Annotations

Session 9

PMAP 8921: Data Visualization with R
Andrew Young School of Policy Studies
Summer 2023

Plan for today

Fretting the little things

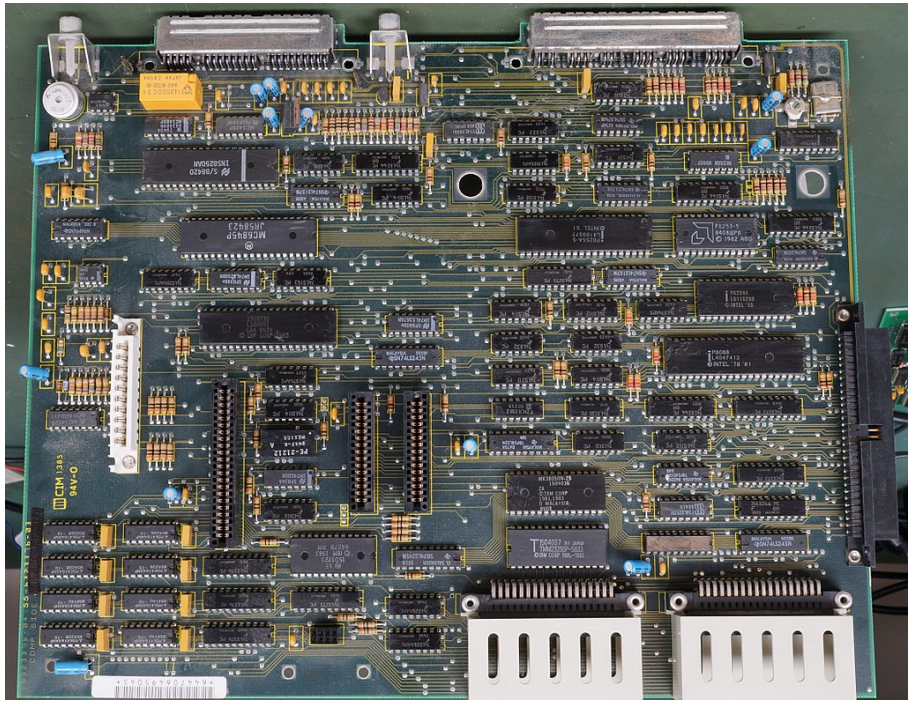
Text in plots

Seeds

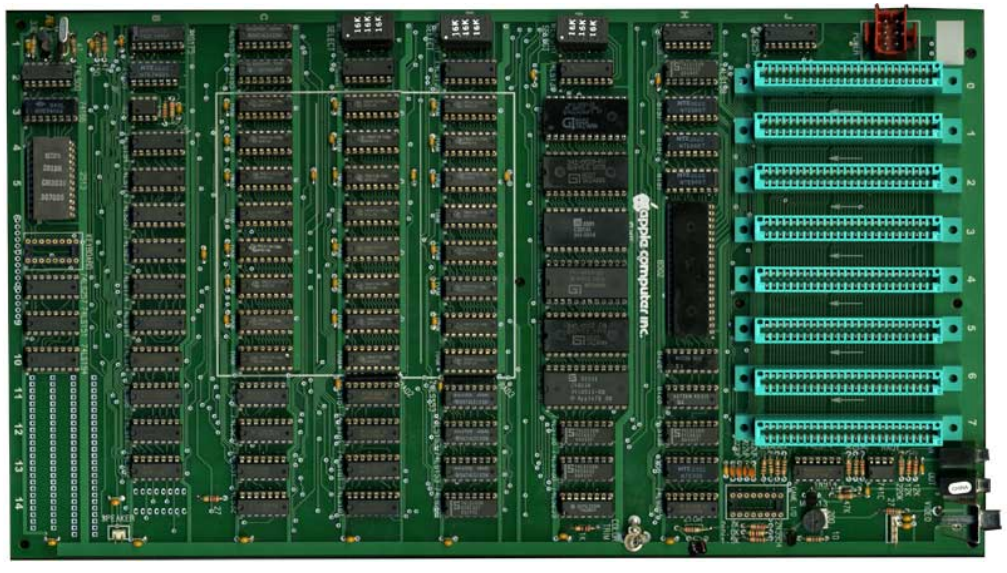
Fretting the little things

Little details matter

Obsession with tiny details



IBM PC Jr.



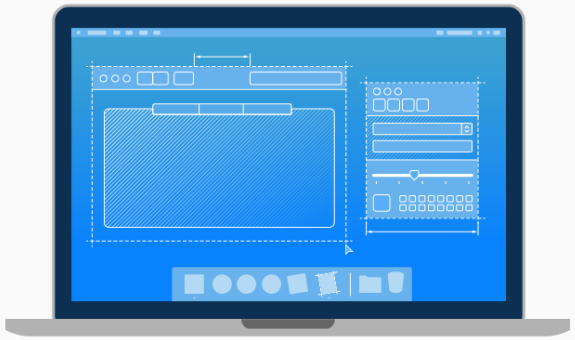
Apple IIe

Human-focused design

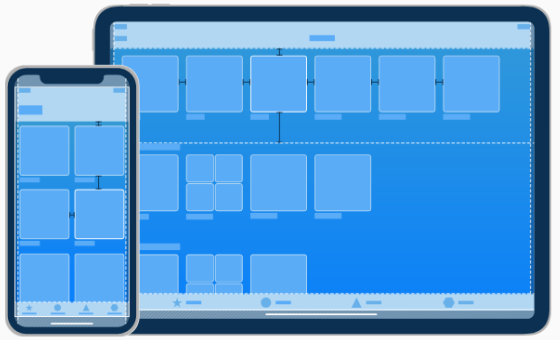
> “This is what customers pay us for—to sweat all these details so it’s easy and pleasant for them to use our computers.”

Human Interface Guidelines

Get in-depth information and UI resources for designing great apps that integrate seamlessly with Apple platforms.



