

# Class 5 Data Visualization with ggplot2

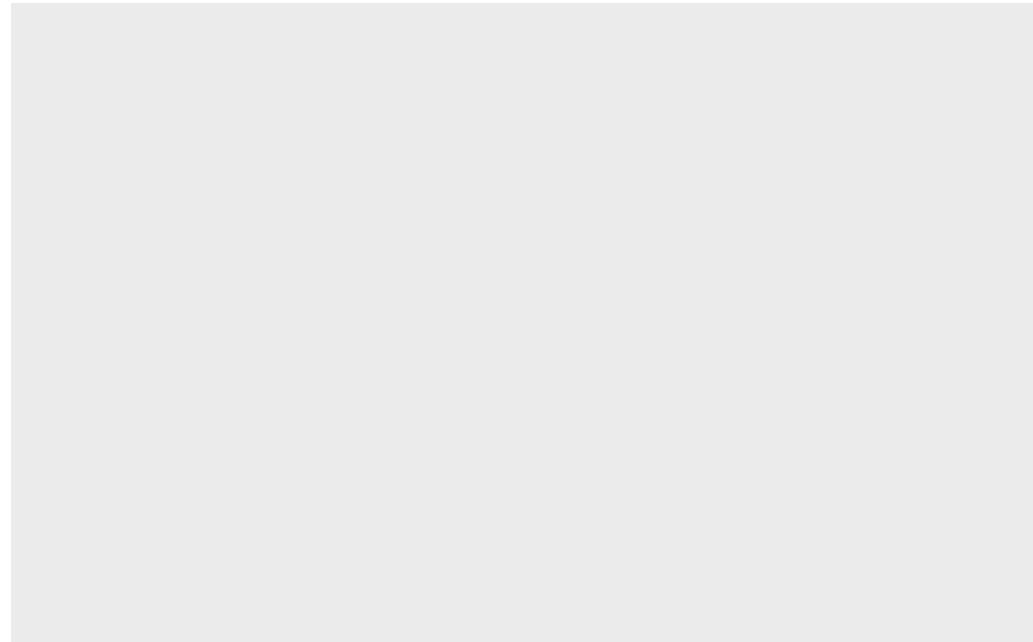
Vanessa (PID: A16666053)

## Using GGPLOT

The ggplot2 package needs to be installed as it does not come with R

We use the ‘install.packages()’ function to do this.

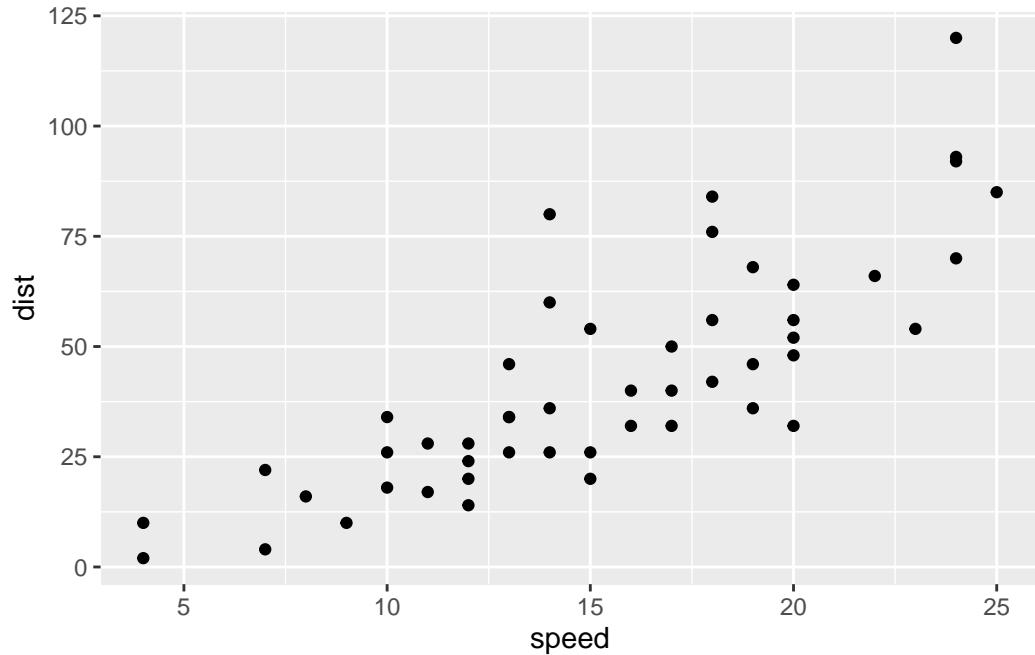
```
library(ggplot2)  
ggplot()
```



To use ggplot I need to load it up before I can call any of the functions in the package. I do this with ‘library()’ function.

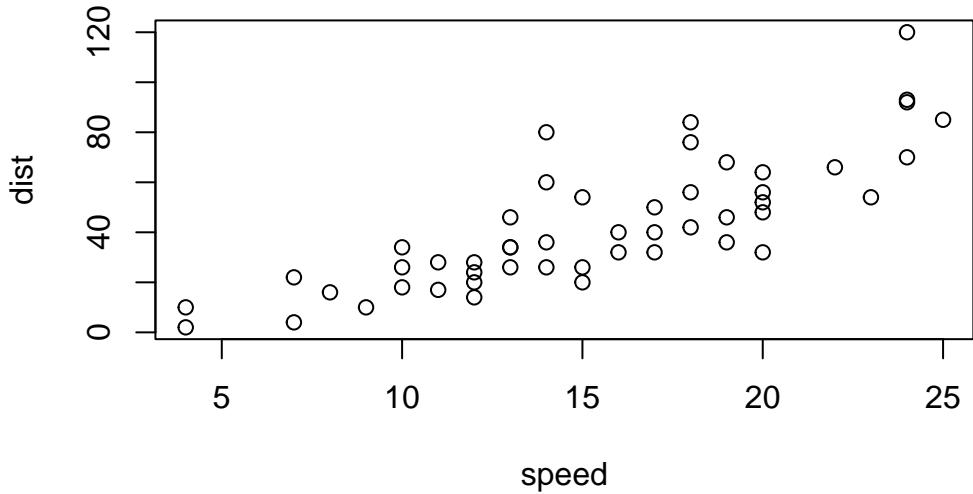
All ggplot figures have at least 3 things: - data (the stuff we want to plot) - aesthetics mapping (aes values) - geoms

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



ggplot is not the only graphing system in R there are lots of others. There is even “base R” graphics.

```
plot(cars)
```



```
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

```
nrow(genes)
```

```
[1] 5196
```

```
colnames(genes)
```

```
[1] "Gene"      "Condition1" "Condition2" "State"
```

```
  ncol(genes)

[1] 4

  table(genes$State)

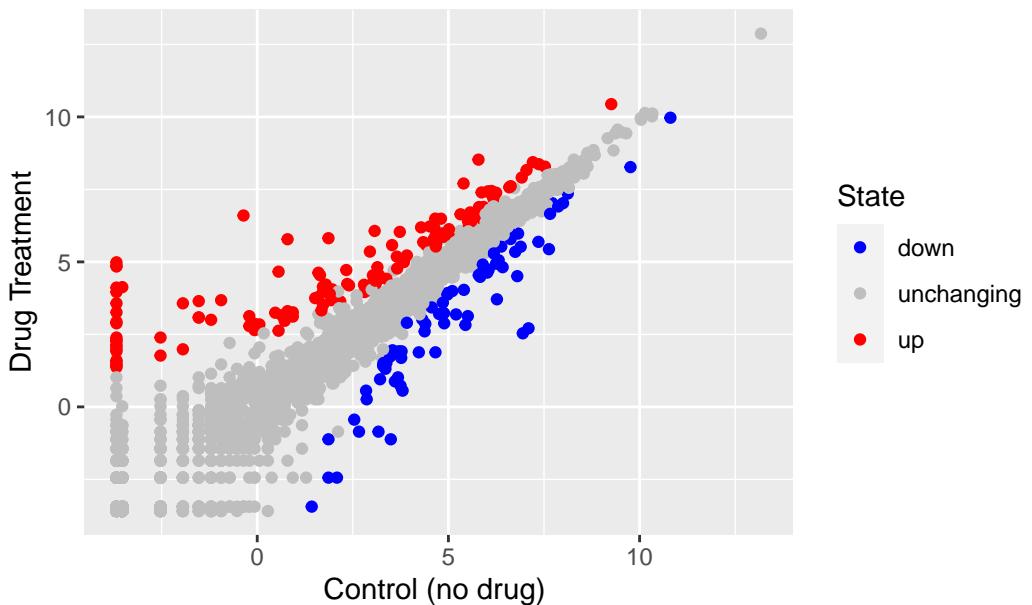
down unchanged      up
  72       4997    127

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

down unchanged      up
 1.39       96.17    2.44

p <- ggplot(genes) +
  aes(x=Condition1, y=Condition2, col=State) +
  geom_point()
p + scale_color_manual(values=c("blue","gray","red") ) +
  labs(title="Gene Expression Changes Upon Drug Treatment",
       x="Control (no drug) ",
       y="Drug Treatment")
```

## Gene Expression Changes Upon Drug Treatment



```
# File location online
url <- "https://raw.githubusercontent.com/jennybc/gapminder/master/inst/extdata/gapminder.csv"
gapminder <- read.delim(url)

library(dplyr)
```

```
Attaching package: 'dplyr'
```

```
The following objects are masked from 'package:stats':
```

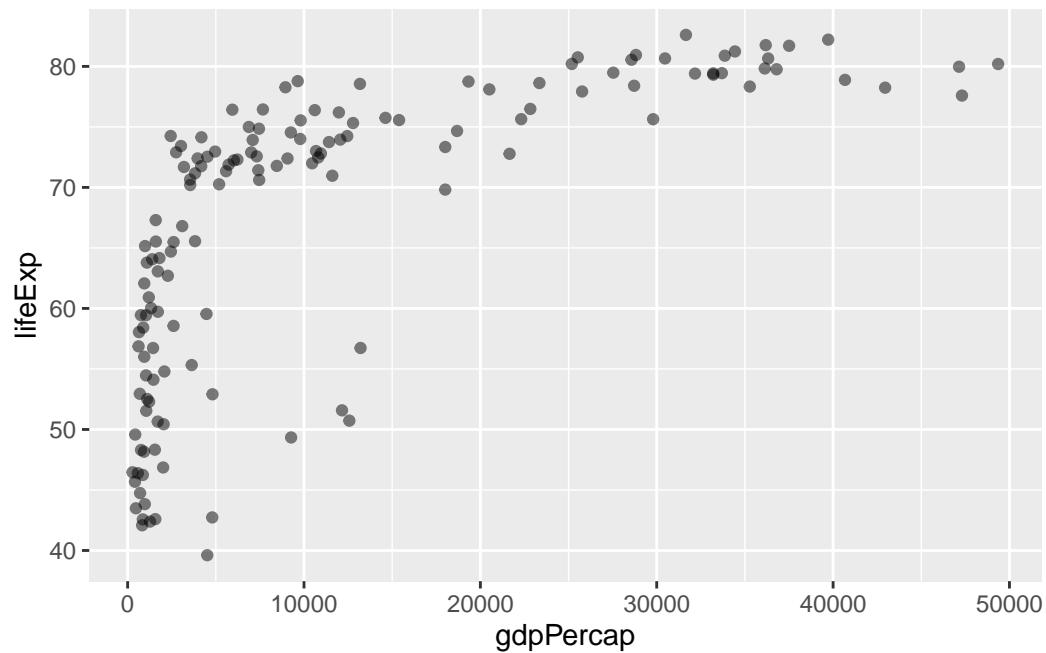
```
filter, lag
```

```
The following objects are masked from 'package:base':
```

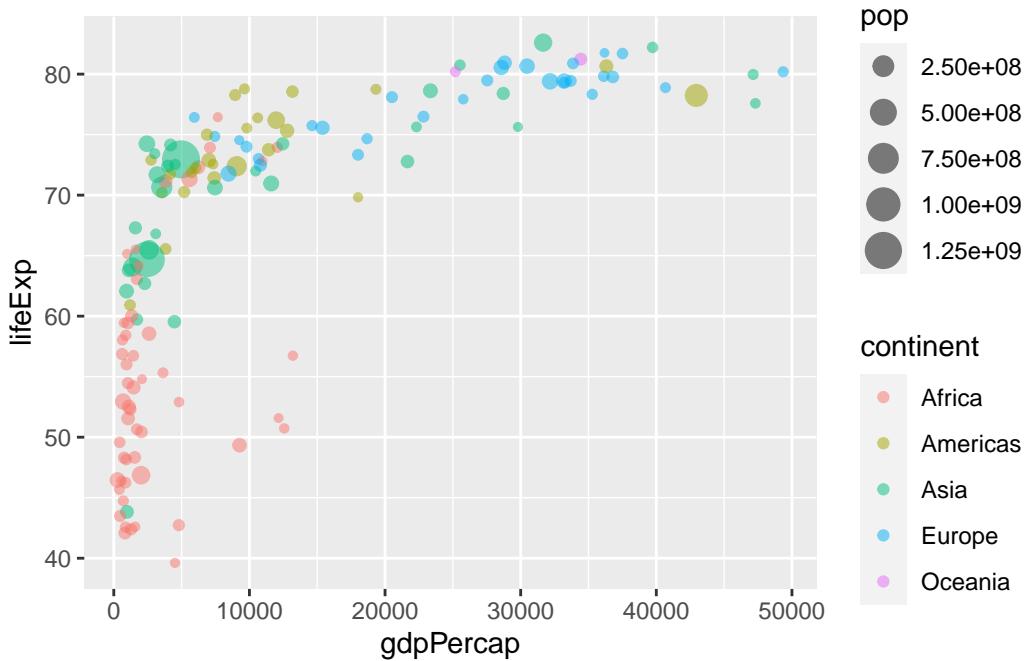
```
intersect, setdiff, setequal, union
```

```
gapminder_2007 <- gapminder %>% filter(year==2007)

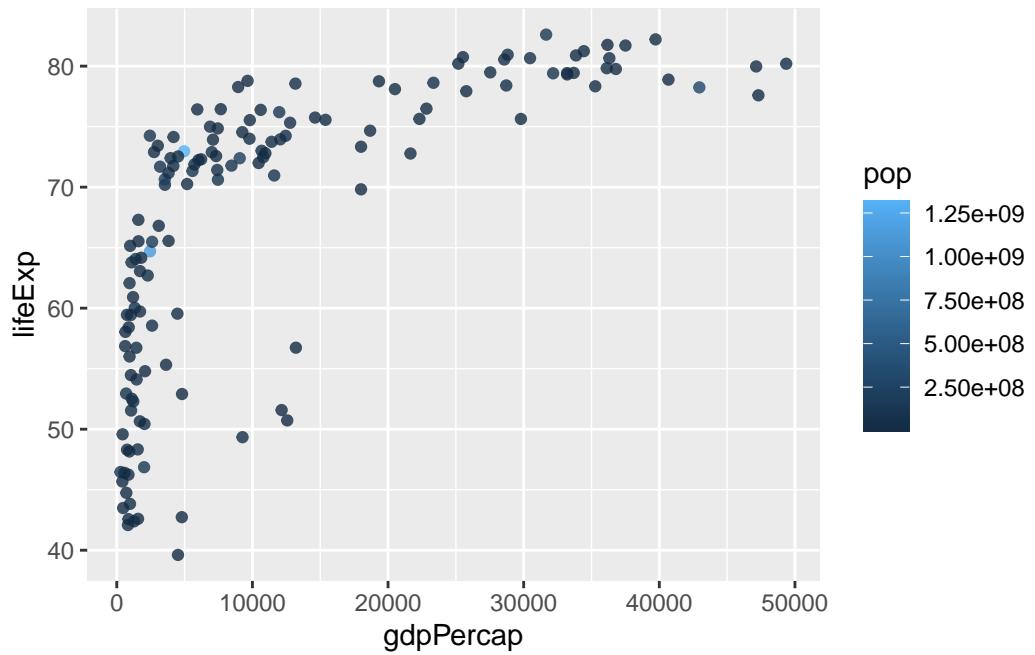
ggplot(gapminder_2007) +
  aes(x=gdpPercap, y=lifeExp) +
  geom_point(alpha=0.5)
```



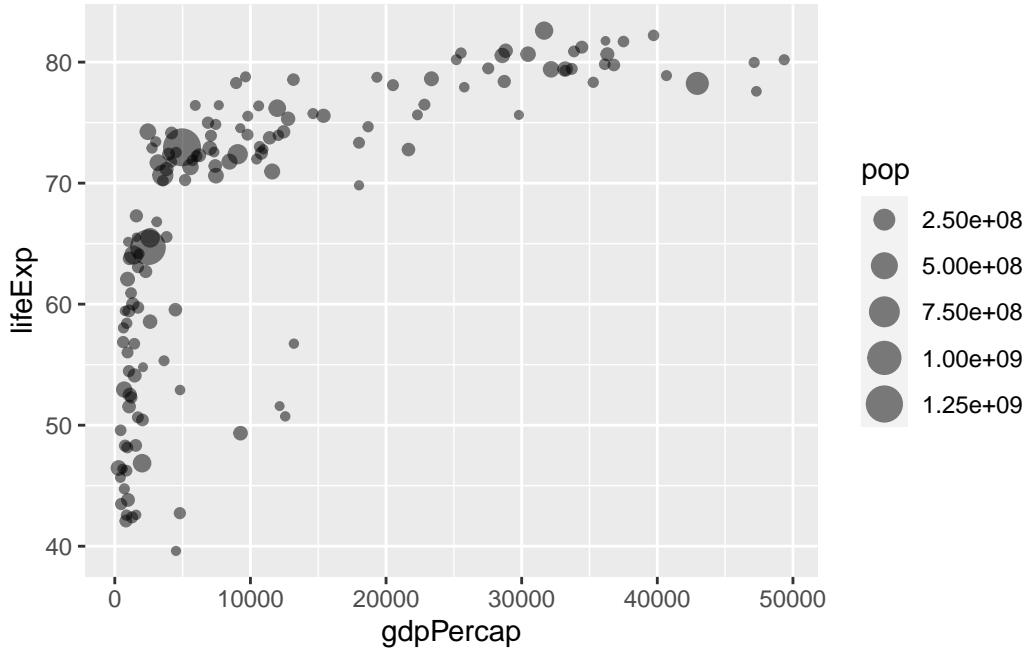
```
ggplot(gapminder_2007) +
  aes(x=gdpPercap, y=lifeExp, color=continent, size=pop) +
  geom_point(alpha=0.5)
```



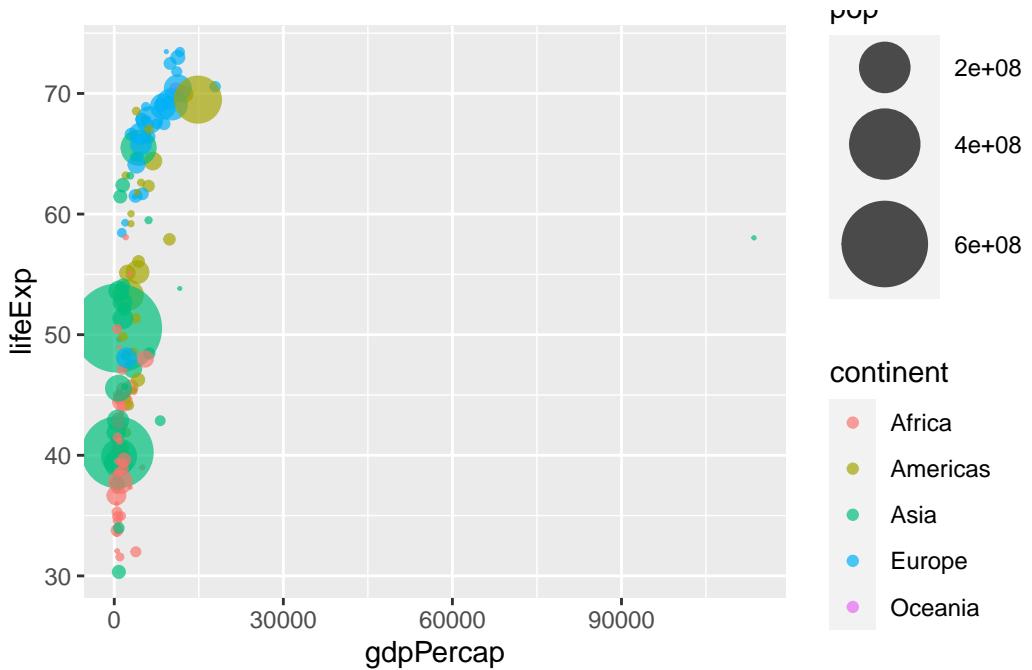
```
ggplot(gapminder_2007) +  
  aes(x = gdpPercap, y = lifeExp, color = pop) +  
  geom_point(alpha=0.8)
```



```
ggplot(gapminder_2007) +  
  aes(x = gdpPercap, y = lifeExp, size = pop) +  
  geom_point(alpha=0.5)
```

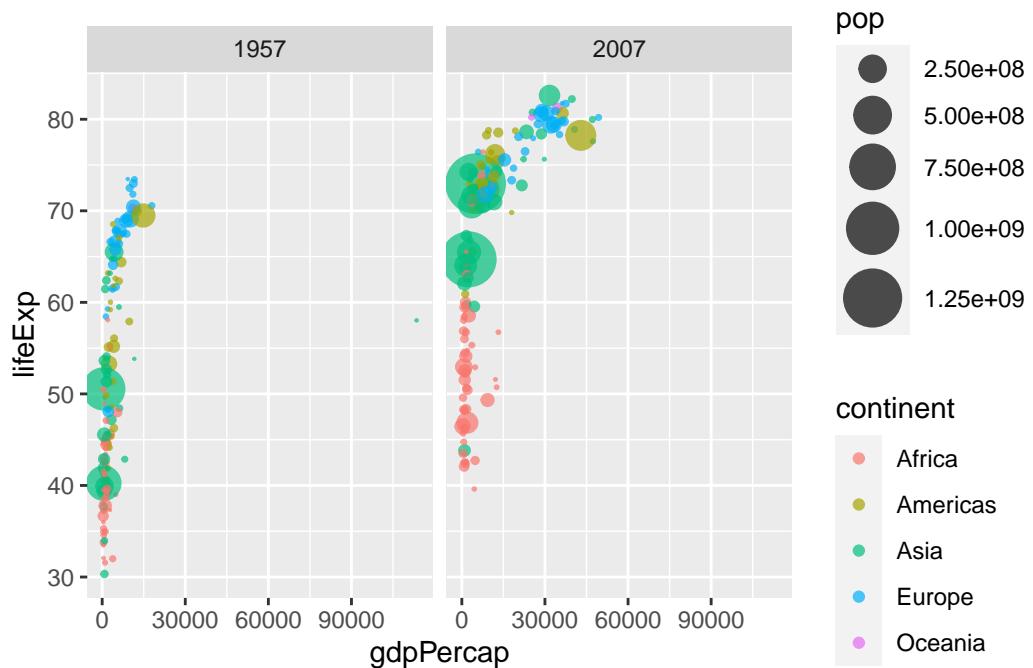


```
gapminder_1957 <- gapminder %>% filter(year==1957)
ggplot(gapminder_1957) +
  aes(x = gdpPercap, y = lifeExp, color=continent, size = pop) +
  geom_point(alpha=0.7) +
  scale_size_area(max_size=15)
```



```
gapminder_1957 <- gapminder %>% filter(year==1957 | year==2007)

ggplot(gapminder_1957) +
  geom_point(aes(x = gdpPercap, y = lifeExp, color=continent,
                 size = pop), alpha=0.7) +
  scale_size_area(max_size = 10) +
  facet_wrap(~year)
```

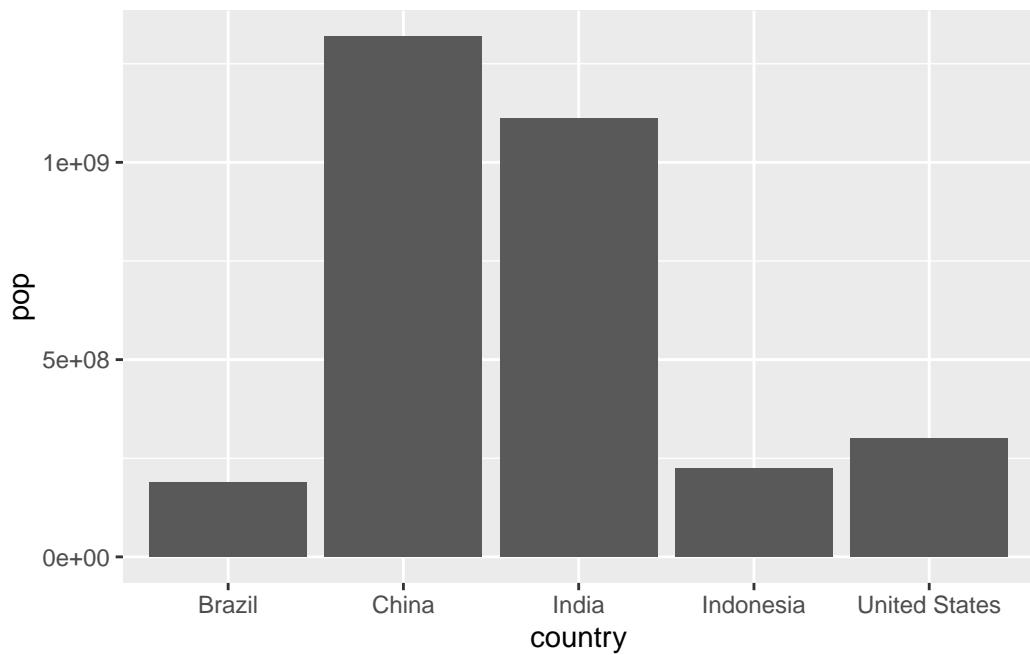


```
gapminder_top5 <- gapminder %>%
  filter(year==2007) %>%
  arrange(desc(pop)) %>%
  top_n(5, pop)
```

