Rsquared Academy

Introduction to ggplot2

Agenda

- explore graphics systems in R
- understand grammar of graphics
- understand geoms
- explore aesthetics to modify geoms
- use facets for sub plots
- change coordinate system

Why visualize data?

- explore and explain patterns and trends
- detect anomalies in data
- make sense of large amount of data efficiently and in time
- easy to communicate and share insights from data

Graphics Systems

- Base R
- ggplot2
- lattice

Libraries

```r
library(ggplot2)
library(readr)
library(descriptr)
library(gridExtra)
```

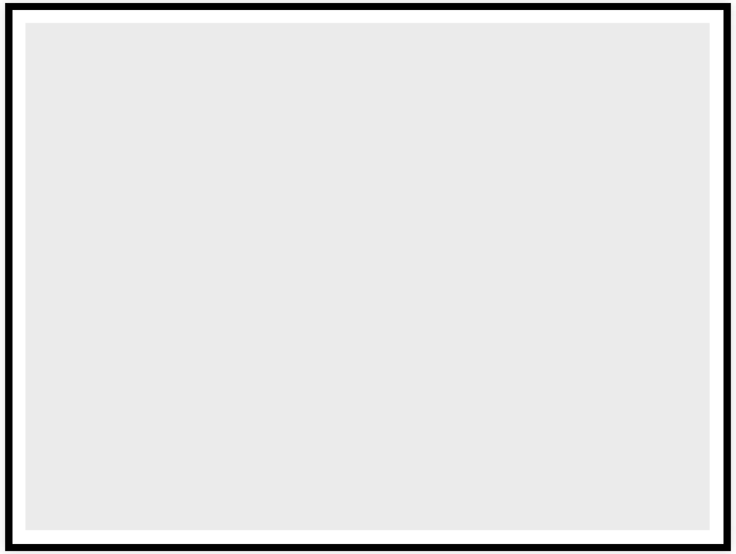
Grammar of Graphics

Grammar of graphics is a formal system for building plots. The core idea is that any plot can be uniquely described as a combination of

- a dataset
- a geom
- a set of mappings
- a statistic
- a position adjustment
- a coordinate system
- a faceting scheme

Coordinate System

```
ggplot()
```

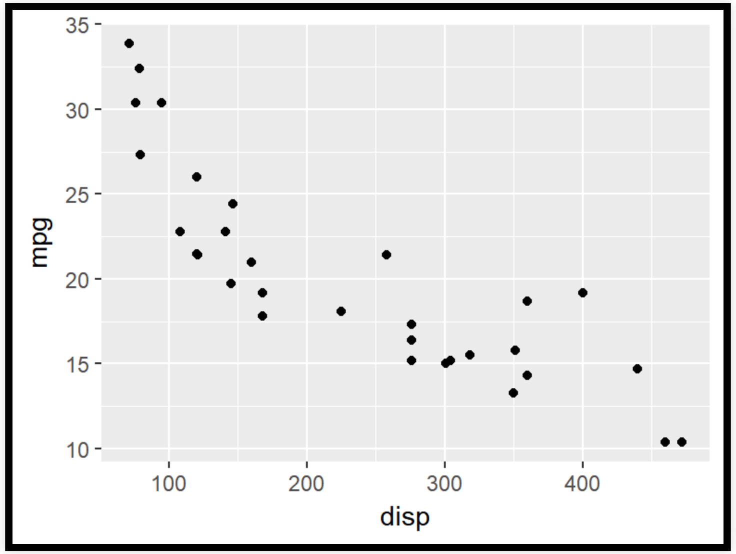


Data Set

```
ggplot(data = mtcarz)
```

Geoms

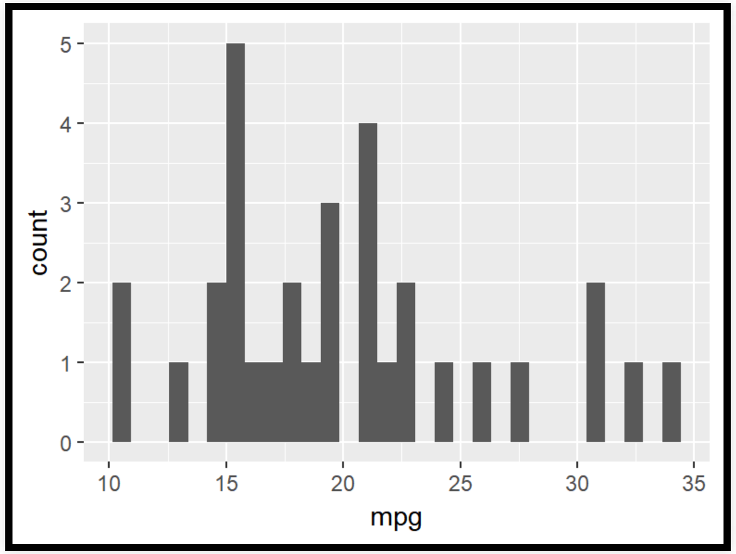
```
ggplot(data = mtcarz) +
  geom_point(mapping = aes(x = disp, y = mpg))
```



Geoms

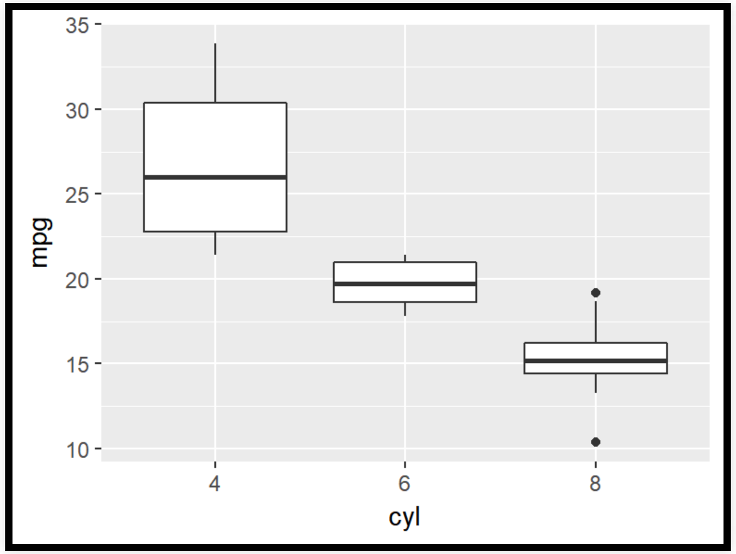
```
ggplot(data = mtcarz) +
  geom_histogram(mapping = aes(x = mpg))
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



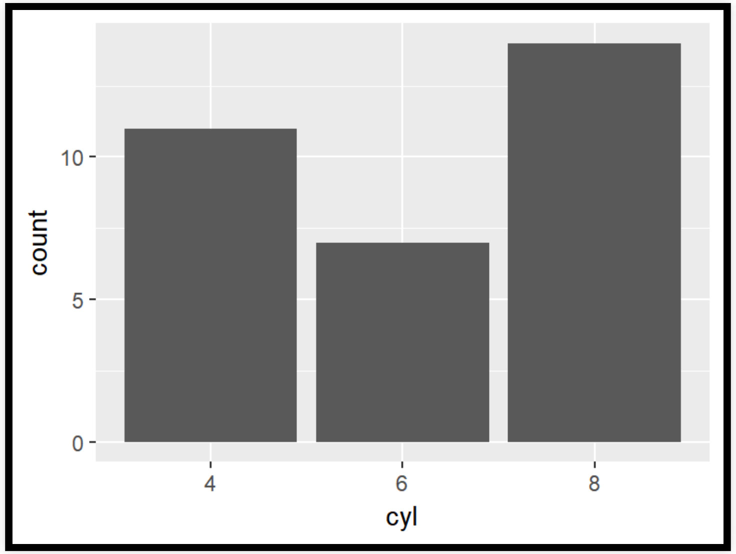
Geoms

