Displaying large data

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1. Introduction to the diamonds data
2. Histograms and bar charts
3. More boxplots
4. Scatterplots for large data
5. Some theory

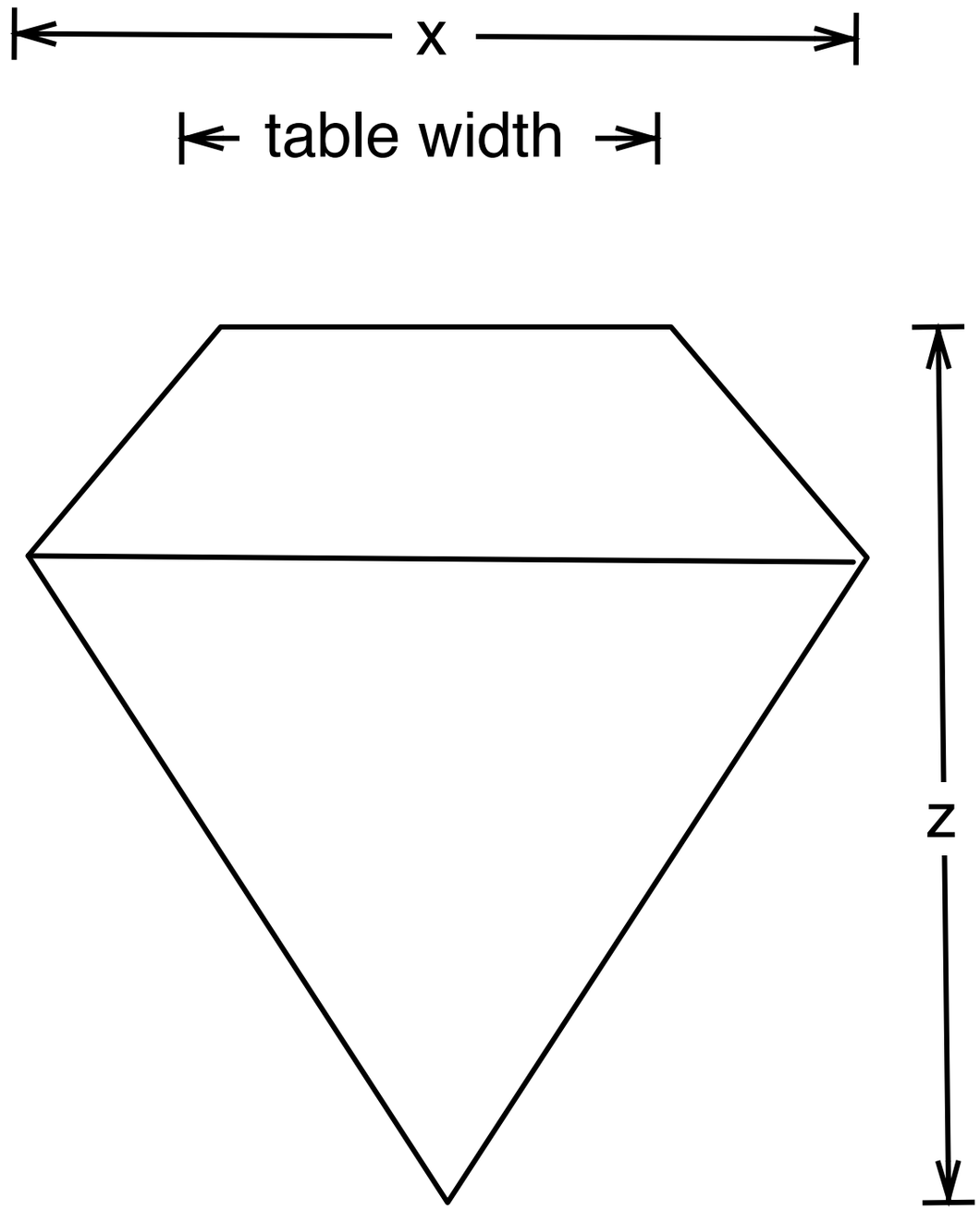
Diamonds data

~**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

Histogram & bar charts

Histograms and barcharts

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

Categorical variable → bar chart

Continuous variable → histogram

Always experiment with the bin width!

Examples

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

qplot(carat, data = diamonds)
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)
```

Examples

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

qplot(carat, data = diamonds)
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)
```

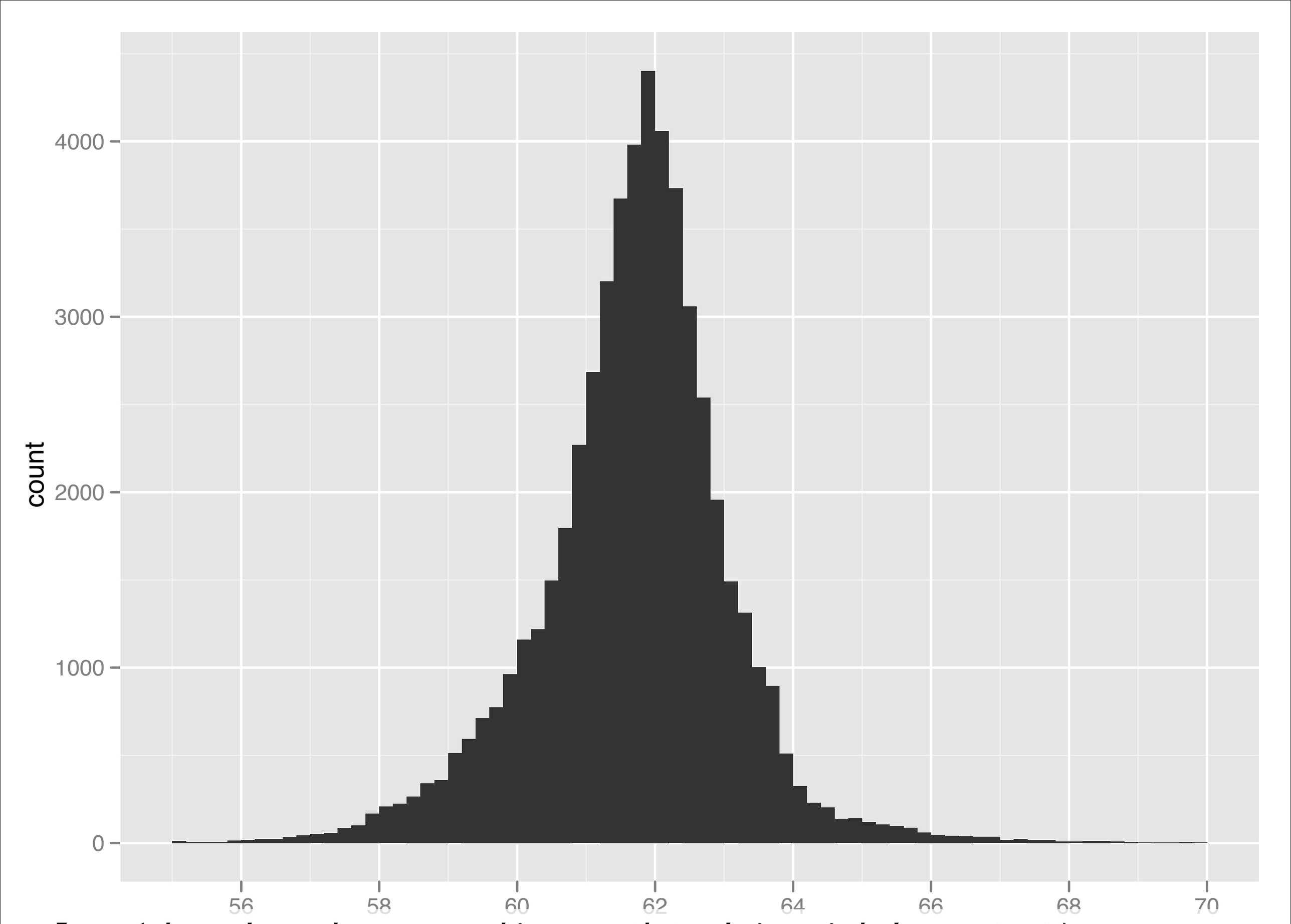
Common ggplot2 technique: adding together plot components

```
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
```

