = "figs/"
)
```

```

- A special chunk label: `setup`
- Typically the first chunk
- All following chunks will use these options (i.e., sets global chunk options)
- **Tip:** set `include=FALSE`
- You can (and should) use individual chunk options too

15:00

Think Pair Share

- 1) Open the **bears.Rmd** file, and title it "*Bears Analysis*"
- 2) Create a "setup" code chunk to read in the **bear_killings.csv** data file
(HINT: You might want to look back at the **rmd_demo.Rmd** file!).
- 3) Use text and code to find answers each of the following questions - show your code and results to justify each answer:
 - Which months have the highest frequency of bear killings?
 - Who has been killed more often by bears: hunters or hikers?
 - How do the the number of bear attacks on men vs women compare?

HINT: Use **bears %>% count(variable)** to count how many rows are in the data for each unique value of **variable**

Week 3: RMarkdown & Plotting

1. Intro to RMarkdown
2. **Intro to ggplot2**
3. Project attributes & levels

BREAK

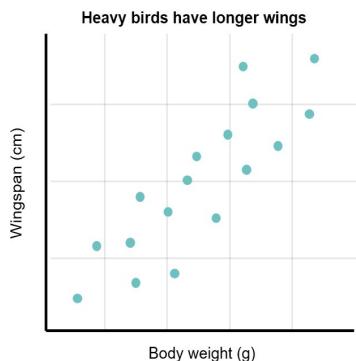
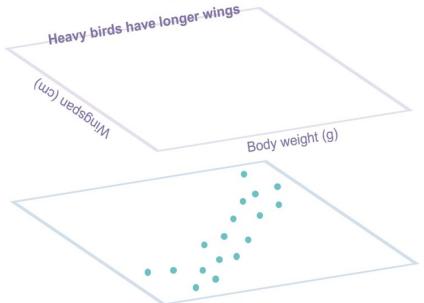
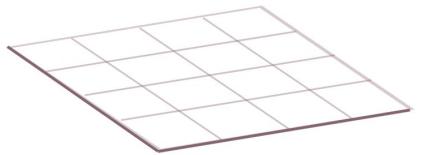
MAKING A GRAPH WITH GGPLOT2

Customise the look of your plot with themes
(pre-made or your own!):
+ theme_bw()

Add labels and titles:
+ labs(x = "Body weight (g)", y = "Wingspan (cm)",
title = "Heavy birds have longer wings")

Specify the type of graph and the variables to use:
+ geom_point(aes(x = body.weight, y = wingspan))

Plot the device containing your data:
ggplot(data = birds)



"Grammar of Graphics"

Concept developed by Leland Wilkinson
(1999)

ggplot2 package developed by Hadley
Wickham (2005)

Making plot layers with ggplot2

1. The data
2. The aesthetic mapping (what goes on the axes?)
3. The geometries (points? bars? etc.)
4. The annotations / labels
5. The theme

Layer 1: The data

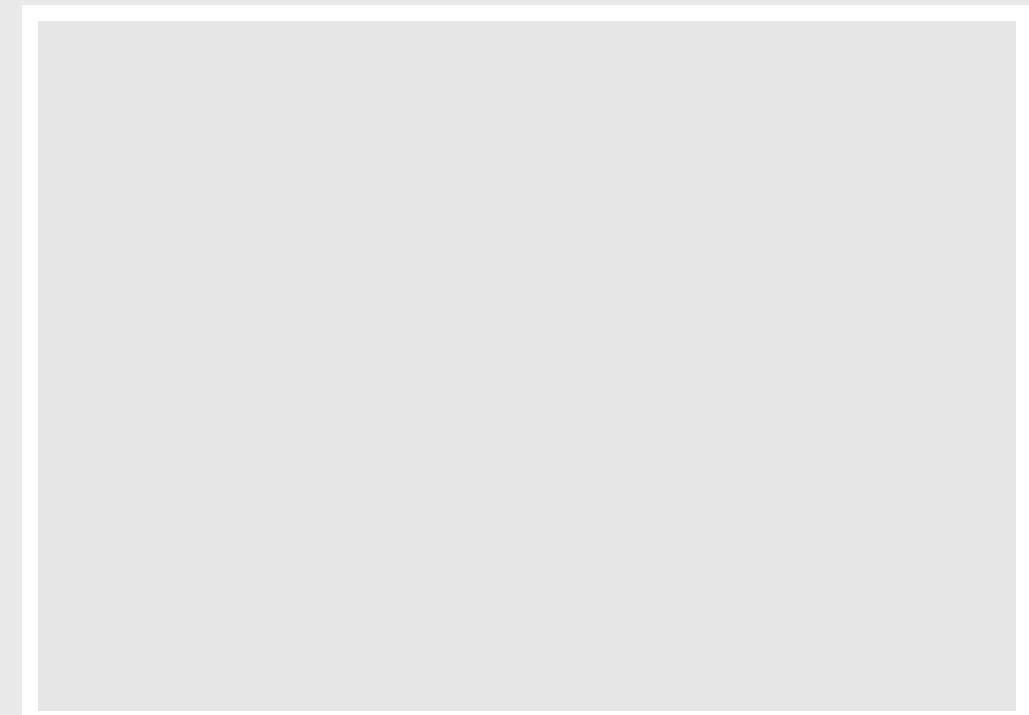
```
head(mpg)
```

```
#> # A tibble: 6 × 11
#>   manufacturer model displ year cyl trans     drv     cty     hwy fl class
#>   <chr>        <chr>  <dbl> <int> <int> <chr>    <chr> <int> <int> <chr> <chr>
#> 1 audi         a4      1.8  1999     4 auto(l5) f       18     29 p   compact
#> 2 audi         a4      1.8  1999     4 manual(m5) f      21     29 p   compact
#> 3 audi         a4      2.0  2008     4 manual(m6) f      20     31 p   compact
#> 4 audi         a4      2.0  2008     4 auto(av)  f      21     30 p   compact
#> 5 audi         a4      2.8  1999     6 auto(l5)  f      16     26 p   compact
#> 6 audi         a4      2.8  1999     6 manual(m5) f      18     26 p   compact
```

