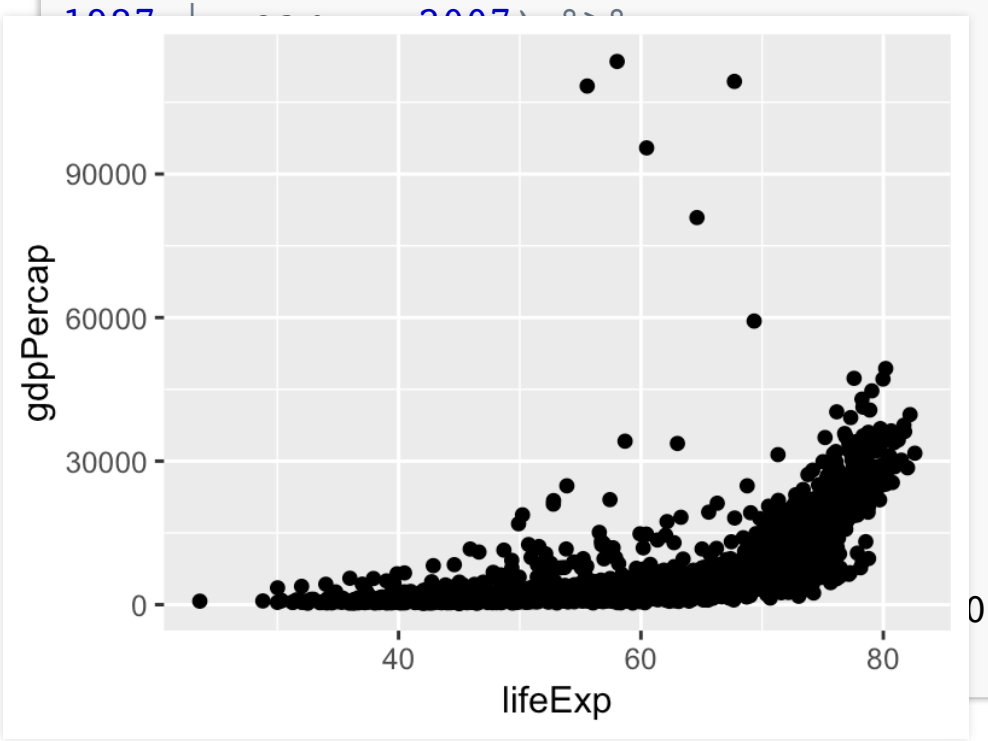
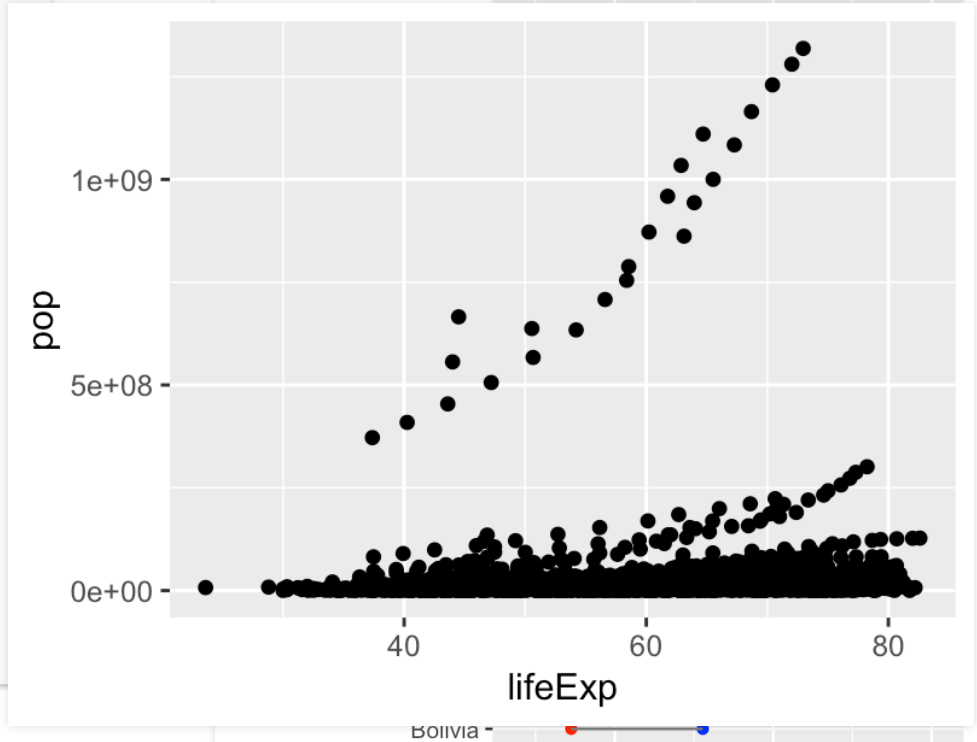
gdp_plot

```
life_exp_6707 <- gapminder %>%
  filter(continent == "Americas", year ==
```




```
07),
```

pop_plot



Agenda

- *Brief* overview of ggplot2 + extensions
- Resources for extensions
- Some existing extensions
- Writing your own extension

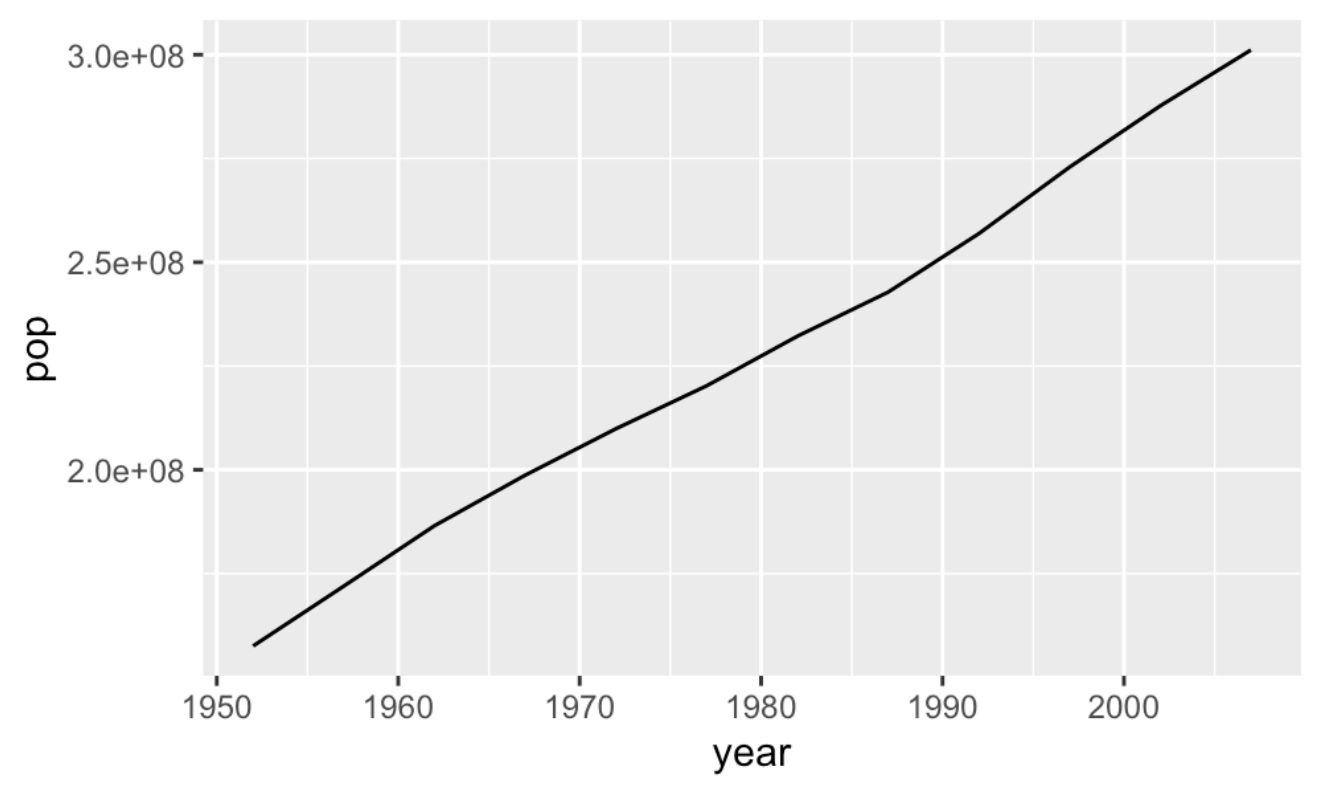
What is ggplot2?

G G

You provide the data, tell ggplot2 how to map variables to aesthetics, what graphical primitives to use, and it takes care of the details.

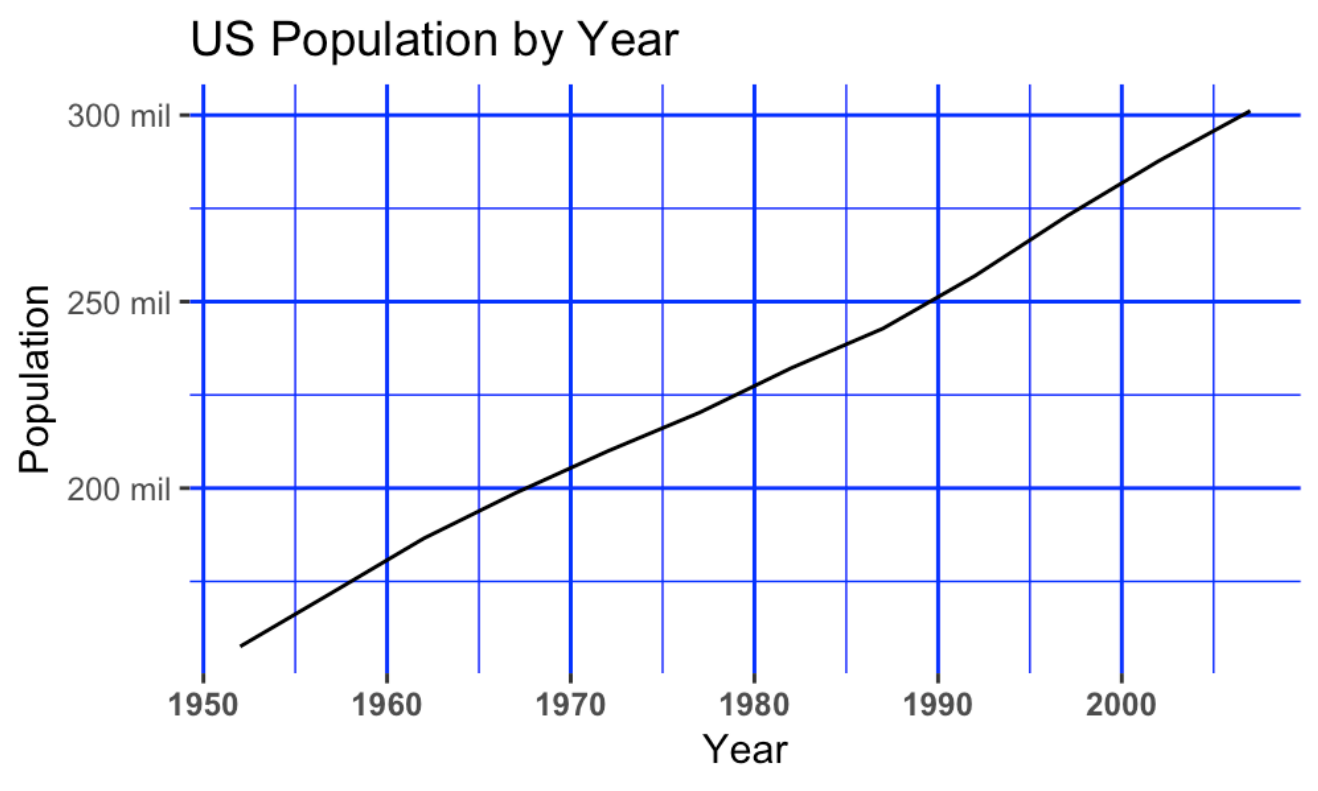
What is ggplot2?

```
library(ggplot2)
library(dplyr)
library(gapminder)

pop_by_year <- gapminder %>%
  filter(country == "United States") %>%
  ggplot(aes(x = year, y = pop, group = country)) +
  geom_line()

pop_by_year
```



