ggplot2 basics

Hadley Wickham

Assistant Professor / Dobelman Family Junior Chair

Department of Statistics / Rice University

July 2012

1. Rstudio
2. Diving in: scatterplots & aesthetics
3. Facetting and geoms
4. Diamonds data
5. Bar charts and histograms

Diving in


Learning a new
language is hard!

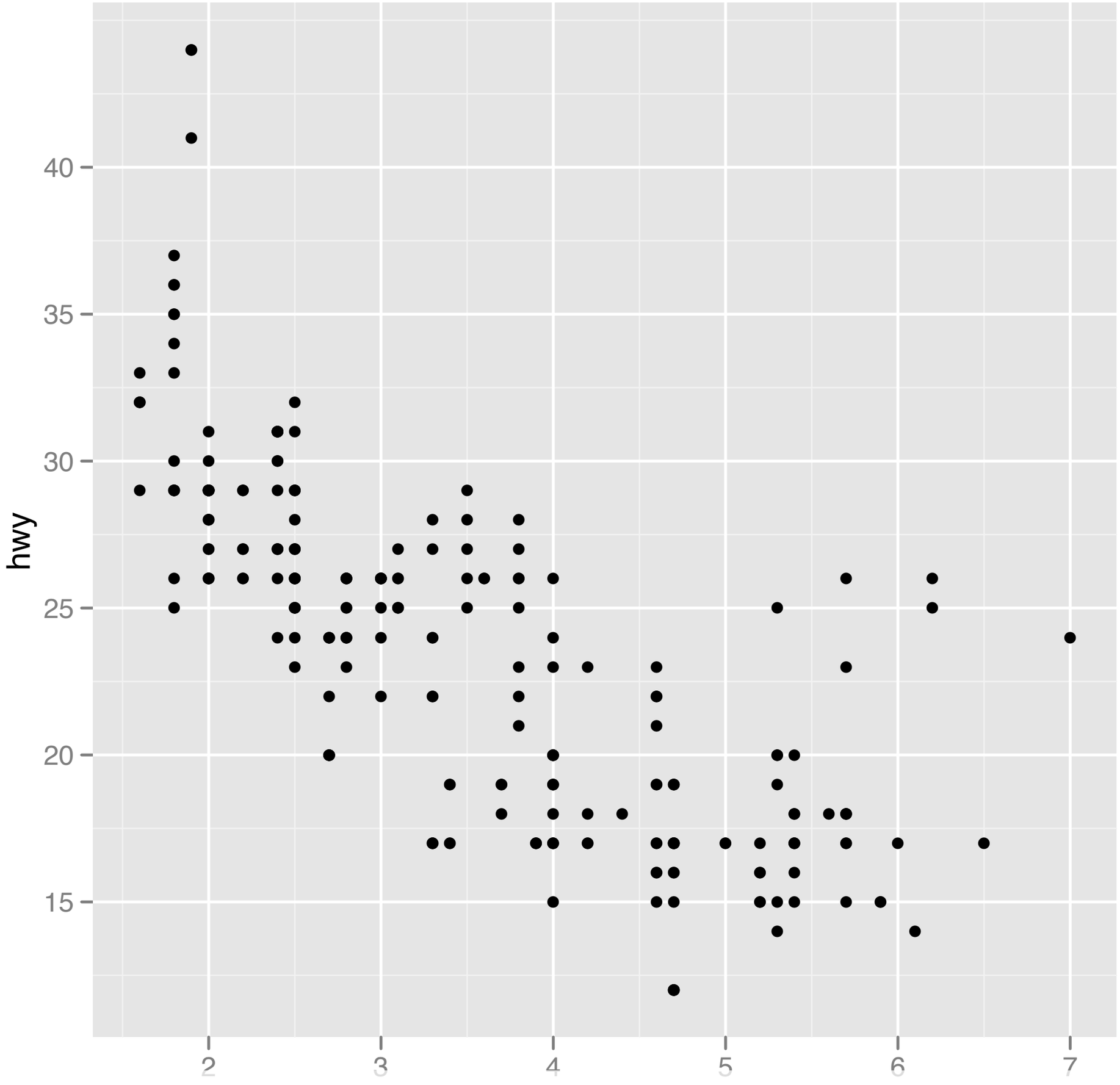
Scatterplot basics

```
install.packages("ggplot2")
library(ggplot2)

?mpg
head(mpg)
str(mpg)
summary(mpg)

qplot(displ, hwy, data = mpg)
```

Scatterplot basics

```
install.packages("ggplot2")
library(ggplot2)

?mpg
head(mpg)
str(mpg)
summary(mpg)

qplot(displ, hwy, data = mpg)
```

