hi

Class 5: Data Viz with ggplot

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Today we are exploring the **gggplot** package and how to make nice figures in R.

There are lots of ways to make figures and plot in R. These include:

- so called “base”R
- and add on packages like **ggplot2**

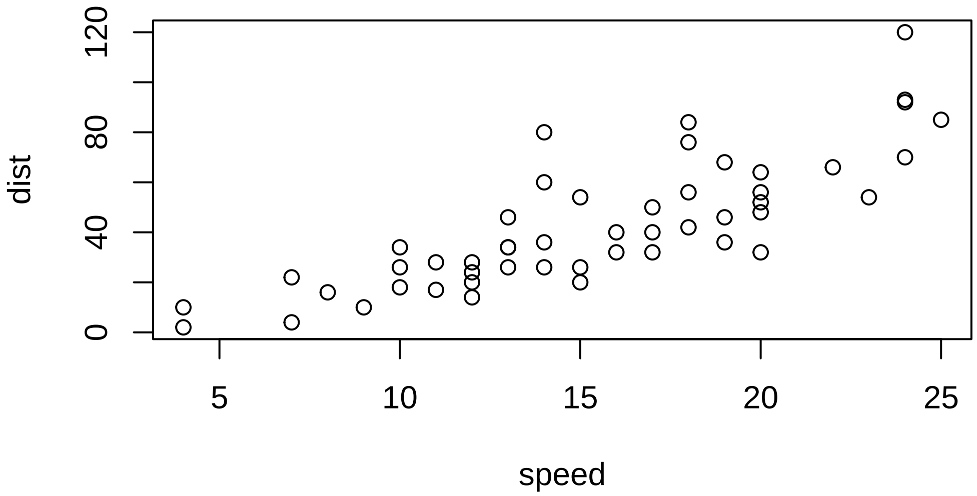
Here is a simple “base” R plot

```r
head(cars)
```

```
  speed dist
1     4    2
2     4   10
3     7    4
4     7   22
5     8   16
6     9   10
```

We can simply pass this to the ‘plot()’ function

```r
plot(cars)
```



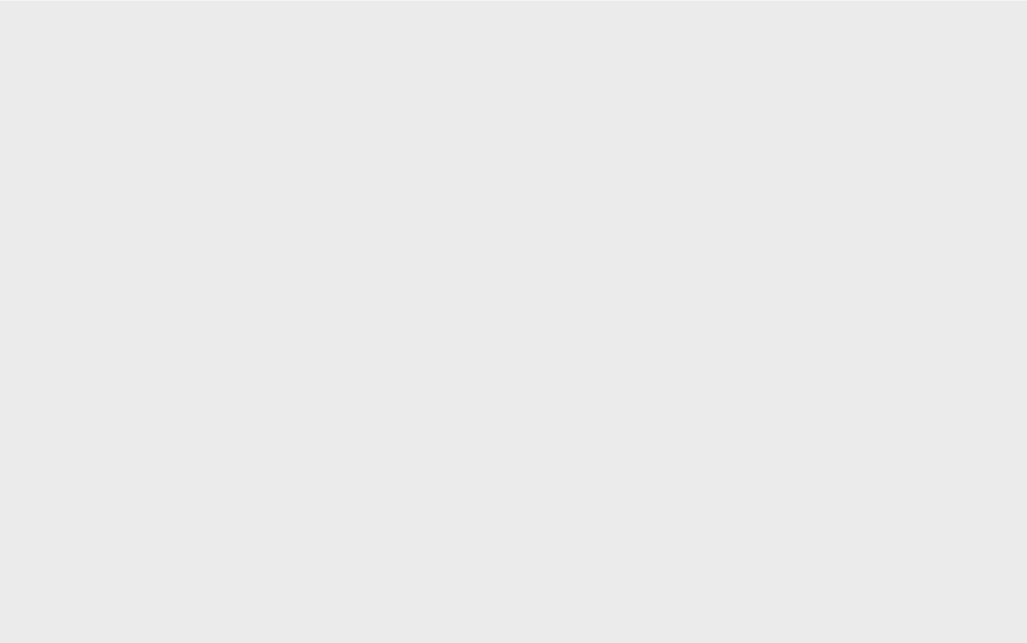
Key-point: Base R is quick but not so nice looking in some folks eyes.

let's see how we can plot this with **ggplot2**

1st I need to install this add-on package. For this we use the 'install.packages()' function - **WE DO THIS IN THE CONSOLE, NOT our report**

2nd We need to load the package with the 'library()' function every time we want to use it.