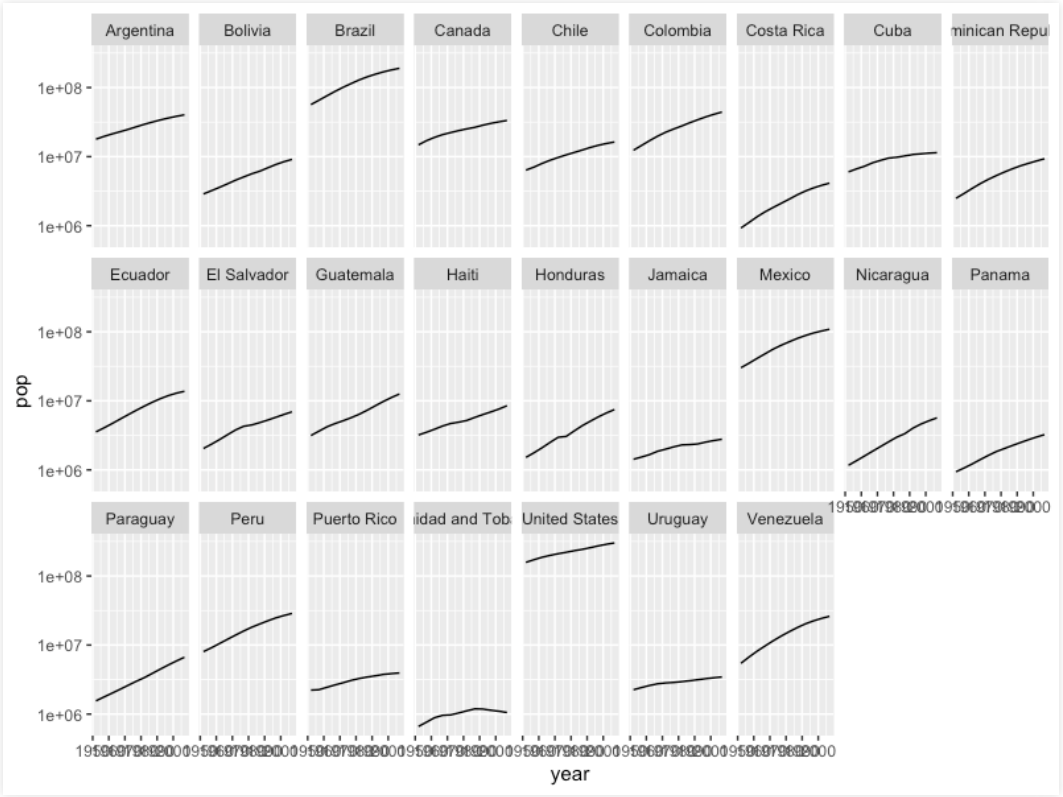
Advantages of using ggplot

```
pop_by_year +
  labs(x = "Year", y = "Population", title = "US Population by Year") +
  scale_y_continuous(labels = function(x) paste0(round(x / 1e6), " mil")) +
  theme(axis.text.x = element_text(face = "bold"),
        panel.background = element_blank(),
        panel.grid = element_line(color = "blue"))
```



Advantages of using ggplot: continued

```
gapminder %>%
  filter(continent == "Americas") %>%
  ggplot(aes(x = year, y = pop, group = country)) +
  geom_line() +
  facet_wrap(~country, nrow = 3) +
  scale_y_log10()
```



Resources for learning ggplot2

- **https://ggplot2.tidyverse.org/**
- **http://r4ds.had.co.nz/data-visualisation.html**
- **http://www.cookbook-r.com/Graphs/**
- **https://www.rstudio.com/wp-content/uploads/2016/11/ggplot2-cheatsheet-2.1.pdf**

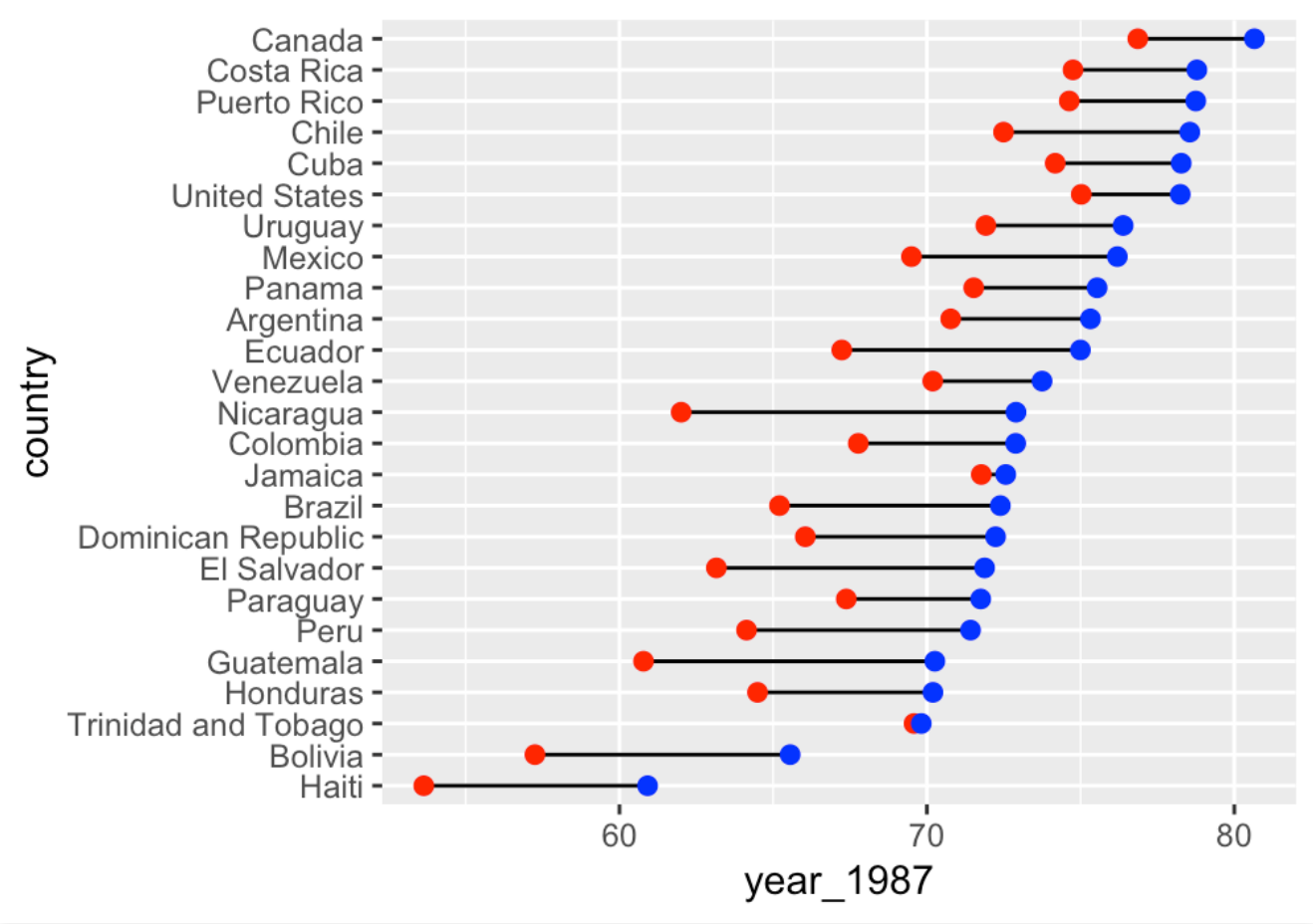
ggplot2 extensions

- What if ggplot2 doesn't have the `geom` you want?
- **extensions** allow you to write your own `geom`
  - share with others in an R package
- **http://www.ggplot2-exts.org/**

ggplot2 extensions: example

ggplot2 extensions: dumbell

```
life_exp_8707 %>%
  ggplot(aes(y = country, x = year_1987, xend = year_2007)) +
  ggalt::geom_dumbbell(colour_x = "red", colour_xend = "blue", size_x = 2,
size_xend = 2)
```



Popular extensions

- patchwork
- gganimate
- ggridges
- ggrepel
- ggExtra
- gghighlight
- ggthemes
- ggiraph