Layer 1: The data

The `ggplot()` function initializes the plot with whatever data you're using

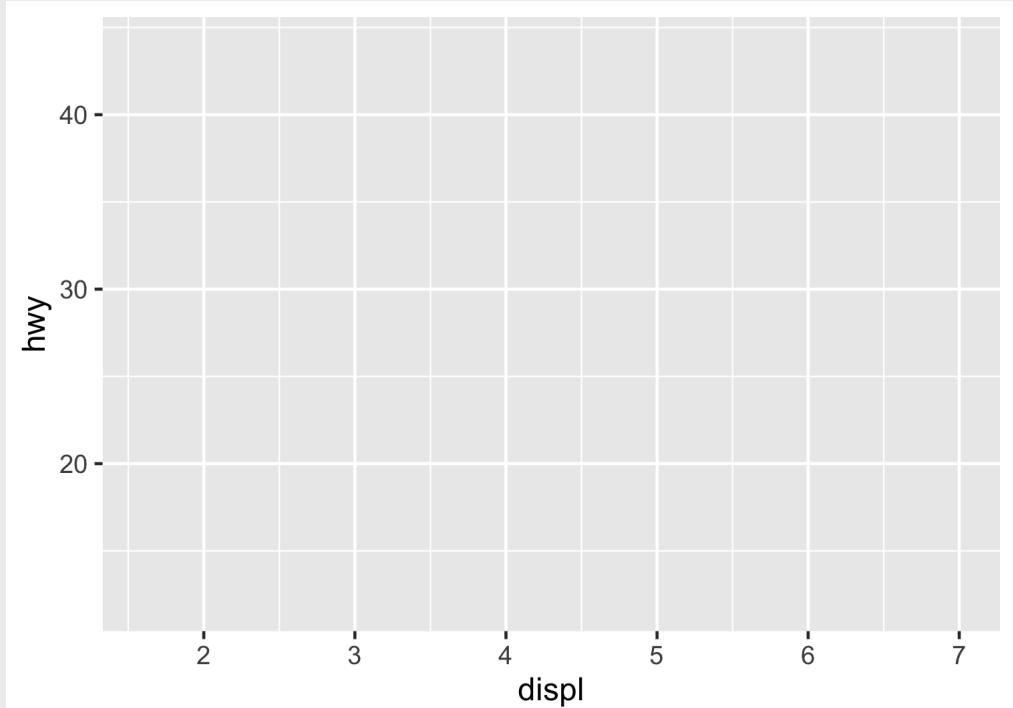
```
mpg %>%  
  ggplot()
```



Layer 2: The aesthetic mapping

The `aes()` function determines which variables will be *mapped* to the geometries (e.g. the axes)

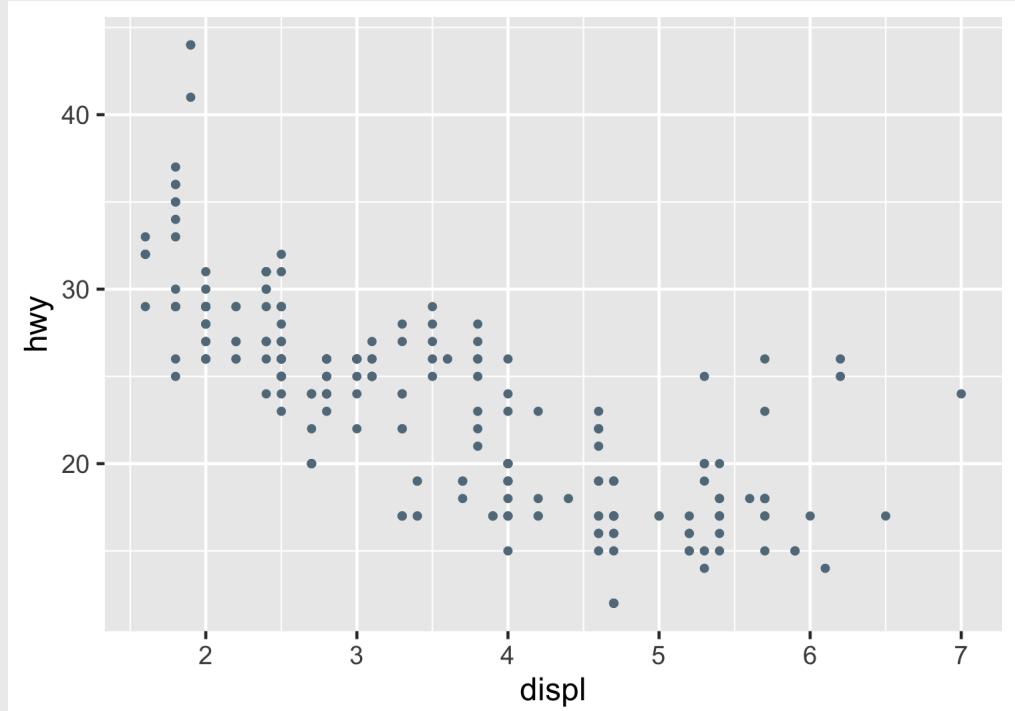
```
mpg %>%
  ggplot(aes(x = displ, y = hwy))
```