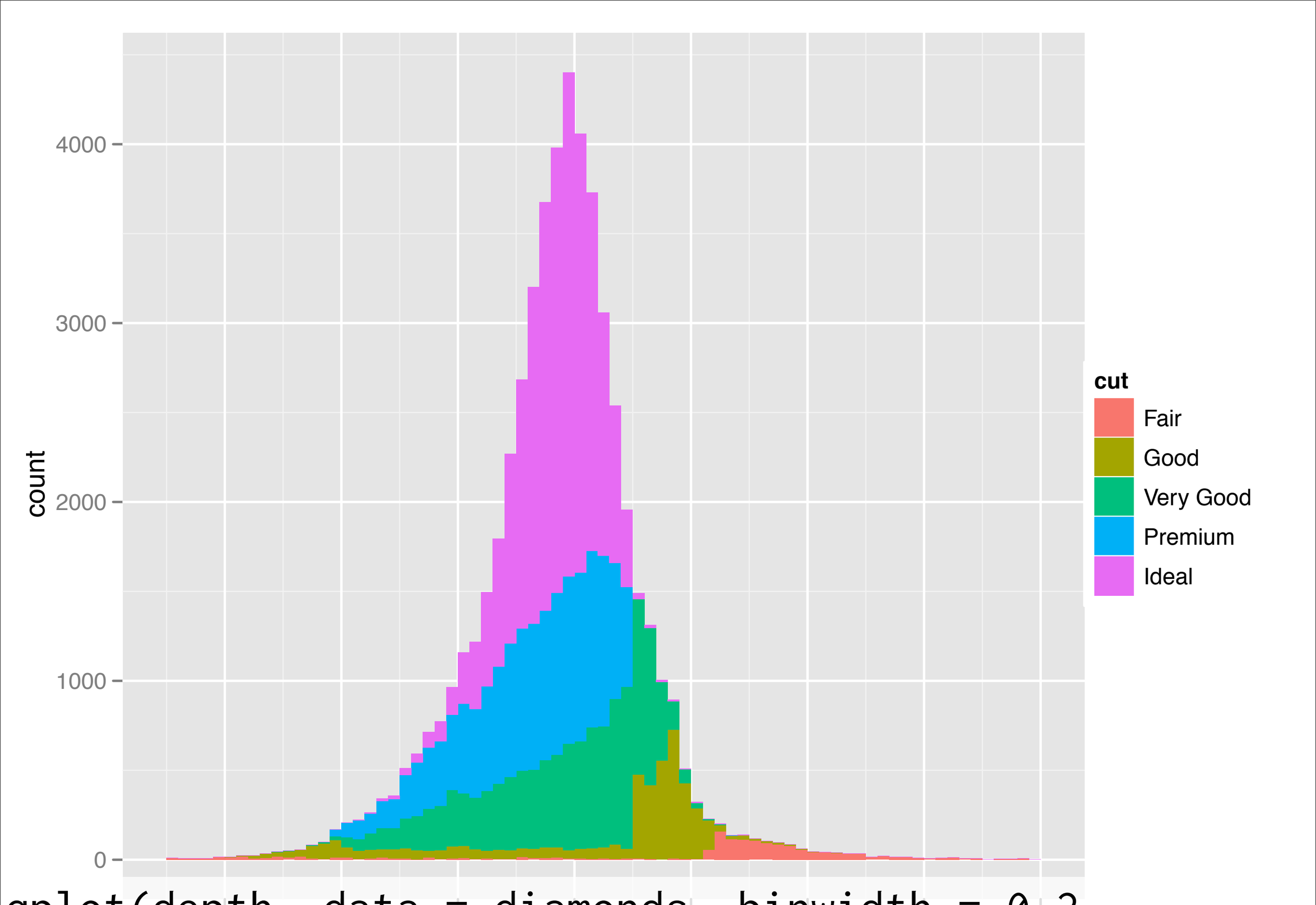
Additional variables

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

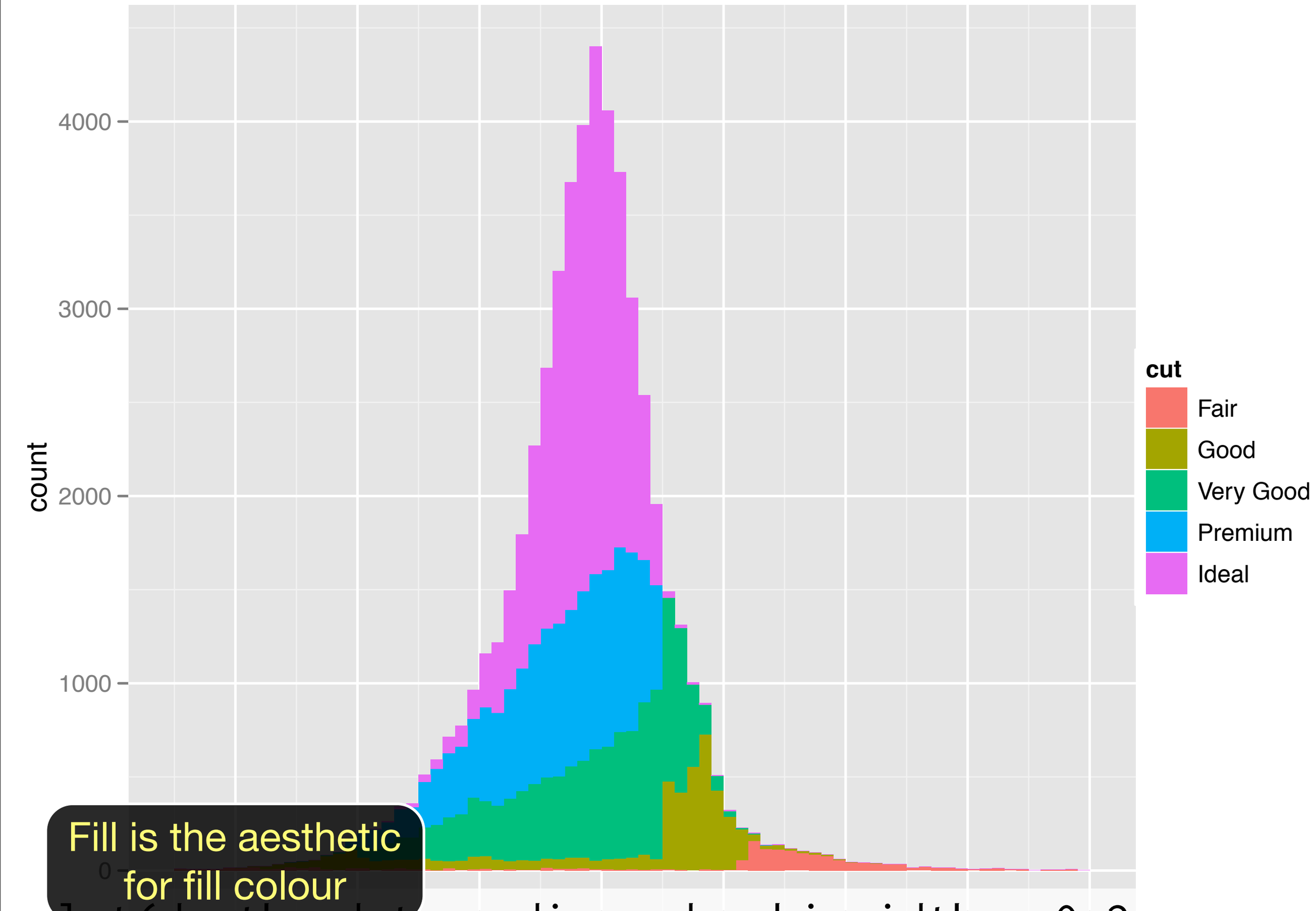
The following examples show the difference, when investigation the relationship between cut and depth.




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

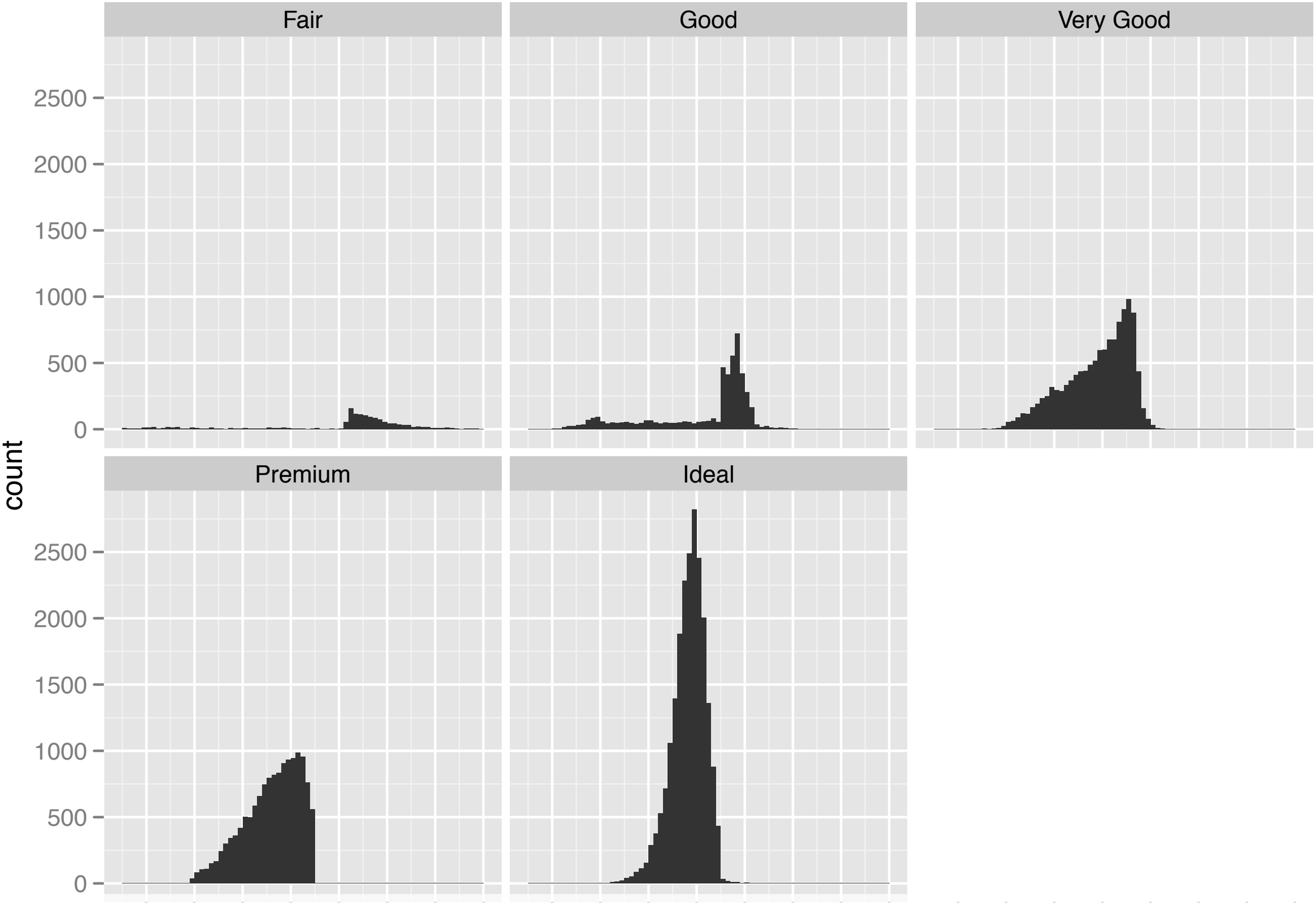



```
qplot(depth, data = diamonds, binwidth = 0.2,
  fill = cut) + xlim(55, 70)
```



Fill is the aesthetic for fill colour

```
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.

How does it vary with colour, or cut, and clarity?

Weighting

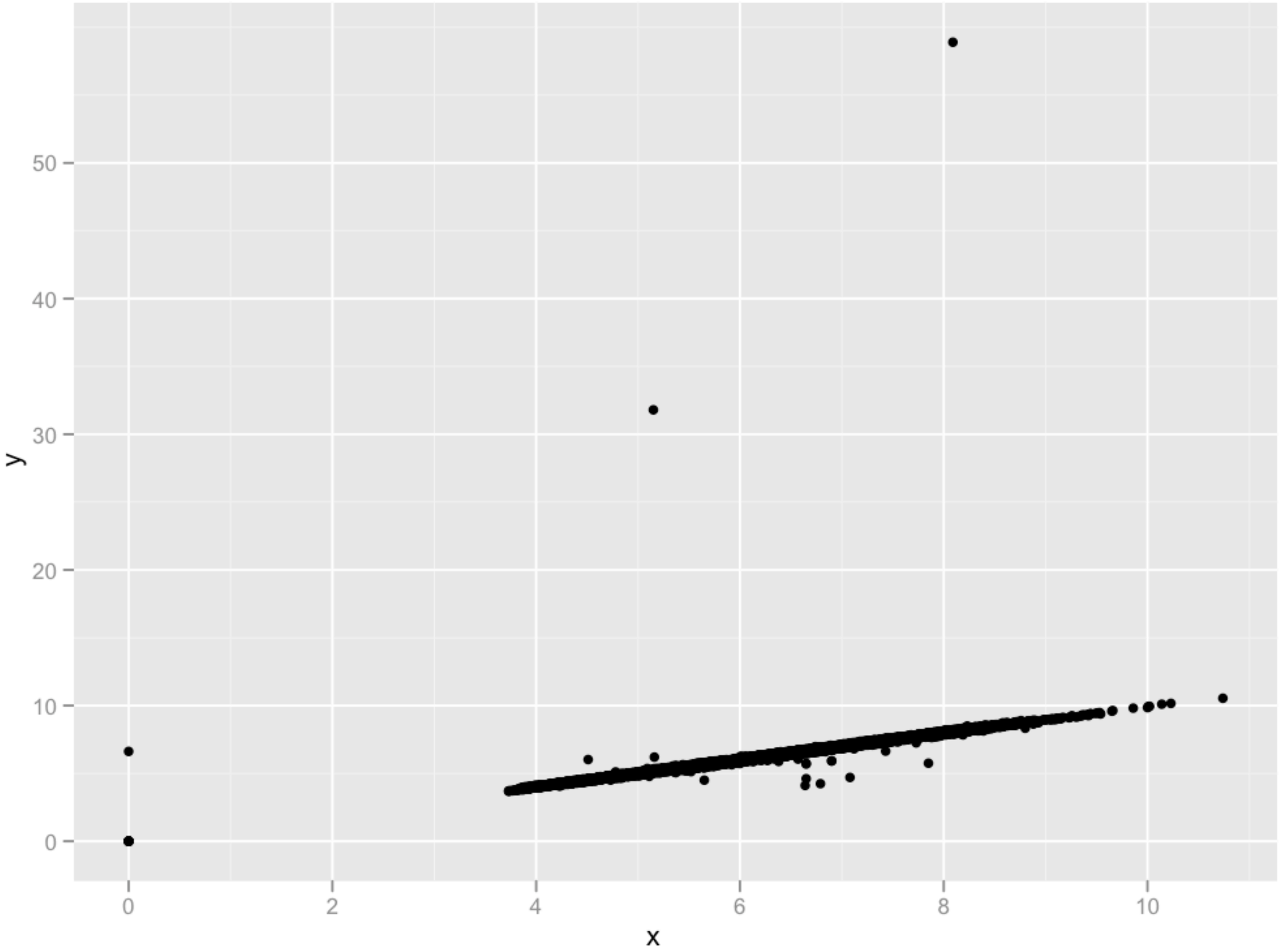
```
qplot(cut, data = diamonds, weight = carat)
qplot(cut, data = diamonds, weight = price)
```

