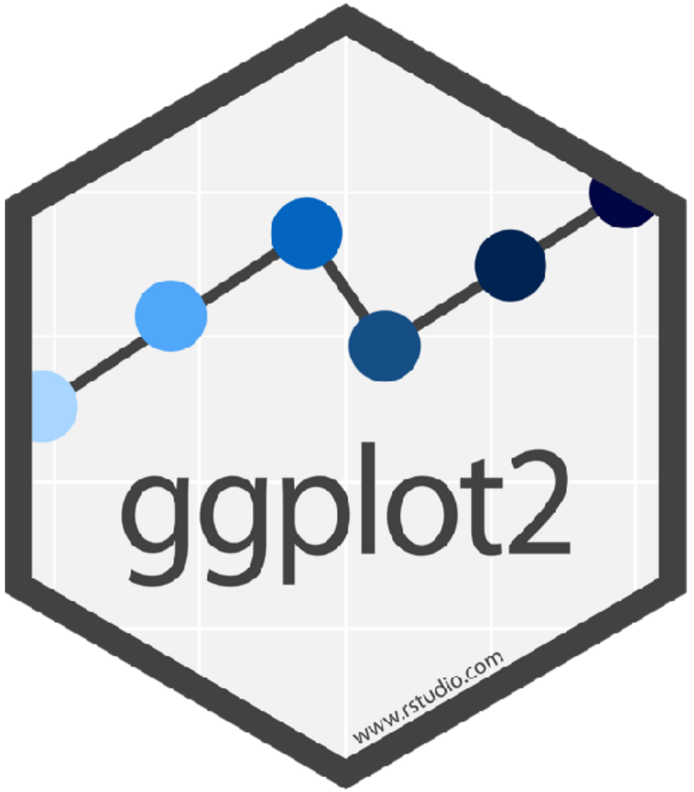
Visualize Data with



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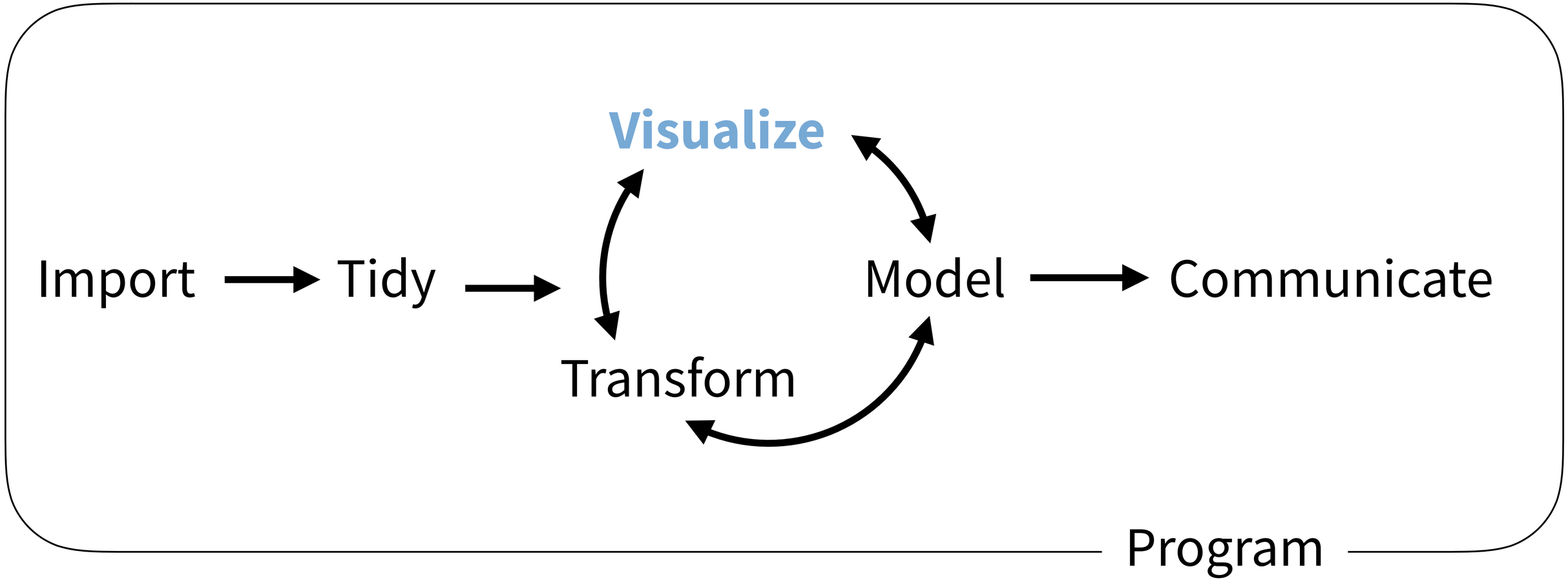
(Applied) **Data Science**



"The simple graph has brought more information to the data analyst’s mind than any other device. "

- John Tukey

mpg

Fuel economy data for 38 models of car.

```
mpg
```

manufacturer <chr>	displ <dbl>	year <int>	cyl <int>	trans <chr>	drv <chr>	cty <int>	h... <int>	fl <chr>	class <chr>
audi	1.8	1999	4	auto(l5)	f	18	29	p	compact
audi	1.8	1999	4	manual(m5)	f	21	29	p	compact
audi	2.0	2008	4	manual(m6)	f	20	31	p	compact
audi	2.0	2008	4	auto(av)	f	21	30	p	compact
audi	2.8	1999	6	auto(l5)	f	16	26	p	compact
audi	2.8	1999	6	manual(m5)	f	18	26	p	compact
audi	3.1	2008	6	auto(av)	f	18	27	p	compact

Quiz

Confer with your group.

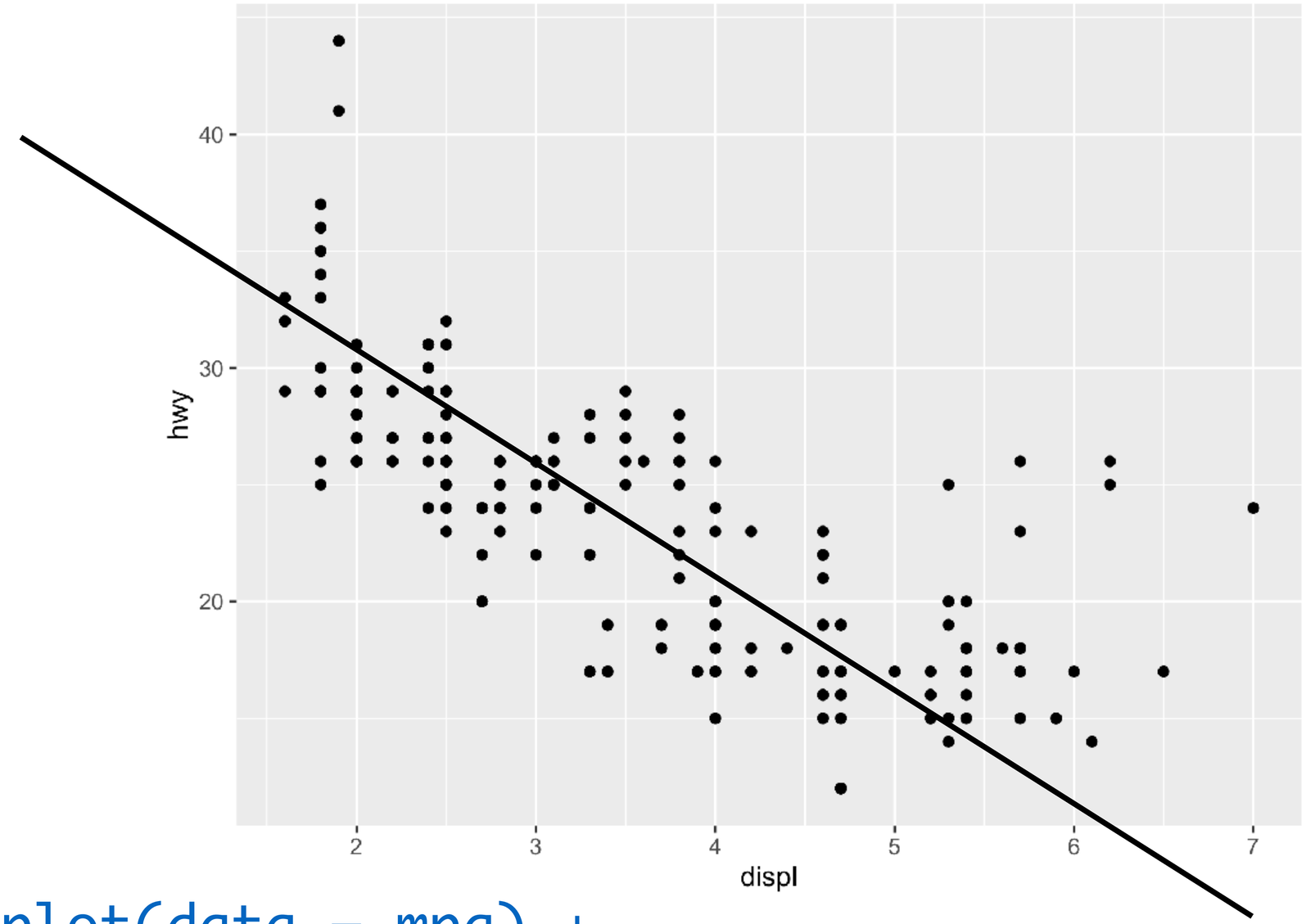
What relationship do you expect to see between engine size (displ) and mileage (hwy)?

No peeking ahead!

Your Turn 1

Run this code in **02-Visualize-Exercises.Rmd** to make a graph. Pay strict attention to spelling, capitalization, and parentheses!

```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy))
```




```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy))
```

1. "Initialize" a plot with ggplot()
2. Add layers with geom_ functions

```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy))
```

Pro tip: Always put the + at the end of a line, Never at the start

```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy))
```

data

+ before new line

```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy))
```

type of layer

aes()

x variable

y variable

A template

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>))
```

```
  geom_point(mapping = aes(x = displ, y = hwy))
```

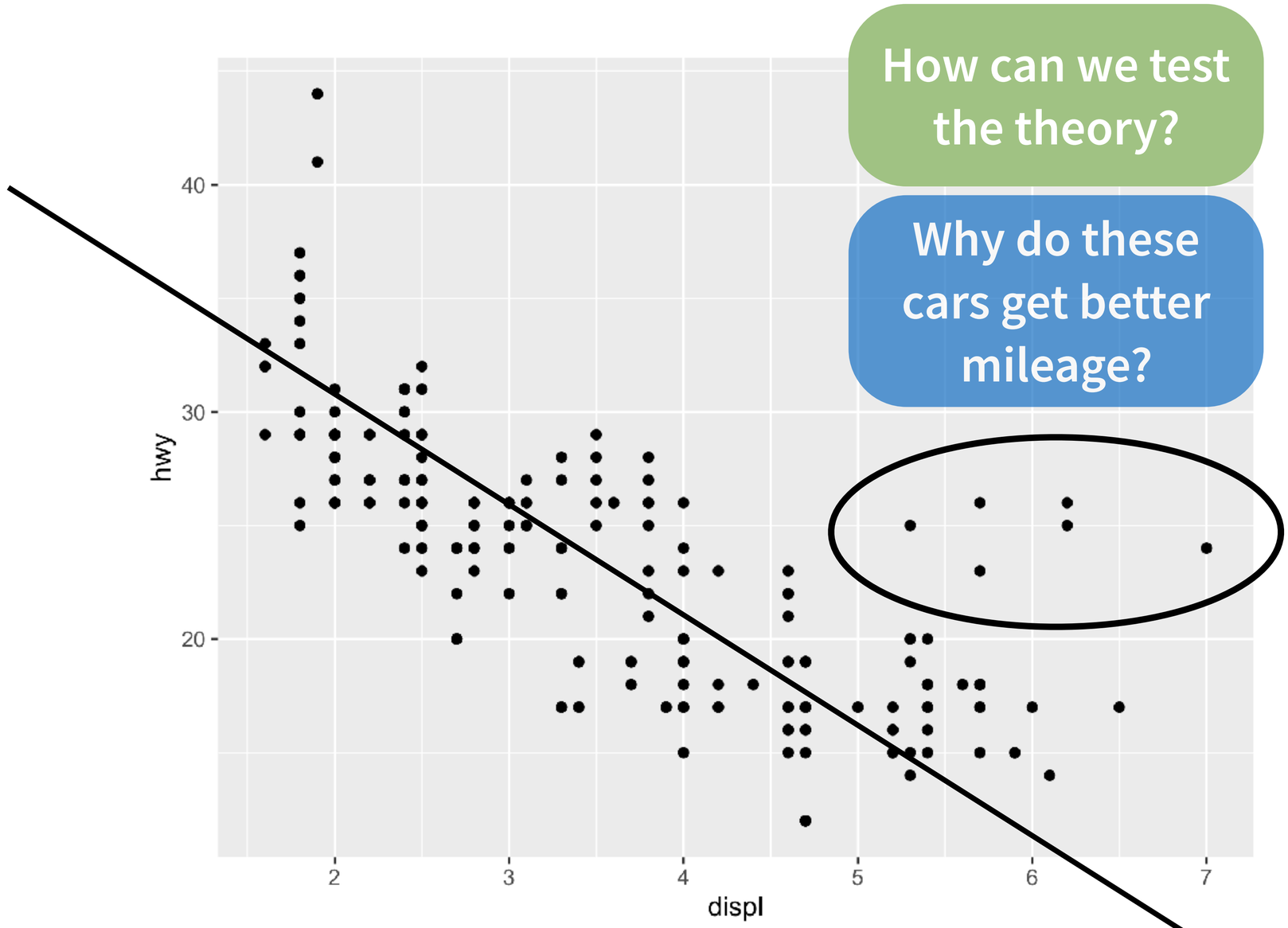
A template

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>))
```

Mappings

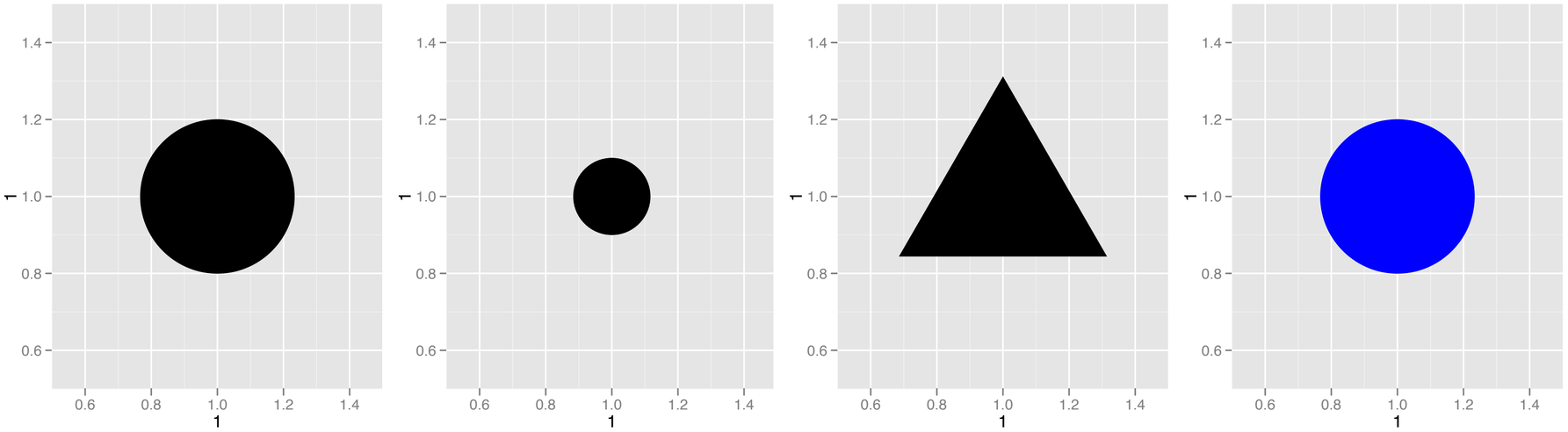
"The greatest value of a picture is when it forces us to notice what we never expected to see."

- John Tukey




```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy))
```

Aesthetics



Aesthetics

aesthetic property

Variable to map it to

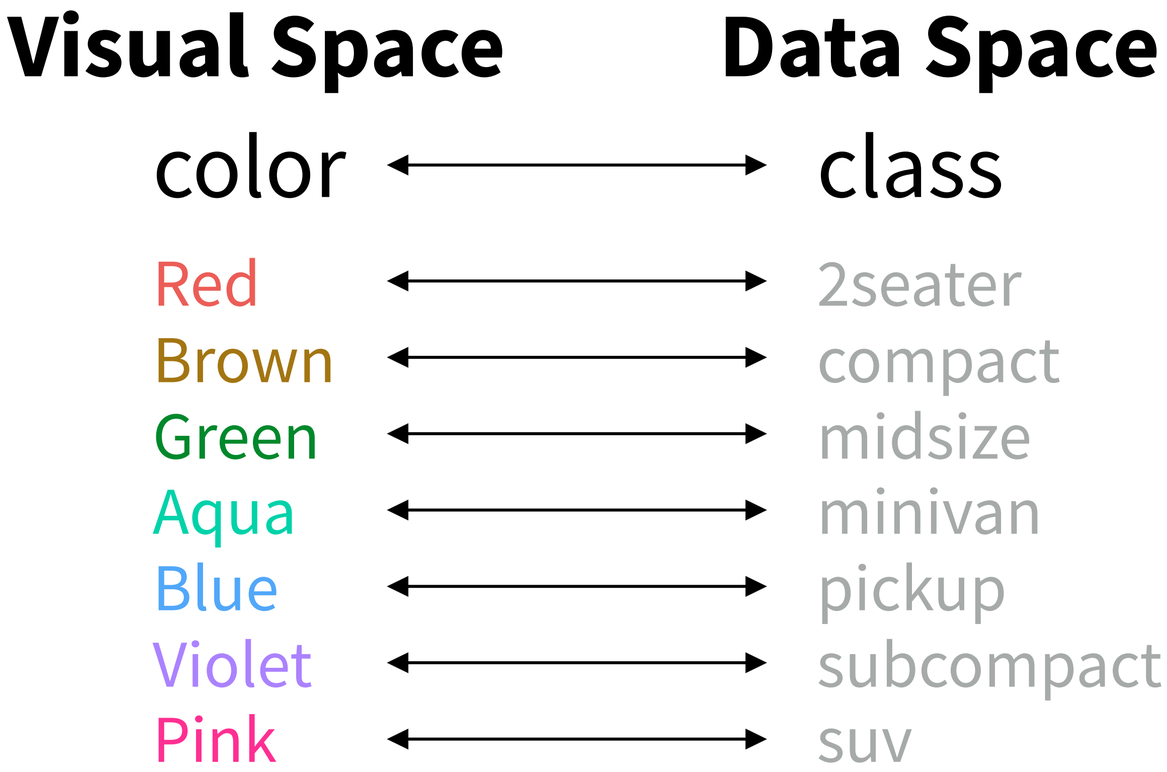
```
ggplot(mpg) + geom_point(aes(x = displ, y = hwy, color = class))
ggplot(mpg) + geom_point(aes(x = displ, y = hwy, size = class))
ggplot(mpg) + geom_point(aes(x = displ, y = hwy, shape = class))
ggplot(mpg) + geom_point(aes(x = displ, y = hwy, alpha = class))
```

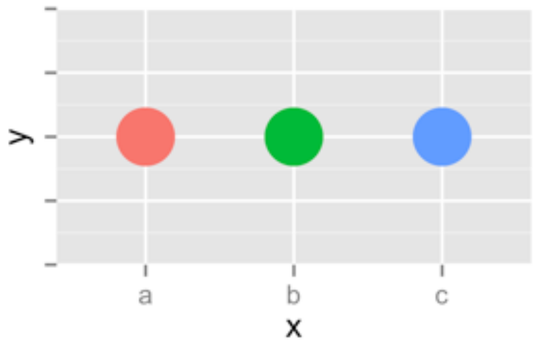
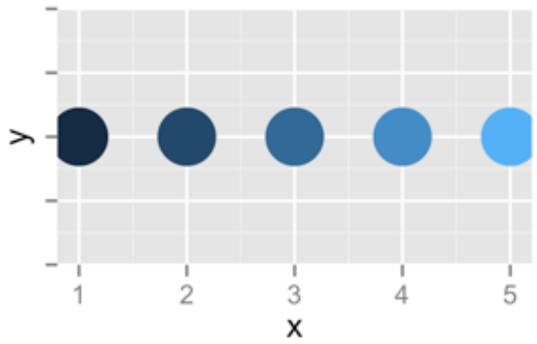
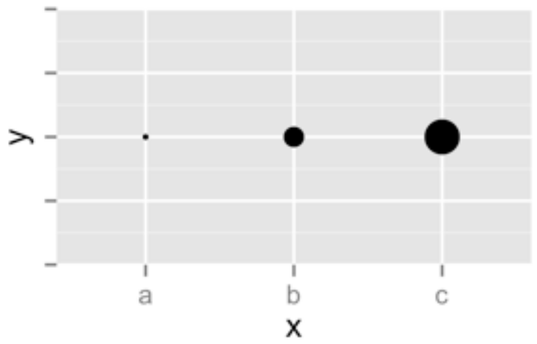
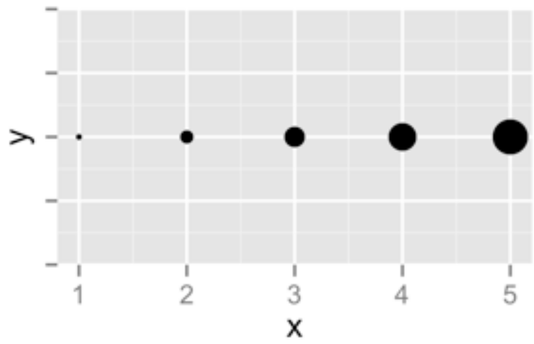
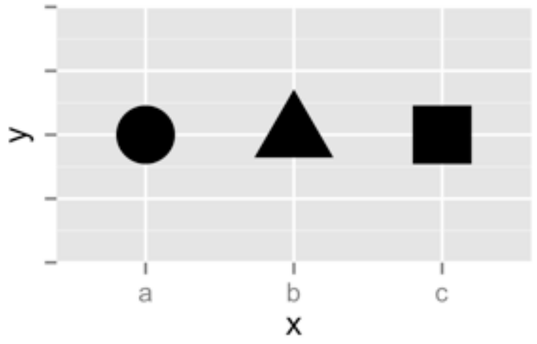
Your Turn 2

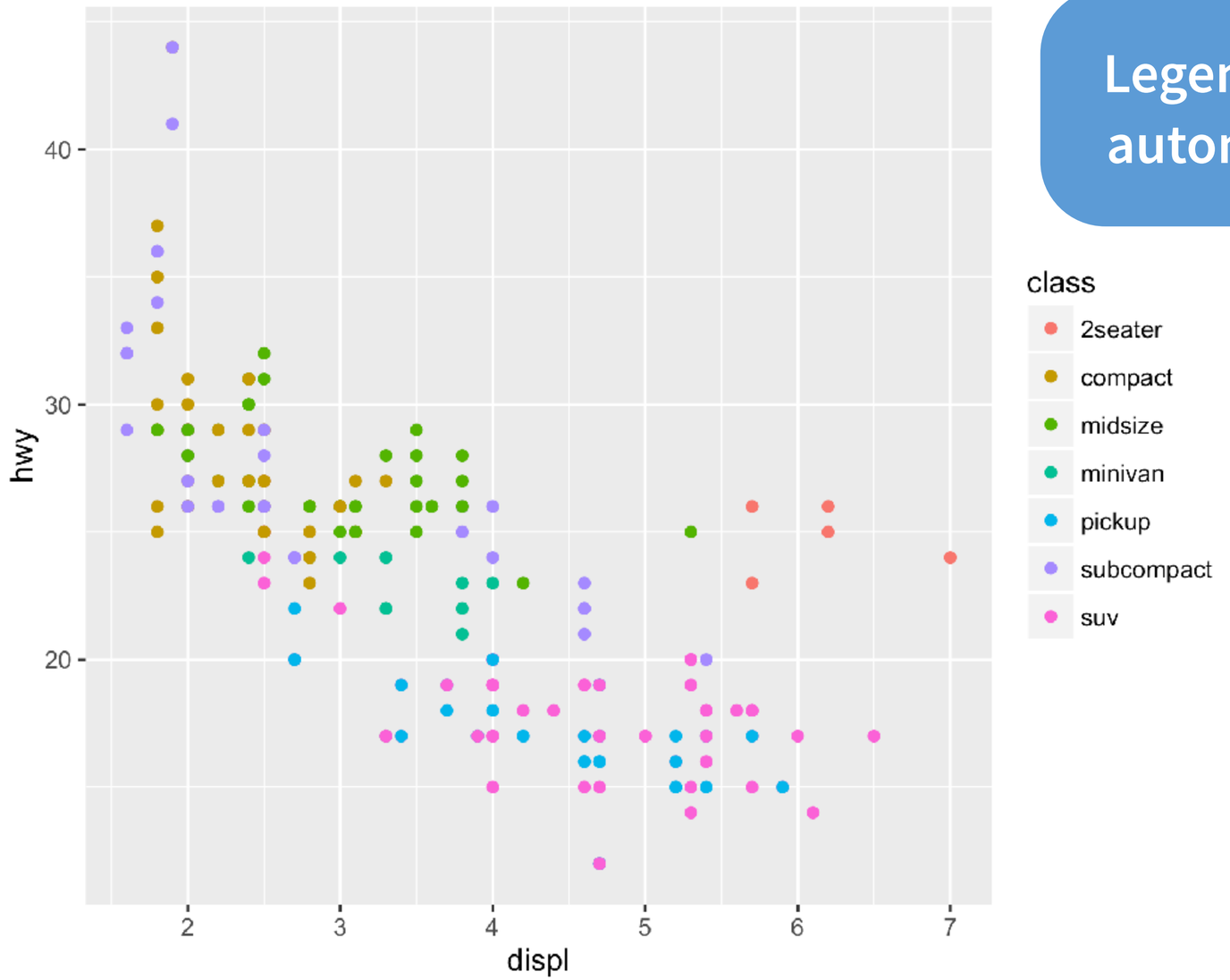
In the next chunk, add color, size, alpha, and shape aesthetics to your graph. Experiment.