```
gapminder_top5
```

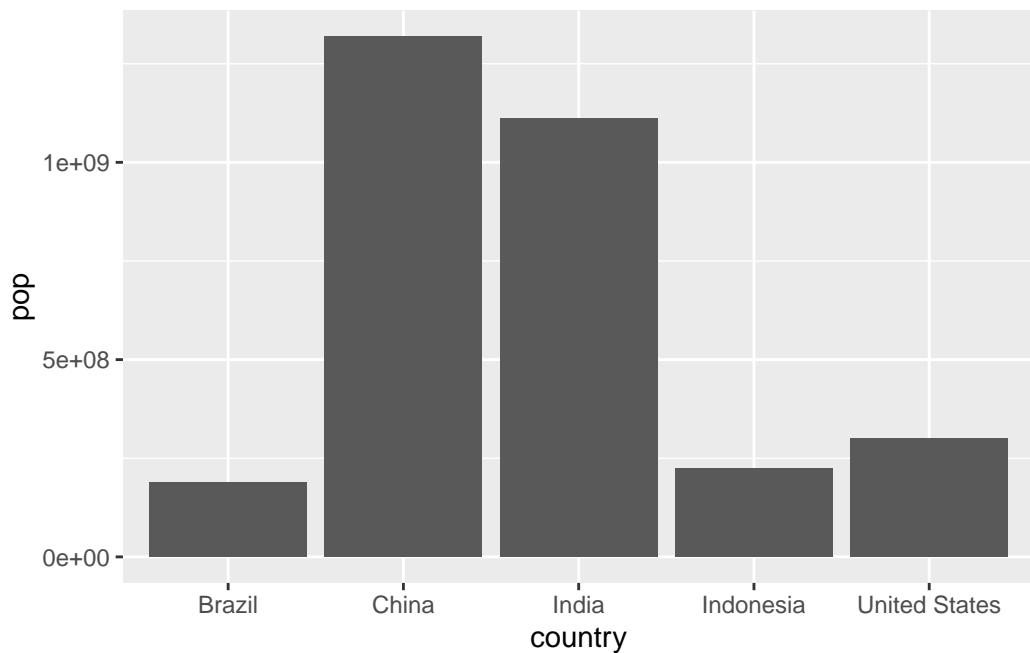
	country	continent	year	lifeExp	pop	gdpPercap
1	China	Asia	2007	72.961	1318683096	4959.115
2	India	Asia	2007	64.698	1110396331	2452.210
3	United States	Americas	2007	78.242	301139947	42951.653
4	Indonesia	Asia	2007	70.650	223547000	3540.652
5	Brazil	Americas	2007	72.390	190010647	9065.801

```
ggplot(gapminder_top5) +
  geom_col(aes(x = country, y = pop))
```

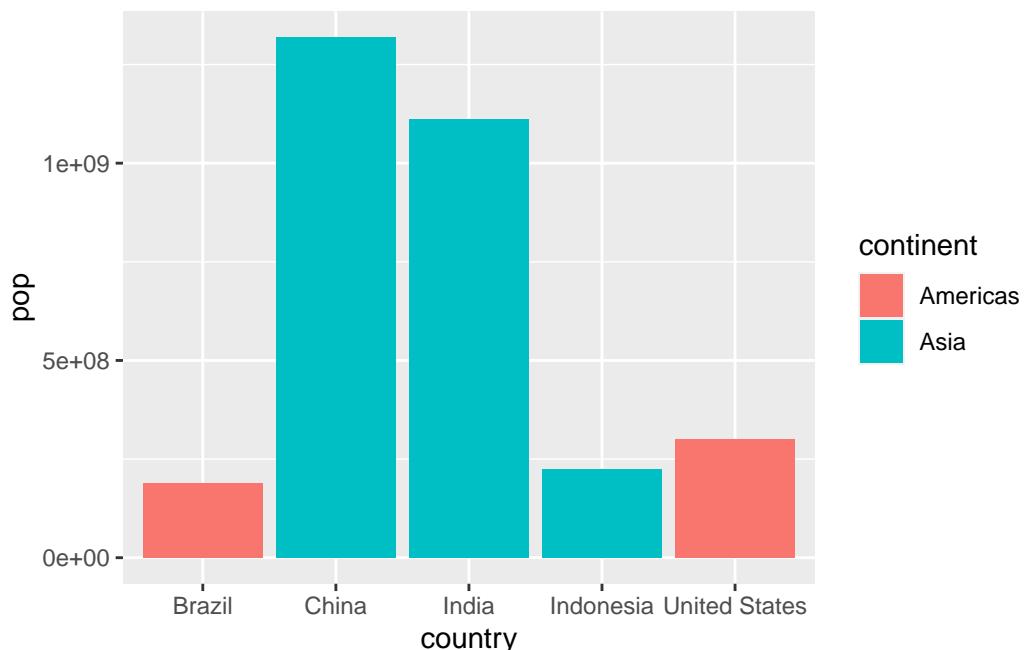


```
gapminder_2007 <- gapminder %>% filter(year==2007)

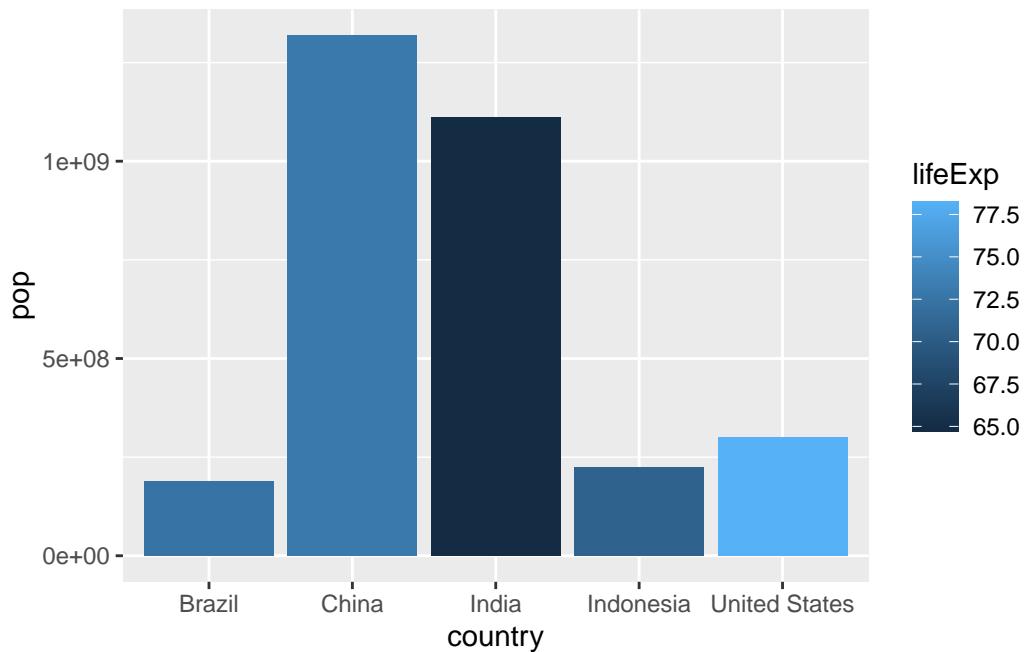
ggplot(gapminder_top5) +
  geom_col(aes(x = country, y = pop))
```



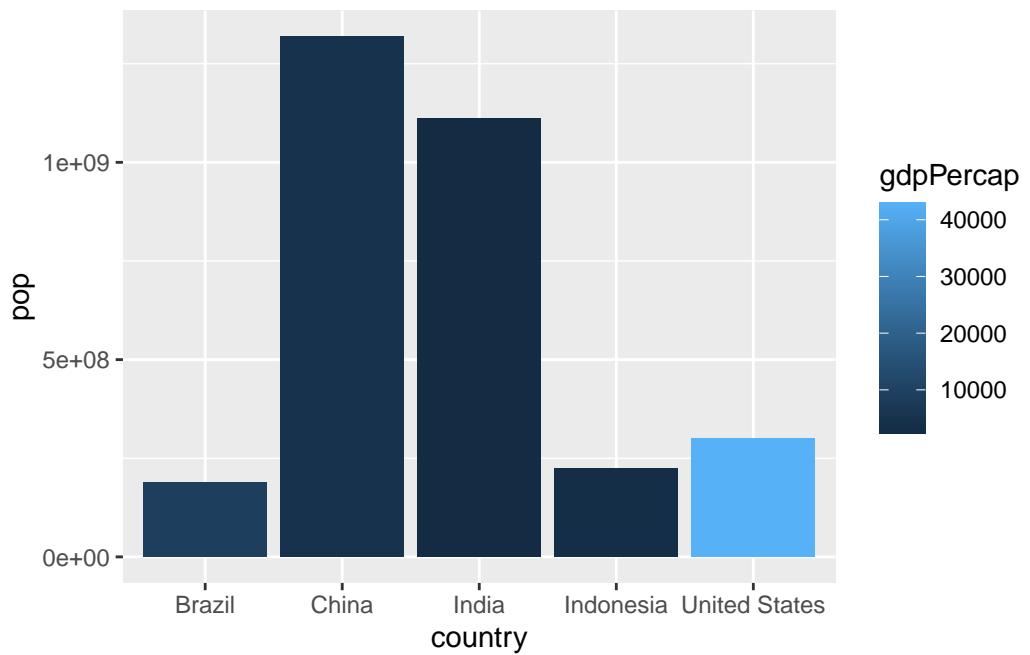
```
ggplot(gapminder_top5) +  
  geom_col(aes(x = country, y = pop, fill = continent))
```



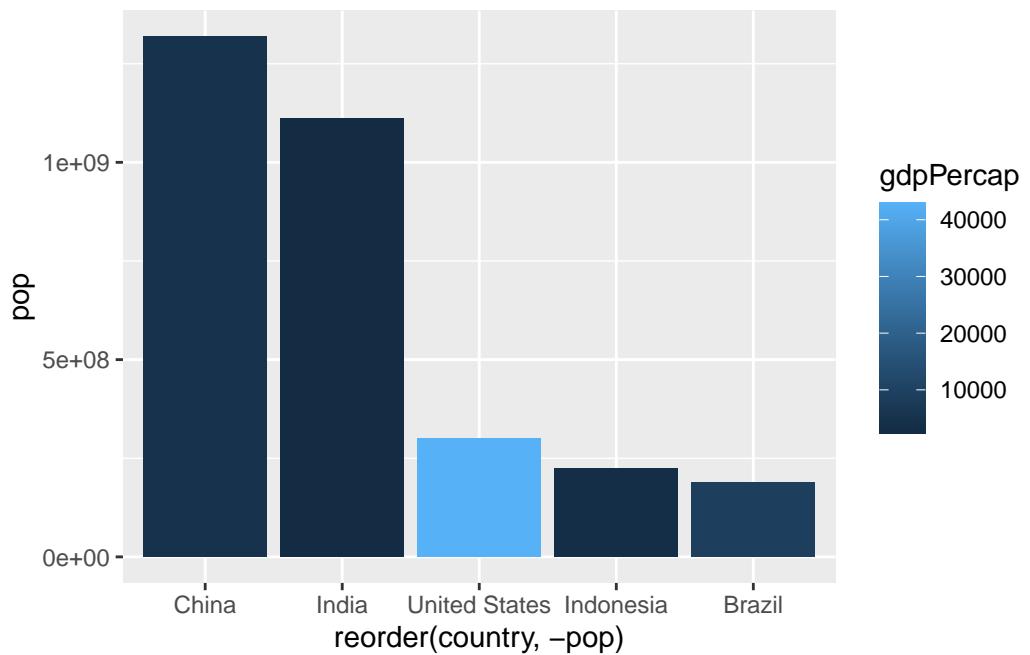
```
ggplot(gapminder_top5) +  
  geom_col(aes(x = country, y = pop, fill = lifeExp))
```



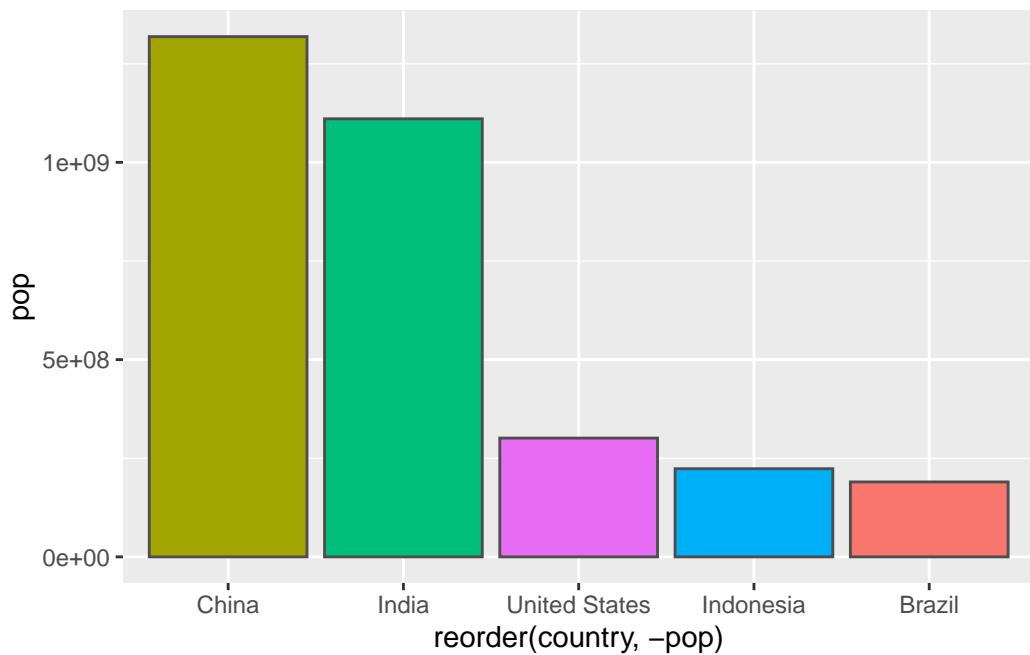
```
ggplot(gapminder_top5) +  
  aes(x=country, y=pop, fill=gdpPerCap) +  
  geom_col()
```



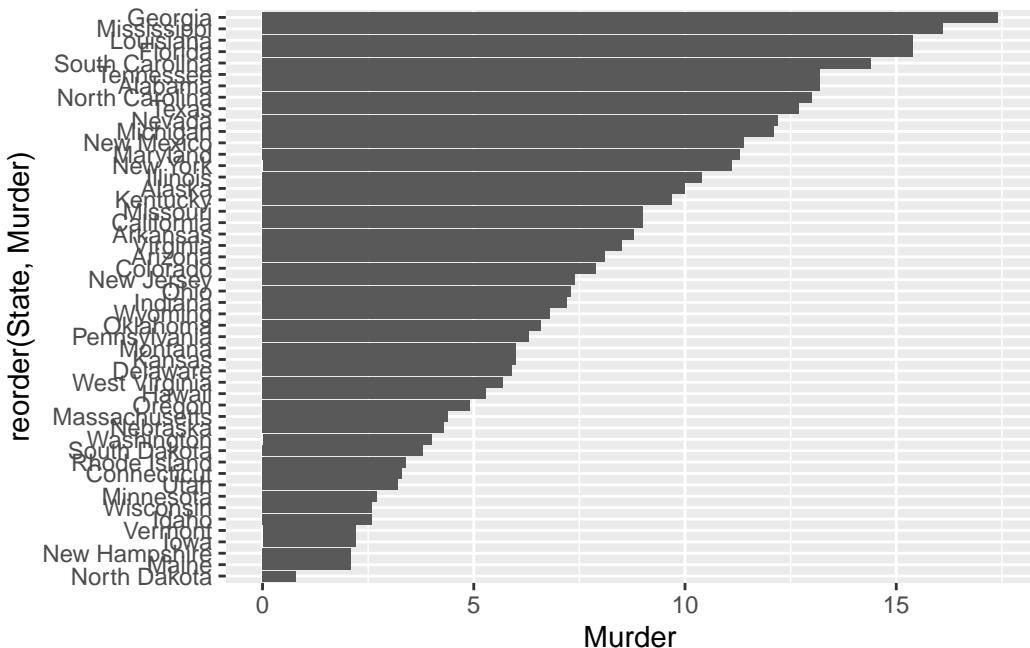
```
ggplot(gapminder_top5) +  
  aes(x=reorder(country, -pop), y=pop, fill=gdpPerCap) +  
  geom_col()
```



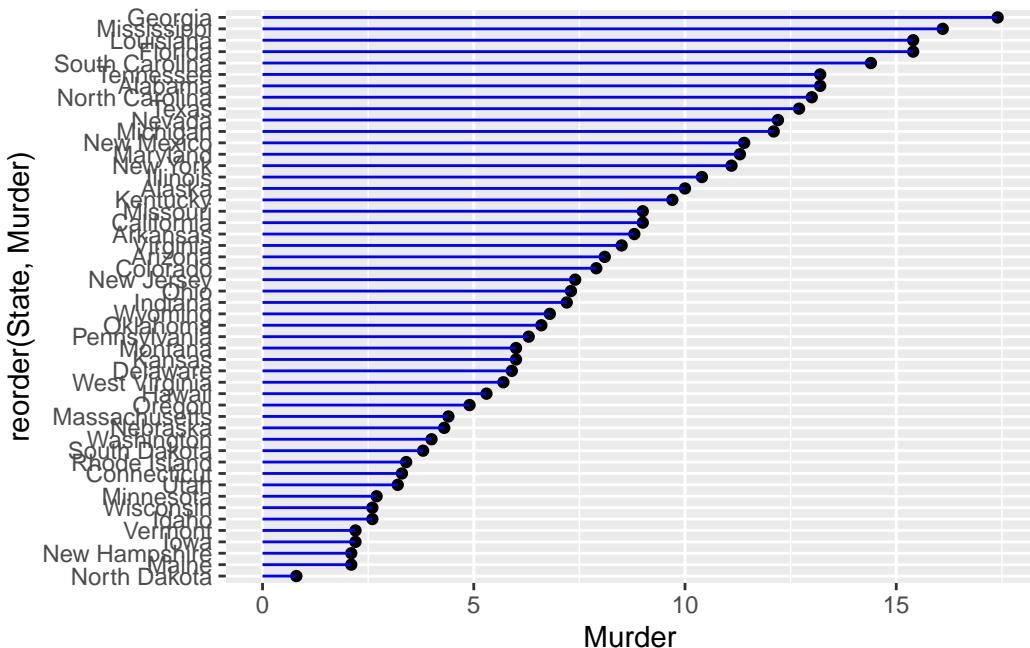
```
ggplot(gapminder_top5) +  
  aes(x=reorder(country, -pop), y=pop, fill=country) +  
  geom_col(col="gray30") +  
  guides(fill="none")
```



```
USArrests$State <- rownames(USArrests)
ggplot(USArrests) +
  aes(x=reorder(State,Murder), y=Murder) +
  geom_col() +
  coord_flip()
```



```
ggplot(USArrests) +
  aes(x=reorder(State,Murder), y=Murder) +
  geom_point() +
  geom_segment(aes(x=State,
                   xend=State,
                   y=0,
                   yend=Murder), color="blue") +
  coord_flip()
```



```
library(gapminder)
```

```
Attaching package: 'gapminder'
```

```
The following object is masked _by_ '.GlobalEnv':
```

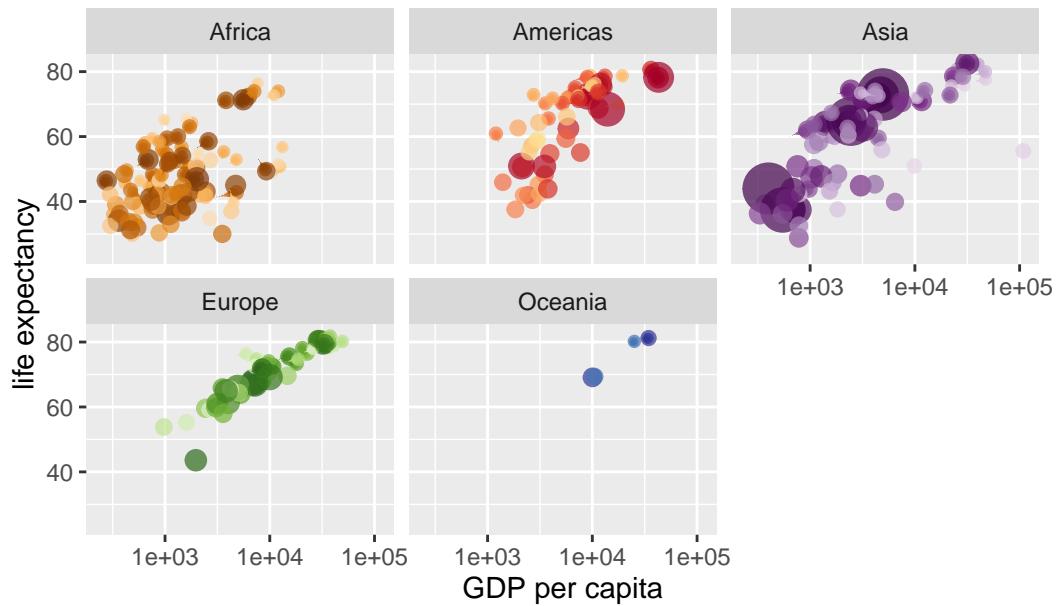
```
gapminder
```

```
library(gganimate)
```

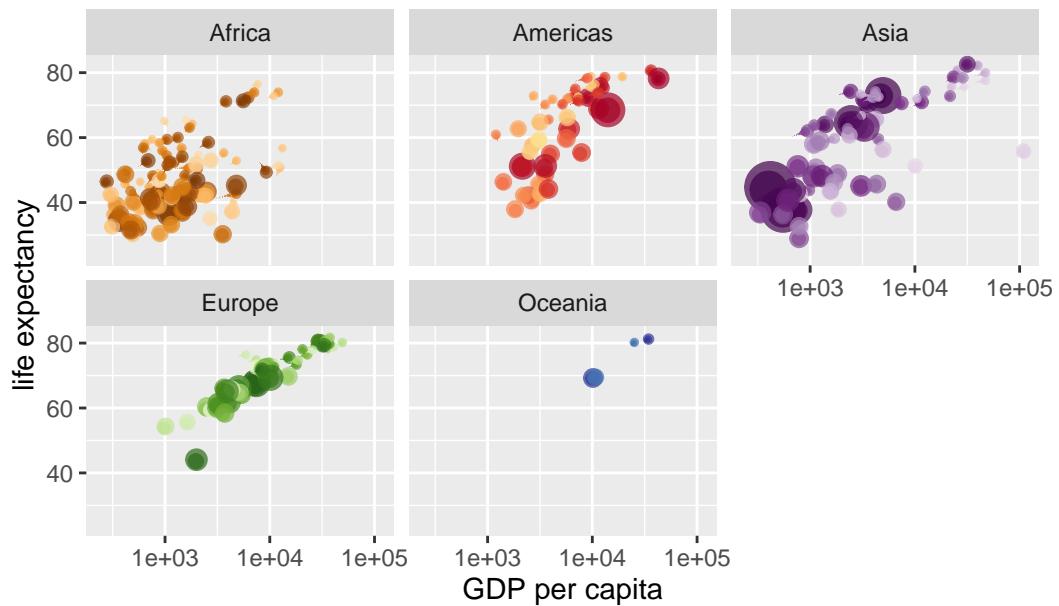
```
ggplot(gapminder, aes(gdpPercap, lifeExp, size = pop, colour = country)) +
  geom_point(alpha = 0.7, show.legend = FALSE) +
  scale_colour_manual(values = country_colors) +
  scale_size(range = c(2, 12)) +
  scale_x_log10() +
  # Facet by continent
  facet_wrap(~continent) +
  # Here comes the gganimate specific bits
  labs(title = 'Year: {frame_time}', x = 'GDP per capita', y = 'life expectancy') +
```