macOS ›

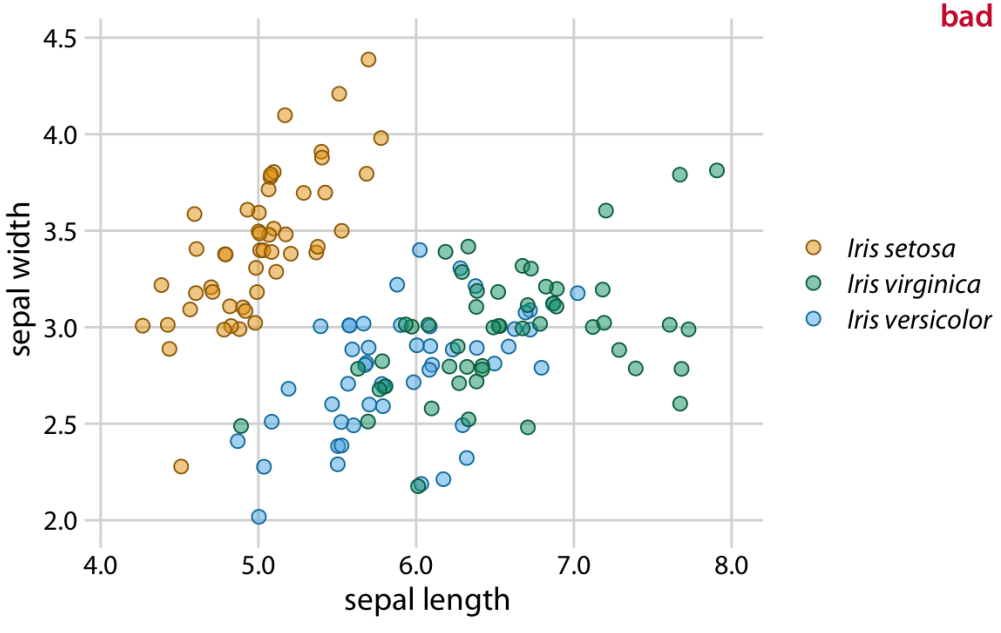


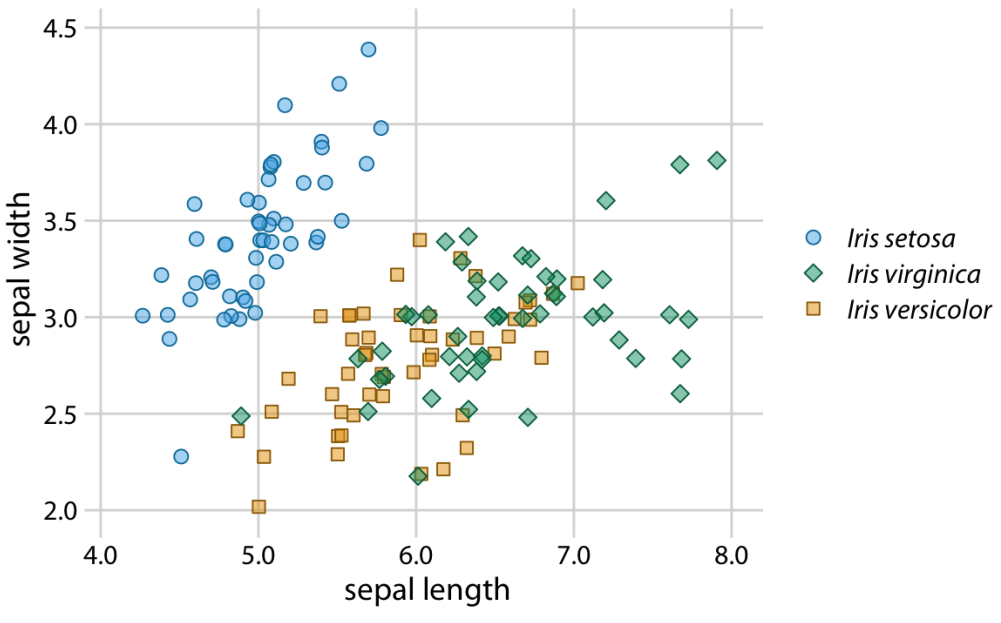
iOS ›

Graph details: Redundant coding

One little change makes this far more accessible

bad

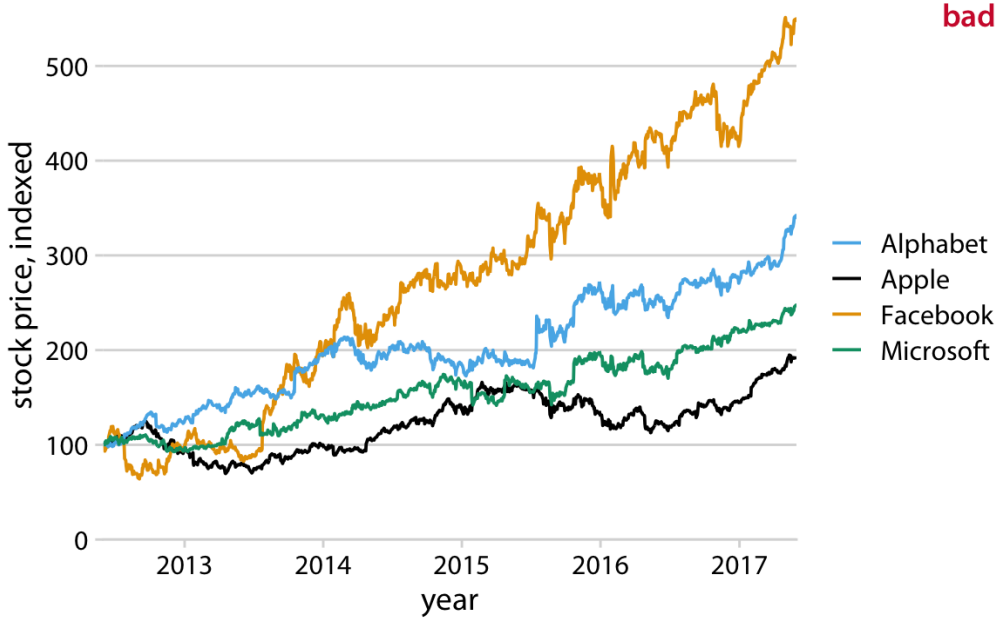


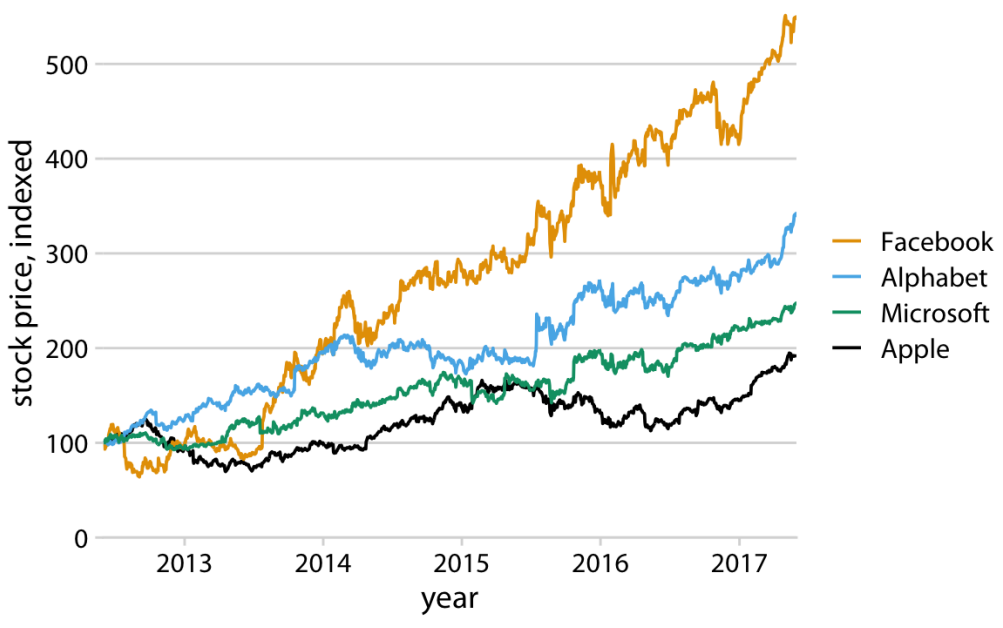


Graph details: Consistent ordering

Again, one little change makes this far more accessible

bad





Details matter

Worrying about tiny details in graphs...

...makes them easier for your audience to understand

...improves their beauty

...enhances the truth

Text in plots

Including text on a plot

Label actual data points

`geom_text()`, `geom_label()`, `geom_text_repel()`, etc.

Add arbitrary annotations

`annotate()`

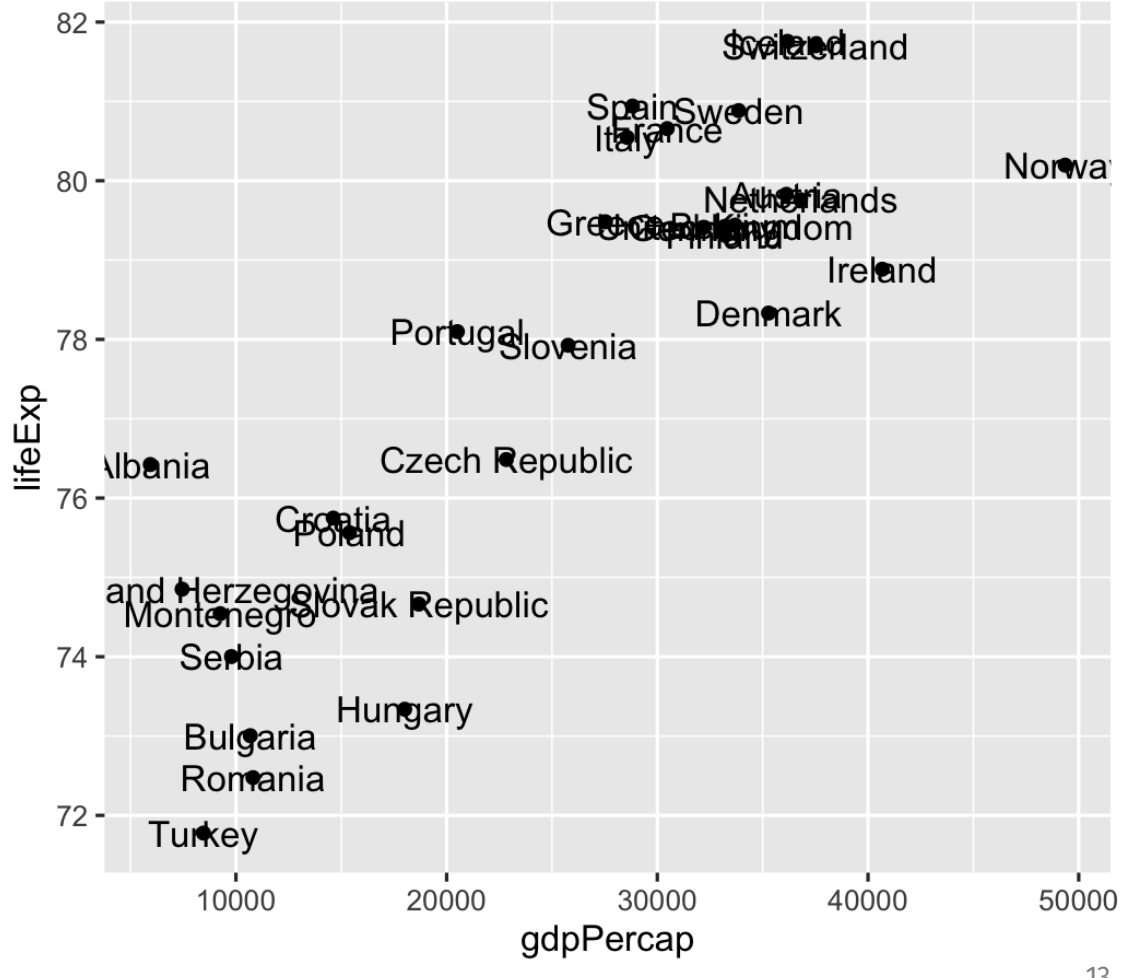
Titles, subtitles, captions, etc.

```
labs(title = "blah", subtitle = "blah", caption = "blah")
```