Do different things happen when you map aesthetics to discrete and continuous variables?

What happens when you use more than one aesthetic?


Visual Space
Data Space
color
class
Red
2seater
Brown
compact
Green
midsize
Aqua
minivan
Blue
pickup
Violet
subcompact
Pink
suv

	Discrete	Continuous
Color		
Size		
Shape		



Legend added automatically

```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy, color = class))
```

ERROR!

```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy), color = class)
```

Facets

Facets

Subplots that display subsets of the data.

CC by RStudio

Help me

What do **facet_grid** and **facet_wrap** do?

```
q <- ggplot(mpg) + geom_point(aes(x = displ, y = hwy))
q + facet_grid(. ~ cyl)
q + facet_grid(drv ~ .)
q + facet_grid(drv ~ cyl)
q + facet_wrap(~ class)
```

CC by RStudio

summary

facet_grid() - 2D grid, rows ~ cols, . for no split
facet_wrap() - 1D ribbon wrapped into 2D

CC by RStudio

A ggplot2 template

Make any plot by filling in the parameters of this template

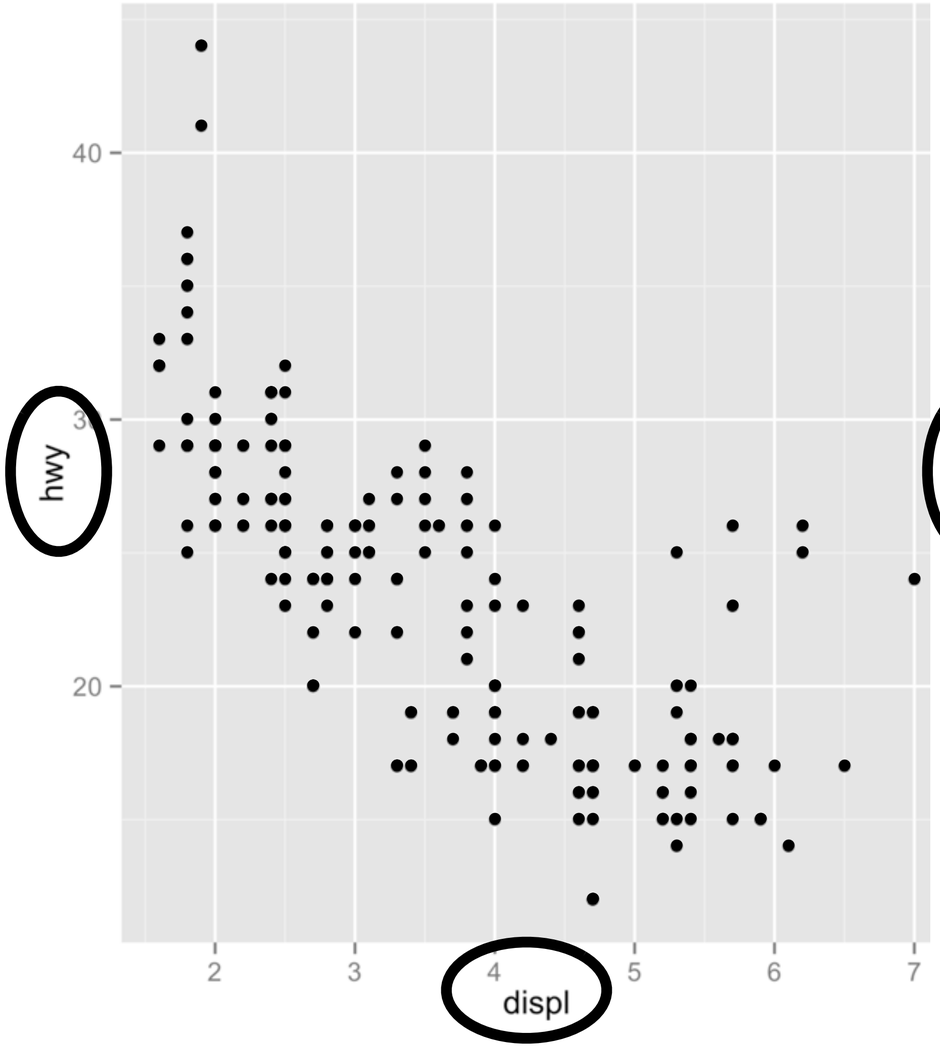
```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>)) +
  <FACET_FUNCTION>
```

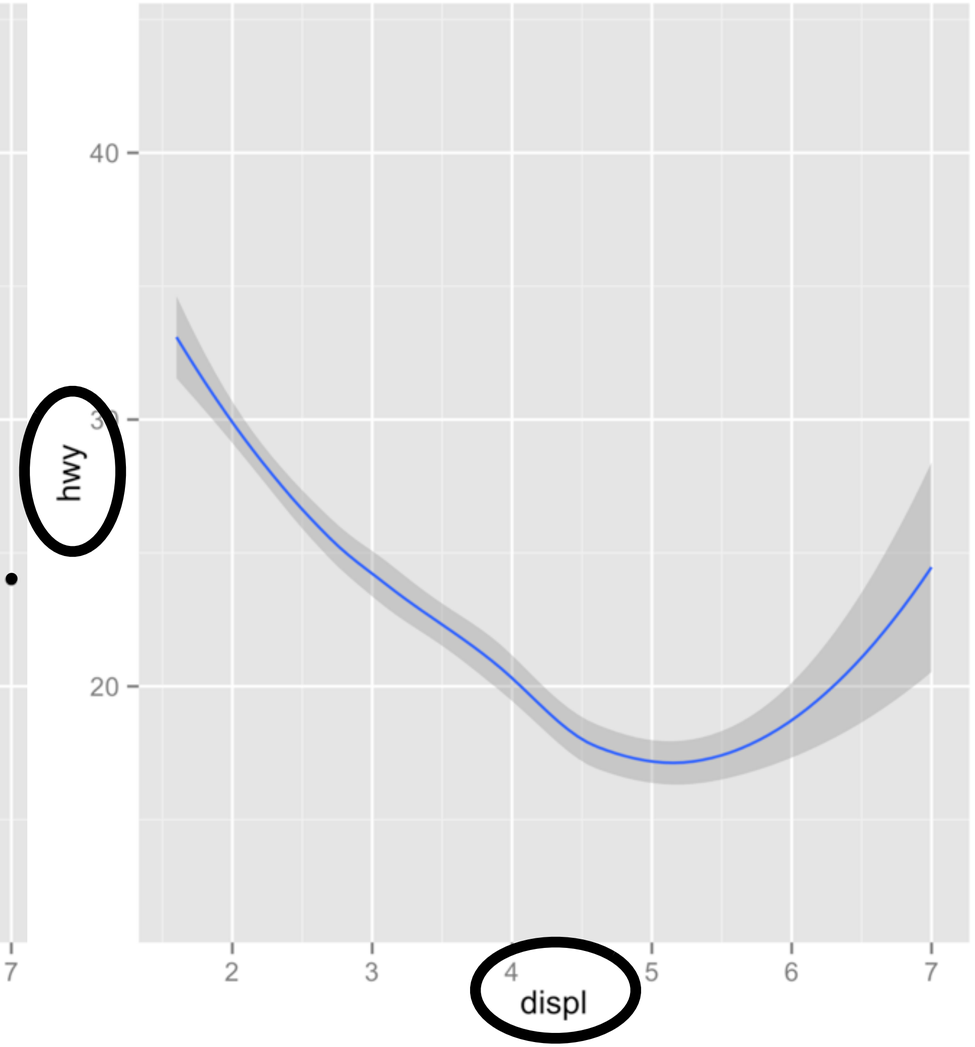
CC by RStudio

Geoms

How are these plots similar?

Same: x var , y var , data



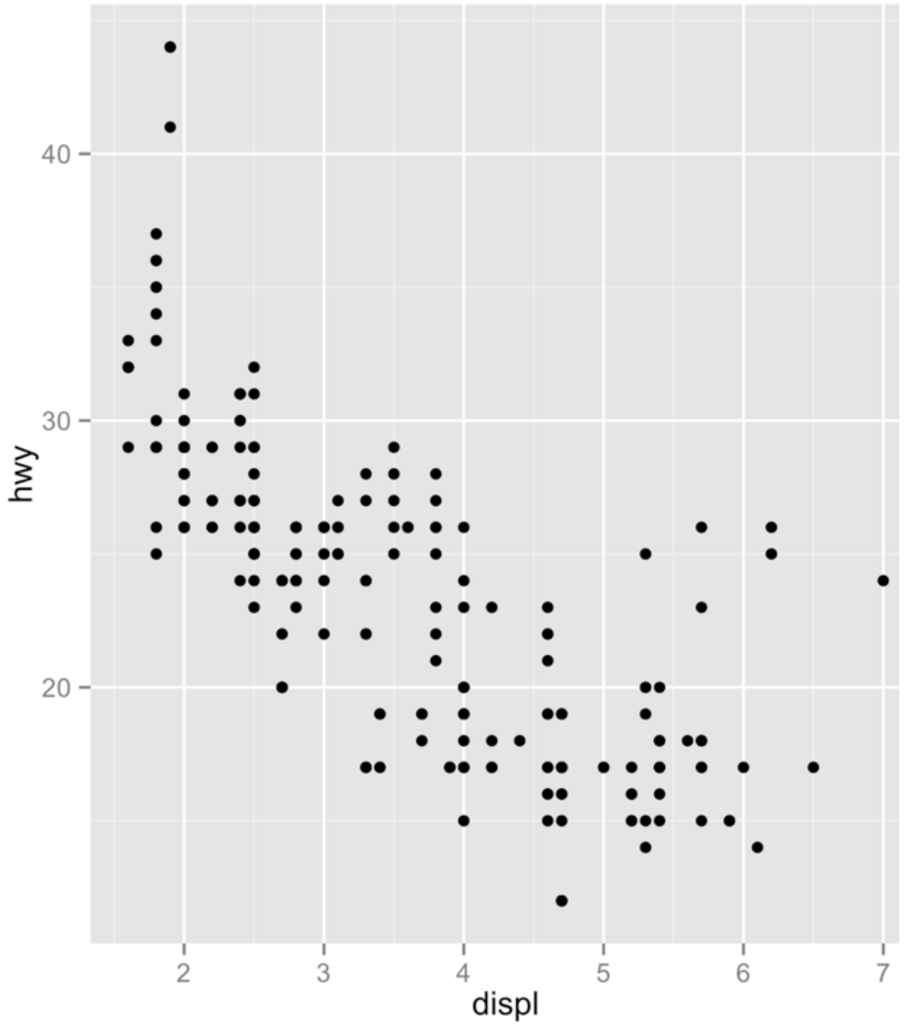


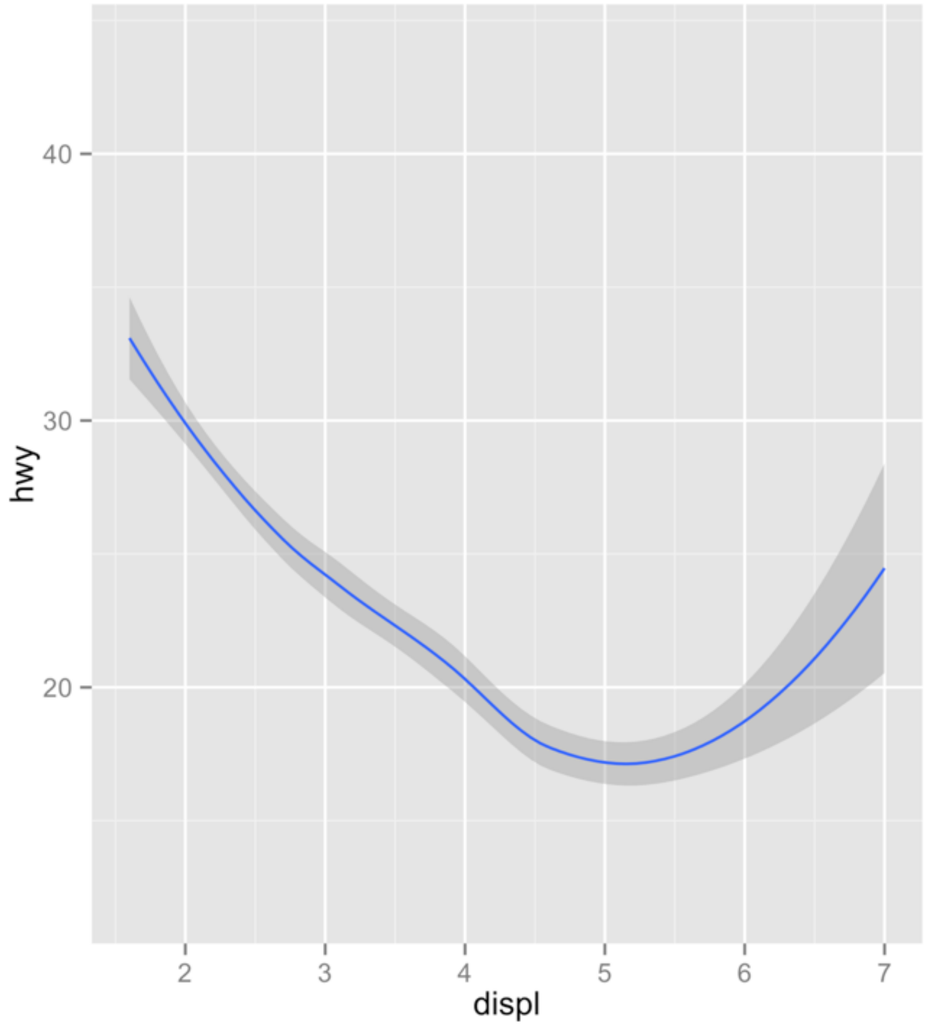
ggplot2

How are these plots different?