```
transition_time(year) +  
shadow_wake(wake_length = 0.1, alpha = FALSE)
```

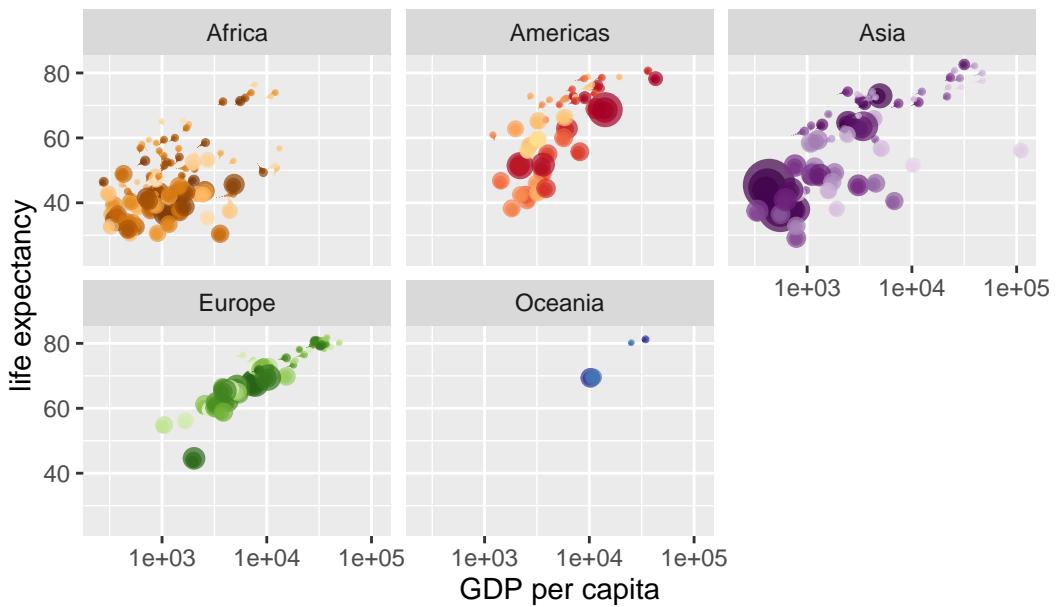
Year: 1952



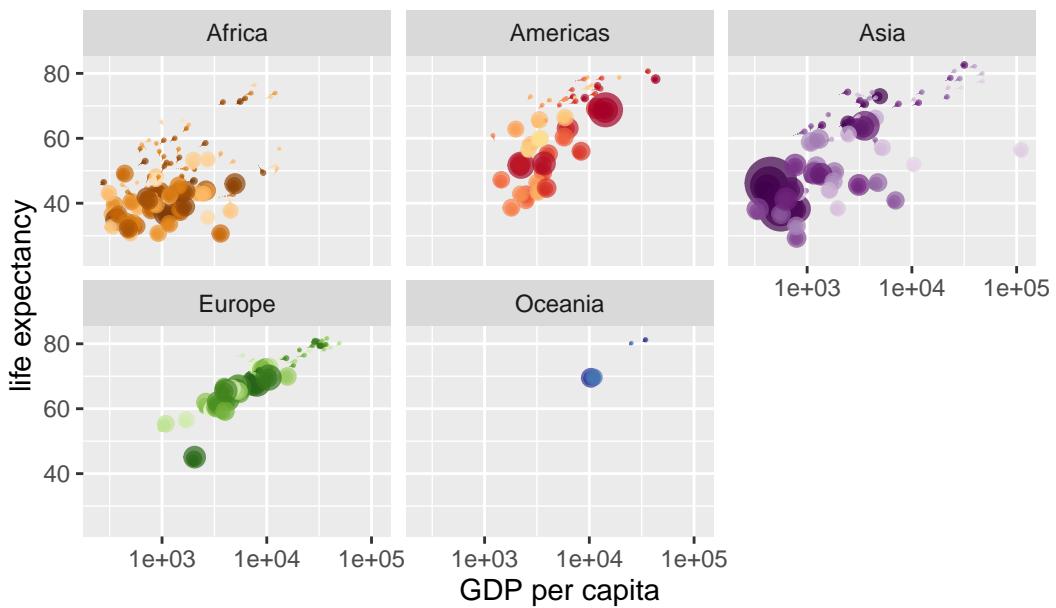
Year: 1953



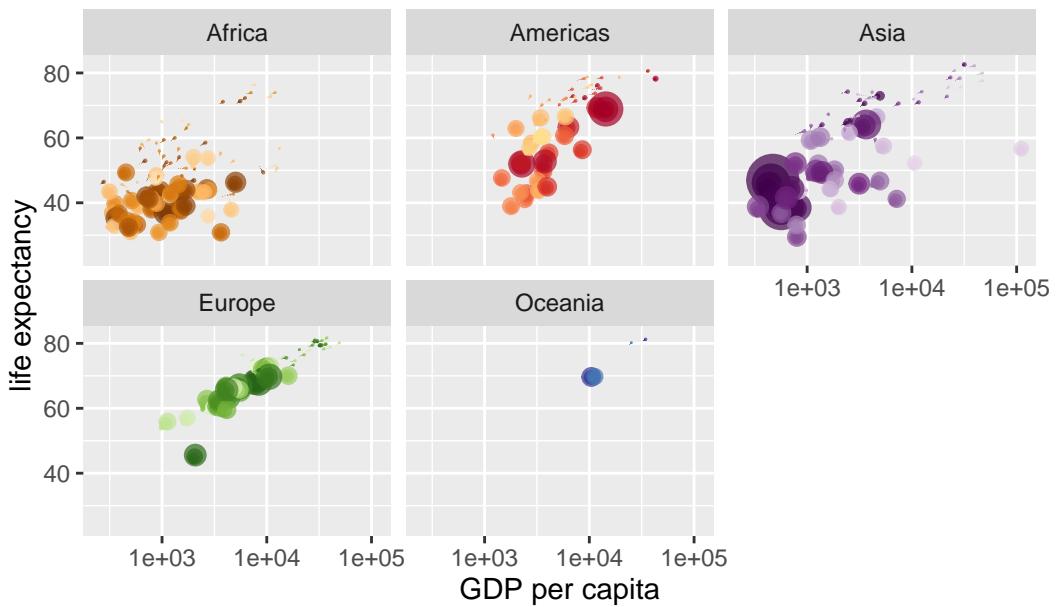
Year: 1953



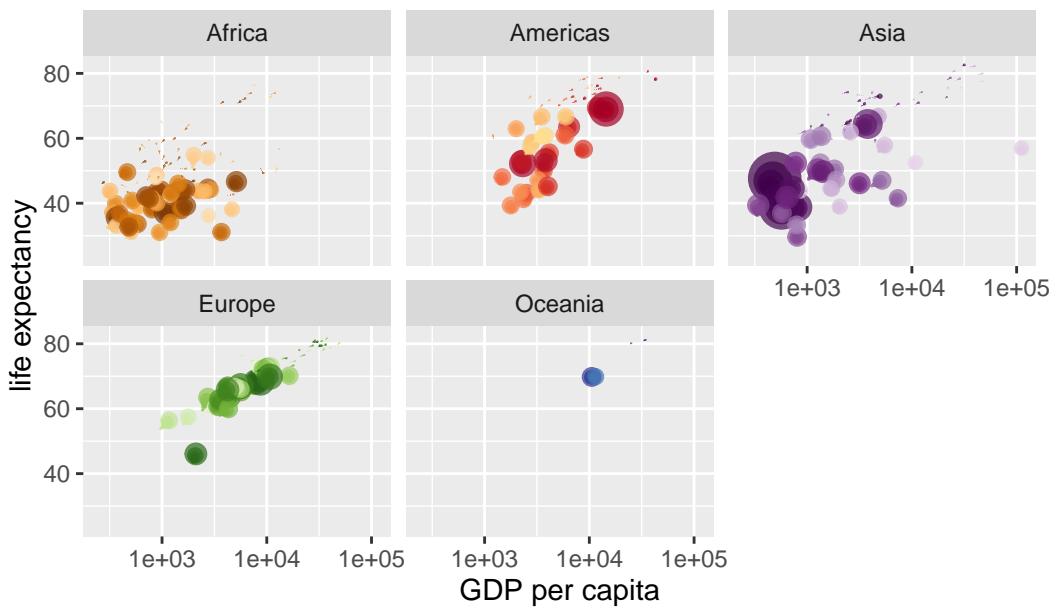
Year: 1954



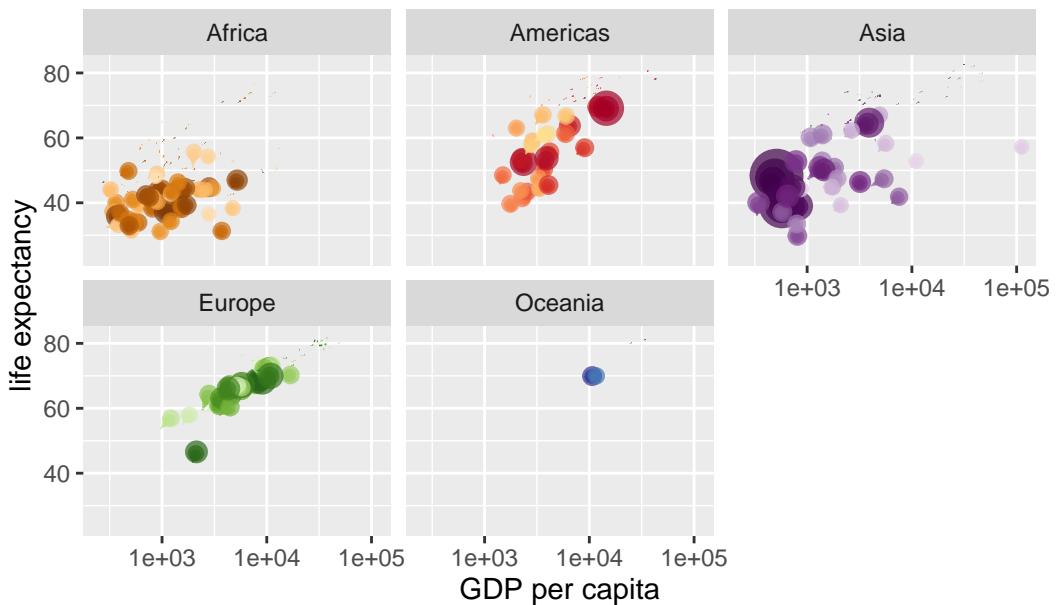
Year: 1954



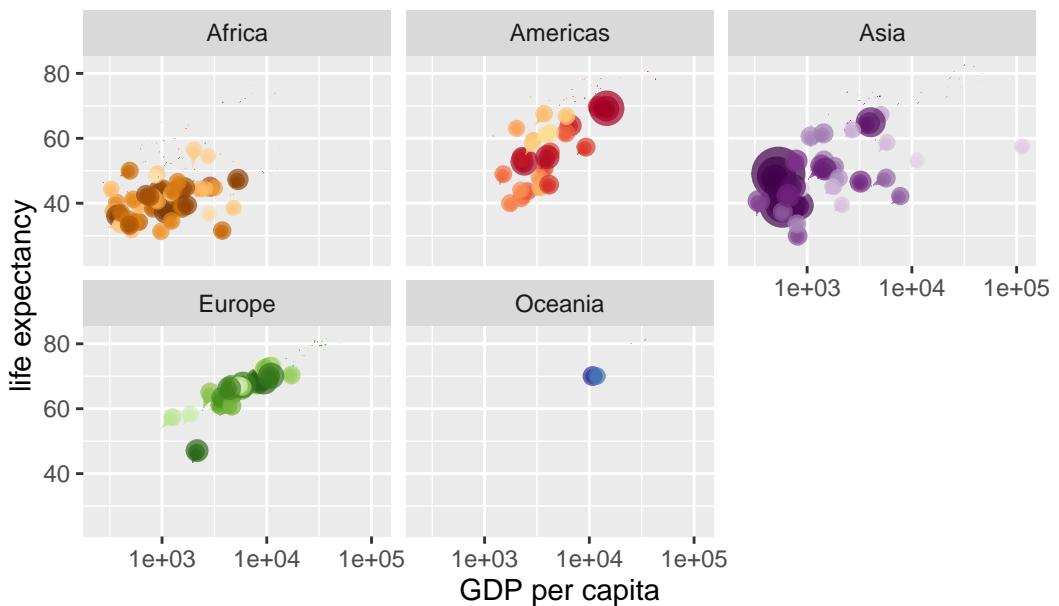
Year: 1955



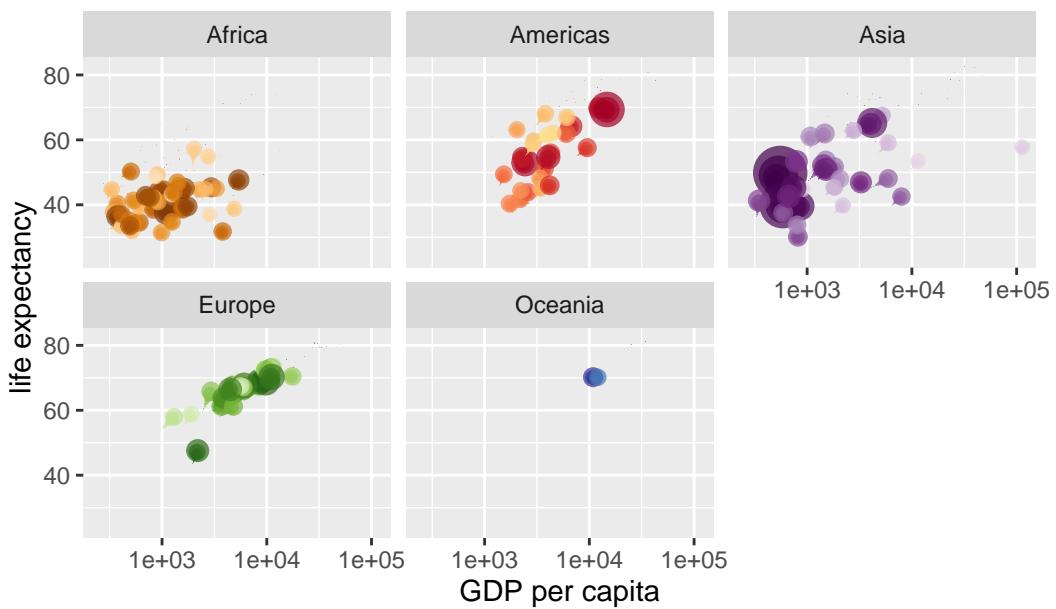
Year: 1955



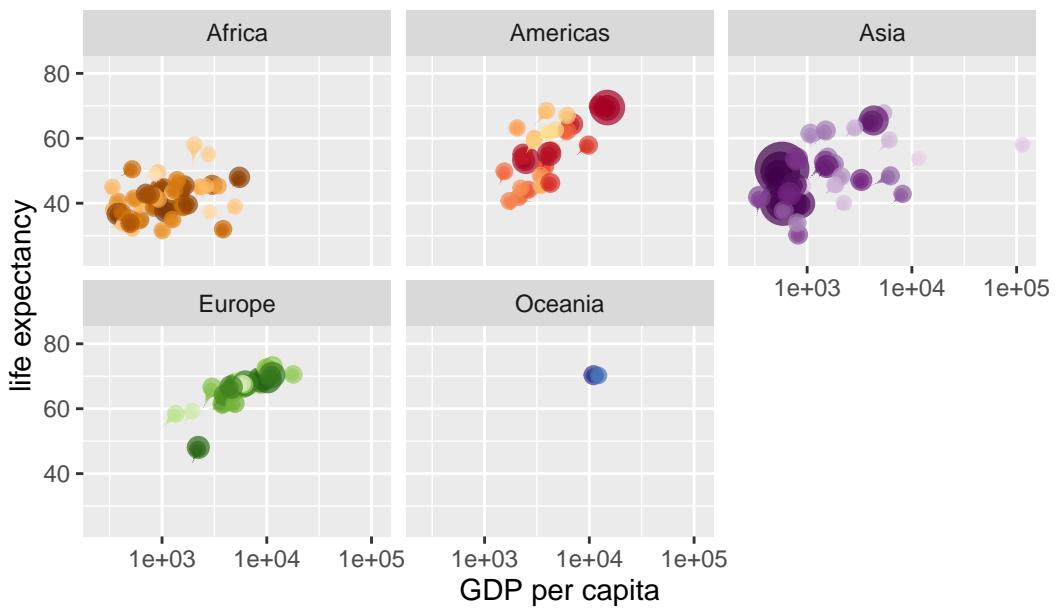
Year: 1956



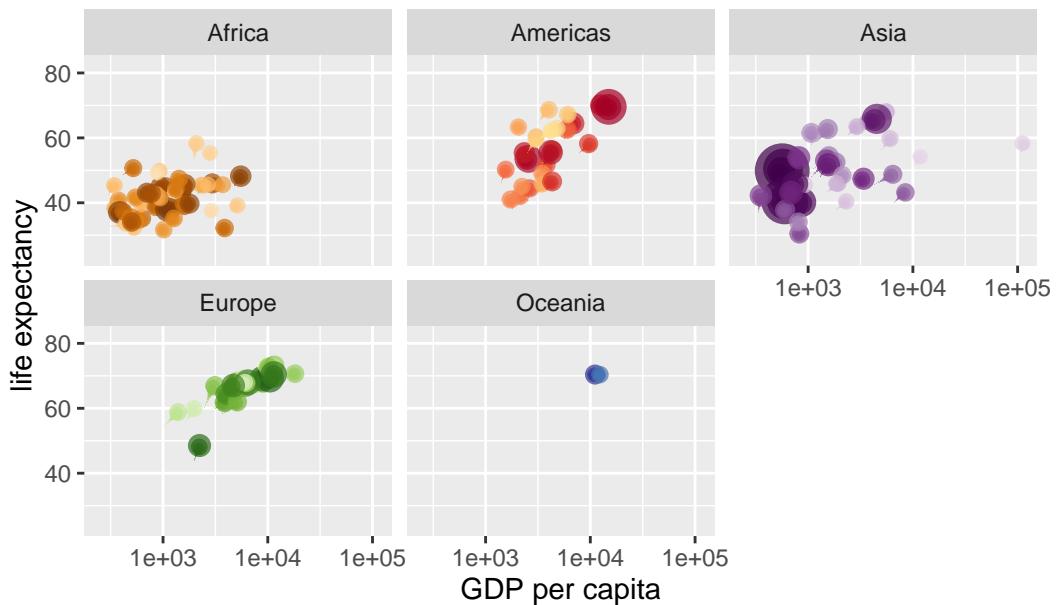
Year: 1956



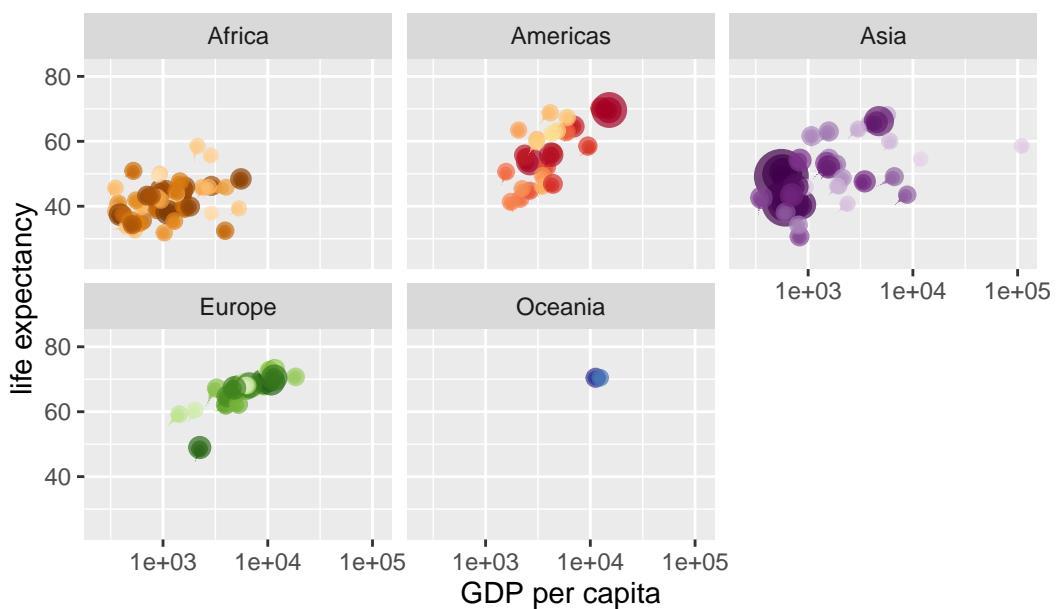
Year: 1957



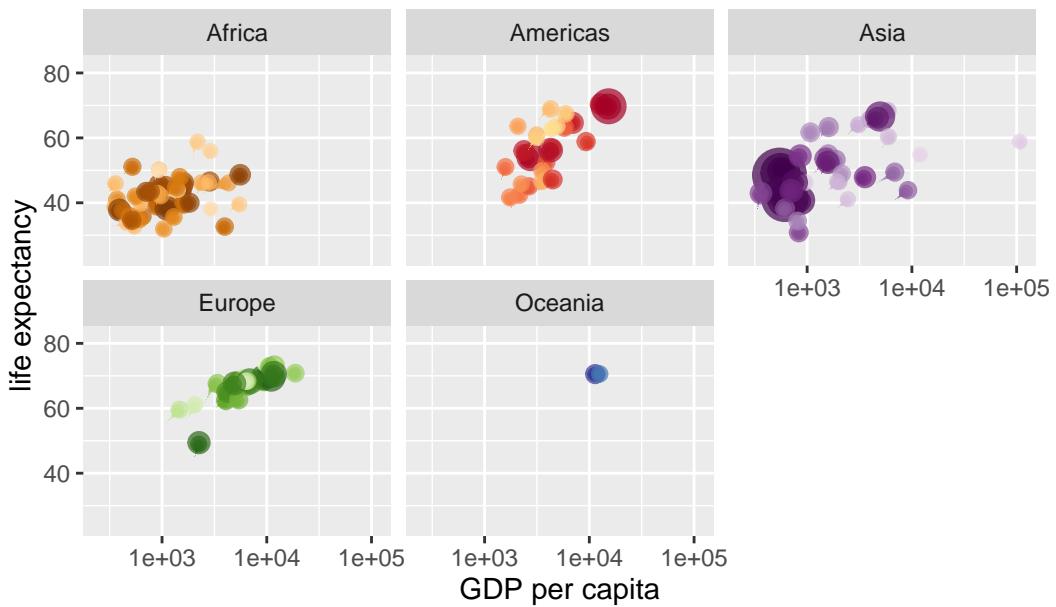
Year: 1958



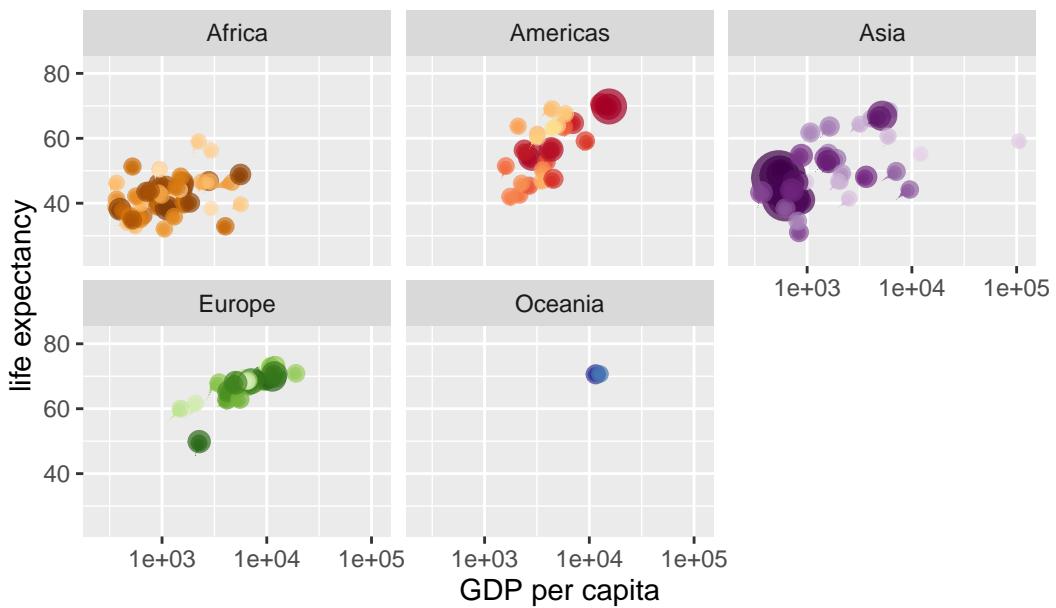