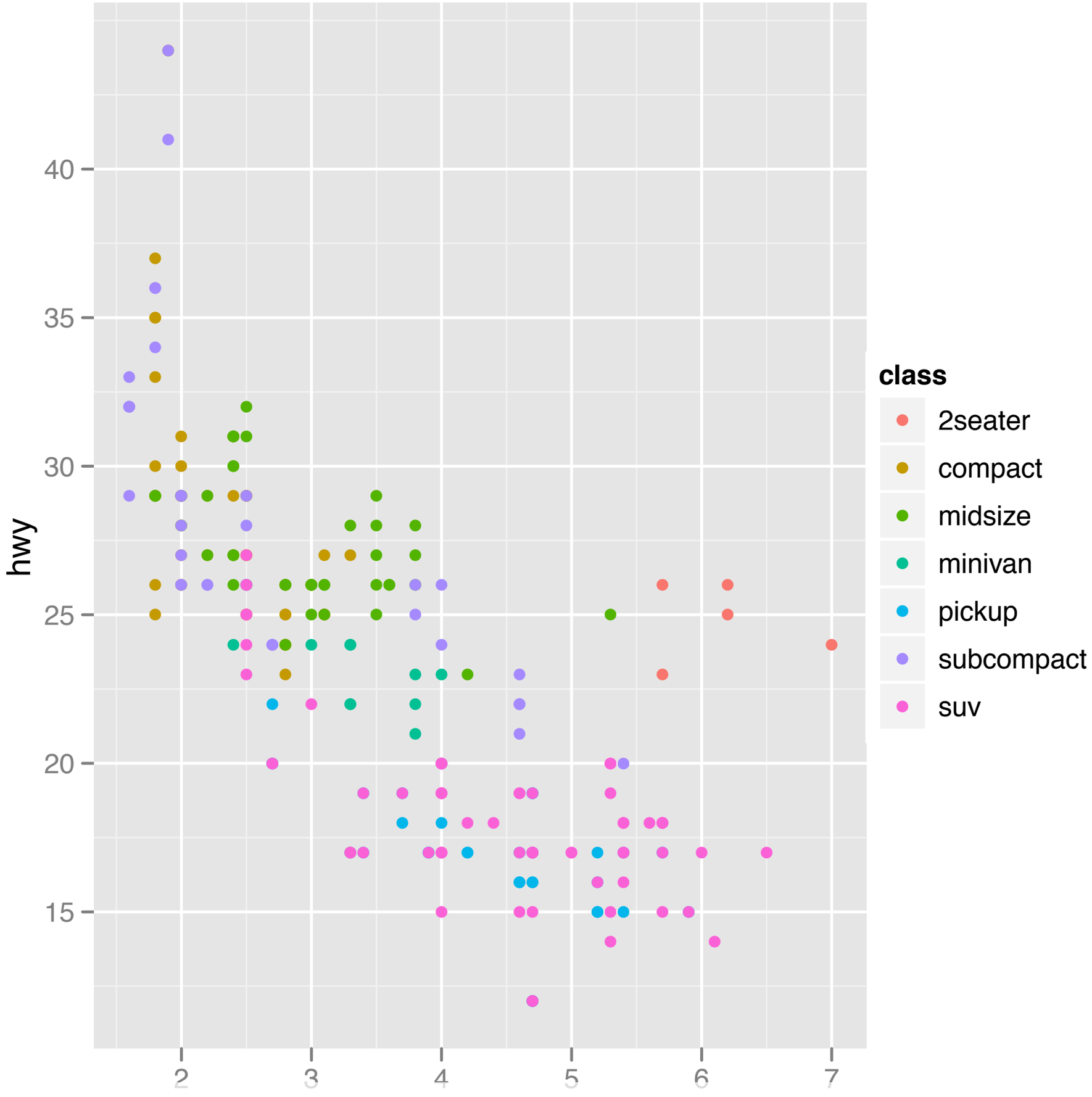
Always explicitly specify the data



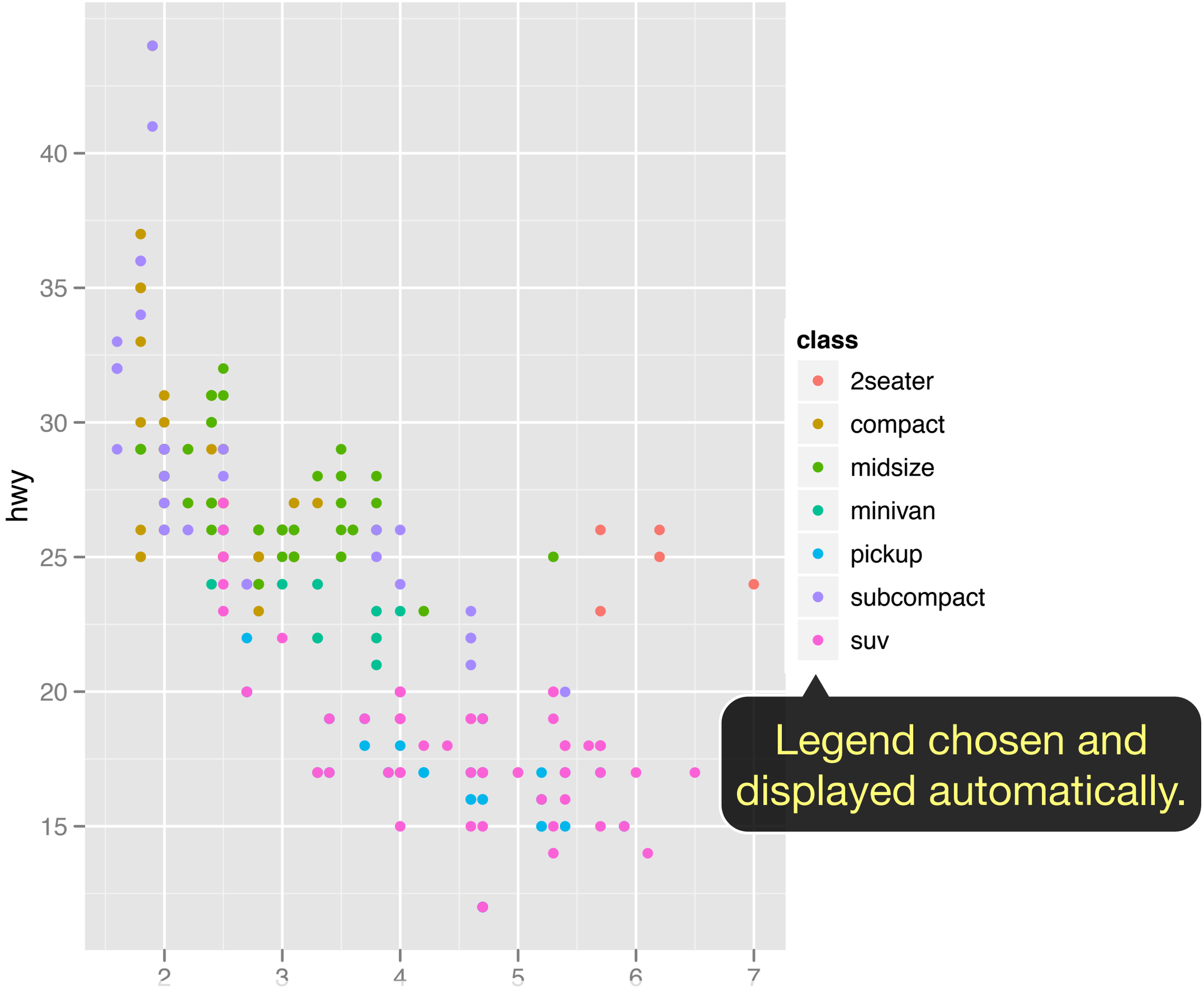

```
qplot(displ, hwy, data = mpg)
```

Additional variables

Can display additional variables with **aesthetics** (like shape, colour, size) or **faceting** (small multiples displaying different subsets)




```
qplot(displ, hwy, colour = class, data = mpg)
```




```
qplot(displ, hwy, colour = class, data = mpg)
```

Your turn

Experiment with colour, size, and shape aesthetics.

What's the difference between discrete or continuous variables?

What happens when you combine multiple aesthetics?

	Discrete	Continuous
Colour	Rainbow of colours	Colour gradient
Size	Discrete size steps	Linear mapping between radius and value
Shape	Different shape for each	Doesn’t work

Facetting

Faceting

Small multiples displaying different subsets of the data.

Useful for exploring conditional relationships. Useful for large data.

Your turn

```
qplot(displ, hwy, data = mpg) +
facet_grid(. ~ cyl)
```

```
qplot(displ, hwy, data = mpg) +
facet_grid(drv ~ .)
```

```
qplot(displ, hwy, data = mpg) +
facet_grid(drv ~ cyl)
```

```
qplot(displ, hwy, data = mpg) +
facet_wrap(~ class)
```

Summary

`facet_grid()`: 2d grid, rows ~ cols, . for no split

`facet_wrap()`: 1d ribbon wrapped into 2d

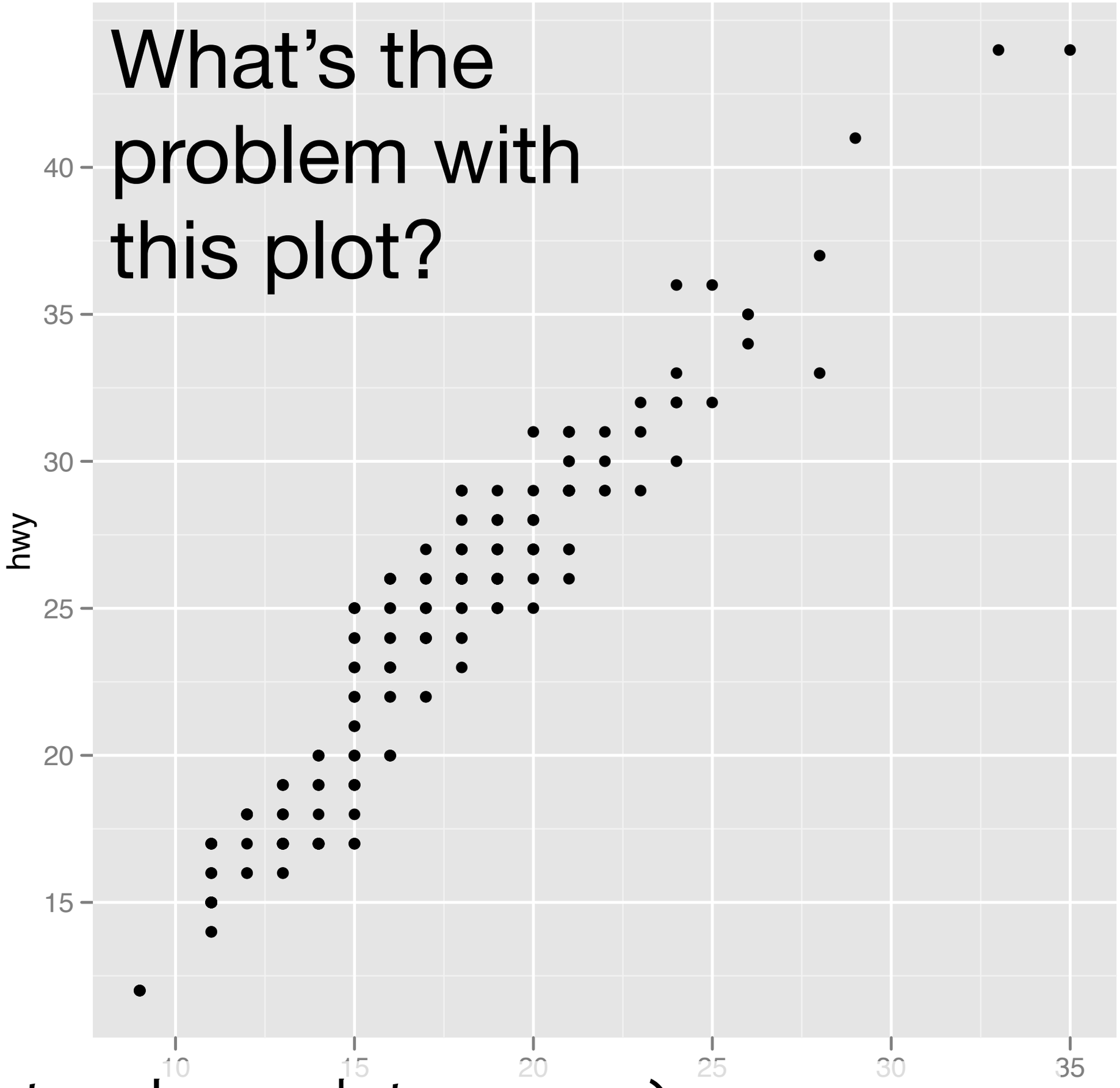
Aside: workflow

Keep a copy of the slides open so that you can copy and paste the code.

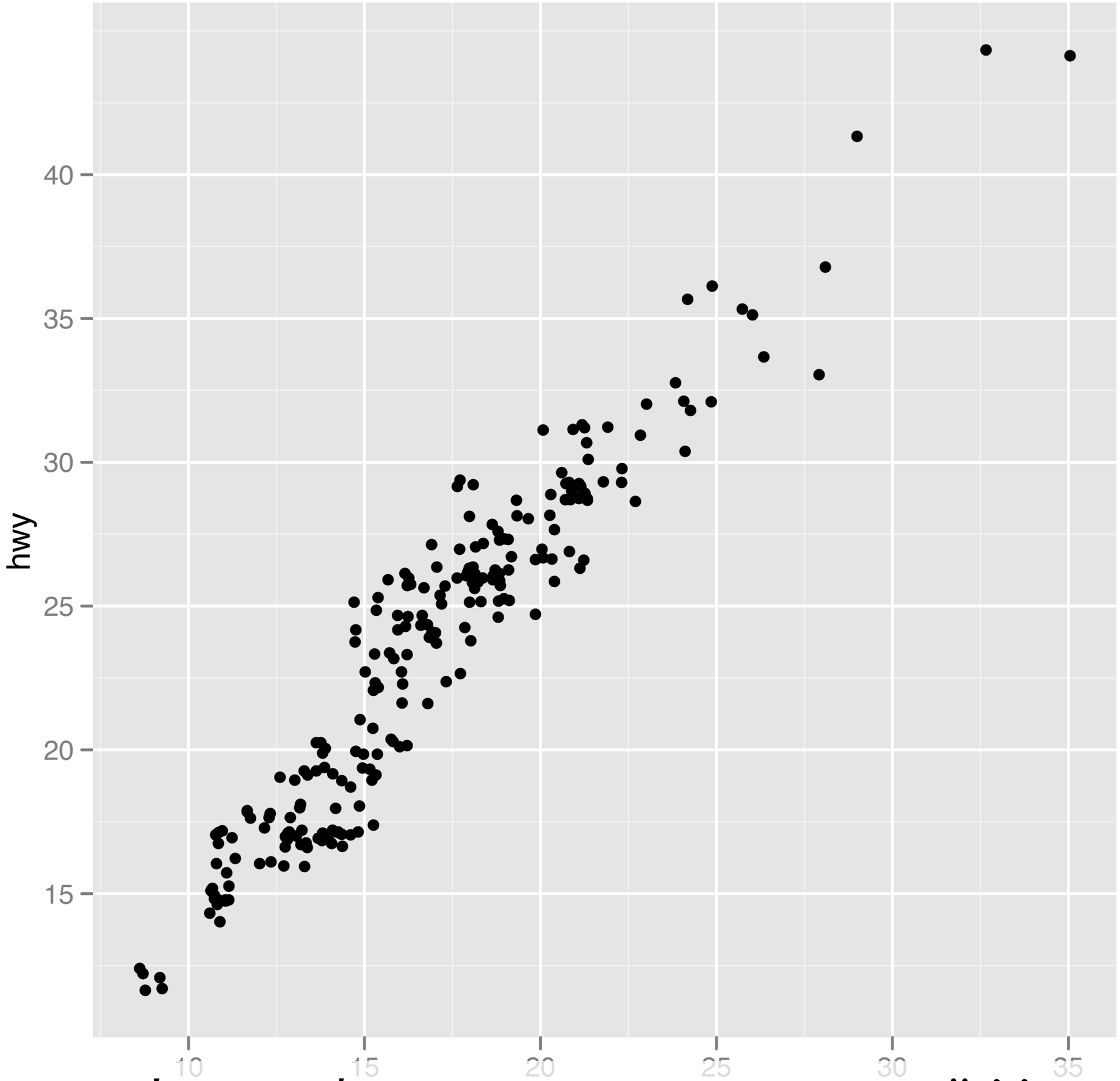
For complicated commands, write them in the editing area and then run.