Different: geometric object (geom),

e.g. the visual object used to represent the data





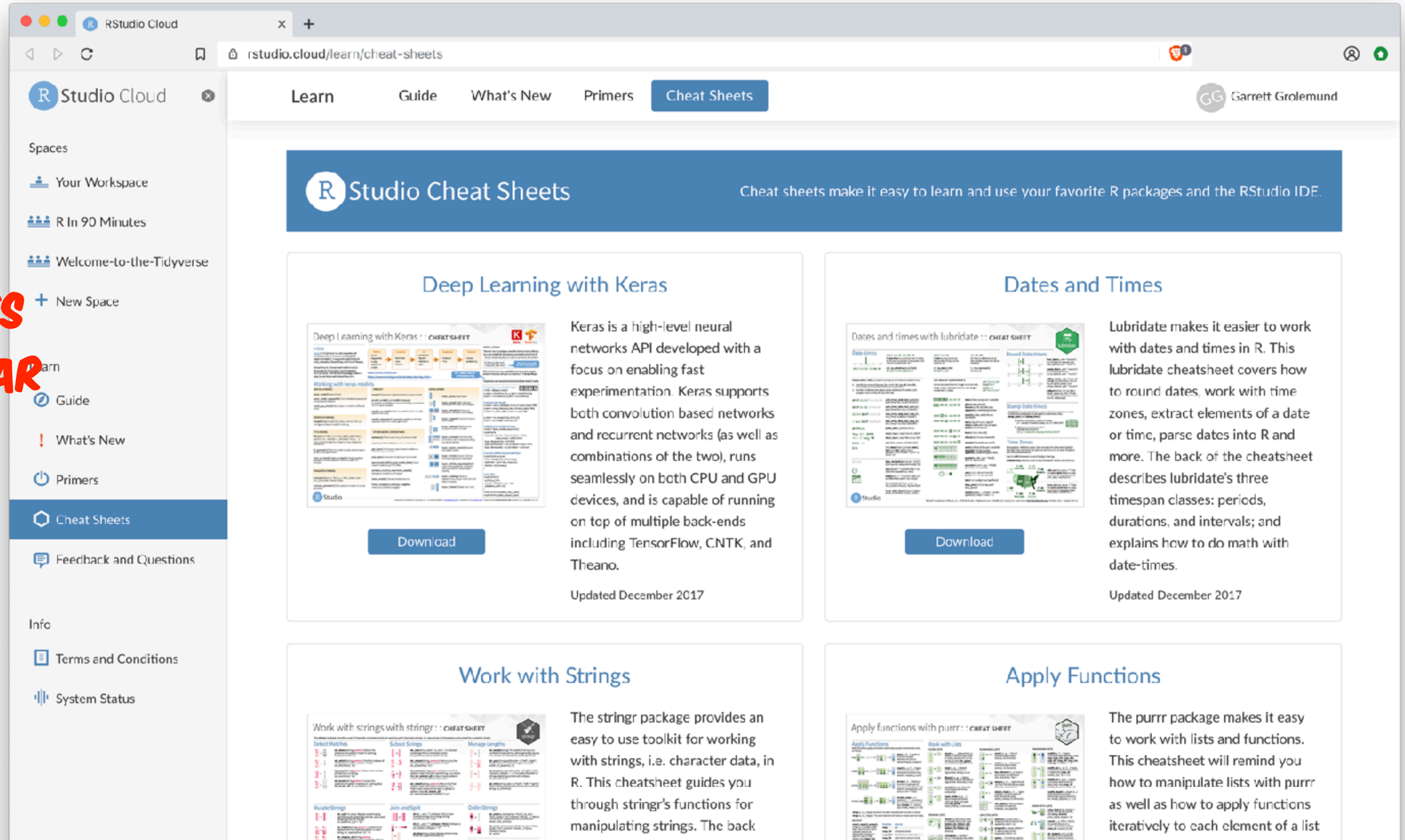
ggplot2

geoms

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>))
```

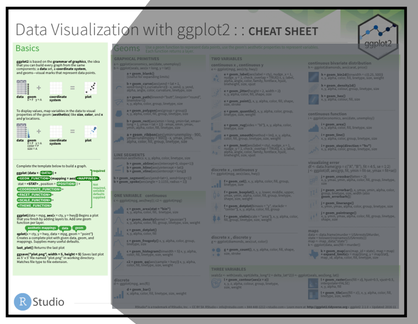
rstudio.cloud/learn/cheat-sheets

CLICK CHEAT SHEETS IN THE SIDEBAR



geom_ functions

Each requires a mapping argument.



Geoms

Use a geom function to represent data points, use the geom's aesthetic properties to represent variables. Each function returns a layer.

ggplot2

GRAPHICAL PRIMITIVES

a <- ggplot(economics, aes(date, unemploy))
b <- ggplot(seals, aes(x = long, y = lat))

a + geom_blank()
(Useful for expanding limits)

b + geom_curve(aes(yend = lat + 1, xend=long+1,curvature=z)**)** - x, xend, y, yend, alpha, angle, color, curvature, linetype, size

a + geom_path(lineend="butt", linejoin="round", linemitre=1**)**
x, y, alpha, color, group, linetype, size

a + geom_polygon(aes(group = group)**)**
x, y, alpha, color, fill, group, linetype, size

b + geom_rect(aes(xmin = long, ymin=lat, xmax= long + 1, ymax = lat + 1)**)** - xmax, xmin, ymax, ymin, alpha, color, fill, linetype, size

a + geom_ribbon(aes(ymin=unemploy - 900, ymax=unemploy + 900)**)** - x, ymax, ymin, alpha, color, fill, group, linetype, size

LINE SEGMENTS

common aesthetics: x, y, alpha, color, linetype, size

b + geom_abline(aes(intercept=0, slope=1)**)**
b + geom_hline(aes(yintercept = lat)**)**
b + geom_vline(aes(xintercept = long)**)**

b + geom_segment(aes(yend=lat+1, xend=long+1)**)**
b + geom_spoke(aes(angle = 1:1155, radius = 1)**)**

ONE VARIABLE continuous

c <- ggplot(mpg, aes(hwy)); c2 <- ggplot(mpg)

c + geom_area(stat = "bin")
x, y, alpha, color, fill, linetype, size

c + geom_density(kernel = "gaussian"**)**
x, y, alpha, color, fill, group, linetype, size, weight

c + geom_dotplot()
x, y, alpha, color, fill

c + geom_freqpoly() x, y, alpha, color, group, linetype, size

c + geom_histogram(binwidth = 5**)** x, y, alpha, color, fill, linetype, size, weight

c2 + geom_qq(aes(sample = hwy)**)** x, y, alpha, color, fill, linetype, size, weight

discrete

d <- ggplot(mpg, aes(fl))

d + geom_bar()
x, alpha, color, fill, linetype, size, weight

TWO VARIABLES

continuous x , continuous y

e <- ggplot(mpg, aes(cty, hwy))

e + geom_label(aes(label = cty), nudge_x = 1, nudge_y = 1, check_overlap = TRUE**)** x, y, label, alpha, angle, color, family, fontface, hjust, lineheight, size, vjust

e + geom_jitter(height = 2, width = 2**)**
x, y, alpha, color, fill, shape, size

e + geom_point(), x, y, alpha, color, fill, shape, size, stroke

e + geom_quantile(), x, y, alpha, color, group, linetype, size, weight

e + geom_rug(sides = "bl"**)**, x, y, alpha, color, linetype, size

e + geom_smooth(method = lm**)**, x, y, alpha, color, fill, group, linetype, size, weight

e + geom_text(aes(label = cty), nudge_x = 1, nudge_y = 1, check_overlap = TRUE**)**, x, y, label, alpha, angle, color, family, fontface, hjust, lineheight, size, vjust

discrete x , continuous y

f <- ggplot(mpg, aes(class, hwy))

f + geom_col(), x, y, alpha, color, fill, group, linetype, size

f + geom_boxplot(), x, y, lower, middle, upper, ymax, ymin, alpha, color, fill, group, linetype, shape, size, weight

f + geom_dotplot(binaxis = "y", stackdir = "center"**)**, x, y, alpha, color, fill, group

f + geom_violin(scale = "area"**)**, x, y, alpha, color, fill, group, linetype, size, weight

discrete x , discrete y

g <- ggplot(diamonds, aes(cut, color))

g + geom_count(), x, y, alpha, color, fill, shape, size, stroke

continuous bivariate distribution

h <- ggplot(diamonds, aes(carat, price))

h + geom_bin2d(binwidth = c(0.25, 500)**)**
x, y, alpha, color, fill, linetype, size, weight

h + geom_density2d()
x, y, alpha, colour, group, linetype, size

h + geom_hex()
x, y, alpha, colour, fill, size

continuous function

i <- ggplot(economics, aes(date, unemploy))

i + geom_area()
x, y, alpha, color, fill, linetype, size

i + geom_line()
x, y, alpha, color, group, linetype, size

i + geom_step(direction = "hv")
x, y, alpha, color, group, linetype, size

visualizing error

df <- data.frame(grp = c("A", "B"), fit = 4:5, se = 1:2)
j <- ggplot(df, aes(grp, fit, ymin = fit-se, ymax = fit+se))

j + geom_crossbar(fatten = 2**)**
x, y, ymax, ymin, alpha, color, fill, group, linetype, size

j + geom_errorbar(), x, ymax, ymin, alpha, color, group, linetype, size, width (also **geom_errorbarh()**)

j + geom_linerange()
x, ymin, ymax, alpha, color, group, linetype, size

j + geom_pointrange()
x, y, ymin, ymax, alpha, color, fill, group, linetype, shape, size

maps

data <- data.frame(murder = USArrests$Murder, state = tolower(rownames(USArrests)))
map <- map_data("state")
k <- ggplot(data, aes(fill = murder))

k + geom_map(aes(map_id = state), map = map**)**
+ expand_limits(x = map$long, y = map$lat**)**,
map_id, alpha, color, fill, linetype, size

THREE VARIABLES

seals$z <- with(seals, sqrt(delta_long^2 + delta_lat^2))l <- ggplot(seals, aes(long, lat))

l + geom_contour(aes(z = z))
x, y, z, alpha, colour, group, linetype, size, weight

l + geom_raster(aes(fill = z), hjust=0.5, vjust=0.5, interpolate=FALSE**)**
x, y, alpha, fill

l + geom_tile(aes(fill = z)**)**, x, y, alpha, color, fill, linetype, size, width

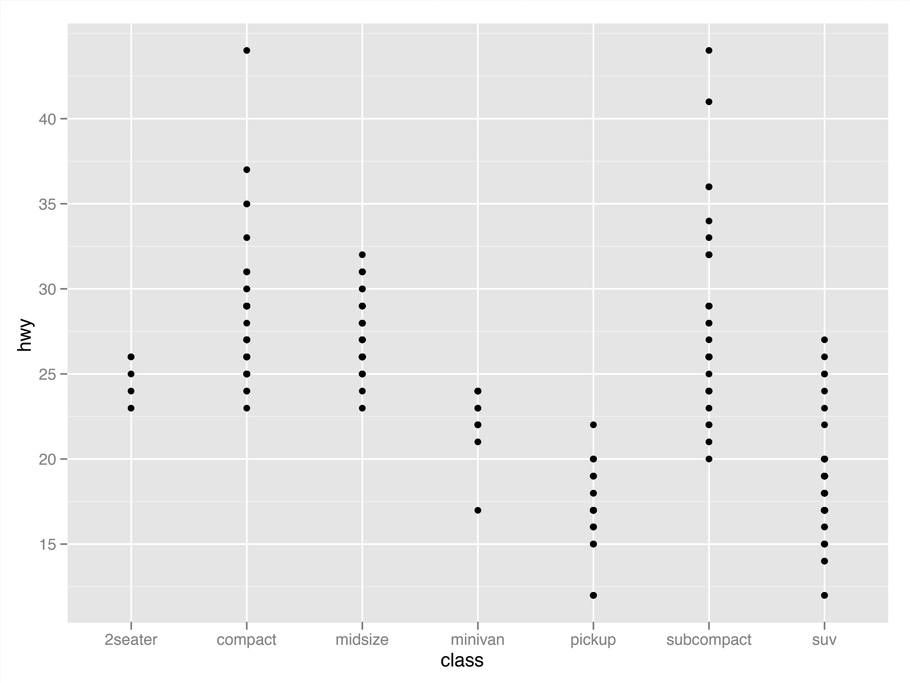
ggplot2

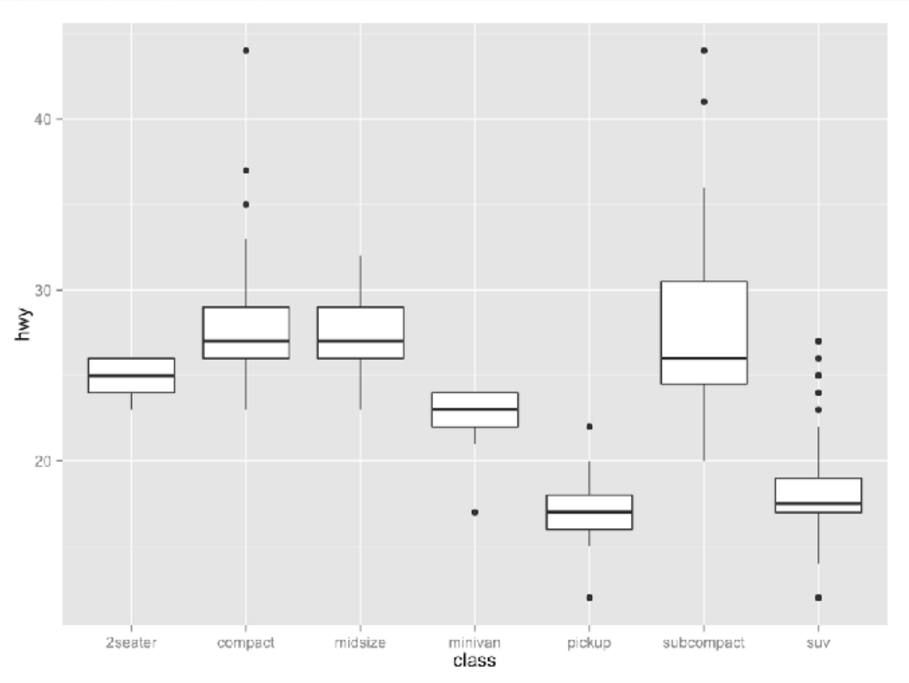
Your Turn

Pair up.

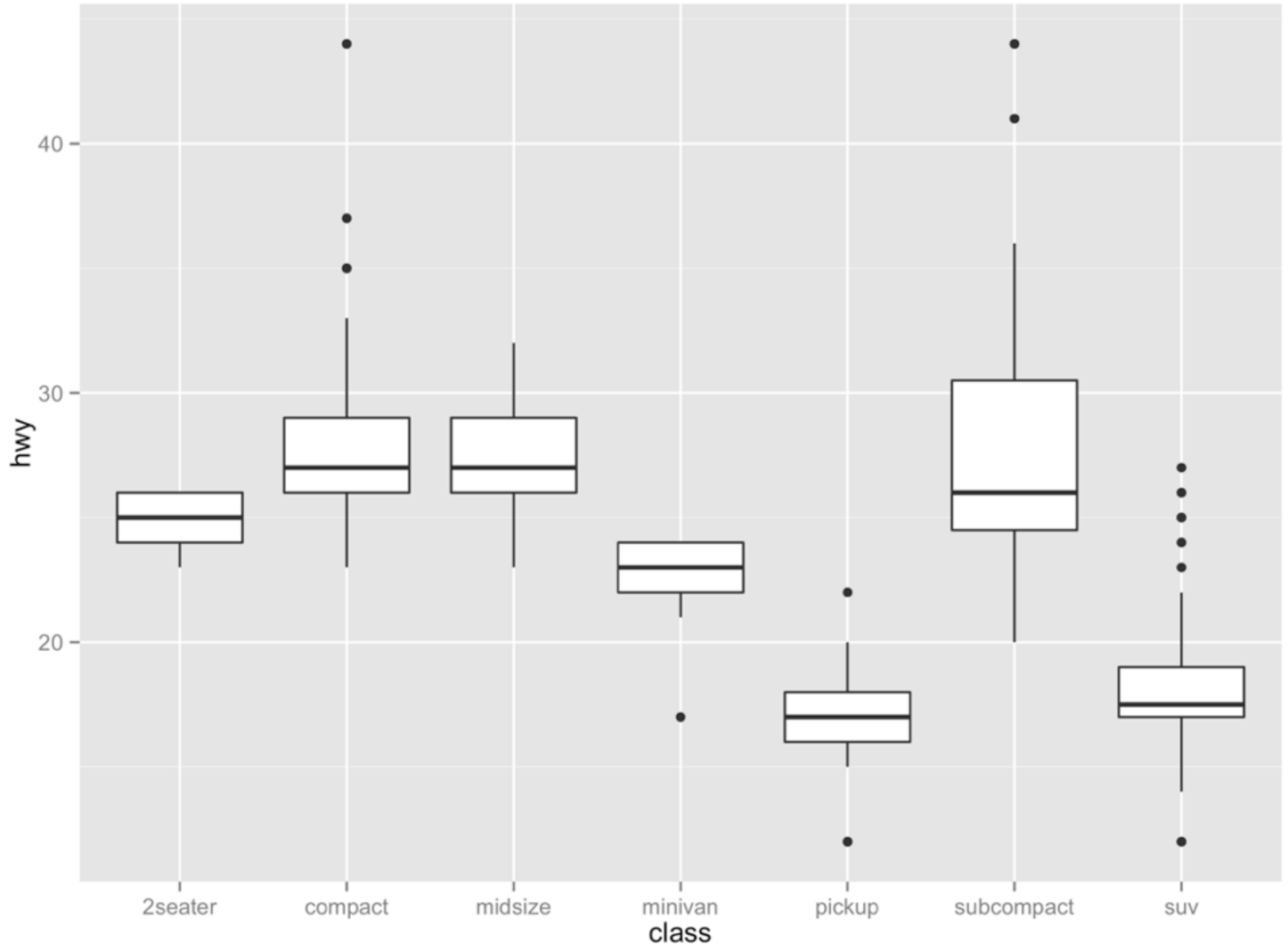
Your Turn 3

With your partner, decide how to replace this scatterplot with one that draws boxplots. Use the cheatsheet. Try your best guess.





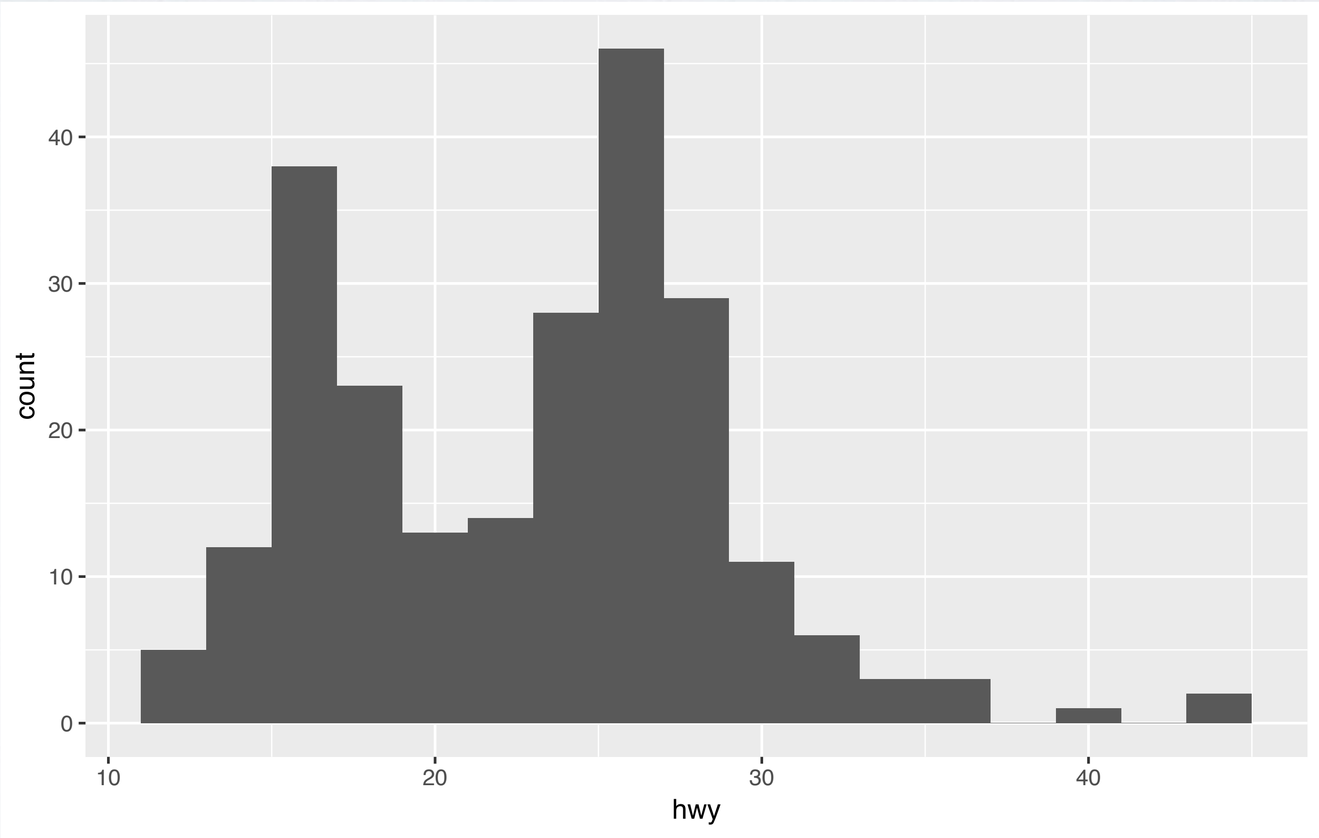

```
ggplot(mpg) + geom_point(aes(class, hwy))
```

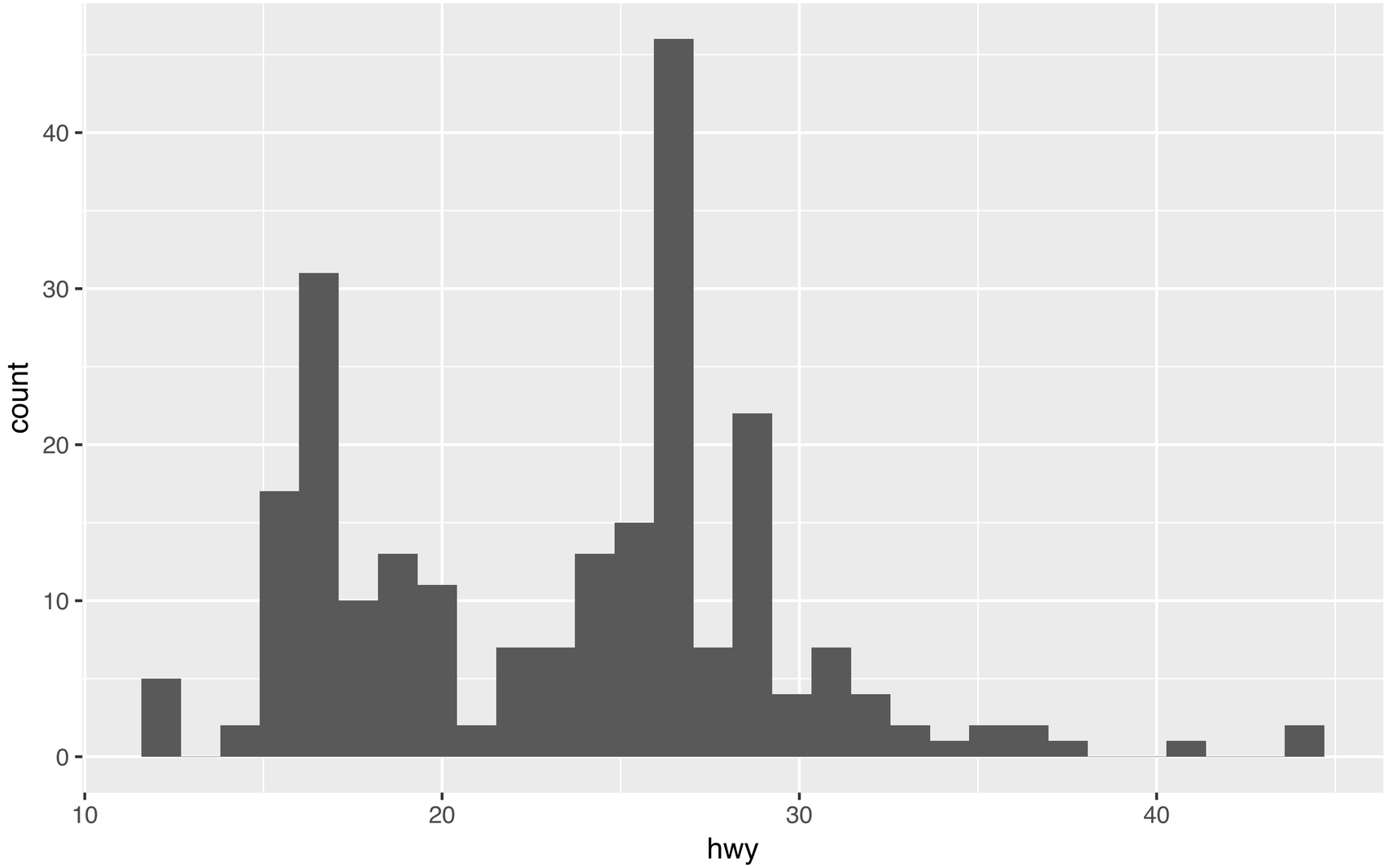



```
ggplot(data = mpg) +
  geom_boxplot(mapping = aes(x = class, y = hwy))
```

Your Turn 4

With a partner, make the histogram of **hwy** below. Use the cheatsheet. Hint: do not supply a **y** variable.

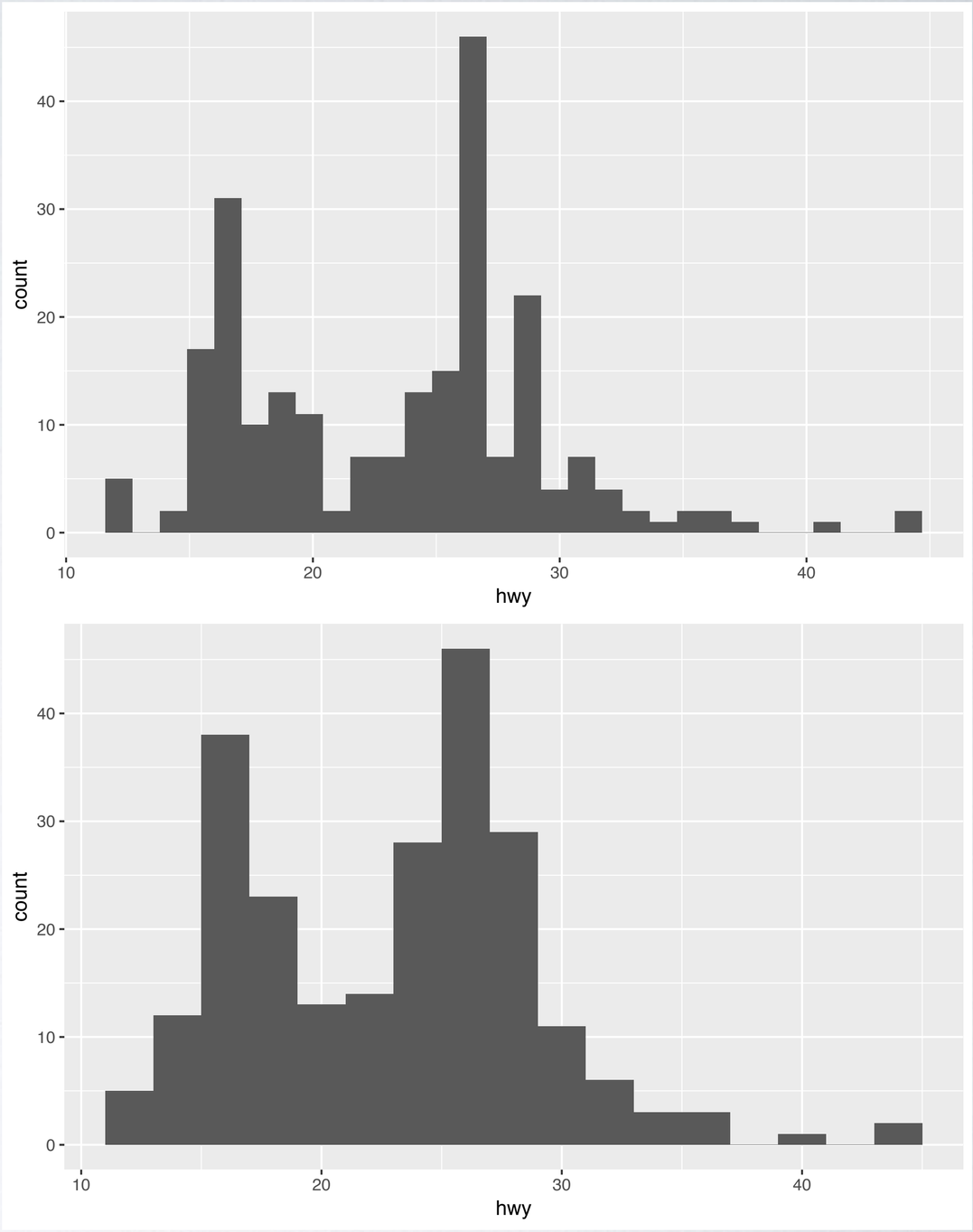





```
ggplot(data = mpg) +
  geom_histogram(mapping = aes(x = hwy))
```

Quiz

What is the difference?



"Help" pages

To open the documentation for a function, type

```
?geom_histogram
```

? — **function name** (no parentheses)

geom_freqpoly {ggplot2} R Documentation

Histograms and frequency polygons

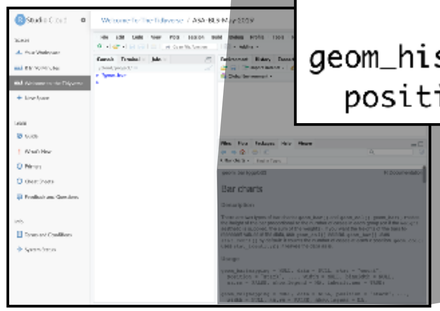
Description

Visualise the distribution of a single continuous variable by dividing the x axis into bins and counting the number of observations in each bin. Histograms (geom_histogram()) display the counts with bars; frequency polygons (geom_freqpoly()) display the counts with lines. Frequency polygons are more suitable when you want to compare the distribution across the levels of a categorical variable.

Usage

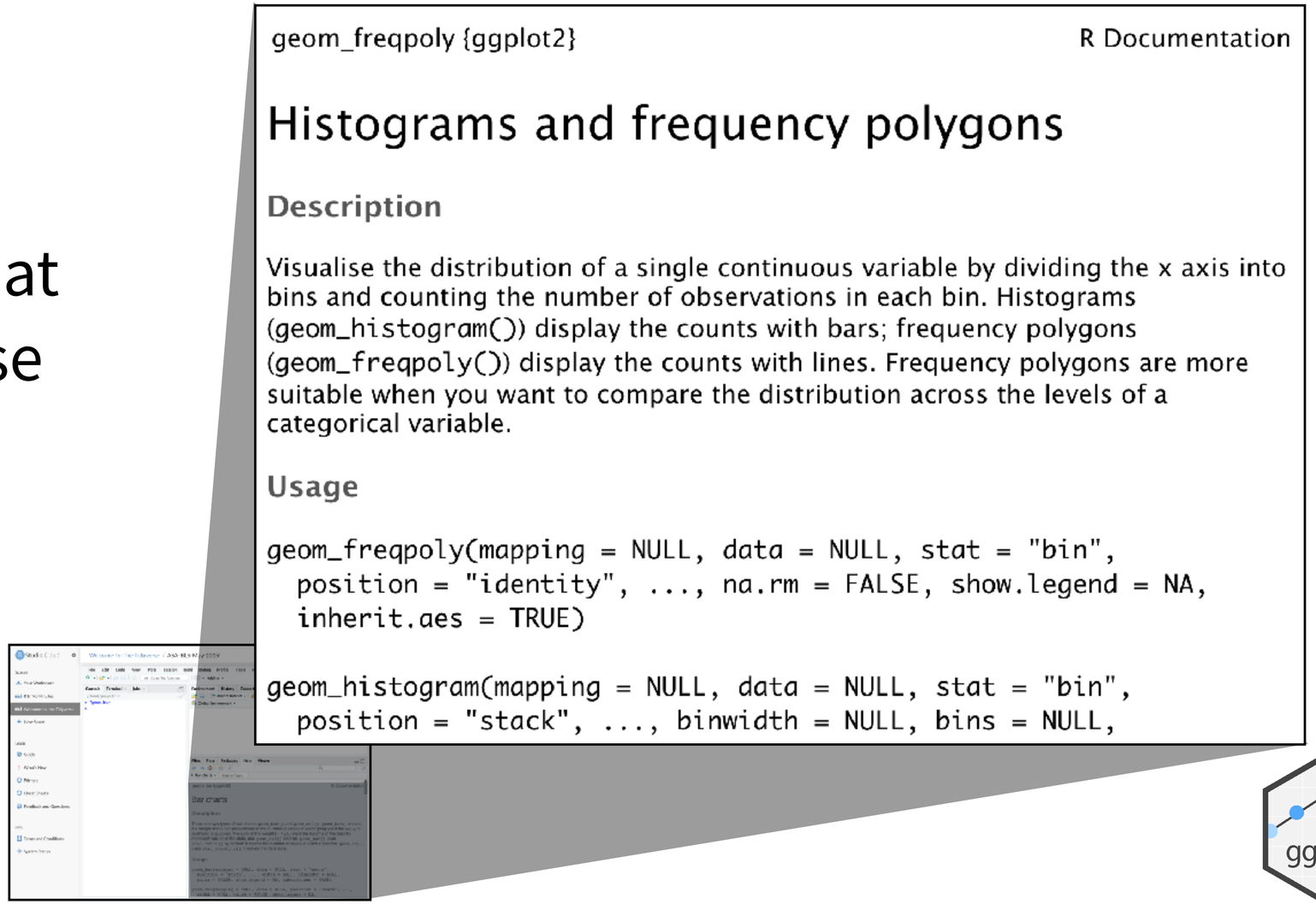
```
geom_freqpoly(mapping = NULL, data = NULL, stat = "bin",
  position = "identity", ..., na.rm = FALSE, show.legend = NA,
  inherit.aes = TRUE)