Label actual data points

```
library(gapminder)

gapminder_europe <- gapminder %>%
  filter(year == 2007,
         continent == "Europe")

ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  geom_text(aes(label = country))
```

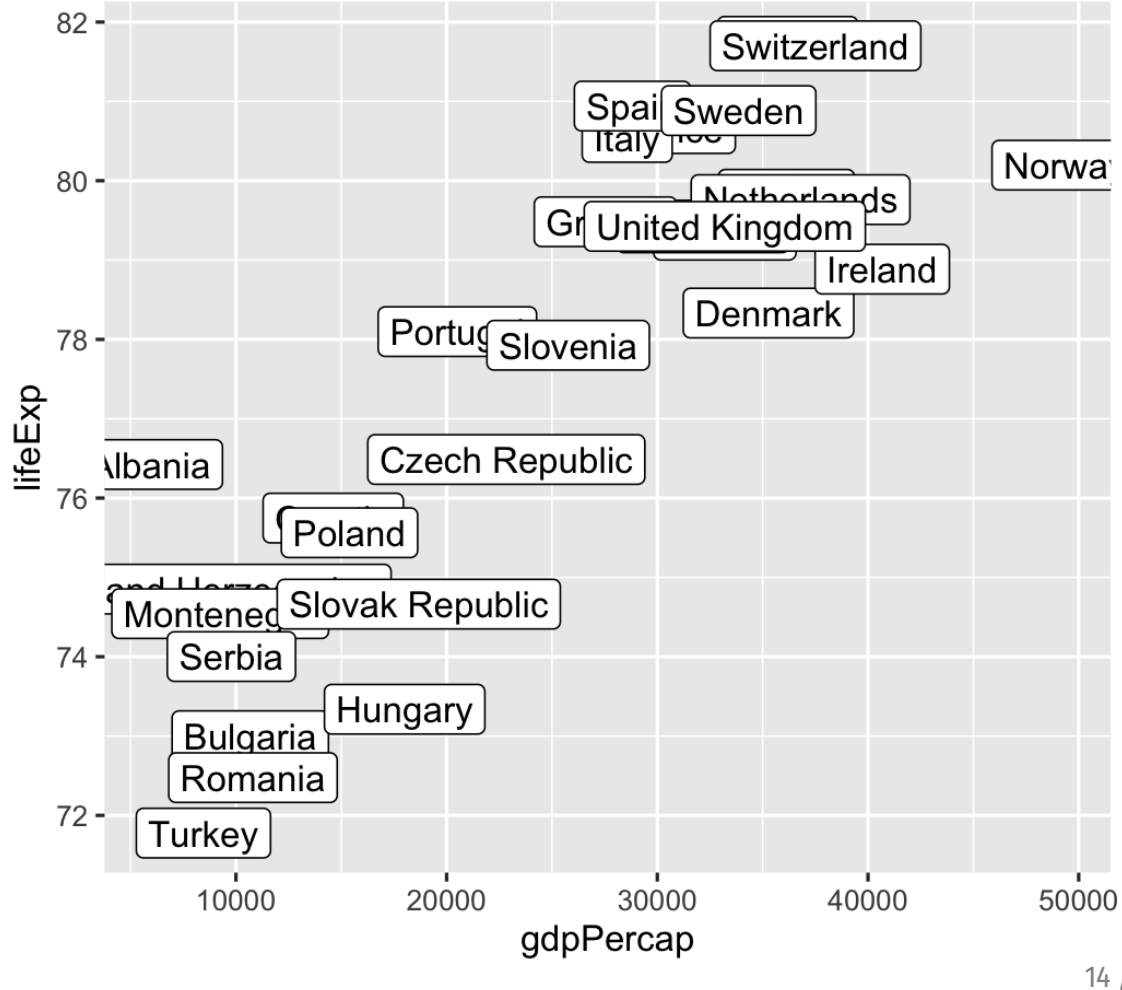
Ew.



Label actual data points

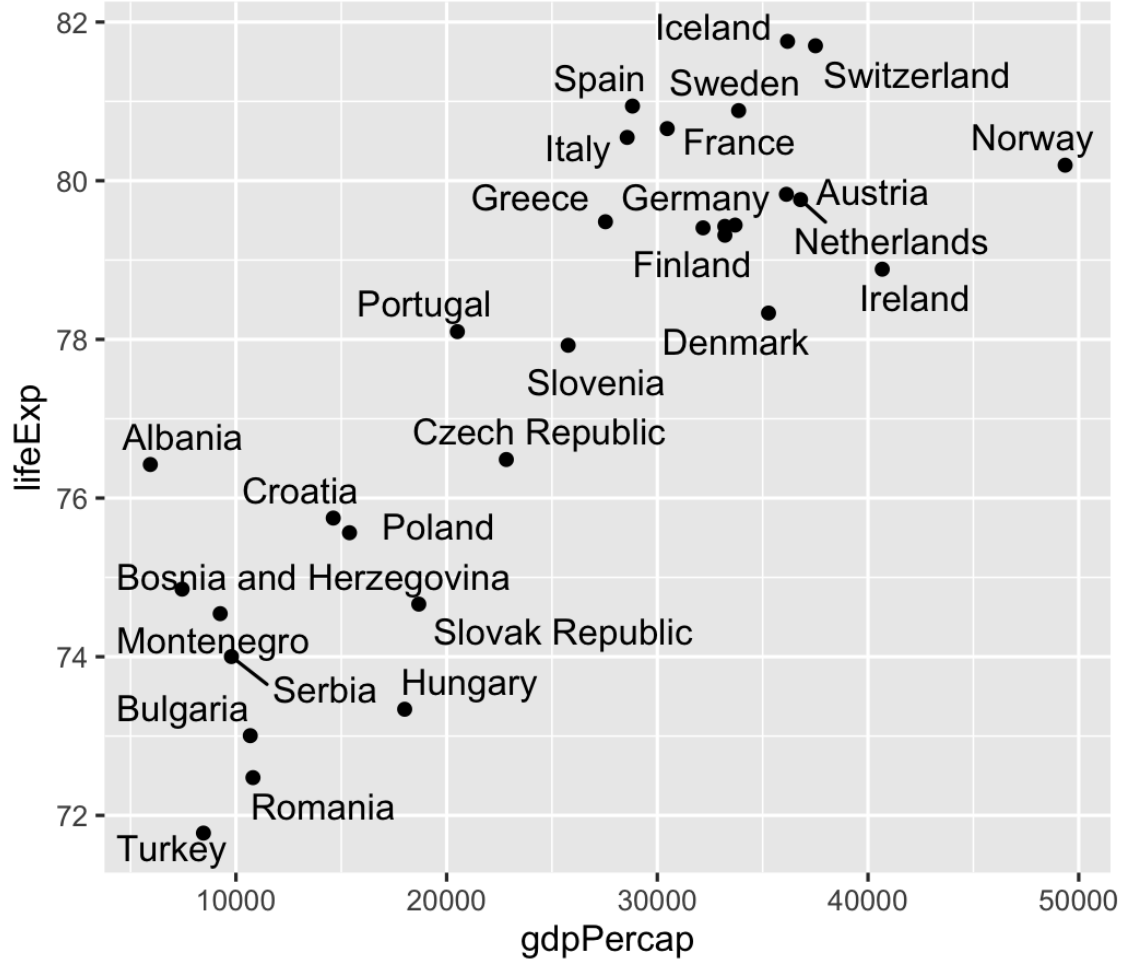
```
ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  geom_label(aes(label = country))
```

Still ew. Labels are neat, but cover the points.