Geoms

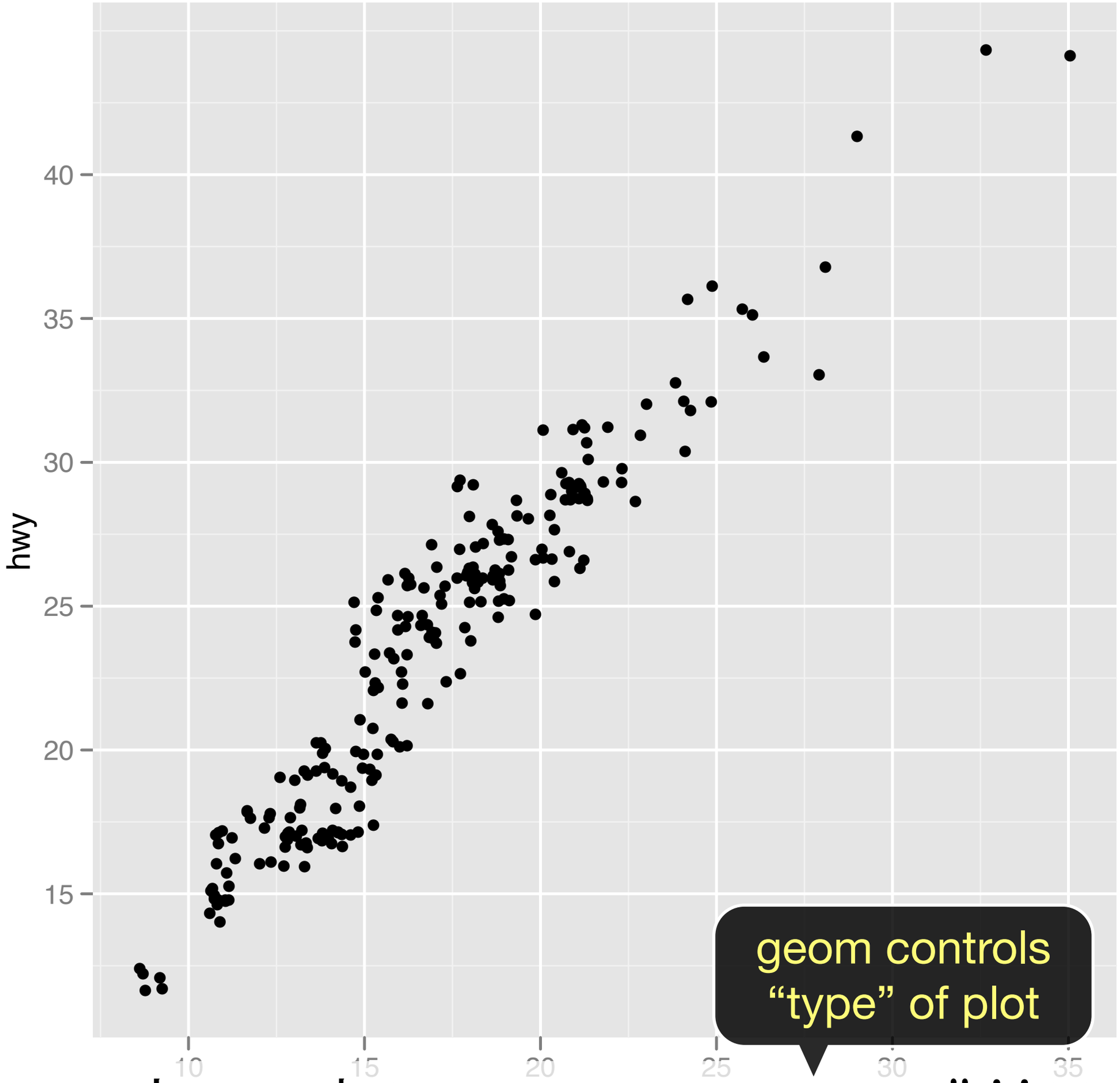
What's the problem with this plot?



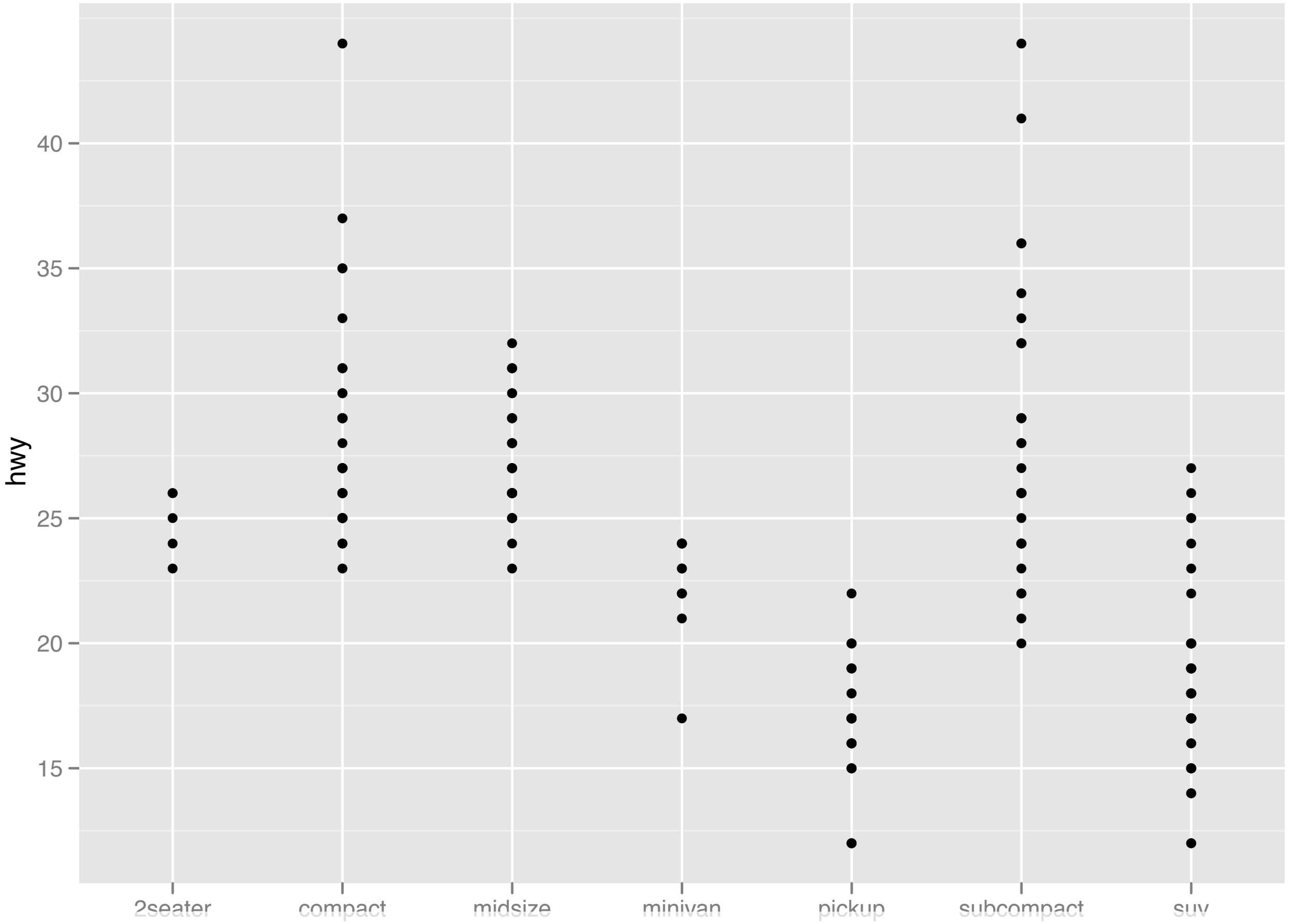

```
qplot(cty, hwy, data = mpg)
```




```
qplot(cty, hwy, data = mpg, geom = "jitter")
```



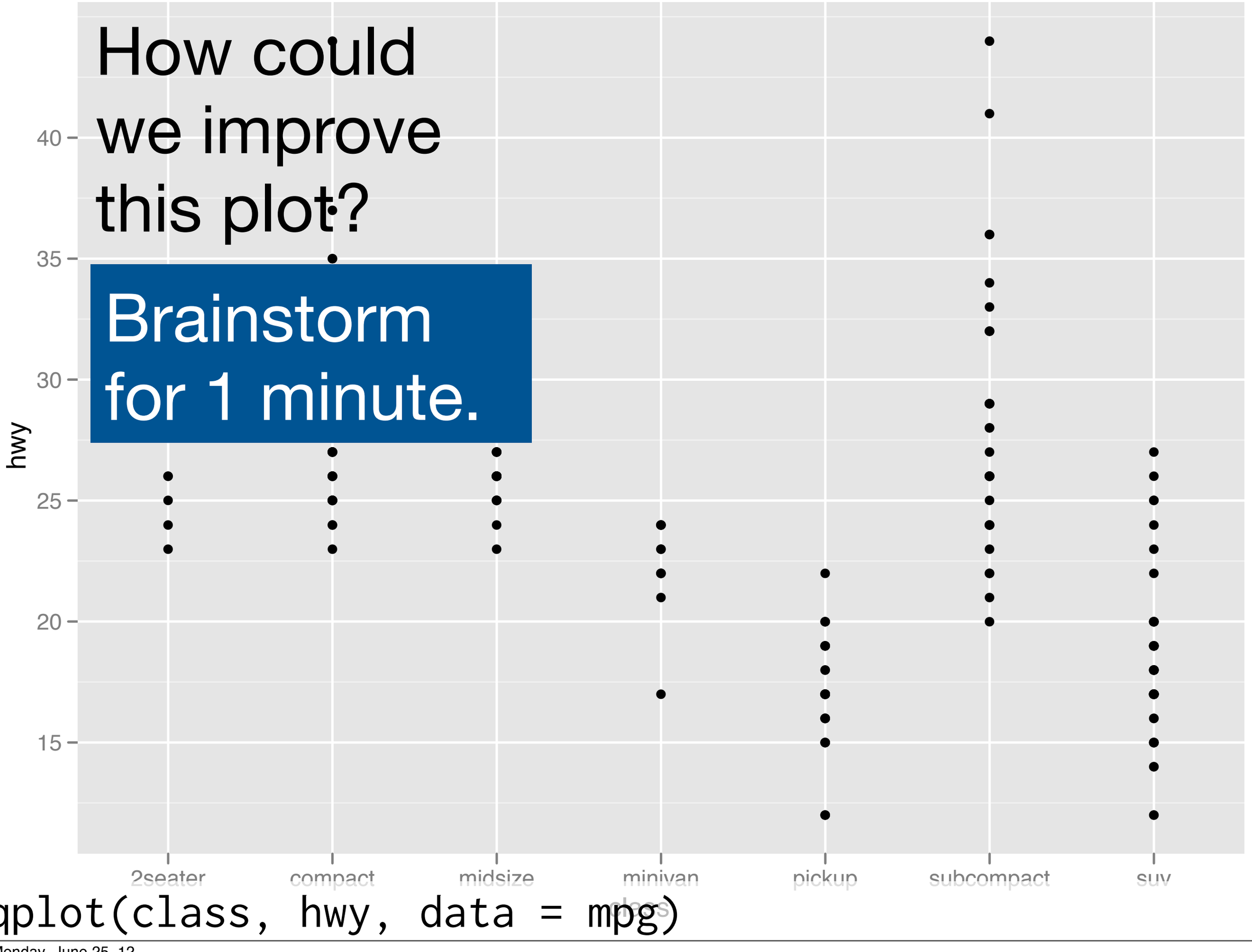

```
qplot(cty, hwy, data = mpg, geom = "jitter")
```