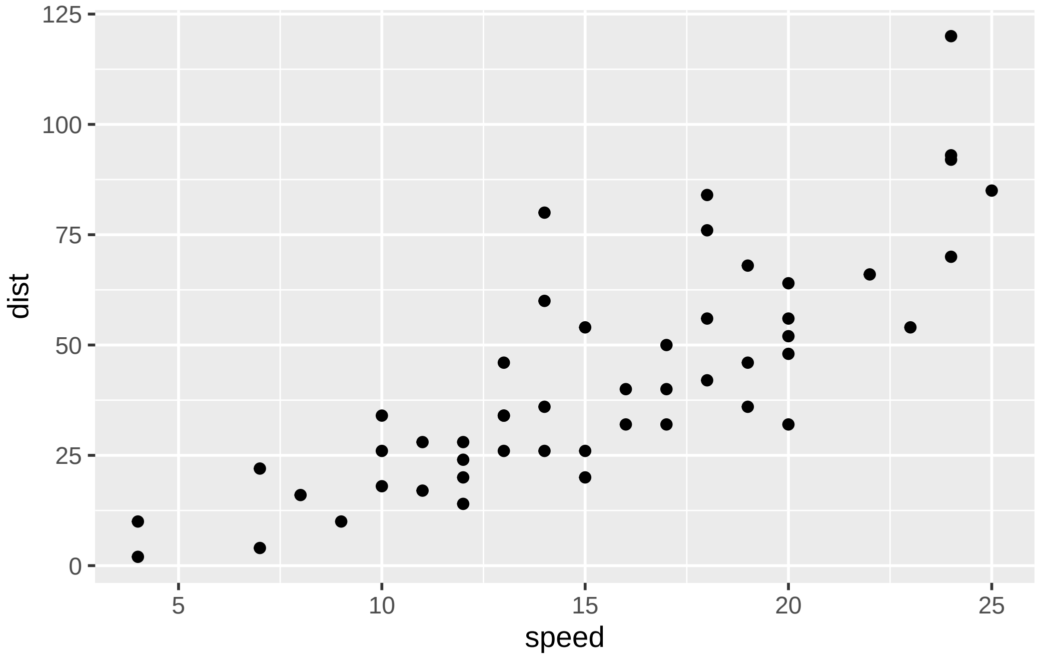
```
library(ggplot2)
ggplot(cars)
```



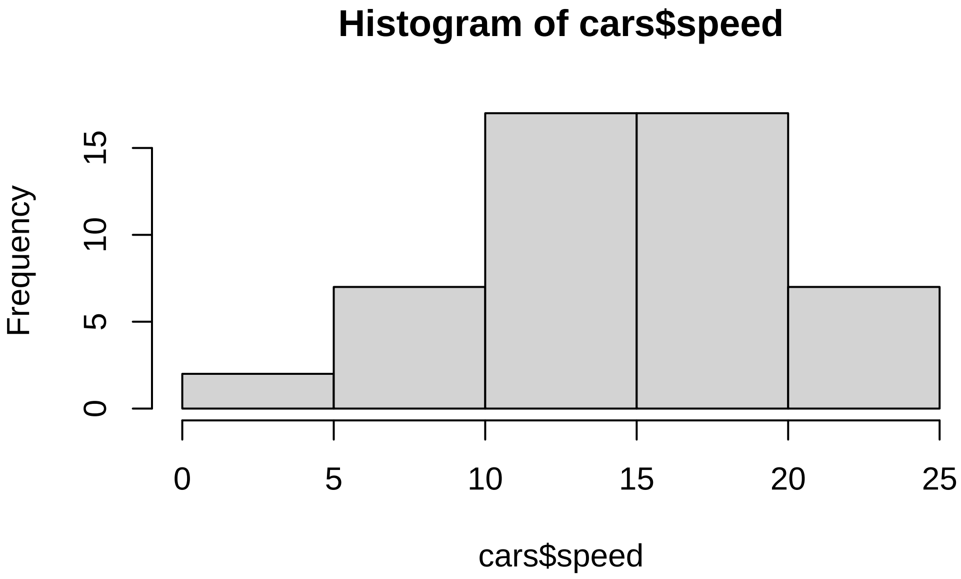
Every ggplot is complosed of at least 3 laryers:

- **data** (i.e. a data.frame with the things you wnat to plot)
- aesthetics **aes()** that map the columns of data to your plot features (i.e. aesthetics)
- geoms like **gemo_plot()** that sort hwo the plot appears

```r
ggplot(cars) +
  aes(x=speed, y=dist) +
  geom_point()
```



```
hist(cars$speed)
```



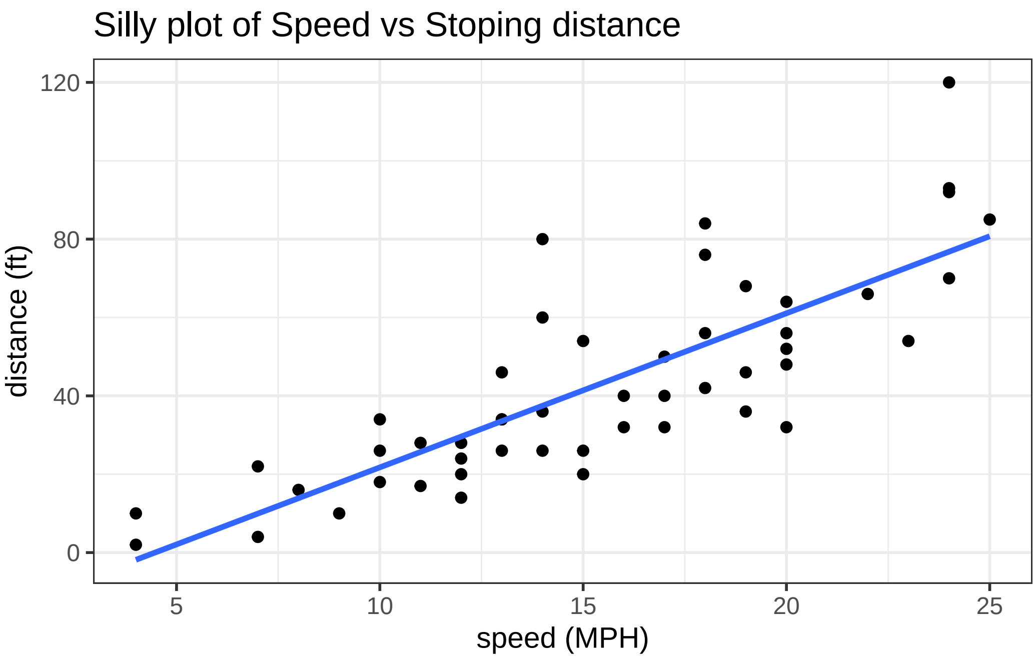
Key point: For simple "canned" graphs base R is quicker and more concise but as things get more custom the elobrate then ggplot wins out…

Let's add more layers to our ggplot

Add a line showing the relationship between x and y Add a title Add custom axis labels "Speed (MPH)" and "Distance (ft)" Change the theme...

```
ggplot(cars) +
  aes(x=speed, y=dist) +
  geom_point() +
  geom_smooth(method="lm",se=FALSE) +
  labs(title="Silly plot of Speed vs Stoping distance",
       x="speed (MPH)",
       y="distance (ft)" ) +
  theme_bw()
```

```
`geom_smooth()` using formula = 'y ~ x'
```



##Going further

Read some gene expression data

```
url <- "https://bioboot.github.io/bimm143_S20/class-material/up_down_expression.txt"
genes <- read.delim(url)

head(genes)
```

```
        Gene Condition1 Condition2      State
1      A4GNT -3.6808610 -3.4401355 unchanging
2       AAAS  4.5479580  4.3864126 unchanging
3      AASDH  3.7190695  3.4787276 unchanging
4       AATF  5.0784720  5.0151916 unchanging
5       AATK  0.4711421  0.5598642 unchanging
6 AB015752.4 -3.6808610 -3.5921390 unchanging
```

> Q1. How many gnees are in this wee dataset

```r
nrow(genes)
```

```
[1] 5196
```

```r
ncol(genes)
```

```
[1] 4
```

> Q2. How many "up" regulated genes are there?

```r
sum(genes$State == "up")
```

```
[1] 127
```

A useful function for counting up occurances of things in a vector is the 'table()' function

```r
table(genes$State)
```

```

      down unchanging         up 
        72       4997        127 
```