patchwork

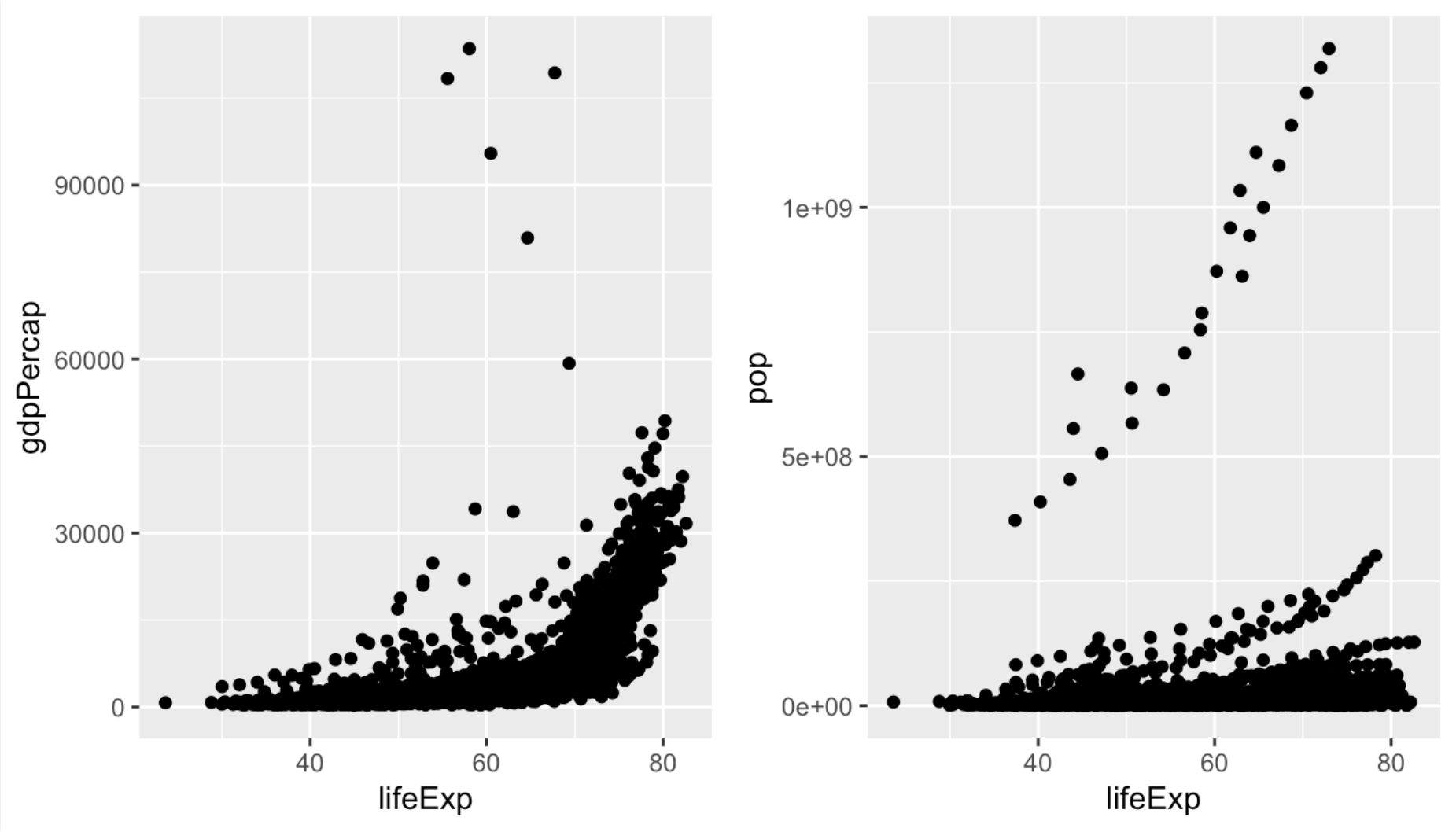
The goal of patchwork is to make it ridiculously simple to combine separate ggplots into the same graphic. As such it tries to solve the same problem as `gridExtra::grid.arrange()` and `cowplot::plot_grid` but using an API that incites exploration and iteration.

https://github.com/thomasp85/patchwork

patchwork: Motivating Example

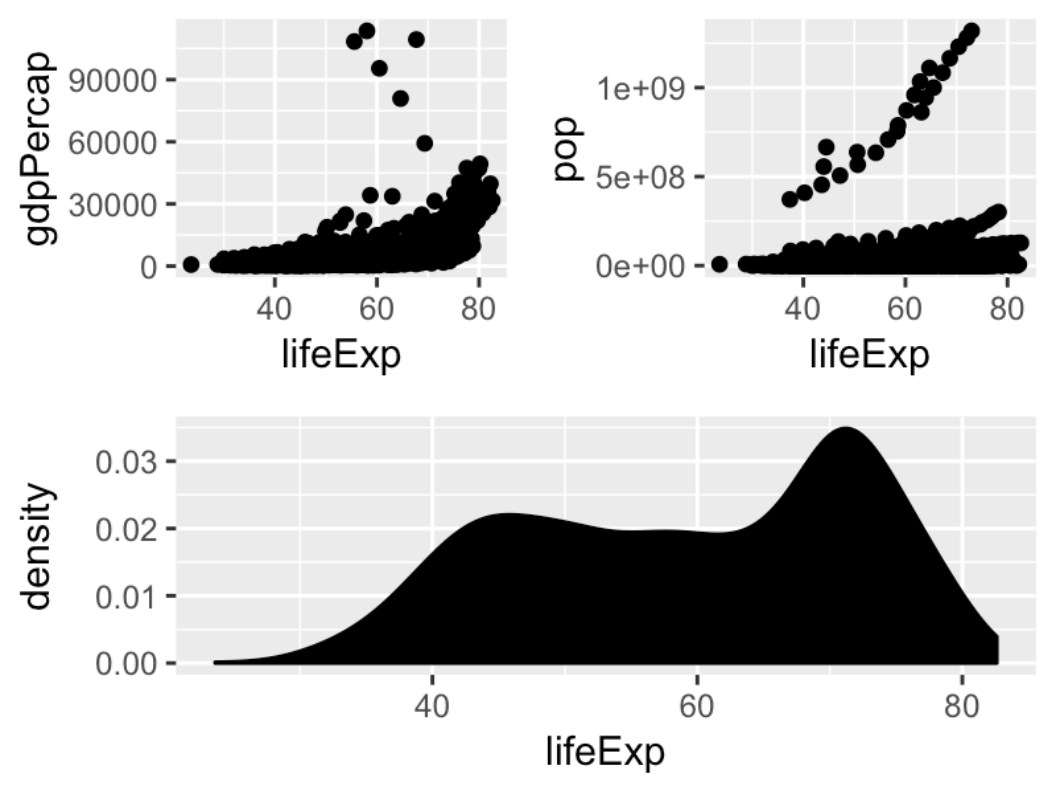
patchwork: Continued

```
gdp_plot + pop_plot
```



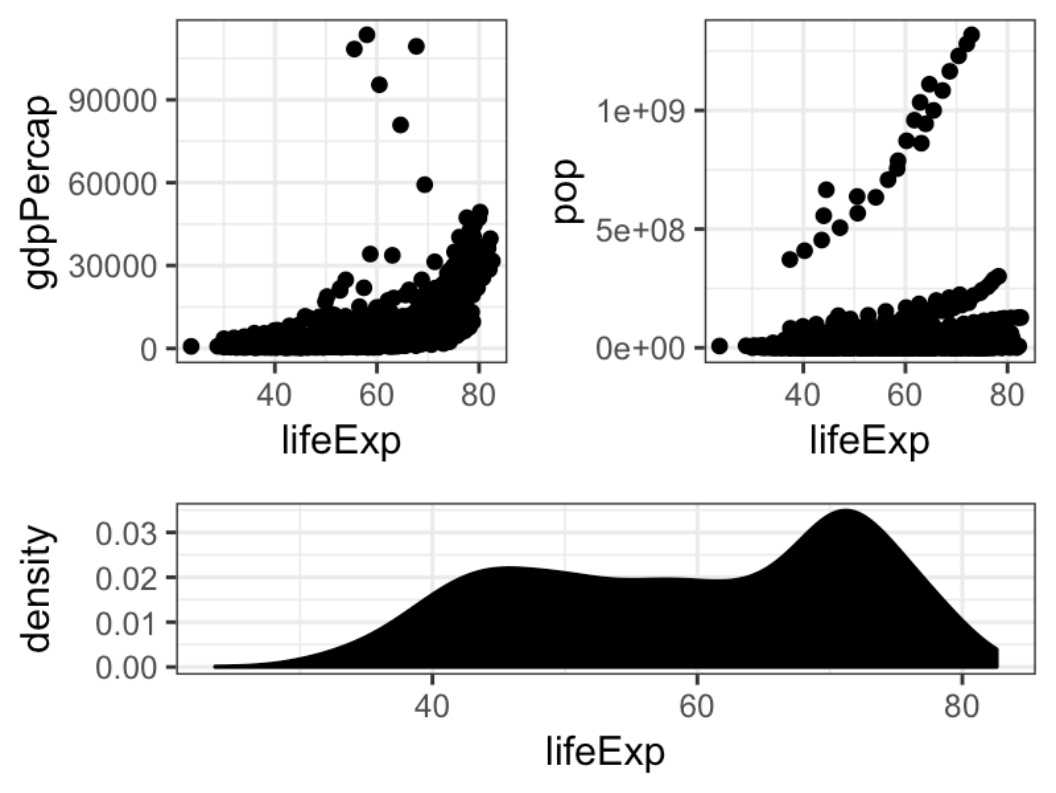
patchwork: Continued

```
# gdp_plot + pop_plot - life_dist_plot + plot_layout(ncol = 1)
(gdp_plot | pop_plot) / life_dist_plot
```



patchwork: Continued

```
gdp_plot + pop_plot - life_dist_plot + plot_layout(ncol = 1, heights = c(2,
1)) & theme_bw()
```



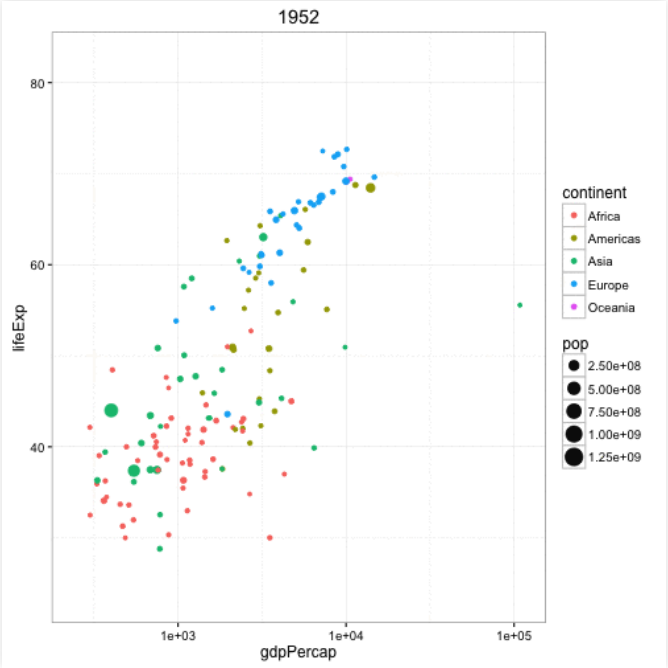
gganimate

The core of the approach is to treat “frame” (as in, the time point within an animation) as another aesthetic, just like x, y, size, color, or so on. Thus, a variable in your data can be mapped to frame just as others are mapped to x or y.

https://github.com/dgrtwo/gganimate

gganimate: example

```
library(gganimate)
year_plot <- gapminder %>%
  ggplot(aes(gdpPercap, lifeExp, size = pop, color = continent, frame = year))
+
  geom_point() +
  scale_x_log10() +
  theme_bw()

gganimate(year_plot, filename =
"~/Documents/Presentations/r_users/year_plot.gif")
```



gganimate: House Keeping

- No longer a single ggplot image
  - doesn't play nice with markdown
- To make smooth transitions between your data use the `tweenr` package
- package is undergoing a total rewrite
  - `aes(frame = ...)` is going away at some point

ggridges

https://blogs.scientificamerican.com/sa-visual/pop-culture-pulsar-origin-story-of-joy-division-s-unknown-pleasures-album-cover-video/