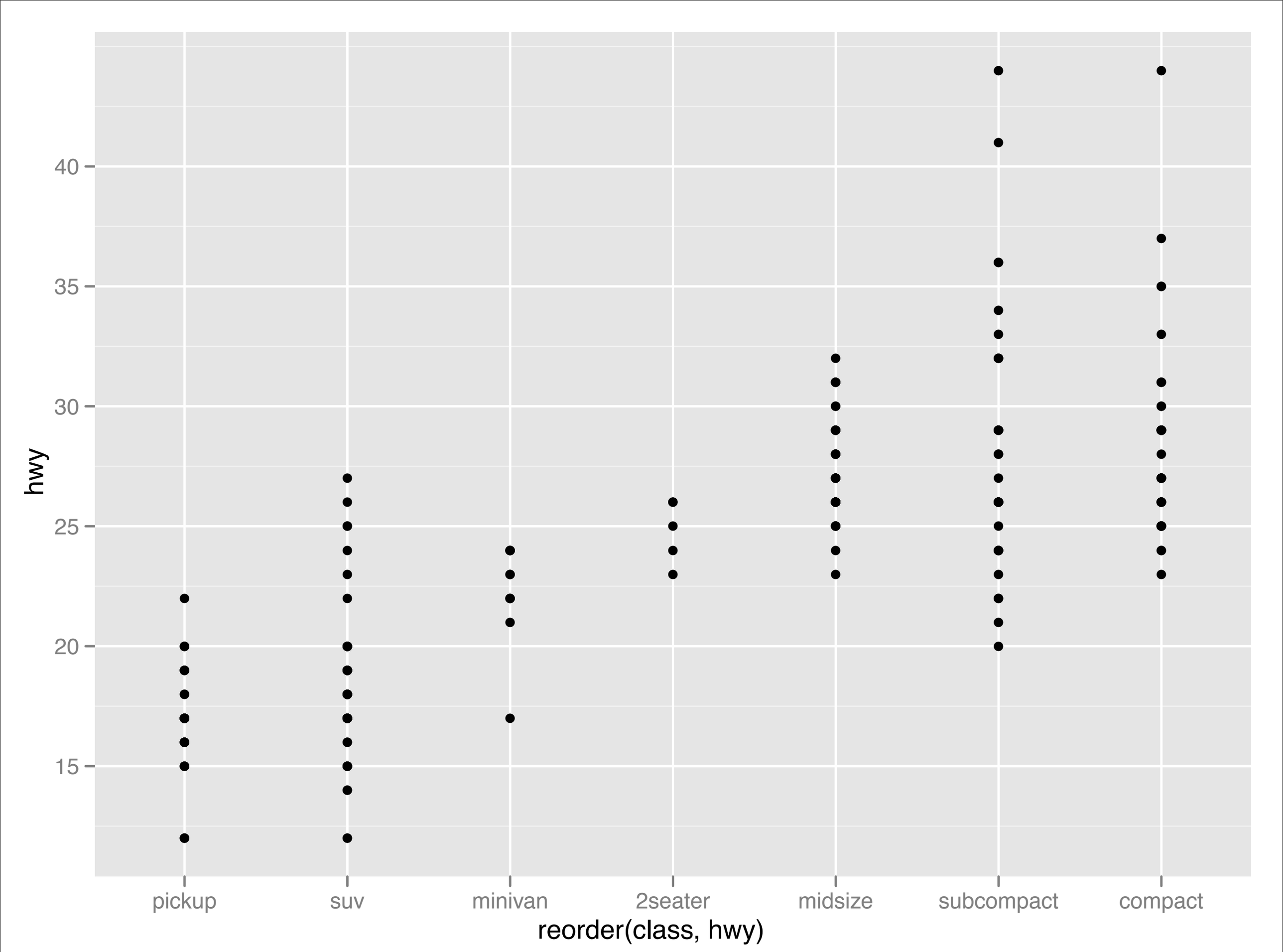

```
qplot(class, hwy, data = mpg)
```

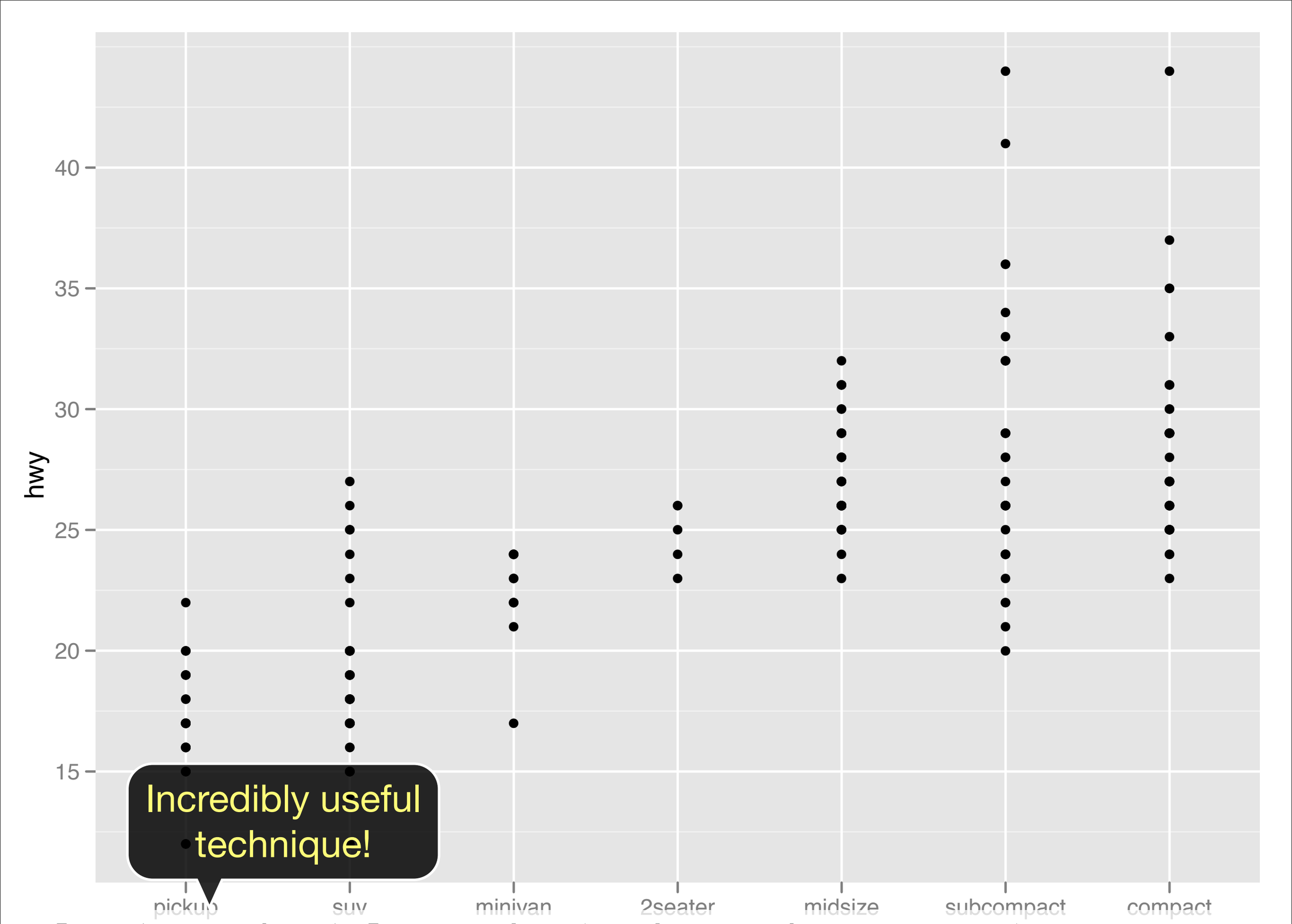
How could we improve this plot?

Brainstorm for 1 minute.