```r
ggplot(data = mtcarz) +
  geom_boxplot(mapping = aes(x = cyl, y = mpg))
```



Geoms

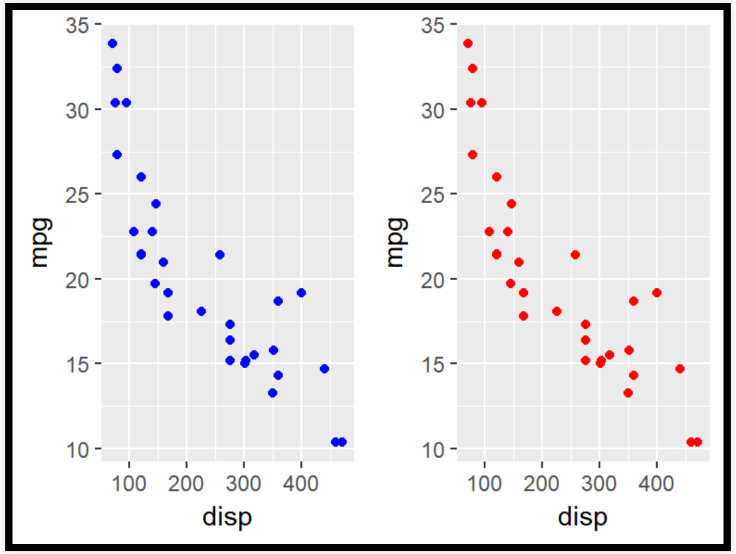
```
ggplot(data = mtcarz) +
  geom_bar(mapping = aes(x = cyl))
```



Aesthetics

- color
- shape
- size
- background color
- transparency
- line type

Color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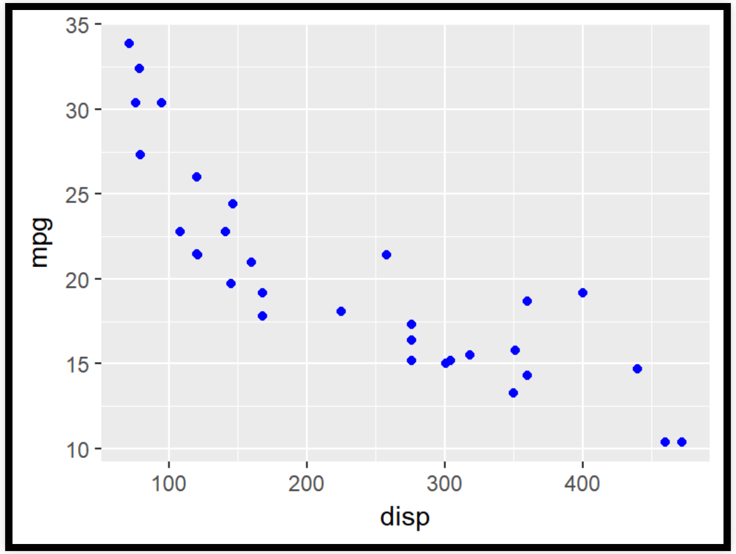
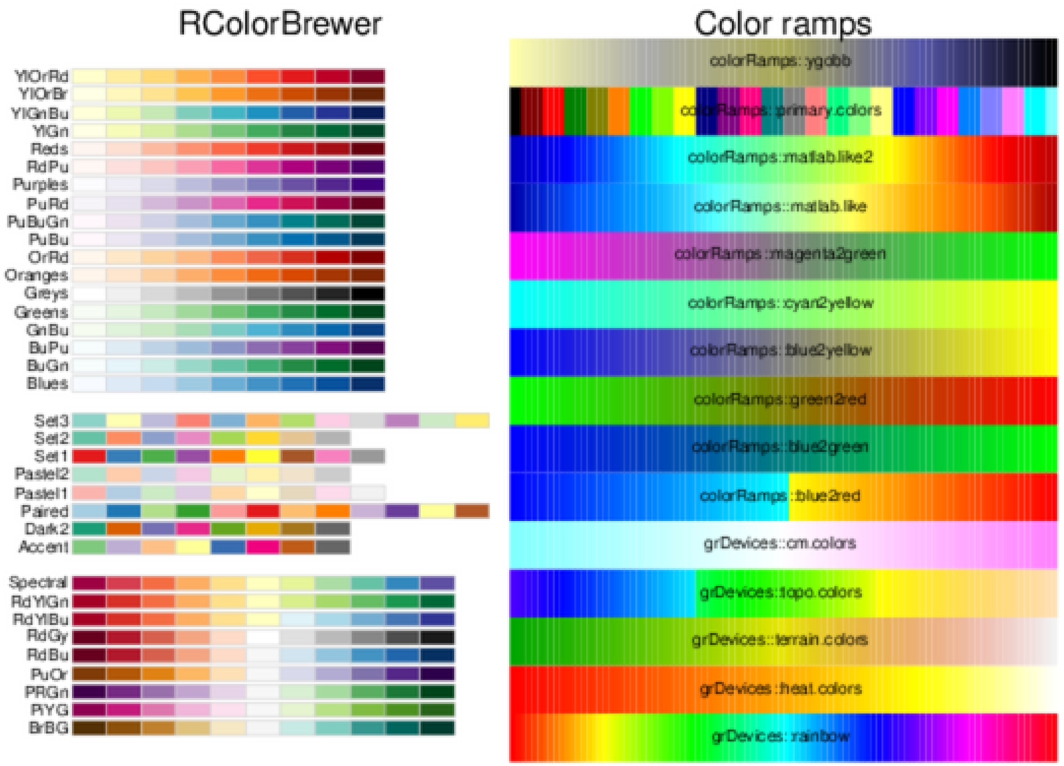
Color Hex Code