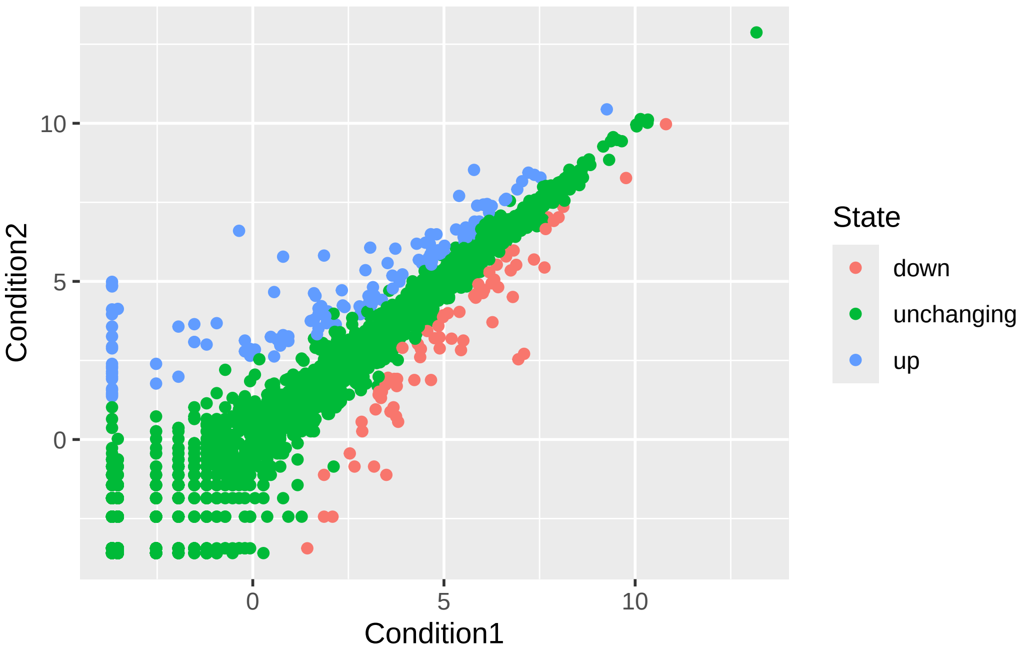
fraction

```r
round( table(genes$State)/nrow(genes) * 100, 2 )
```

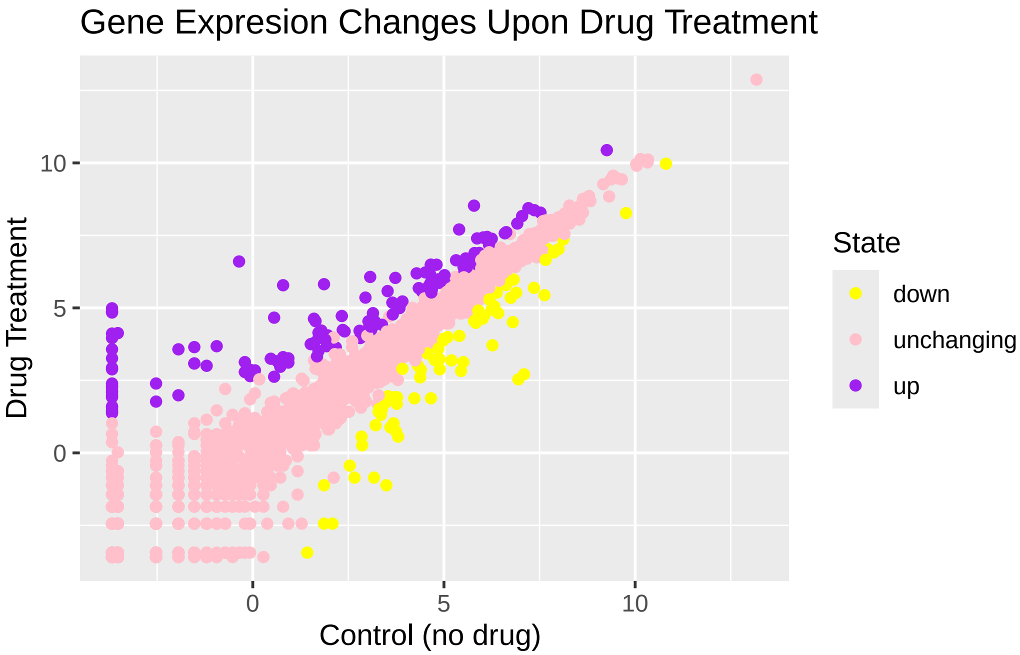
```

      down unchanging         up 
      1.39      96.17       2.44 
```