Layer 3: The geometries

Use `+` to add geometries, e.g. `geom_points()` for points

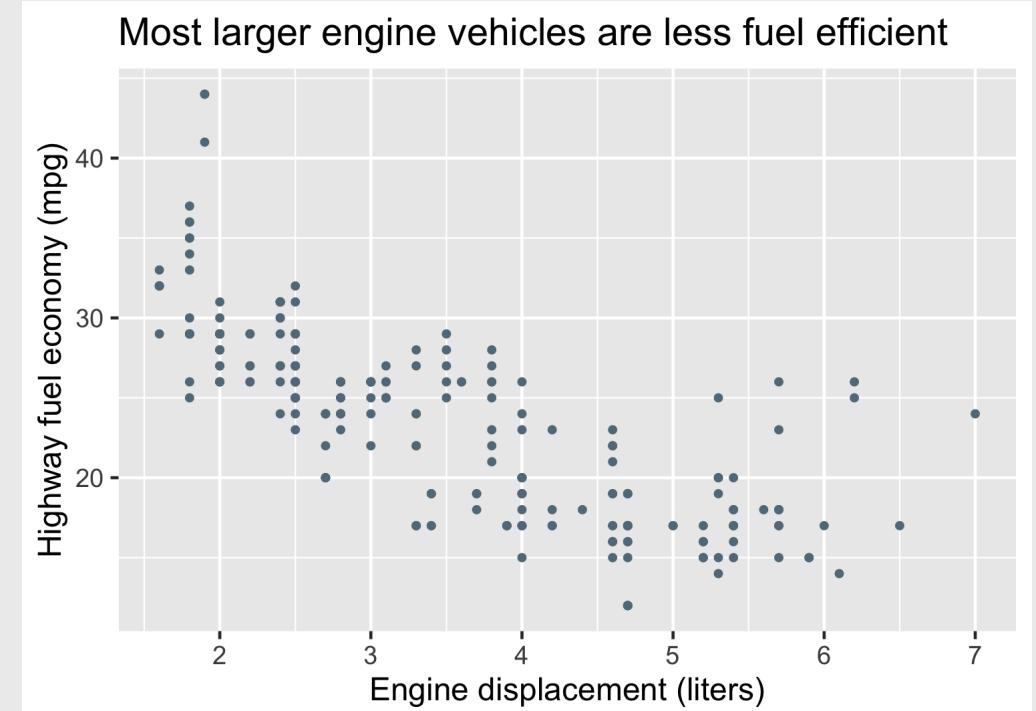
```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point()
```



Layer 4: The annotations / labels

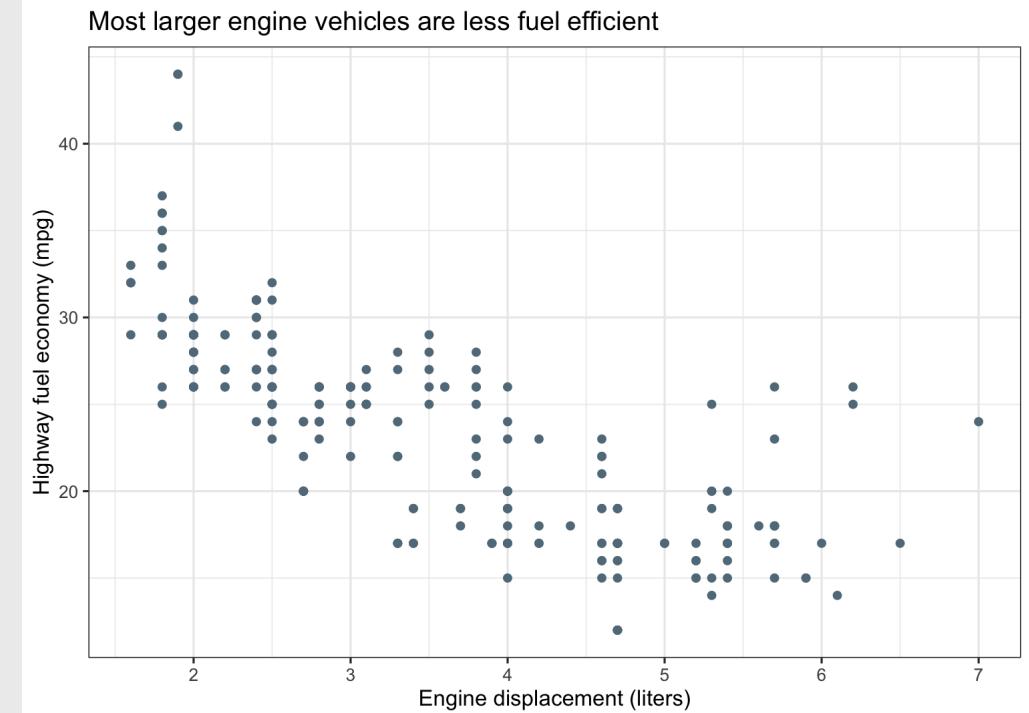
Use `labs()` to modify most labels

```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  labs(
    x = "Engine displacement (liters)",
    y = "Highway fuel economy (mpg)",
    title = "Most larger engine vehicles  
are less fuel efficient"
  )
```