geom_histogram(mapping = NULL, data = NULL, stat = "bin",
  position = "stack", ..., binwidth = NULL, bins = NULL,
```



Tips

- **scan** page for relevant info
- **ignore** things that don't make sense
- **try** out the examples



geom_freqpoly {ggplot2} R Documentation

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Description

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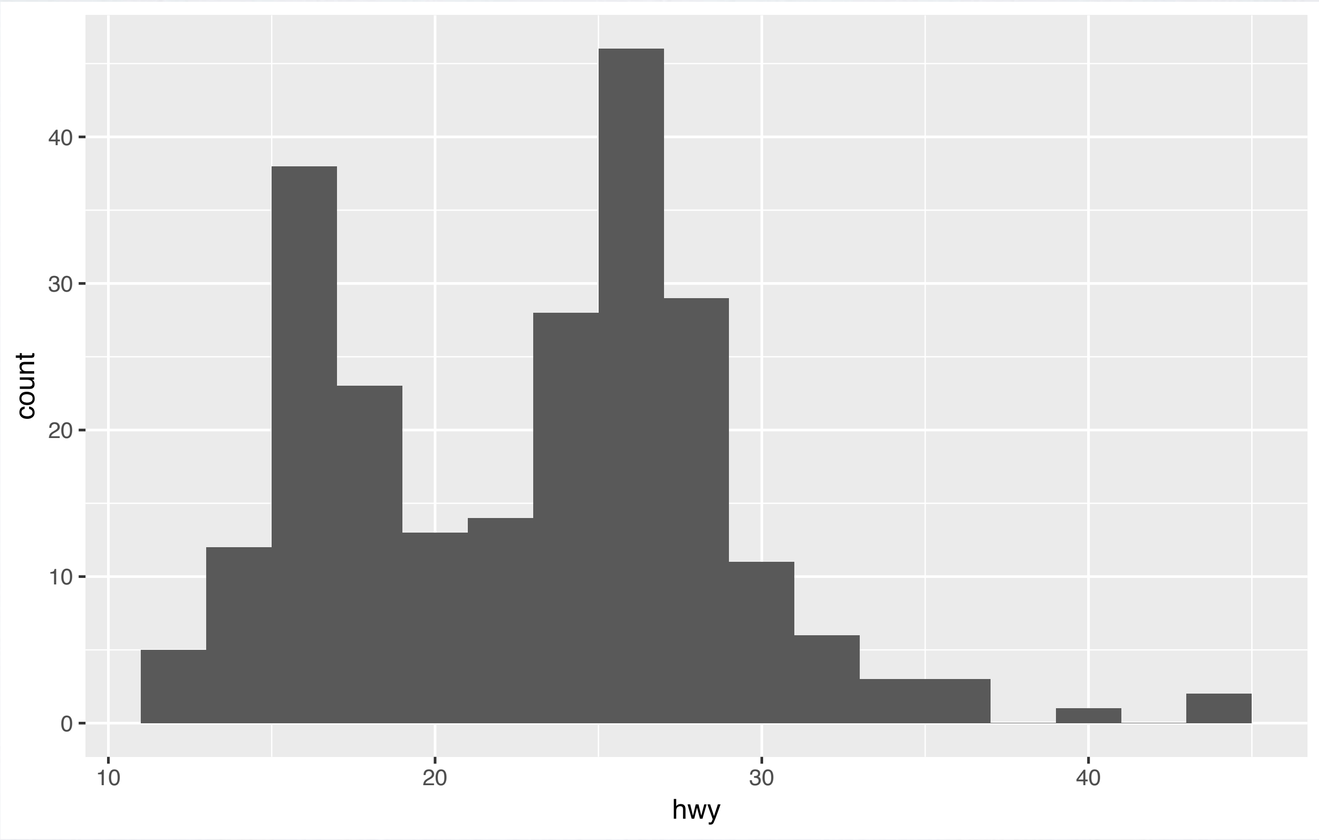
Usage

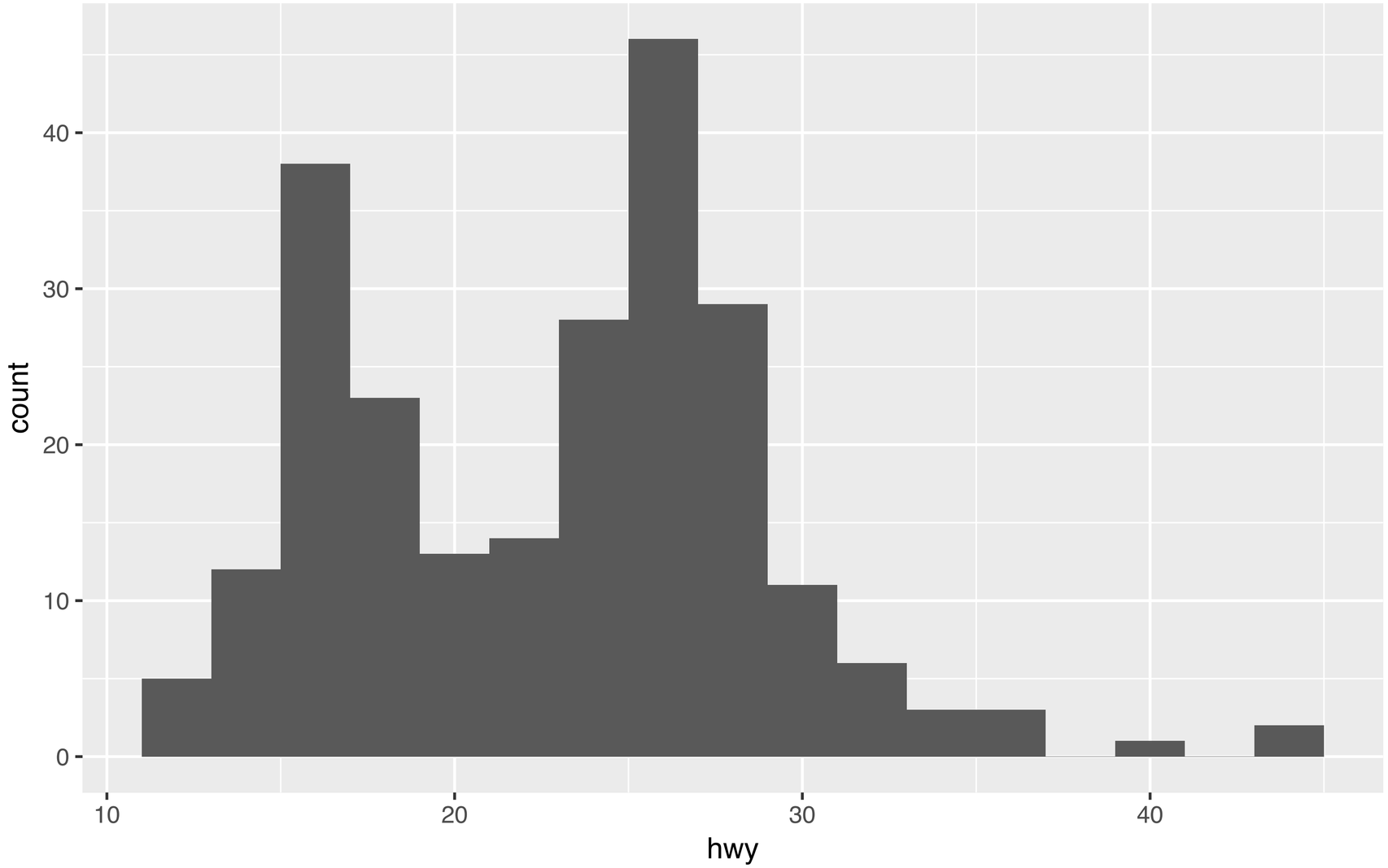
```
geom_freqpoly(mapping = NULL, data = NULL, stat = "bin",
  position = "identity", ..., na.rm = FALSE, show.legend = NA,
  inherit.aes = TRUE)

geom_histogram(mapping = NULL, data = NULL, stat = "bin",
  position = "stack", ..., binwidth = NULL, bins = NULL,
```

Your Turn 5

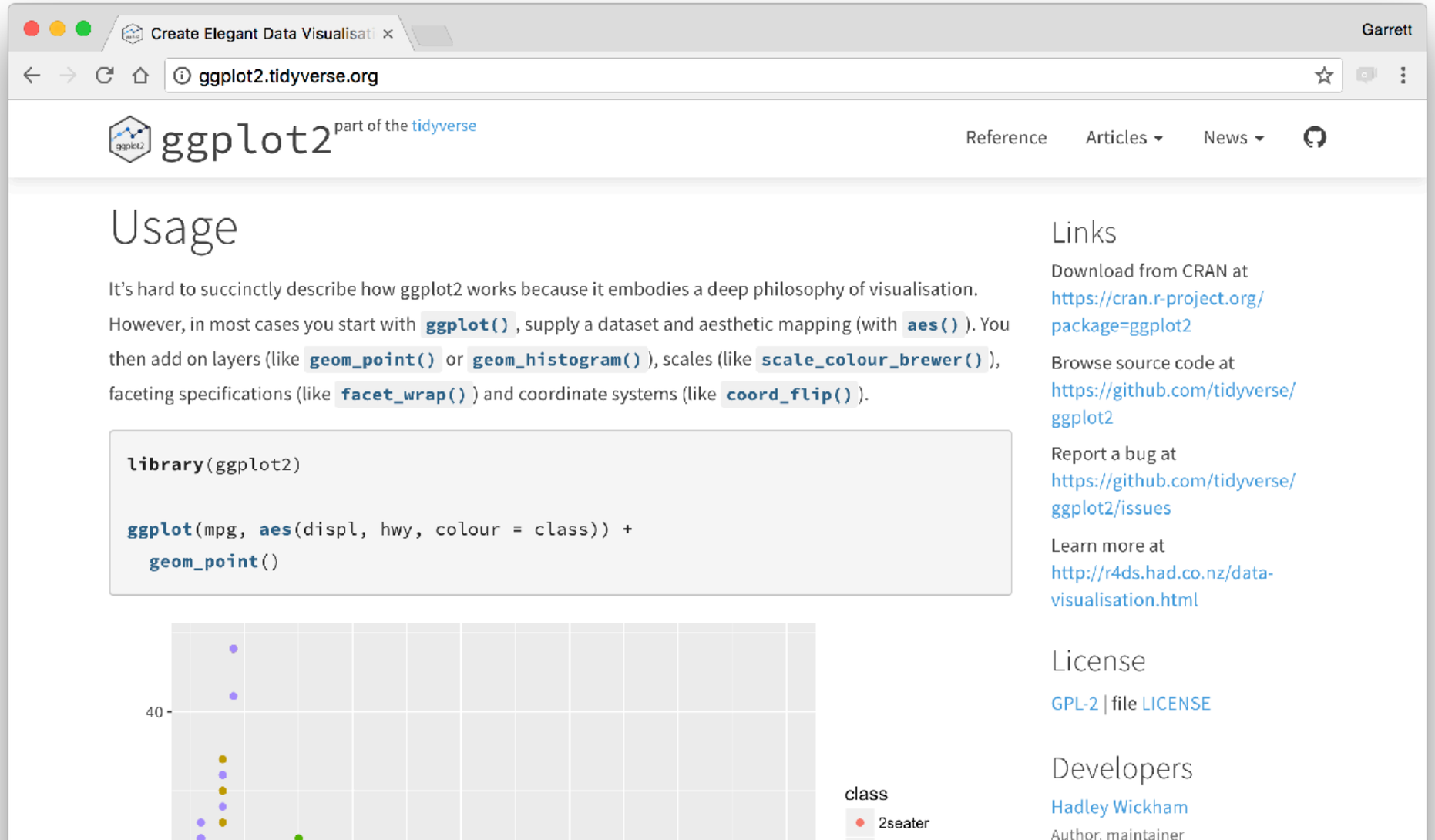
Use the help page for **geom_histogram** to make the bins **2** mpg wide.





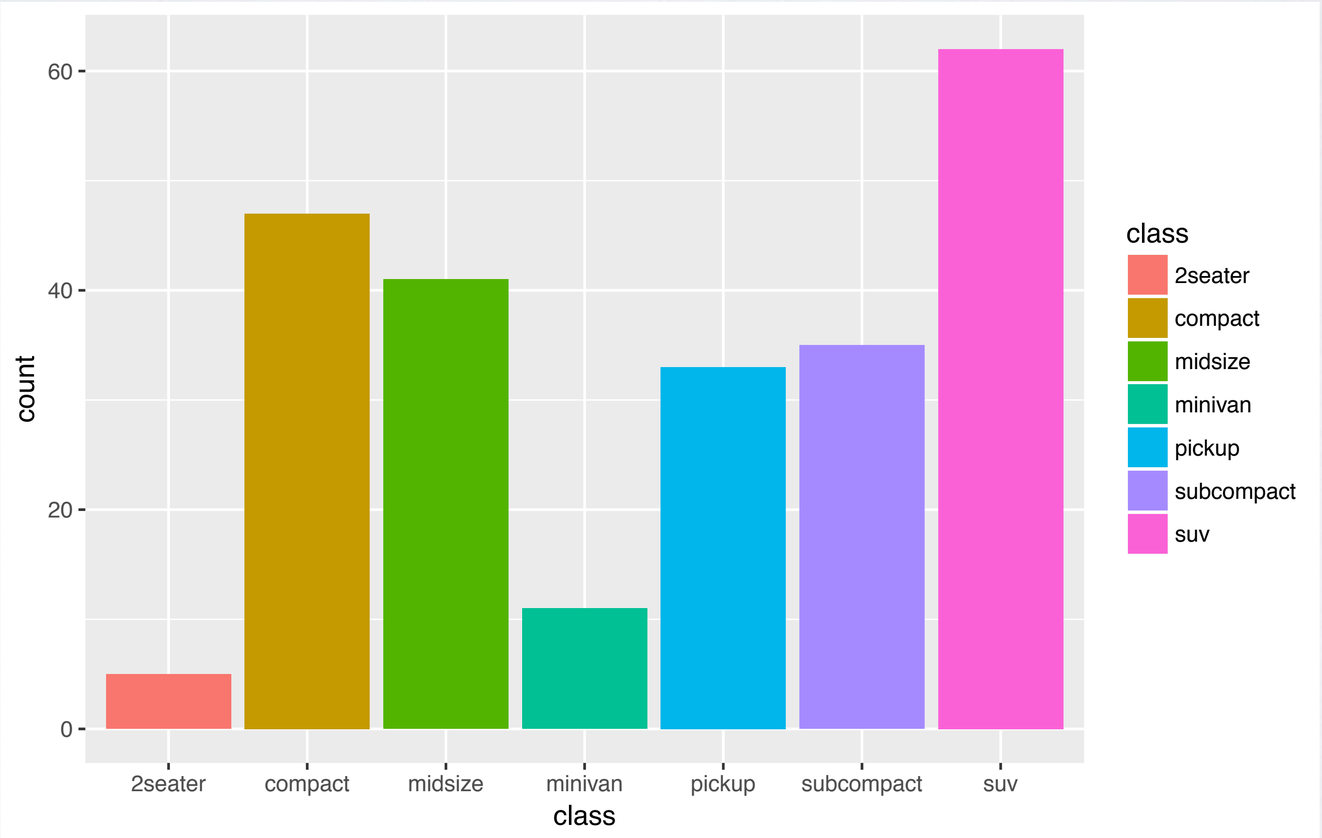

```
ggplot(data = mpg) +
  geom_histogram(mapping = aes(x = hwy), binwidth = 2)
```

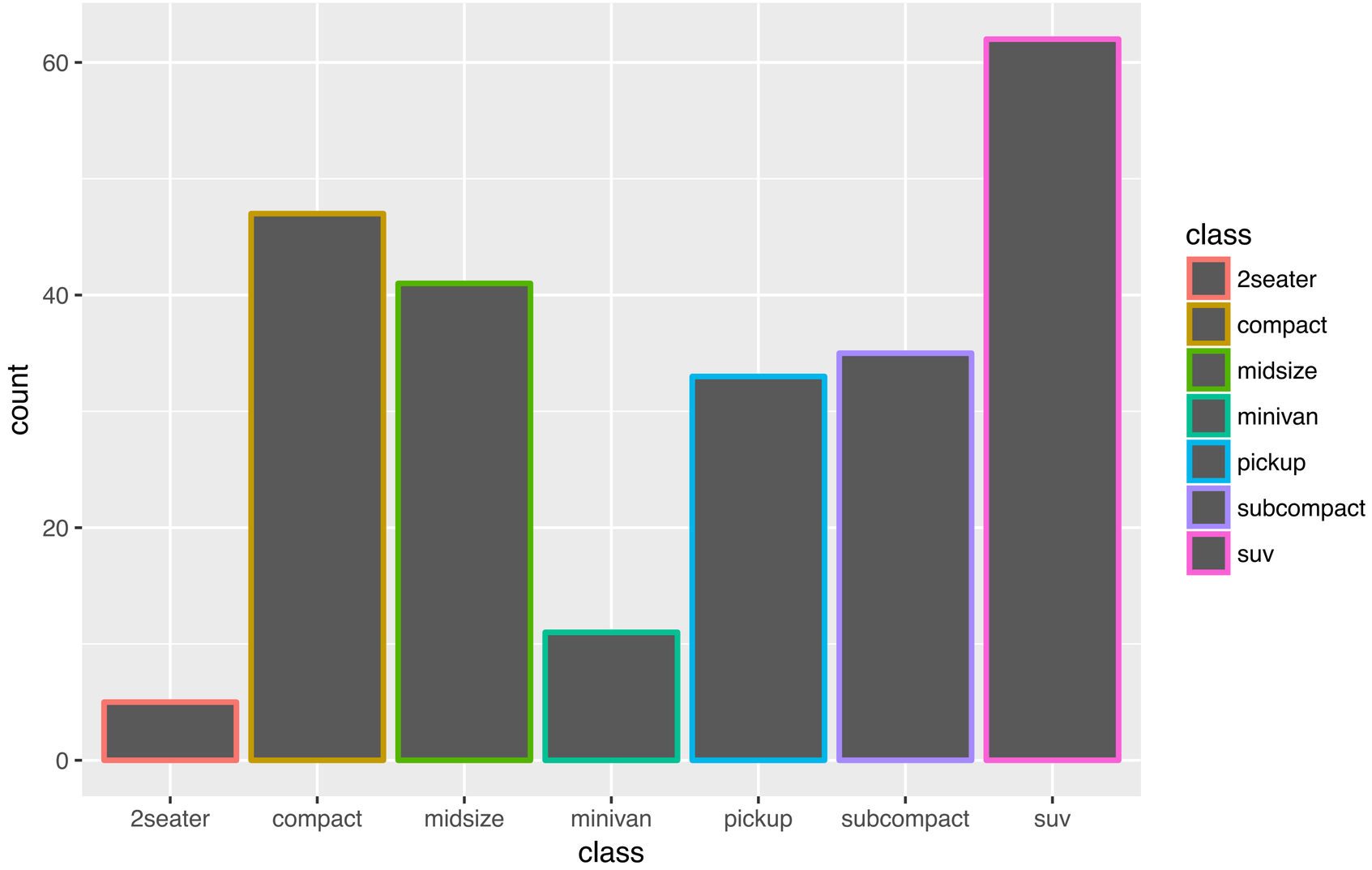
ggplot2.tidyverse.org



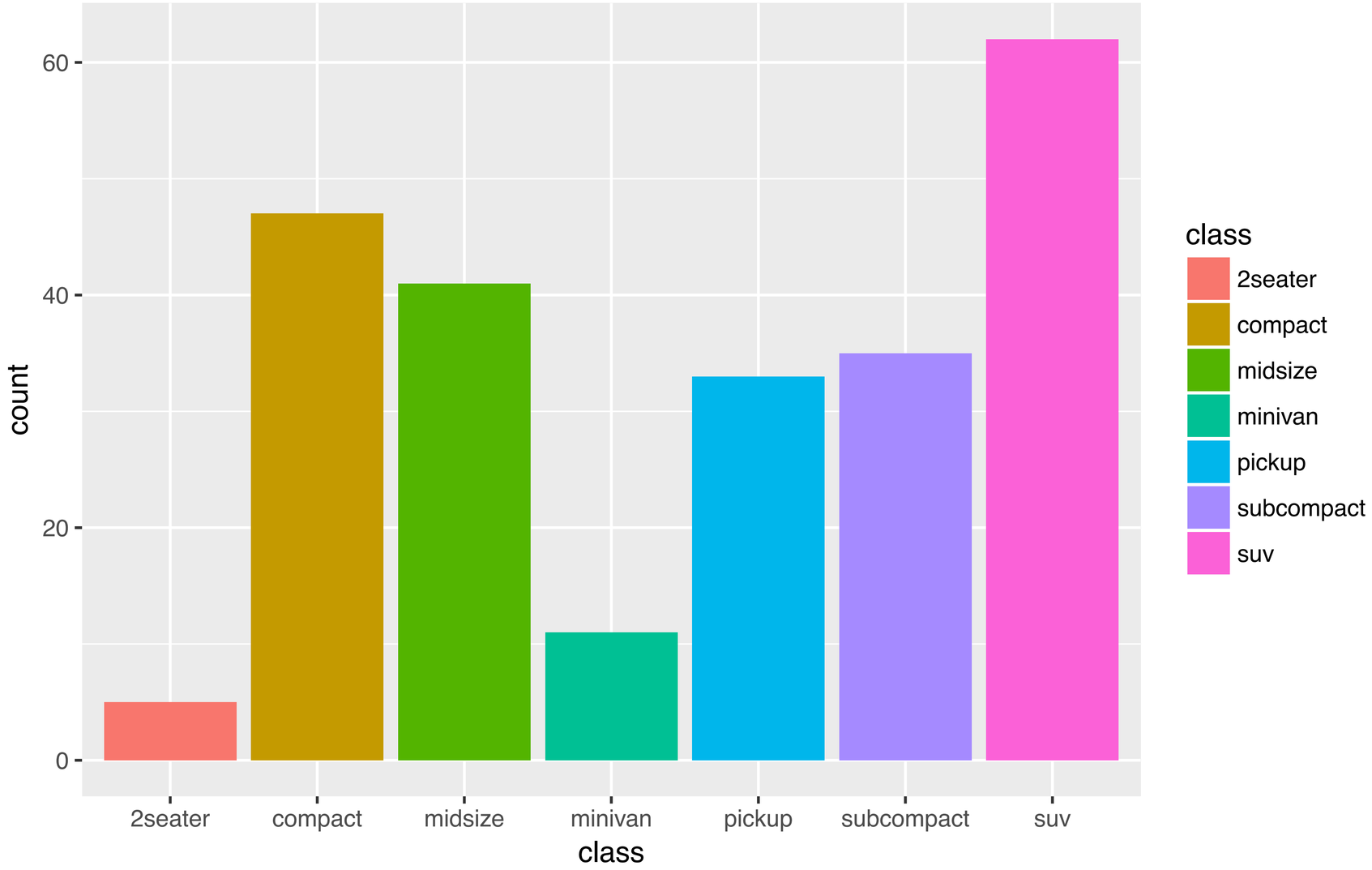
Your Turn 6

With a partner, make the bar chart of **class** below. Use the cheatsheet. Hint: do not supply a **y** variable.

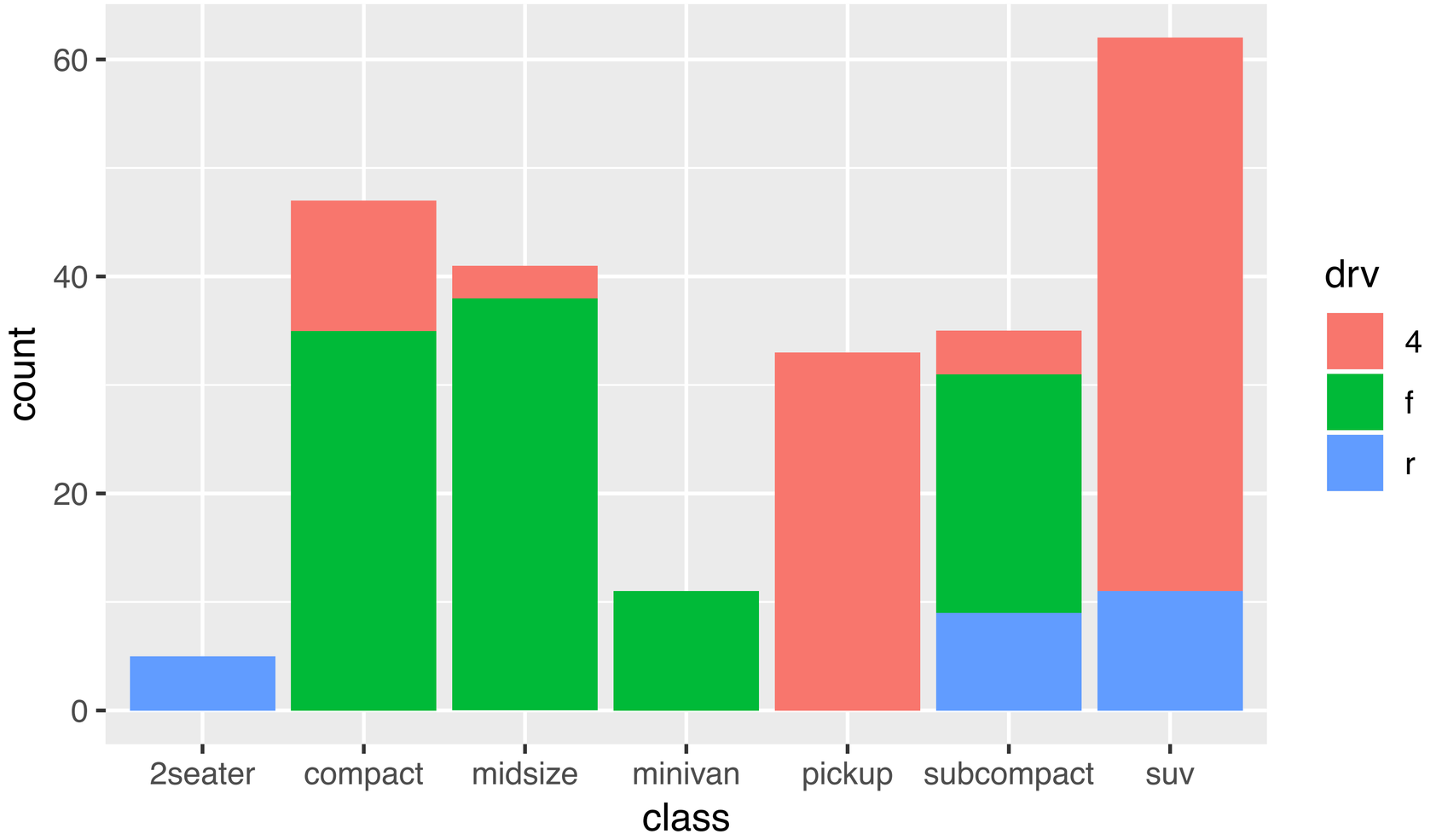