Make a v1 figure

```
p <-ggplot(genes) +
  aes(x=Condition1,
      y=Condition2,
      col=State) +
  geom_point()

p
```



```
p + scale_colour_manual(values=c("yellow","pink","purple")) +
    labs(title="Gene Expresion Changes Upon Drug Treatment",
         x="Control (no drug) ",
         y="Drug Treatment")
```



More Plotting

Read gapmider

```
# File location online
url <- "https://raw.githubusercontent.com/jennybc/gapminder/master/inst/extdata/gapminder.tsv

gapminder <- read.delim(url)
```

Lets have a wee peak

```
head(gapminder,3)
```

```
      country continent year lifeExp      pop gdpPercap
1 Afghanistan      Asia 1952  28.801  8425333  779.4453
2 Afghanistan      Asia 1957  30.332  9240934  820.8530
3 Afghanistan      Asia 1962  31.997 10267083  853.1007
```

Q4. How many different country values are in this dataset?

```r
nrow(gapminder)
```

```
[1] 1704
```

```r
table(gapminder$country)
```

```

             Afghanistan                  Albania                  Algeria 
                      12                       12                       12 
                  Angola                Argentina                Australia 
                      12                       12                       12 
                 Austria                  Bahrain               Bangladesh 
                      12                       12                       12 
                 Belgium                    Benin                  Bolivia 
                      12                       12                       12 
  Bosnia and Herzegovina                 Botswana                   Brazil 
                      12                       12                       12 
                Bulgaria             Burkina Faso                  Burundi 
                      12                       12                       12 
                Cambodia                 Cameroon                   Canada 
                      12                       12                       12 
Central African Republic                     Chad                    Chile 
                      12                       12                       12 
                   China                 Colombia                  Comoros 
                      12                       12                       12 
        Congo, Dem. Rep.              Congo, Rep.               Costa Rica 
                      12                       12                       12 
           Cote d'Ivoire                  Croatia                     Cuba 
                      12                       12                       12 
          Czech Republic                  Denmark                 Djibouti 
                      12                       12                       12 
      Dominican Republic                  Ecuador                    Egypt 
                      12                       12                       12 
             El Salvador        Equatorial Guinea                  Eritrea 
                      12                       12                       12 
                Ethiopia                  Finland                   France 
                      12                       12                       12 
                   Gabon                   Gambia                  Germany 
                      12                       12                       12 
                   Ghana                   Greece                Guatemala 
                      12                       12                       12 
```

Guinea	Guinea-Bissau	Haiti
12	12	12
Honduras	Hong Kong, China	Hungary
12	12	12
Iceland	India	Indonesia
12	12	12
Iran	Iraq	Ireland
12	12	12
Israel	Italy	Jamaica
12	12	12
Japan	Jordan	Kenya
12	12	12
Korea, Dem. Rep.	Korea, Rep.	Kuwait
12	12	12
Lebanon	Lesotho	Liberia
12	12	12
Libya	Madagascar	Malawi
12	12	12
Malaysia	Mali	Mauritania
12	12	12
Mauritius	Mexico	Mongolia
12	12	12
Montenegro	Morocco	Mozambique
12	12	12
Myanmar	Namibia	Nepal
12	12	12
Netherlands	New Zealand	Nicaragua
12	12	12
Niger	Nigeria	Norway
12	12	12
Oman	Pakistan	Panama
12	12	12
Paraguay	Peru	Philippines
12	12	12
Poland	Portugal	Puerto Rico
12	12	12
Reunion	Romania	Rwanda
12	12	12
Sao Tome and Principe	Saudi Arabia	Senegal
12	12	12
Serbia	Sierra Leone	Singapore
12	12	12
Slovak Republic	Slovenia	Somalia

```
                      12                       12                       12
            South Africa                    Spain                Sri Lanka
                      12                       12                       12
                   Sudan                Swaziland                   Sweden
                      12                       12                       12
             Switzerland                    Syria                   Taiwan
                      12                       12                       12
                Tanzania                 Thailand                     Togo
                      12                       12                       12
     Trinidad and Tobago                  Tunisia                   Turkey
                      12                       12                       12
                  Uganda           United Kingdom            United States
                      12                       12                       12
                 Uruguay                Venezuela                  Vietnam
                      12                       12                       12
      West Bank and Gaza              Yemen, Rep.                   Zambia
                      12                       12                       12
                Zimbabwe
                      12
```

```
length(table(gapminder$country))
```