Year: 1958



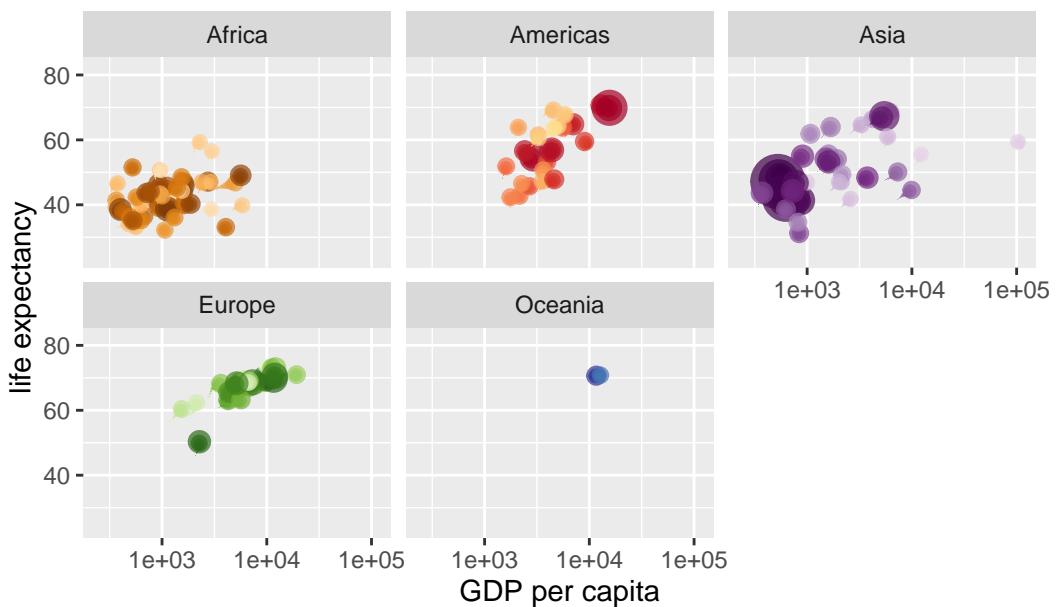
Year: 1959



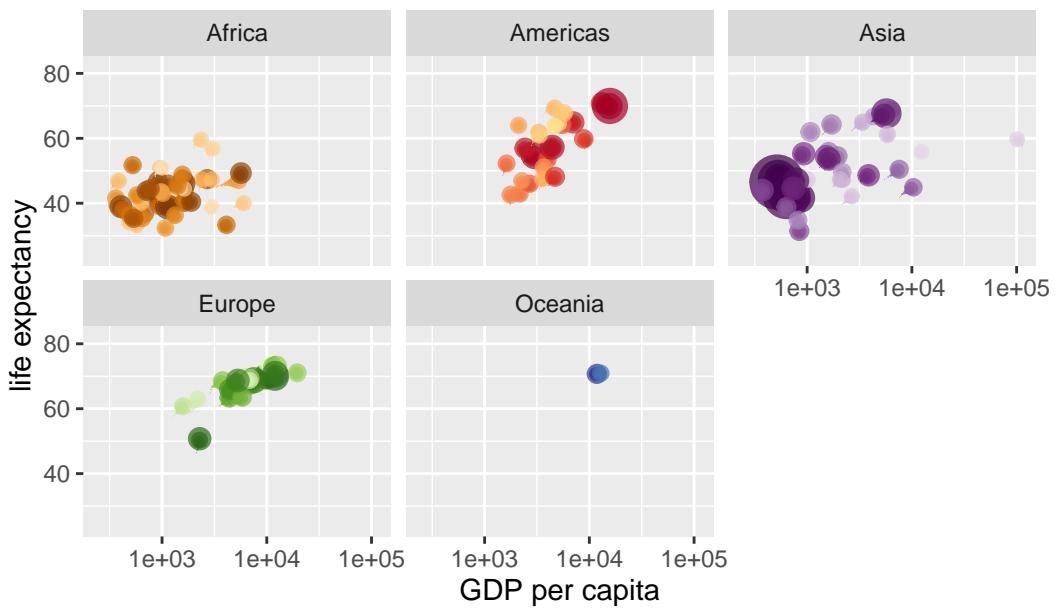
Year: 1959



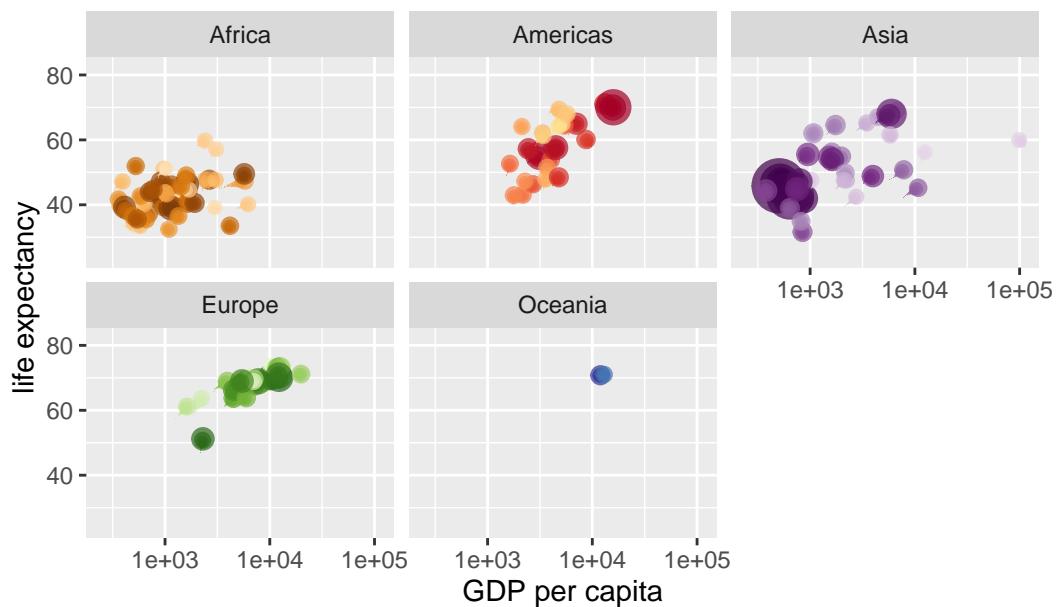
Year: 1960



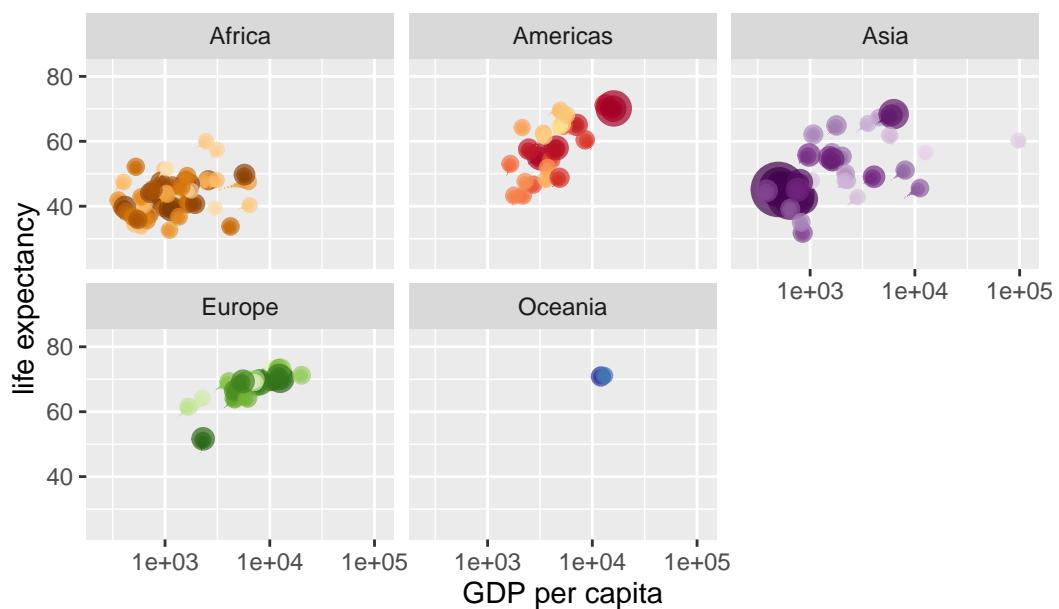
Year: 1960



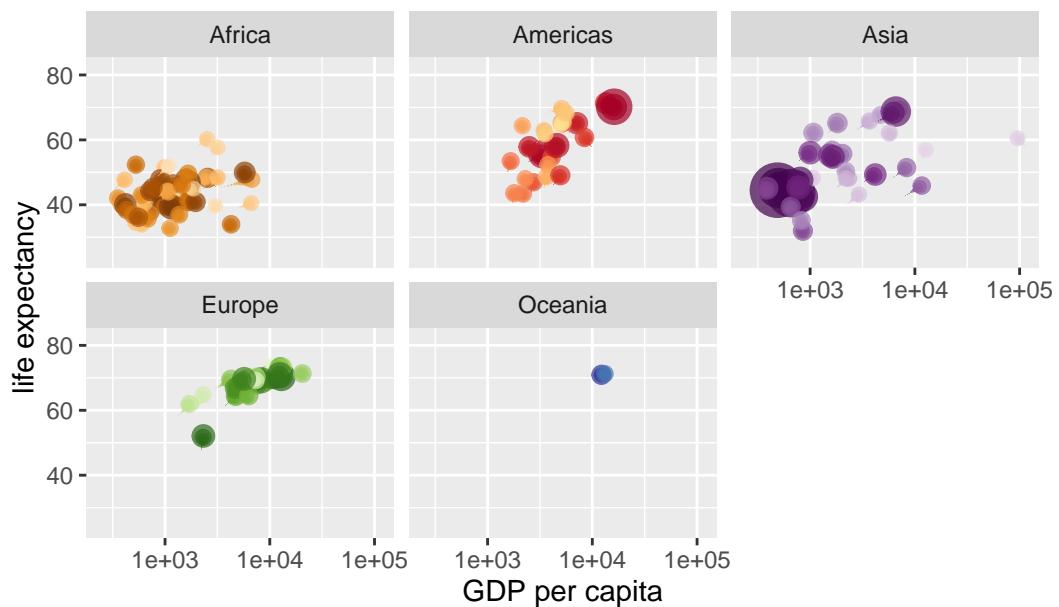
Year: 1961



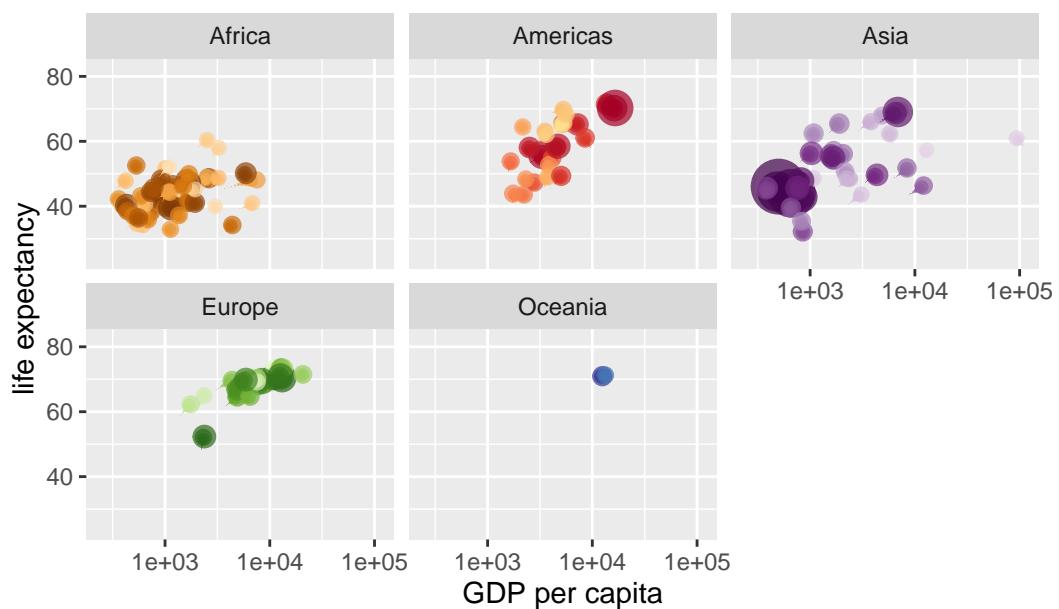
Year: 1961



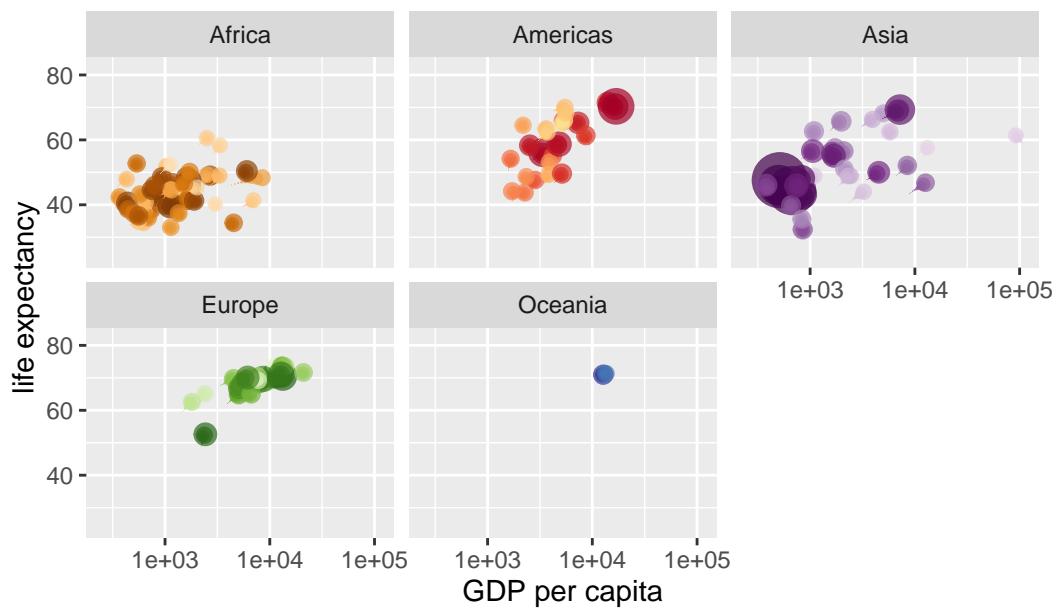
Year: 1962



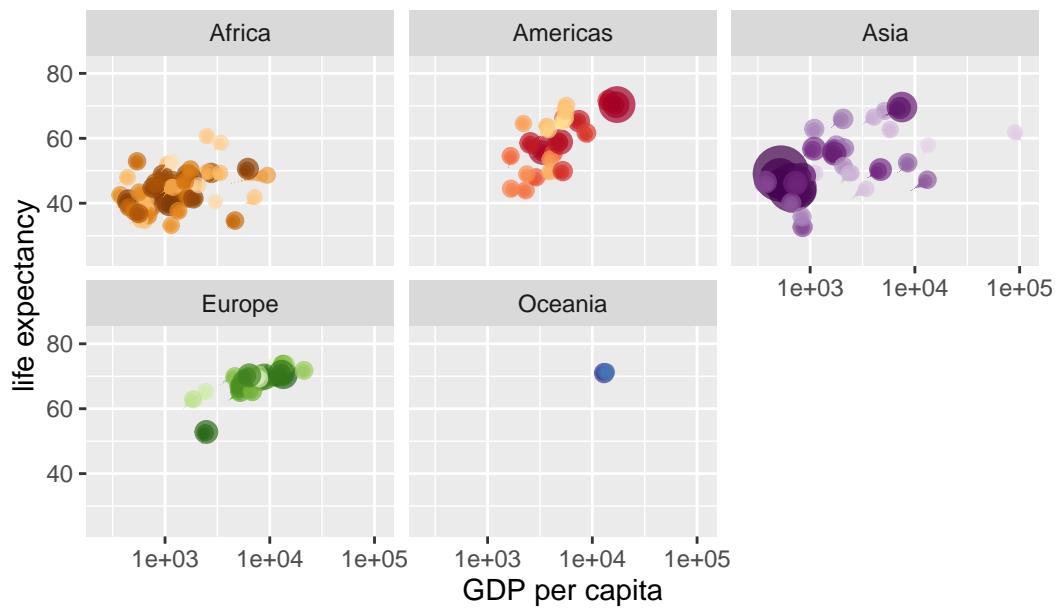
Year: 1963



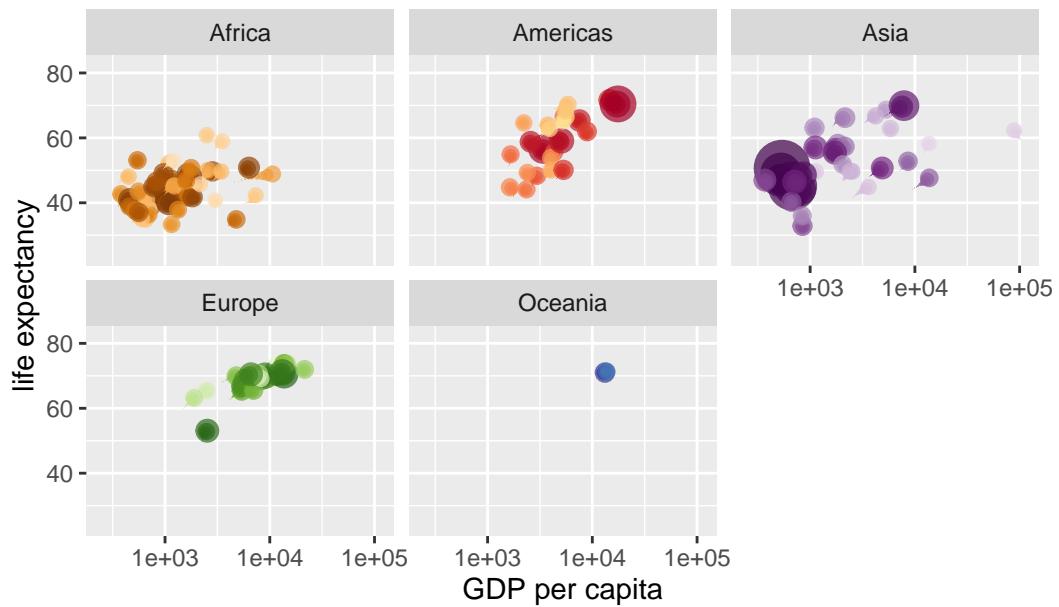
Year: 1963



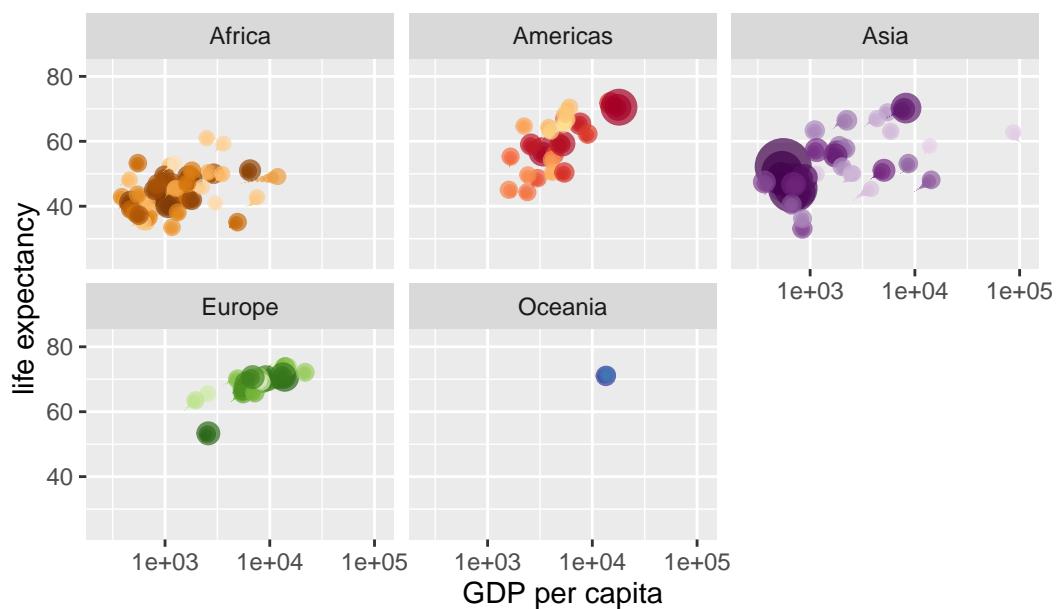
Year: 1964



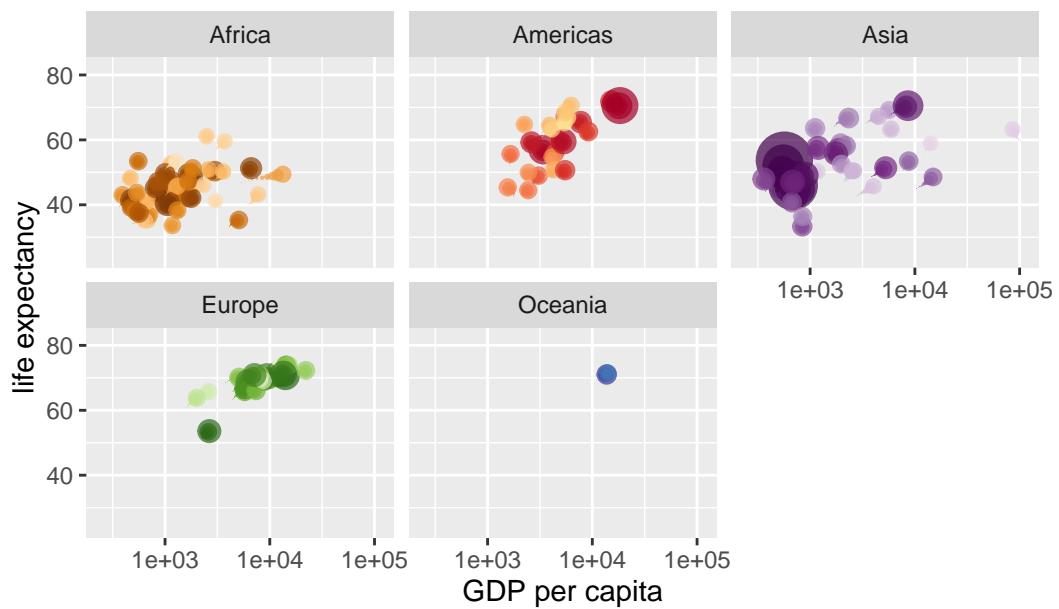
Year: 1964



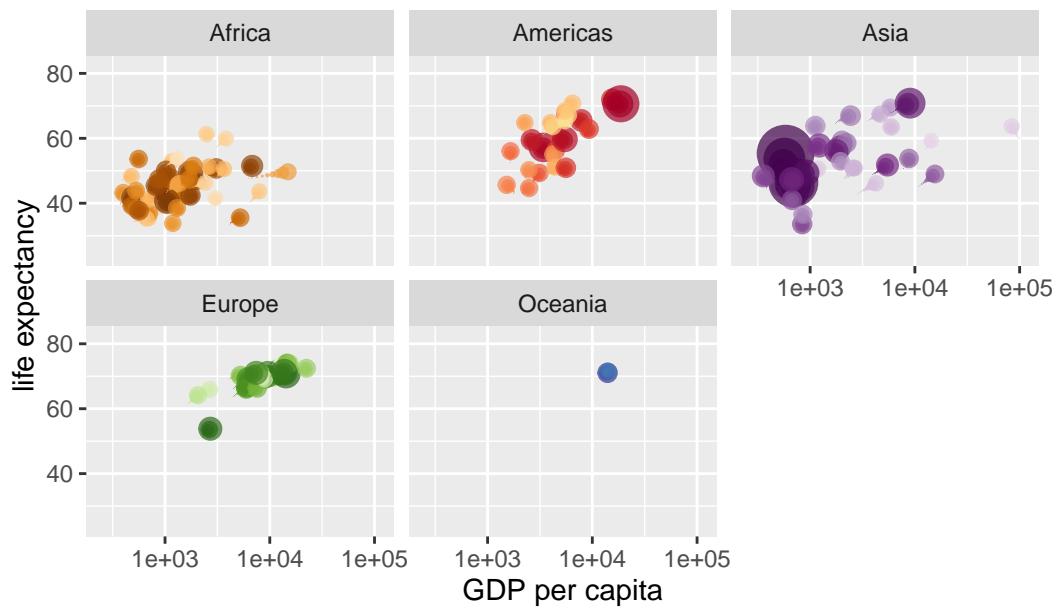
Year: 1965



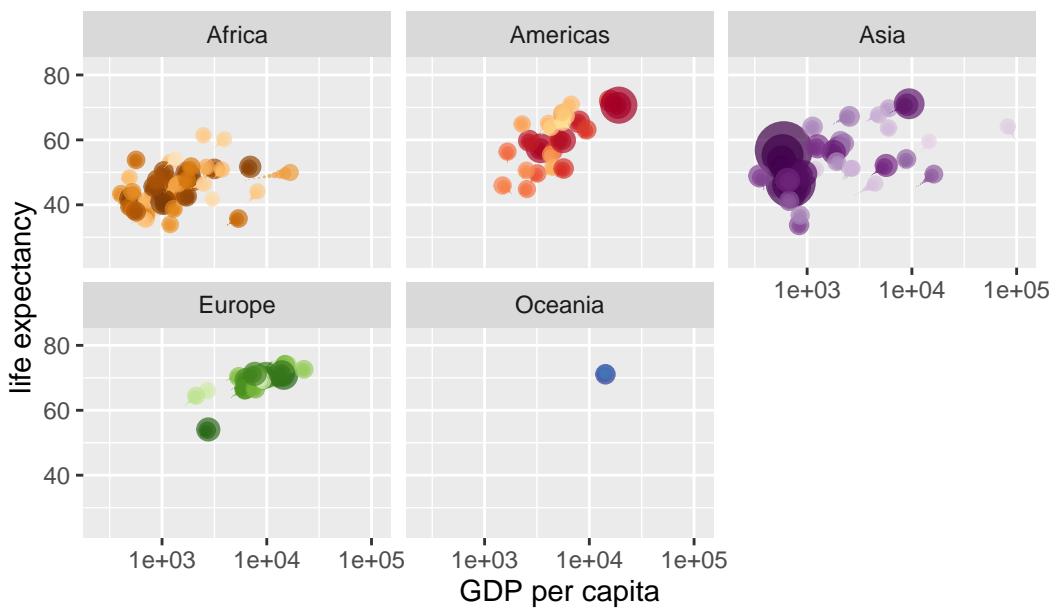