```
ggplot(data = mtcarz) +
  geom_point(mapping = aes(x = disp, y = mpg), color = "#0000ff")
```

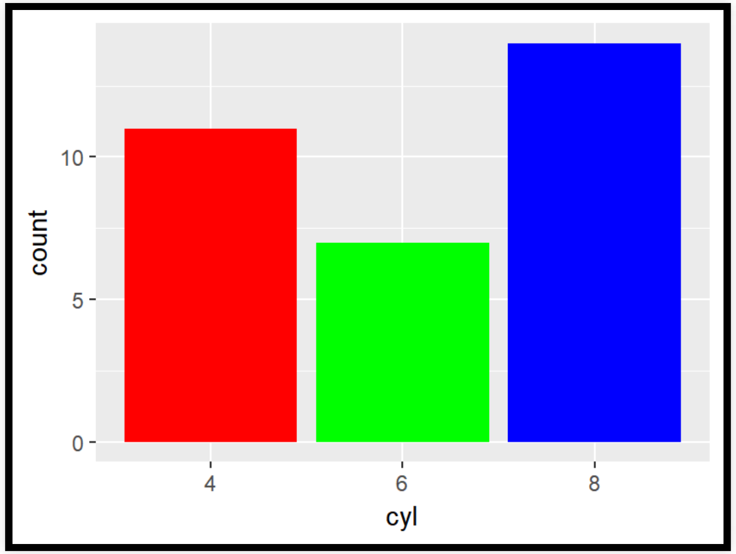


Color Palette

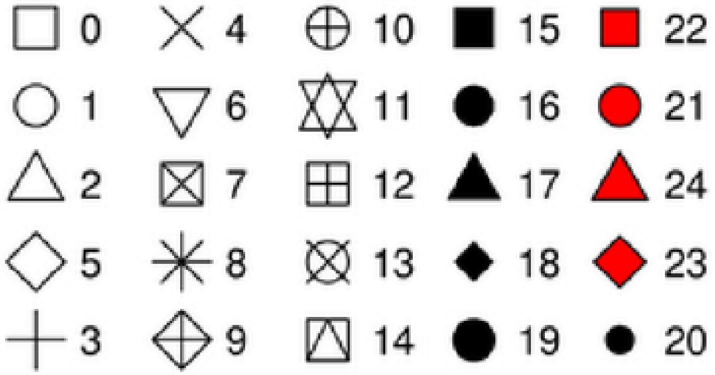


Color Palette

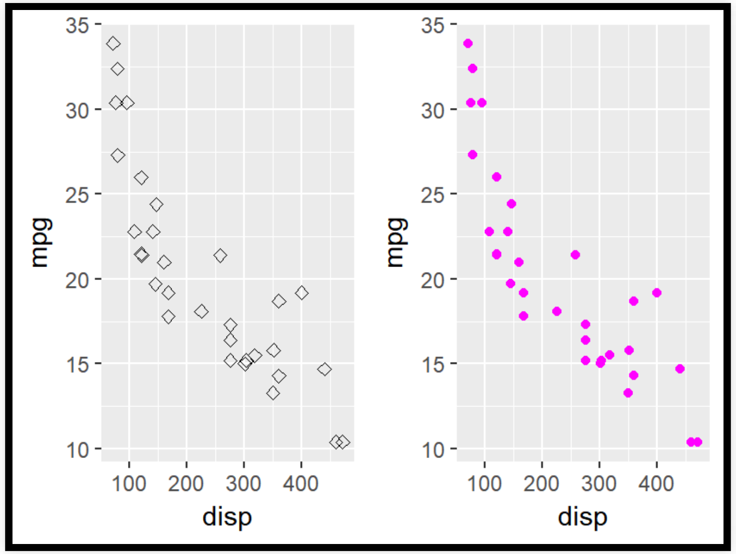
```
ggplot(mtcarz) +
  geom_bar(aes(x = cyl), fill = rainbow(3))
```



Shape



Shape



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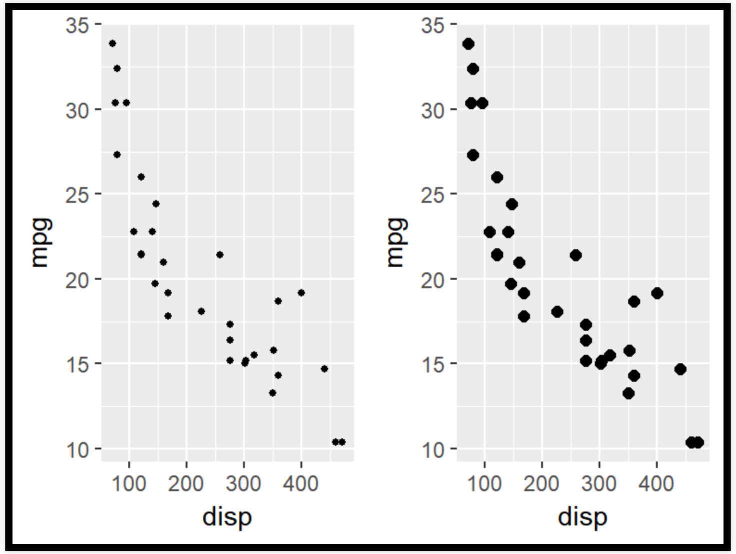
Size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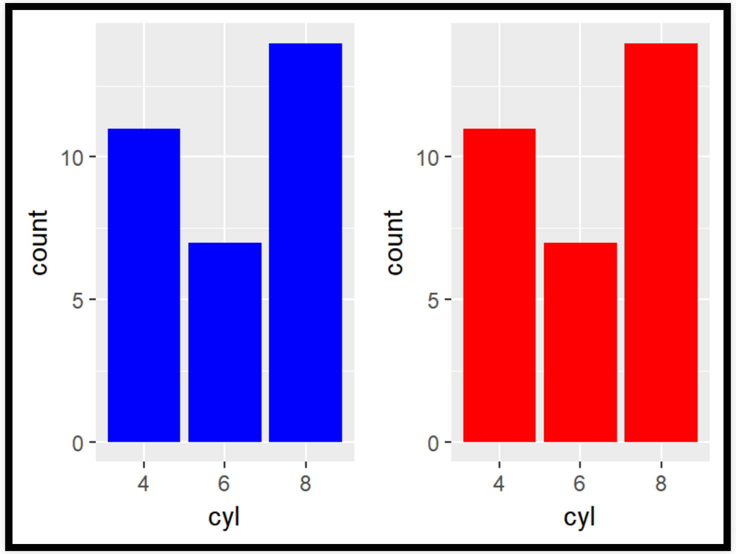
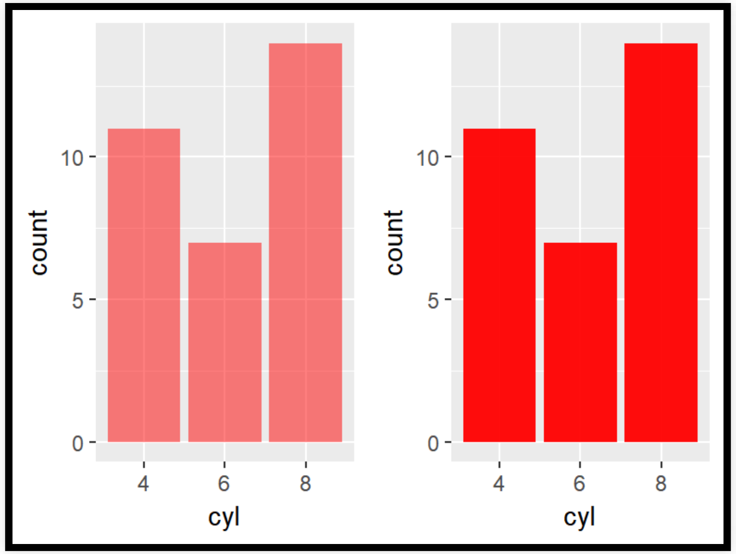
Background Color

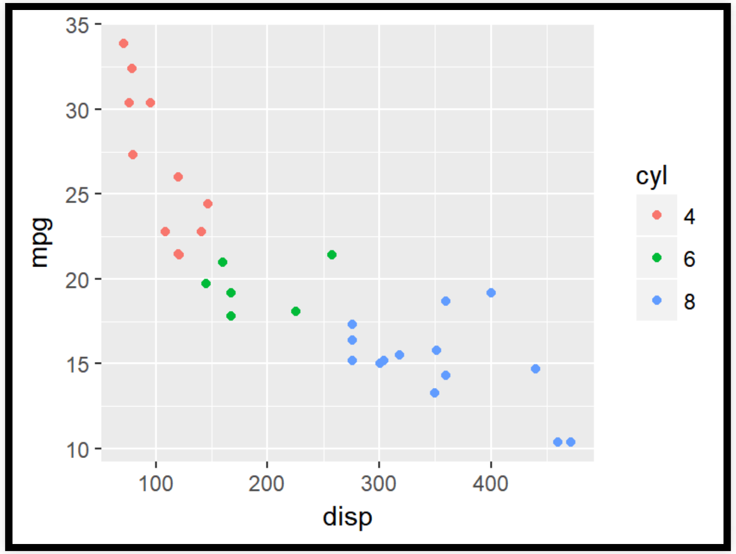


Transparency



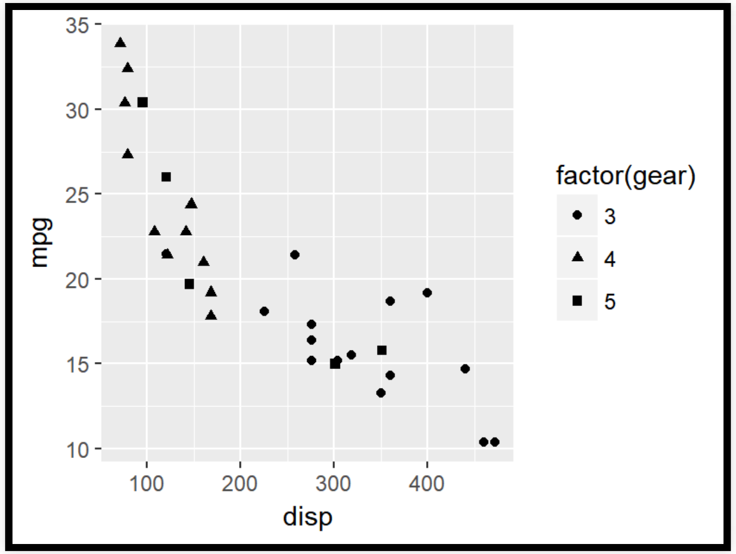
Map Color

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg, color = cyl))
```



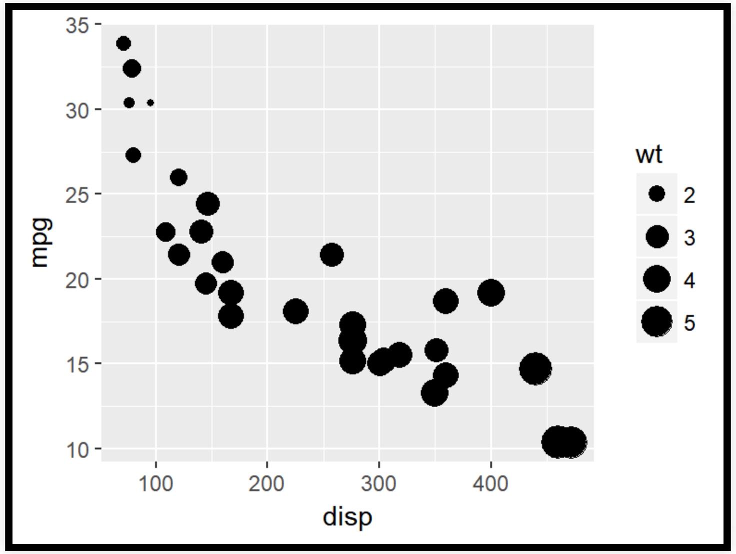
Map Shape

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg, shape = factor(gear)))
```



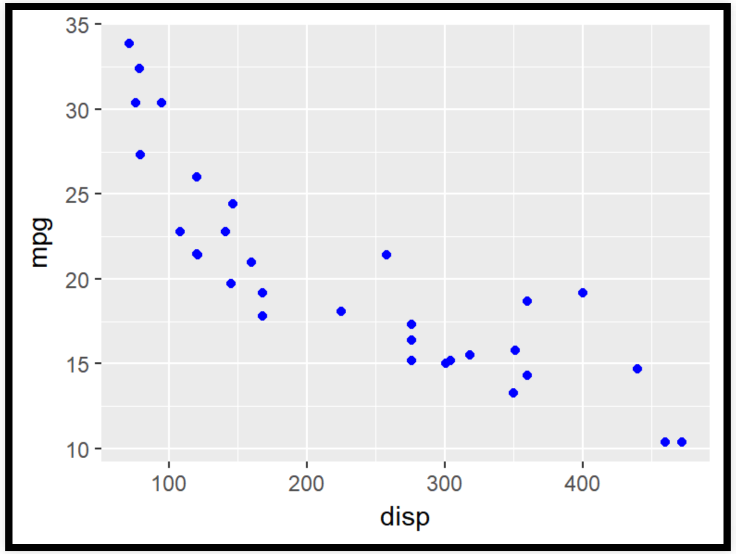
Map Size

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg, size = wt))
```