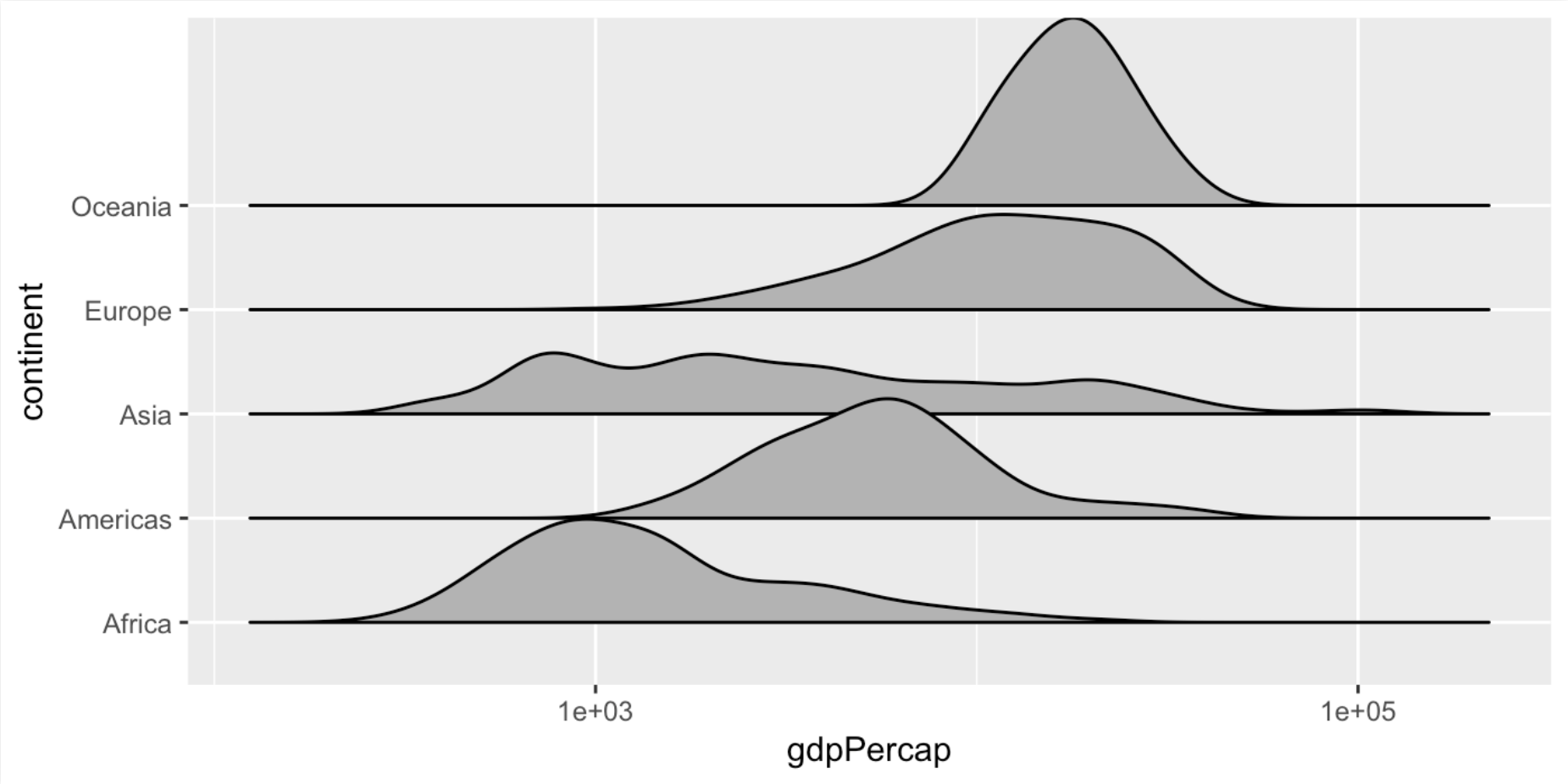
ggridges

Ridgeline plots are partially overlapping line plots that create the impression of a mountain range. They can be quite useful for visualizing changes in distributions over time or space.

https://github.com/clauswilke/ggridges

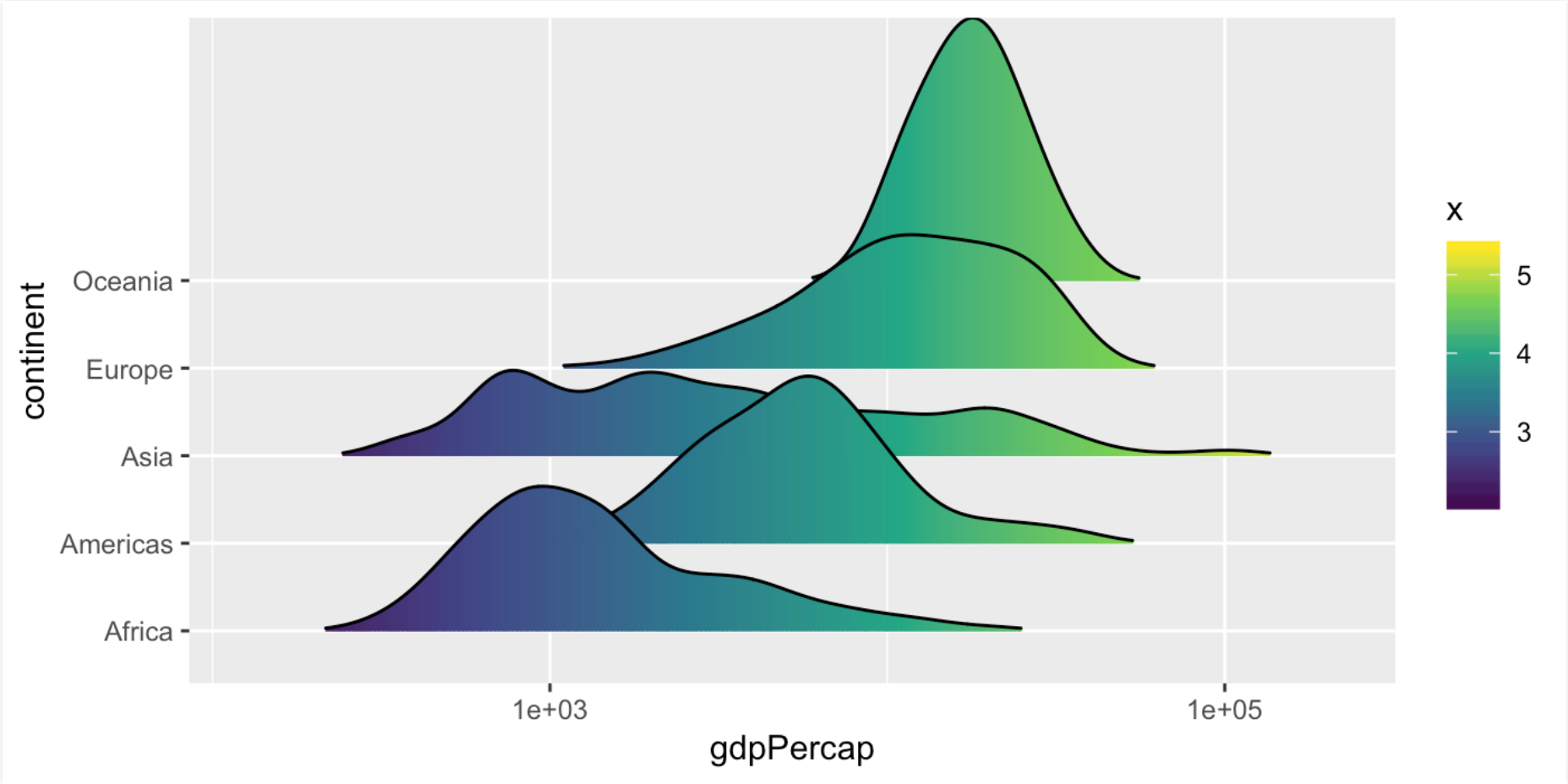
ggridges: example

```
library(ggridges)
gapminder %>%
  ggplot(aes(x = gdpPercap, y = continent)) +
  ggridges::geom_density_ridges2() +
  scale_x_log10()
```



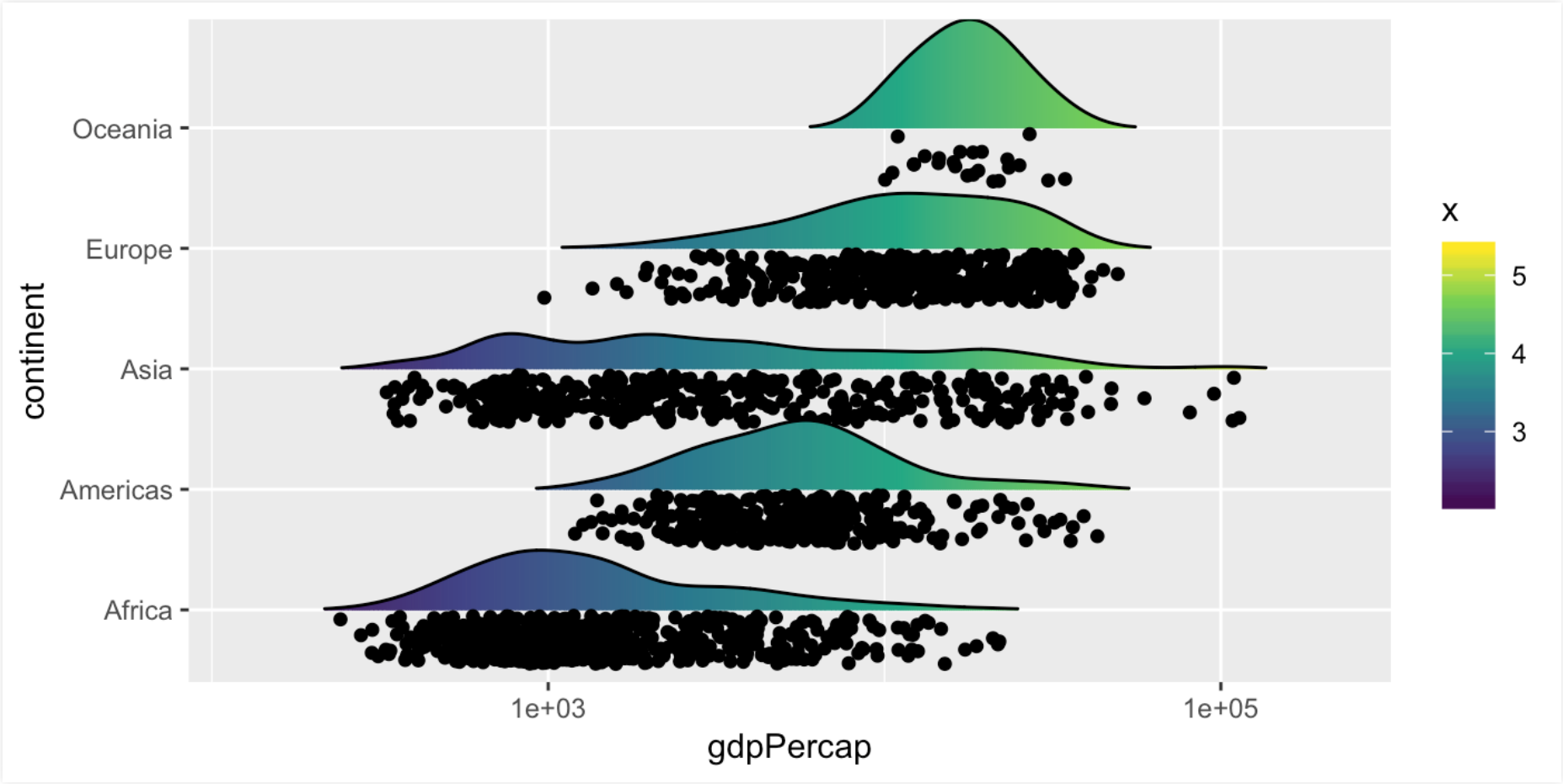
ggridges: Continued

```
gapminder %>%
  ggplot(aes(x = gdpPercap, y = continent, fill = ..x..)) +
  ggridges::geom_density_ridges_gradient(scale = 3, rel_min_height = .01) +
  scale_fill_viridis_c() +
  scale_x_log10()
```



ggridges: raincloud plots

```
gapminder %>%
  ggplot(aes(x = gdpPercap, y = continent, fill = ..x..)) +
  ggridges::geom_density_ridges_gradient(scale = .9, rel_min_height = .01,
position = position_raincloud(), jittered_points = T) +
  scale_fill_viridis_c() +
  scale_x_log10()
```