```
ggplot(data = mpg) +
  geom_bar(mapping = aes(x = class, color = class))
```




```
ggplot(data = mpg) +
  geom_bar(mapping = aes(x = class, fill = class))
```

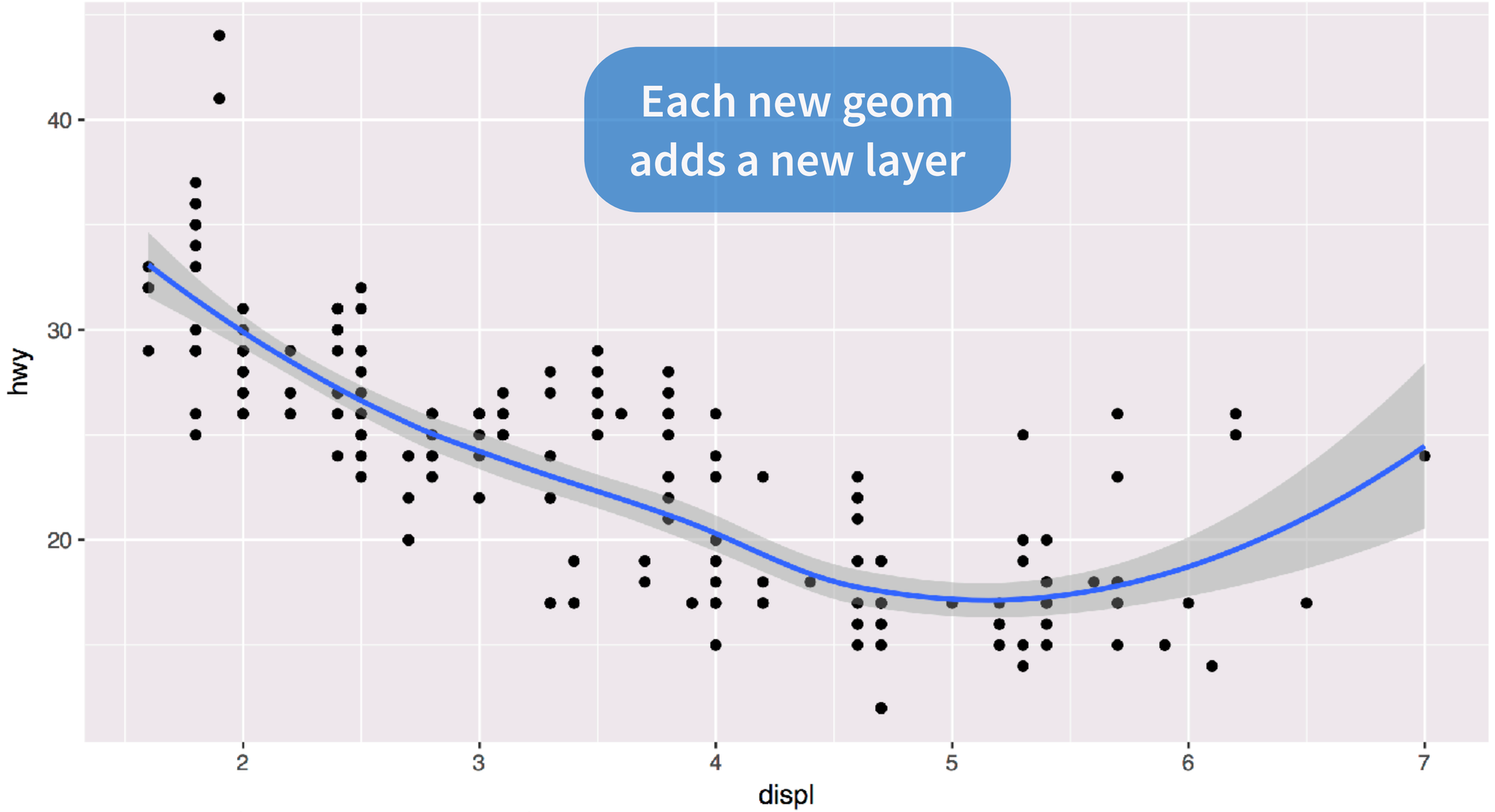



```
ggplot(data = mpg) +
  geom_bar(mapping = aes(x = class, fill = drv))
```

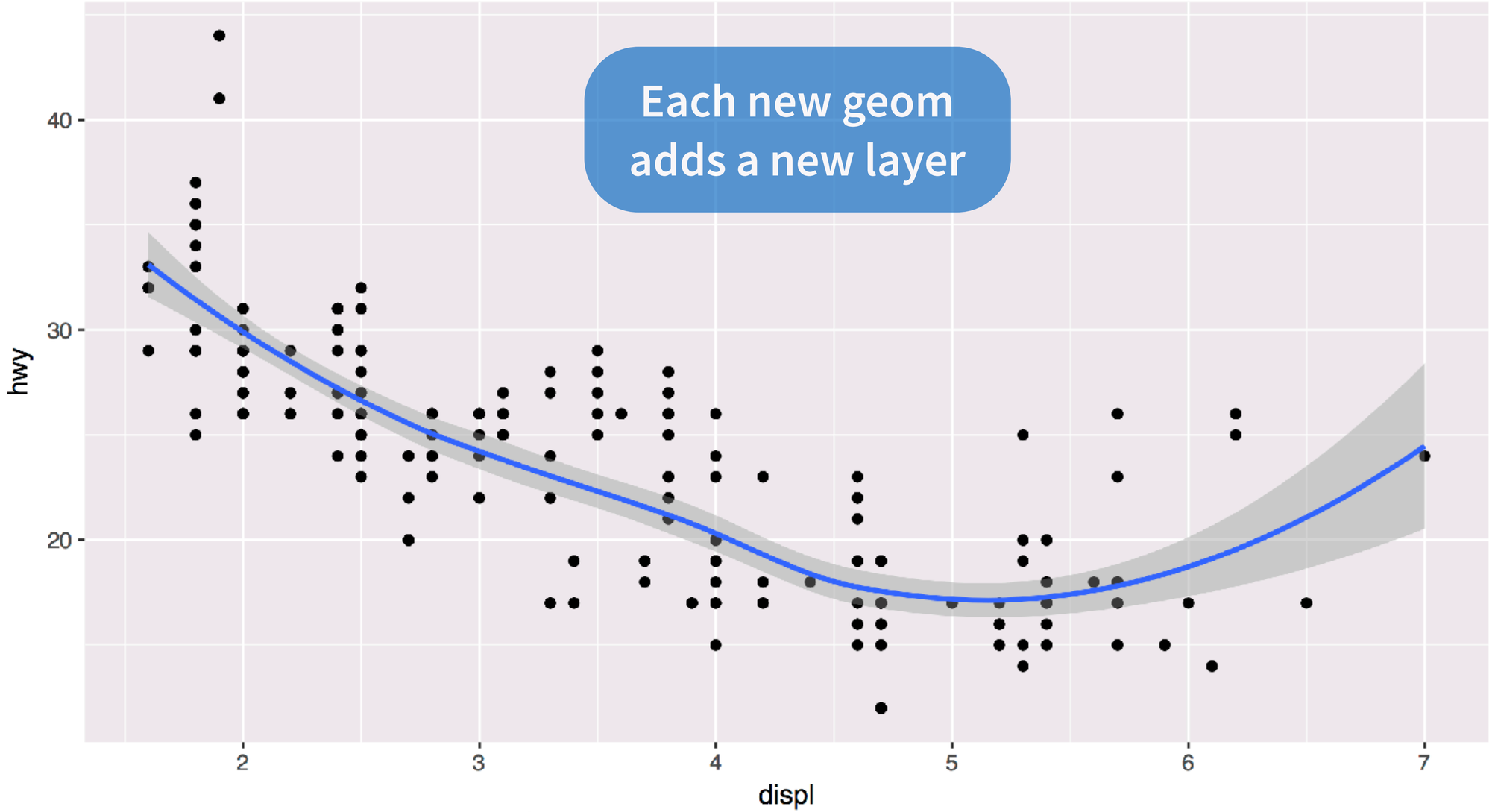
Quiz

What will this code do?

```
ggplot(mpg) +
  geom_point(aes(displ, hwy)) +
  geom_smooth(aes(displ, hwy))
```



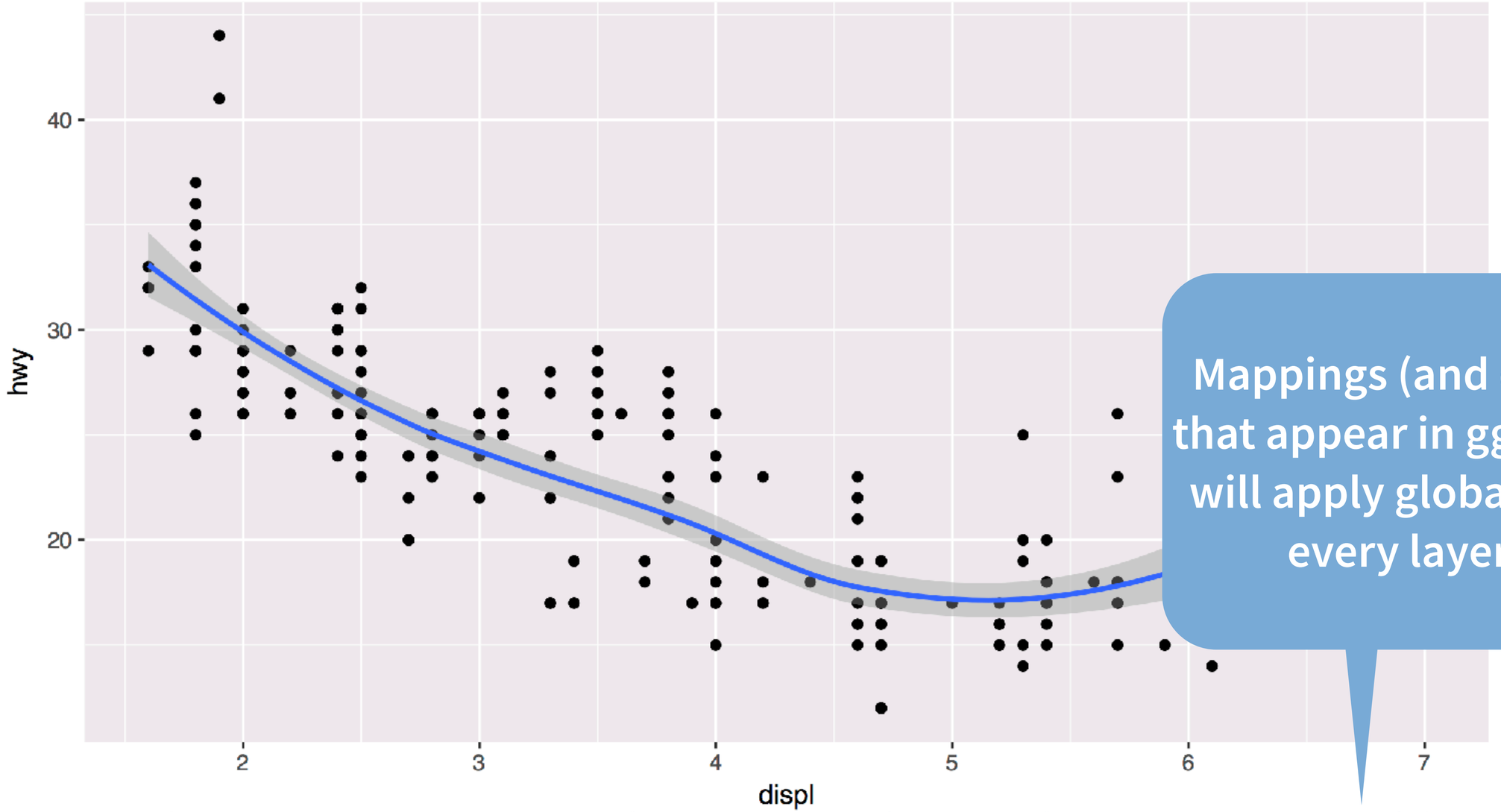

```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy)) +
  geom_smooth(mapping = aes(x = displ, y = hwy))
```




```
ggplot(data = mpg) +
  geom_point(mapping = aes(x = displ, y = hwy)) +
  geom_smooth(mapping = aes(x = displ, y = hwy))
```

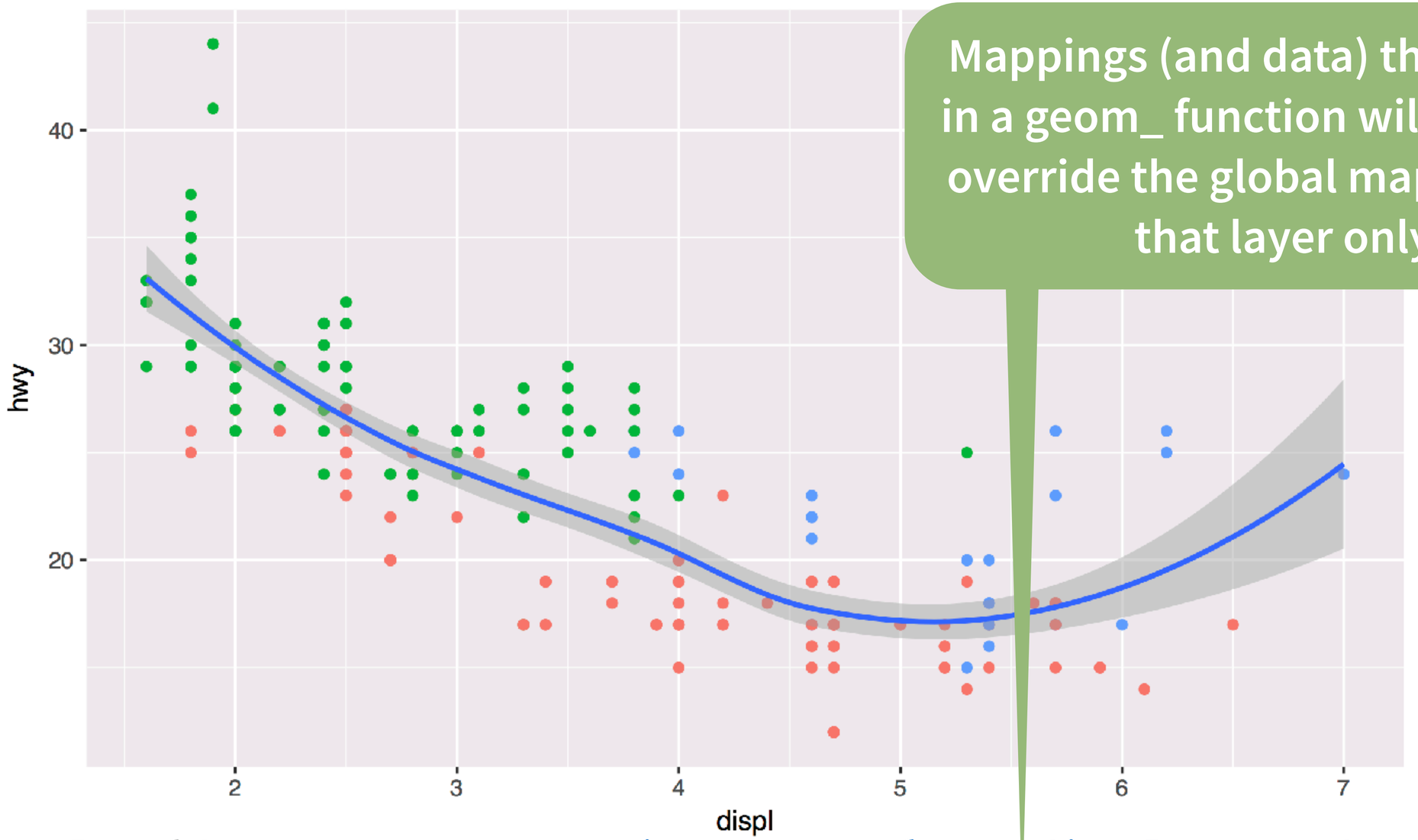
ggplot2

global vs. local



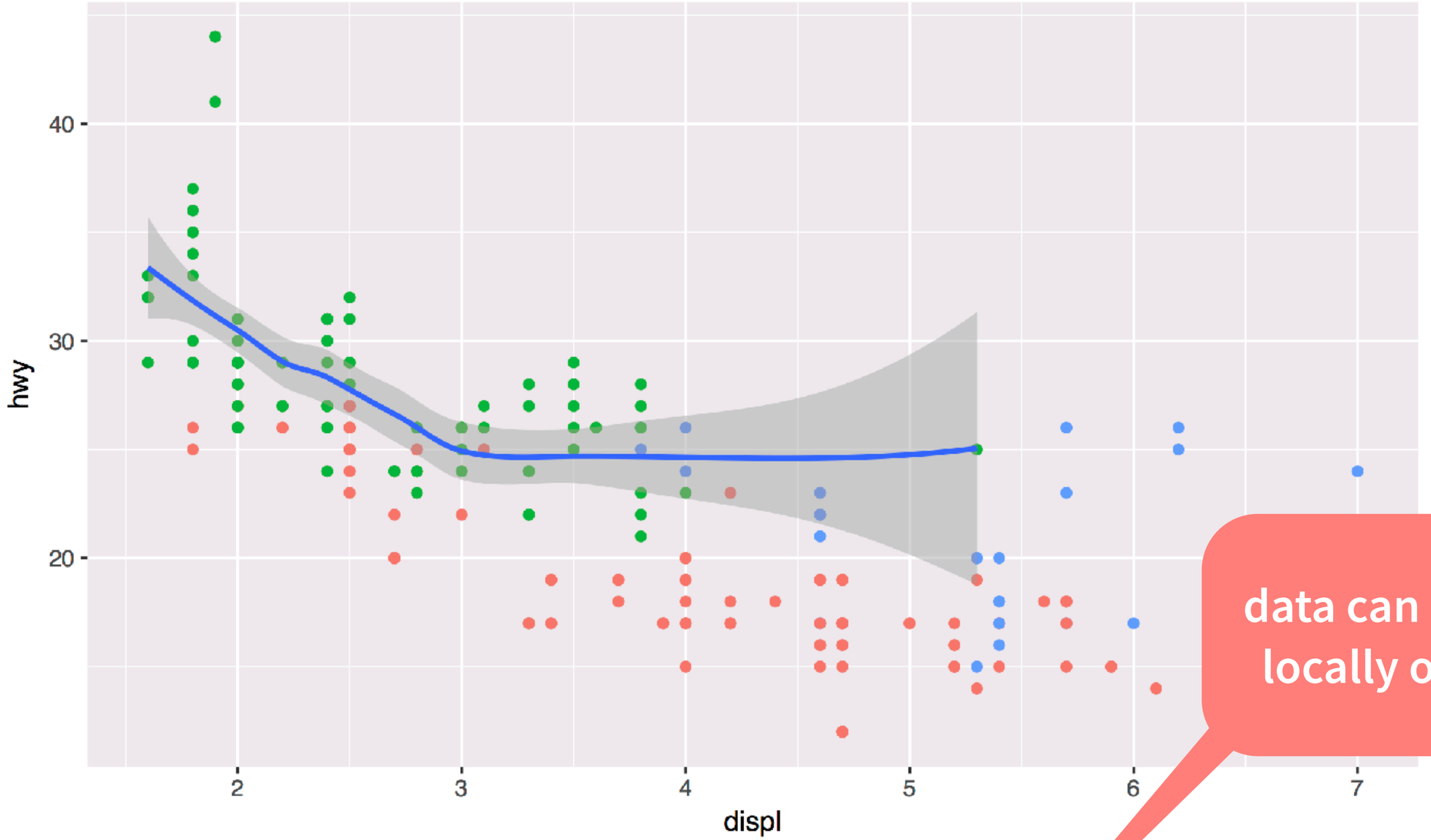
Mappings (and data) that appear in ggplot() will apply globally to every layer

```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy)) +
  geom_point() +
  geom_smooth()
```



Mappings (and data) that appear in a geom_ function will add to or override the global mappings for that layer only

```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy)) +
  geom_point(mapping = aes(color = drv)) +
  geom_smooth()
```



data can also be set locally or globally

```
ggplot(data = mpg, mapping = aes(x = displ, y = hwy)) +
  geom_point(mapping = aes(color = drv)) +
  geom_smooth(data = filter(mpg, drv == "f"))
```

Quiz

What is different about this plot? Run the code!

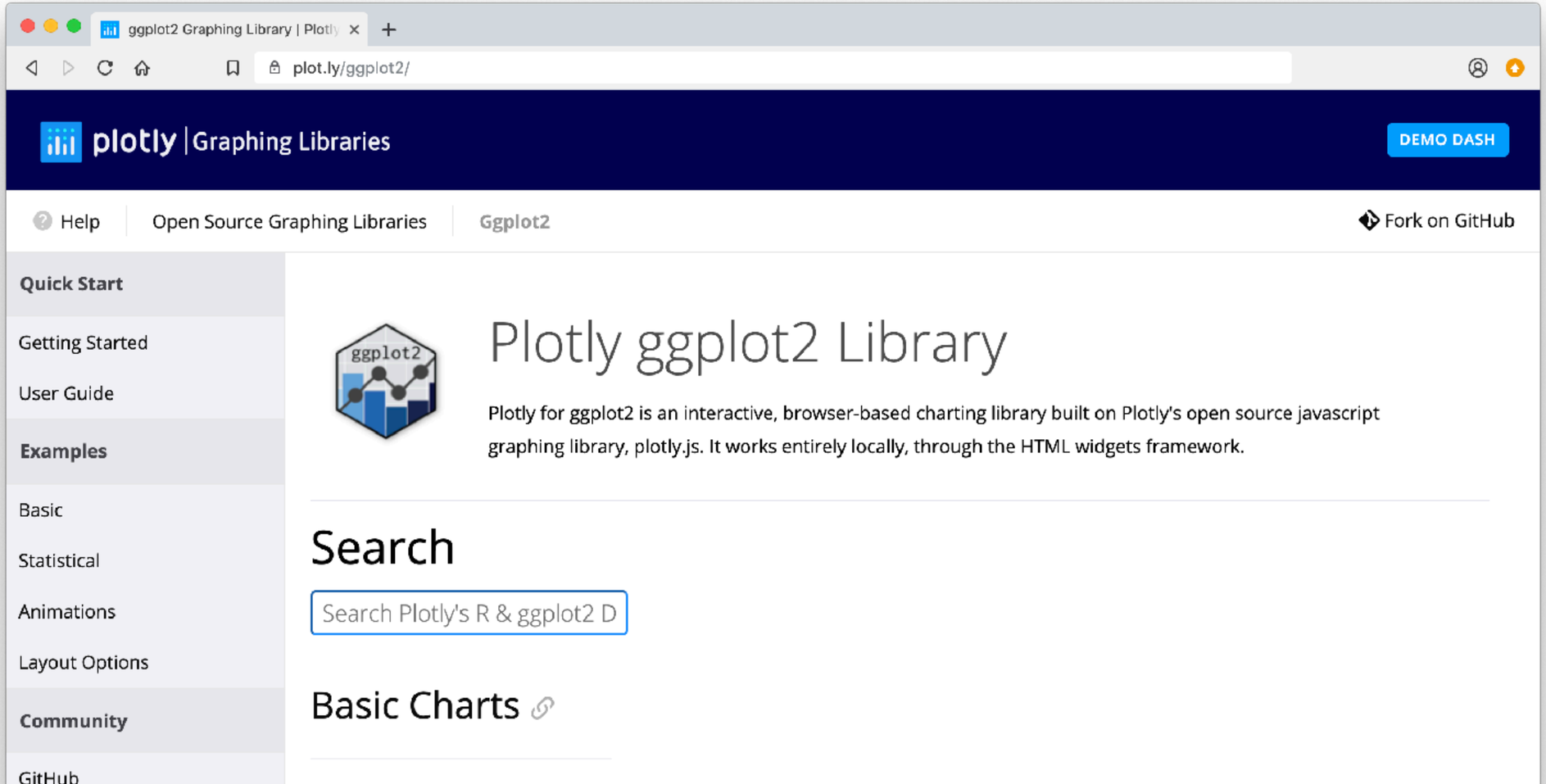
```
p <- ggplot(mpg) +
  geom_point(aes(displ, hwy)) +
  geom_smooth(aes(displ, hwy))

library(plotly)
ggplotly(p)
```

interactivity

Plotly

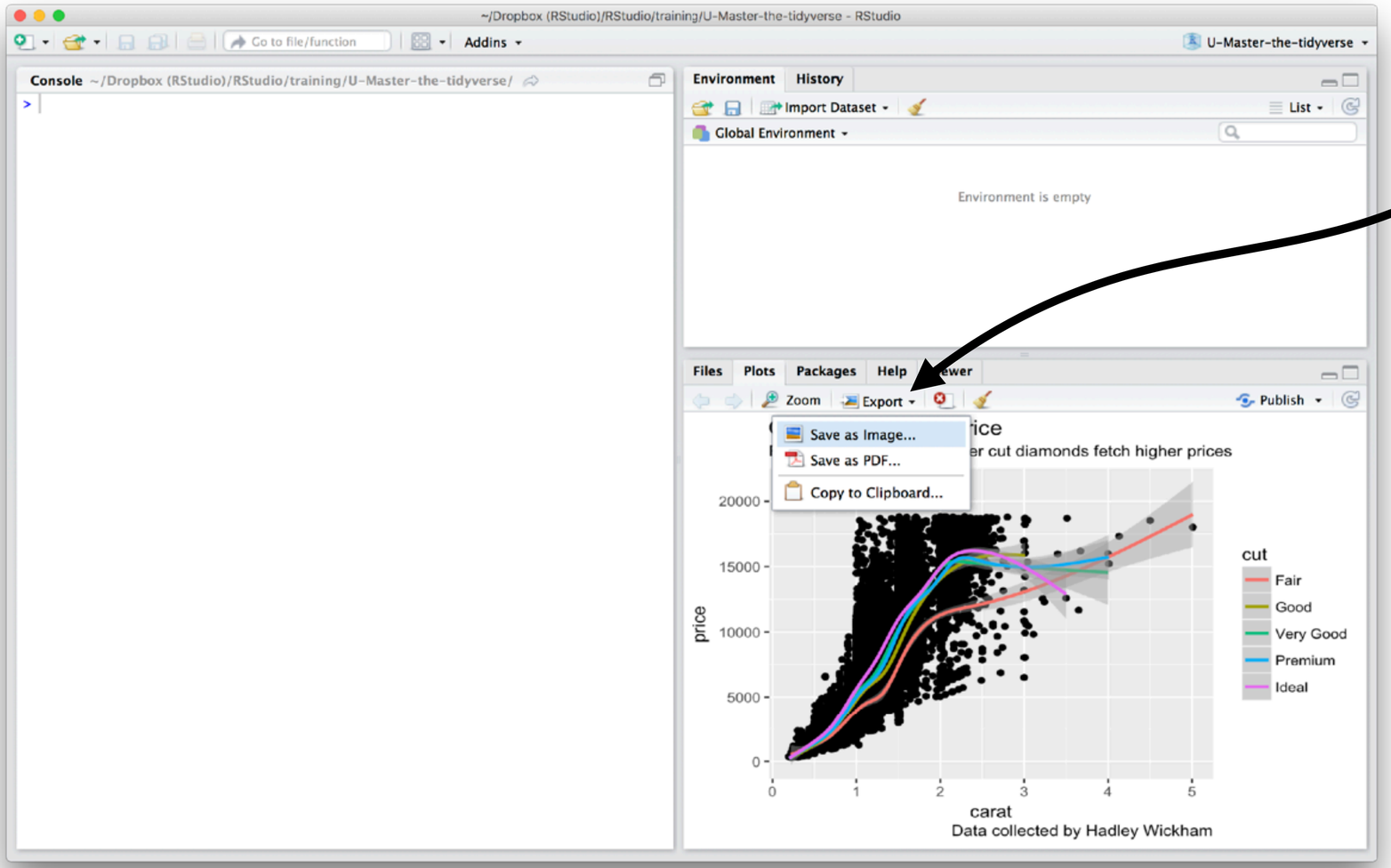
Tools for making interactive plots. plot.ly/ggplot2/



Saving graphs

Manually saving plots

Save plots manually with the export menu



ggplot2

Saving plots

ggsave() saves the last plot.
Uses size on screen:

```
ggsave("my-plot.pdf")
ggsave("my-plot.png")
```

Specify size in inches

```
ggsave("my-plot.pdf", width = 6, height
```

But where will it save it?

Your Turn 7

What does this command return?