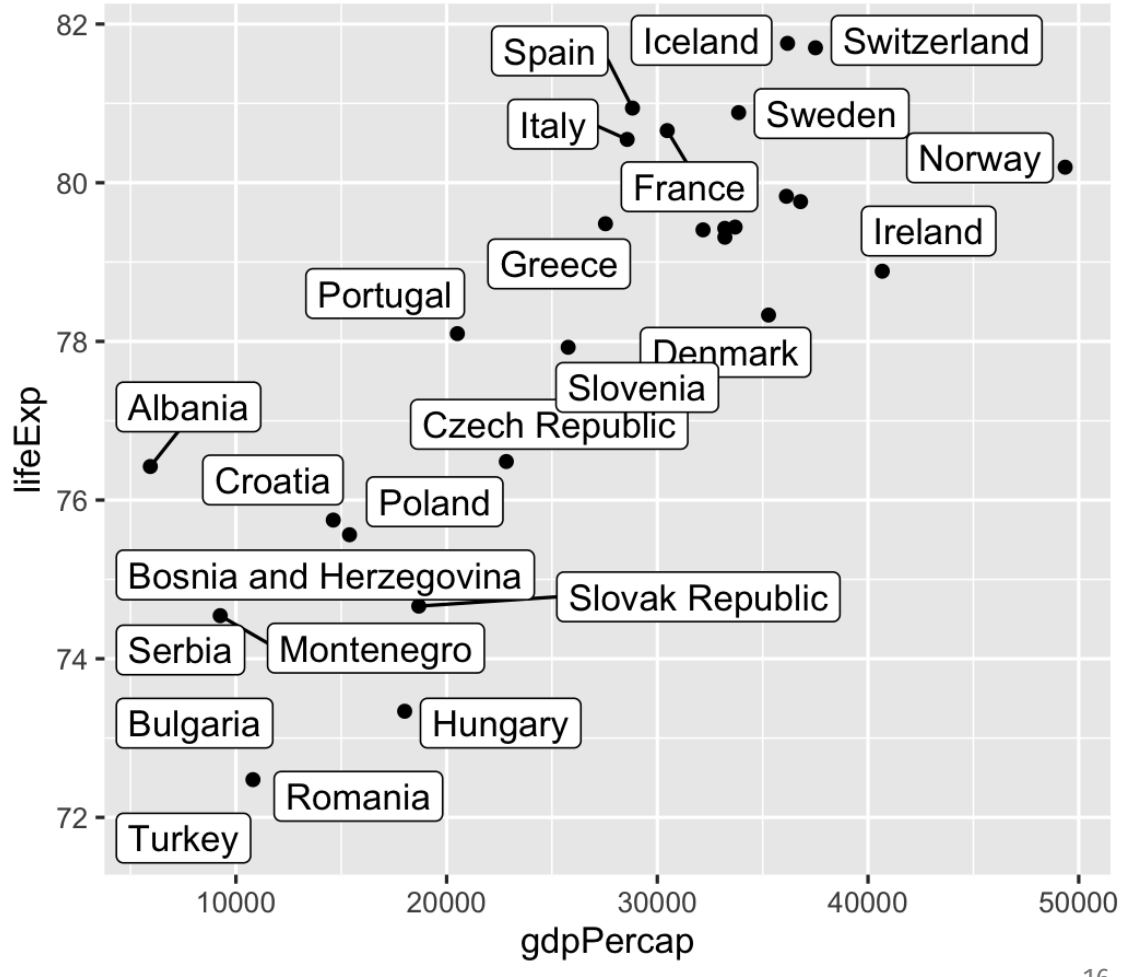
Solution 1: Repel labels

```
library(ggrepel)

ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  geom_text_repel(aes(label = country))
```



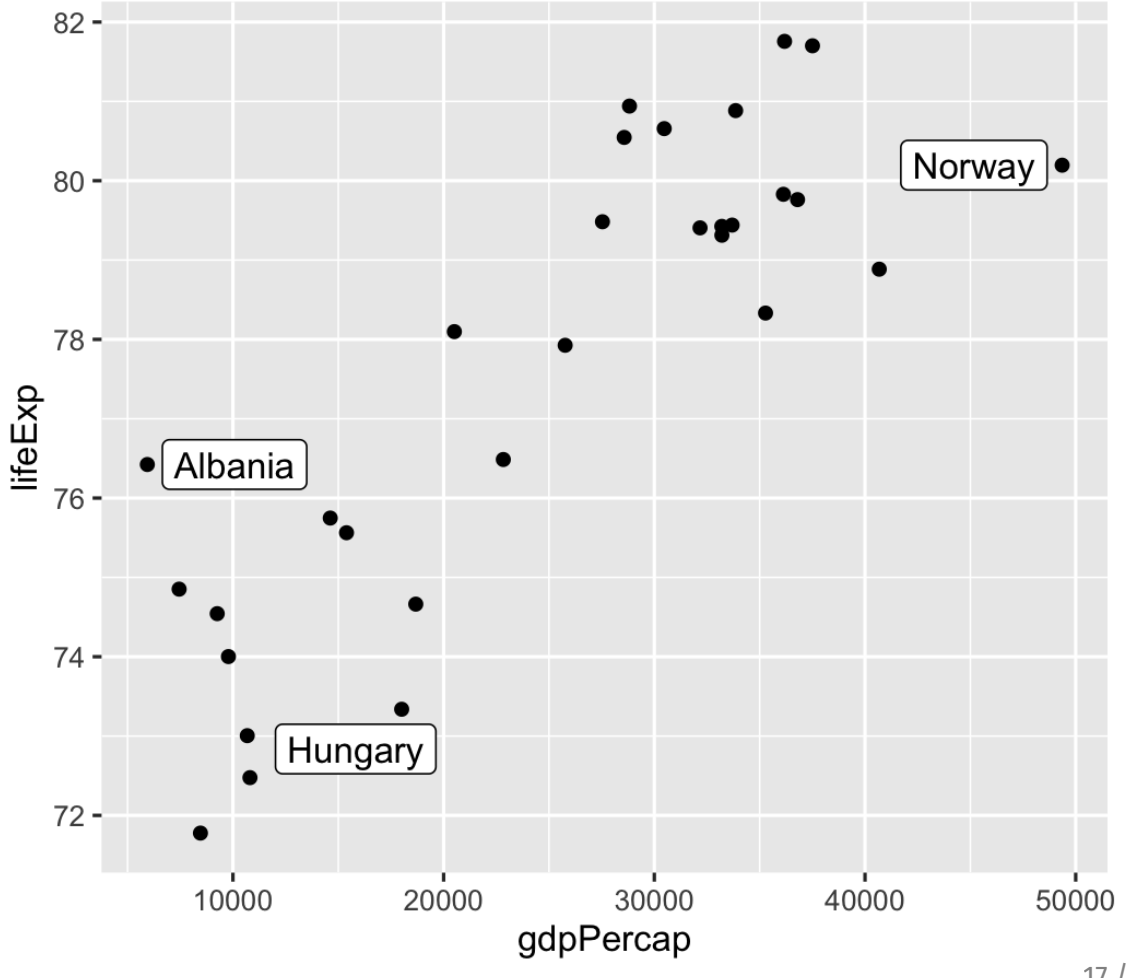
Solution 1: Repel labels

```
library(ggrepel)

ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  geom_label_repel(aes(label = country))
```