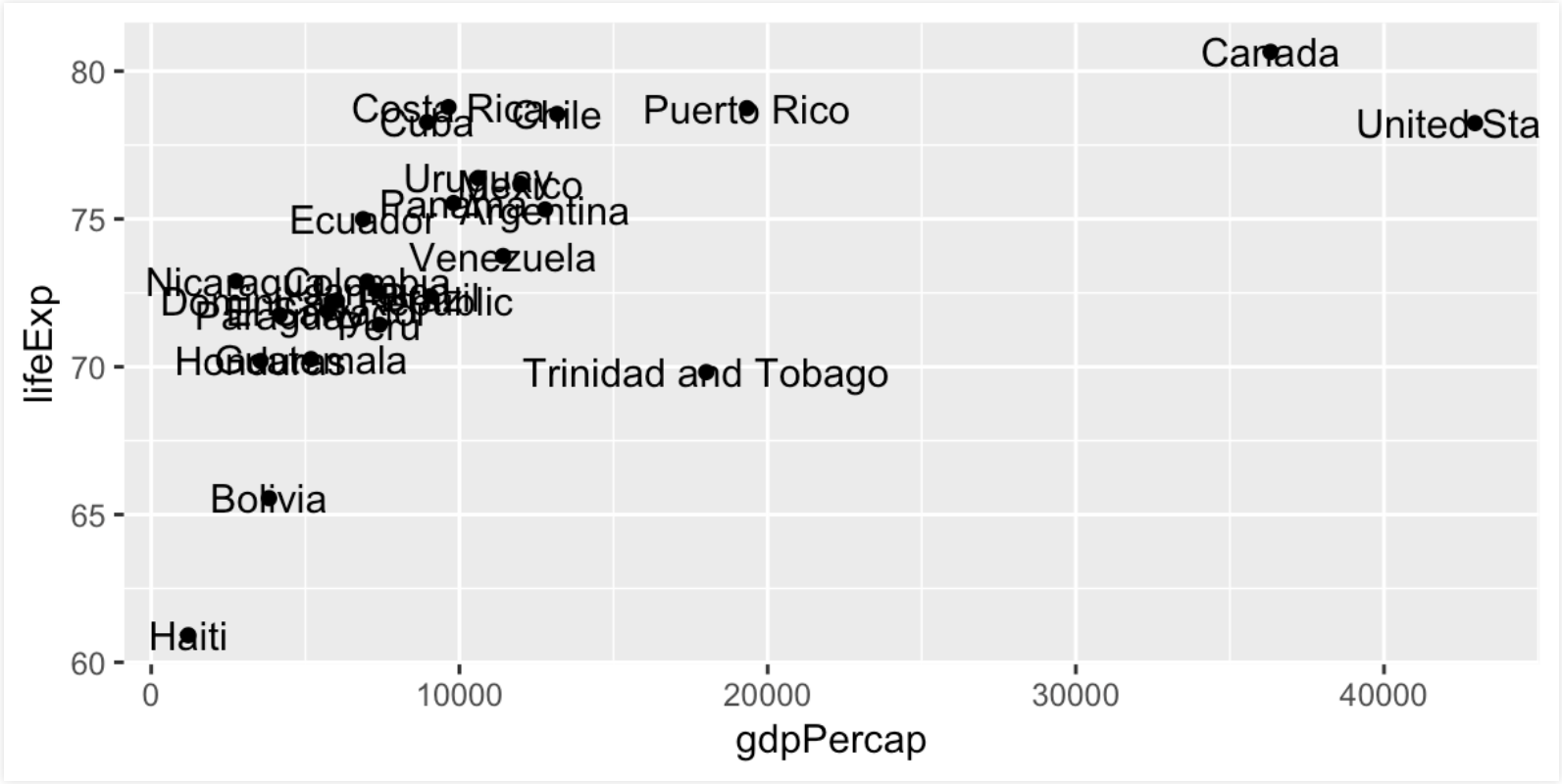
ggrepel

ggrepel provides geoms for ggplot2 to repel overlapping text labels:

https://github.com/slowkow/ggrepel

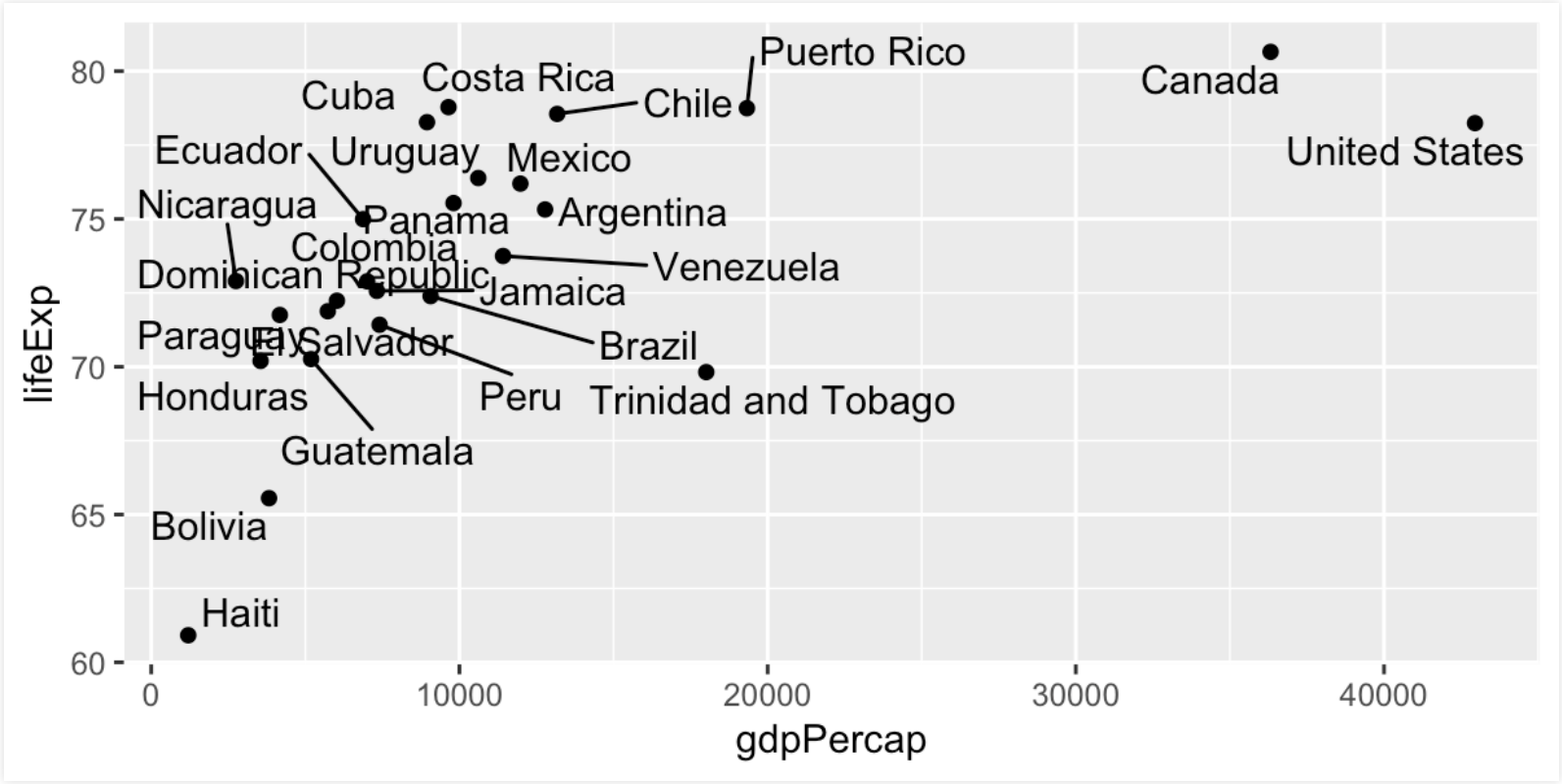
ggrepel: example

```
library(ggrepel)

gapminder %>%
  filter(year == 2007, continent == "Americas") %>%
  ggplot(aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  geom_text(aes(label = country))
```