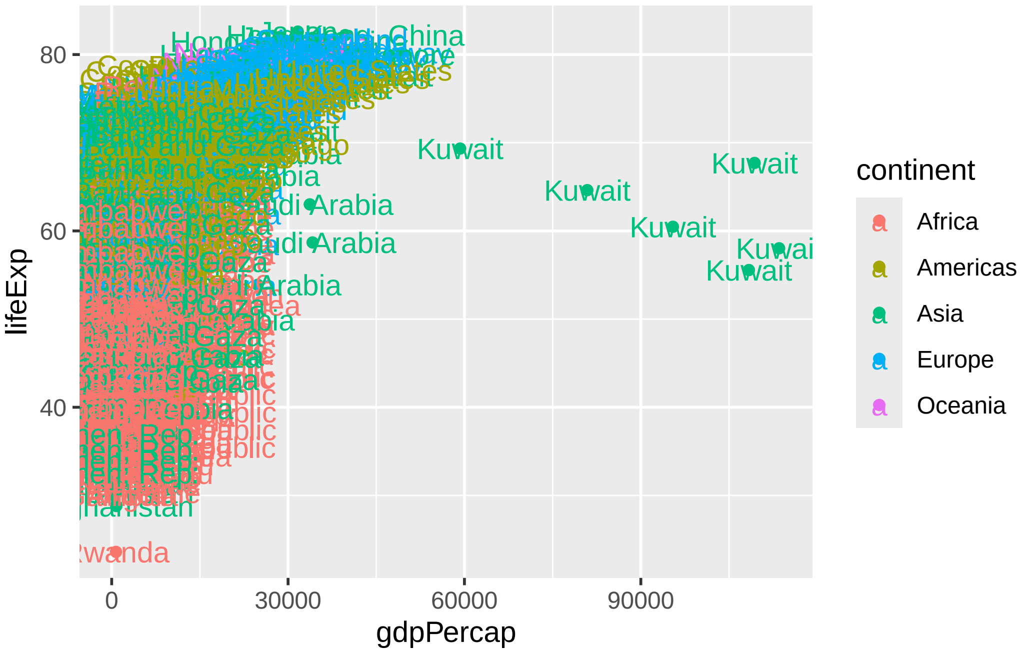
```
[1] 142
```

Q5.How many different continent values are in this dataset.

```
unique(gapminder$continent)
```

```
[1] "Asia"     "Europe"   "Africa"   "Americas" "Oceania"
```

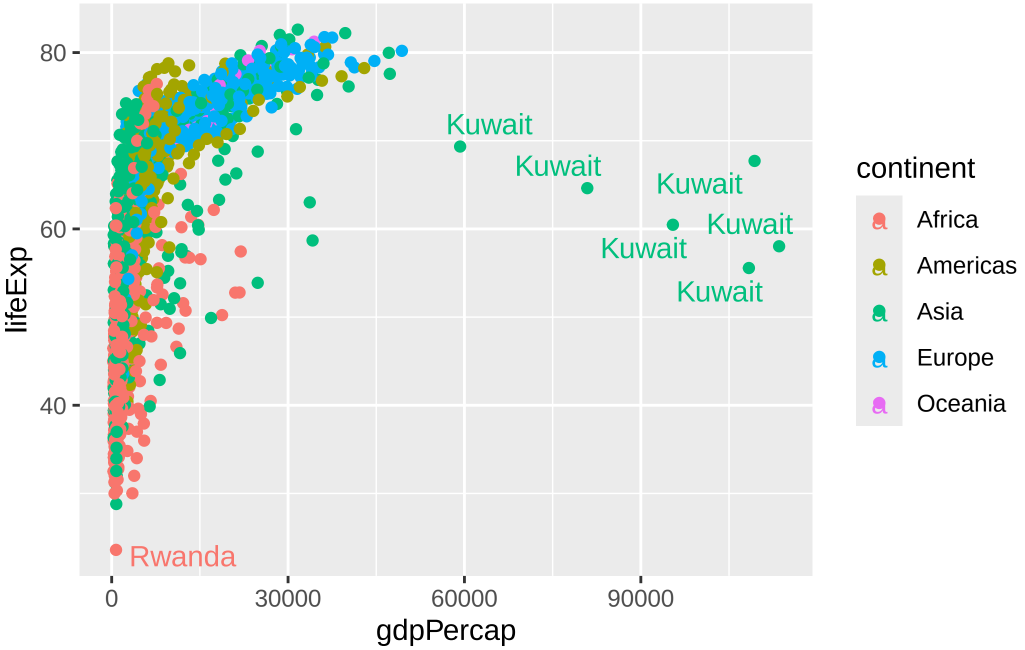
```
ggplot(gapminder) +
  aes(gdpPercap, lifeExp, col=continent, label=country) +
  geom_point() +
  geom_text()
```