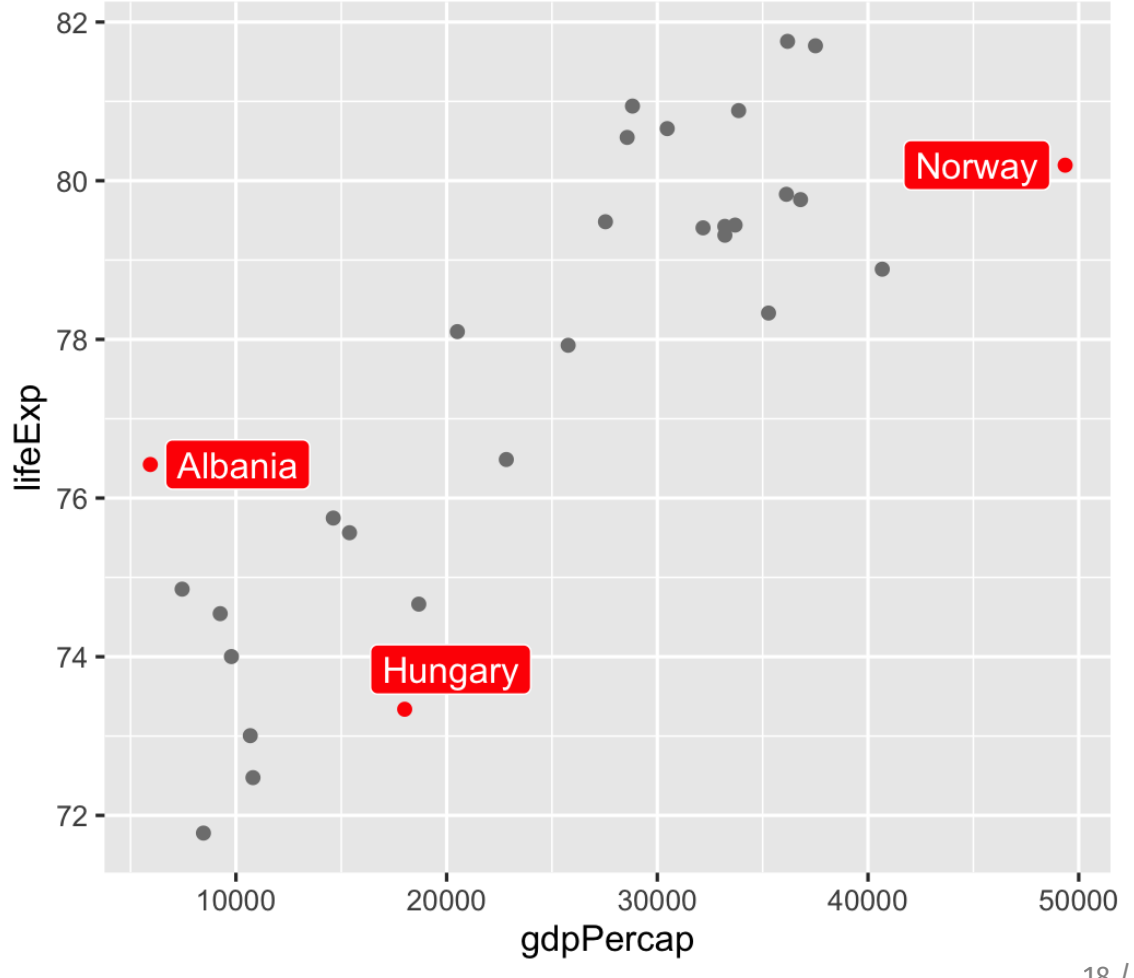
Solution 2a: Don't use so many labels

```
gapminder_europe <- gapminder_europe %>%
  mutate(should_be_labeled =
           ifelse(country %in% c("Albania",
                                 "Norway",
                                 "Hungary"),
                  TRUE, FALSE))

ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  geom_label_repel(
    data = filter(gapminder_europe,
                  should_be_labeled == TRUE)
    aes(label = country)
  )
```



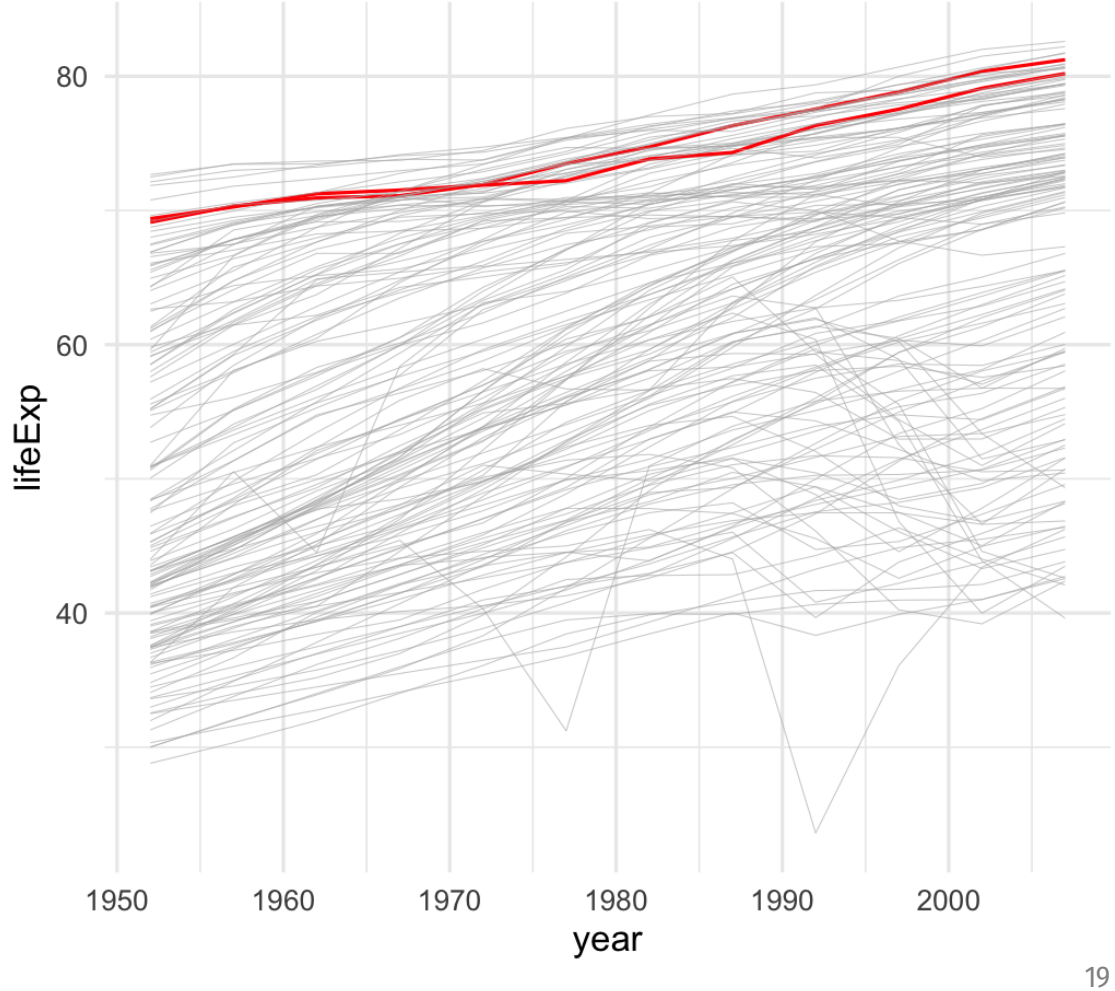
Solution 2b: Use other aesthetics too

```
ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point(aes(color = should_be_labeled))
  geom_label_repel(
    data = filter(
      gapminder_europe,
      should_be_labeled == TRUE
    ),
    aes(label = country,
        fill = should_be_labeled),
    color = "white"
  ) +
  scale_color_manual(values = c("grey50",
                                "red")) +
  scale_fill_manual(values = c("red")) +
  guides(color = "none", fill = "none")
```



(Highlight non-text things too!)

```
# Color just Oceania
gapminder_highlighted <- gapminder %>%
  mutate(is_oceania =
           ifelse(continent == "Oceania",
                  TRUE, FALSE))

ggplot(gapminder_highlighted,
       aes(x = year, y = lifeExp,
           group = country,
           color = is_oceania,
           size = is_oceania)) +
  geom_line() +
  scale_color_manual(values = c("grey70",
                                "red")) +
  scale_size_manual(values = c(0.1, 0.5)) +
  guides(color = "none", size = "none") +
  theme_minimal()
```