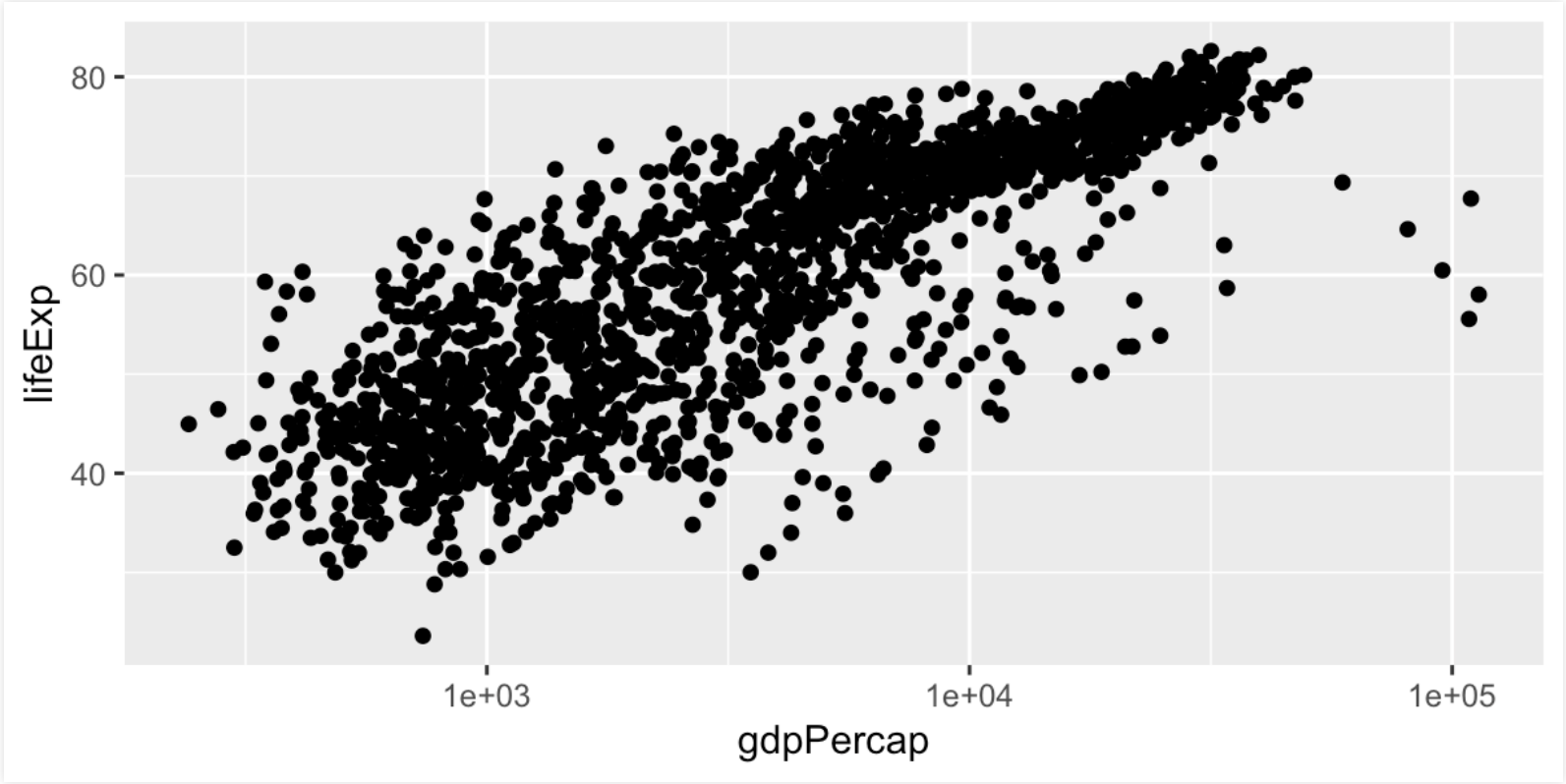


ggrepel: example

```
library(ggrepel)

gapminder %>%
  filter(year == 2007, continent == "Americas") %>%
  ggplot(aes(x = gdpPercap, y = lifeExp)) +
  geom_point() +
  geom_text_repel(aes(label = country))
```



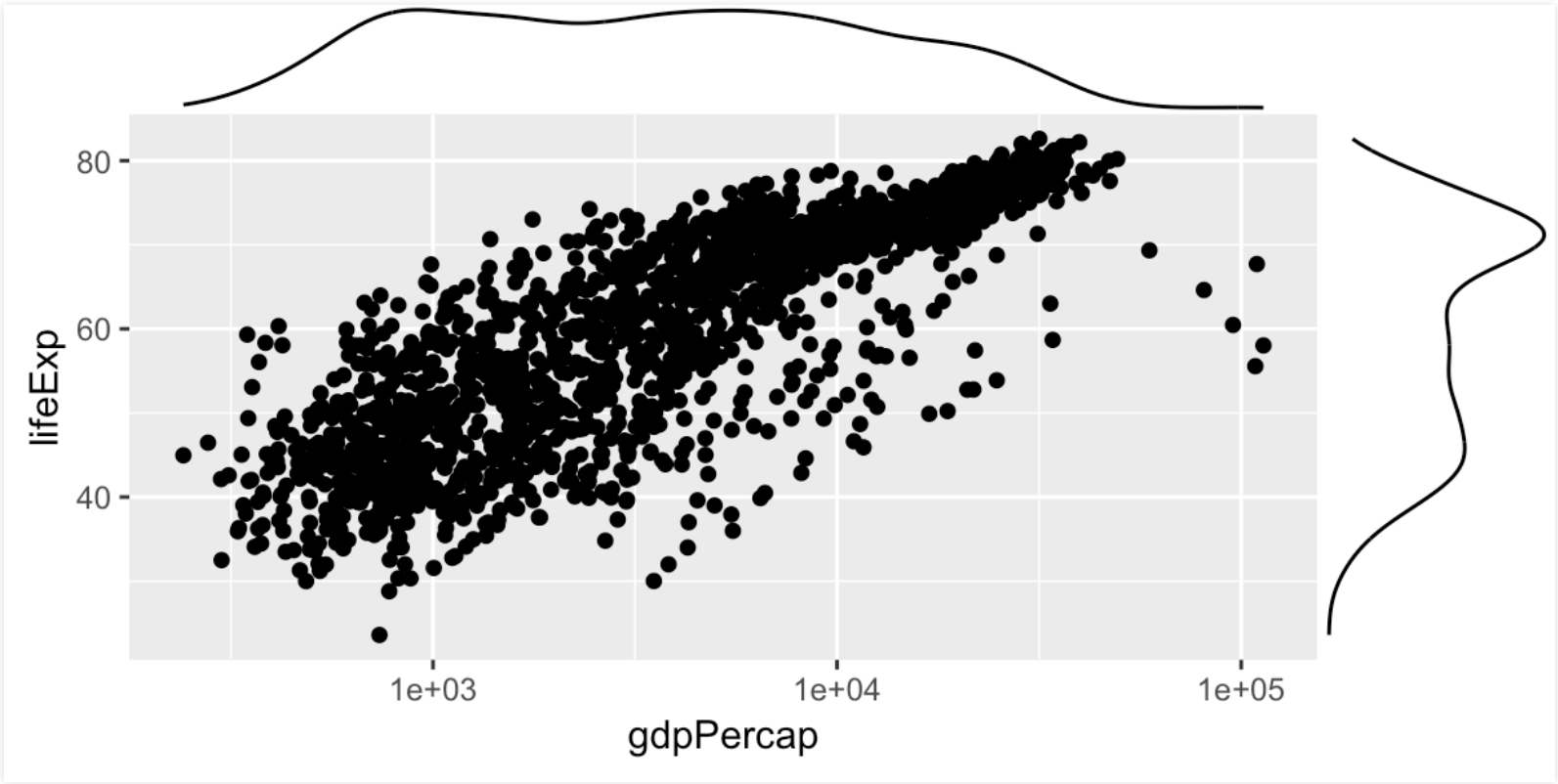
ggextra



https://github.com/daattali/ggExtra

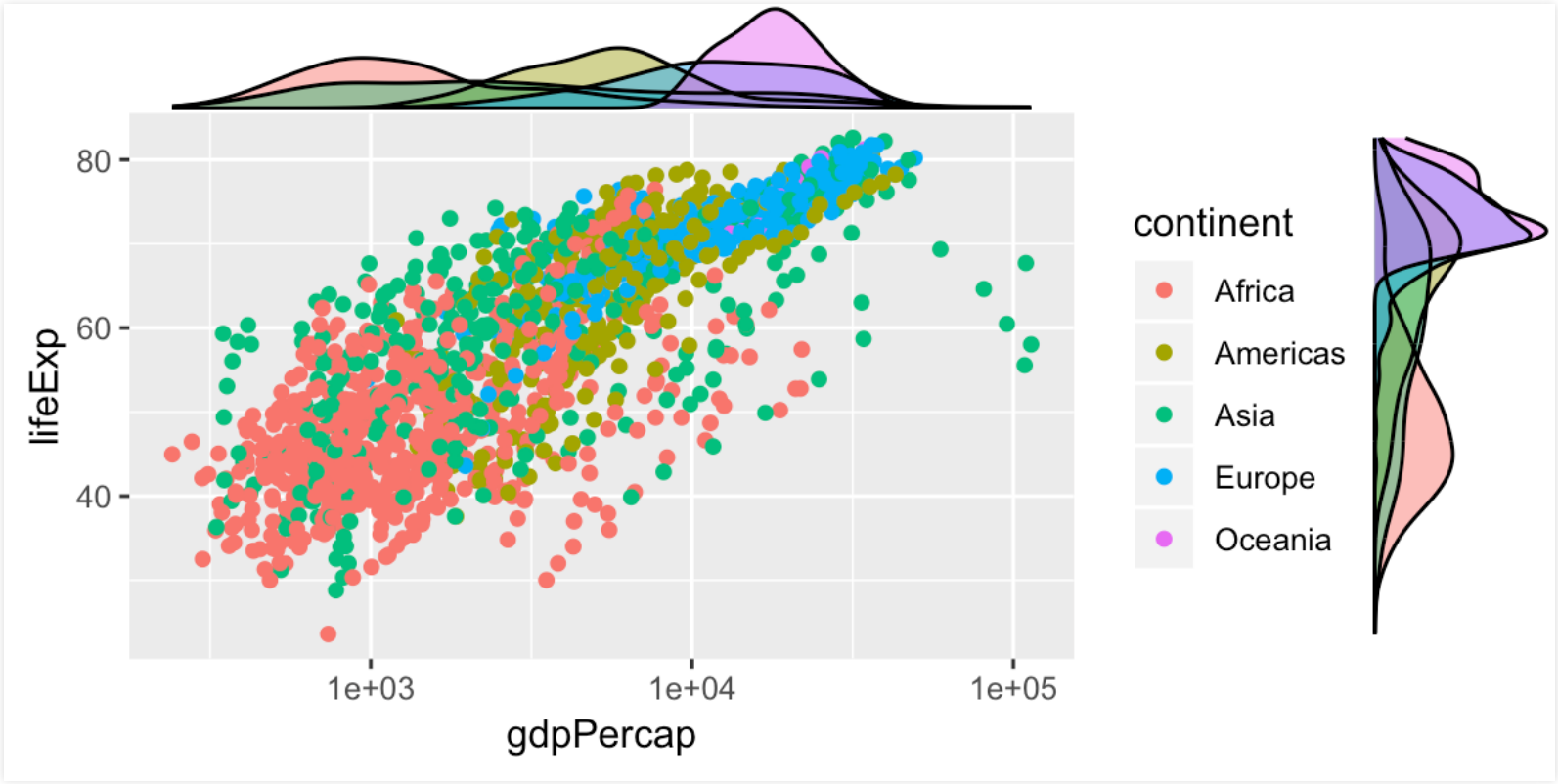
ggExtra: example

```
p <- ggExtra::ggMarginal(life_vs_gdp_plot)

grid::grid.newpage()
grid::grid.draw(p)
```



ggExtra: Continued

```
p2 <- gapminder %>%
  ggplot(aes(x = gdpPercap, y = lifeExp, color = continent)) +
  geom_point() +
  scale_x_log10()

p2 <- ggExtra::ggMarginal(p2, groupFill = T)

grid::grid.newpage()
grid::grid.draw(p2)
```