```
# Also useful for pretabulated data
cuts <- as.data.frame(table(
  cut = diamonds$cut))
qplot(cut, weight = Freq, data = cuts)
```

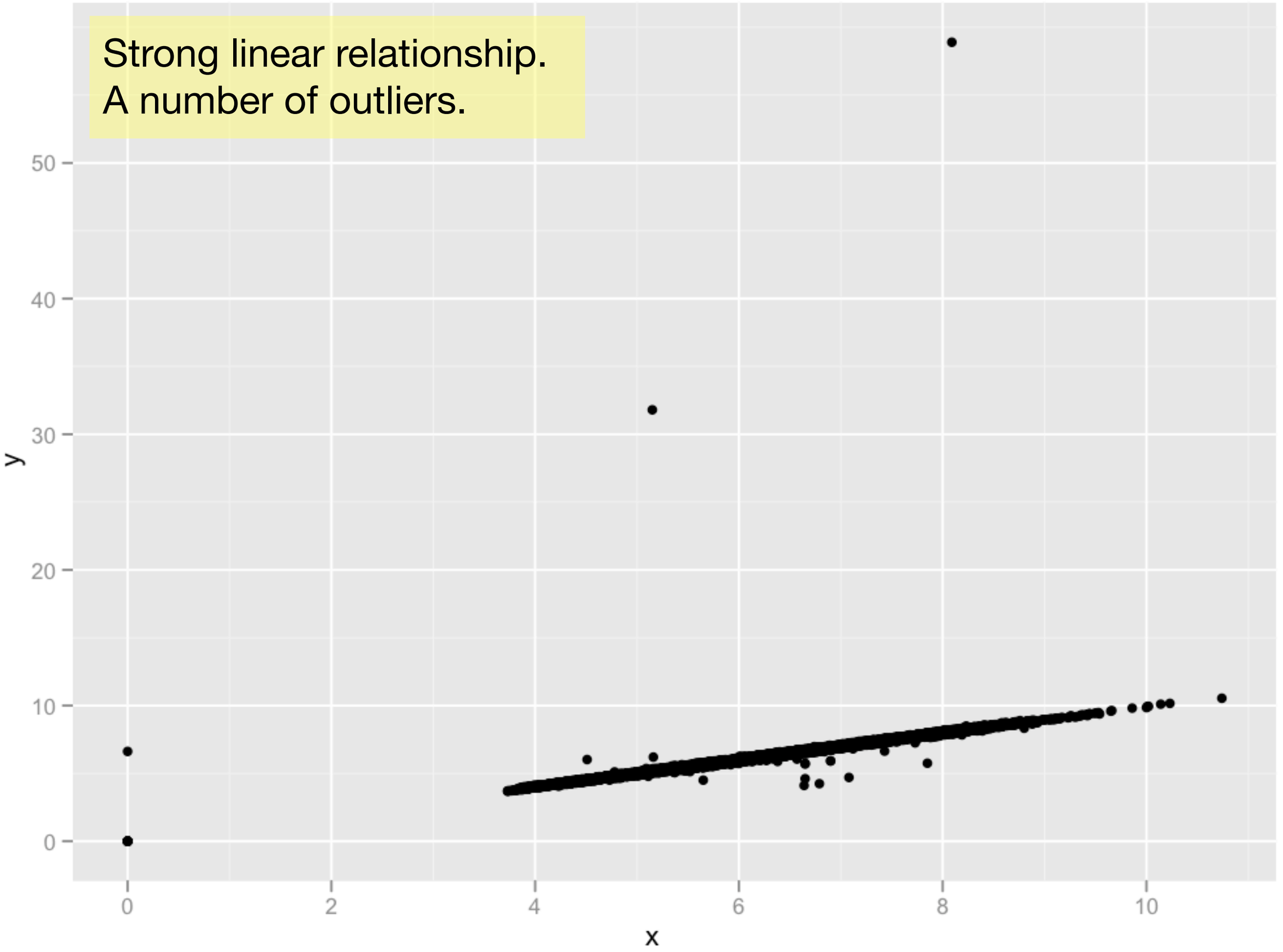
Scatterplots

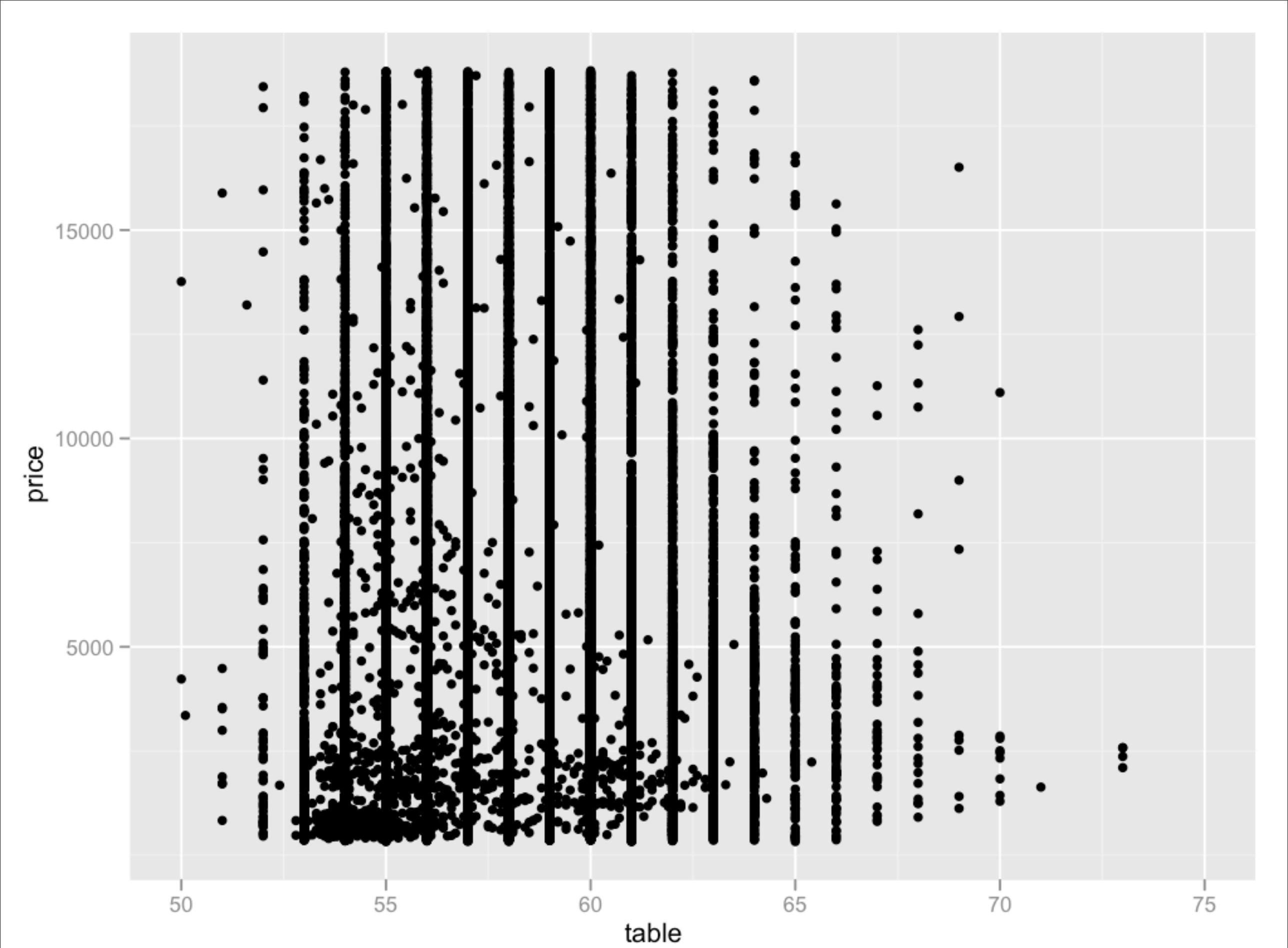
Revision:
Interpreting a scatterplot

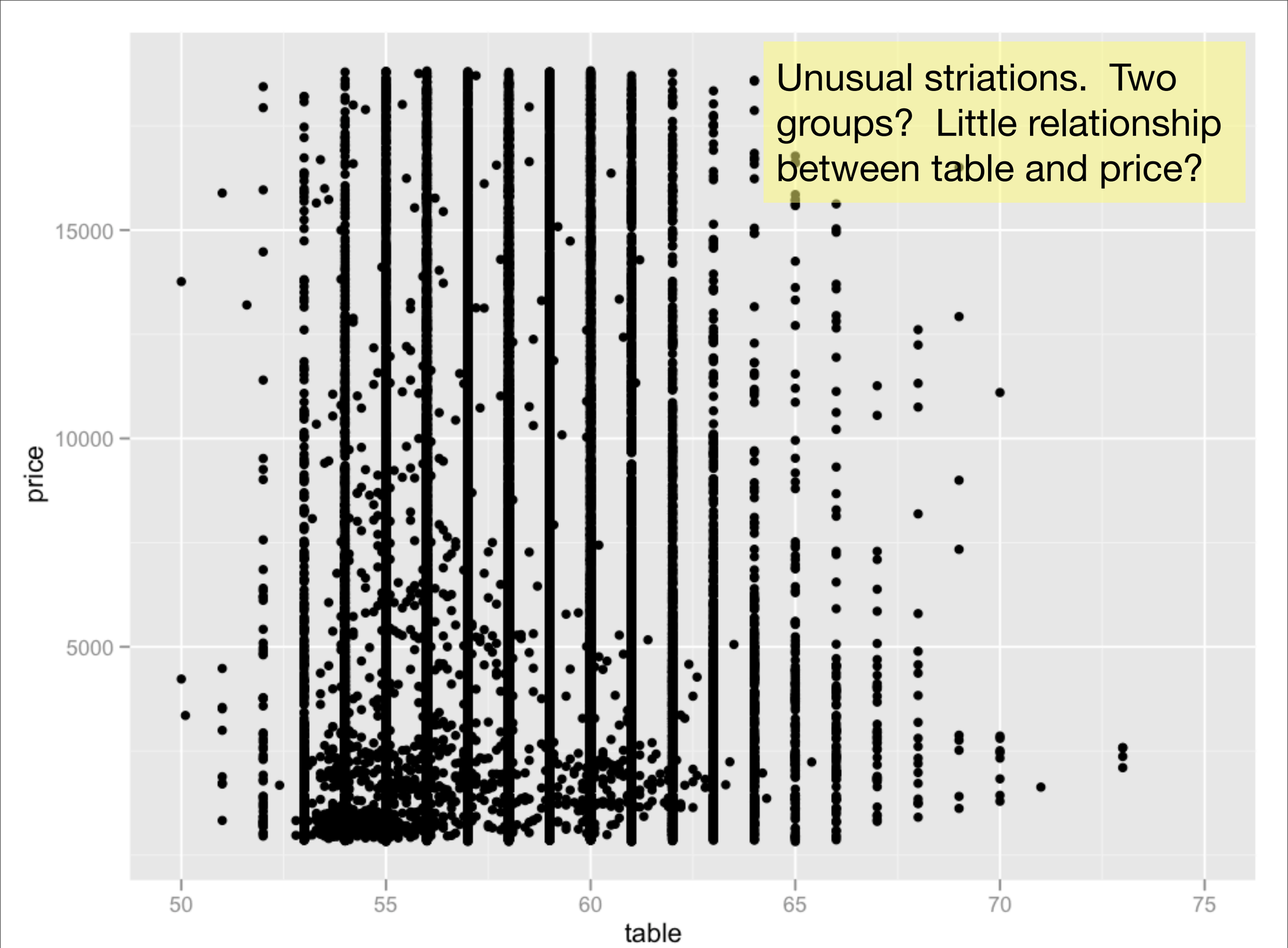
- Big patterns
- Small patterns
- Deviations from the pattern
- Strange patterns

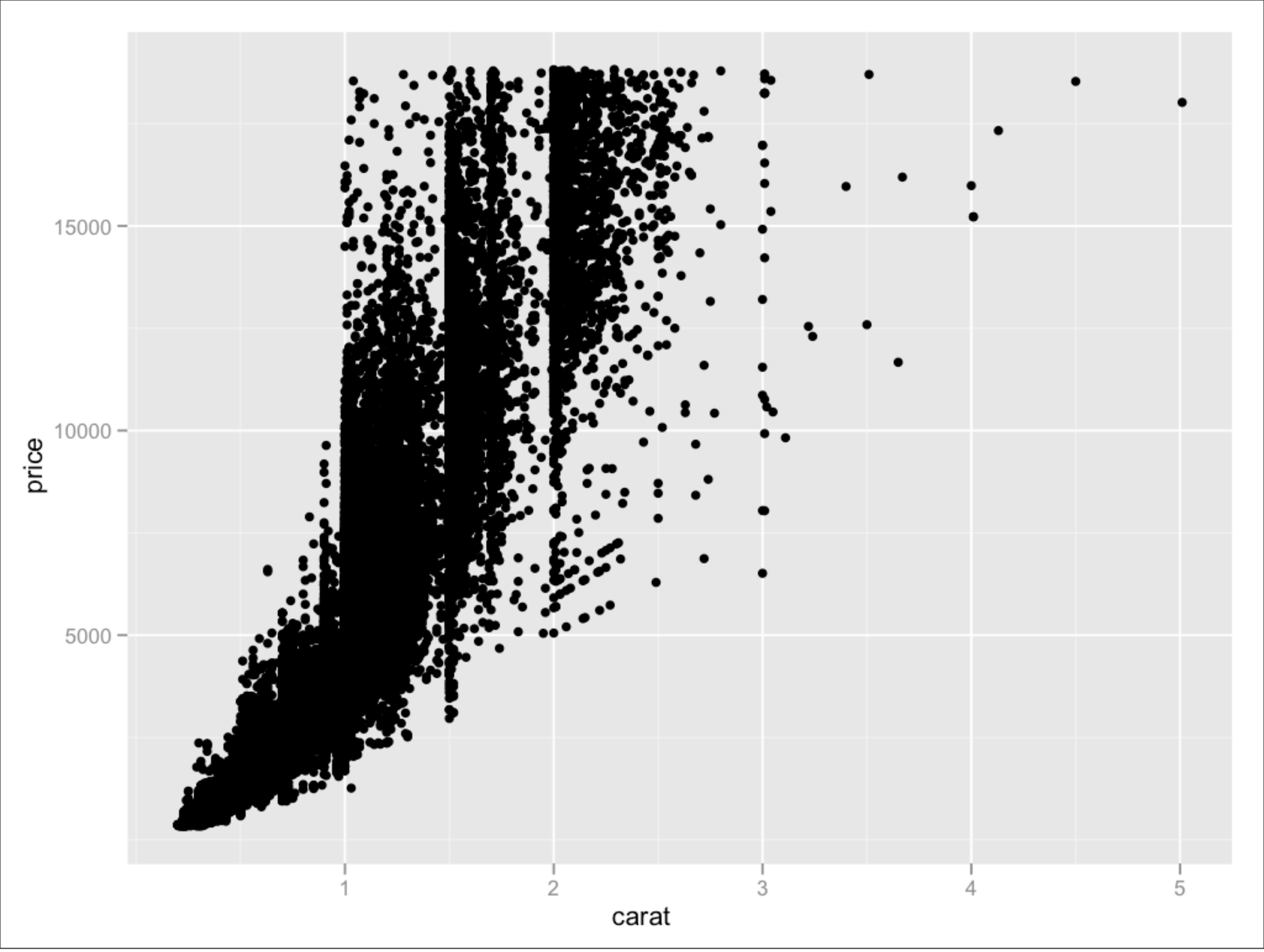

y
50
40
30
20
10
0
0
2
4
6
8
10
x

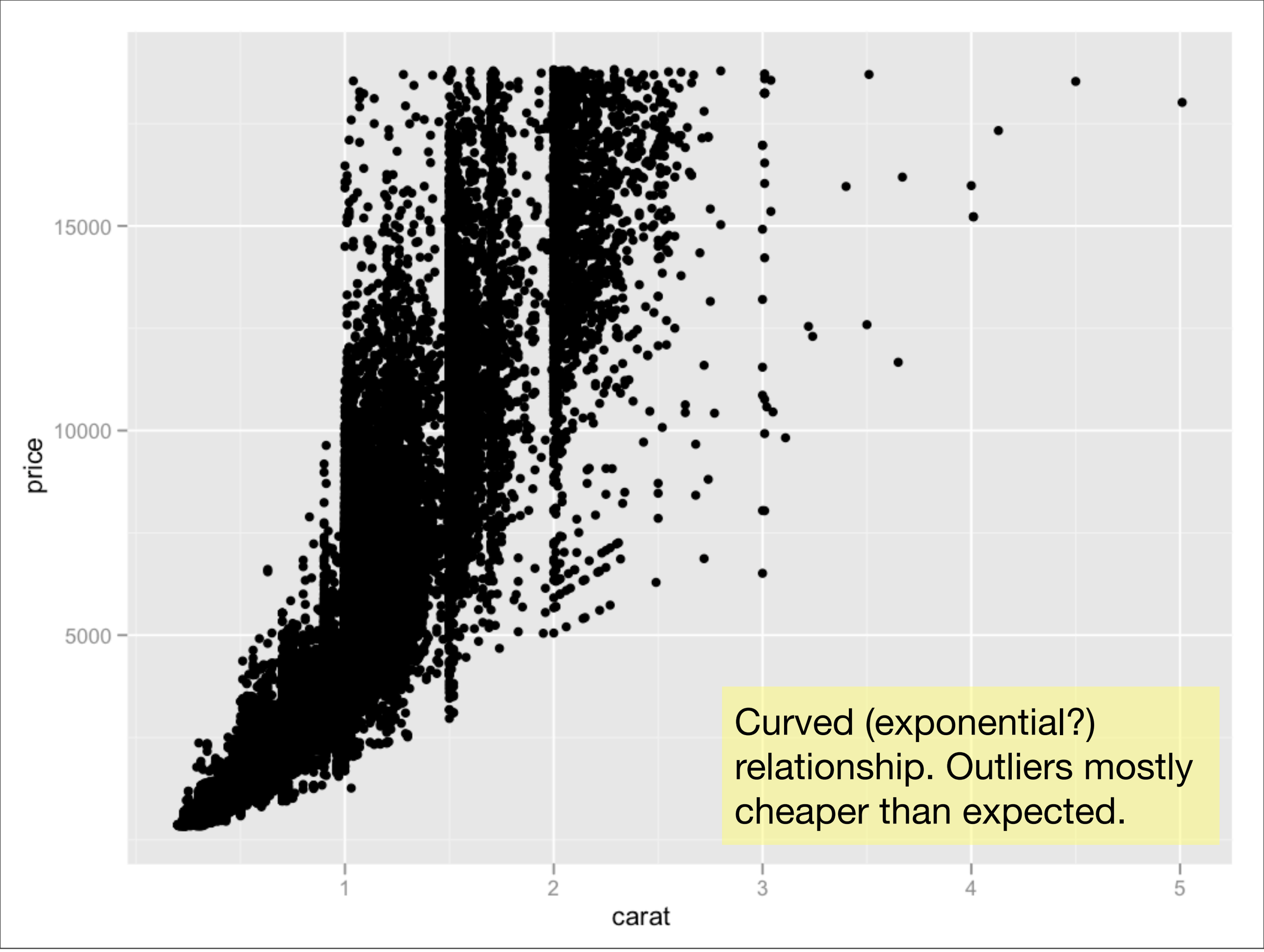
Strong linear relationship.
A number of outliers.

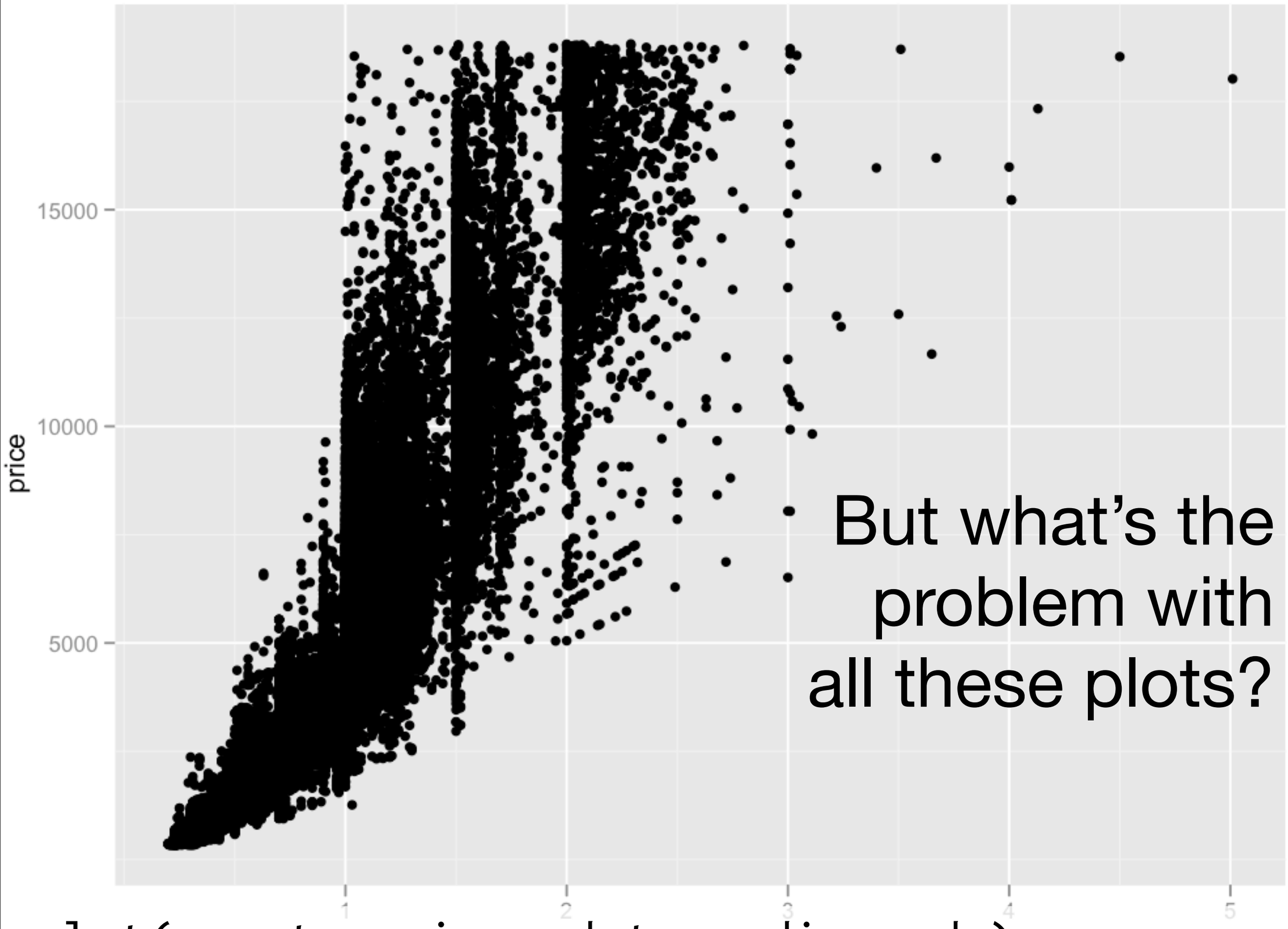