Layer 5: The theme

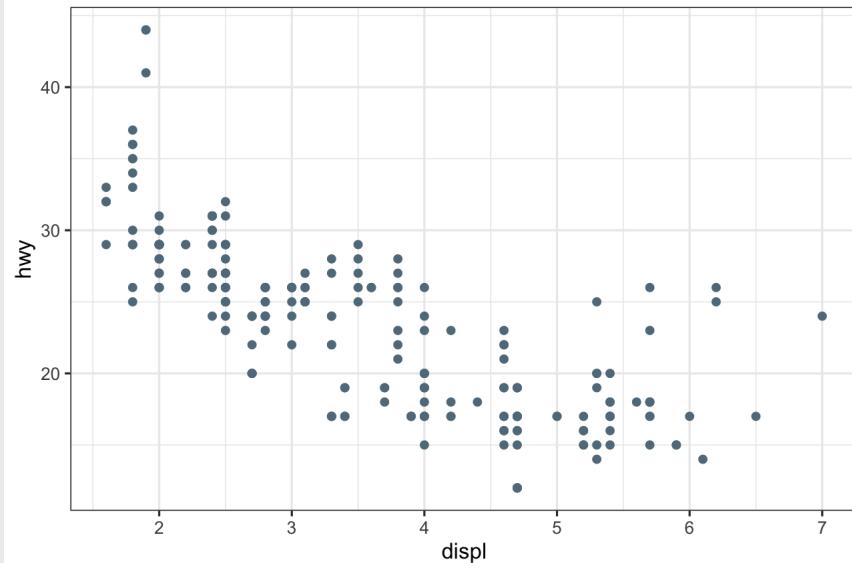
```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  labs(
    x = "Engine displacement (liters)",
    y = "Highway fuel economy (mpg)",
    title = "Most larger engine vehicles
are less fuel efficient"
  ) +
  theme_bw()
```



Common themes

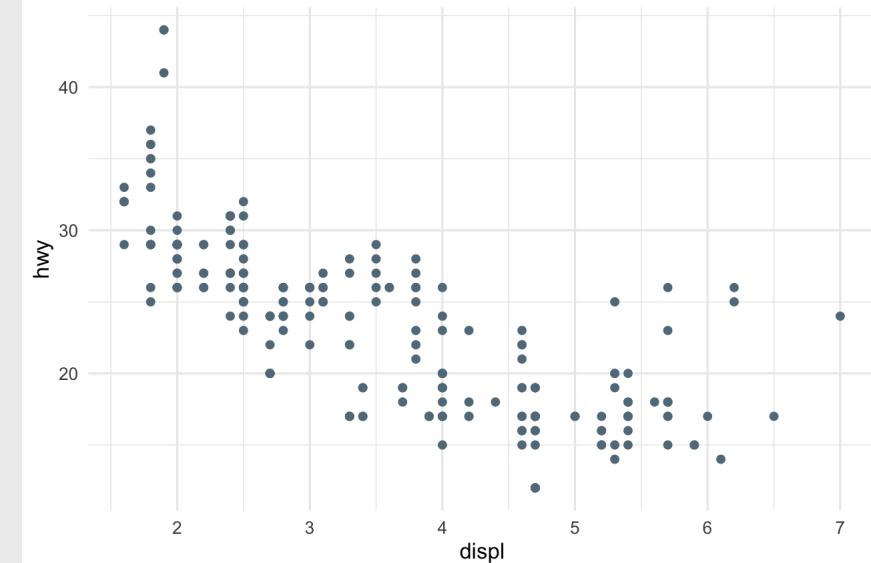
`theme_bw()`

```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  theme_bw()
```