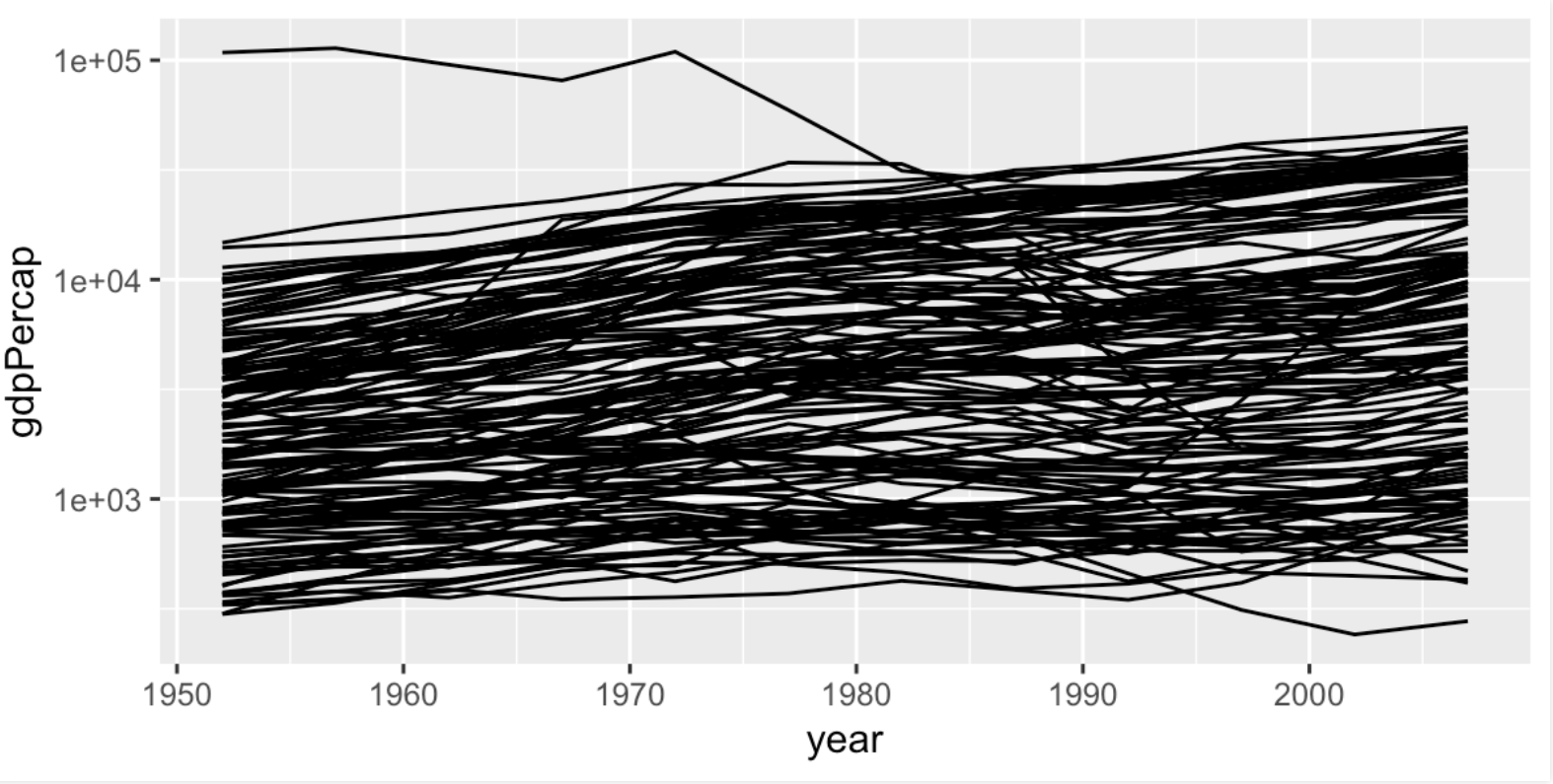


gghighlight

https://github.com/yutannihilation/gghighlight

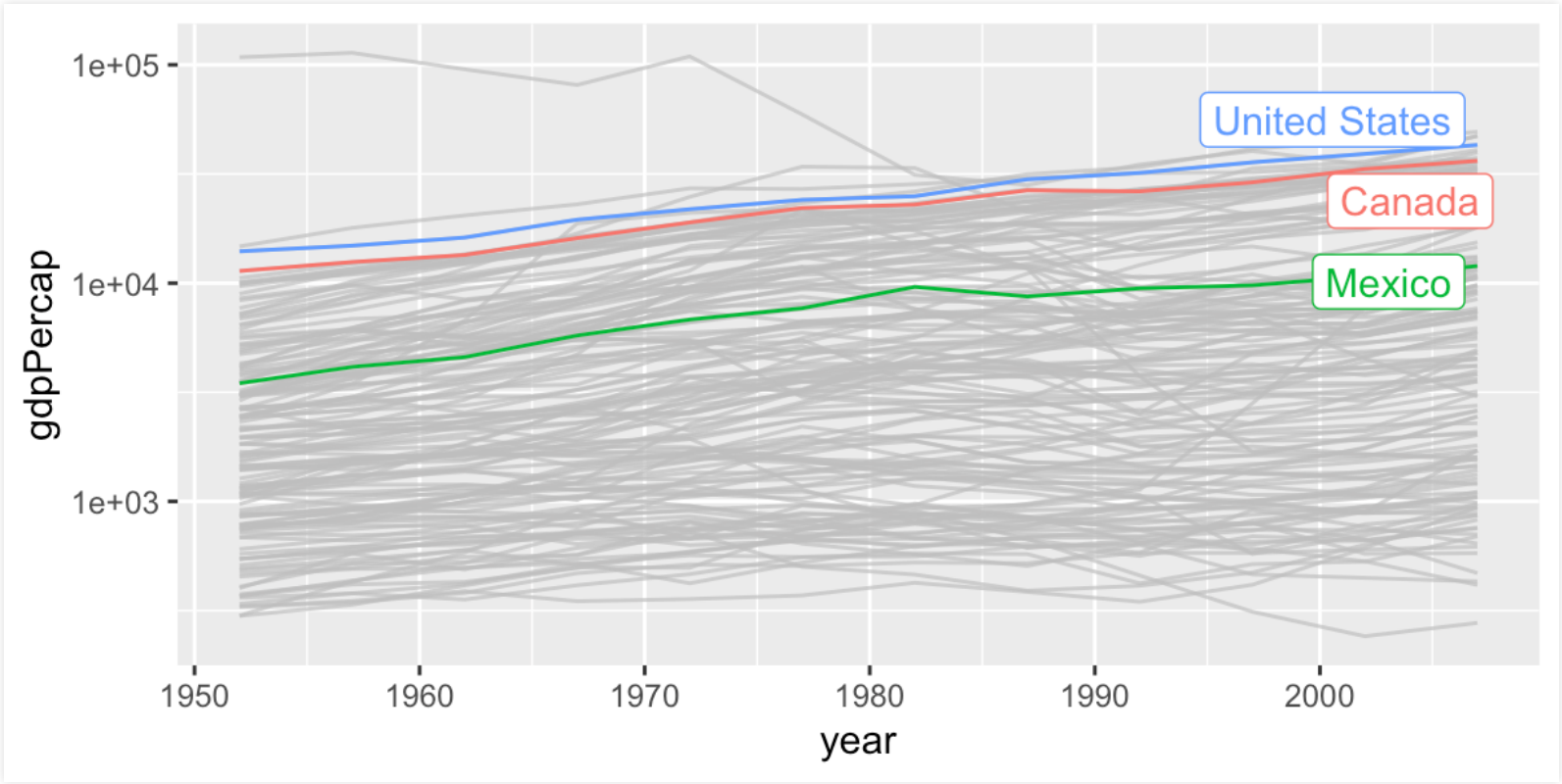
- The package on `cran` is old

```
gapminder %>%
  ggplot(aes(x = year, y = gdpPercap, group = country)) +
  geom_line() +
  scale_y_log10()
```


1e+05
1e+04
1e+03
gdpPercap
1950
1960
1970
1980
1990
2000
year

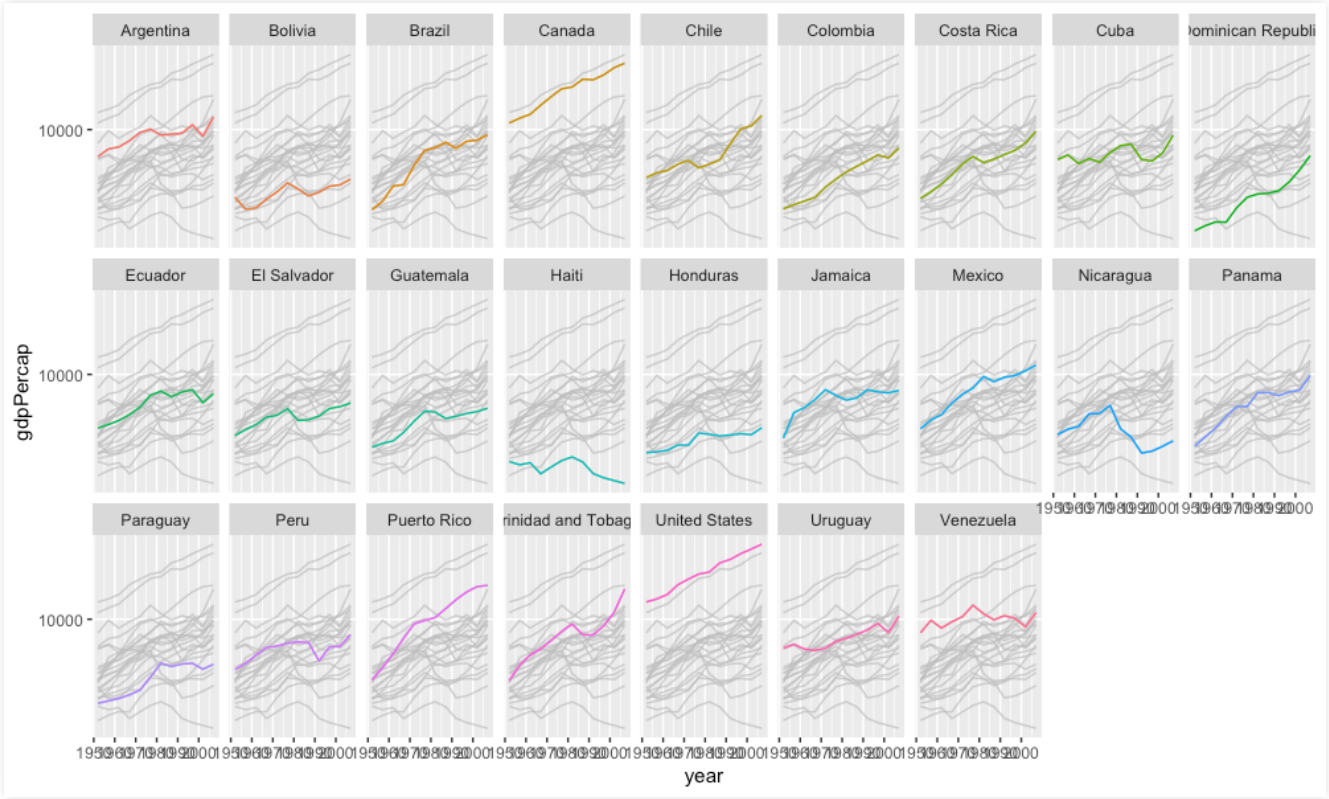
gghighlight: example

```
library(gghighlight)

gapminder %>%
  ggplot(aes(x = year, y = gdpPercap, group = country, color = country)) +
  geom_line() +
  scale_y_log10() +
  gghighlight(country %in% c("United States", "Canada", "Mexico"),
use_group_by = F)
```



gghighlight: continued

```
gapminder %>%
  filter(continent == "Americas") %>%
  ggplot(aes(x = year, y = gdpPercap, group = country, color = country)) +
  geom_line() +
  scale_y_log10() +
  facet_wrap(~country, nrow = 3) +
  gghighlight(T, use_group_by = F, use_direct_label = F) +
  scale_color_discrete(guide = F)
```