Including text on a plot

Label actual data points

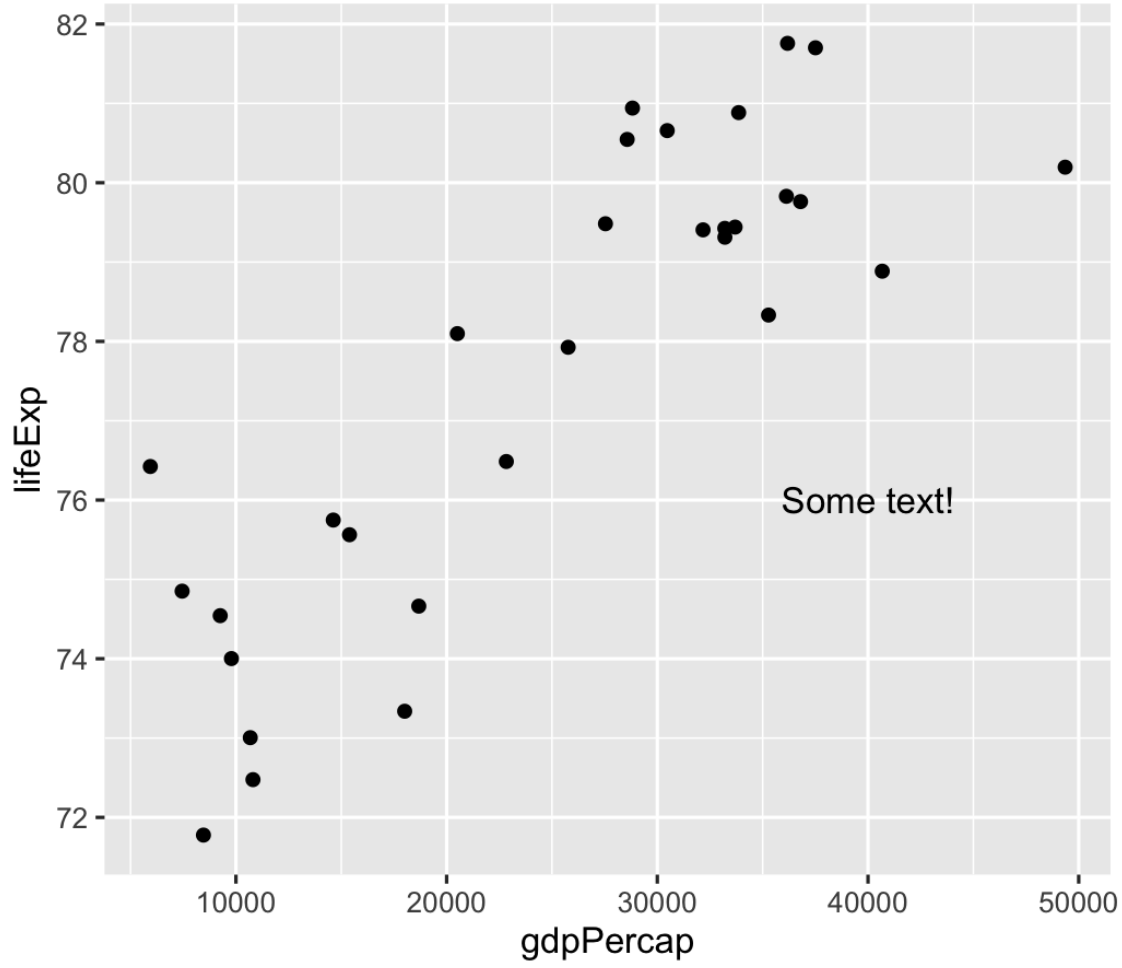
`geom_text()`, `geom_label()`, `geom_text_repel()`, etc.

Add arbitrary annotations

`annotate()`

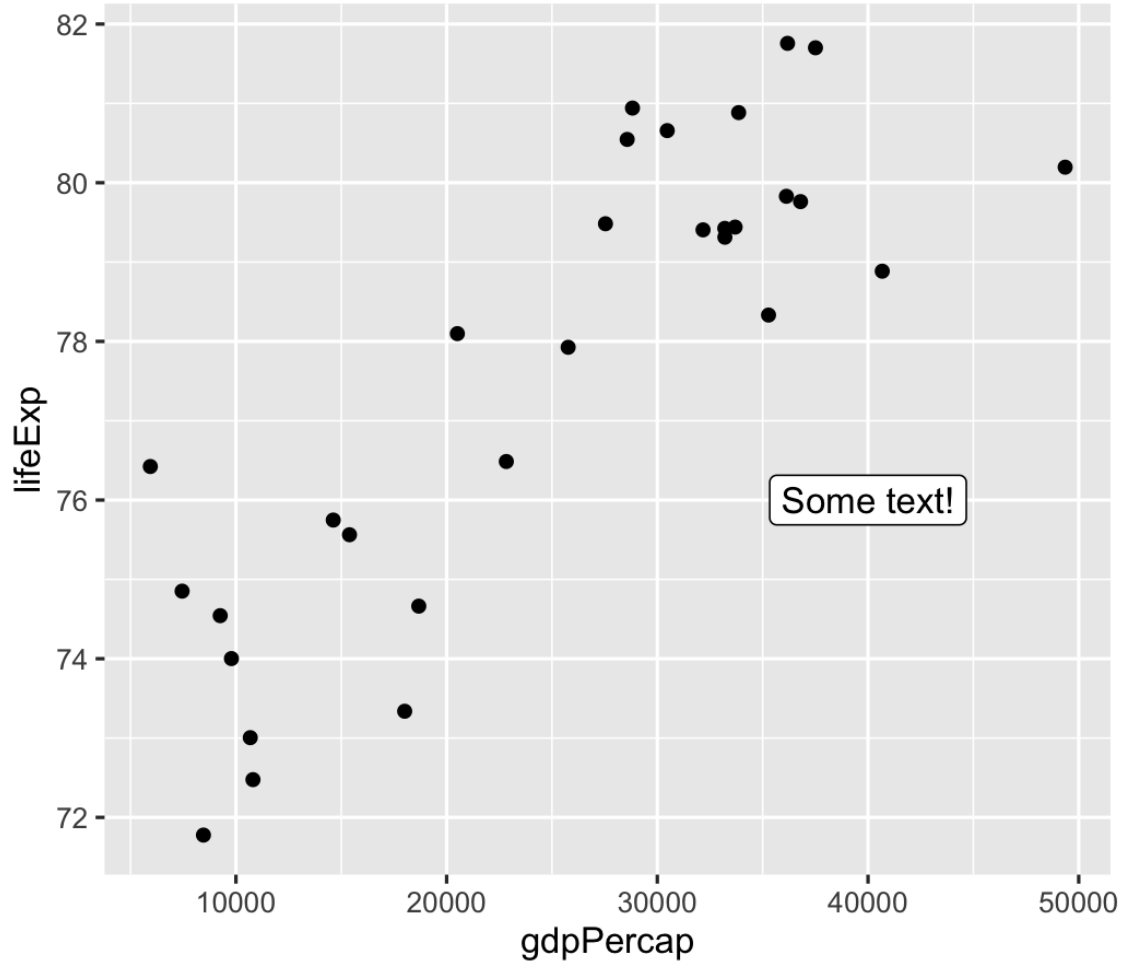
Adding arbitrary annotations

```
ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  annotate(geom = "text",
           x = 40000, y = 76,
           label = "Some text!")
```