15000
10000
5000
price
50
55
60
65
70
75
table


Unusual striations. Two groups? Little relationship between table and price?
15000
10000
5000
price
50
55
60
65
70
75
table

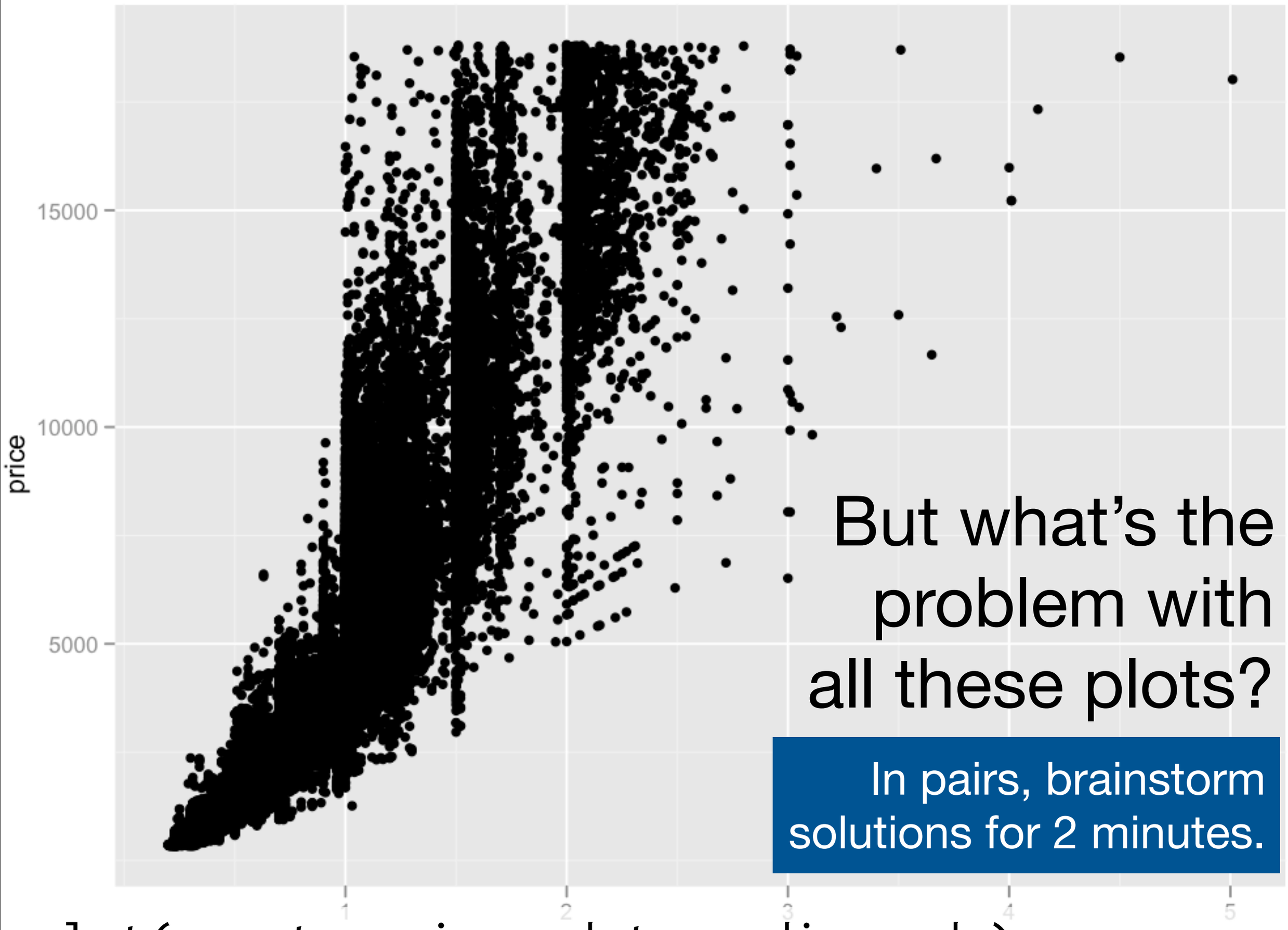

15000
10000
5000
price
1
2
3
4
5
carat


15000
10000
5000
price
1
2
3
4
5
carat
Curved (exponential?) relationship. Outliers mostly cheaper than expected.



But what's the problem with all these plots?

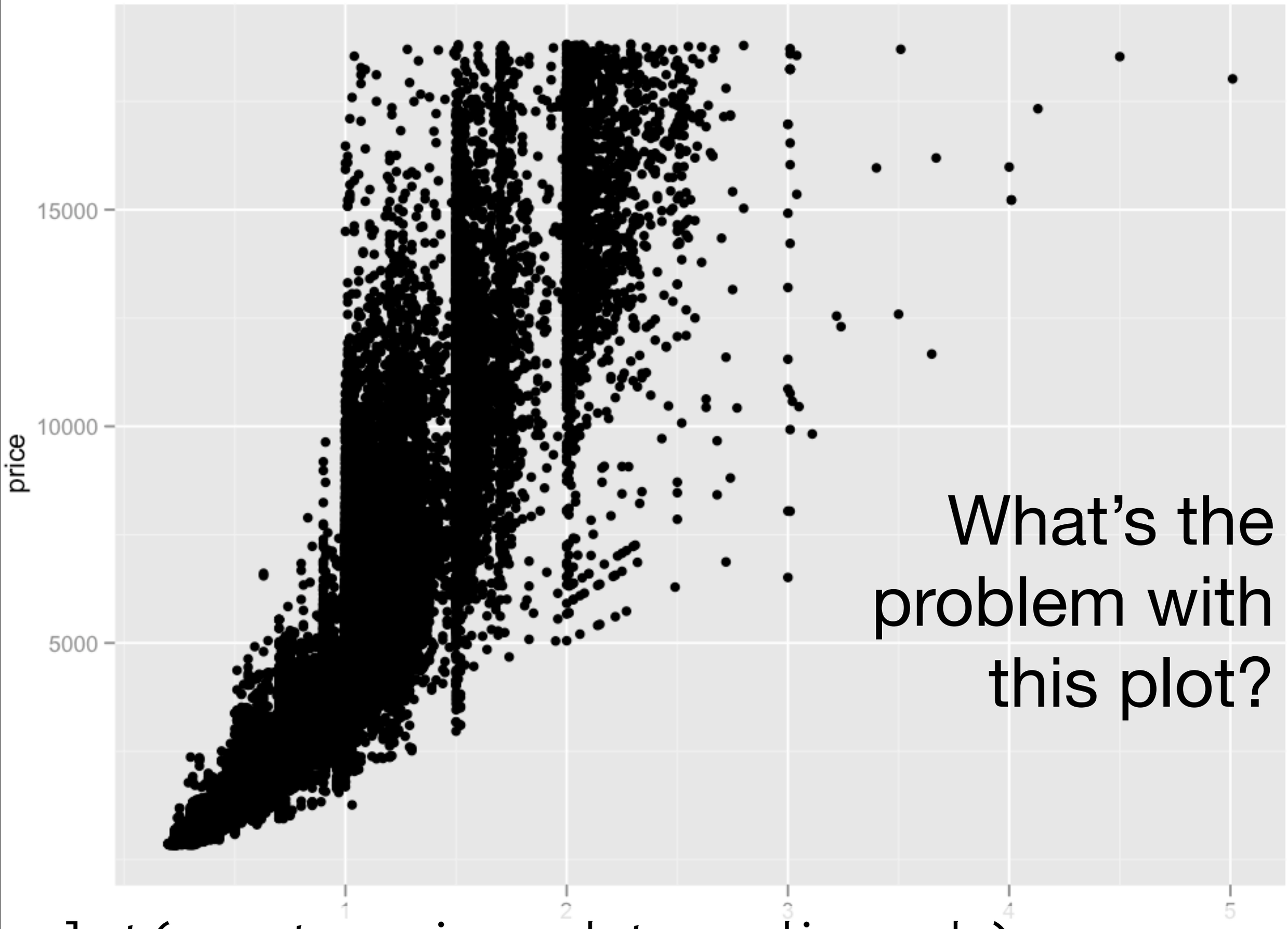
```
qplot(carat, price, data = diamonds)
```



But what's the problem with all these plots?

In pairs, brainstorm solutions for 2 minutes.