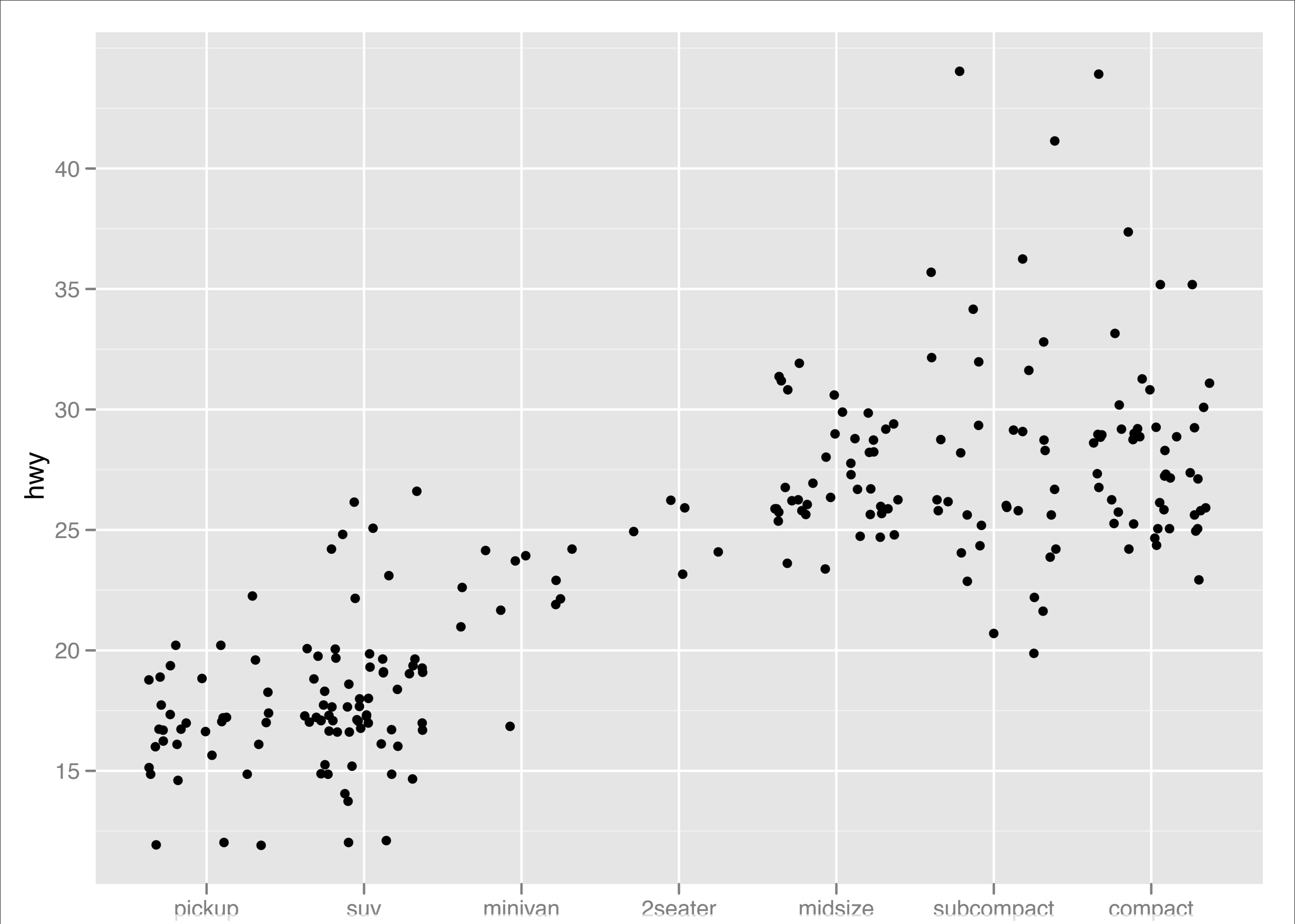



```
qplot(class, hwy, data = mpg)
```

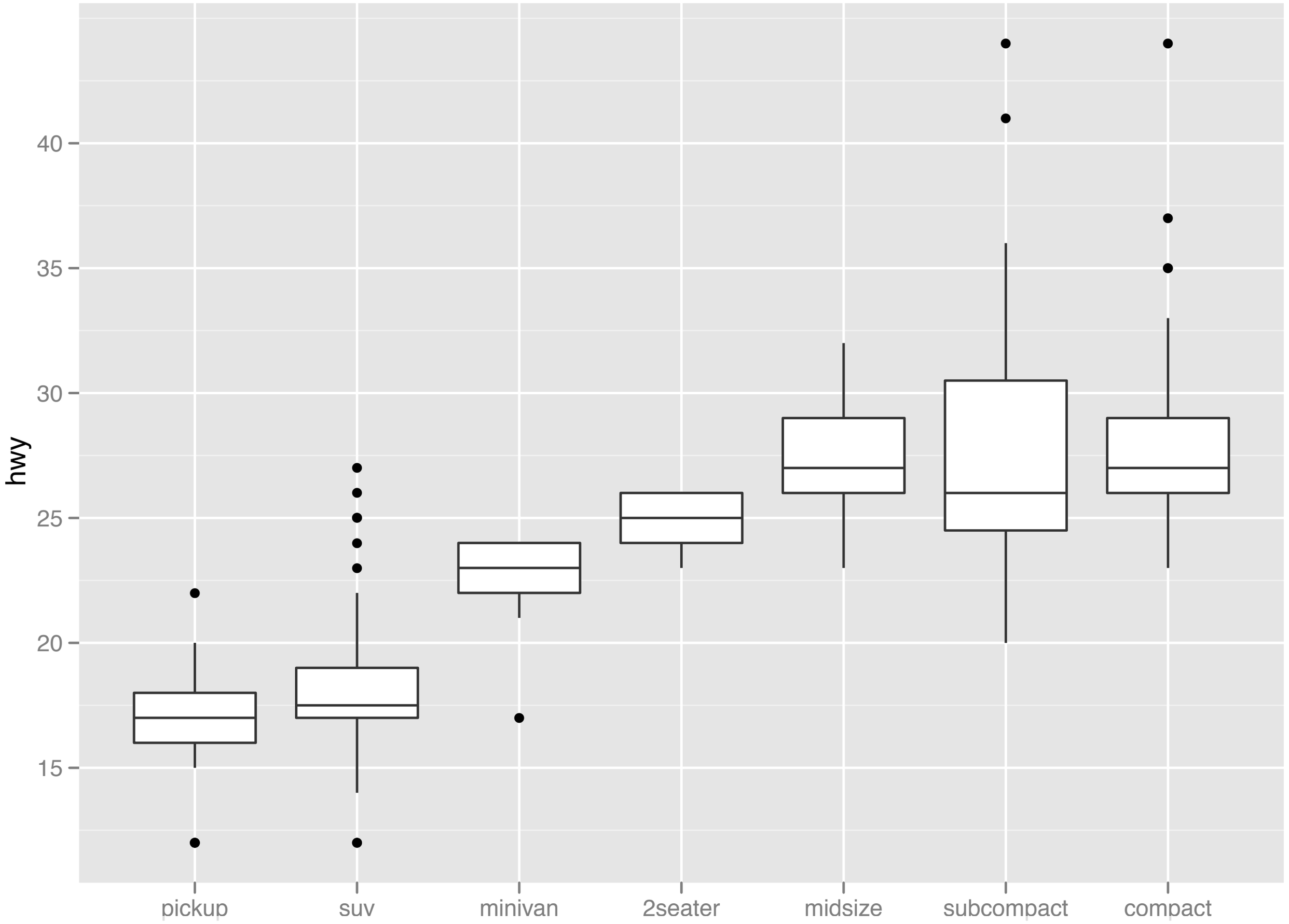

hwy
40
35
30
25
20
15
pickup
suv
minivan
2seater
midsize
subcompact
compact
reorder(class, hwy)



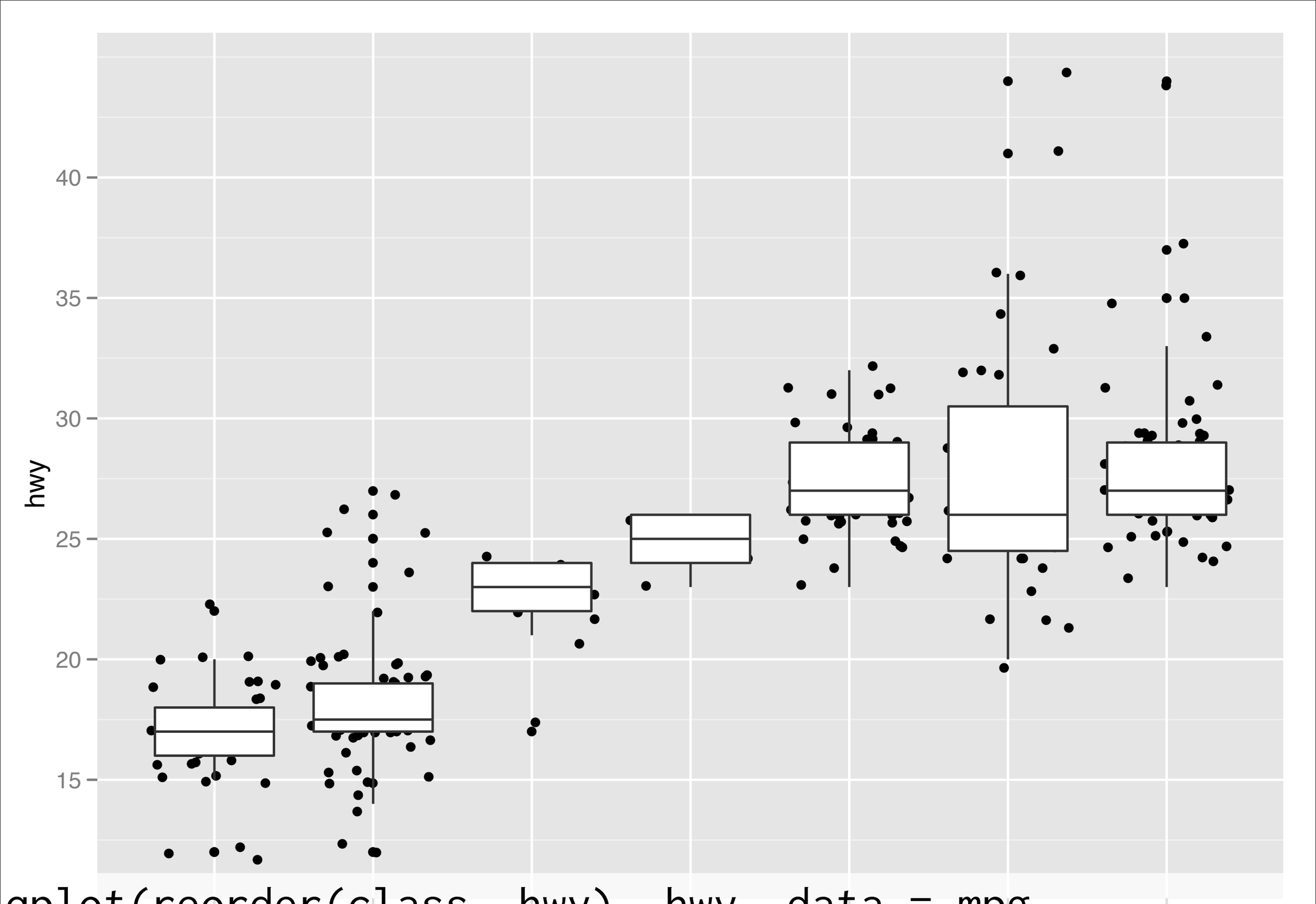

```
qplot(reorder(class, hwy), hwy, data = mpg)
```




```
qplot(reorder(class, hwy), hwy, data = mpg, geom = "jitter")
```




```
qplot(reorder(class, hwy), hwy, data = mpg, geom = "boxplot")
```




```
qplot(reorder(class, hwy), hwy, data = mpg,
  geom = c("jitter", "boxplot"))
```

Your turn

Read the help for reorder. Redraw the previous plots with class ordered by median hwy.