Year: 1965



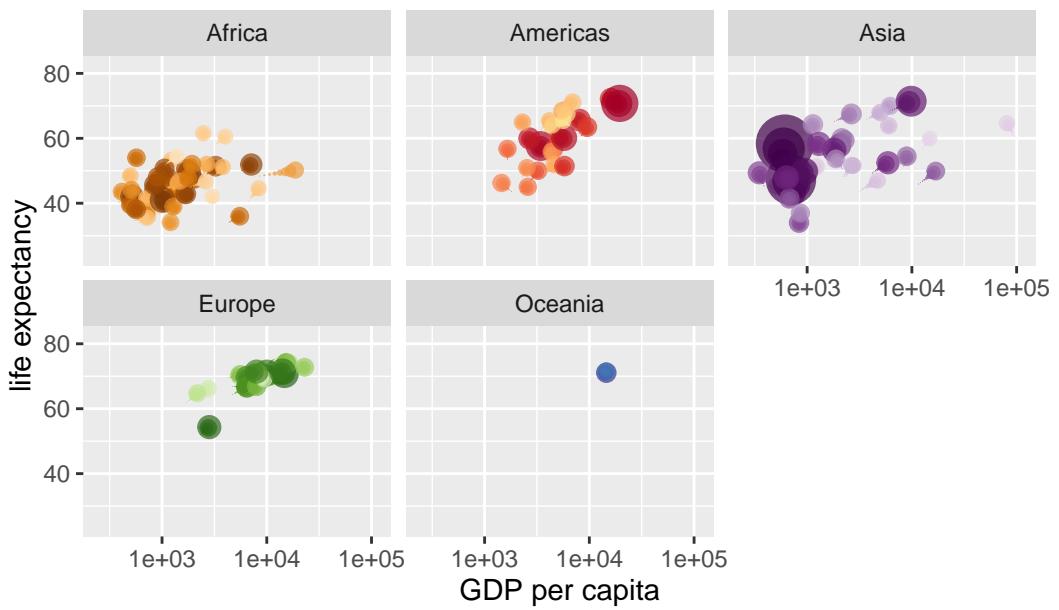
Year: 1966



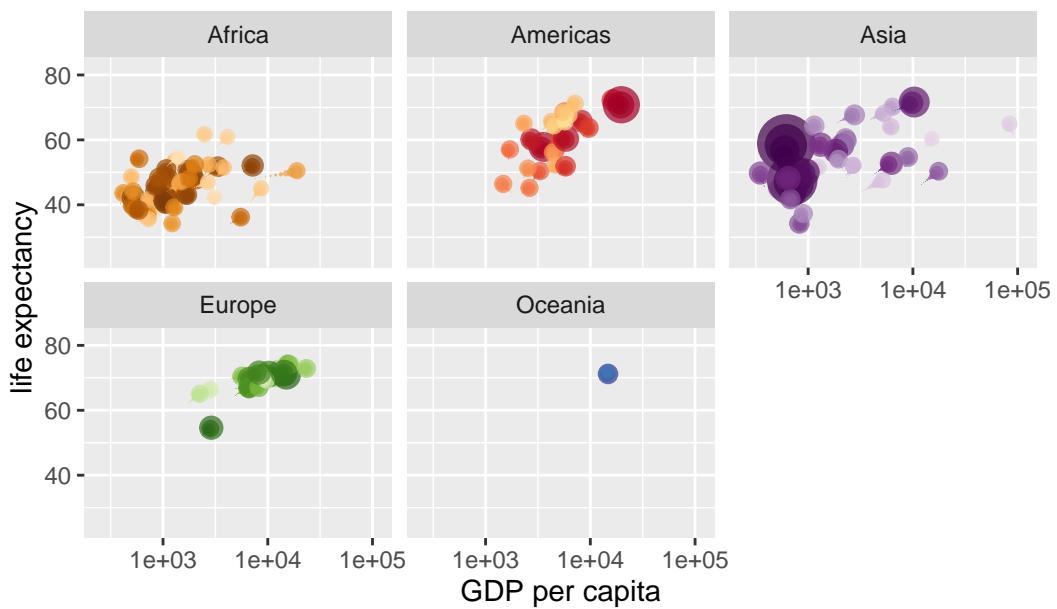
Year: 1966



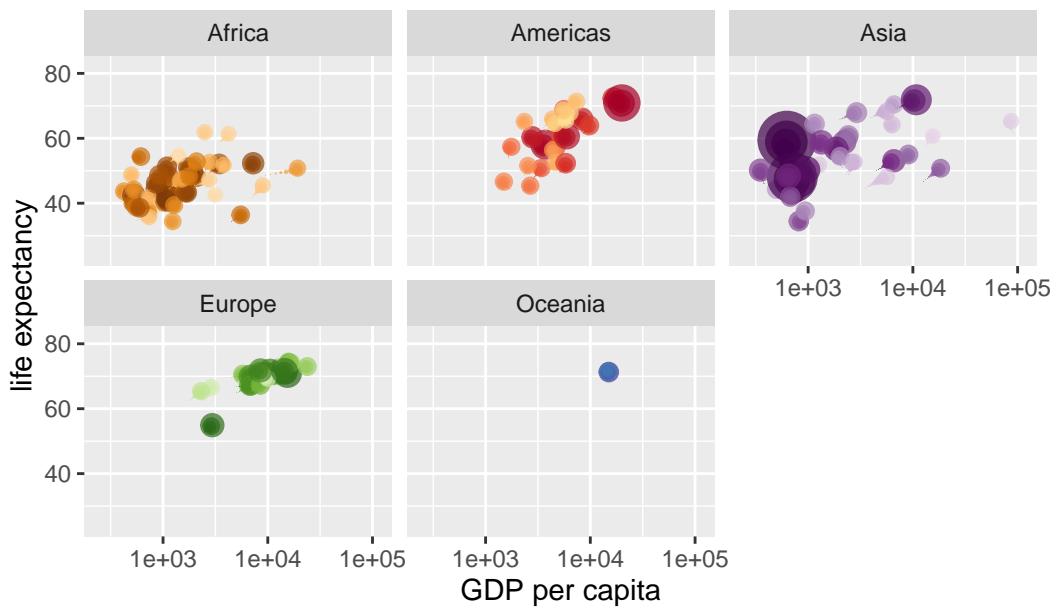
Year: 1967



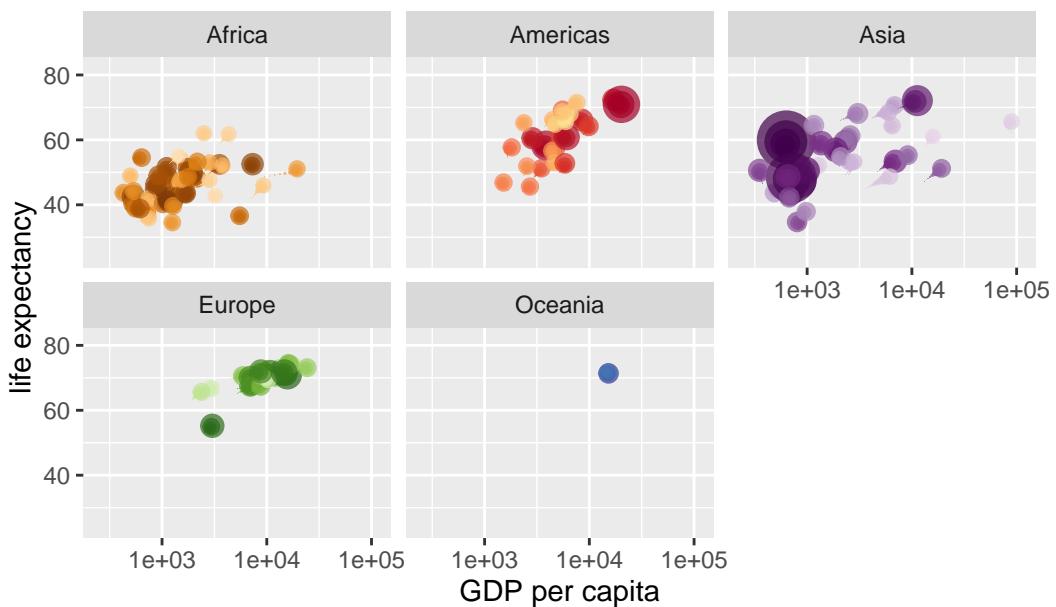
Year: 1968



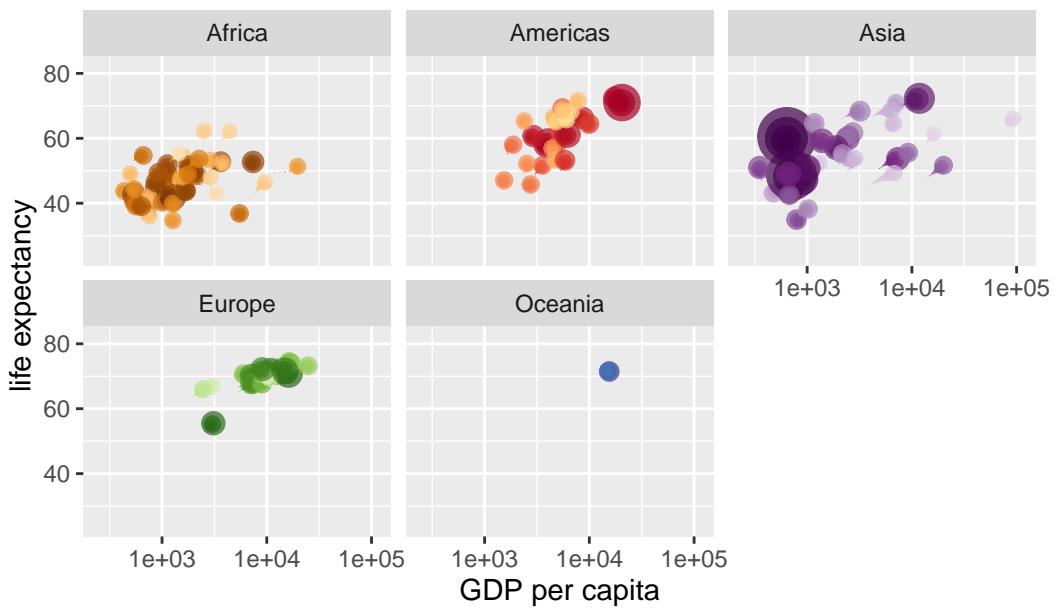
Year: 1968



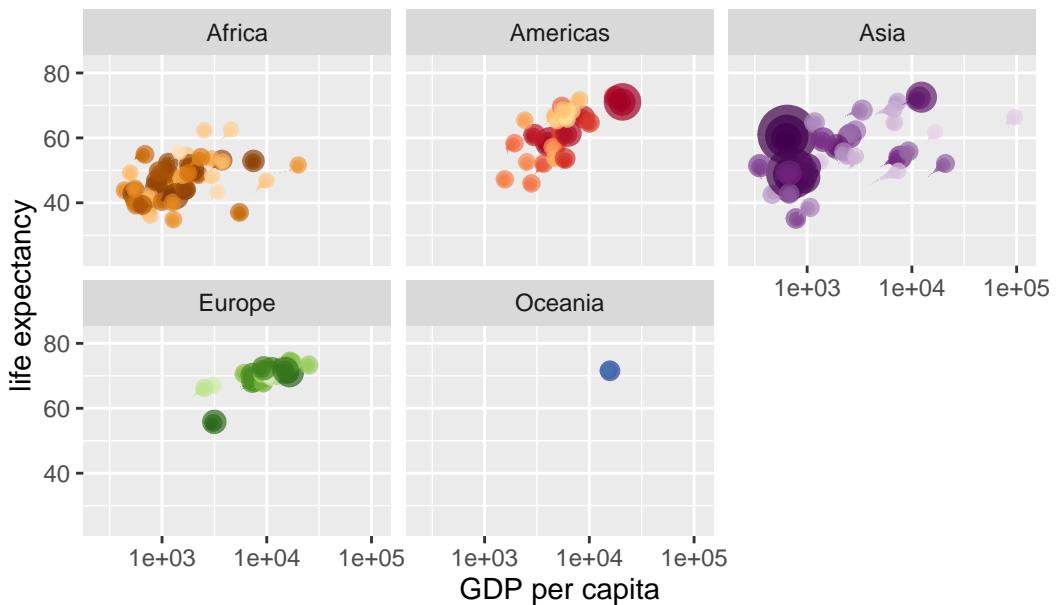
Year: 1969



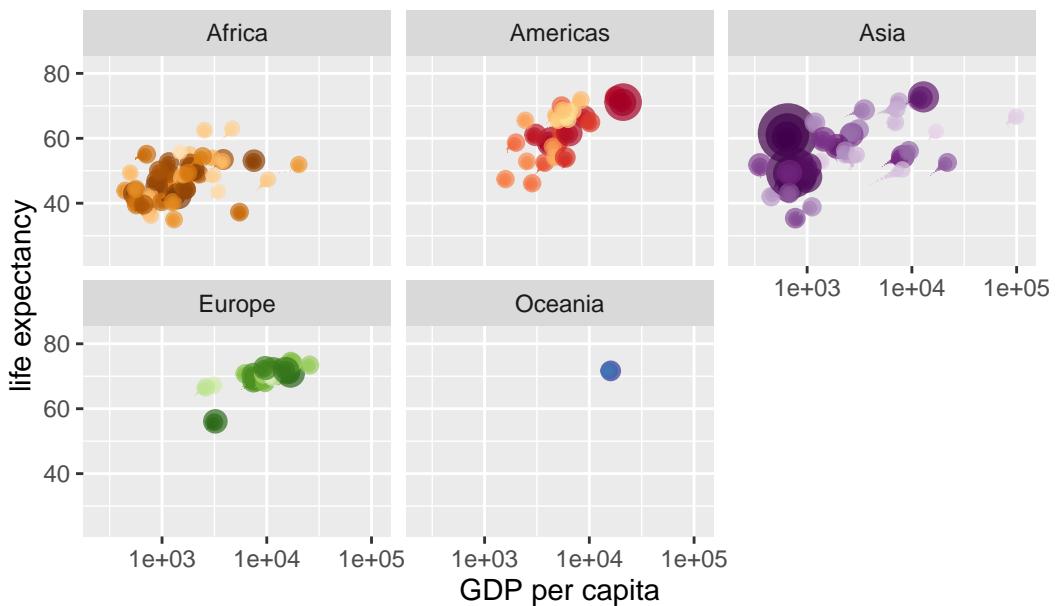
Year: 1969



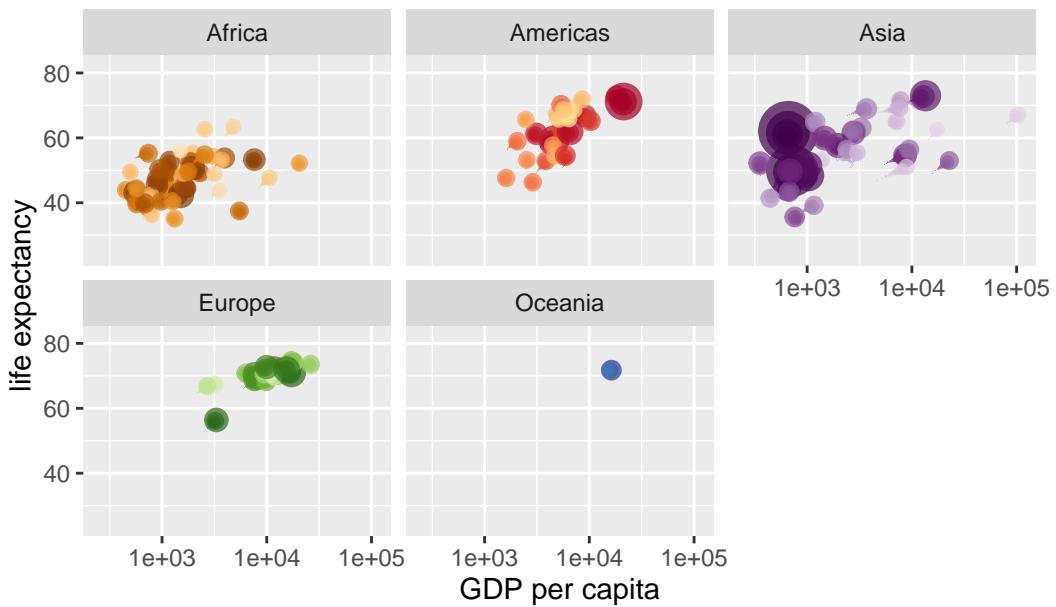
Year: 1970



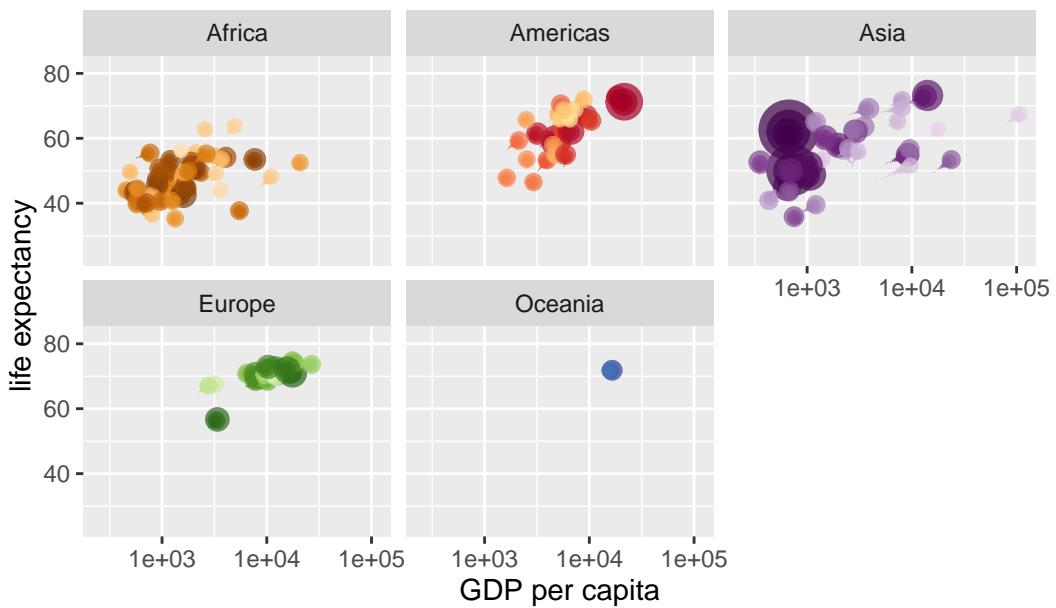
Year: 1970



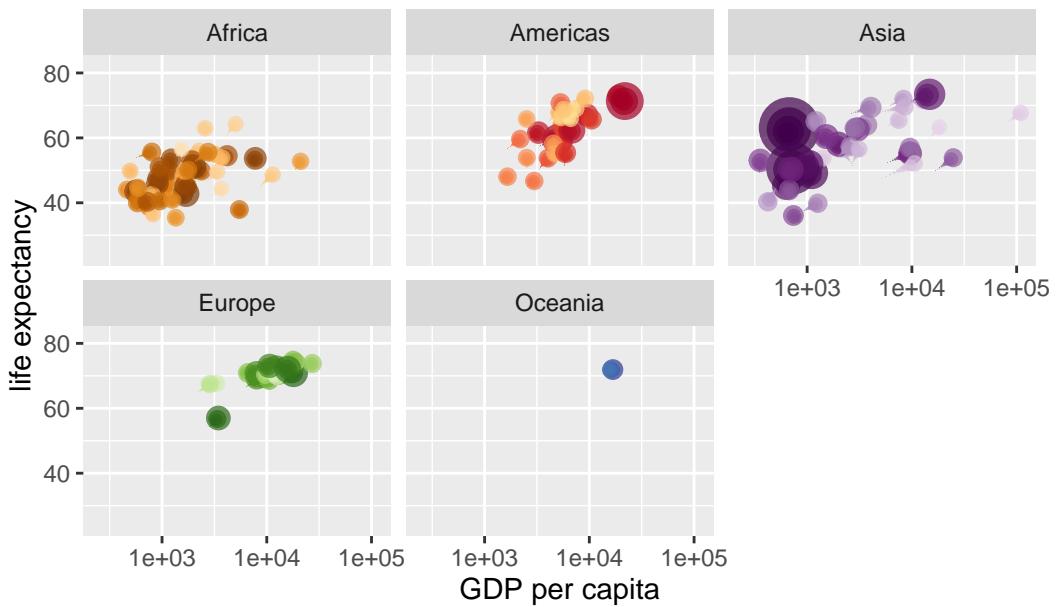
Year: 1971



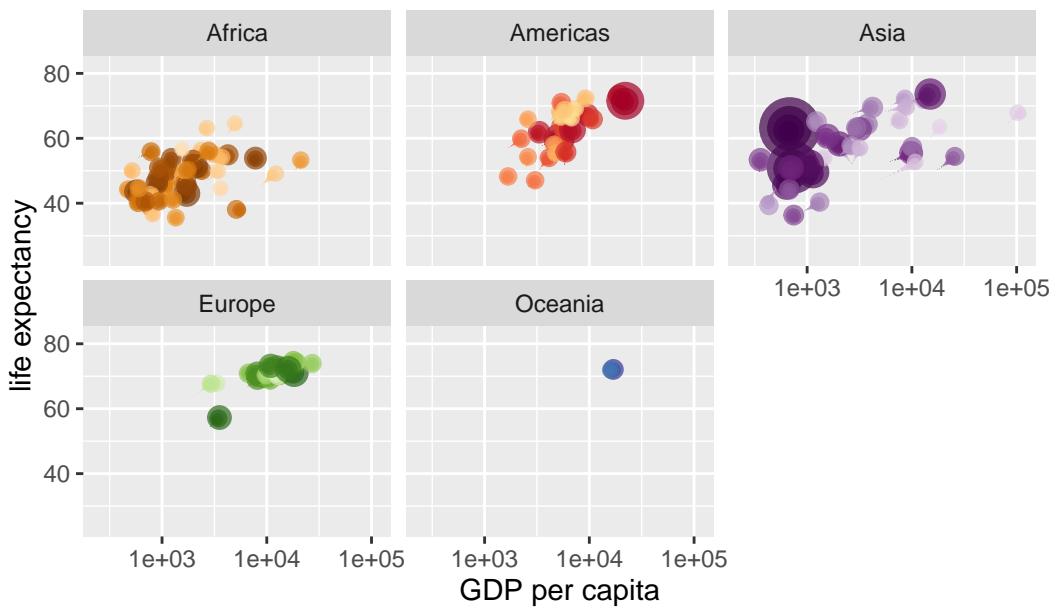
Year: 1971



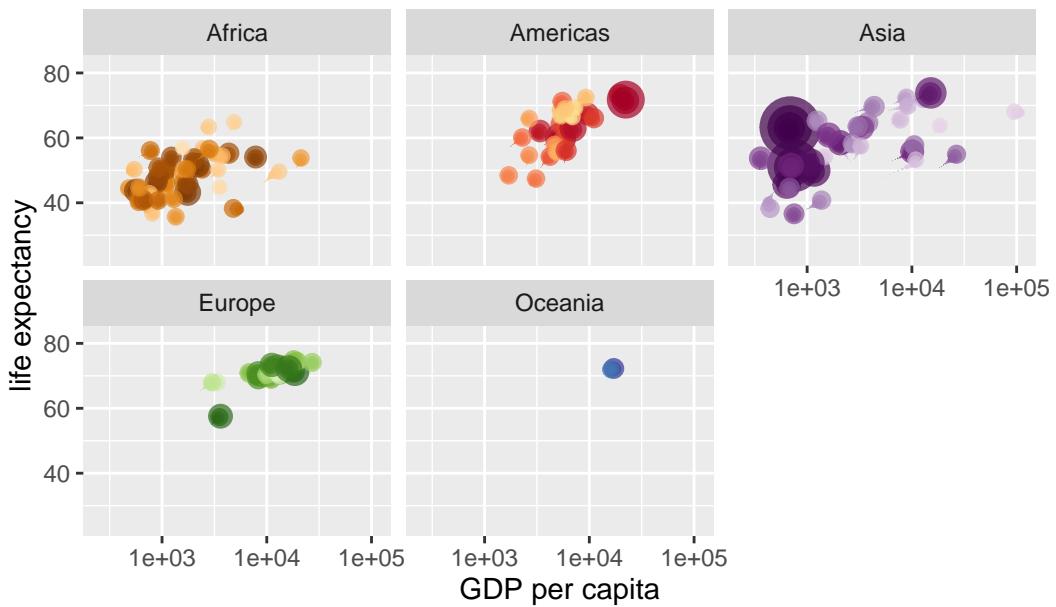
Year: 1972



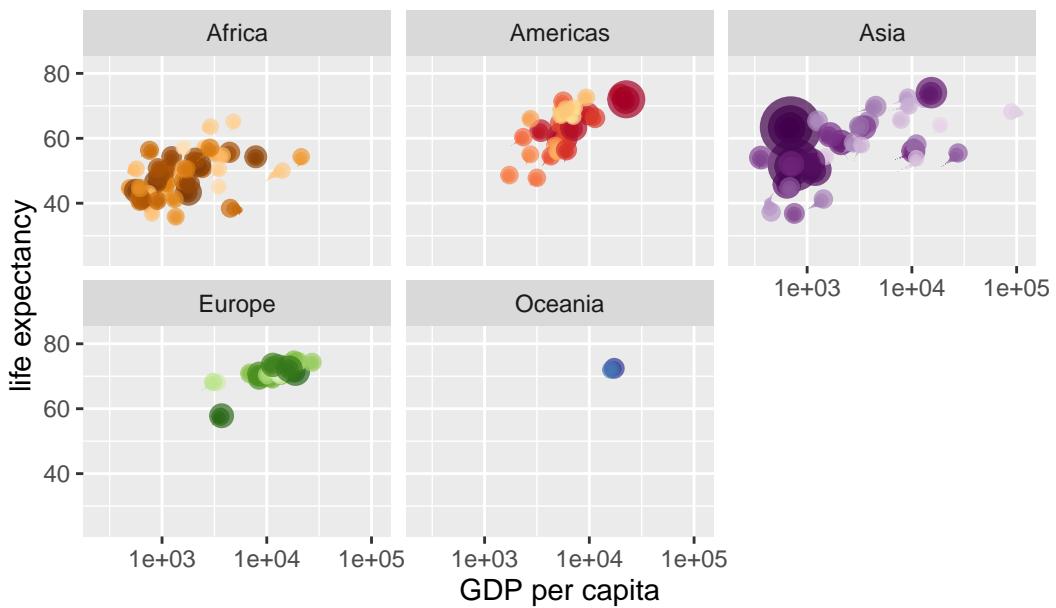