```
qplot(carat, price, data = diamonds)
```



What's the problem with this plot?

```
qplot(carat, price, data = diamonds)
```

What's the problem with this plot?

In pairs, brainstorm solutions for 2 minutes.

```
qplot(carat, price, data = diamonds)
```

Ideas

If x discrete, use boxplots.

Use semi-transparent points.

Divide into bins and count number of points in each bin (2d histogram).

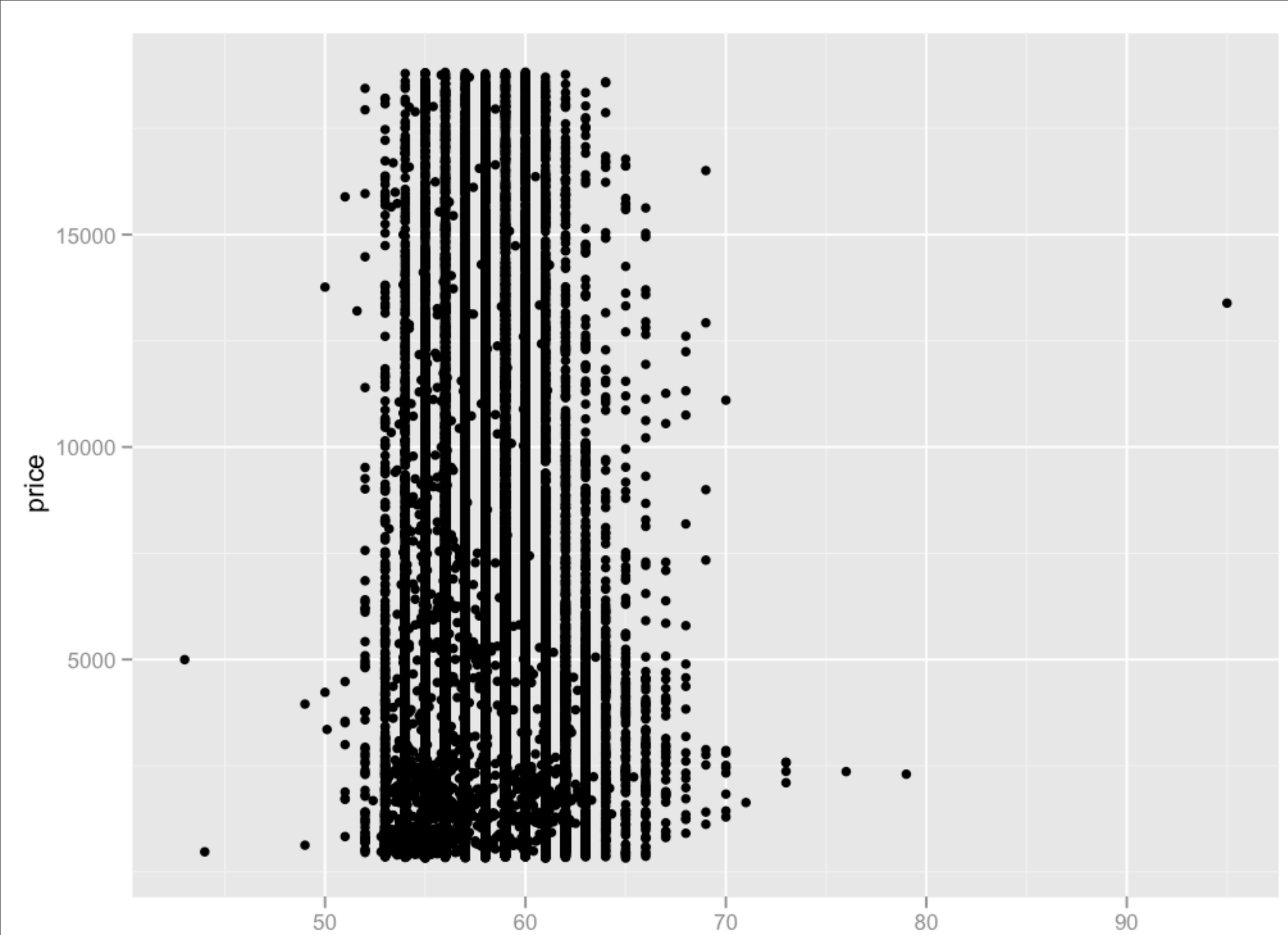
Display statistical summary.

Box and whisker plots