`theme_minimal()`

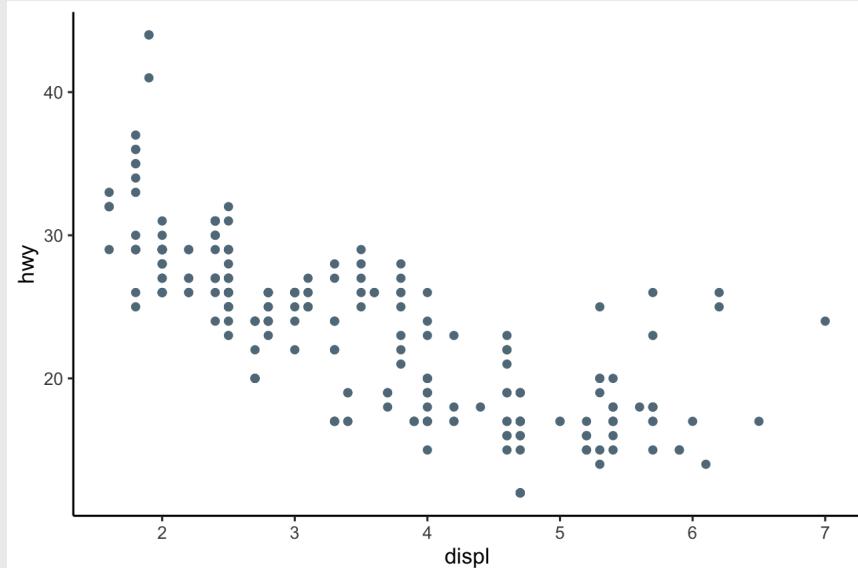
```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  theme_minimal()
```



Common themes

`theme_classic()`

```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  theme_classic()
```



`theme_void()`

```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  theme_void()
```

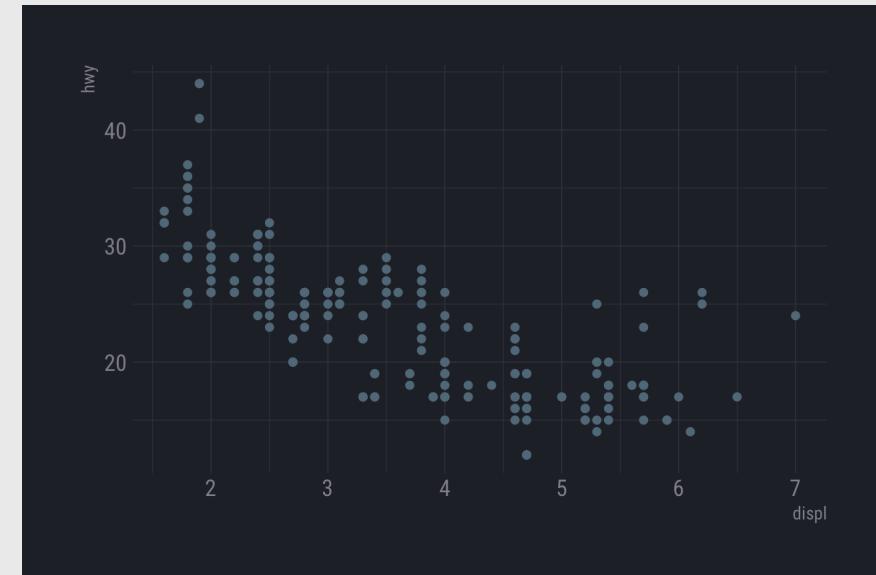
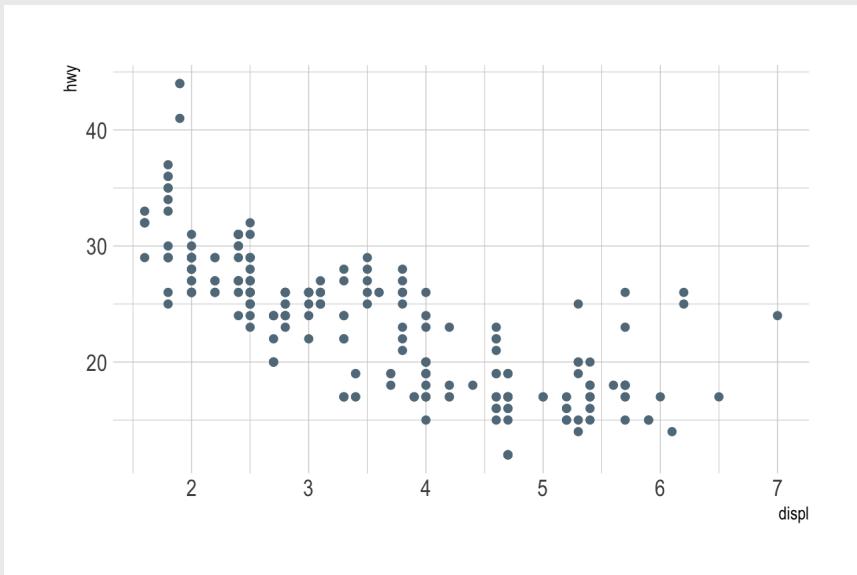


Other themes: hrbrthemes

```
remotes::install_github("hrbrmstr/hrbrthemes")
```

```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  hrbrthemes::theme_ipsum()
```