```
getwd()
```

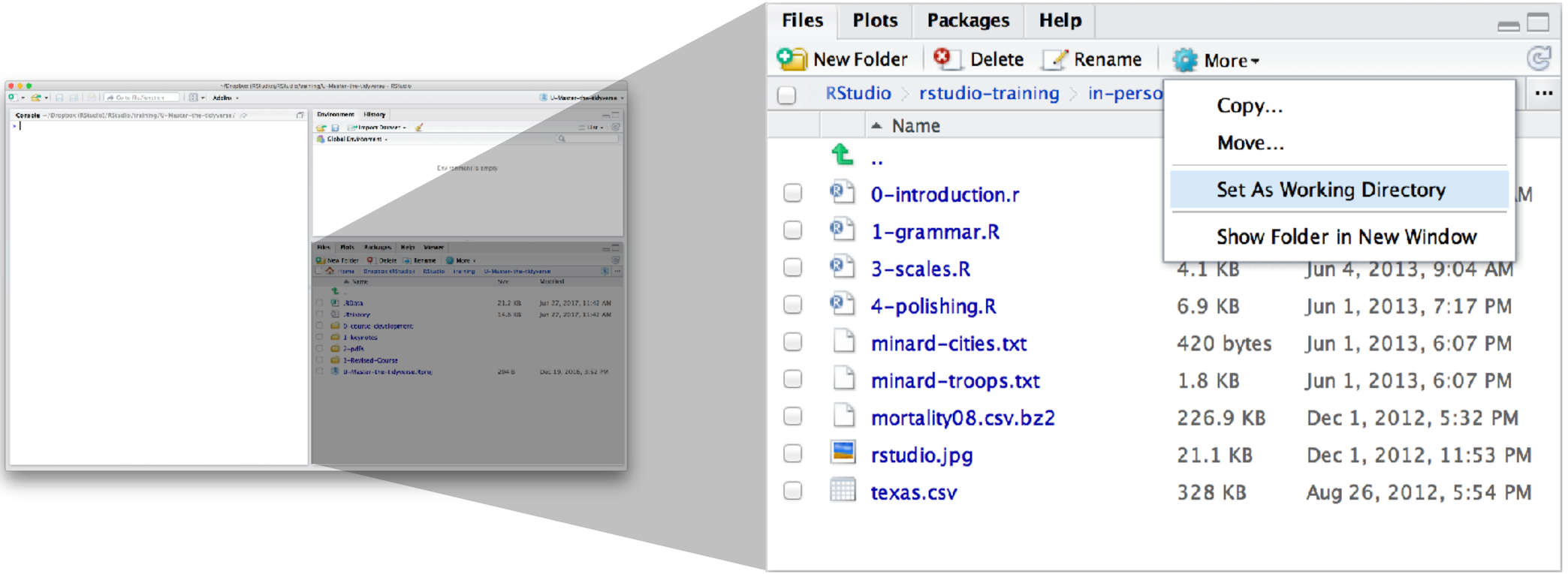
Working directory

R associates itself with a folder (i.e. directory) on your computer.

- This folder is known as your "working directory"
- When you save files, R will save them here
- When you load files, R will look for them here

Changing the Working directory

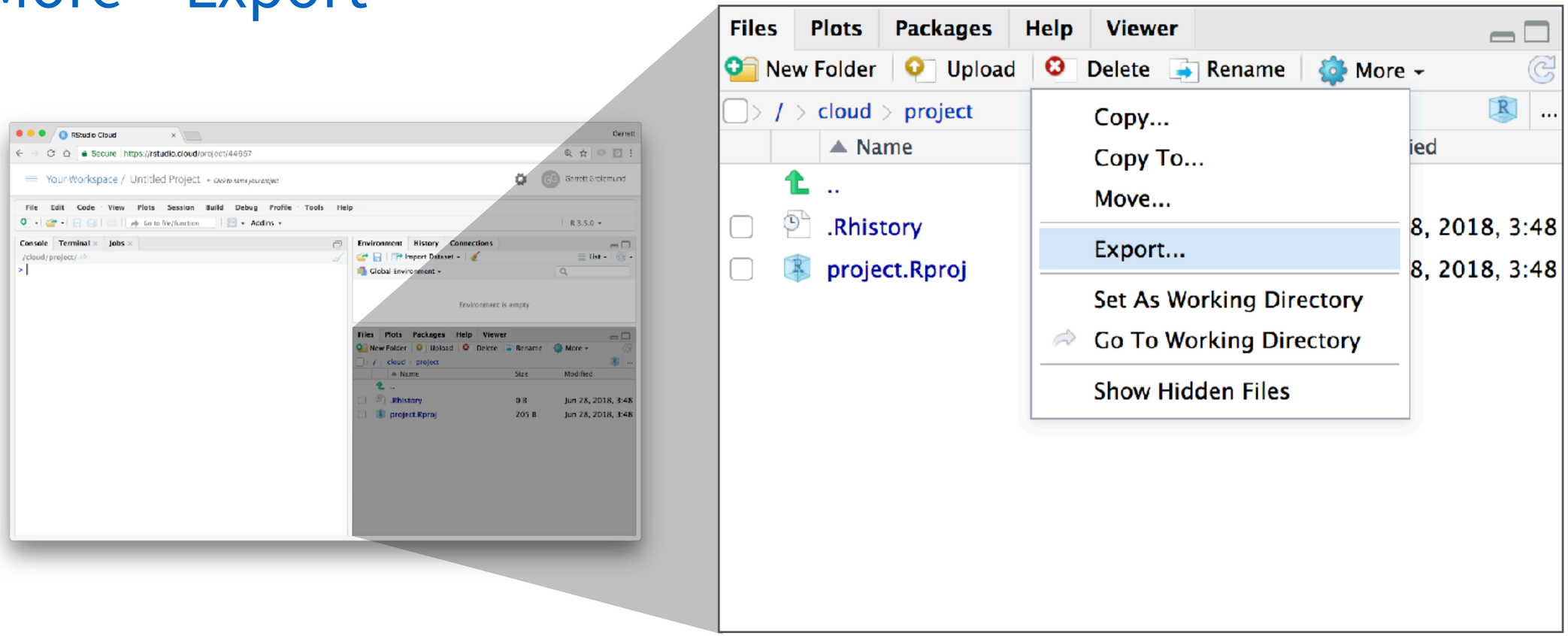
Navigate in the files pane to a new directory. Click More > Set As Working Directory



Download files

In the files pane, check next to the file(s) to download

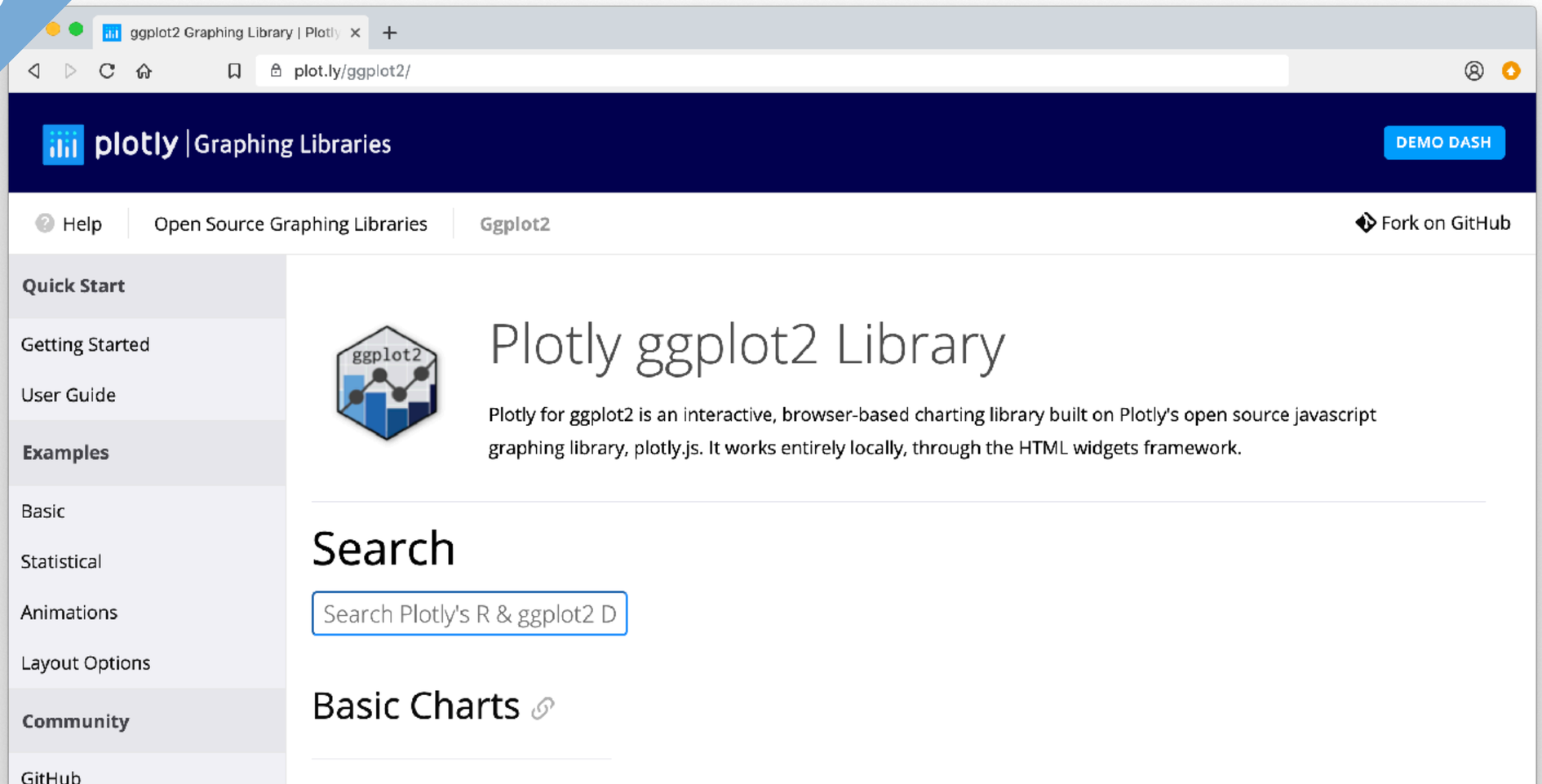
More > Export



Save with htmlwidgets::saveWidget()

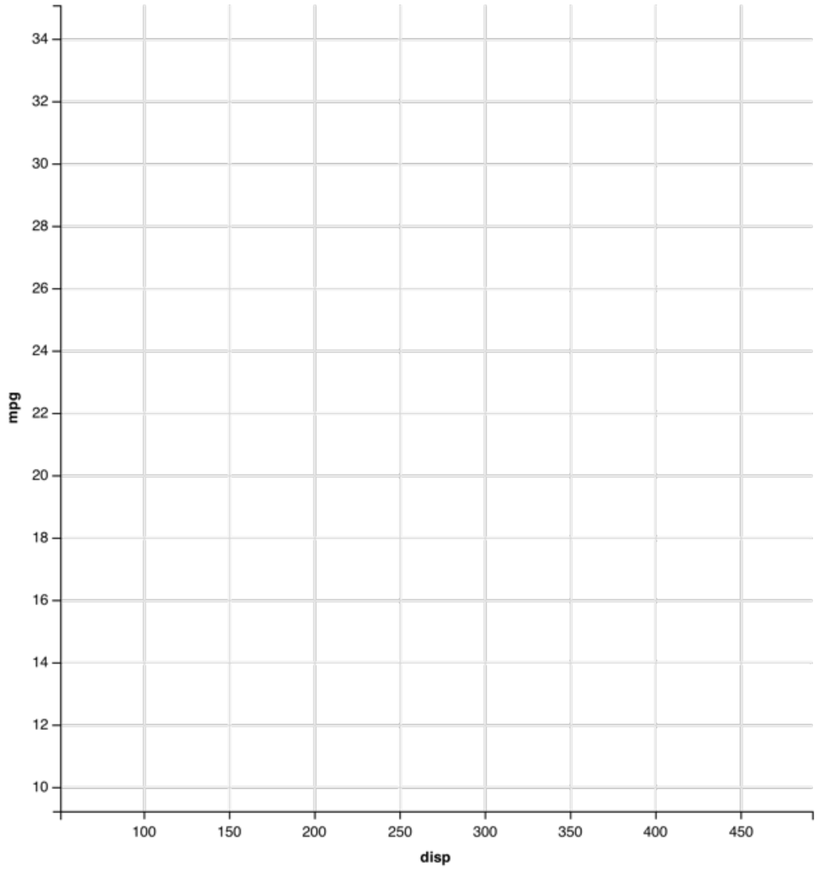
Plotly

s for making interactive plots. plot.ly/ggplot2/



Grammar of Graphics

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



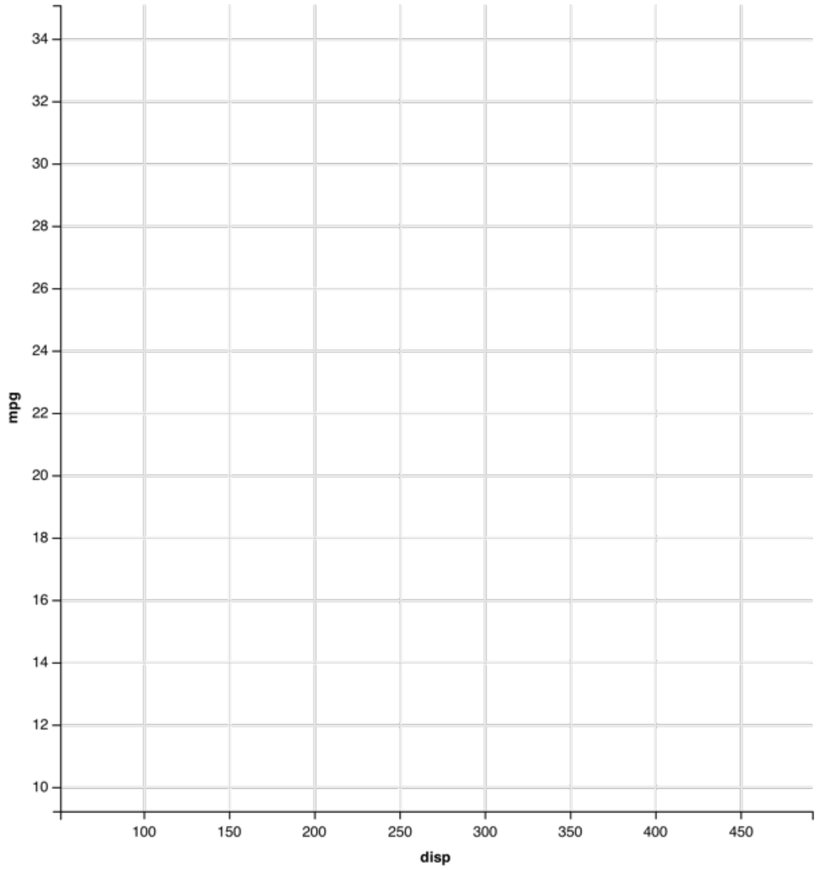
data geom

ggplot2

mappings

fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



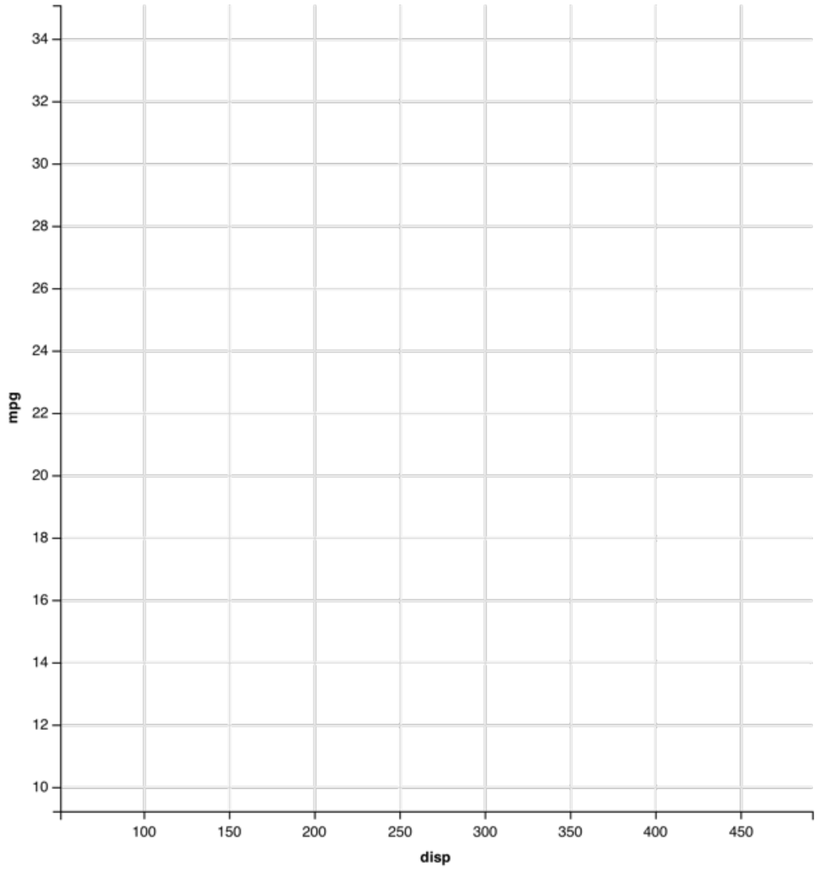
data geom

mappings

shape fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1

data

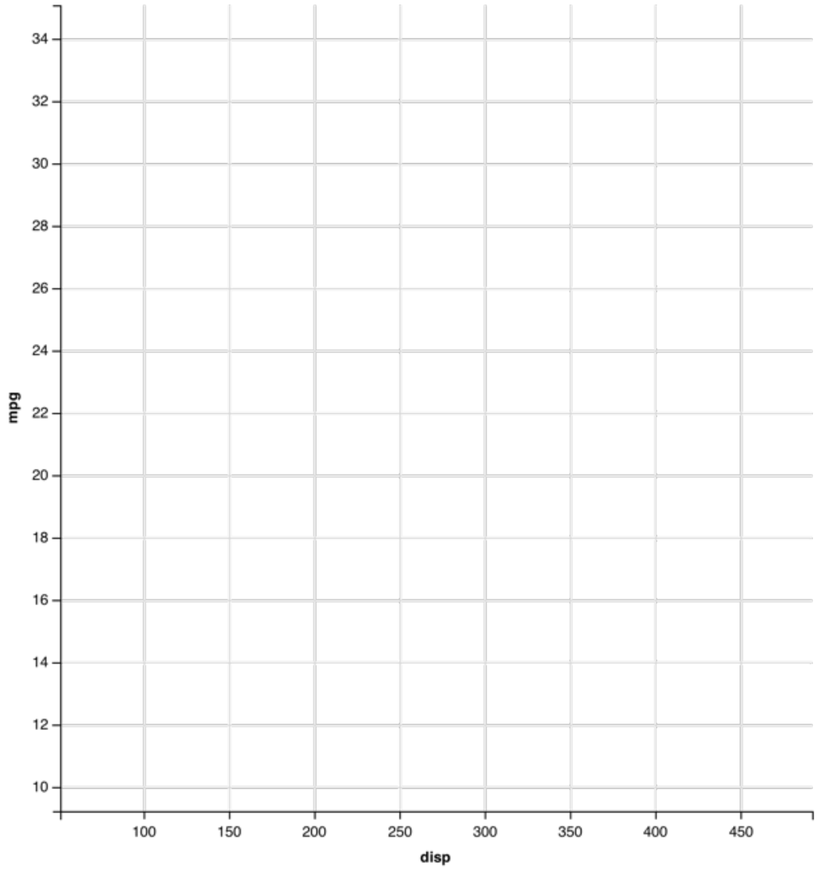


geom

mappings

shape x fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



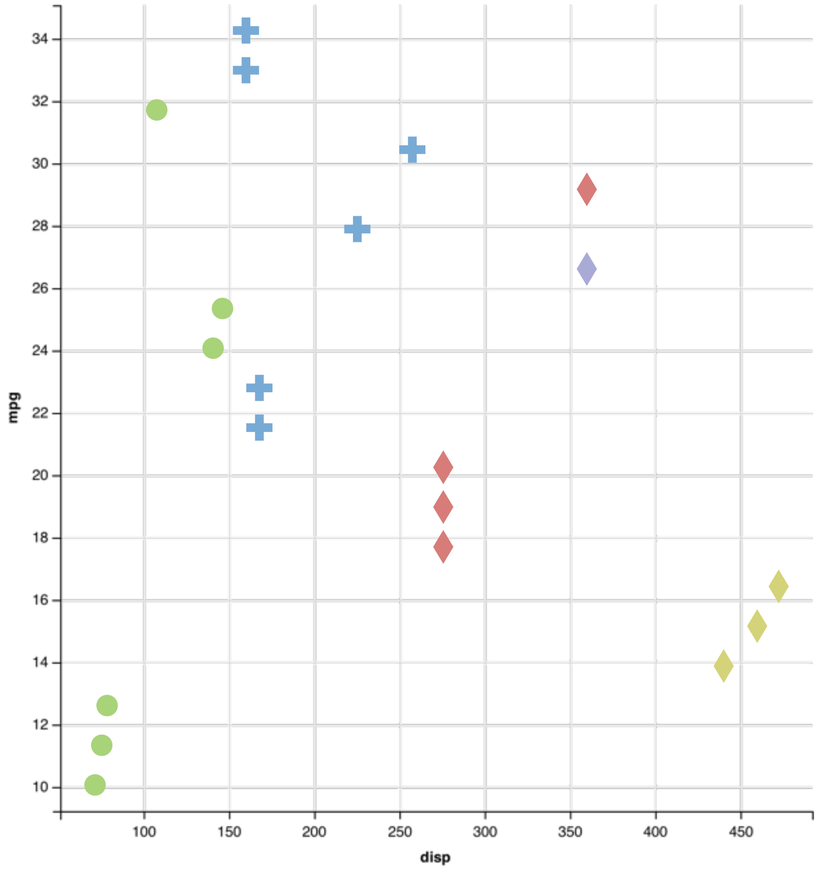
data geom

ggplot2

mappings

y shape x fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



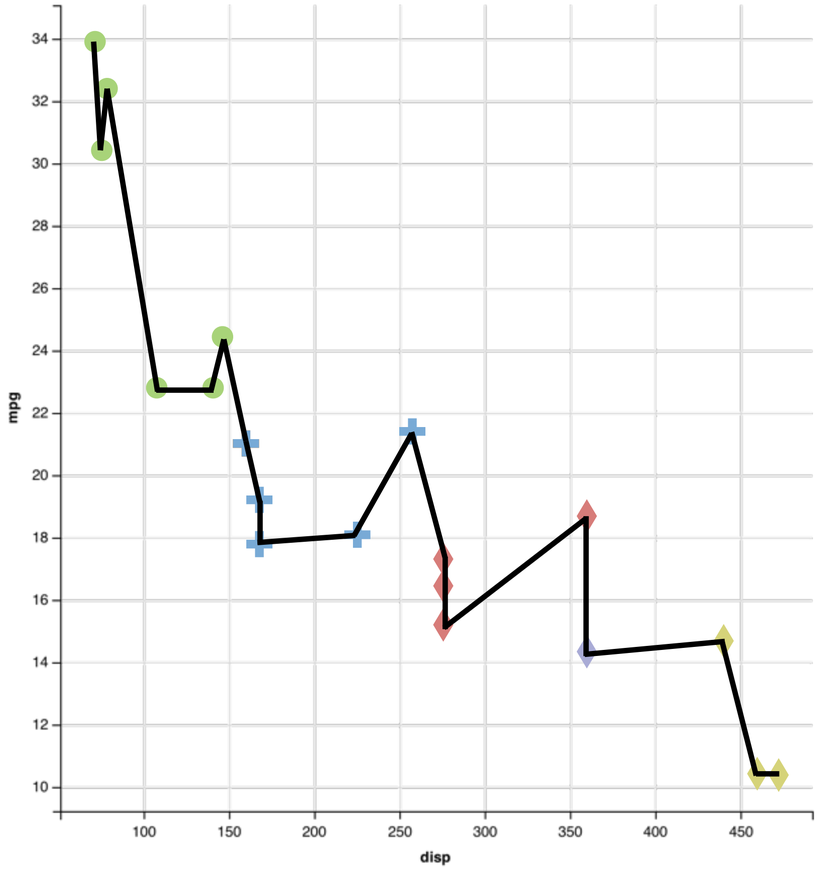
data geom

ggplot2

mappings

y shape x fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



data

geom

points

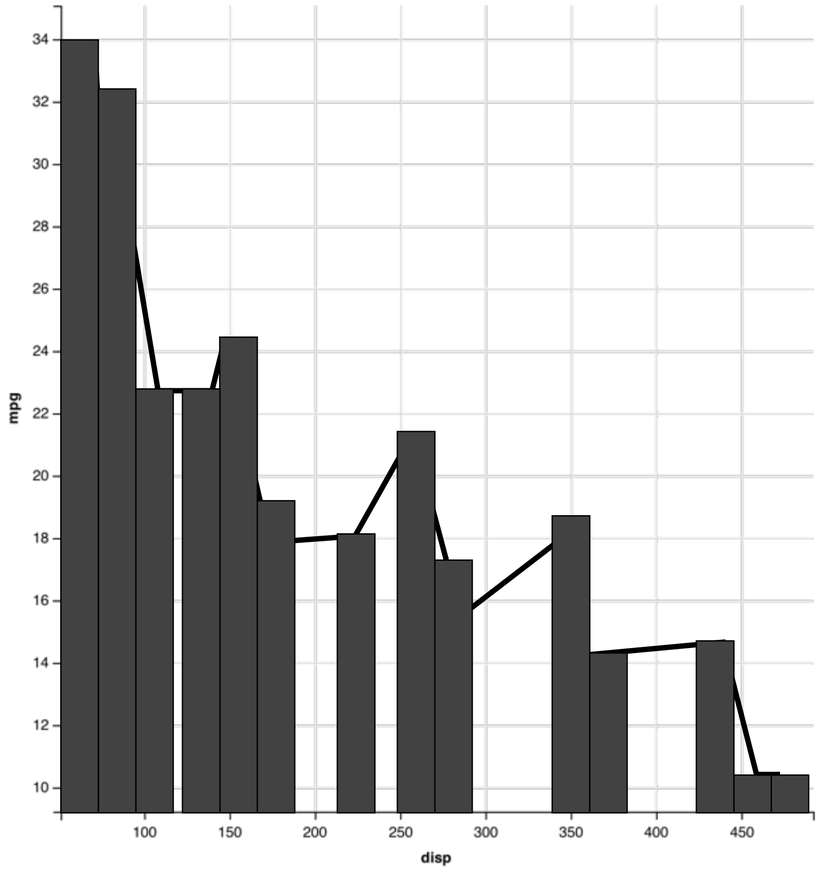
lines

ggplot2

mappings

y x

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



data **geom**

points

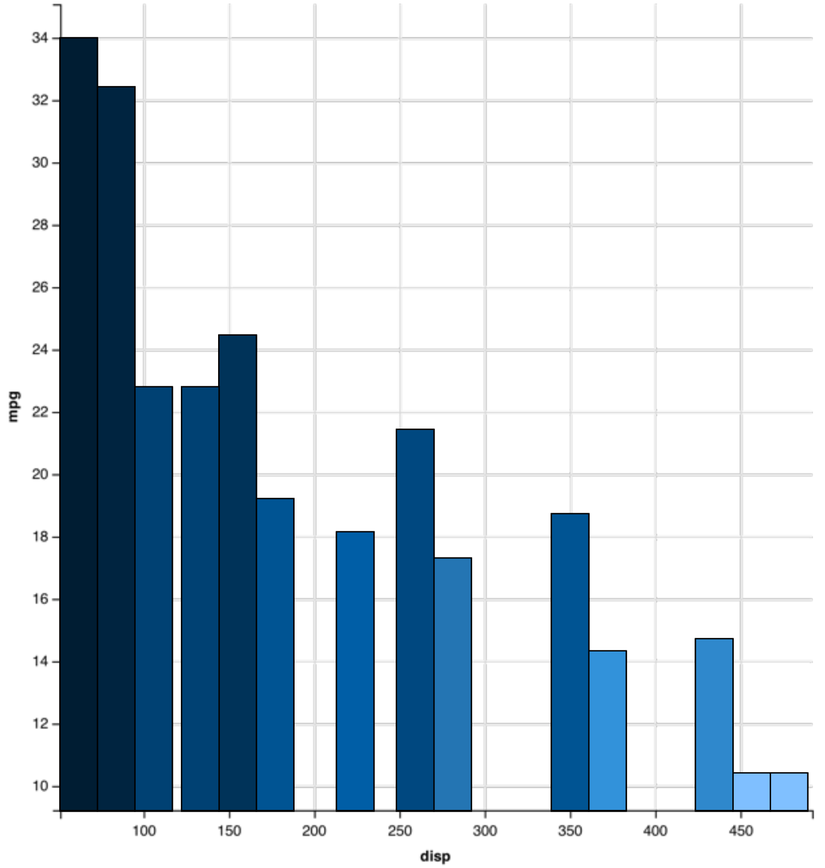
lines

bars

mappings

y fill

mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1



data

geom

points

lines

bars

ggplot2

To make a graph

[template]

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>))
```