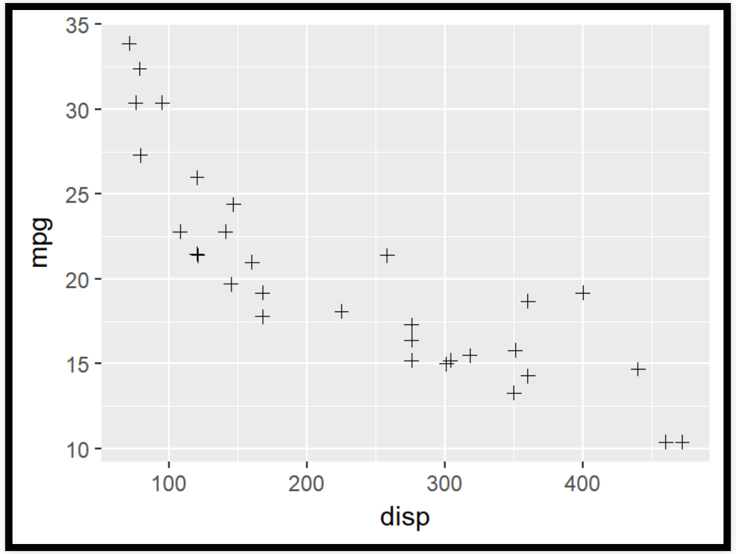
Color = blue

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg), color = "blue")
```



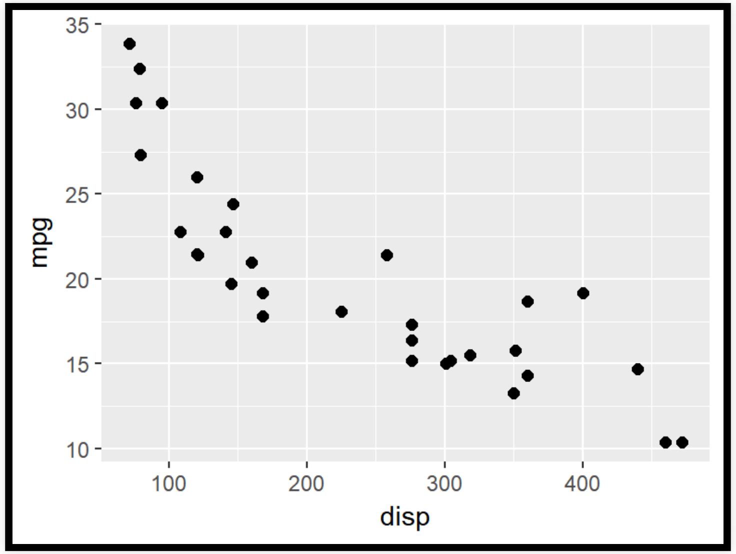
Shape = 3

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg), shape = 3)
```

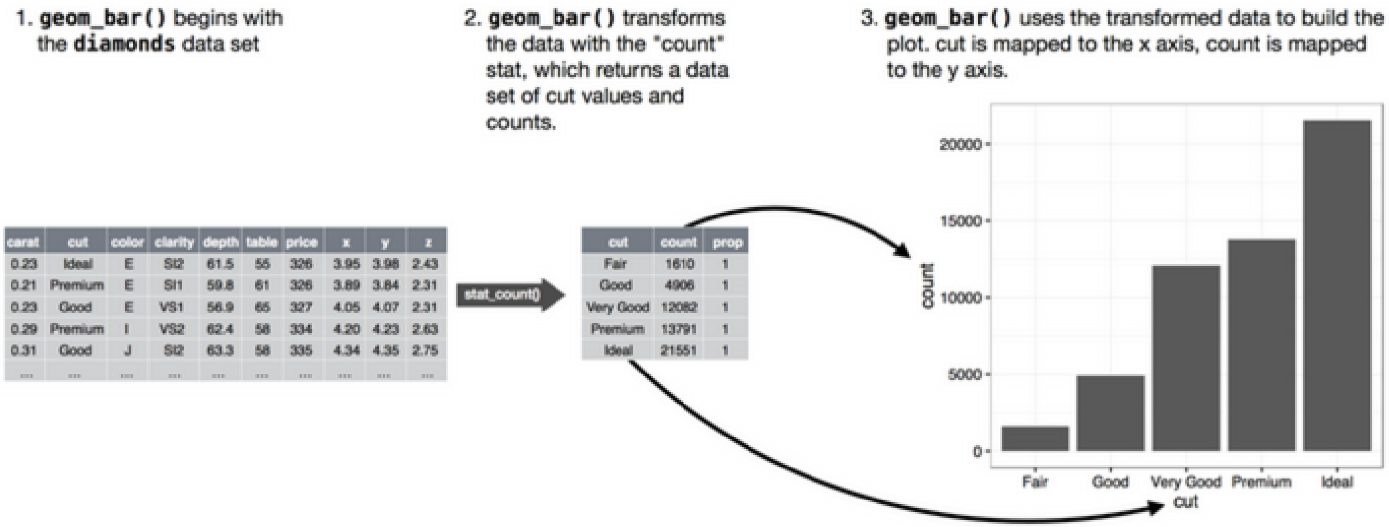


Size = 2

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg), size = 2)
```



Transform



1. **geom_bar()** begins with the **diamonds** data set

2. **geom_bar()** transforms the data with the "count" stat, which returns a data set of cut values and counts.

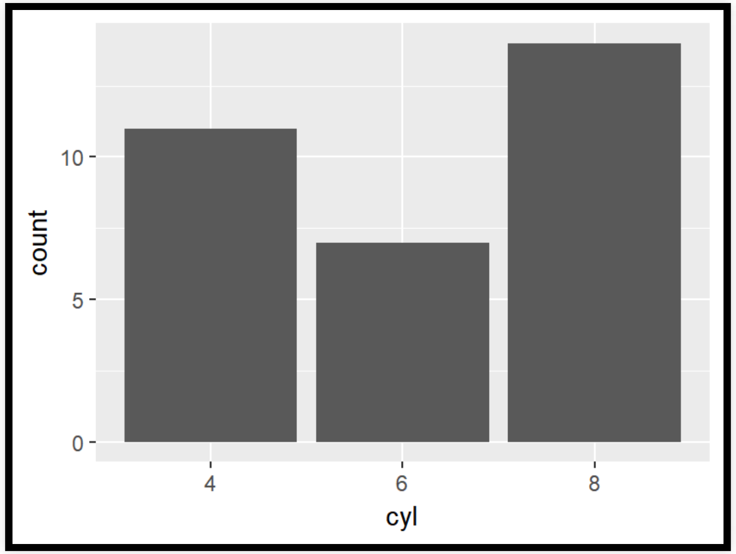
3. **geom_bar()** uses the transformed data to build the plot. cut is mapped to the x axis, count is mapped to the y axis.

carat	cut	color	clarity	depth	table	price	x	y	z
0.23	Ideal	E	SI2	61.5	55	326	3.95	3.98	2.43
0.21	Premium	E	SI1	59.8	61	326	3.89	3.84	2.31
0.23	Good	E	VS1	56.9	65	327	4.05	4.07	2.31
0.29	Premium	I	VS2	62.4	58	334	4.20	4.23	2.63
0.31	Good	J	SI2	63.3	58	335	4.34	4.35	2.75
...	...	...	...	...	...	...	...	...	...

cut	count	prop
Fair	1610	1
Good	4906	1
Very Good	12082	1
Premium	13791	1
Ideal	21551	1

Bar chart

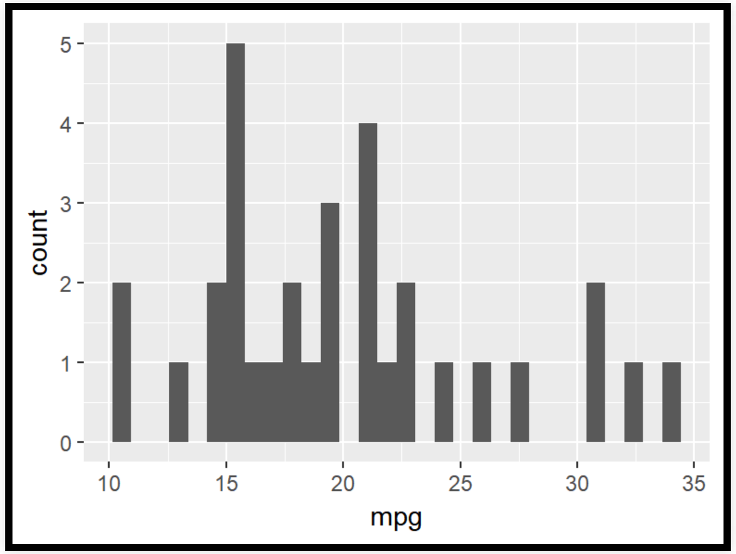
```
ggplot(data = mtcarz) +
  stat_count(mapping = aes(x = cyl))
```



Histograms

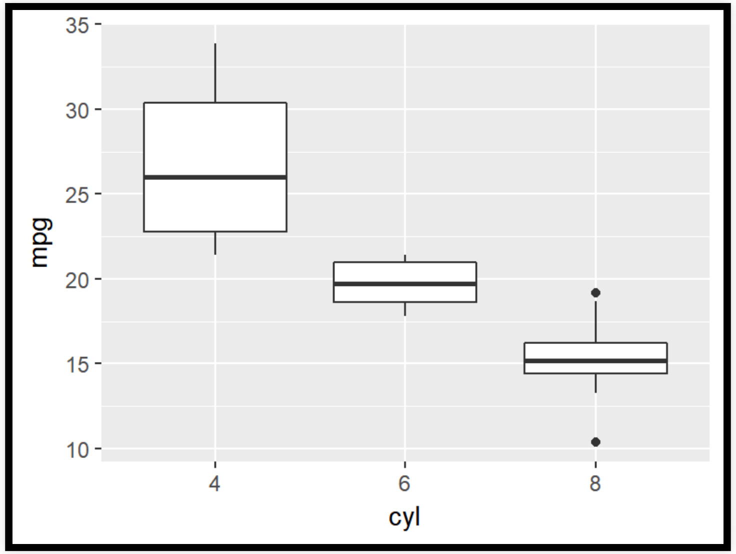
```
ggplot(data = mtcarz) +
  stat_bin(mapping = aes(x = mpg))
```