I can use **ggrepl** package to make more sensible labels here.

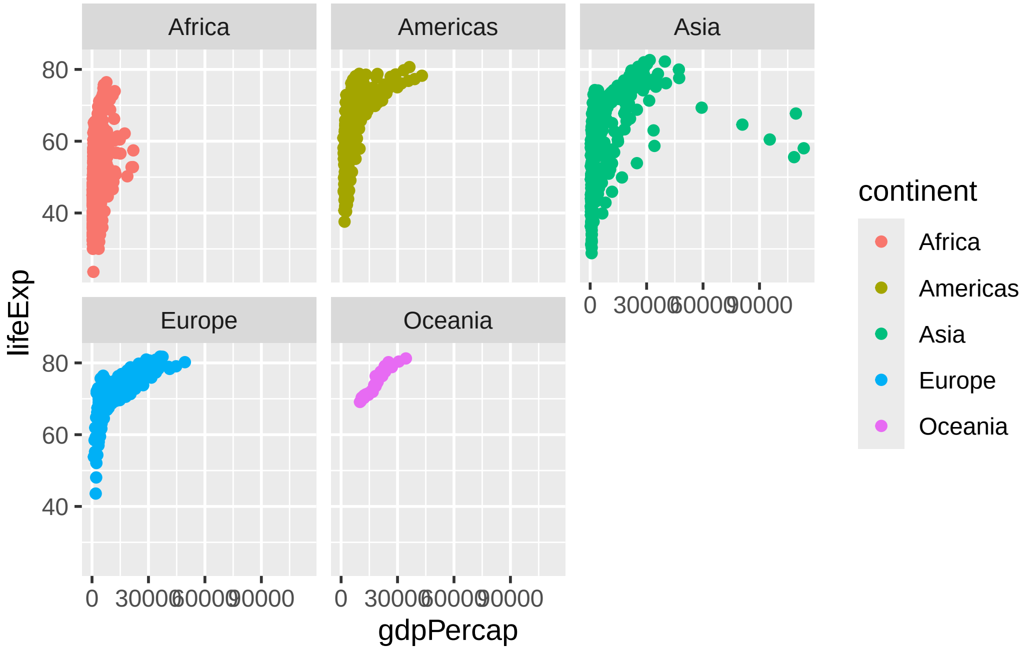
```r
library(ggrepel)

ggplot(gapminder) +
  aes(gdpPercap, lifeExp, col=continent, label=country) +
  geom_point() +
  geom_text_repel()
```

```
Warning: ggrepel: 1697 unlabeled data points (too many overlaps). Consider
increasing max.overlaps
```



I want a seperate a pnnel per continent

```
ggplot(gapminder) +
  aes(gdpPercap, lifeExp, col=continent, label=country) +
  geom_point() +
  facet_wrap(~continent)
```



##Summary

The main advantages of ggplot over base R plotting are:

Let's focus on the main advantages of ggplot2 over base R plotting:

1. ggplot2 uses a layered approach (data, aesthetics, geometry), making it easier to build complex, publication-quality plots by adding layers step by step. Base R requires different functions and many arguments for each plot type, which can be fiddly and time-consuming to refine for publication-quality figures.

2. ggplot2 provides sensible defaults for aesthetics and themes, so plots look visually appealing with less manual tweaking. Base R gives full control but often needs more effort to polish.

3. ggplot2 code is more concise for complex plots, while base R is quicker for simple, exploratory plots but gets verbose and complicated for advanced visualizations.

4. ggplot2 makes it easier to automate and reproduce plots, especially for reports, since the same code structure applies to different datasets and plot types.