To make a graph

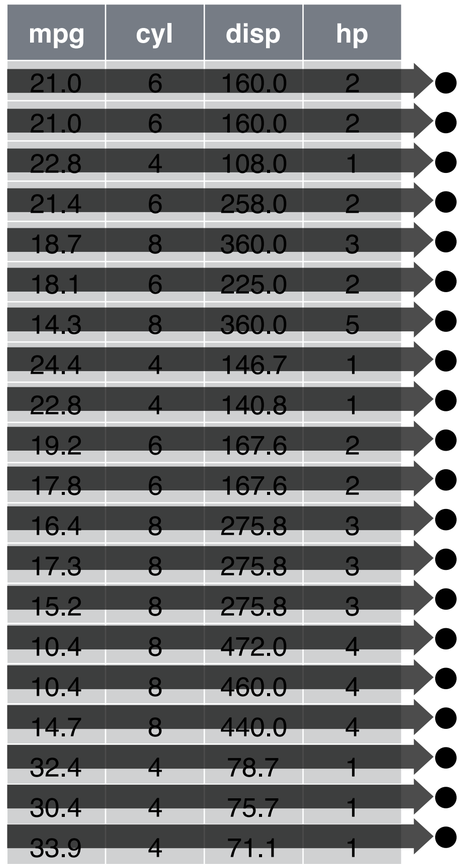
mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1

data

1. Pick a **data** set

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>))
```

To make a graph



mpg	cyl	disp	hp
21.0	6	160.0	2
21.0	6	160.0	2
22.8	4	108.0	1
21.4	6	258.0	2
18.7	8	360.0	3
18.1	6	225.0	2
14.3	8	360.0	5
24.4	4	146.7	1
22.8	4	140.8	1
19.2	6	167.6	2
17.8	6	167.6	2
16.4	8	275.8	3
17.3	8	275.8	3
15.2	8	275.8	3
10.4	8	472.0	4
10.4	8	460.0	4
14.7	8	440.0	4
32.4	4	78.7	1
30.4	4	75.7	1
33.9	4	71.1	1

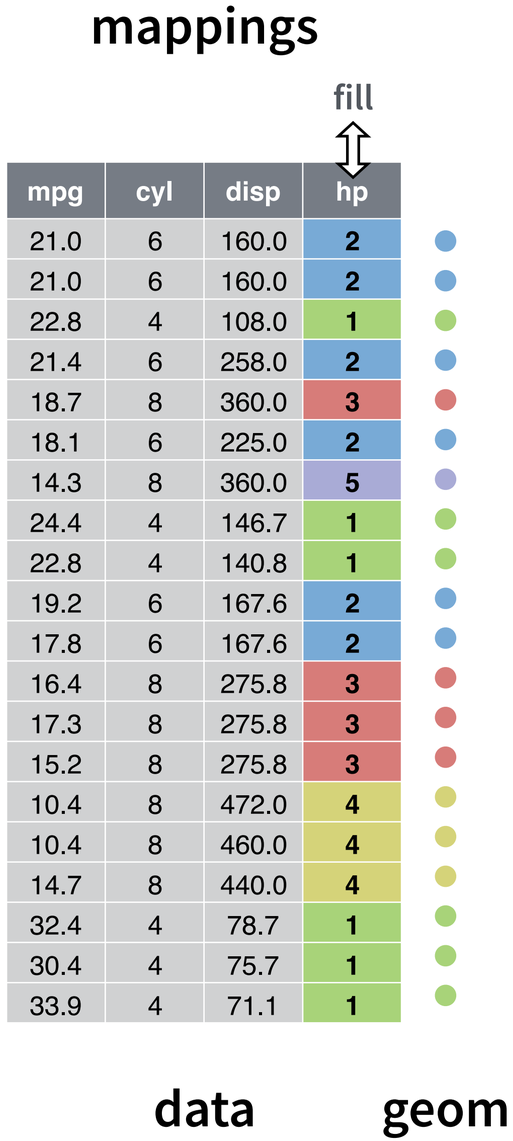
data **geom**

1. Pick a **data** set

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>))
```

2. Choose a **geom** to display cases

To make a graph



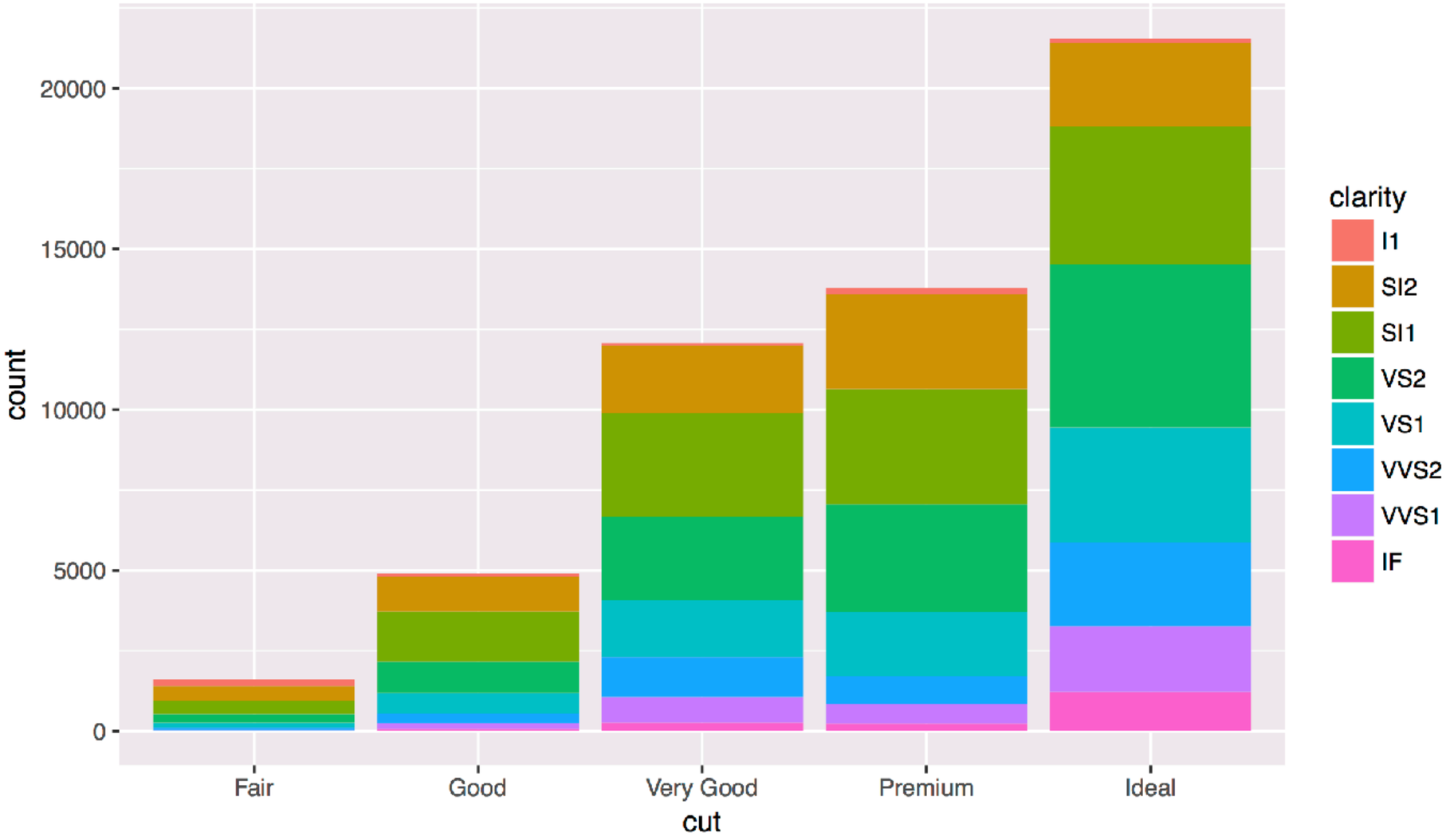
1. Pick a **data** set

```
ggplot(data = <DATA>) +
  <GEOM_FUNCTION>(mapping = aes(<MAPPINGS>))
```

2. Choose a **geom** to display cases

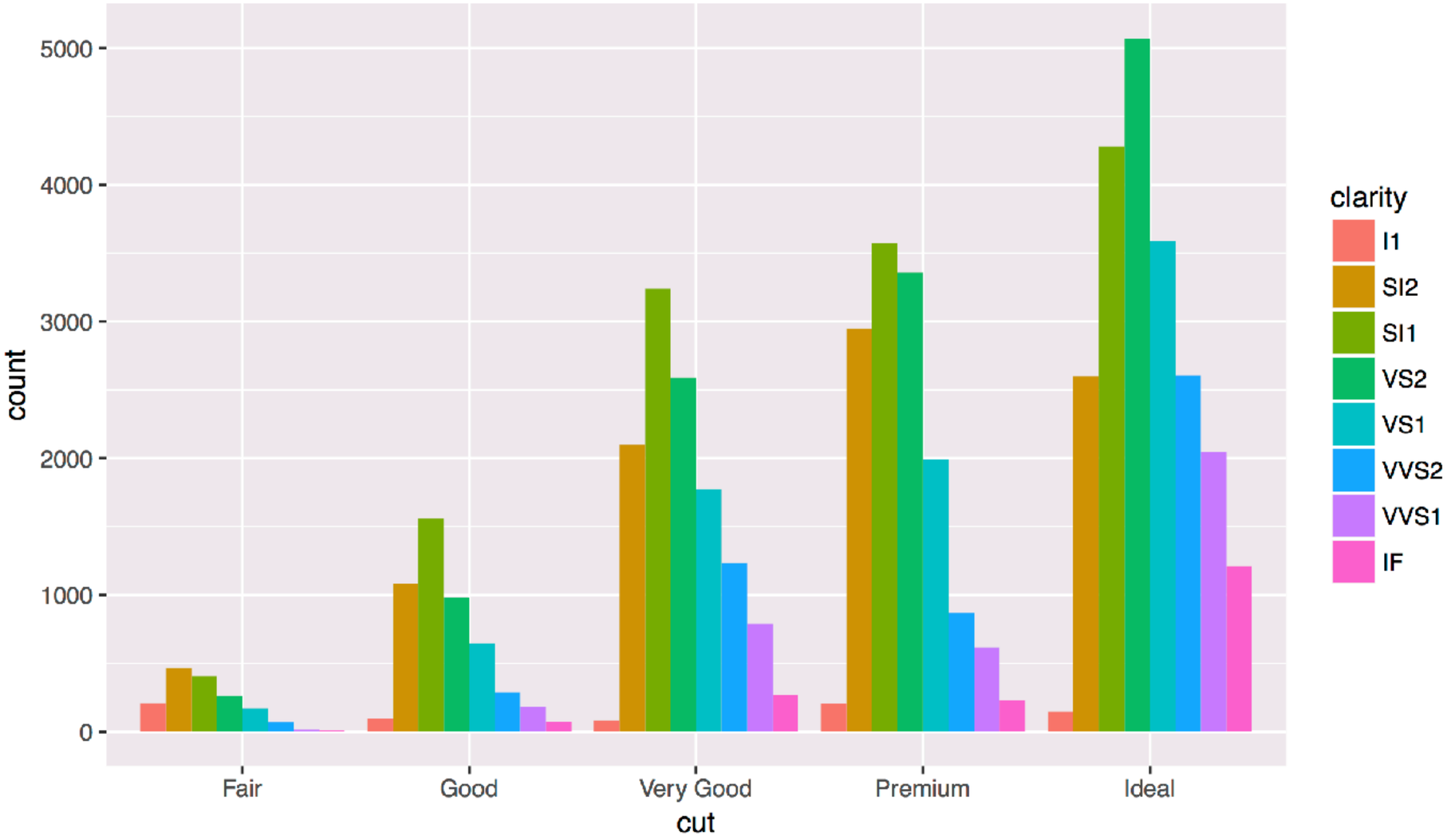
3. **Map** aesthetic properties to variables

What else?


20000
15000
10000
5000
0
count
Fair
Good
Very Good
Premium
Ideal
cut
clarity
I1
SI2
SI1
VS2
VS1
VVS2
VVS1
IF

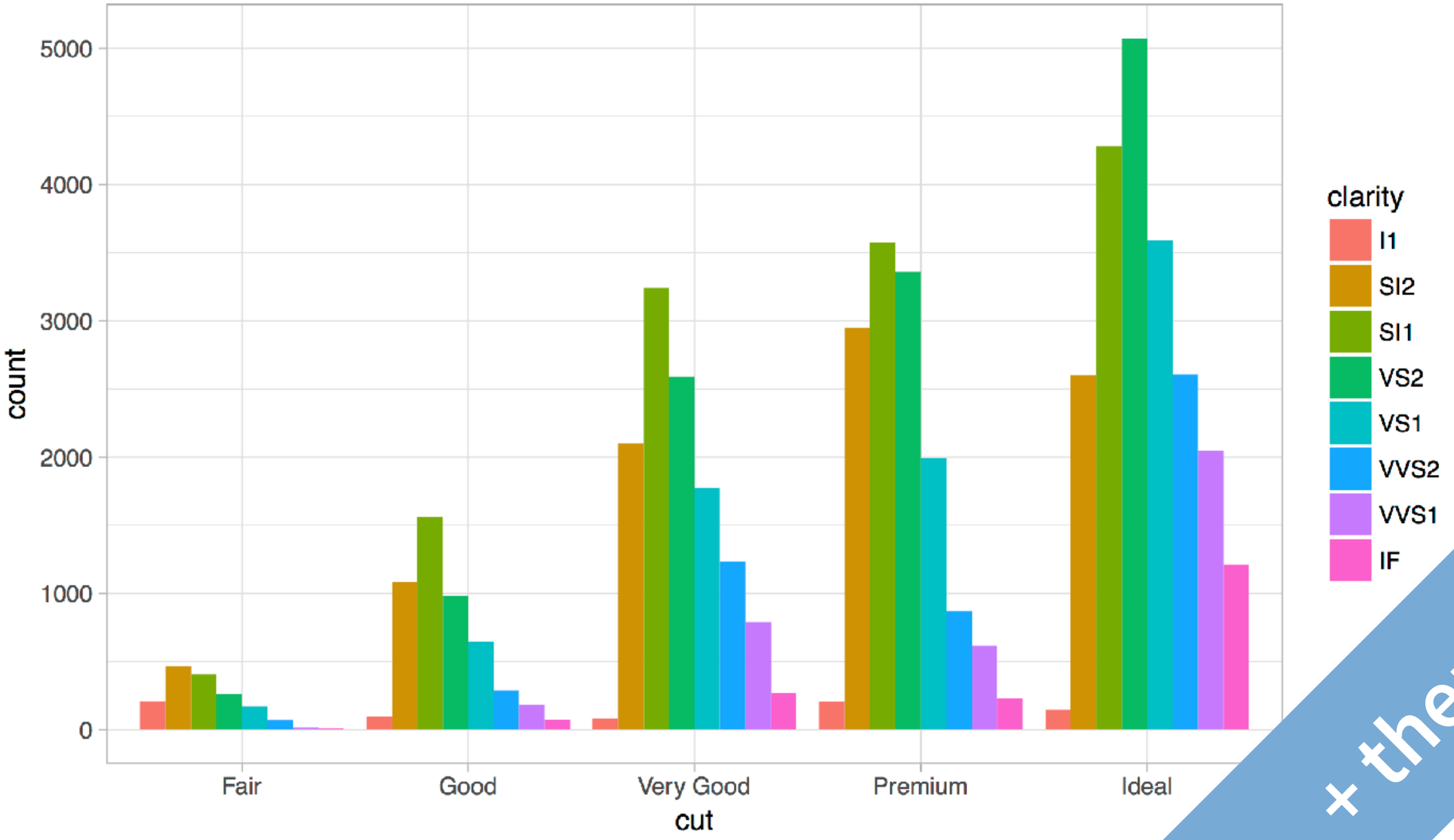
Position Adjustments

How overlapping objects are arranged



Themes

Visual appearance of non-data elements

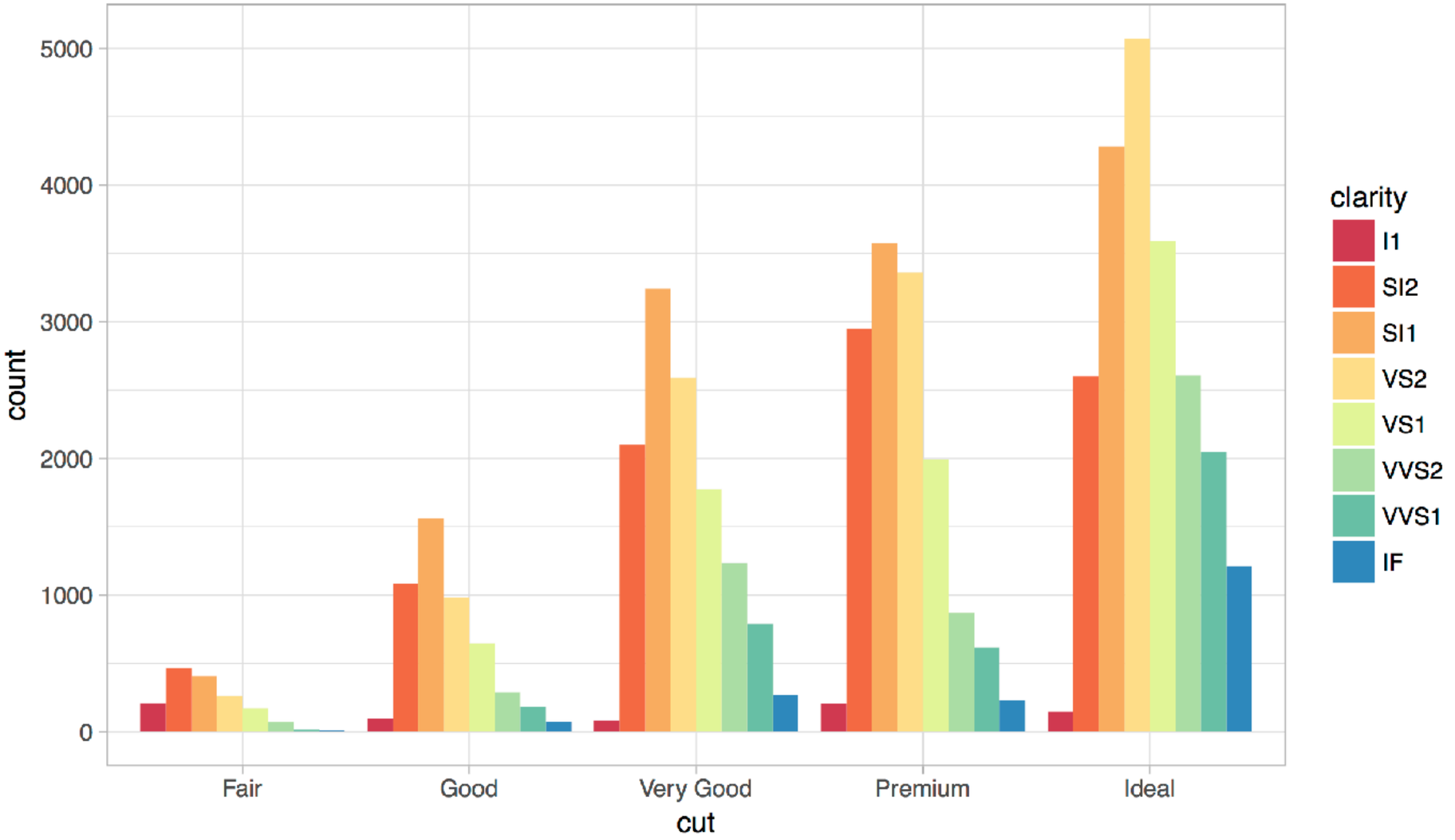


+ theme_bw()