```
## `stat_bin()` using `bins = 30`. Pick better value with `binwidth`.
```



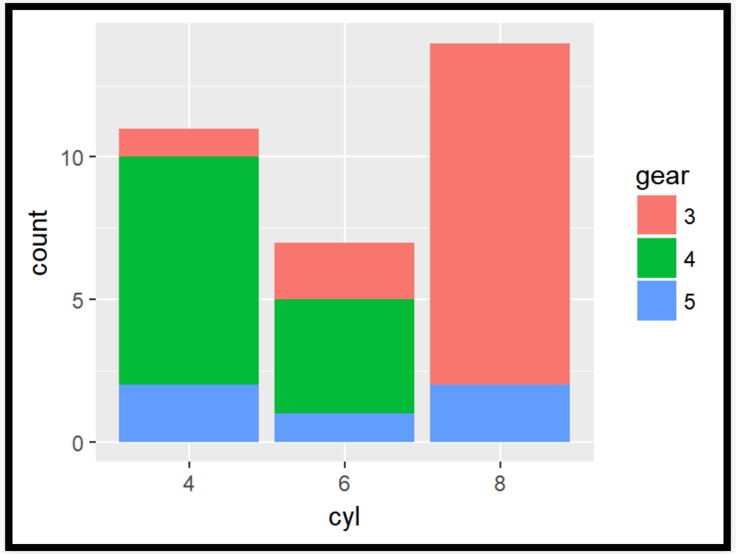
Box plots

```r
ggplot(data = mtcarz) +
  stat_boxplot(mapping = aes(x = cyl, y = mpg))
```



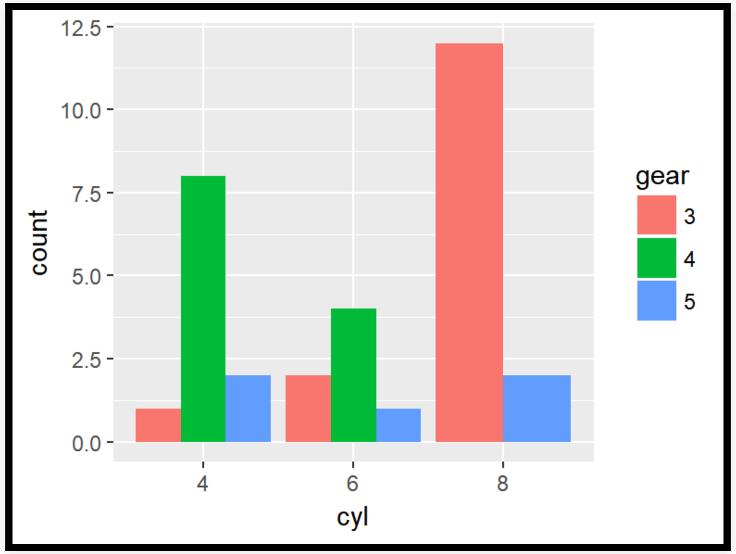
Position

```r
ggplot(data = mtcarz) +
  geom_bar(mapping = aes(x = cyl, fill = gear))
```



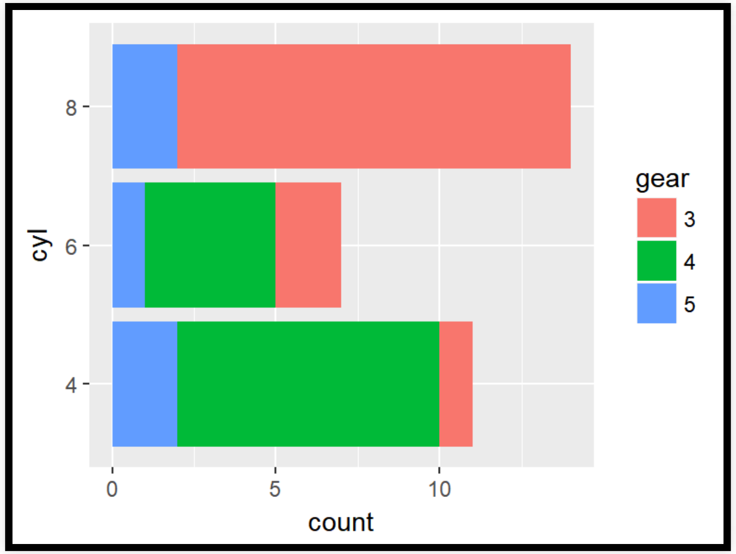
Position

```
ggplot(data = mtcarz) +
  geom_bar(mapping = aes(x = cyl, fill = gear), position = "dodge")
```



Flip Coordinates

```r
ggplot(data = mtcarz) +
  geom_bar(mapping = aes(x = cyl, fill = gear)) +
  coord_flip()
```

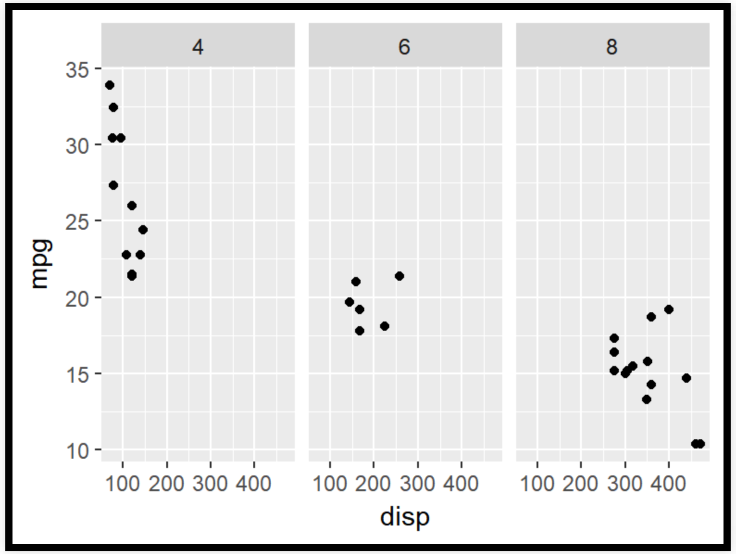


Facets

- split the plot into sub plots
- each subplot displays a subset of the data
- use `facet_wrap()` to create sub plots based on a single variable
- use `facet_grid()` to create sub plots based on a two variable

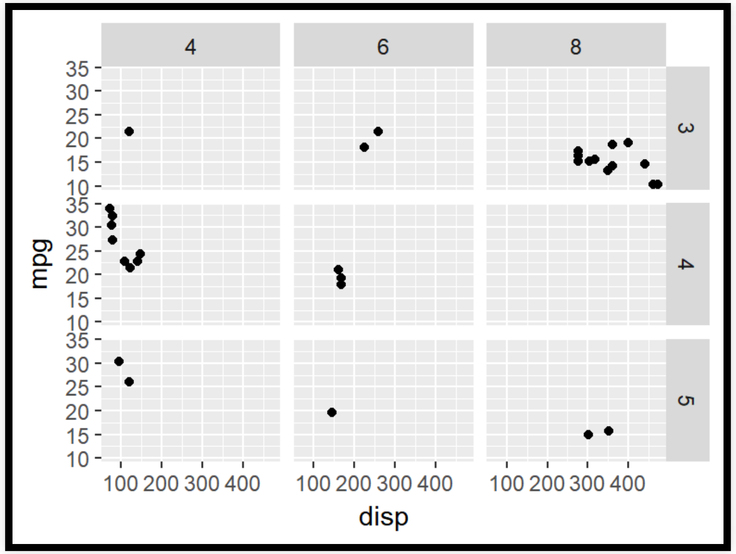
Facets