How would you put the jittered points on top of the boxplots?

Aside: coding strategy

At the end of each interactive session, you want a summary of everything you did. Two options:

1. Copy from the history panel.
2. Build up the important bits as you go. (recommended)

Diamonds

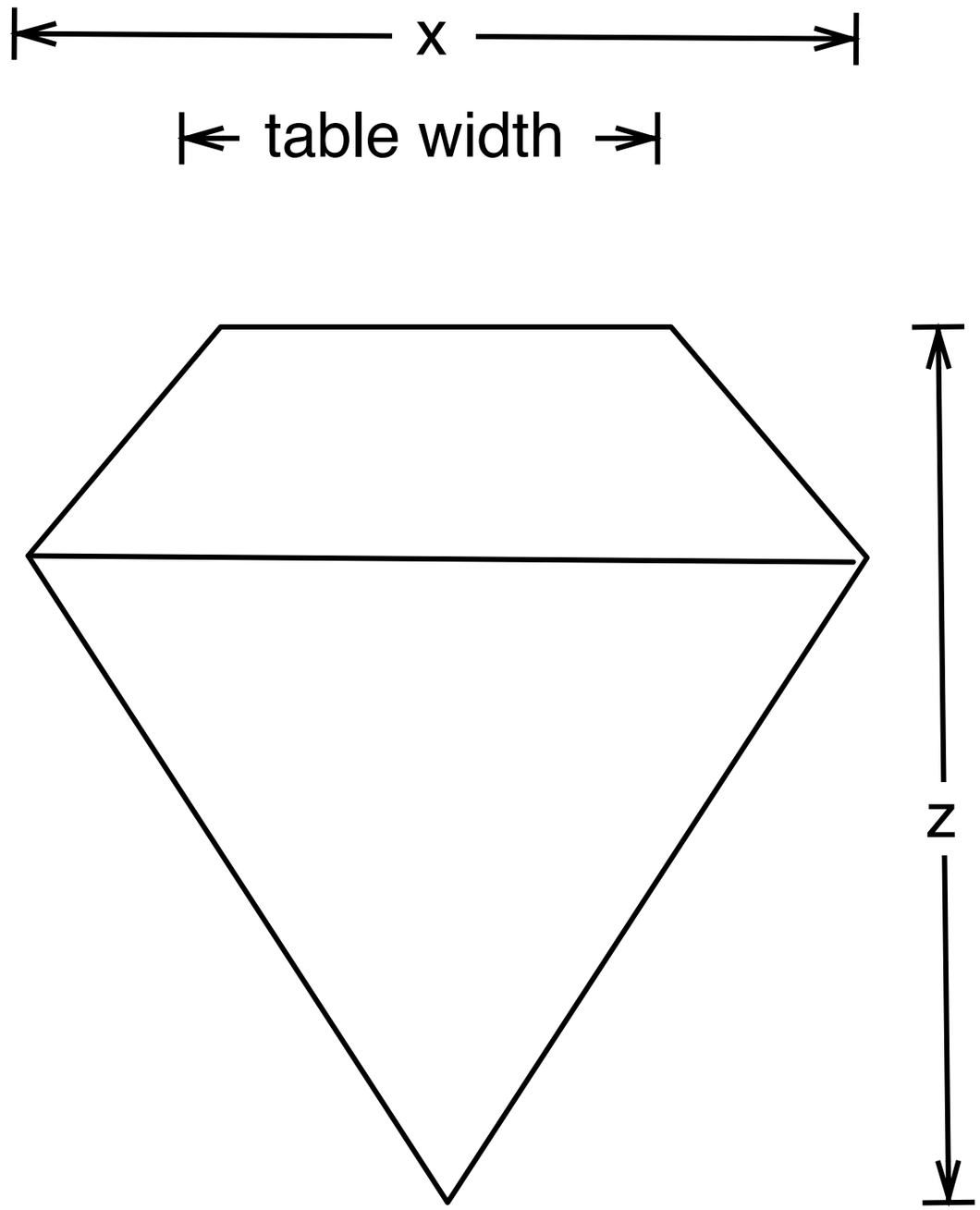
Diamonds data

~**54,000** round diamonds from
http://www.diamondse.info/

Carat, colour, clarity, cut

Total depth, table, depth, width, height

Price



depth = z / diameter
table = table width / x * 100

Recall

Write down five ways to inspect the diamonds dataset.

You have one minute!

Histogram & bar charts

Histograms and barcharts

Used to display the **distribution** of a variable

Categorical variable → bar chart

Continuous variable → histogram

```
# With only one variable, qplot guesses that
# you want a bar chart or histogram
qplot(cut, data = diamonds)

qplot(carat, data = diamonds)

# Change binwidth:
qplot(carat, data = diamonds, binwidth = 1)
qplot(carat, data = diamonds, binwidth = 0.1)
qplot(carat, data = diamonds, binwidth = 0.01)
resolution(diamonds$carat)

last_plot() + xlim(0, 3)
```

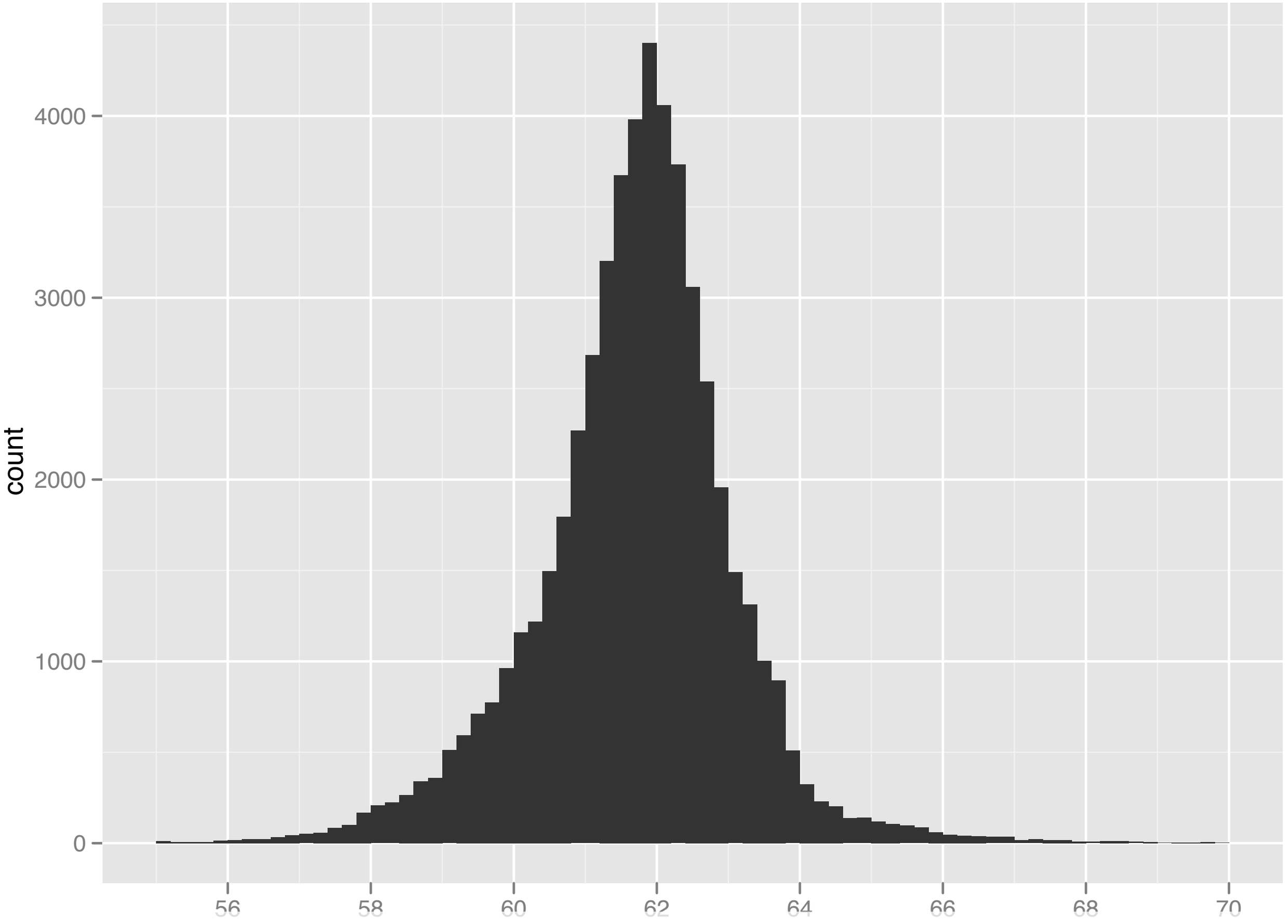
Always experiment with the bin width!

```
qplot(table, data = diamonds, binwidth = 1)

# To zoom in on a plot region use xlim() and ylim()
qplot(table, data = diamonds, binwidth = 1) +
   xlim(50, 70)
qplot(table, data = diamonds, binwidth = 0.1) +
  xlim(50, 70)
qplot(table, data = diamonds, binwidth = 0.1) +
  xlim(50, 70) + ylim(0, 50)

# Note that this type of zooming discards data
# outside of the plot regions. See
# ?coord_cartesian() for an alternative
qplot(table, data = diamonds, binwidth = 0.1) +
coord_cartesian(xlim = c(50, 70), ylim = c(0, 50))
```