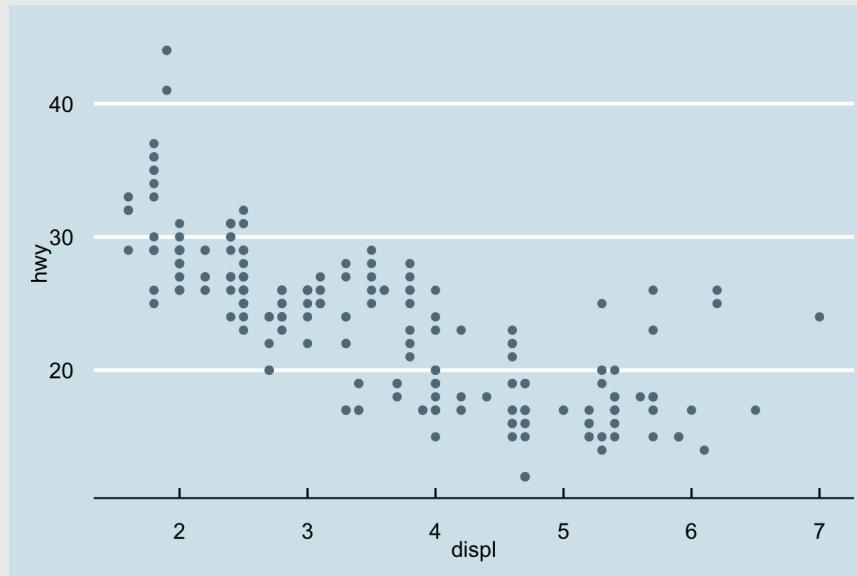
```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  hrbrthemes::theme_ft_rc()
```



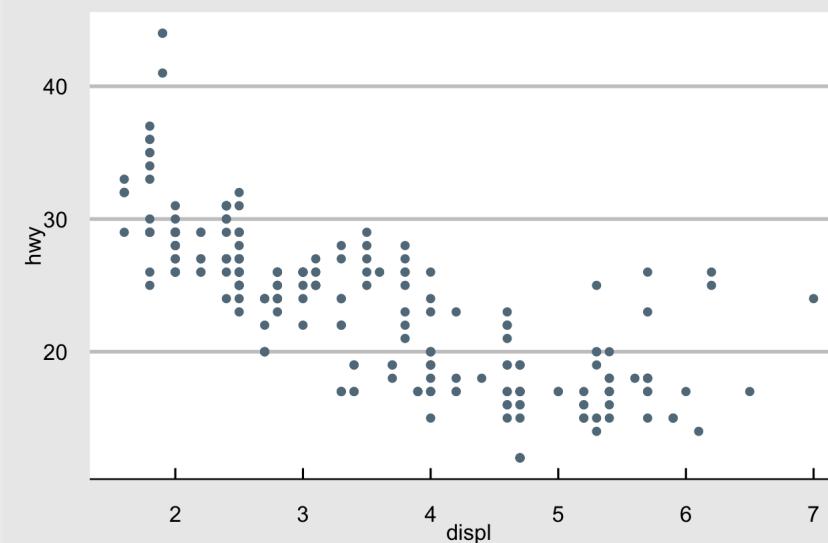
Other themes: [ggthemes](#)

```
install.packages('ggthemes', dependencies = TRUE)
```

```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  ggthemes::theme_economist()
```



```
mpg %>%
  ggplot(aes(x = displ, y = hwy)) +
  geom_point() +
  ggthemes::theme_economist_white()
```