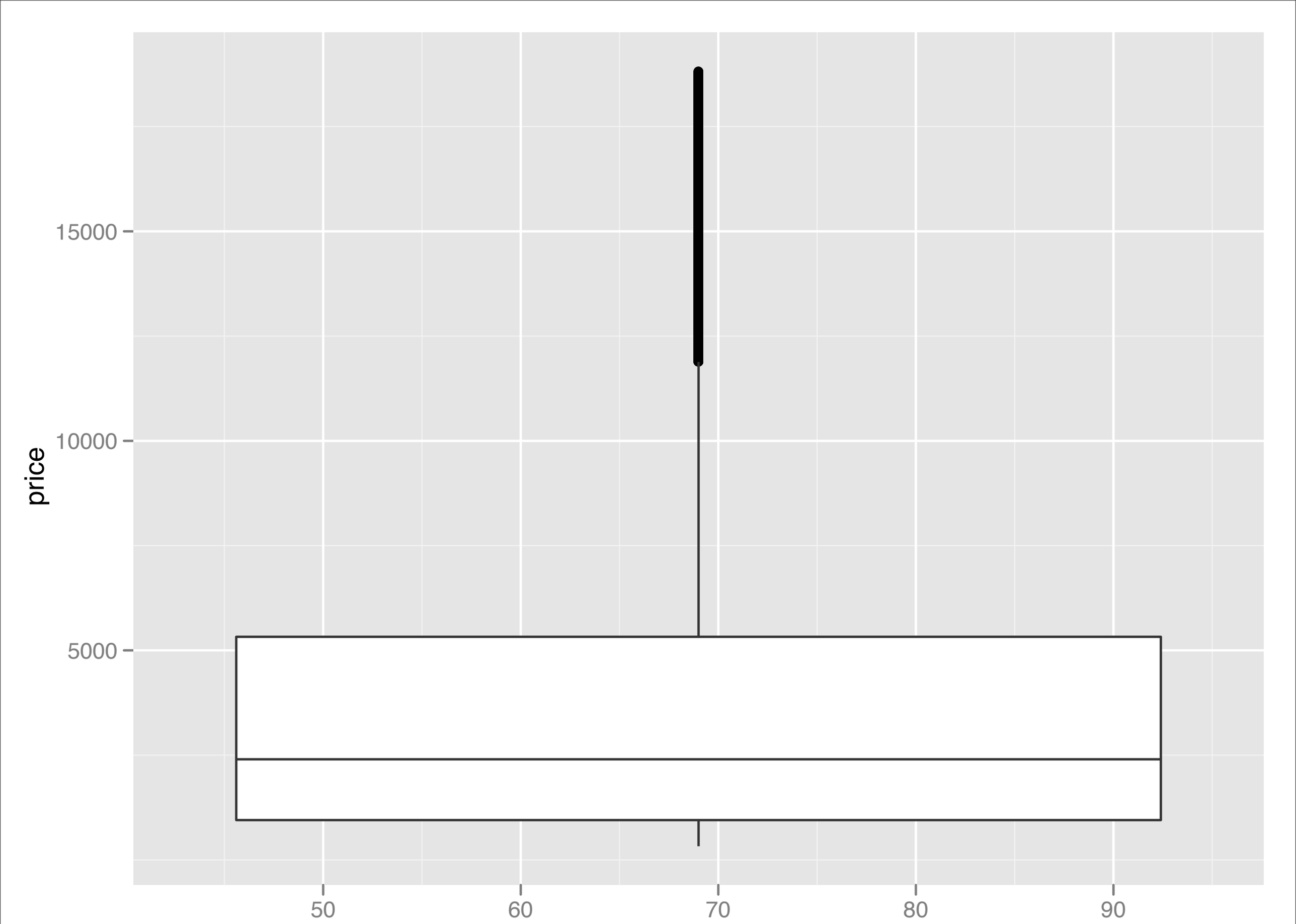
Boxplots

Less information than a histogram, but take up much less space.

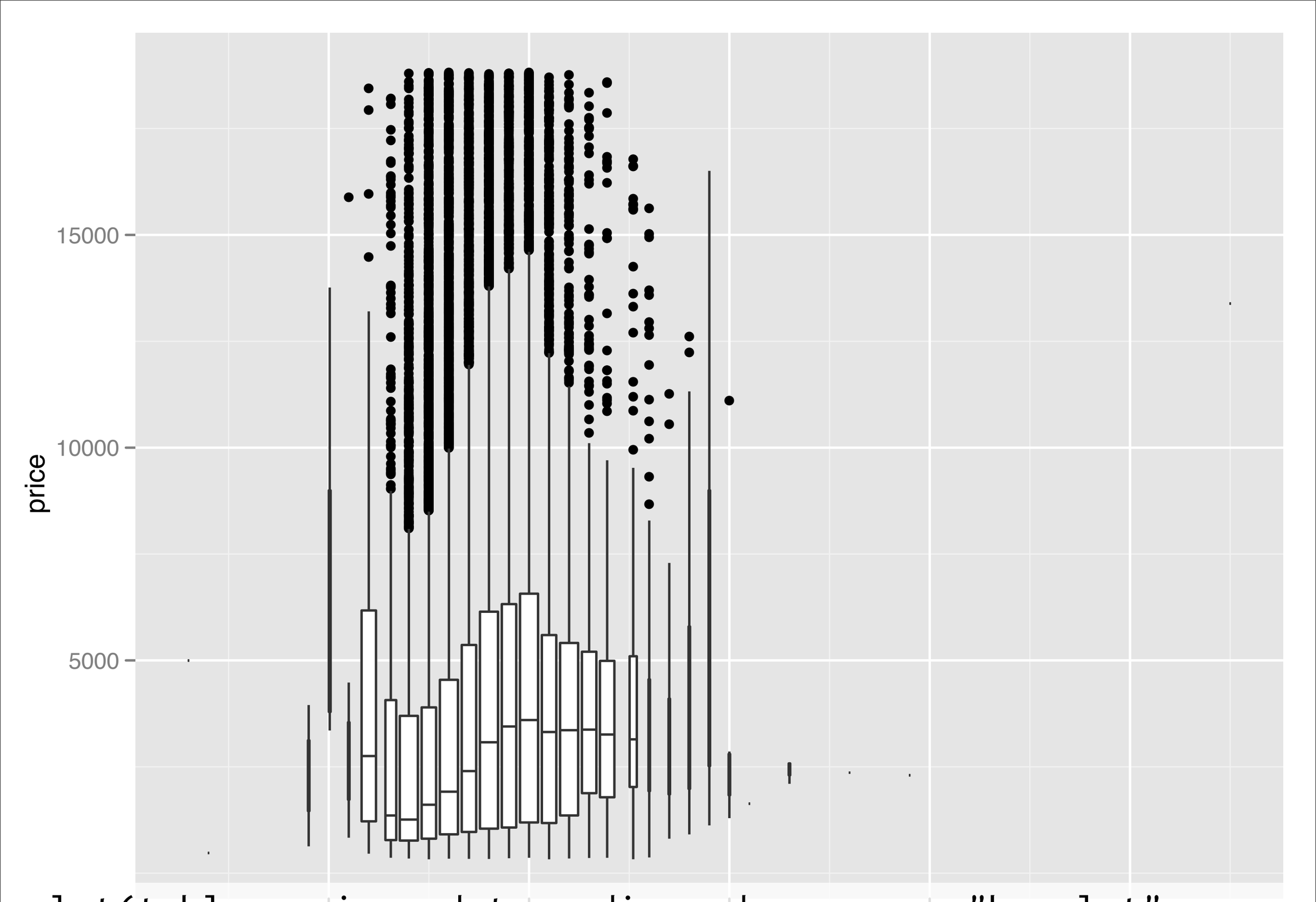
Already seen them used with discrete x values. Can also use with continuous x values, by specifying how we want the data **group**ed.



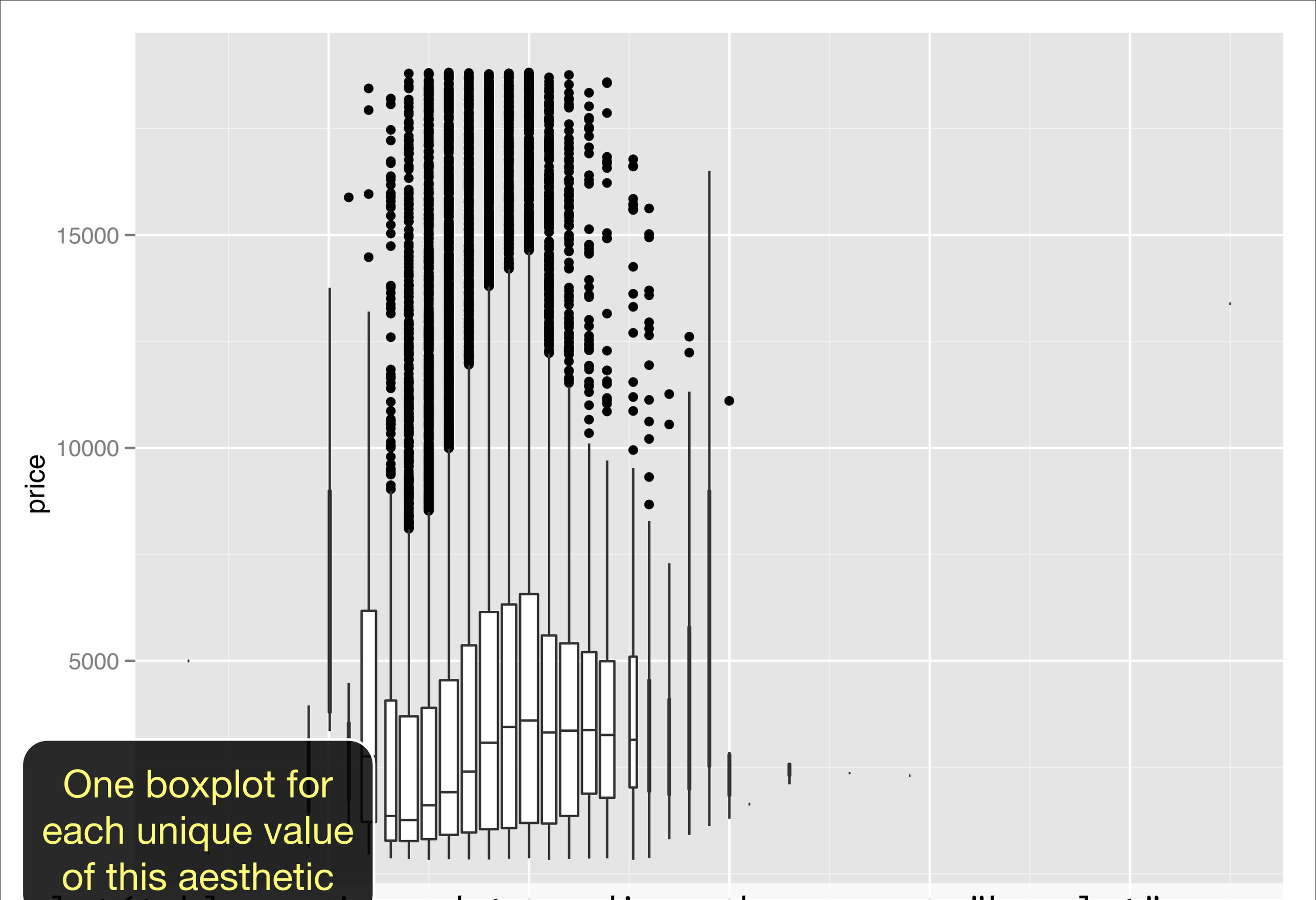

```
qplot(table, price, data = diamonds)
```




```
qplot(table, price, data = diamonds, geom = "boxplot")
```



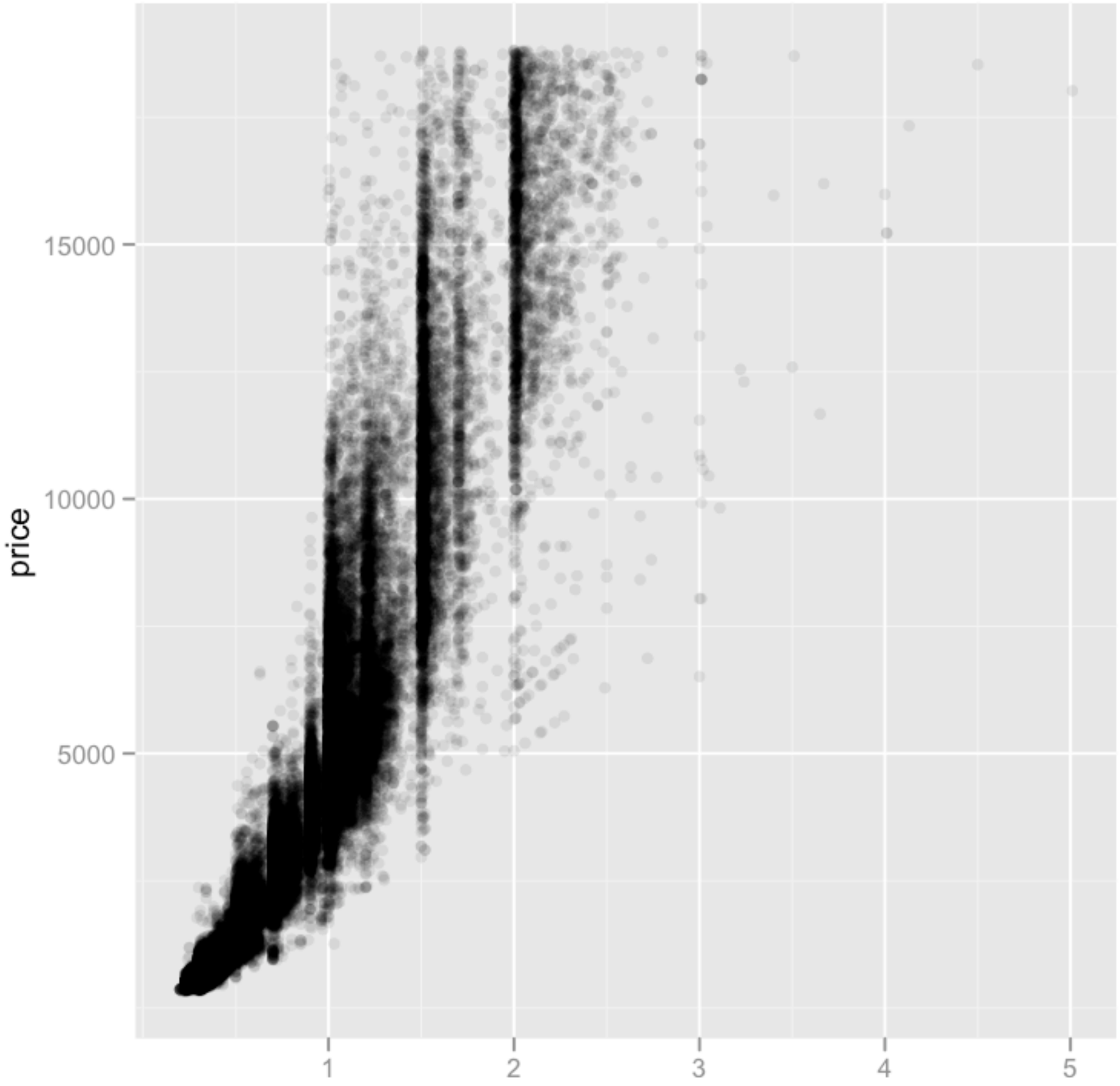