```
ggplot(data = mtcarz) +
  geom_point(mapping = aes(x = disp, y = mpg)) +
  facet_wrap(~ cyl)
```



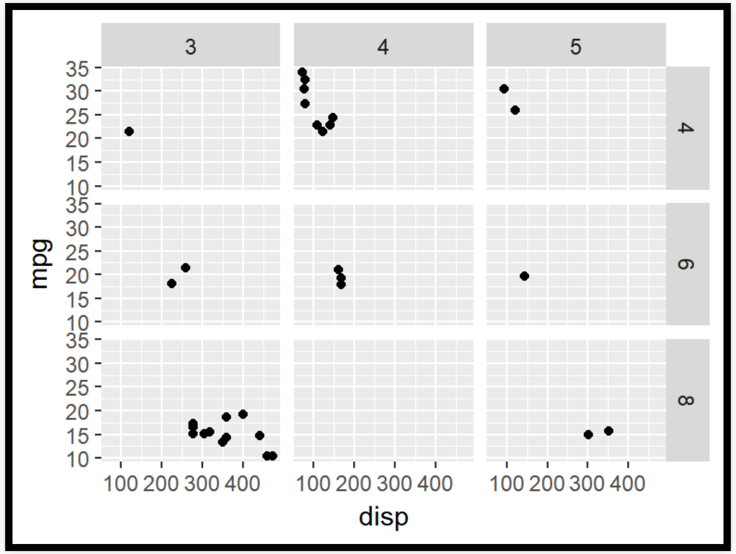
Facets

```
ggplot(data = mtcarz) +
  geom_point(mapping = aes(x = disp, y = mpg)) +
  facet_grid(gear ~ cyl)
```



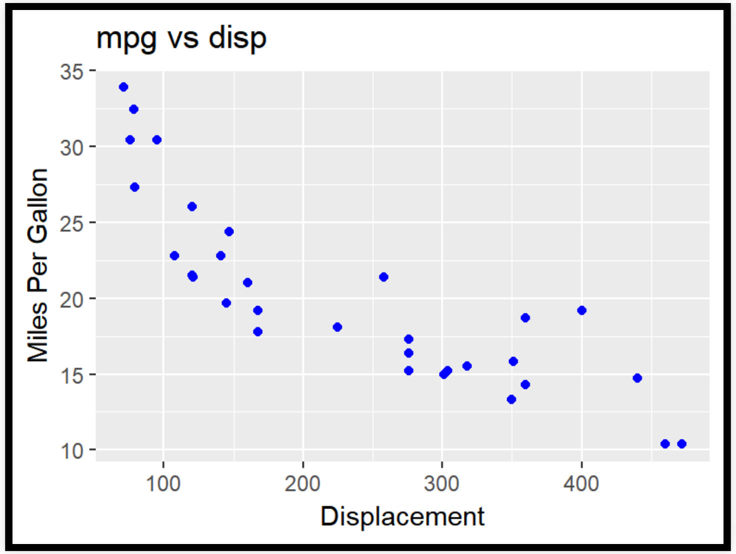
Facets

```
ggplot(data = mtcarz) +
  geom_point(mapping = aes(x = disp, y = mpg)) +
  facet_grid(cyl ~ gear)
```



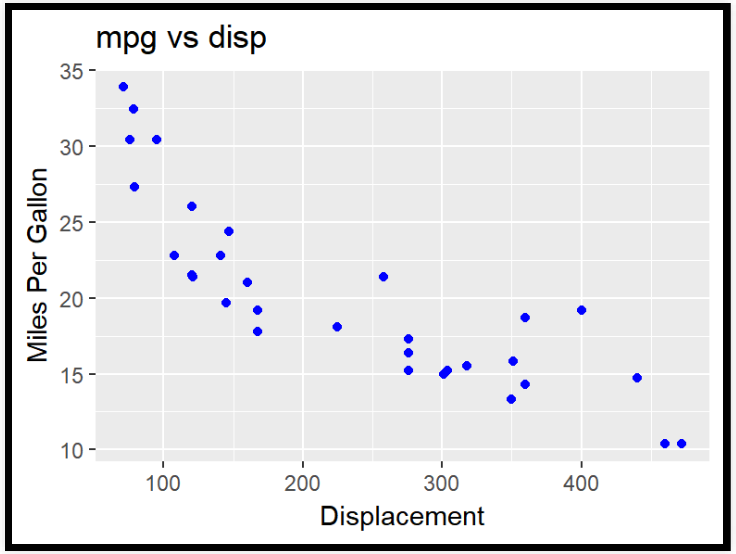
Title, Axis Labels & Limits

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg), color = "blue") +
  labs(title = "mpg vs disp", x = "Displacement",
       y = "Miles Per Gallon")
```



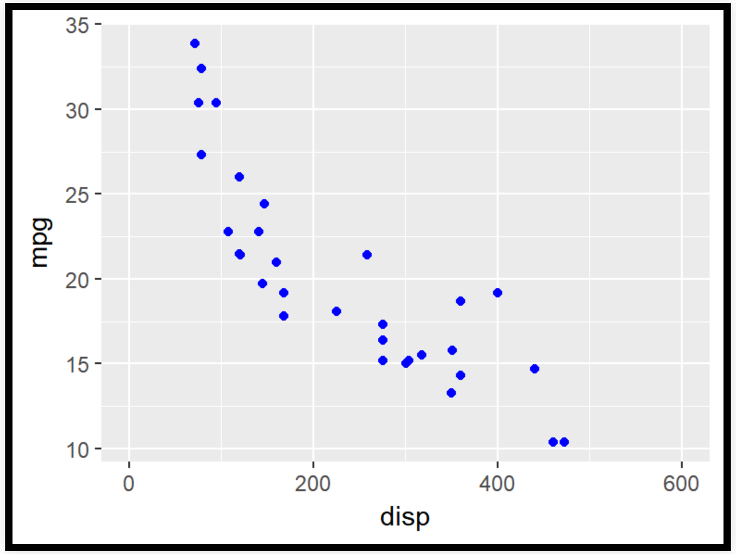
Title

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg), color = "blue") +
  ggtitle("mpg vs disp") + xlab("Displacement") +
  ylab("Miles Per Gallon")
```



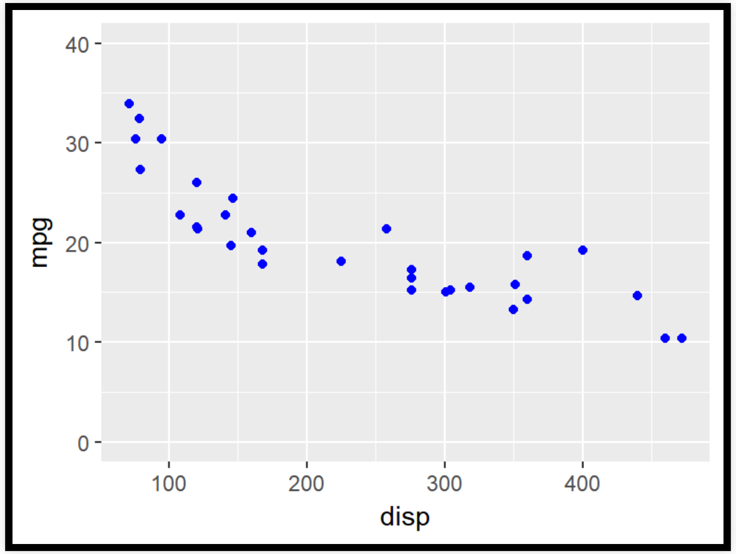
Axis Limits

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg), color = "blue") +
  xlim(c(0, 600))
```