Year: 1973



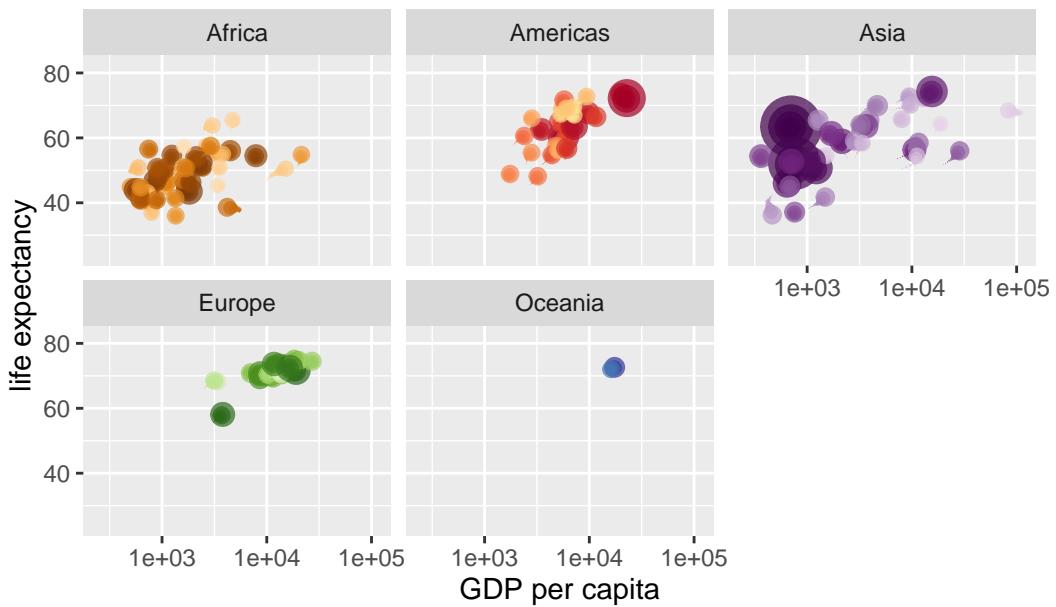
Year: 1973



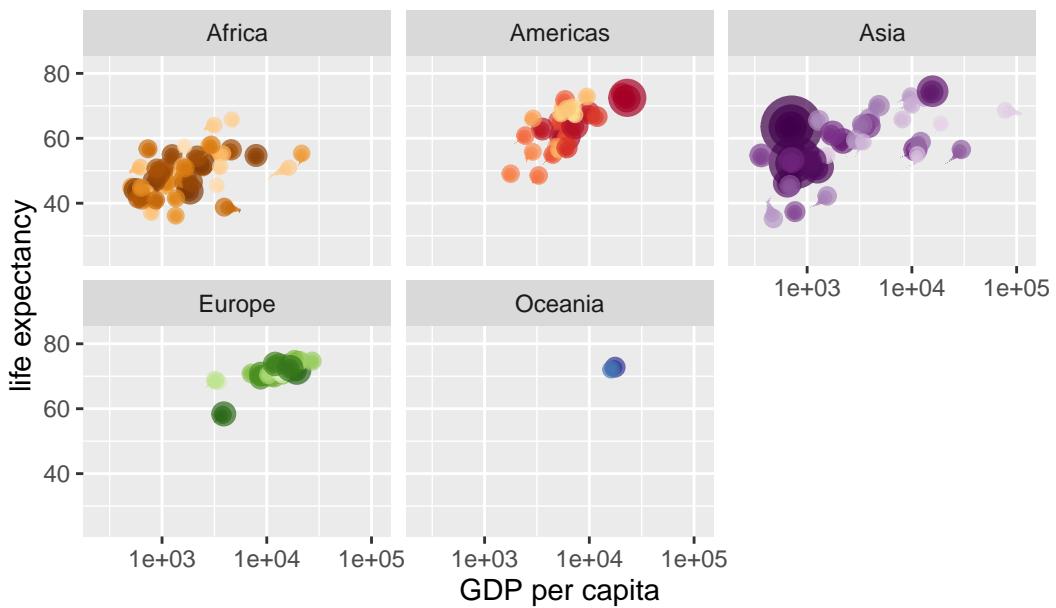
Year: 1974



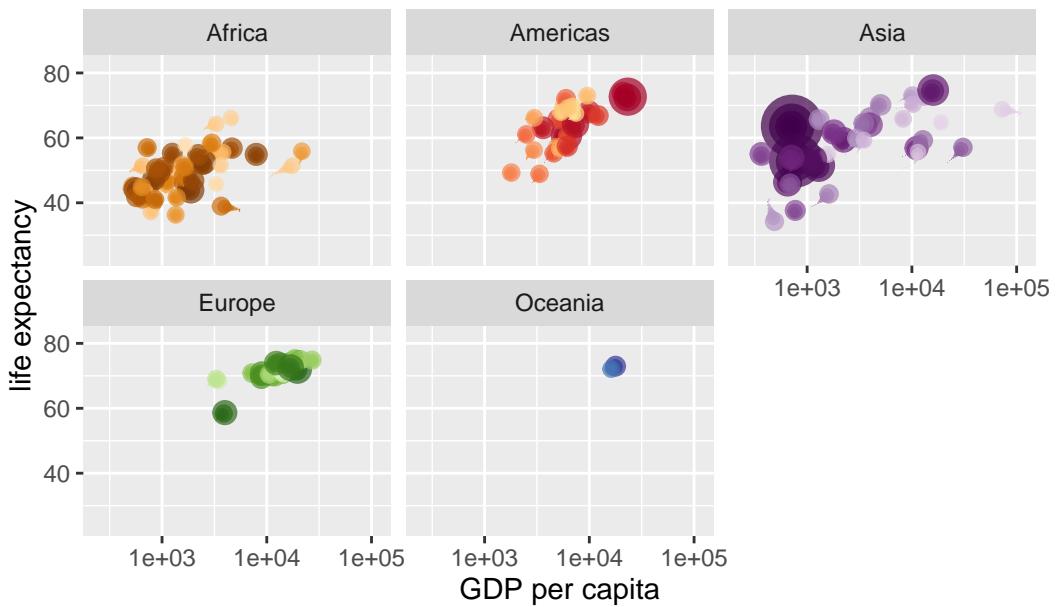
Year: 1974



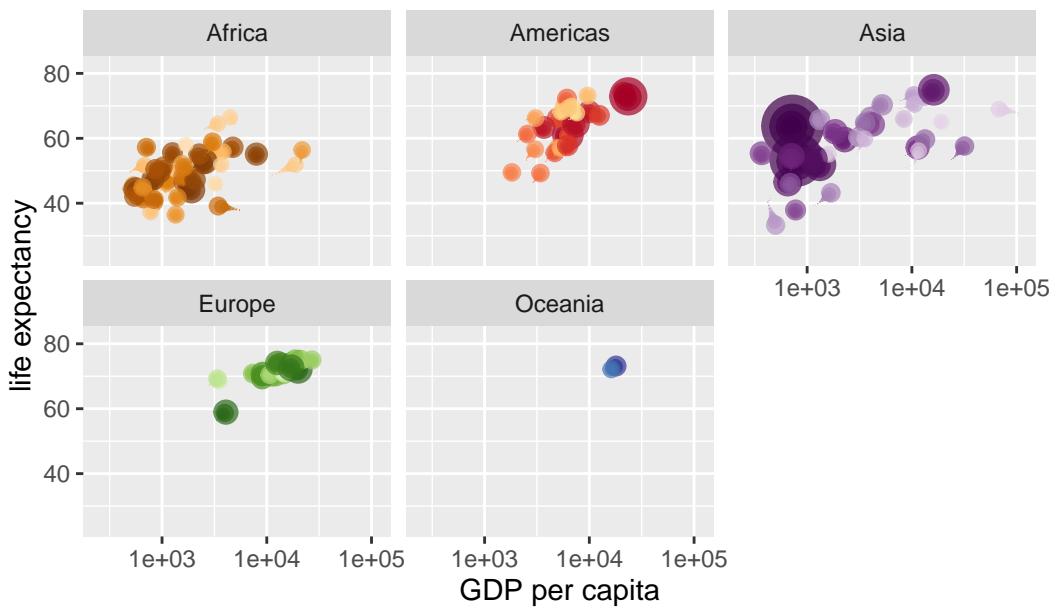
Year: 1975



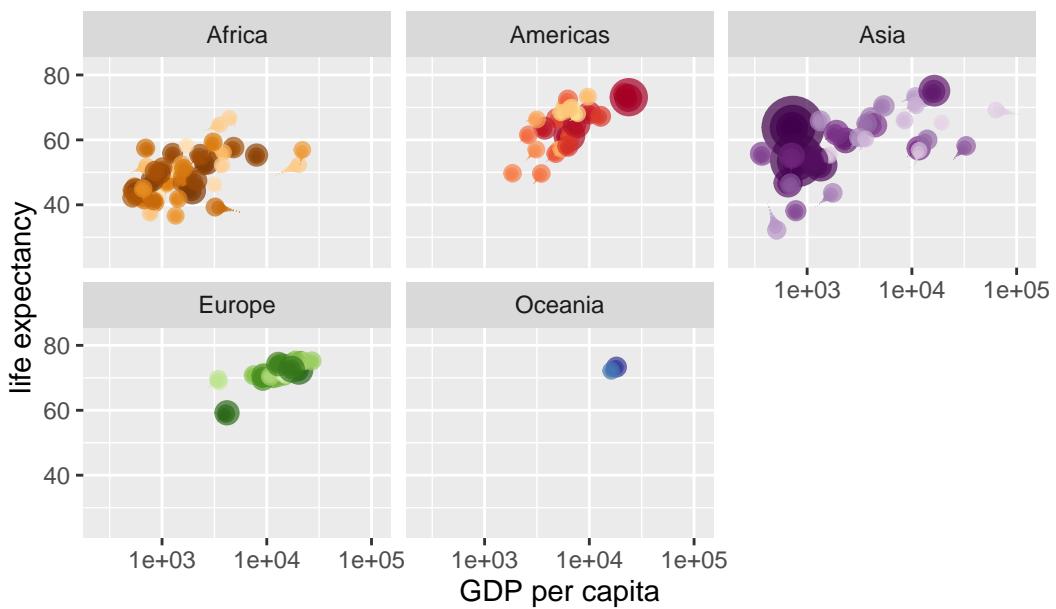
Year: 1975



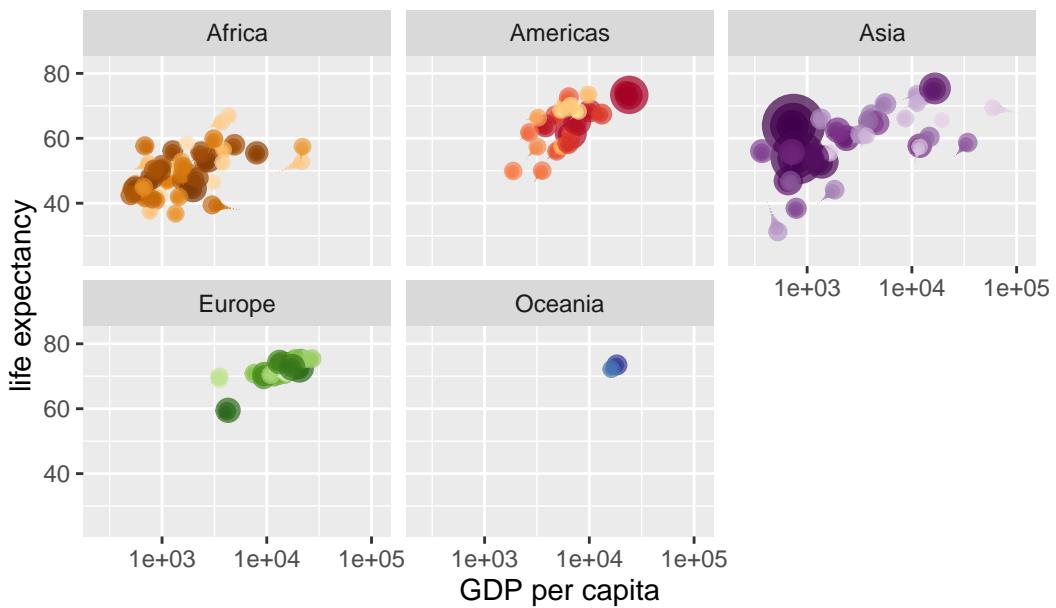
Year: 1976



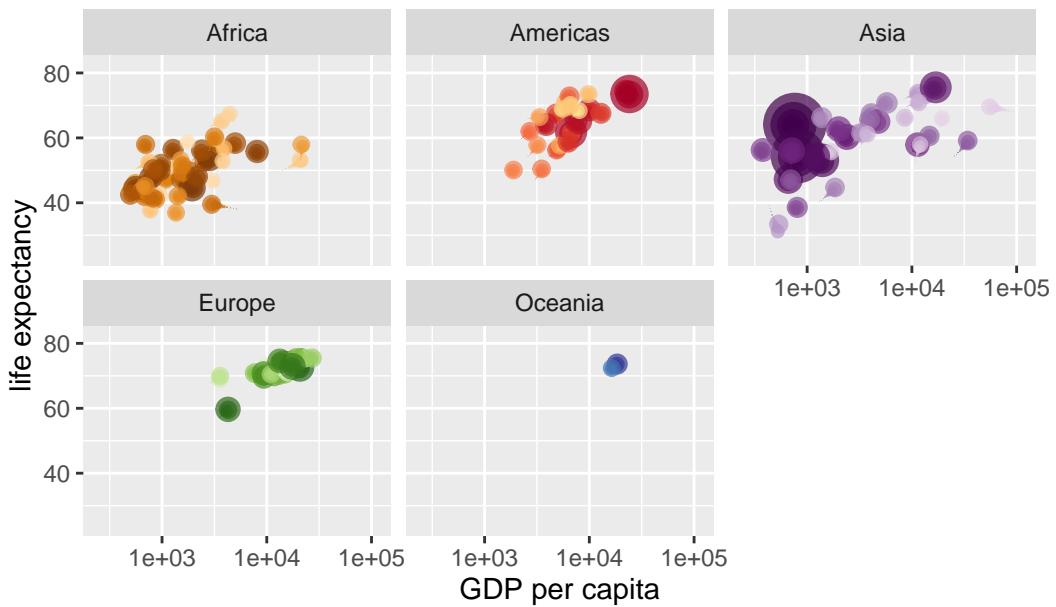
Year: 1976



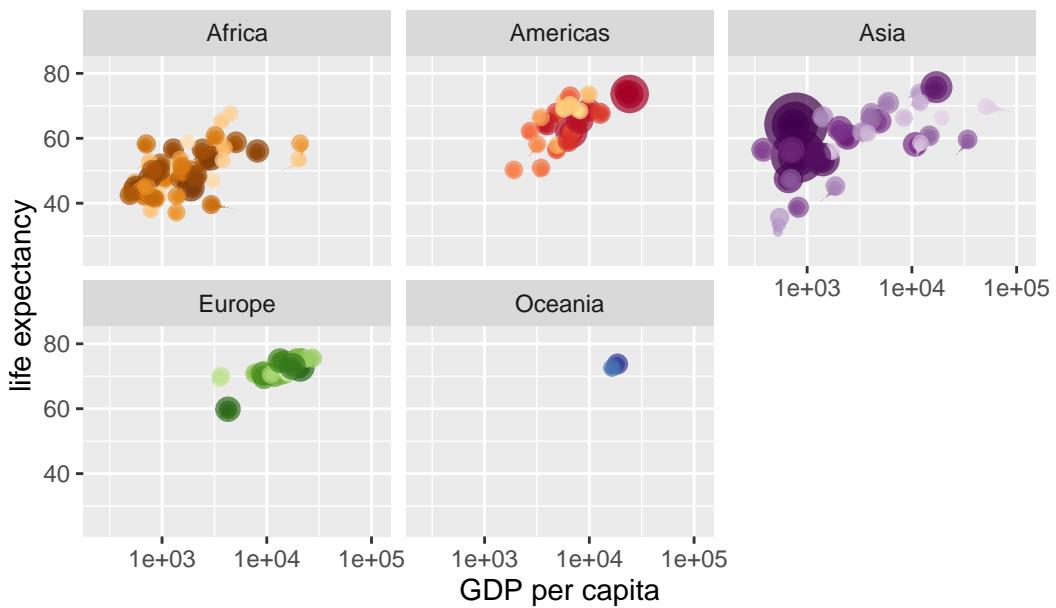
Year: 1977



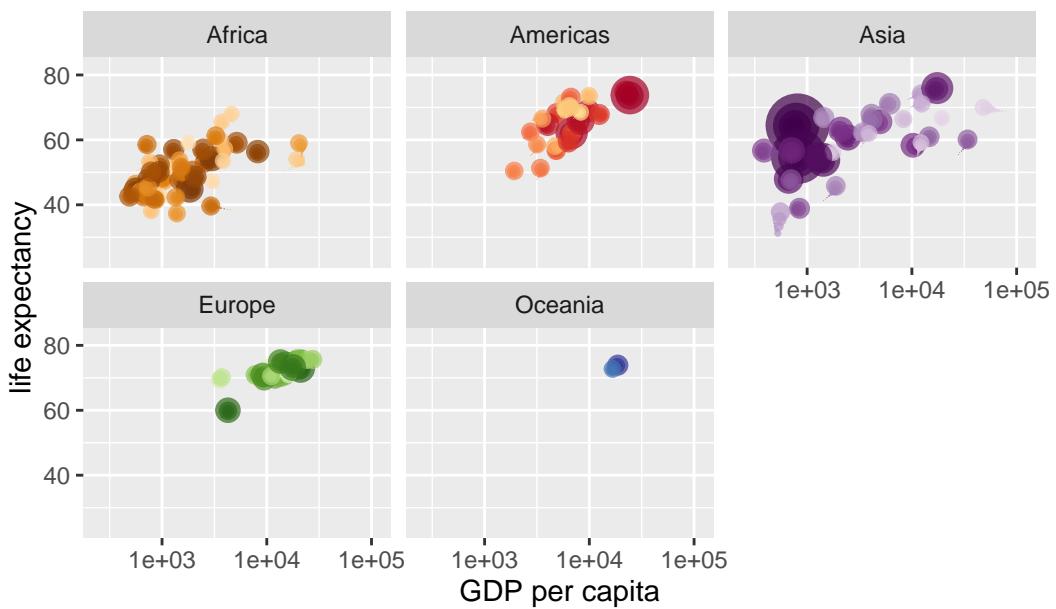
Year: 1978



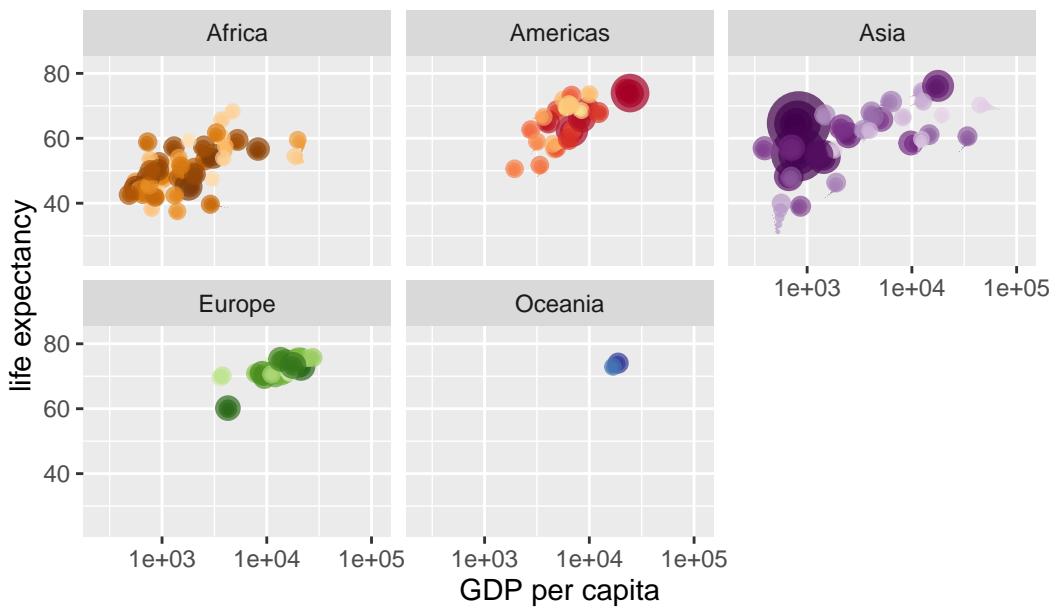
Year: 1978



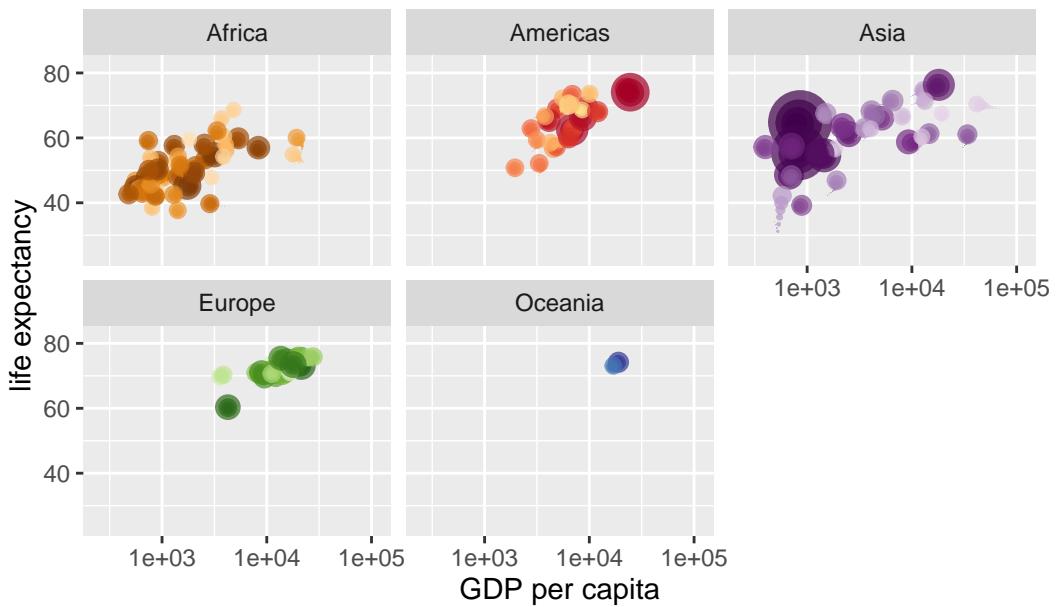
Year: 1979



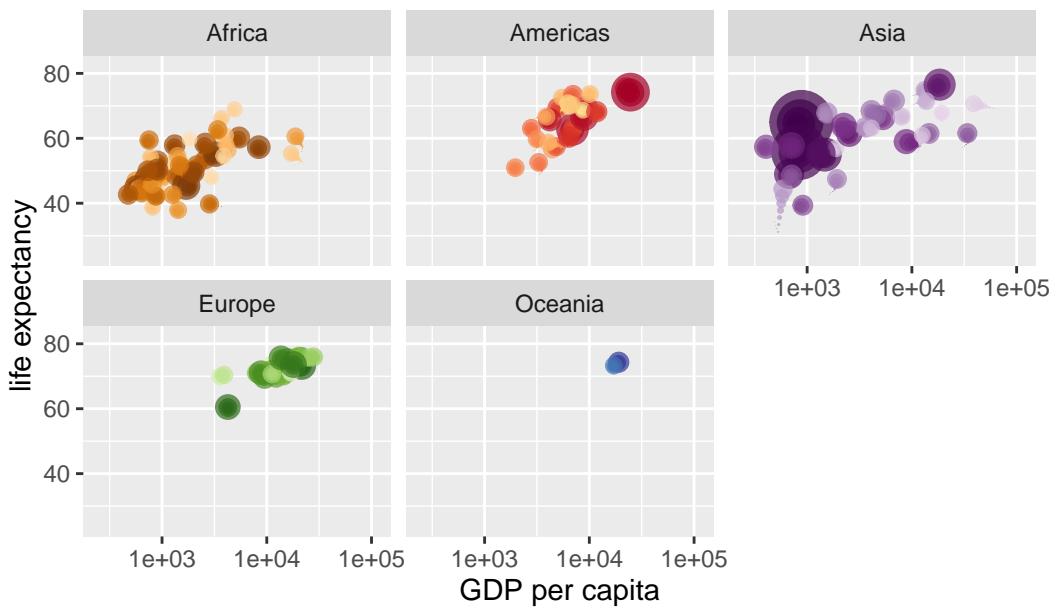
Year: 1979



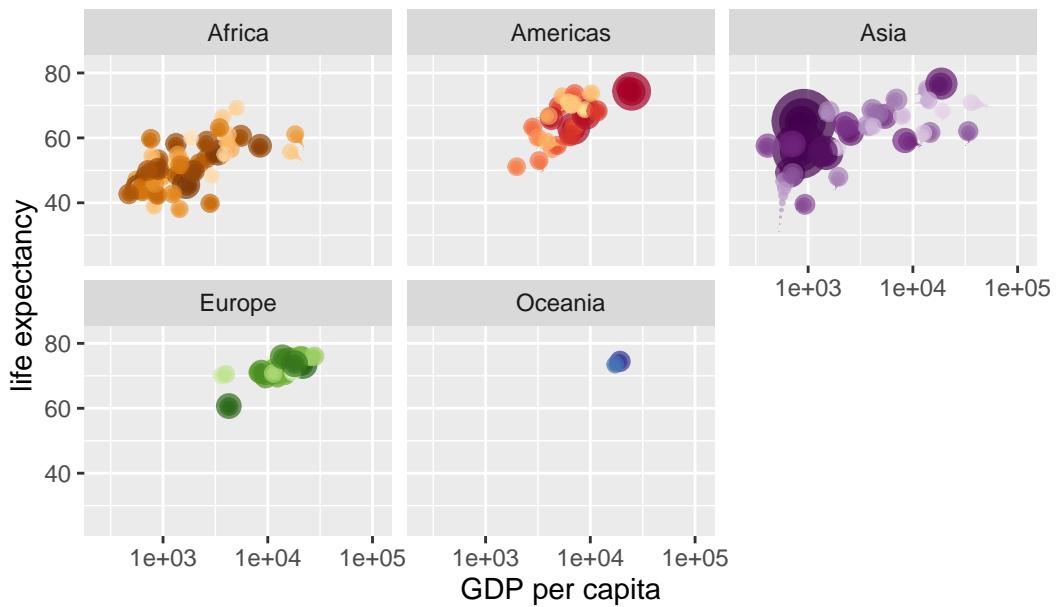