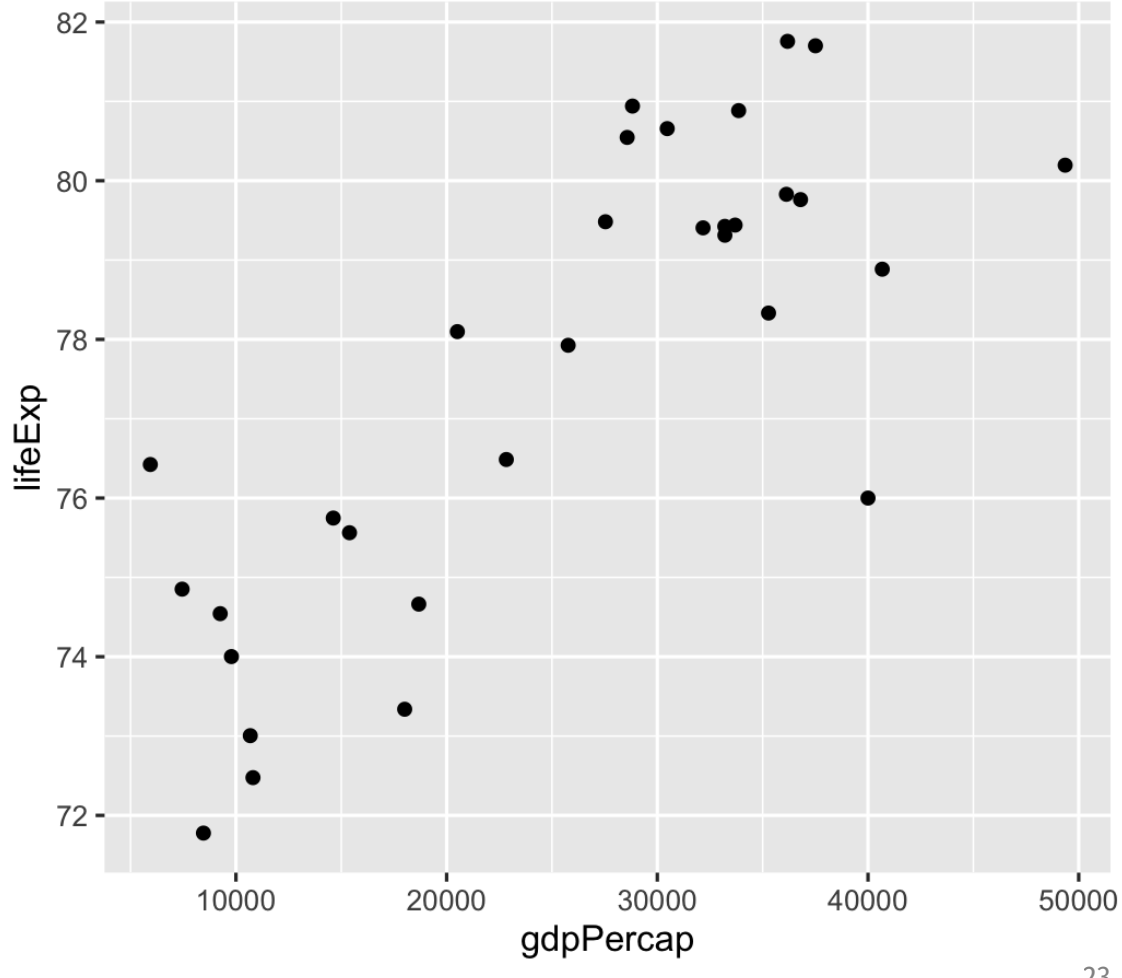
Adding arbitrary annotations

```
ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  annotate(geom = "label",
           x = 40000, y = 76,
           label = "Some text!")
```



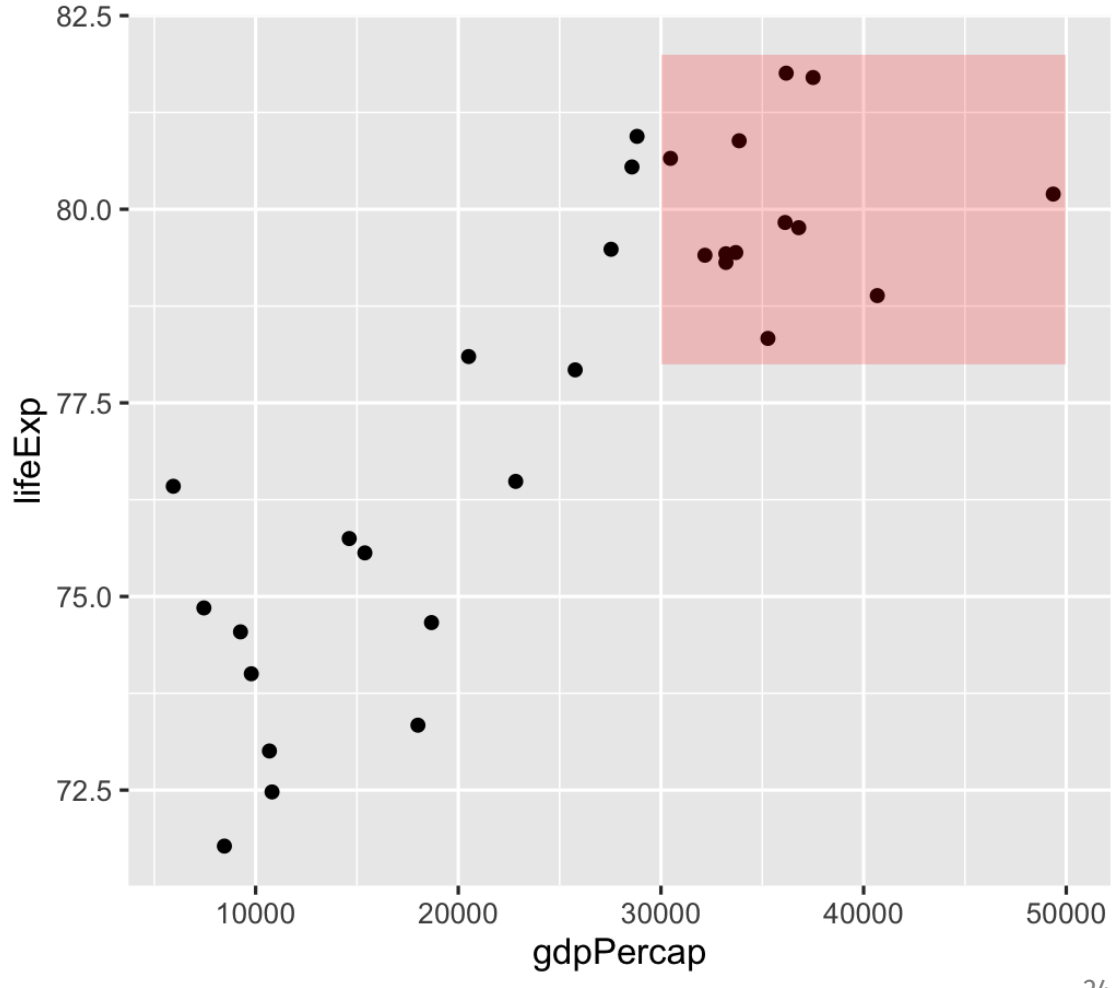
Any geom works

```
ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  # This is evil though!!!
  # We just invented a point
  annotate(geom = "point",
           x = 40000, y = 76)
```



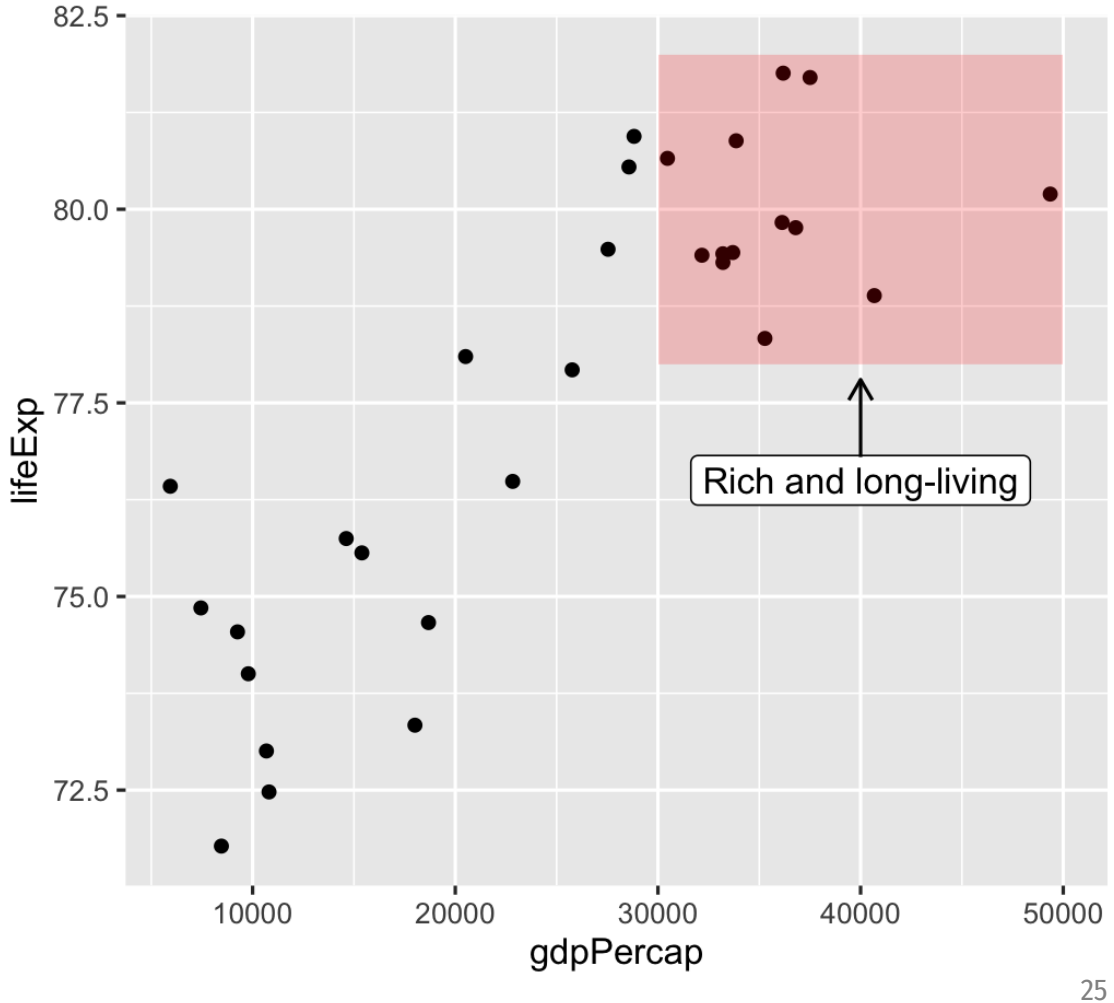
Any geom works

```
ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  annotate(geom = "rect",
           xmin = 30000, xmax = 50000,
           ymin = 78, ymax = 82,
           fill = "red", alpha = 0.2)
```