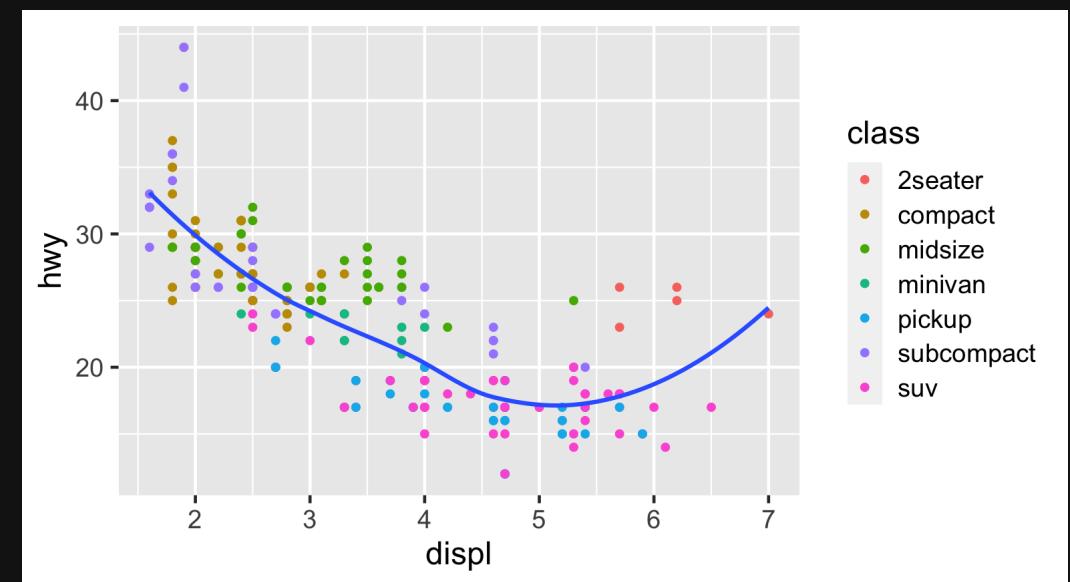
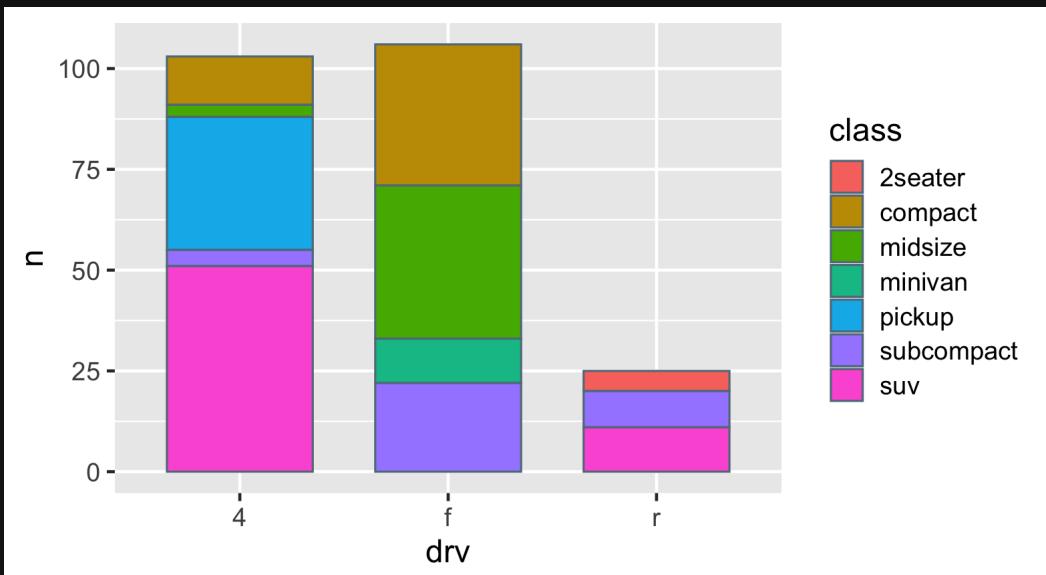
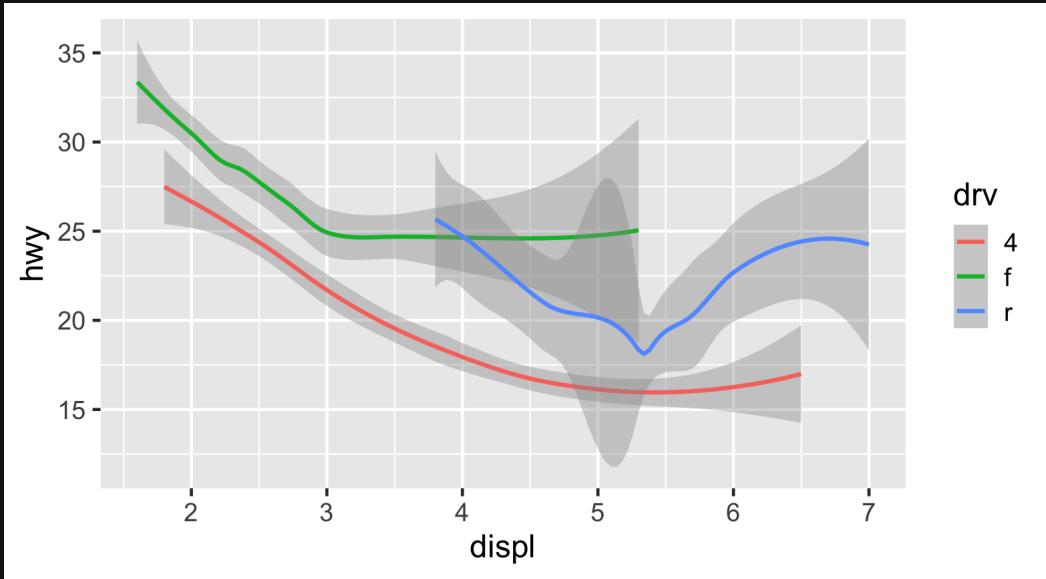