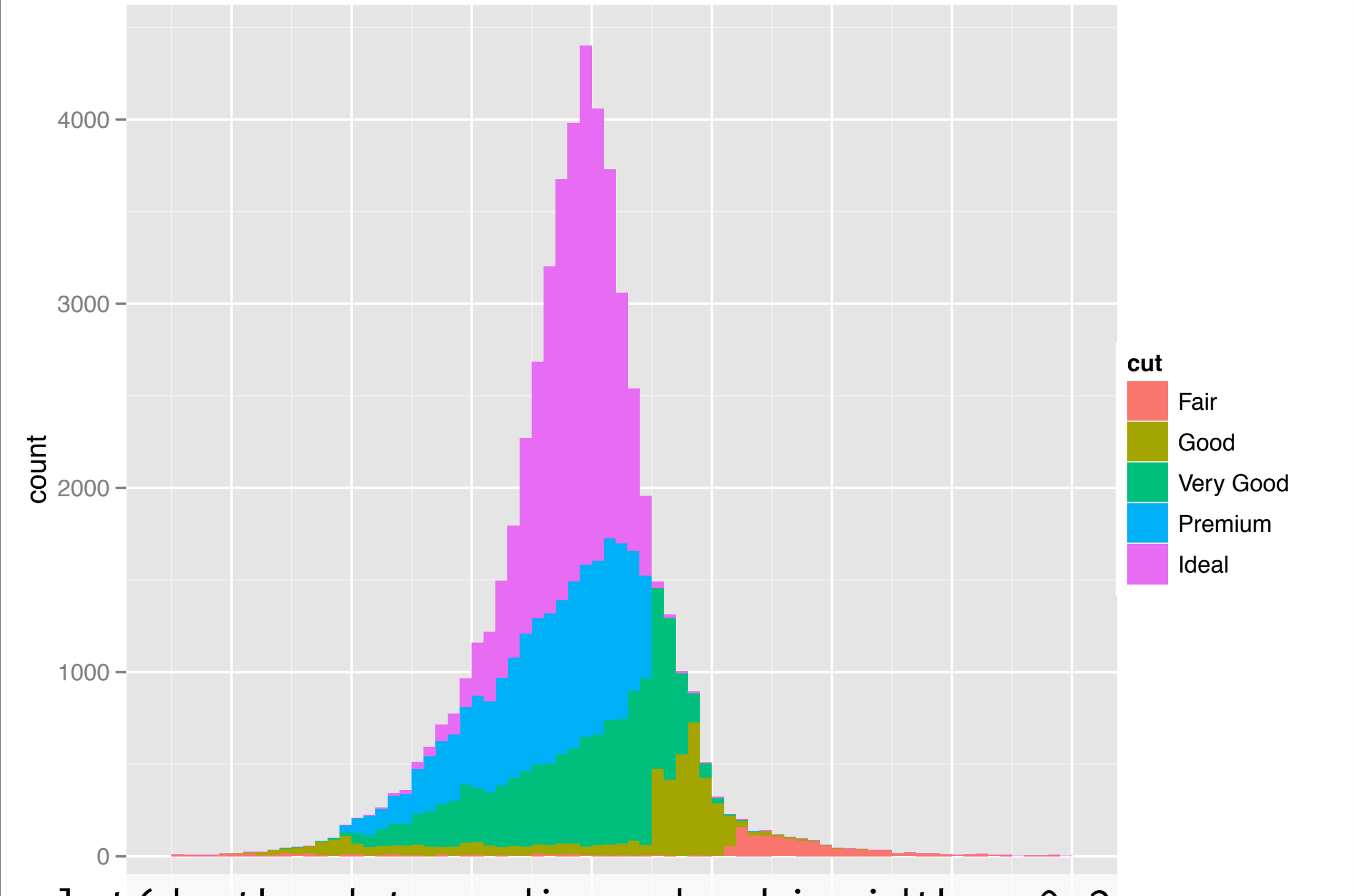
Additional variables

As with scatterplots can use **aesthetics** or **faceting**. Using aesthetics creates pretty, but ineffective, plots.

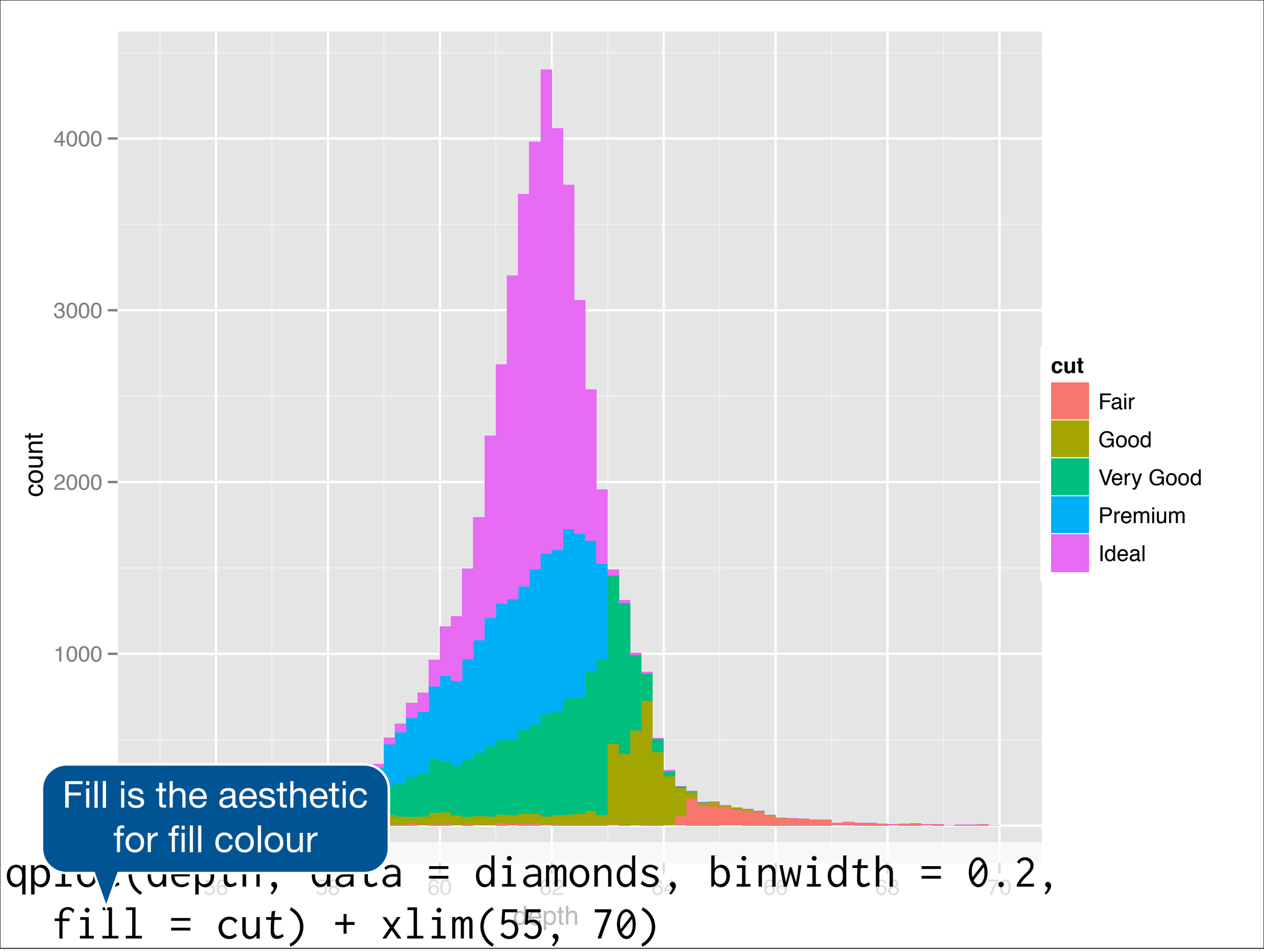
The following examples show the difference, when investigation the relationship between cut and depth.



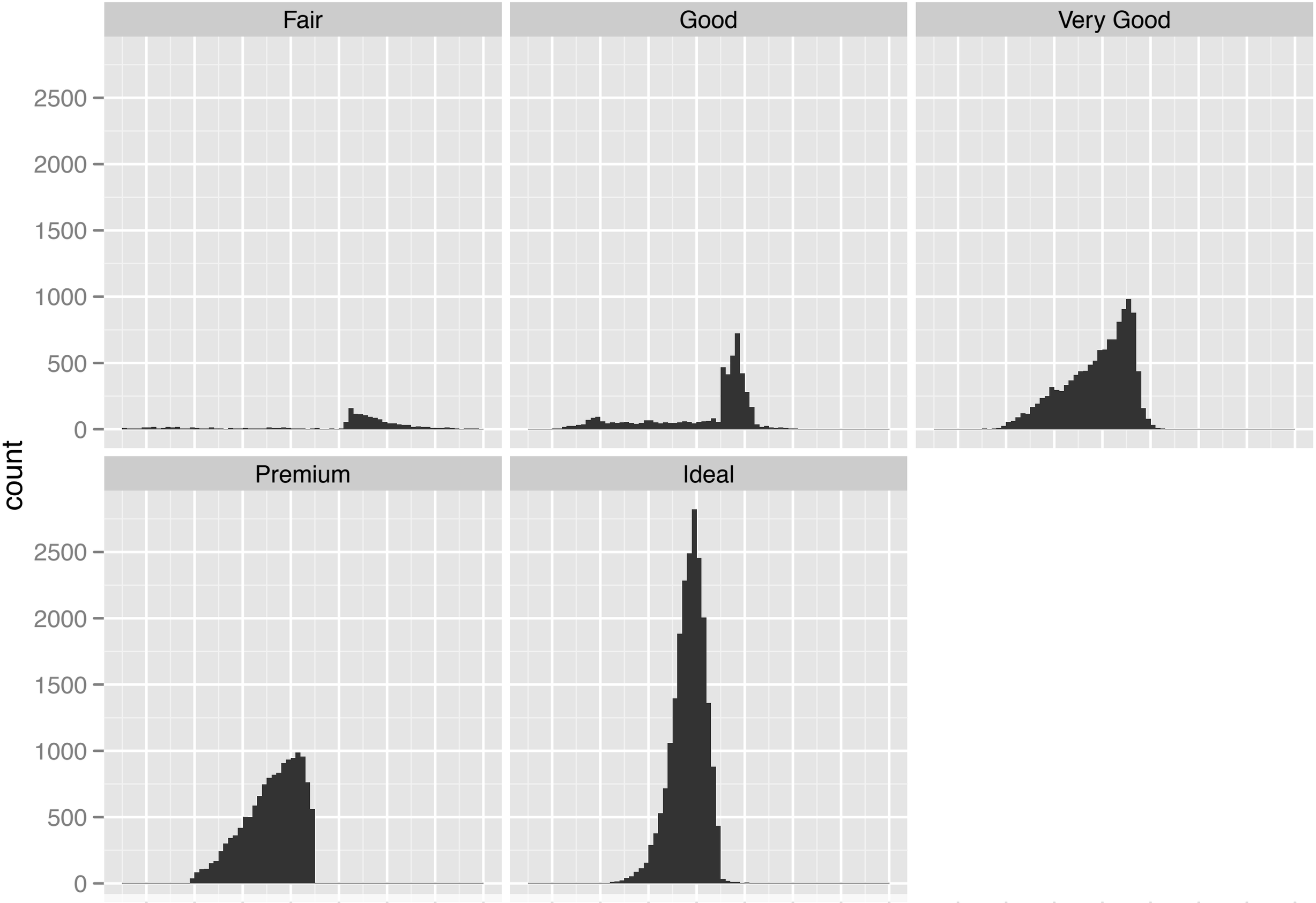

```
qplot(depth, data = diamonds, binwidth = 0.2)
```




```
qplot(depth, data = diamonds, binwidth = 0.2,
  fill = cut) + xlim(55, 70)
```




```
qplot(depth, data = diamonds, binwidth = 0.2,
  fill = cut) + xlim(55, 70)
```