Year: 1980



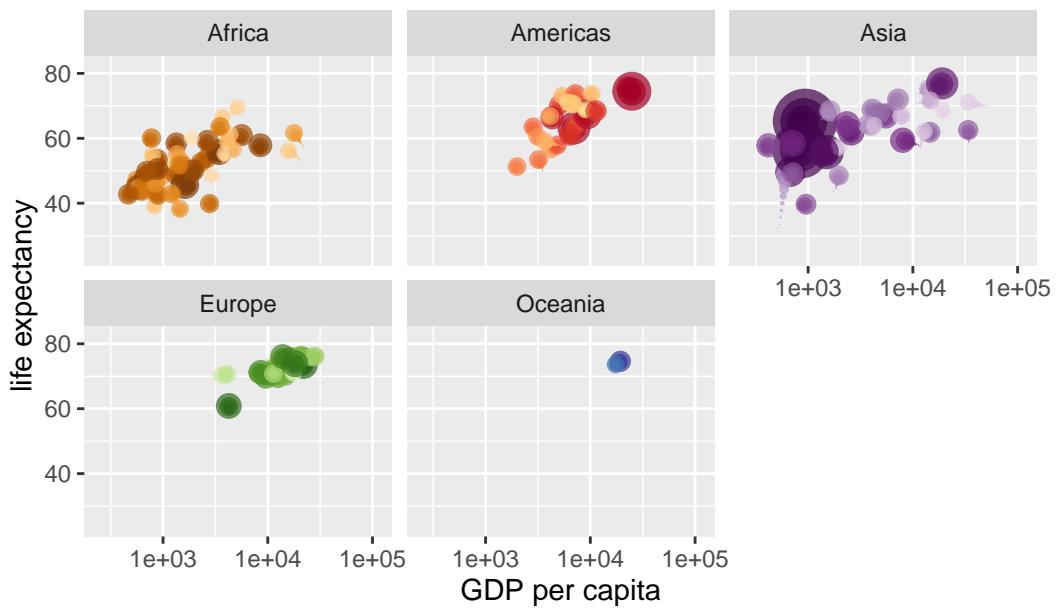
Year: 1980



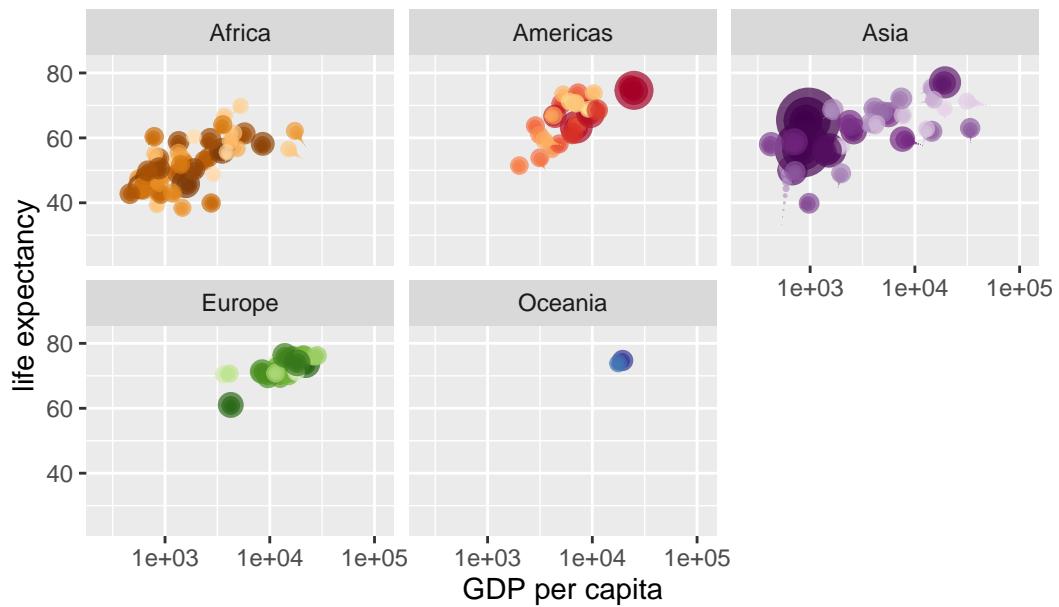
Year: 1981



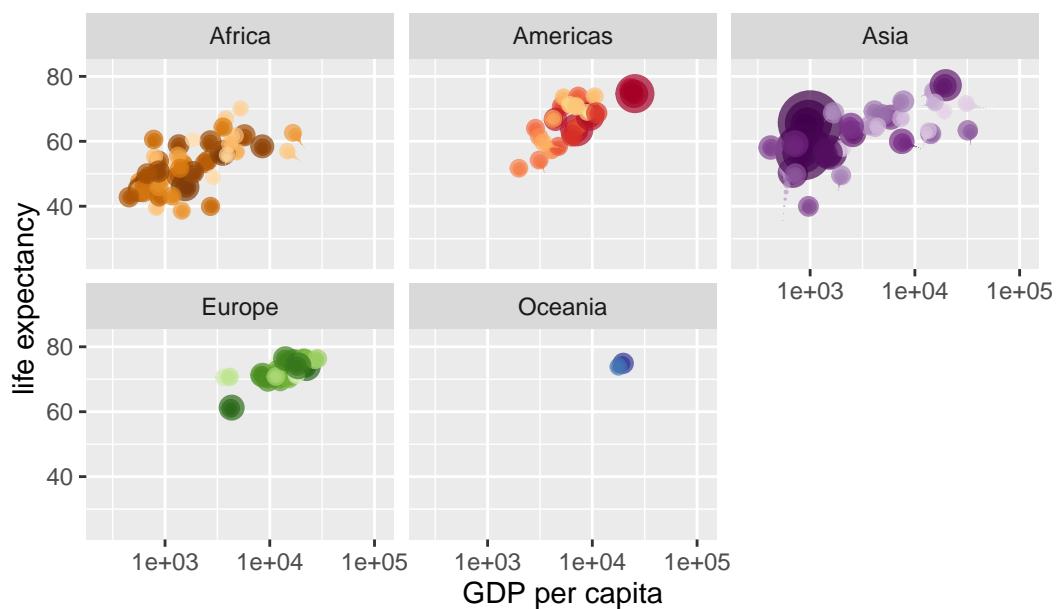
Year: 1981



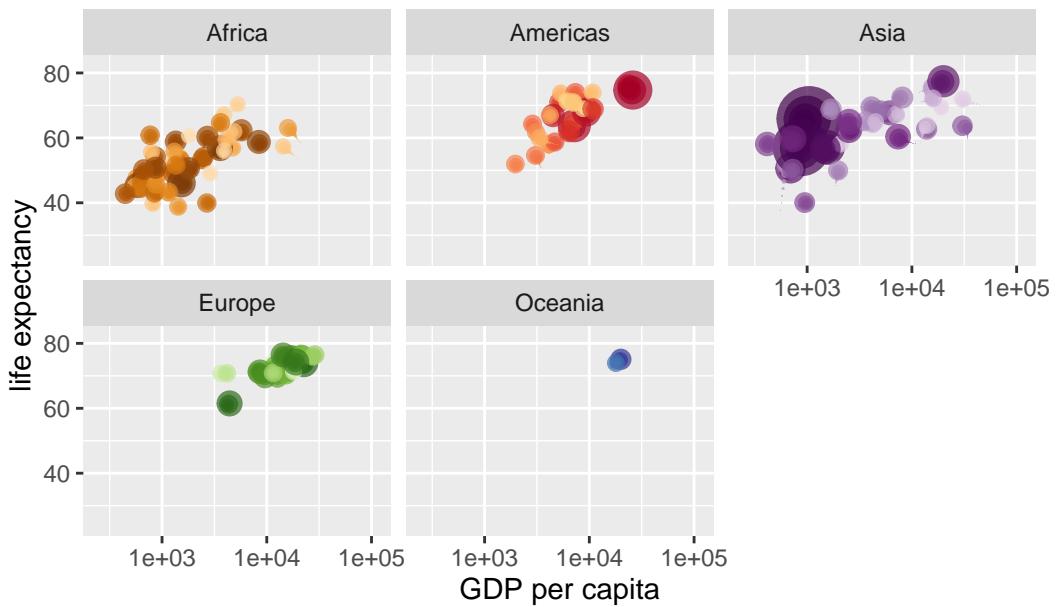
Year: 1982



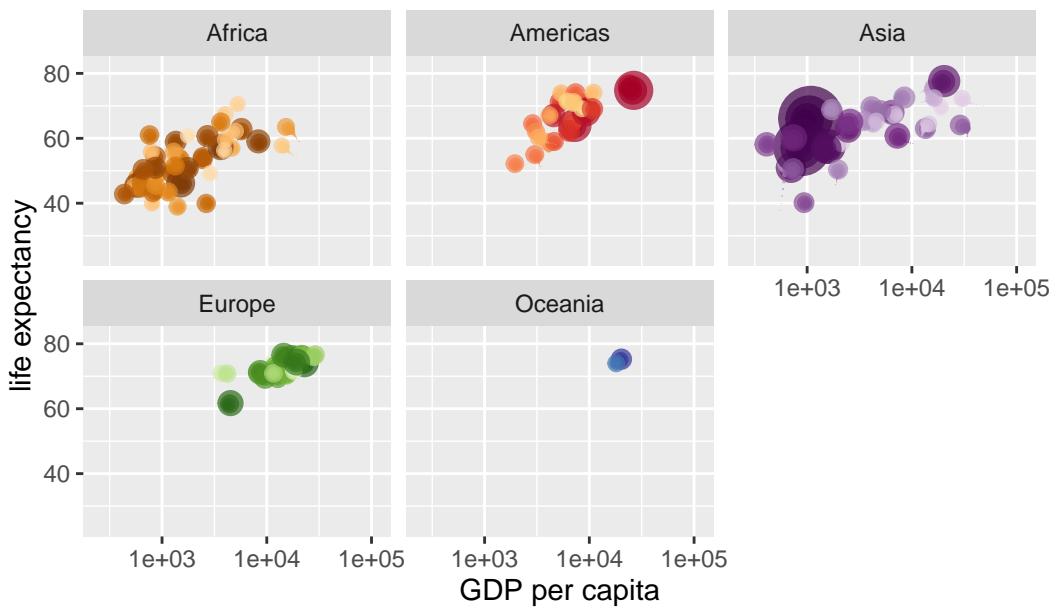
Year: 1983



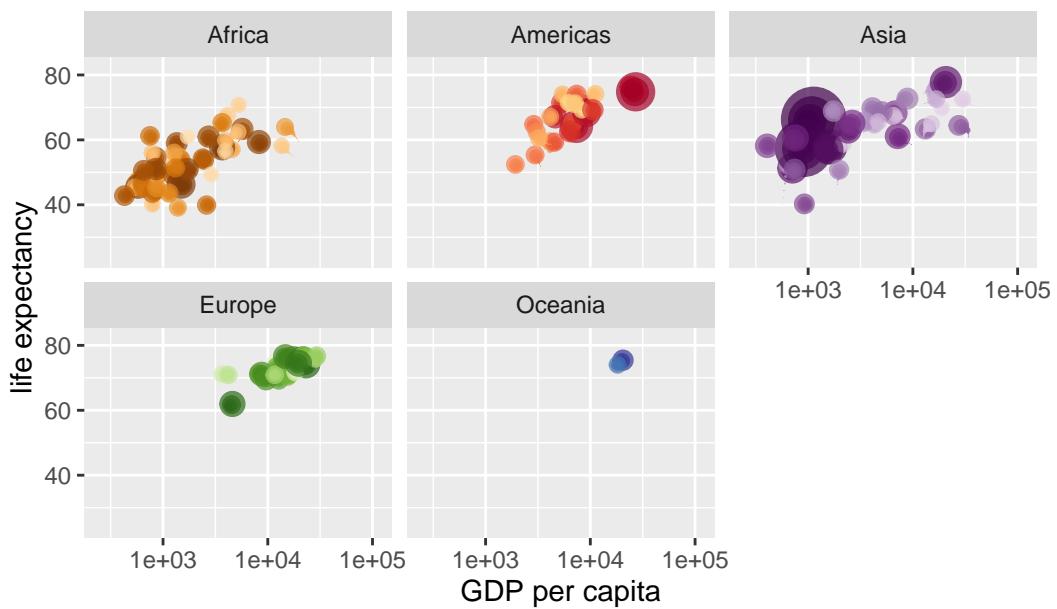
Year: 1983



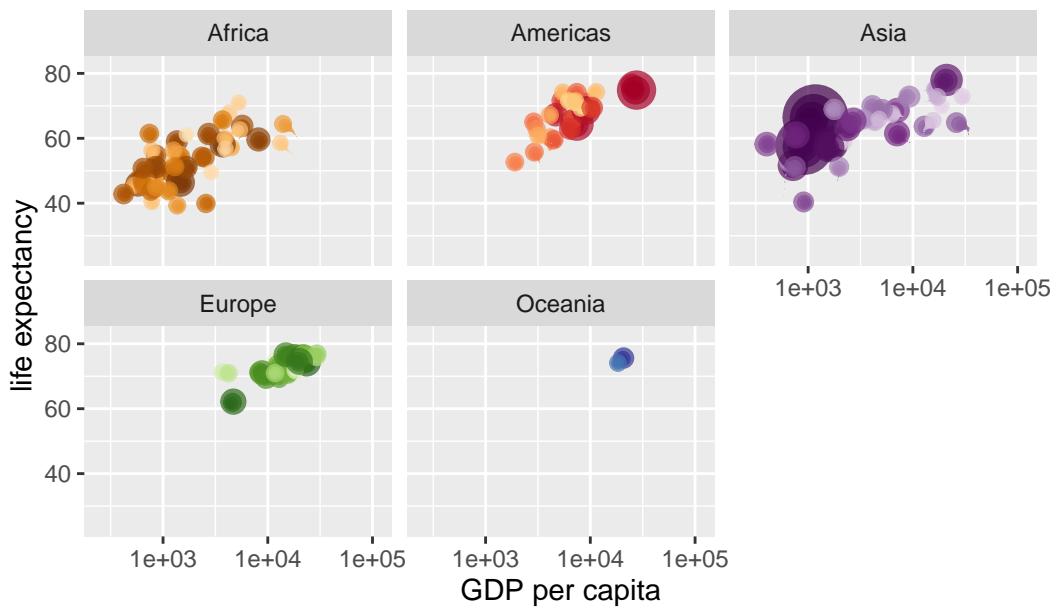
Year: 1984



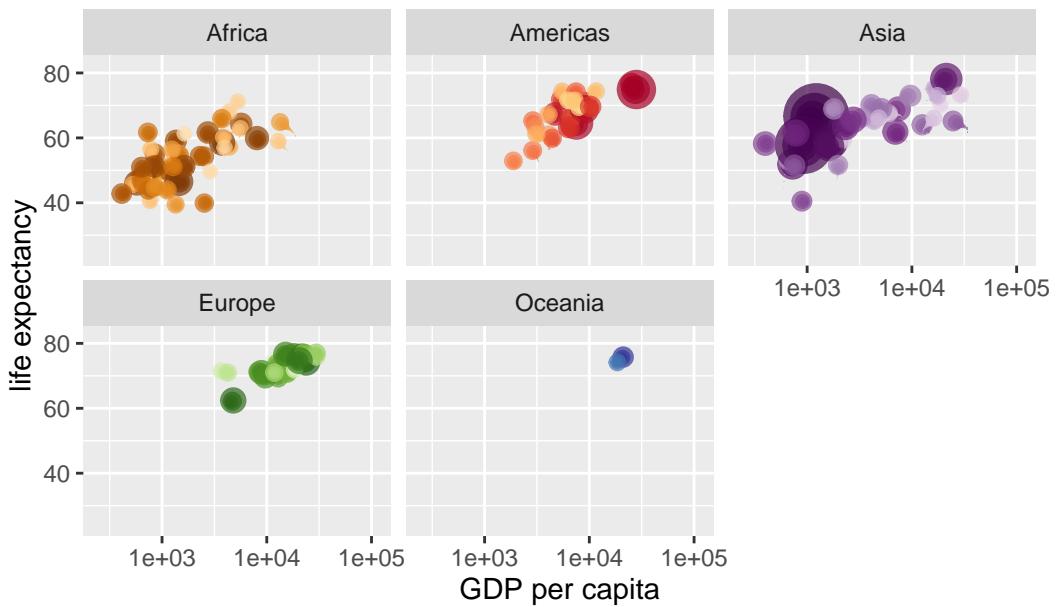
Year: 1984



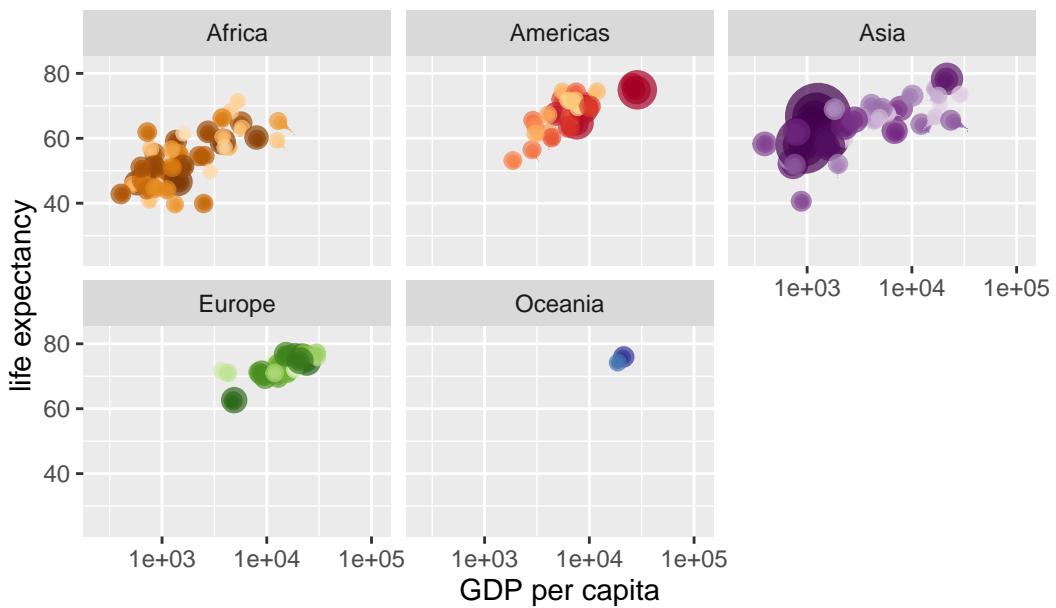
Year: 1985



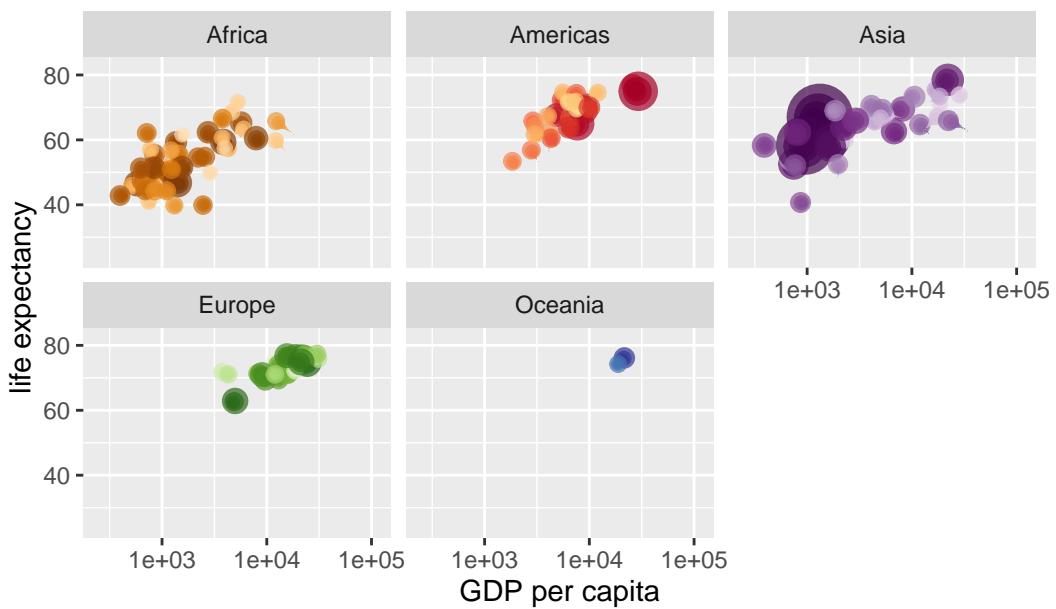
Year: 1985



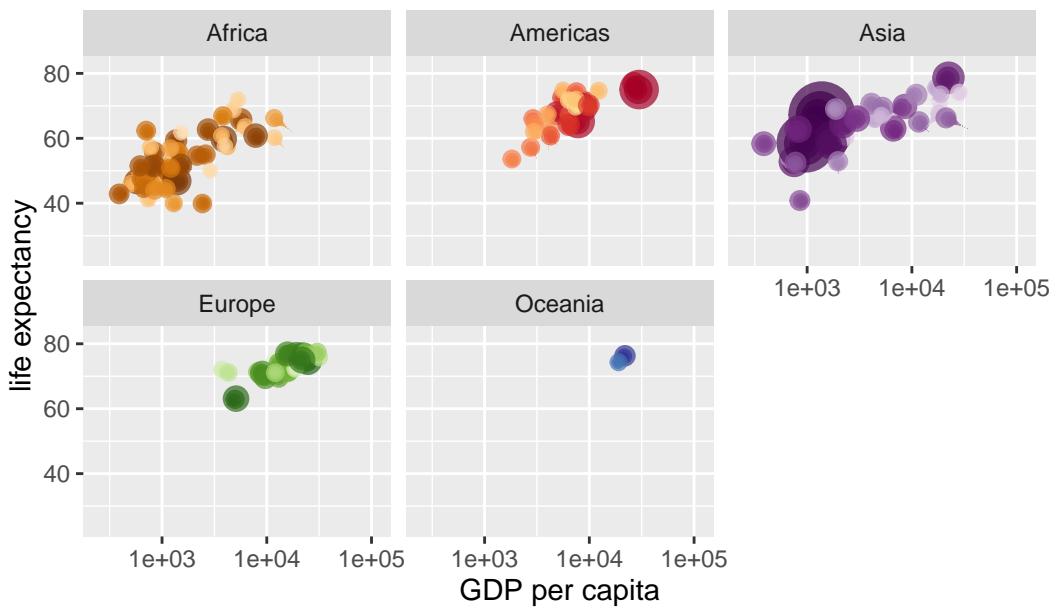
Year: 1986



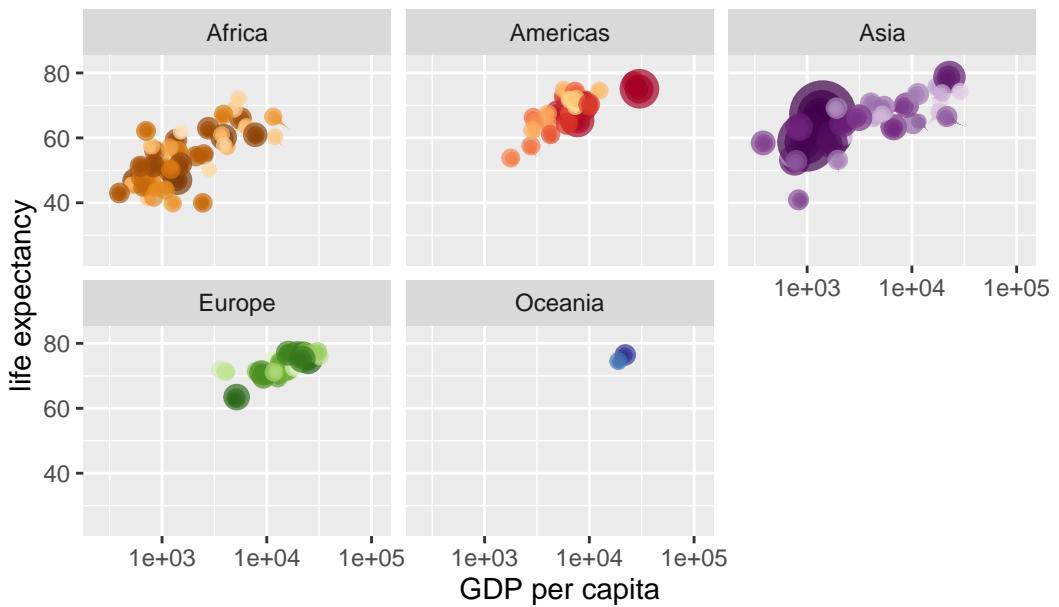
Year: 1986



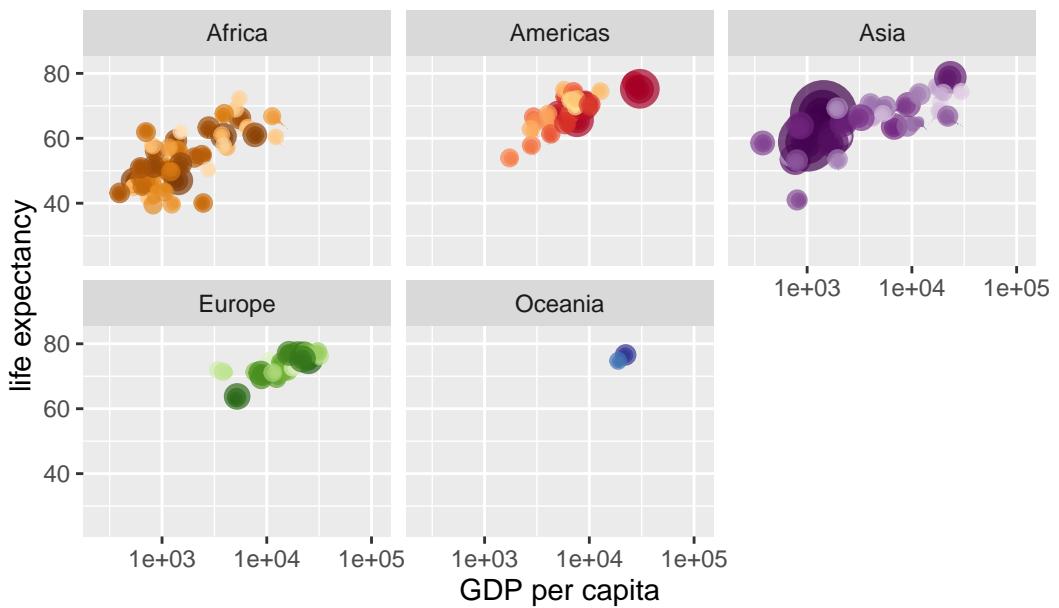
Year: 1987