ggplot2

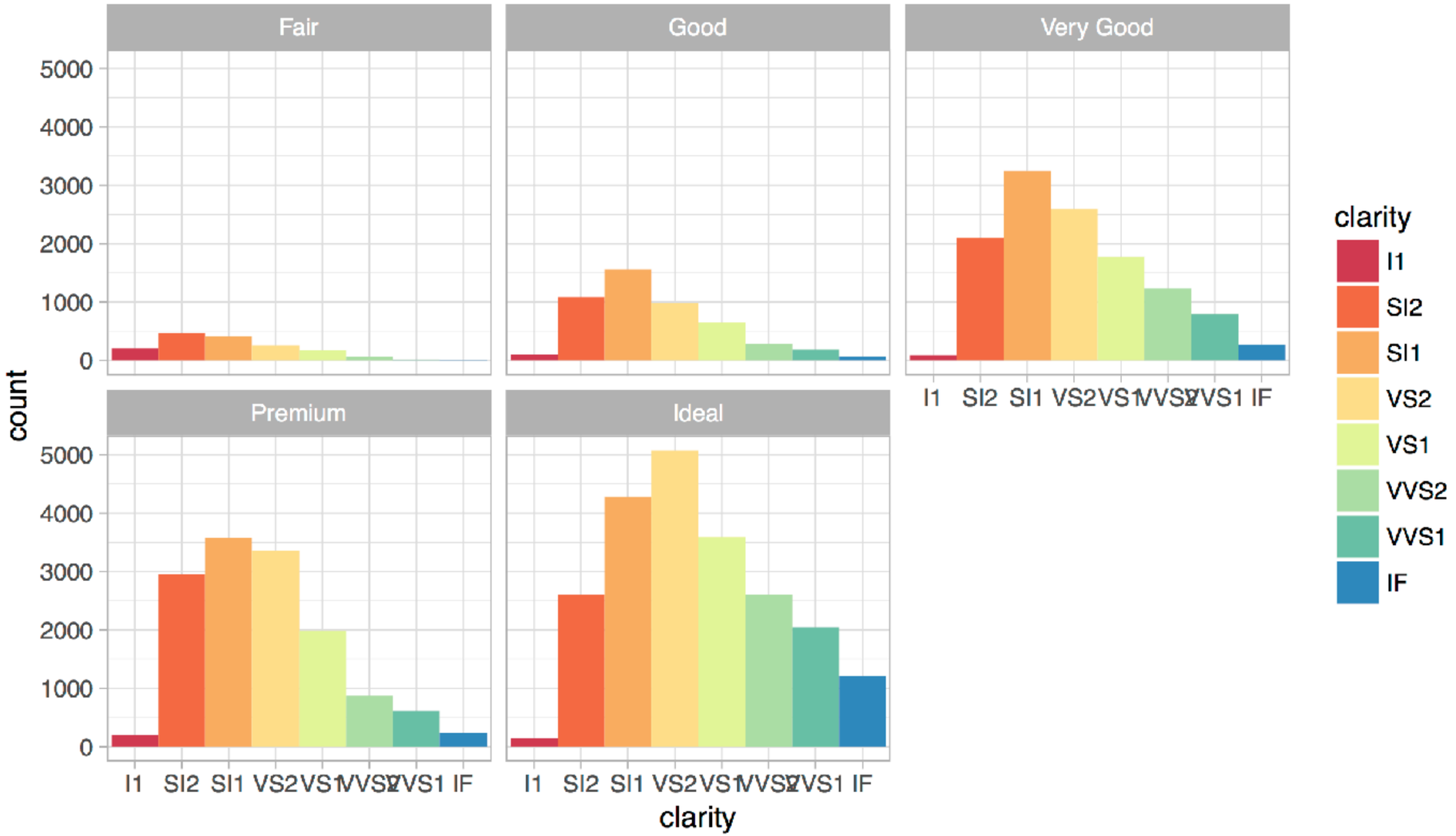
Scales

Customize color scales, other mappings



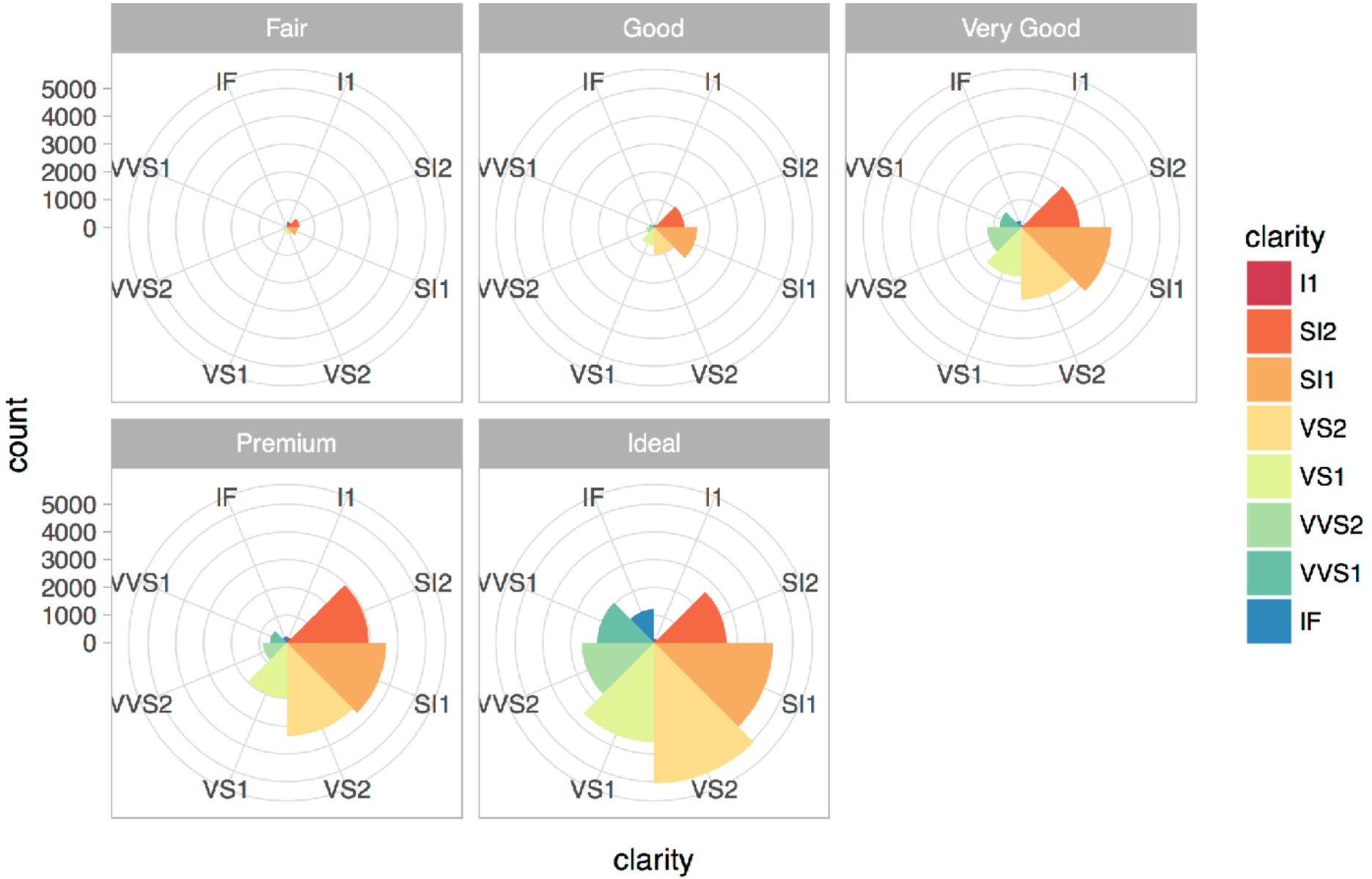
Facets

Subplots that display subsets of the data.

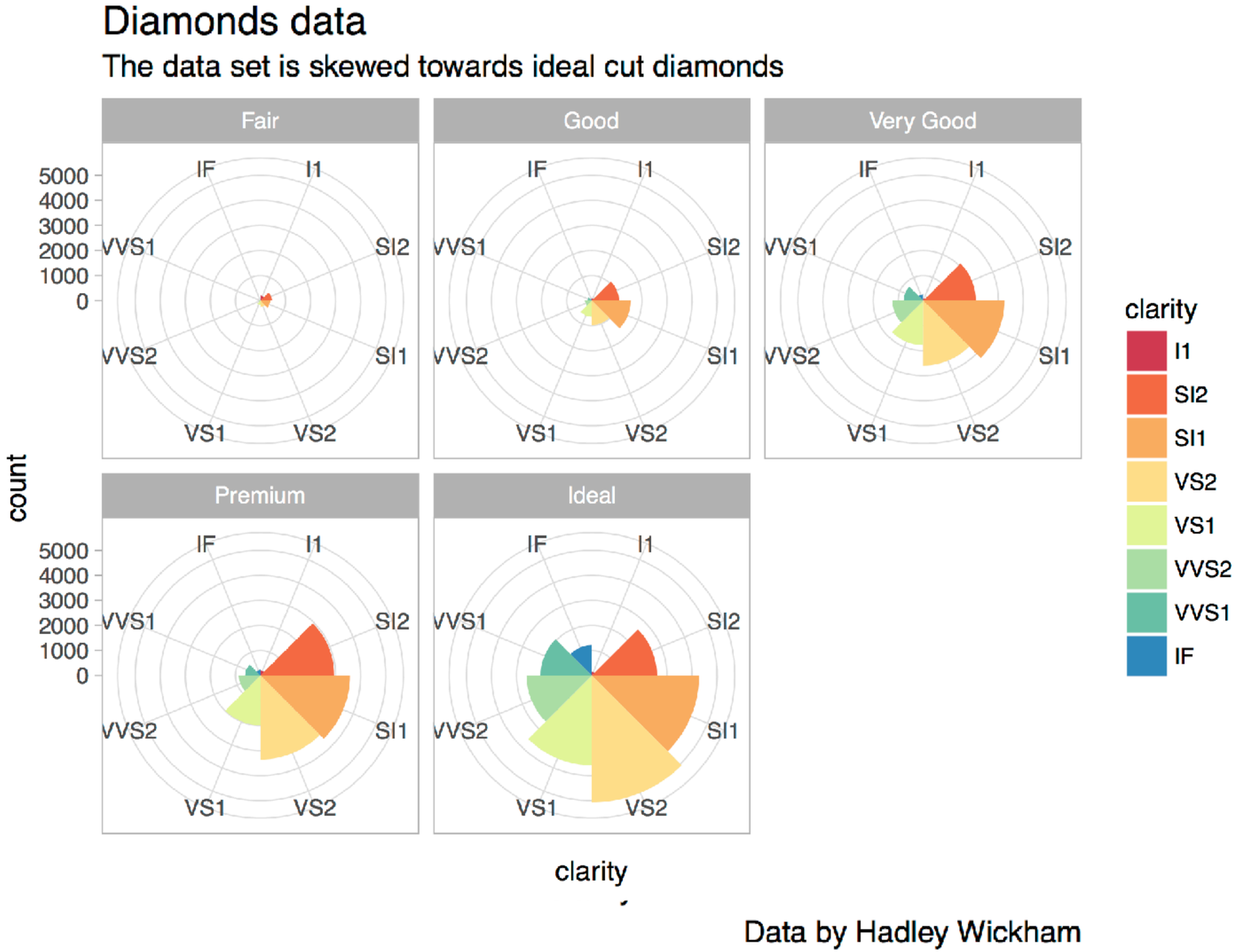


ggplot2

Coordinate systems



Titles and captions



A ggplot2 template

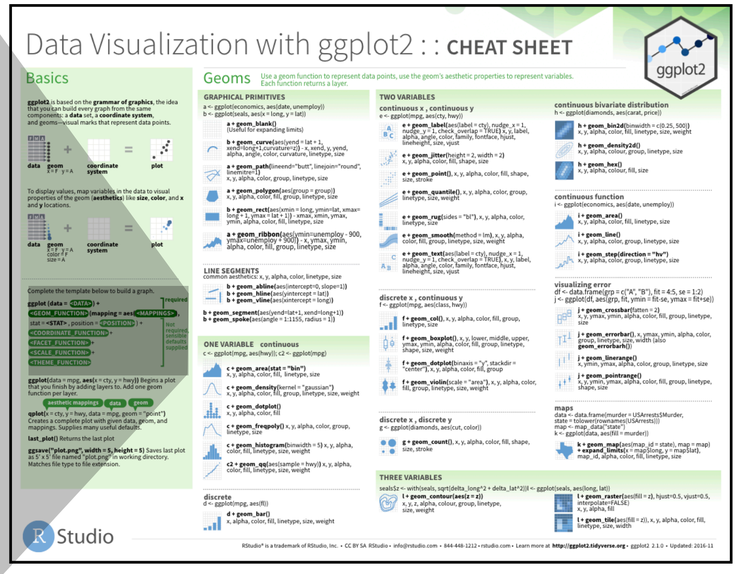
Make any plot by filling in the parameters of this template

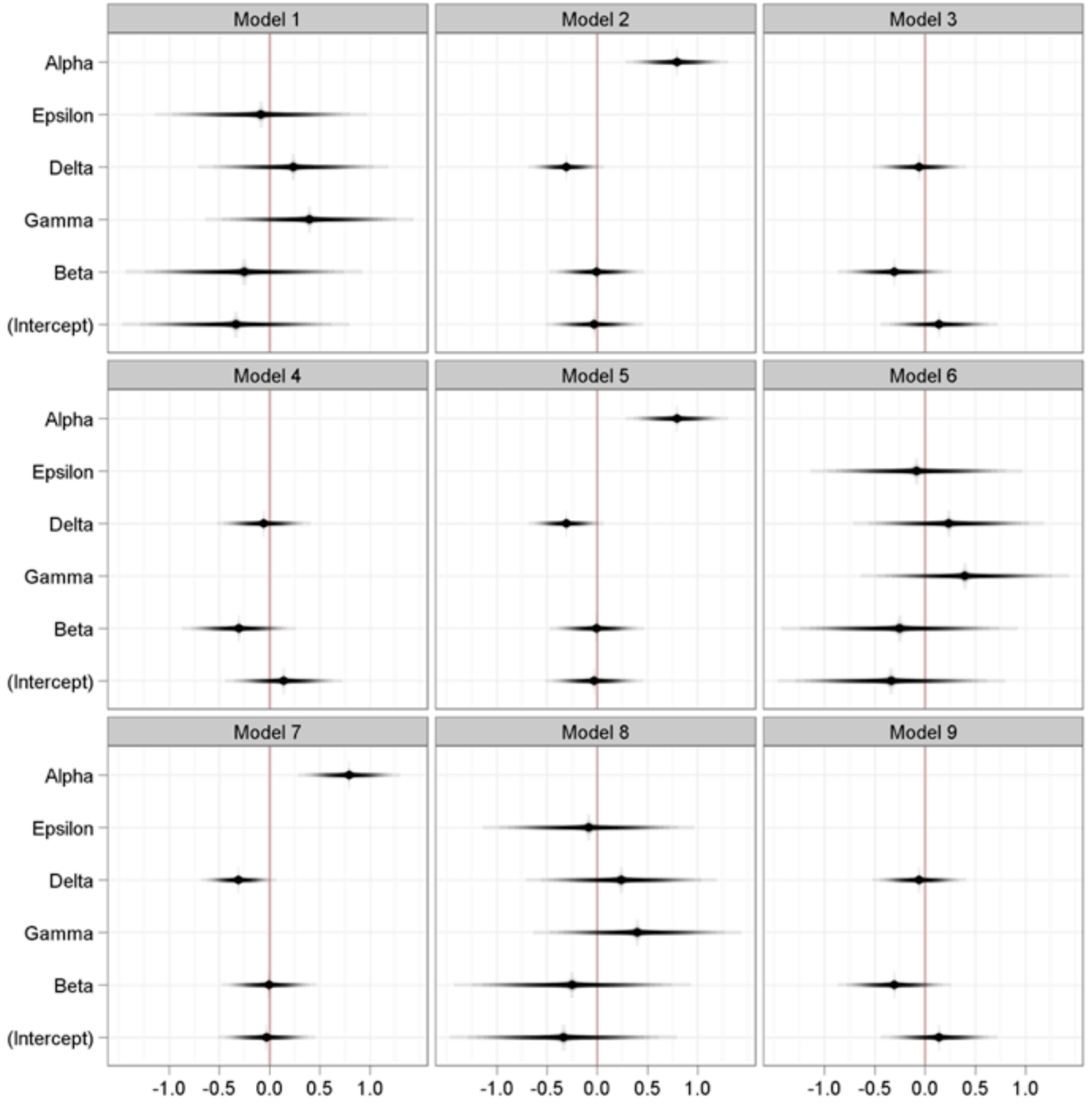
Complete the template below to build a graph.

```
ggplot (data = <DATA>) +
<GEOM_FUNCTION>(mapping = aes(<MAPPINGS>),
 stat = <STAT>, position = <POSITION> ) +
<COORDINATE_FUNCTION> +
<FACET_FUNCTION> +
<SCALE_FUNCTION> +
<THEME_FUNCTION>
```

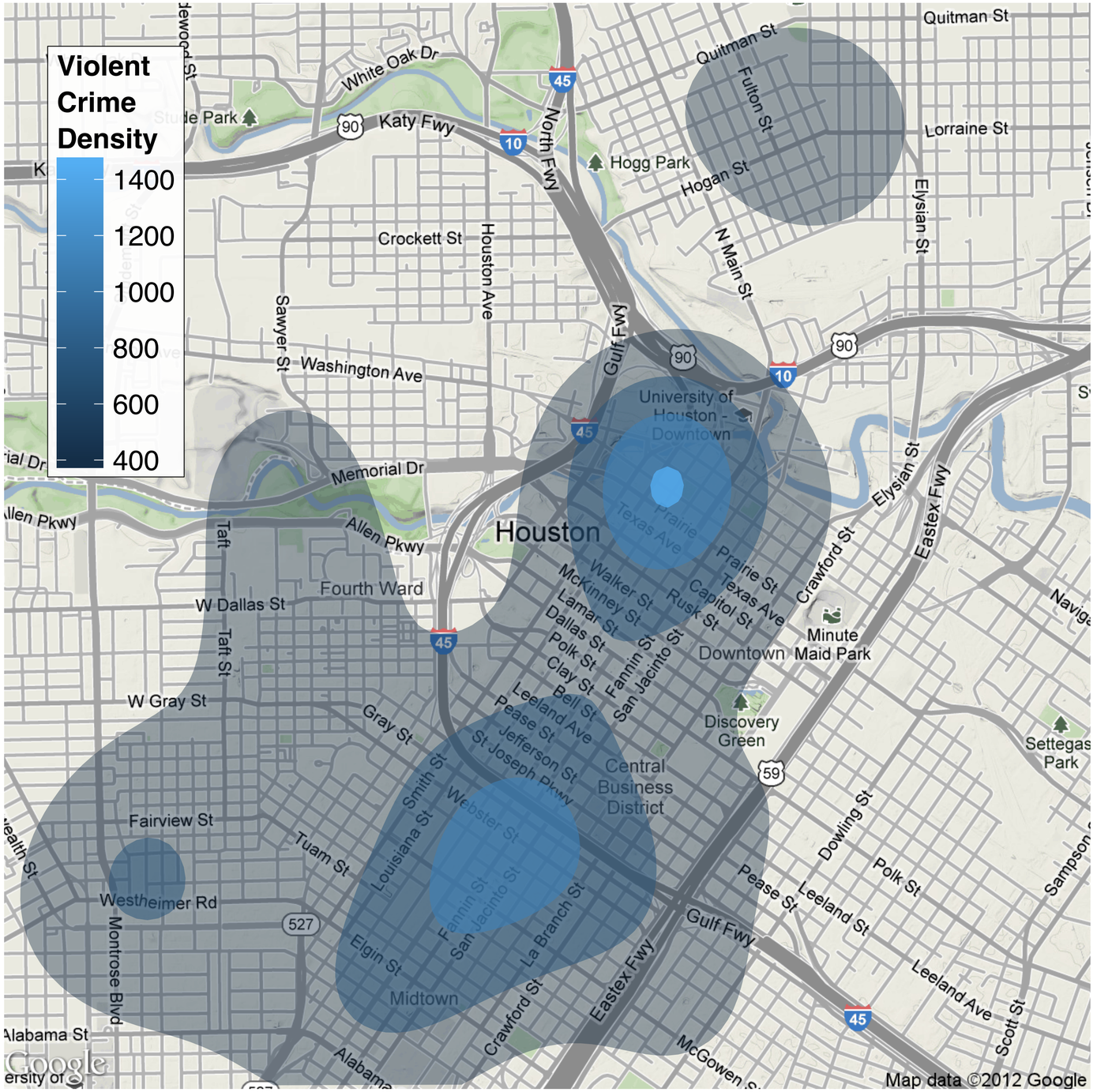
required

Not required, sensible defaults supplied

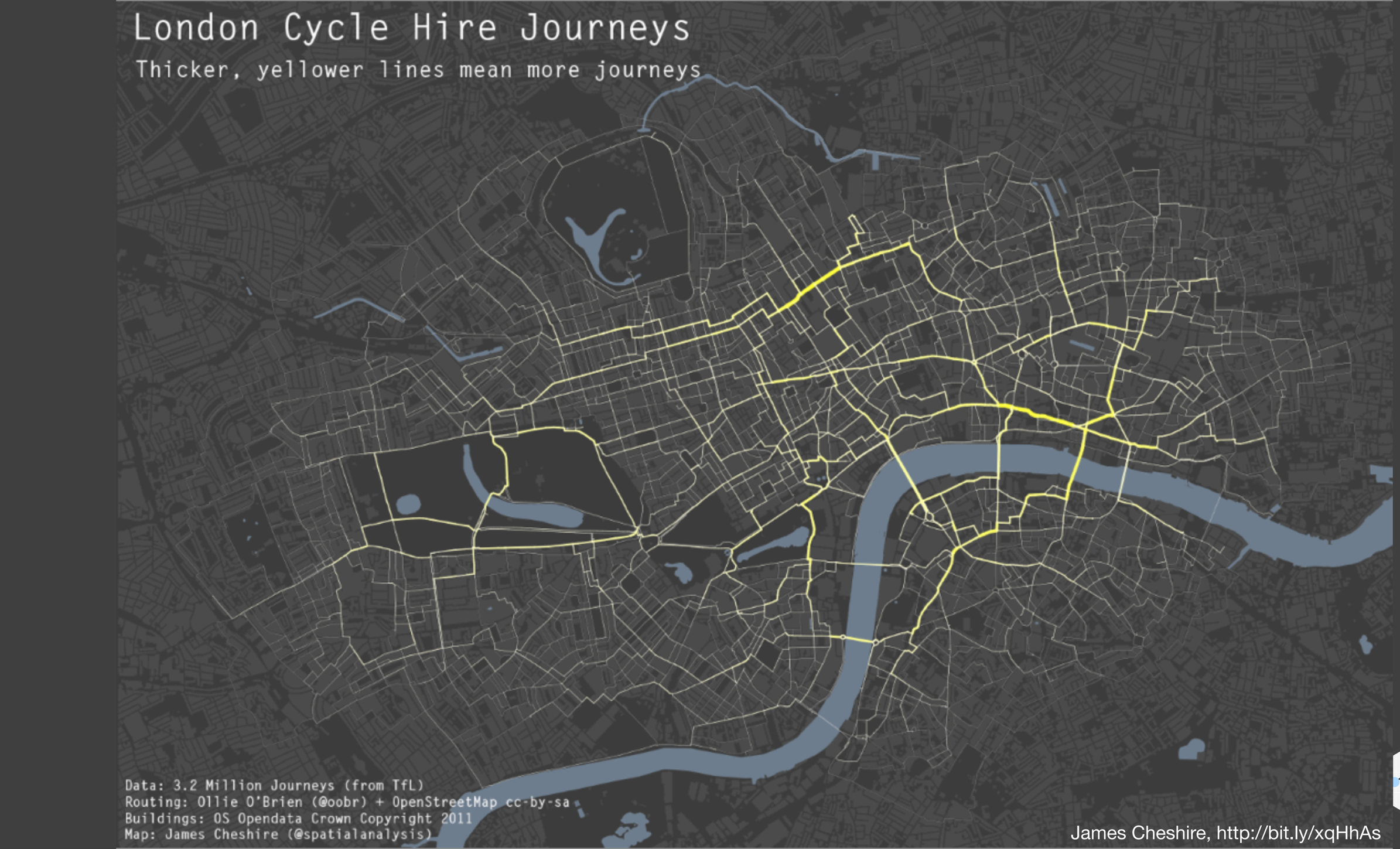




David B Sparks, http://bit.ly/hn54NW



David Kahle, https://dl.dropbox.com/u/24648660/ggmap%20useR%202012.pdf



ggplot2

James Cheshire, http://bit.ly/xqHhAs

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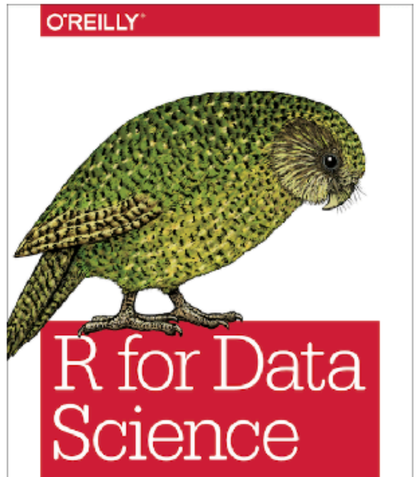
R for Data Science

Garrett Grolemund

Hadley Wickham

Welcome

This is the website for **"R for Data Science"**. This book will teach you how to do data science with R: You'll learn how to get your data into R, get it into the most useful structure, transform it, visualise it and model it. In this book, you will find a practicum of skills for data science. Just as a chemist learns how to clean test tubes and stock a lab, you'll learn how to clean data and draw plots—and many other things besides. These are the skills that allow data science to happen, and here you will find the best practices for doing each of these things with R. You'll learn how to use the grammar of graphics, literate programming, and reproducible research to save time. You'll also learn how to



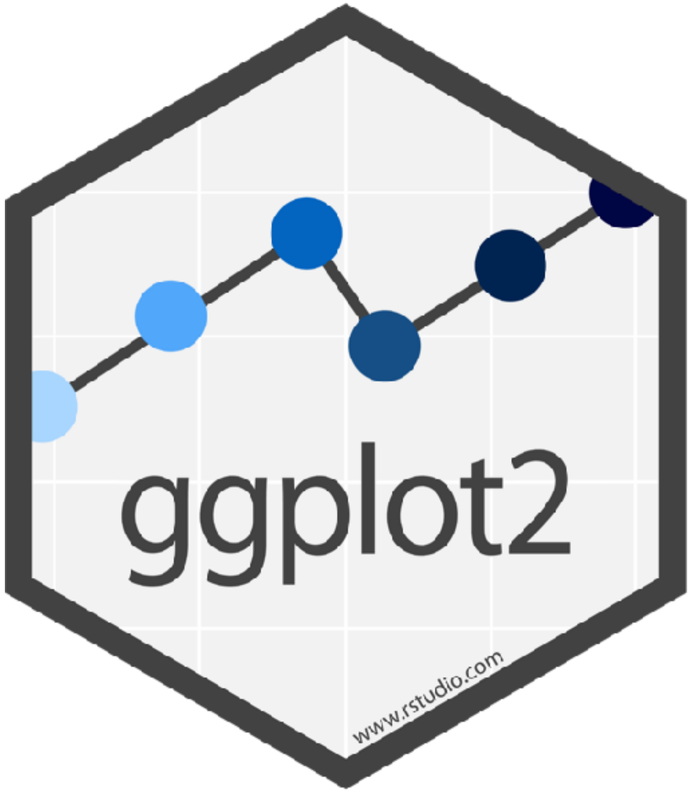
ggplot2

Your Turn

Navigate up to the **03-Transform** folder.

Open **03-Transform-Exercises.Rmd**

Visualize Data with



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