```
qplot(table, price, data = diamonds, geom = "boxplot",
  group = round(table))
```



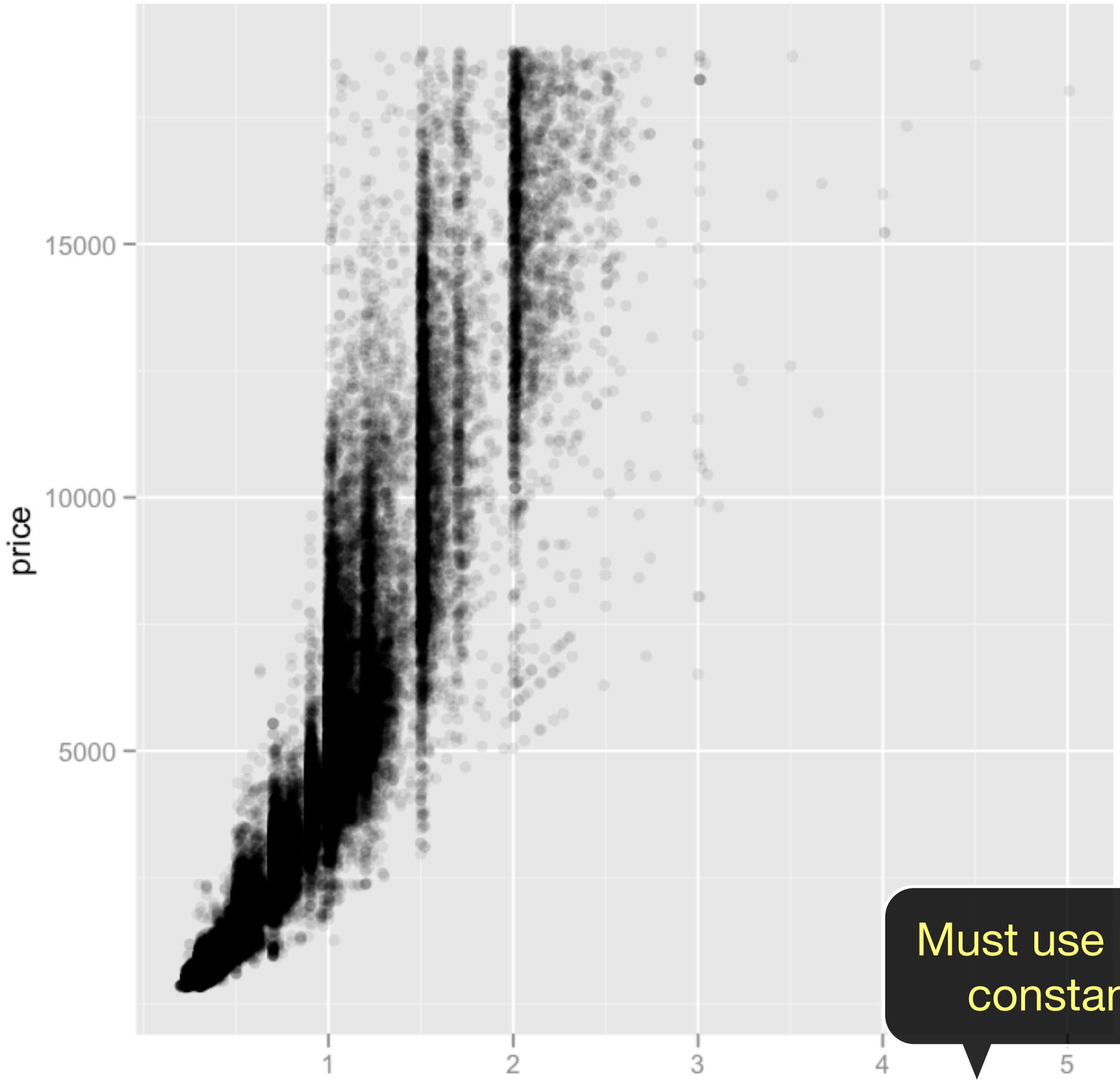
One boxplot for each unique value of this aesthetic

```
qplot(table, price, data = diamonds, geom = "boxplot",
  group = round(table))
```

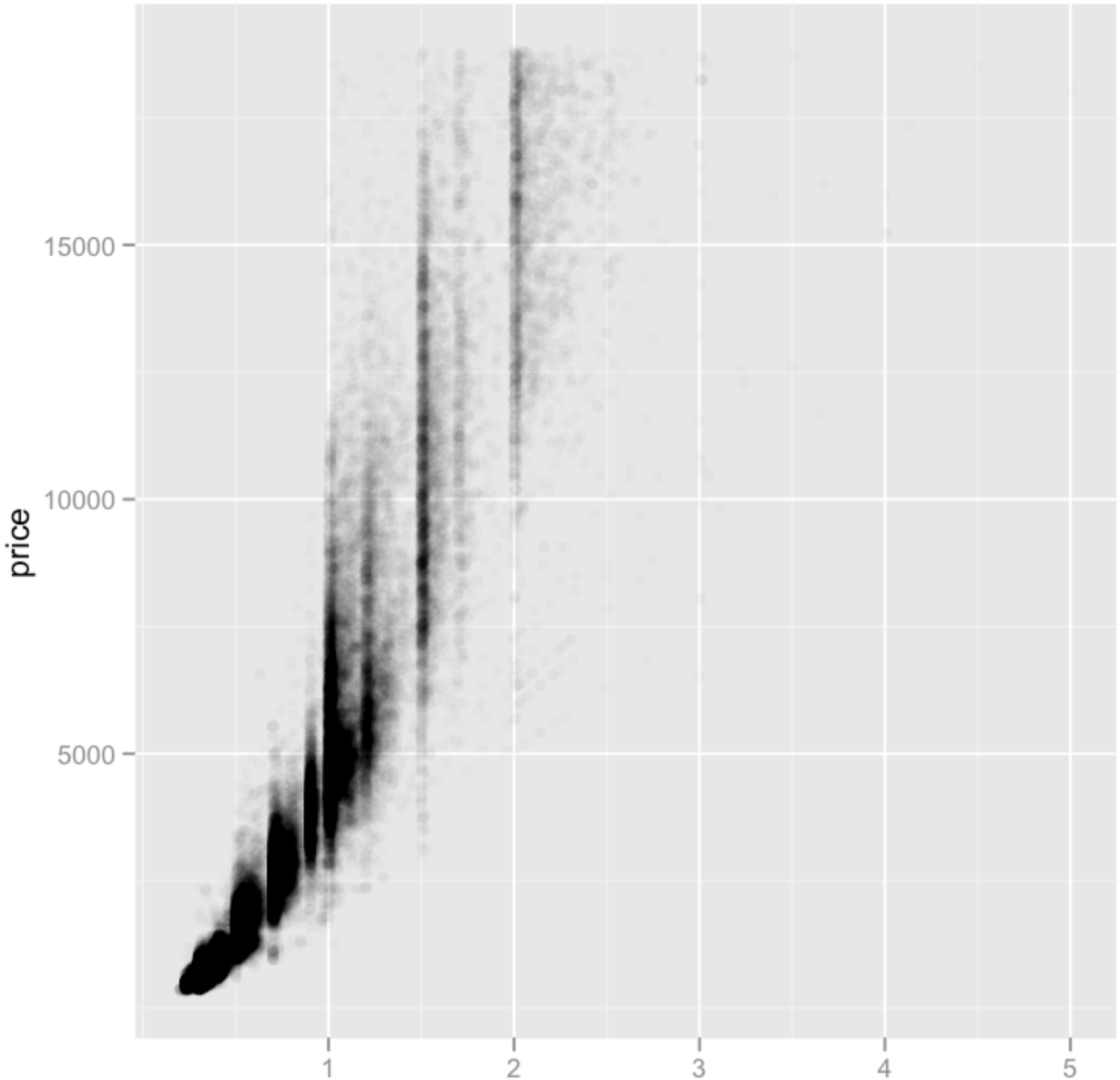
Alpha blending



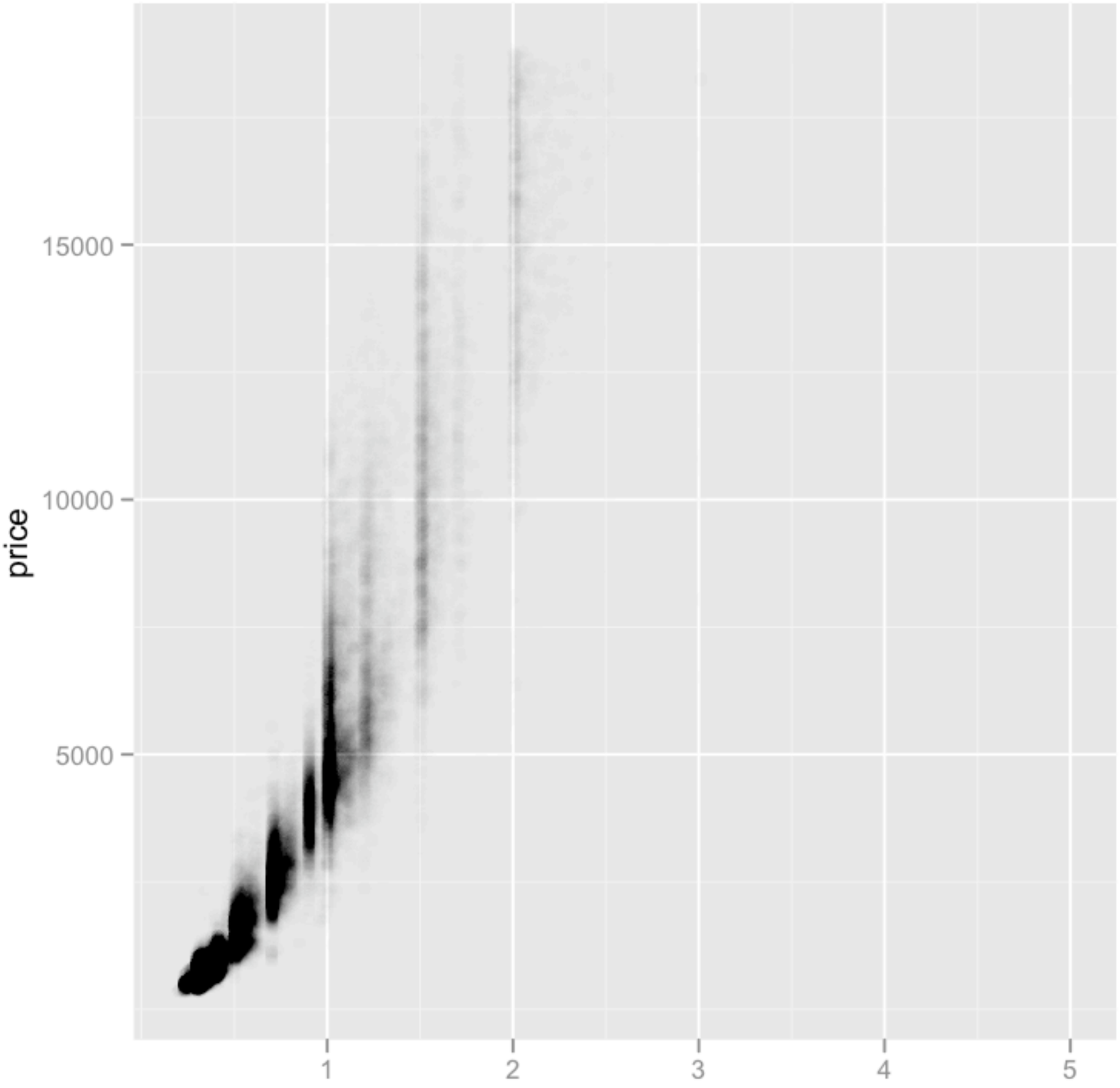