More practice

Open `ggplot2.Rmd`

15:00

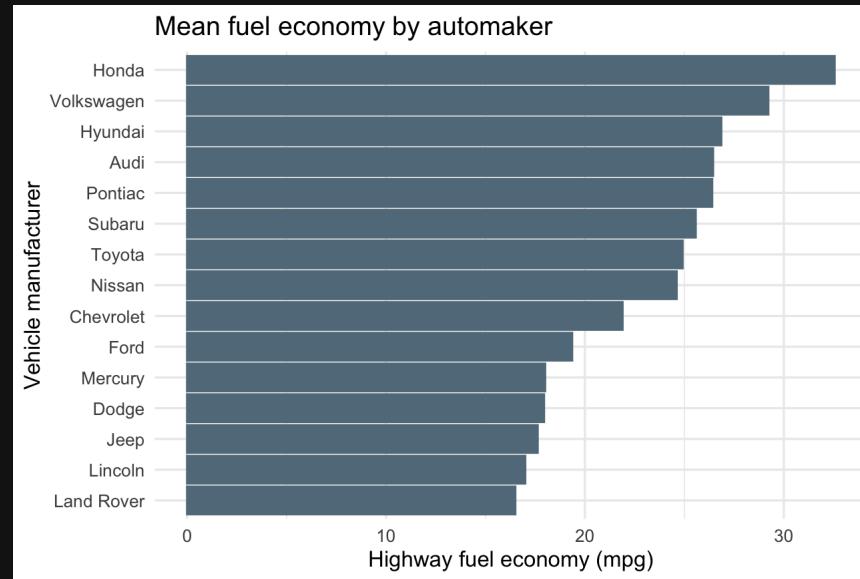
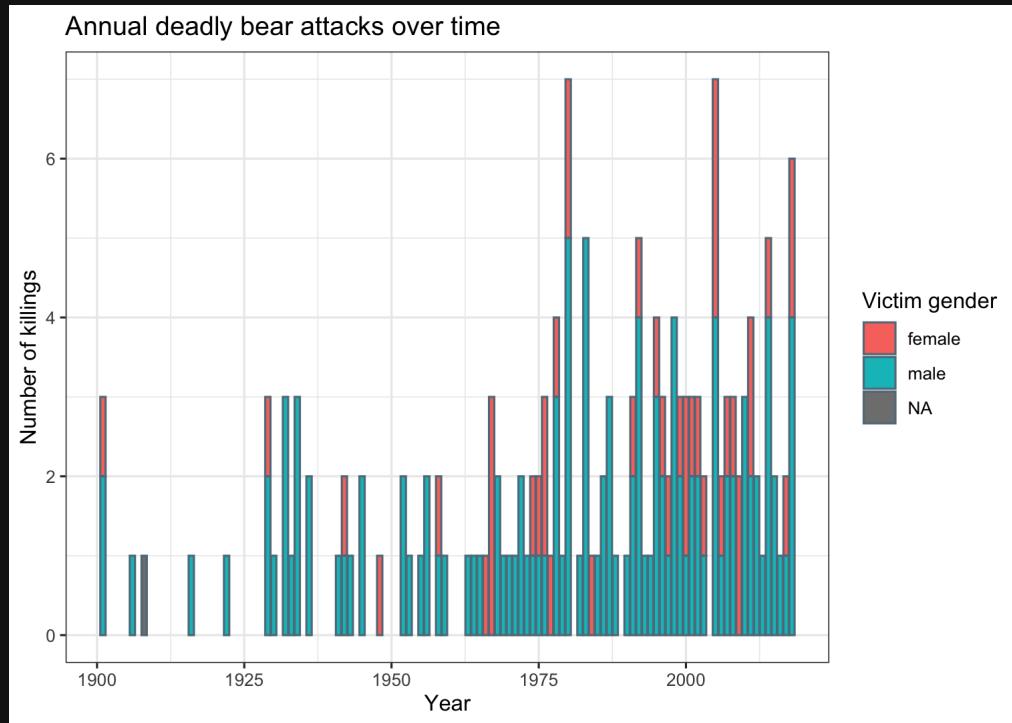
Think Pair Share



Break

05 : 00

Extra practice



Week 3: RMarkdown & Plotting

1. Intro to RMarkdown
2. Intro to ggplot2
3. Project attributes & levels

BREAK

Model Relationships Table (example)

| | Decision Variables | | | Demand | Competitors | | | |
|--------------------|--------------------|------------------|----------------|-------------|------------------|----------------------|-----------------|----------|
| | Power Density | Degradation Rate | Packing Design | | Aims Solar Panel | SUAOKI Solar Charger | Units | |
| Product Attributes | Price | - | - | + | - | 225 | 160 | USD |
| | Weight | - | - | + | - | 2.6 | 2.06 | kg |
| | Power Output | + | + | + | + | 120 | 60 | W |
| | Durability | - | + | - | + | 60 | 12 | Months |
| | Portability | - | -/+ | + | + | 20.6"x11"x 1.2" | 11.5"x7.1"x2.9" | L"xW"xH" |
| Domain | | [2.5, 60] | [24,1000] | [200, 2800] | | | | |
| Units | | W/kg | Hours | cm^3 | | | | |

Start defining attribute *levels*

Defining attribute levels

Continuous

- **Price:** 1, 2, 3, 4, 5 (\$)
- **Power Output:** 60, 80, 120 (Watts)

- Look at competitors
- Search web for values that cover the full set of values available today (and maybe some into the future)

Discrete

- **Color:** Red, Blue, Yellow
- **Material:** Plastic, Aluminum, Glass