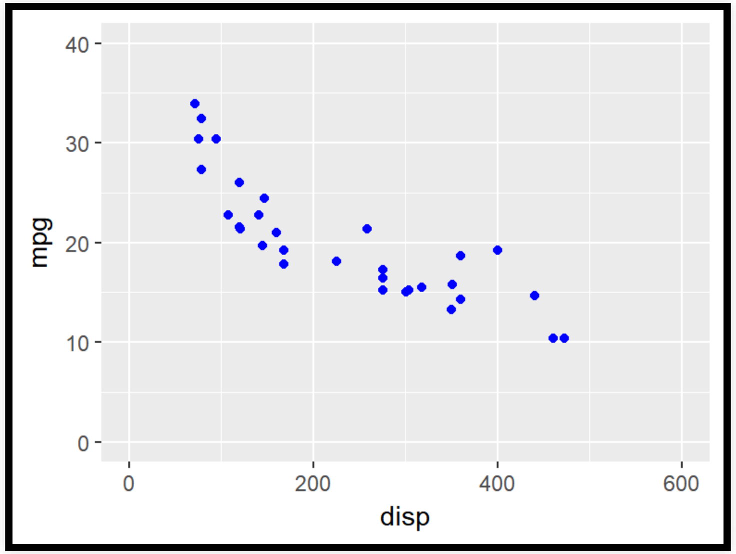
Axis Limits

```r
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg), color = "blue") +
  ylim(c(0, 40))
```



Axis Limits

```
ggplot(data = mtcarz) +
  geom_point(aes(x = disp, y = mpg), color = "blue") +
  expand_limits(x = c(0, 600), y = c(0, 40))
```

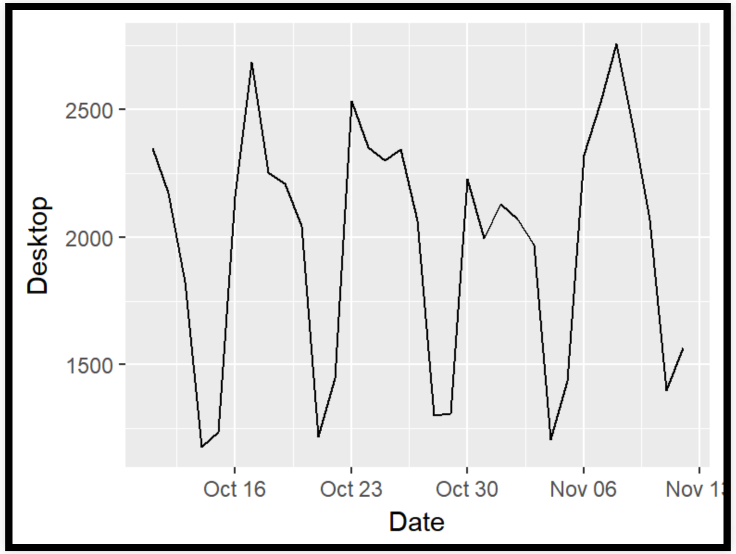


Line Chart: Data

```r
device <- read_csv("data/users_device.csv",
                   col_types = list(col_date(format = "%m/%d/%y"),
                                    col_integer(), col_integer(),
                                    col_integer()))
```

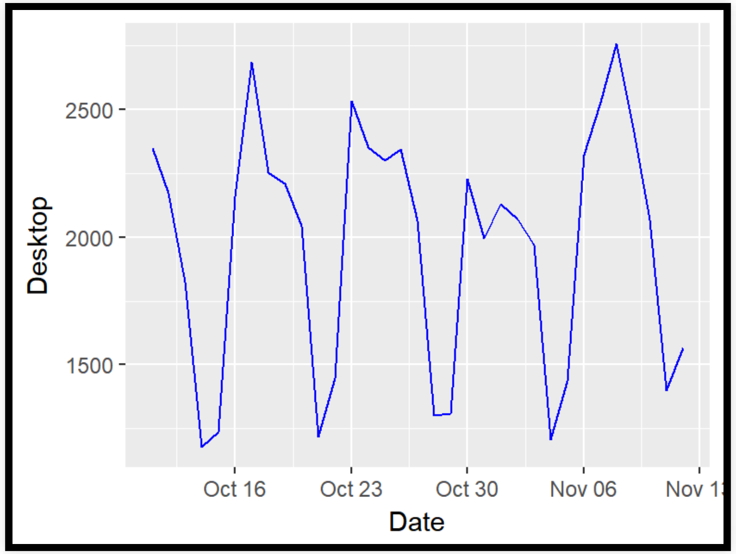
Line Chart

```
ggplot(data = device) +
  geom_line(mapping = aes(x = Date, y = Desktop))
```



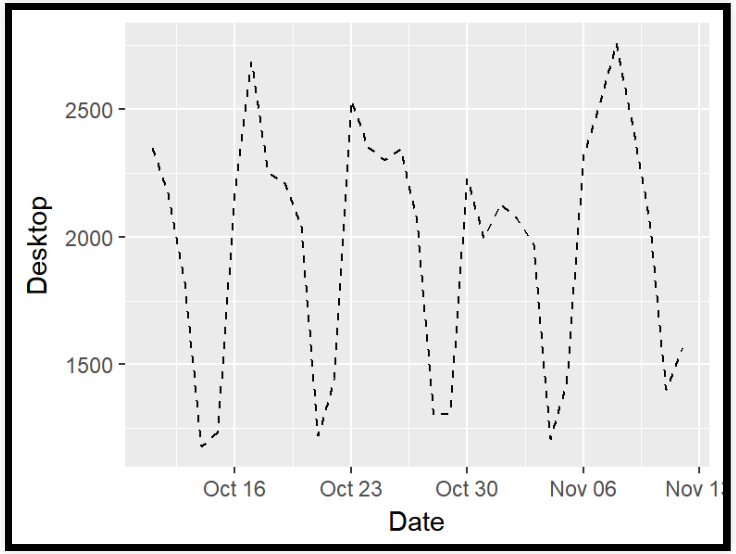
Line Color

```
ggplot(data = device) +
  geom_line(mapping = aes(x = Date, y = Desktop), color = "blue")
```



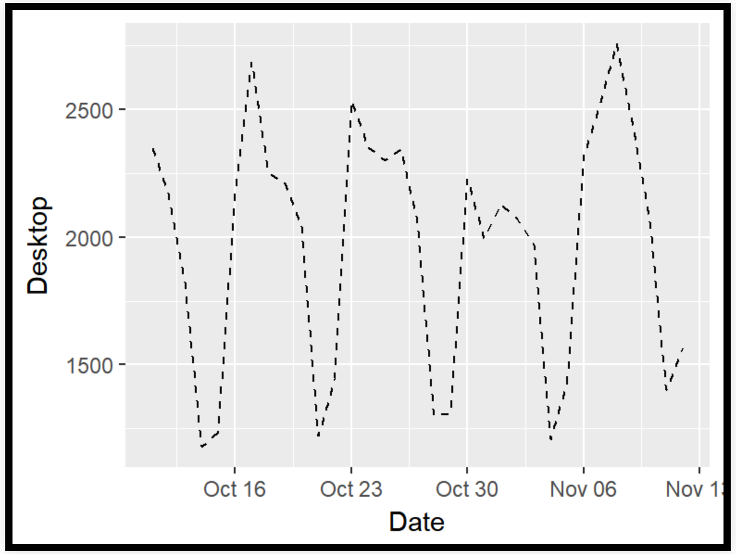
Line Type

```
ggplot(data = device) +
  geom_line(mapping = aes(x = Date, y = Desktop), linetype = 2)
```



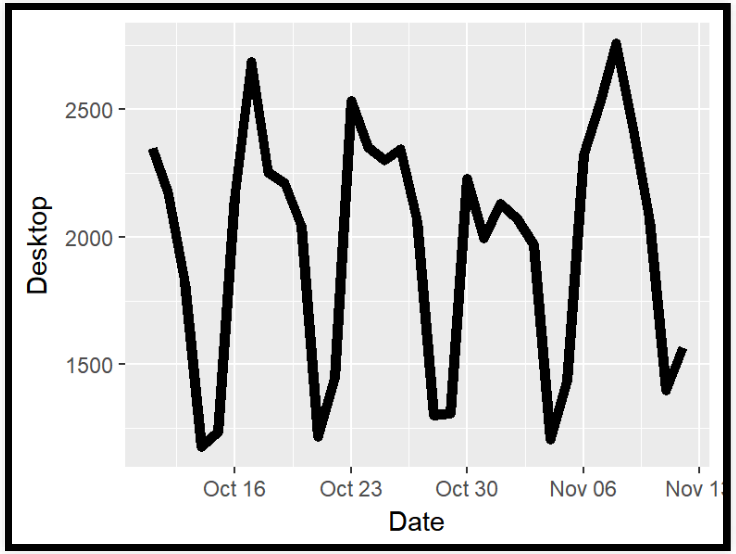
Line Type

```r
ggplot(data = device) +
  geom_line(mapping = aes(x = Date, y = Desktop), linetype = "dashed")
```