Use multiple annotations

```
ggplot(gapminder_europe,
       aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  annotate(geom = "rect",
           xmin = 30000, xmax = 50000,
           ymin = 78, ymax = 82,
           fill = "red", alpha = 0.2) +
  annotate(geom = "label",
           x = 40000, y = 76.5,
           label = "Rich and long-living") +
  annotate(geom = "segment",
           x = 40000, xend = 40000,
           y = 76.8, yend = 77.8,
           arrow = arrow(
             length = unit(0.1, "in")))
```



Including text on a plot

Label actual data points

`geom_text()`, `geom_label()`, `geom_text_repel()`, etc.

Add arbitrary annotations

`annotate()`

Titles, subtitles, captions, etc.

```
labs(title = "blah", subtitle = "blah", caption = "blah")
```

Which is better?

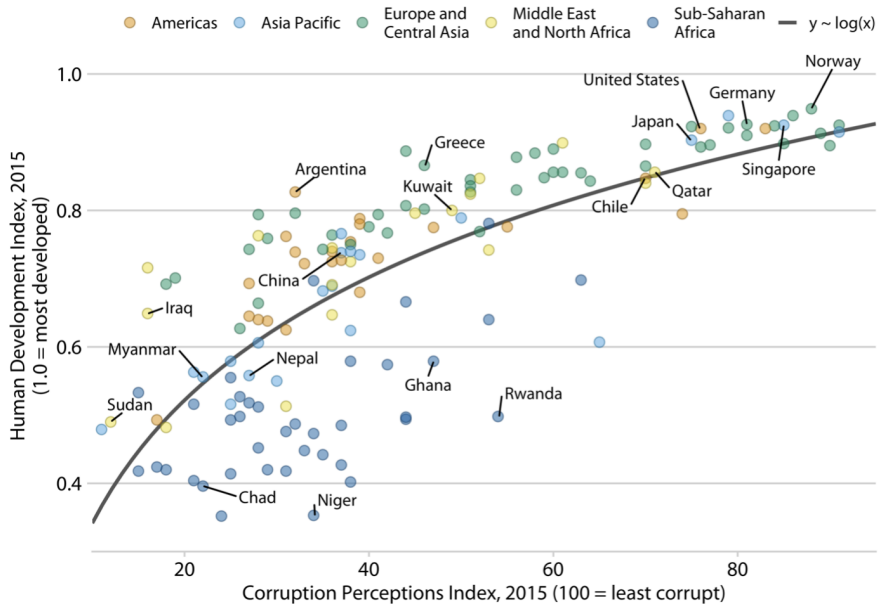
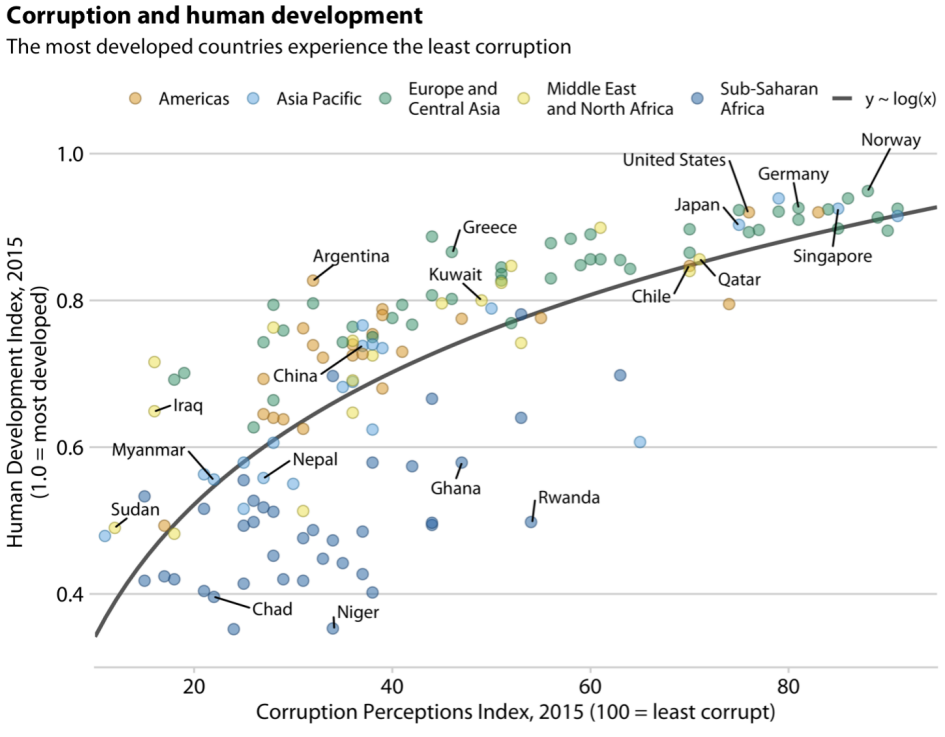


Figure 22.1: Corruption and human development: The most developed countries experience the least corruption. This figure was inspired by a posting in The Economist online (2011). Data sources: Transparency International & UN Human Development Report



Neither! Depends on the final document output.

Seeds

Pseudorandomness

Your computer uses a complicated algorithm to generate random numbers

Different programs use different algorithms

You can actually sometimes reverse engineer the algorithm!

These algorithms all start with something called a "seed", or some number

In R this is the current time on your computer + the internal program process ID

If two random functions use the same seed, they'll create the same numbers

Seeds

Open R on your computer and run this:

```
rnorm(3)
```

You'll generate 3 random numbers from a normal distribution with a mean of 0 and a standard deviation of 1.

They will 100% **not** be these 3 numbers:

-1.033, -0.949, and 1.394

Seeds

Now run these two lines in R:

```
set.seed(1234)
```

```
rnorm(3)
```

You'll again generate 3 random numbers, but they will 100% be these:

-1.207, 0.277, and 1.084

Why should we care?

Because we set a seed the random numbers will be the same random numbers every time

- Reproducible simulations
- Reproducible Bayesian models
- Jittering in plots
- `geom_text_repel()` in plots

What is a good seed?

Any whole number

1234(567)

1

13, 42, 8675309, or your favorite number

20200519

Random.org atmospheric noise

Best practice

If you're doing *anything* with randomness, include `set.seed(SOME_NUMBER)` at the beginning of your document

Some functions have a `seed` argument—use it

```
geom_label_repel(..., seed = 1234)
```

```
position_jitter(..., seed = 1234)
```

Example

```
ggplot(mpg, aes(x = drv, y = hwy)) +
  geom_point(position =
               position_jitter(seed = 1234,
                               width = 0.3))
```

As long as the seed is 1234, those dots will always be in those exact spots on any computer running R