```
qplot(carat, price, data = diamonds, alpha = I(1/10))
```




```
qplot(carat, price, data = diamonds, alpha = I(1/10))
```



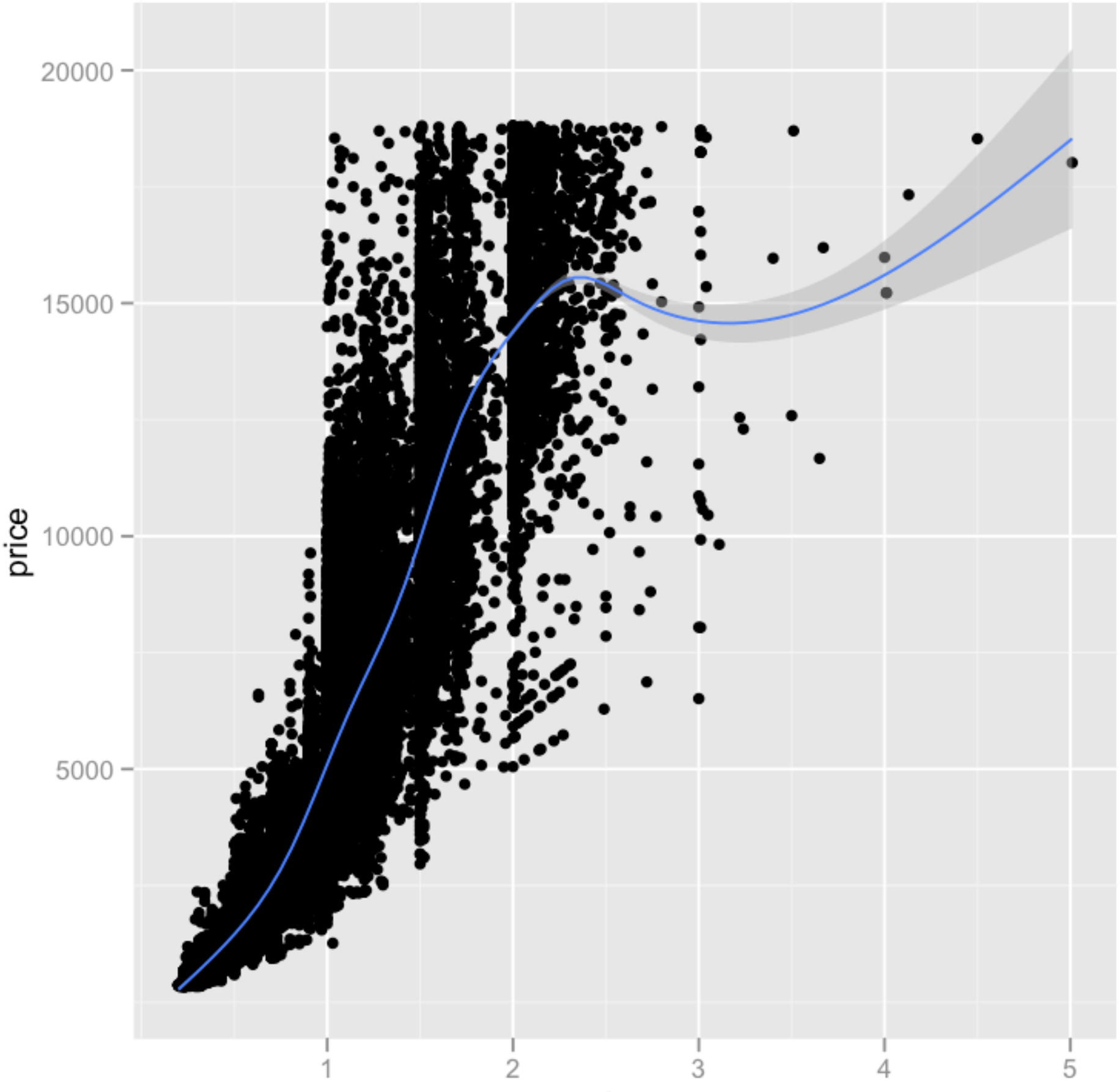

```
qplot(carat, price, data = diamonds, alpha = I(1/50))
```



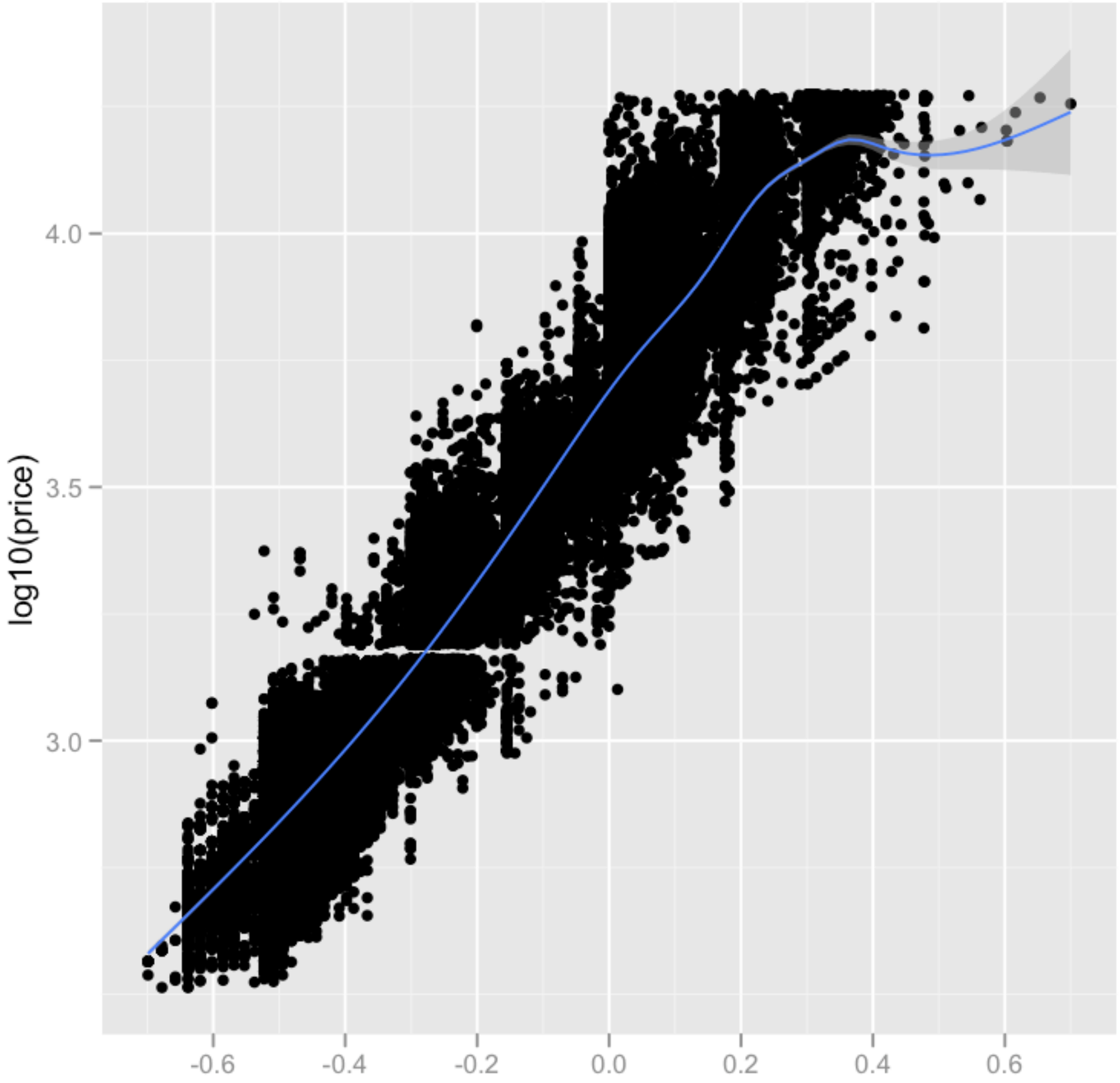

```
qplot(carat, price, data = diamonds, alpha = I(1/250))
```

```
qplot(carat, price, data = diamonds,
  colour = I(alpha("black", 1/255)))

qplot(carat, price, data = diamonds, geom = "bin2d")
qplot(carat, price, data = diamonds, geom = "bin2d",
bins = 100)
qplot(carat, price, data = diamonds, geom = "hex")

qplot(carat, price, data = diamonds) + geom_smooth()
```

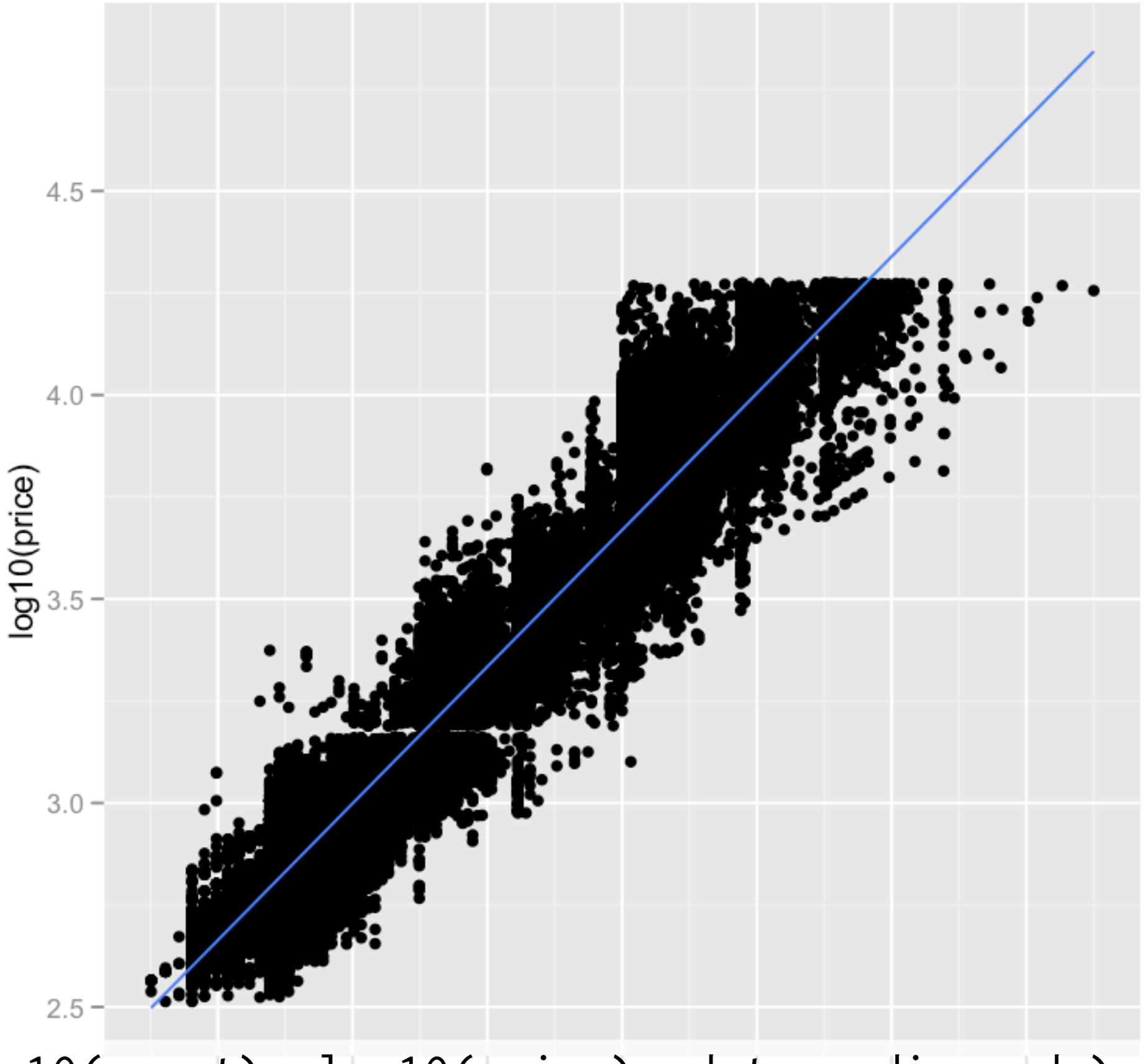
Statistical summary




```
qplot(carat, price, data = diamonds) + geom_smooth()
```




```
qplot(log10(carat), log10(price), data = diamonds) + geom_smooth()
```




```
qplot(log10(carat), log10(price), data = diamonds) +
  geom_smooth(method = "lm")
```

2d bins

```
# Very basic cleaning
diamonds$x[diamonds$x == 0] <- NA
diamonds$y[diamonds$y == 0] <- NA
diamonds$y[diamonds$y > 12] <- NA

qplot(x, y, data = diamonds)
qplot(x, y, data = diamonds, geom = "bin2d")
qplot(x, y, data = diamonds, geom = "hex")
qplot(x, y, data = diamonds, geom = "bin2d", bins = 100)
qplot(x, y, data = diamonds, geom = "hex", bins = 100)

# Zoom in
qplot(x, y, data = diamonds, geom = "bin2d", bins = 100) +
  xlim(4,7) + ylim(4,7)
qplot(x, y, data = diamonds, geom = "bin2d", bins = 100) +
  xlim(4,5) + ylim(4,5)
```

```
qplot(x, x / y, data = diamonds,
  geom = "bin2d")
qplot(x, log(x / y), data = diamonds,
  geom = "bin2d")

clean <- subset(diamonds, abs(log(x / y)) < 0.1)

qplot(x, log(x / y), data = clean, geom = "bin2d")
qplot(x, log(x / y), data = clean, geom = "bin2d",
  bins = 80)
```

```
qplot(x, x / y, data = diamonds,
  geom = "bin2d")
qplot(x, log(x / y), data = diamonds,
  geom = "bin2d")

clean <- subset(diamonds, abs(log(x / y)) < 0.1)

qplot(x, log(x / y), data = clean, geom = "bin2d")
qplot(x, log(x / y), data = clean, geom = "bin2d",
  bins = 80)
```

What would be a good name for log(x / y)? What other variable might you create to go with it?

Your turn

Continue to explore the relationship between x, y, z and carat. Create new variables as necessary.

You might also want to do more cleaning.

Some good ideas here: http://www.diamondhelpers.com/fivesteps/4-certified-diamonds.shtml