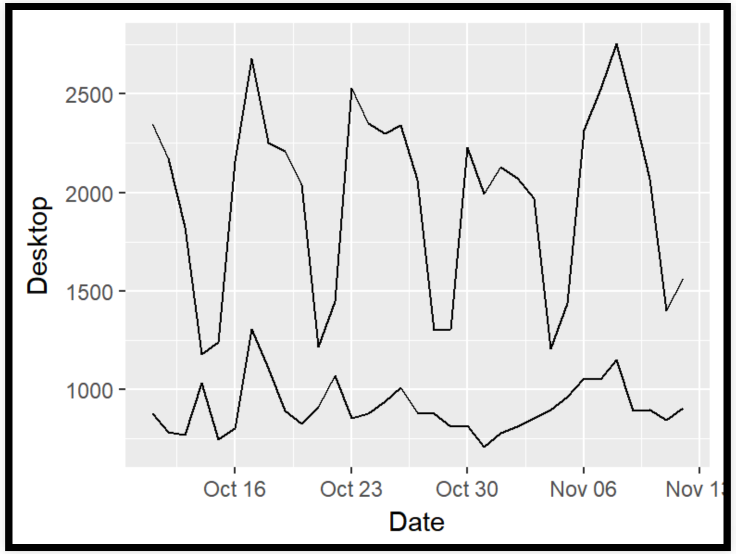
Line Width

```
ggplot(data = device) +
  geom_line(mapping = aes(x = Date, y = Desktop), size = 2)
```



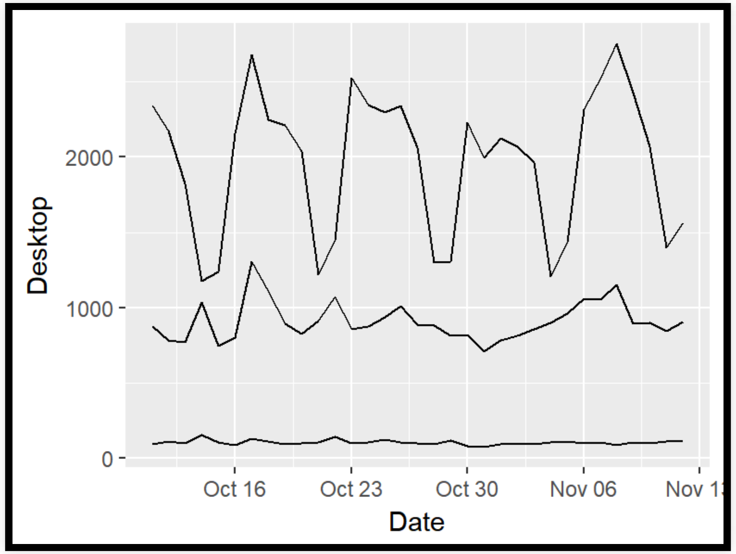
Multiple Lines

```
ggplot(data = device) +
  geom_line(mapping = aes(x = Date, y = Desktop)) +
  geom_line(mapping = aes(x = Date, y = Mobile))
```



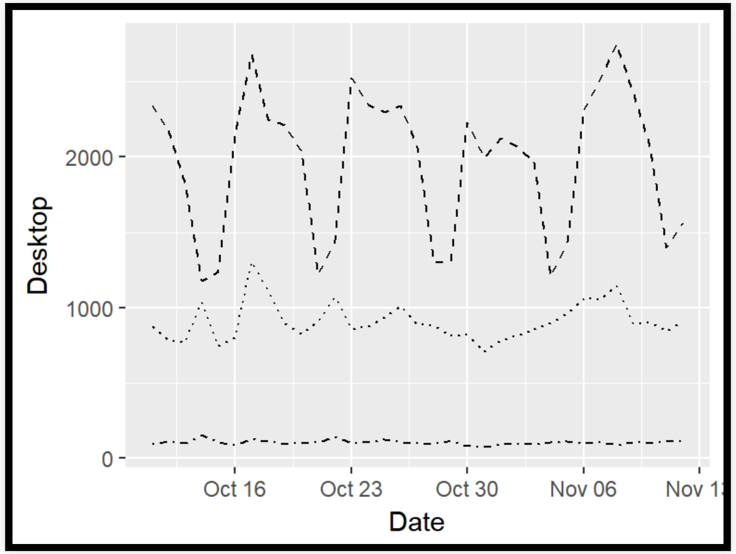
Multiple Lines

```
ggplot(data = device) +
  geom_line(mapping = aes(x = Date, y = Desktop)) +
  geom_line(mapping = aes(x = Date, y = Mobile)) +
  geom_line(mapping = aes(x = Date, y = Tablet))
```



Multiple Lines

```
ggplot(data = device) +
  geom_line(mapping = aes(x = Date, y = Desktop), linetype = 2) +
  geom_line(mapping = aes(x = Date, y = Mobile), linetype = 3) +
  geom_line(mapping = aes(x = Date, y = Tablet), linetype = 4)
```

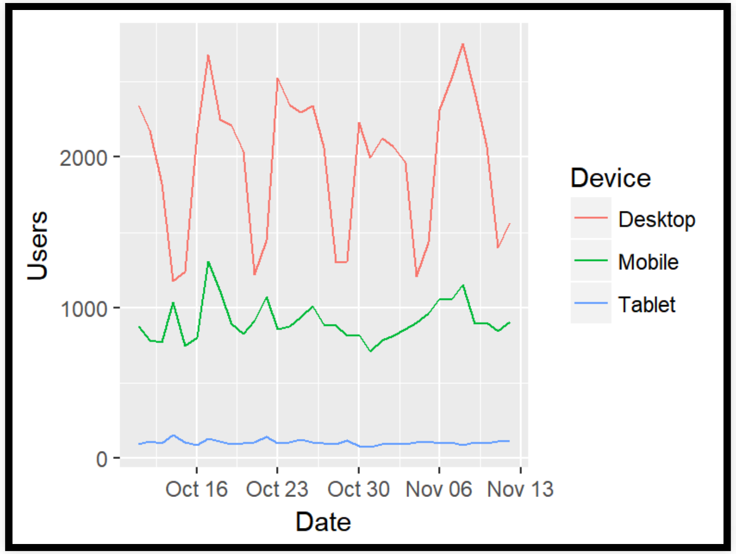


Line Chart: Data

```
tidy_device <- read_csv("data/tidy_users.csv",
                        col_types = list(col_date(format = "%m/%d/%y"),
                                         col_character(), col_integer())
```

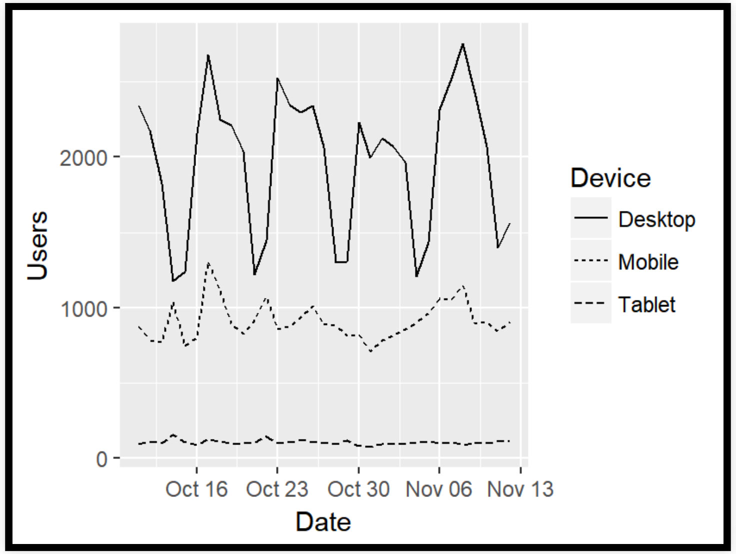
Multiple Lines

```
ggplot(data = tidy_device) +
  geom_line(mapping = aes(x = Date, y = Users, group = Device,
                          color = Device))
```



Multiple Lines

```
ggplot(data = tidy_device) +
  geom_line(mapping = aes(x = Date, y = Users, group = Device,
                          linetype = Device))
```



Thank You

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