ggthemes

https://cran.r-project.org/web/packages/ggthemes/vignettes/ggthemes.html

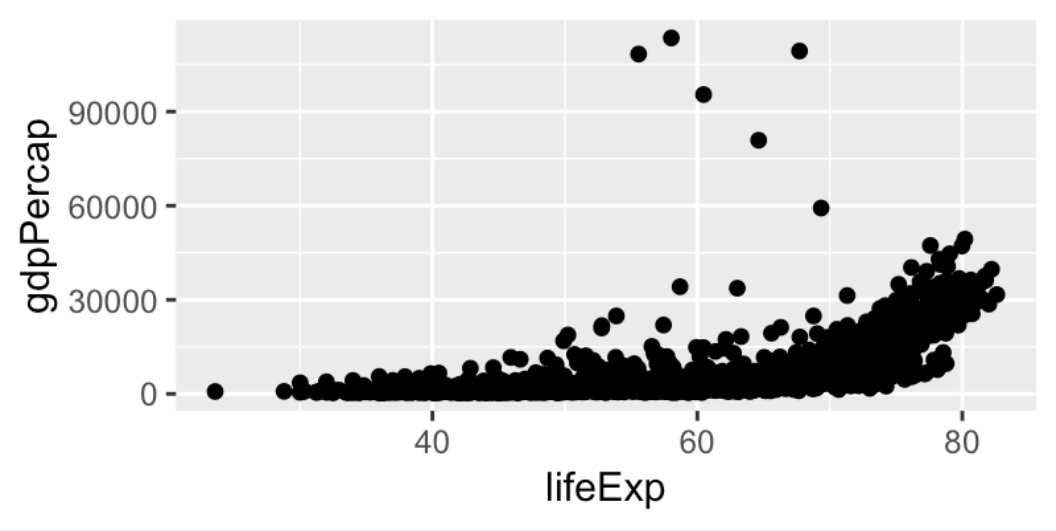
ggiraph

http://davidgohel.github.io/ggiraph/articles/offcran/using_ggiraph.html

Writing your own extension

https://ggplot2.tidyverse.org/articles/extending-ggplot2.html

```
gdp_plot
```




```
class(gdp_plot)
```

```
[1] "gg"     "ggplot"
```

Geoms and Stats

```
?ggplot2::Geom
```

All geom_ functions (like geom_point) return a layer that contains a Geom object (like GeomPoint). The Geom* object is responsible for rendering the data in the plot.

- `geom_point` => `GeomPoint` object
- calling the function tells ggplot what data to use to create the object

ggproto

- `ggproto` is the sytem of OO that ggplot uses.
- Different object types for different parts
  - `Geom`
  - `Stat`
  - `Position`
  - `Scale`
  - `Coord`
  - `Facets`
- Each type has its own methods you must customize (override)

Custom Stat

- We need to tell ggplot what calculation to run and what geom to plot once we get the results

```
?Stat
```

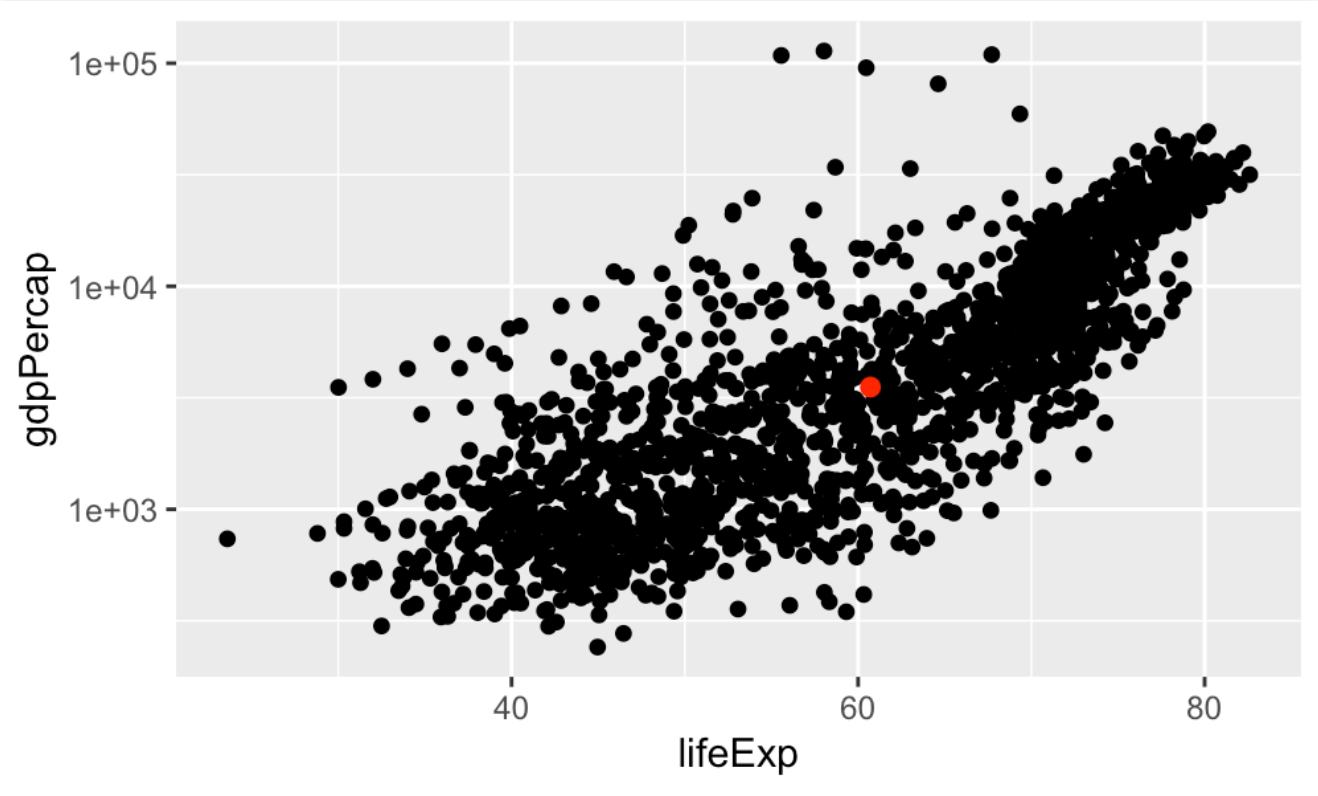
```
StatMiddle <- ggproto("StatMiddle", Stat,
  compute_group = function(data, scales) {
    xmed <- median(data$x)
    ymed <- median(data$y)

    data.frame(x = xmed, y = ymed)
  },

  required_aes = c("x", "y")
)
```

Custom Stat: Continued

```
stat_middle <- function(mapping = NULL, data = NULL, geom = "point",
                        position = "identity", na.rm = FALSE, show.legend = NA,
                        inherit.aes = TRUE, ...) {
  ggplot2::layer(
    stat = StatMiddle, data = data, mapping = mapping, geom = geom,
    position = position, show.legend = show.legend, inherit.aes = inherit.aes,
    params = list(na.rm = na.rm, ...)
  )
}
```

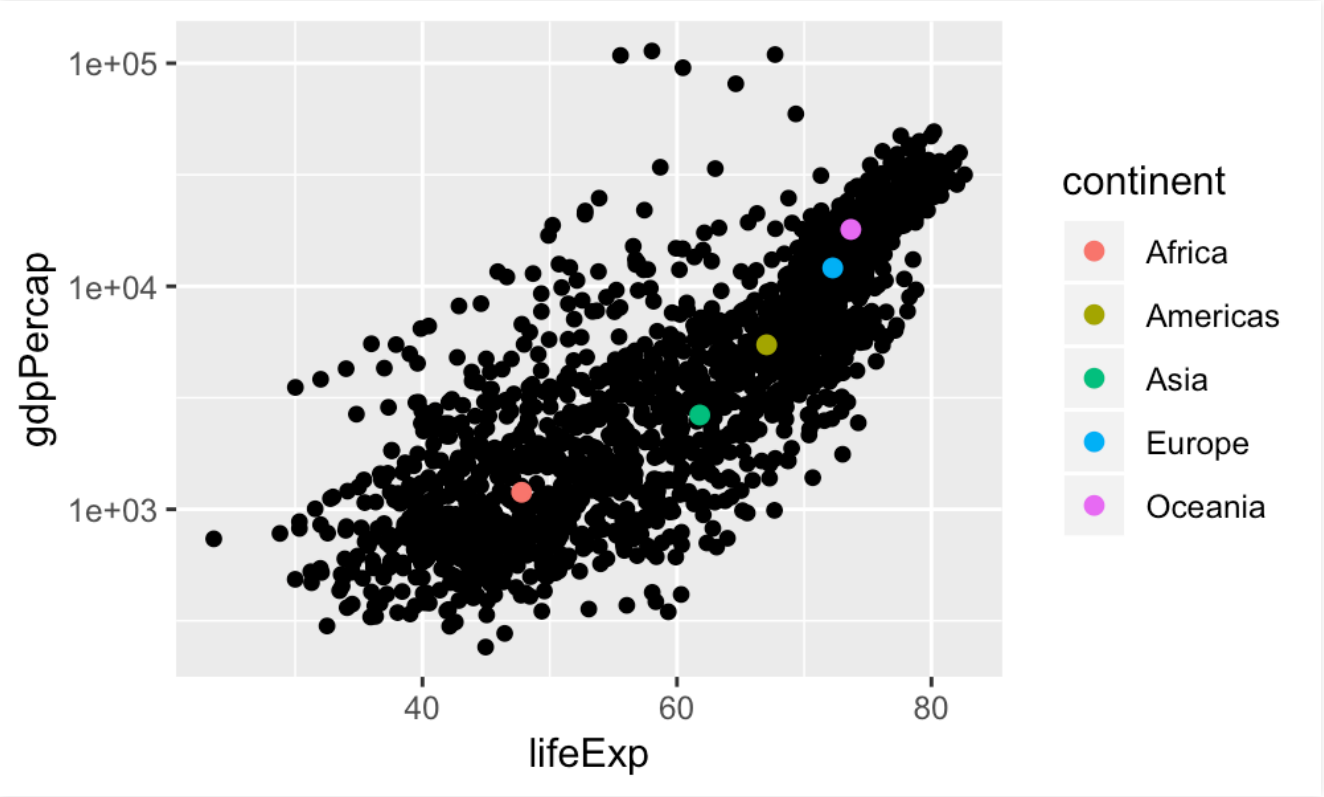
Custom Stat: example

```
gapminder %>%
  ggplot(aes(x = lifeExp, y = gdpPercap)) +
  geom_point() +
  scale_y_log10() +
  stat_middle(color = "red", size = 2)
```



Custom Stat: example

```
gapminder %>%
  ggplot(aes(x = lifeExp, y = gdpPercap)) +
  geom_point() +
  scale_y_log10() +
  stat_middle(aes(color = continent), size = 2)
```



Questions?

https://github.com/AtlantaRUsers/Meetups