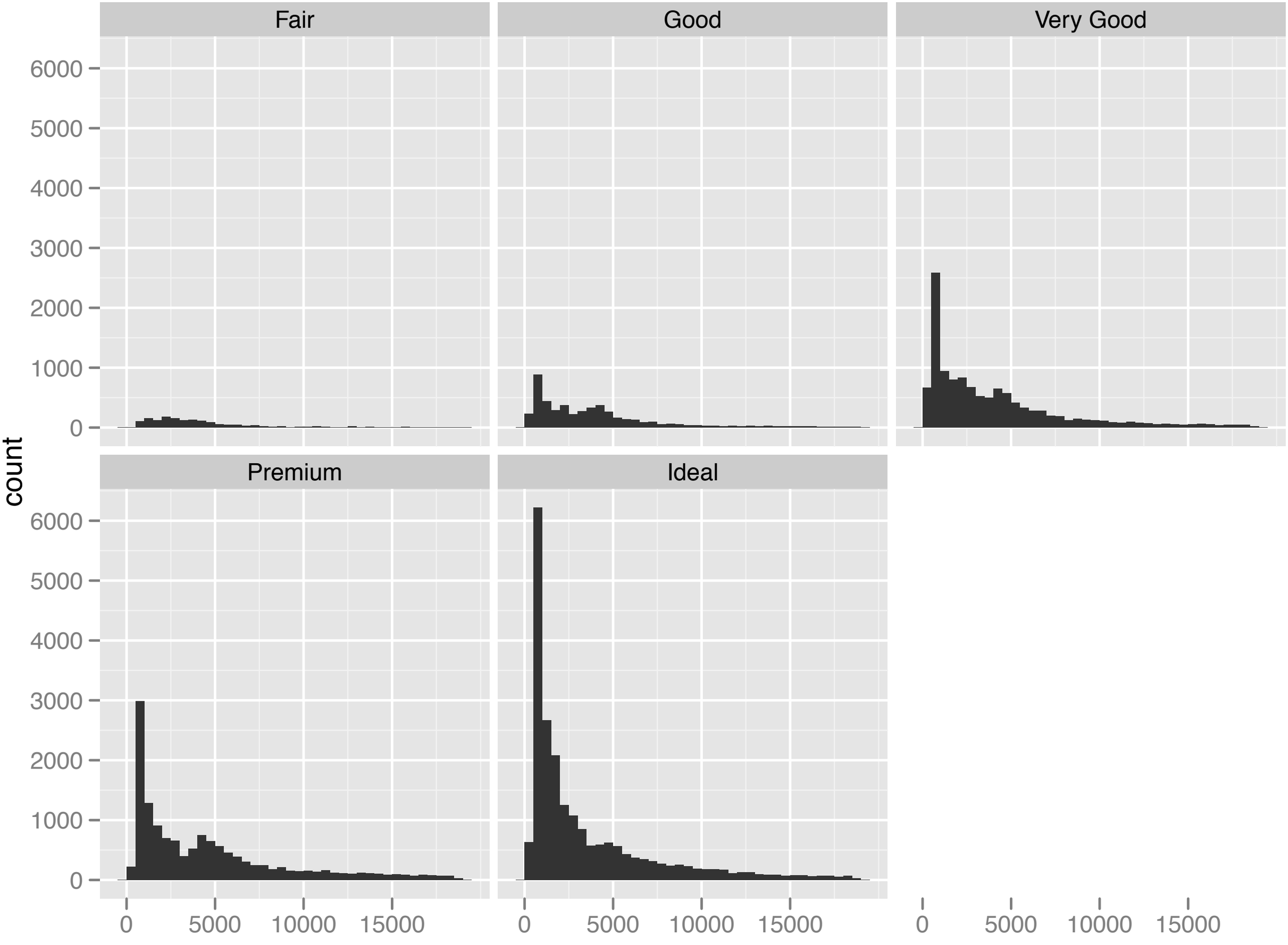



```
qplot(depth, data = diamonds, binwidth = 0.2) +
  xlim(55, 70) + facet_wrap(~cut)
```

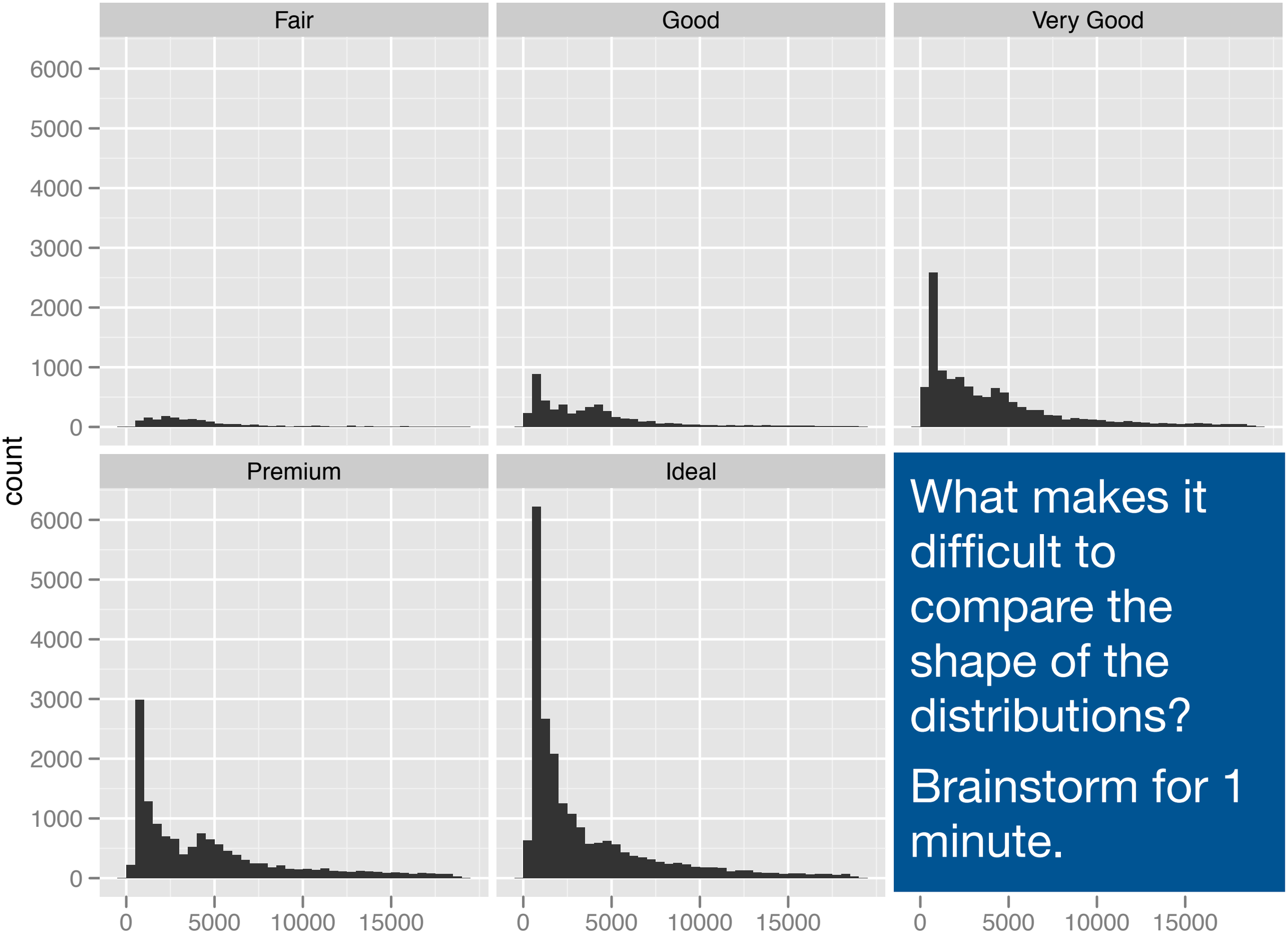
Your turn

Explore the distribution of price. What is a good binwidth to use? (**Hint**: How many bins will a binwidth of 1 give you?) Practice zooming in on regions of interest.

How does price vary with colour, cut, or clarity?




```
qplot(price, data = diamonds, binwidth = 500) + facet_wrap(~ cut)
```



What makes it difficult to compare the shape of the distributions?

Brainstorm for 1 minute.

```
qplot(price, data = diamonds, binwidth = 500) + facet_wrap(~ cut)
```

Problems

Each histogram far away from the others, but we know stacking is hard to read → *use another way of displaying densities*

Varying relative abundance makes comparisons difficult → *rescale to ensure constant area*

```
# Large distances make comparisons hard
qplot(price, data = diamonds, binwidth = 500) +
  facet_wrap(~ cut)

# Stacked heights hard to compare
qplot(price, data = diamonds, binwidth = 500, fill = cut)

# Much better - but still have differing relative abundance
qplot(price, data = diamonds, binwidth = 500,
  geom = "freqpoly", colour = cut)

# Instead of displaying count on y-axis, display density
# .. indicates that variable isn't in original data
qplot(price, ..density.., data = diamonds, binwidth = 500,
  geom = "freqpoly", colour = cut)

# To use with histogram, you need to be explicit
qplot(price, ..density.., data = diamonds, binwidth = 500,
  geom = "histogram") + facet_wrap(~ cut)
```