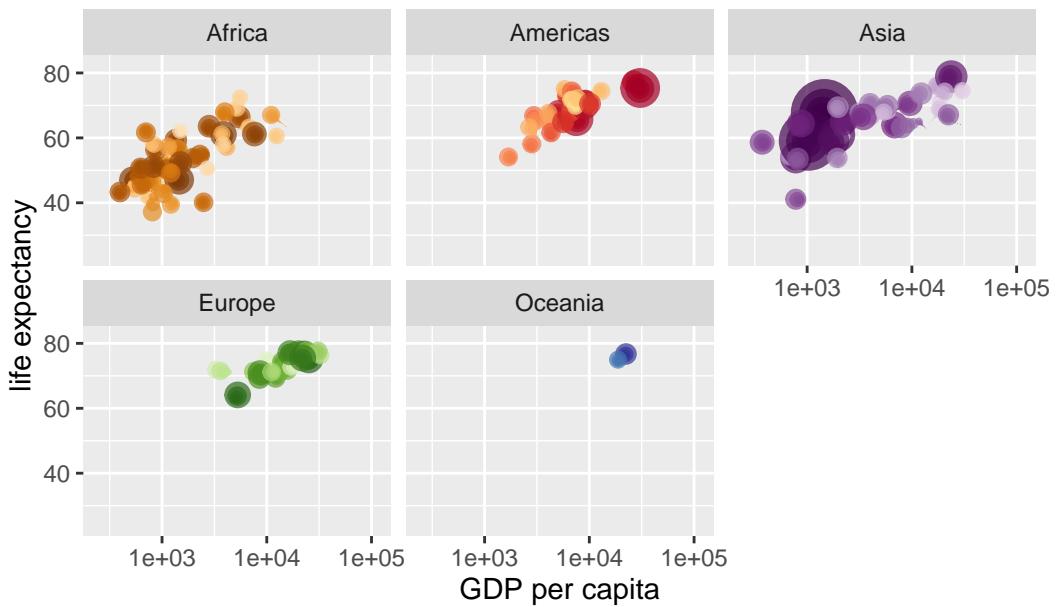
Year: 1988



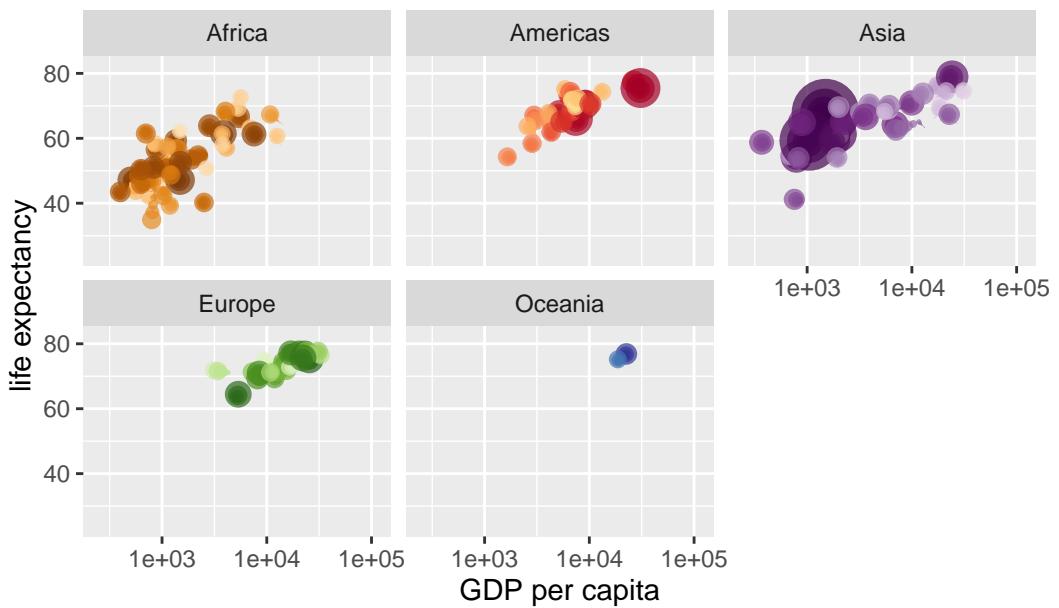
Year: 1988



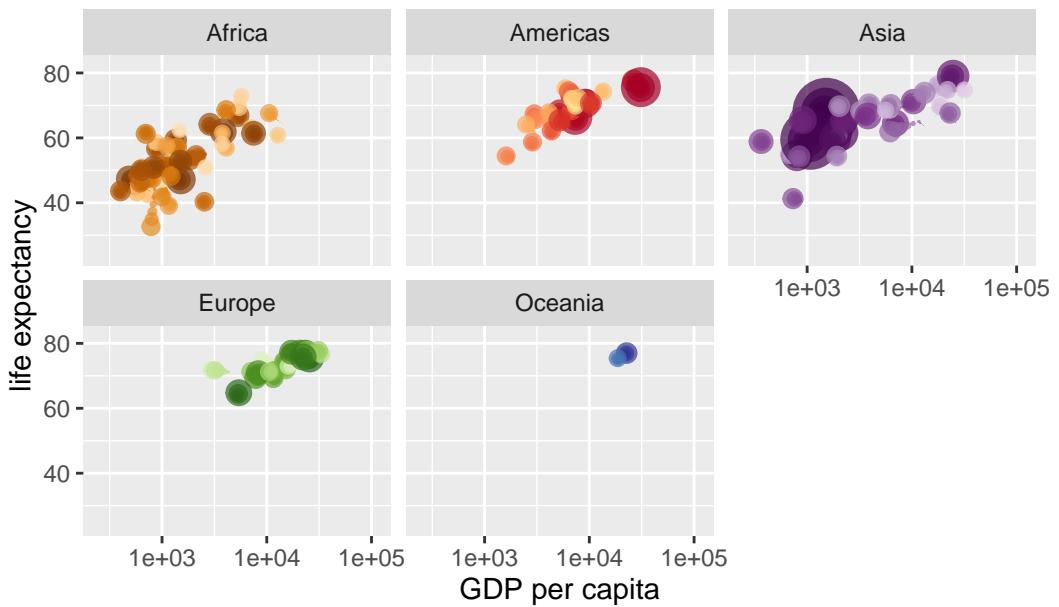
Year: 1989



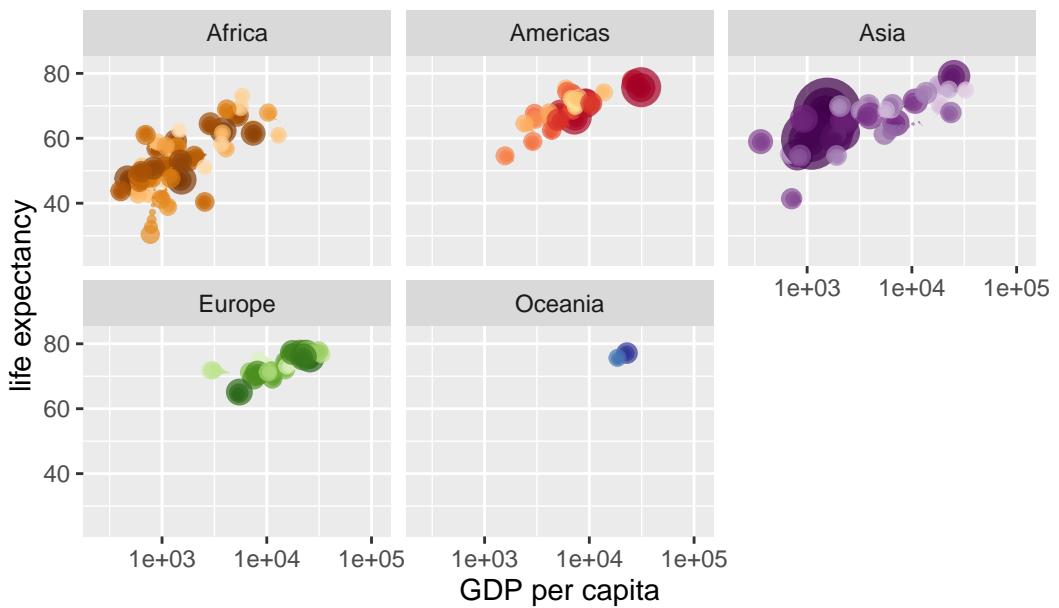
Year: 1989



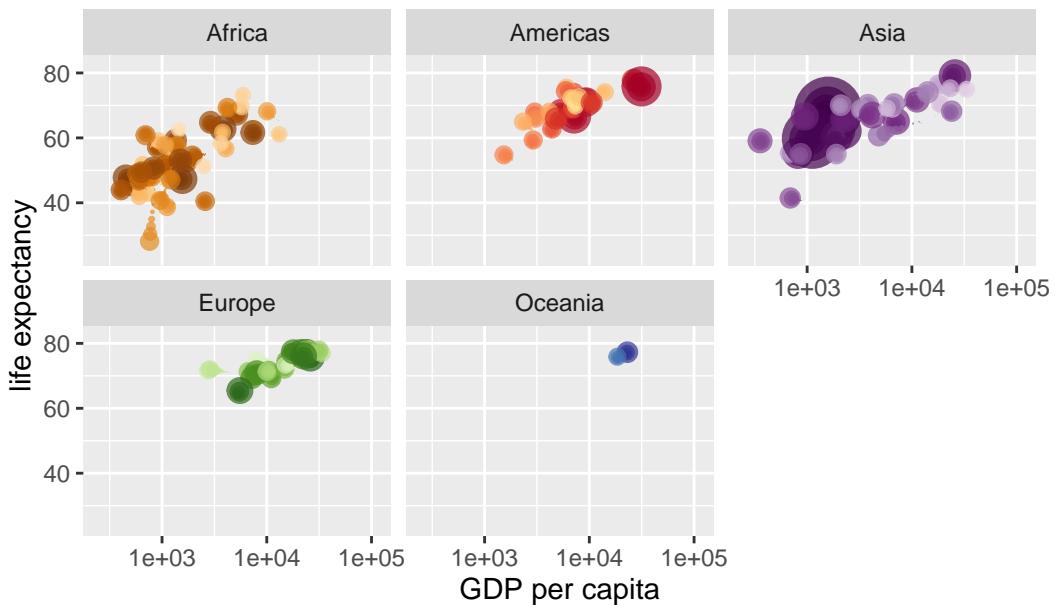
Year: 1990



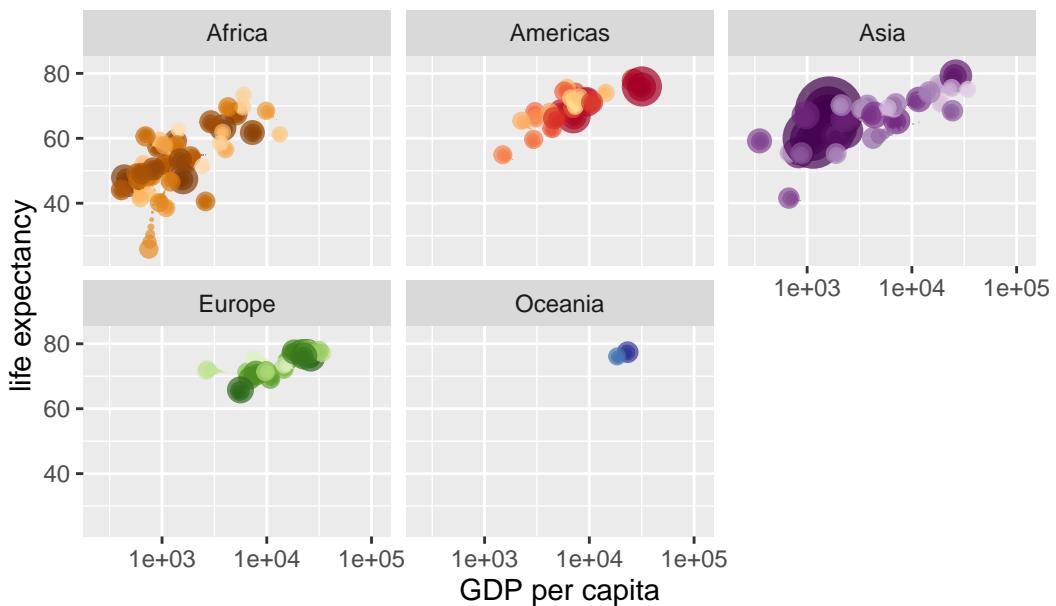
Year: 1990



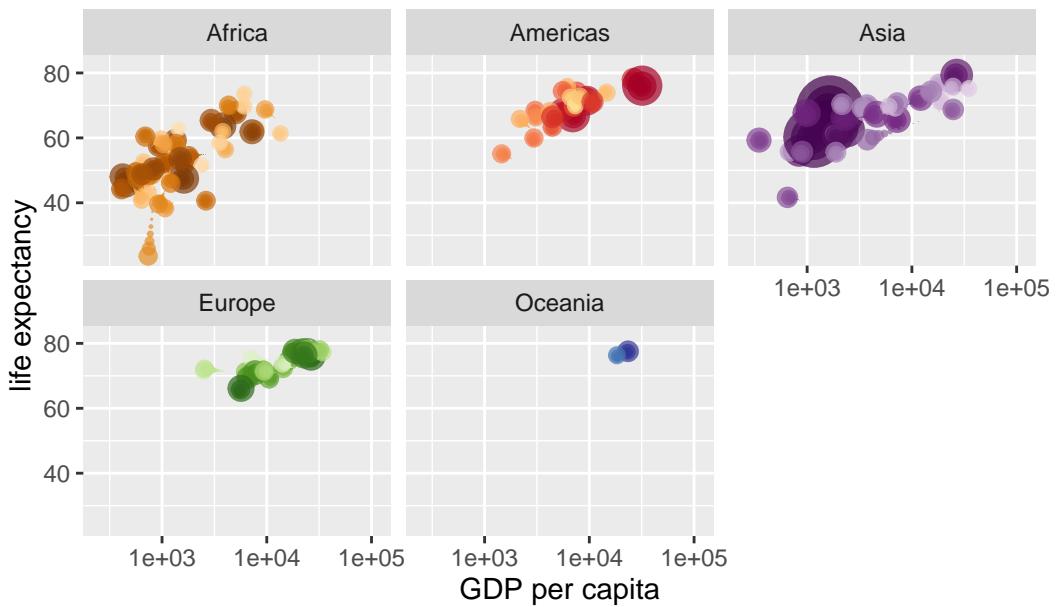
Year: 1991



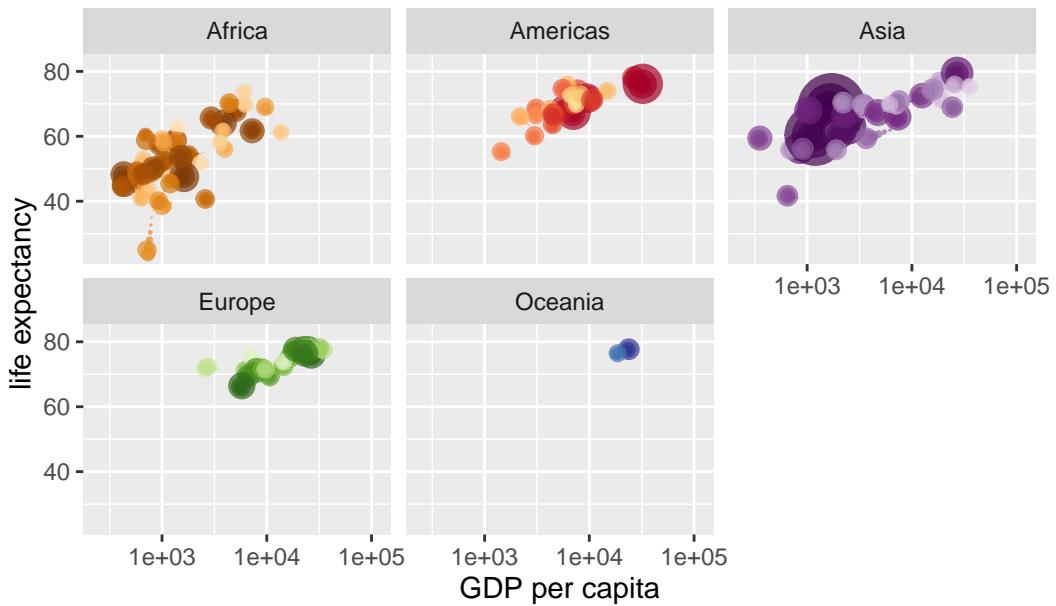
Year: 1991



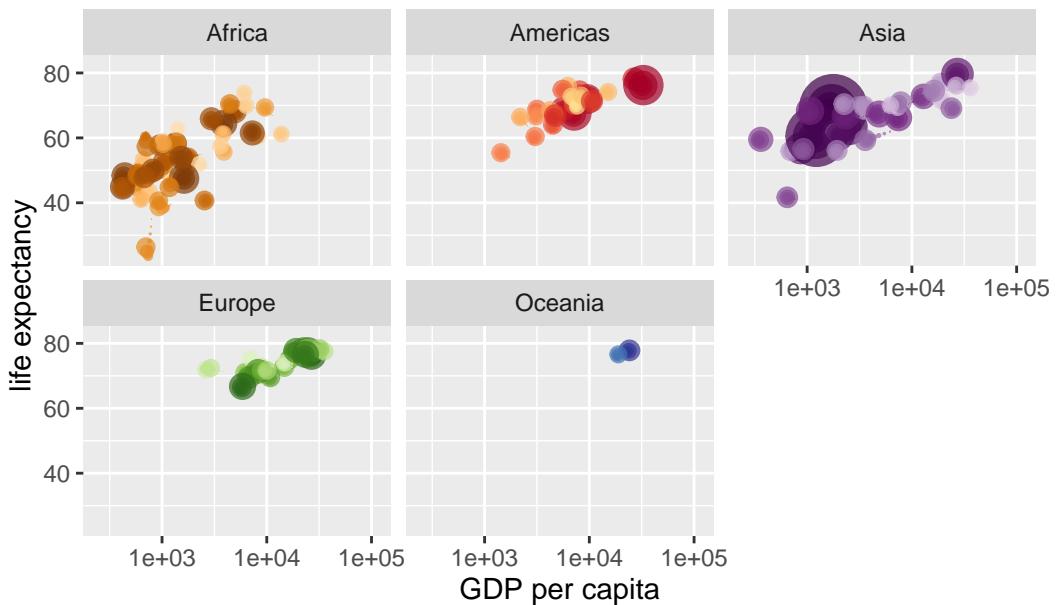
Year: 1992



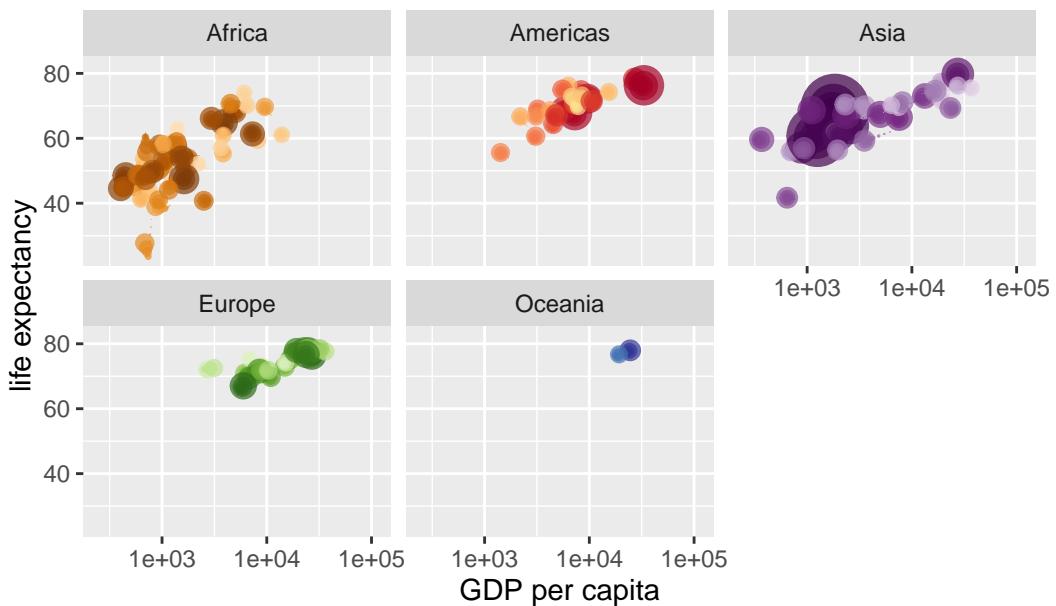
Year: 1993



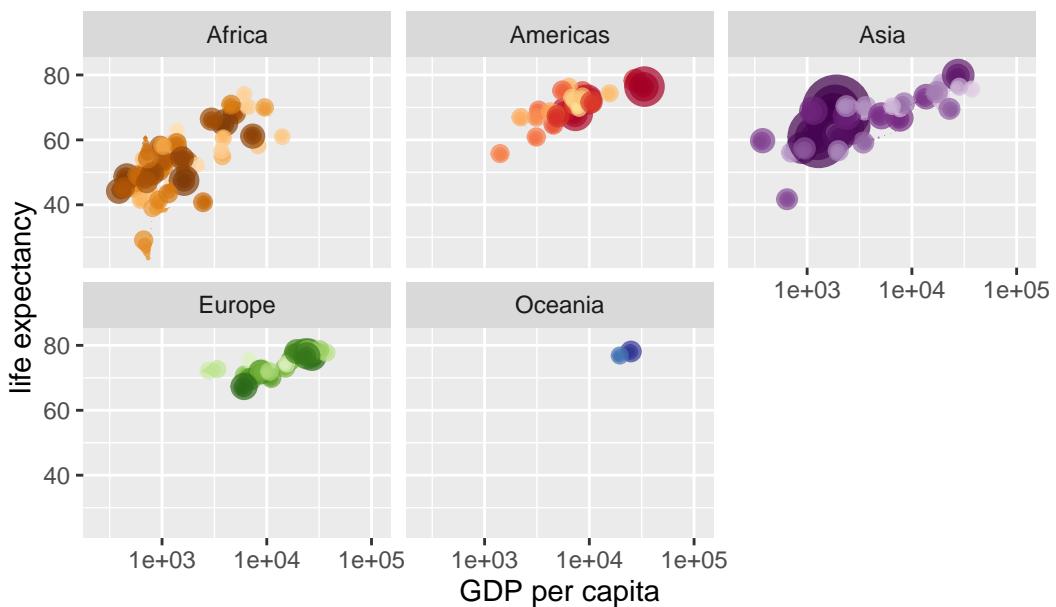
Year: 1993



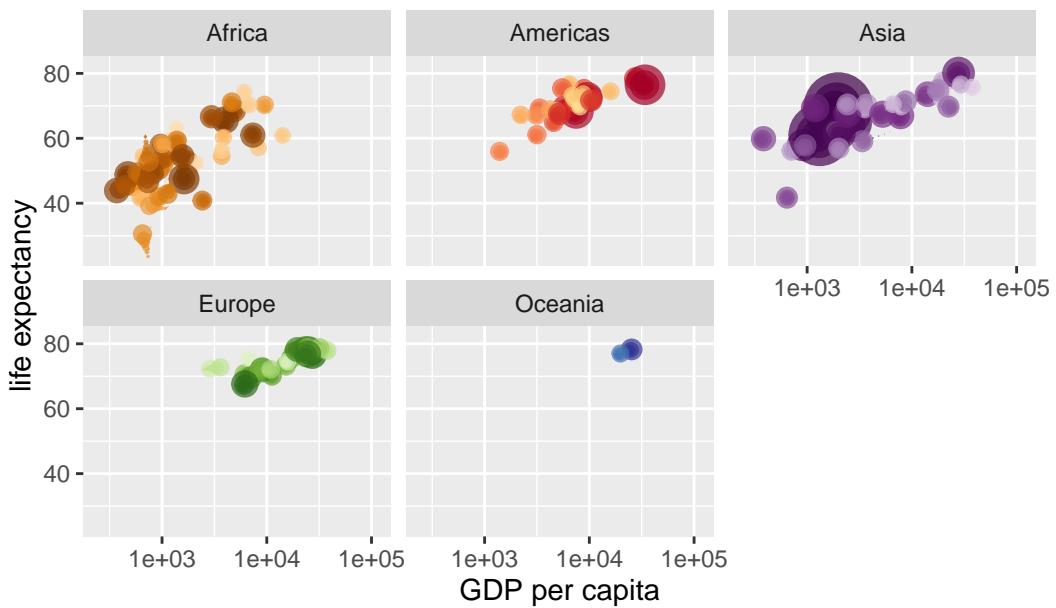
Year: 1994



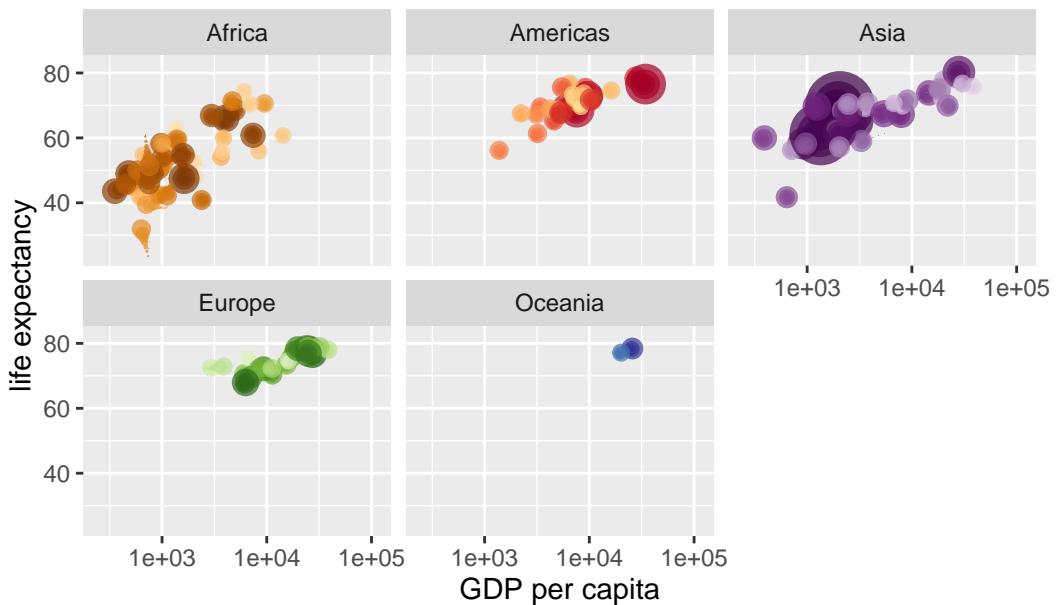
Year: 1994



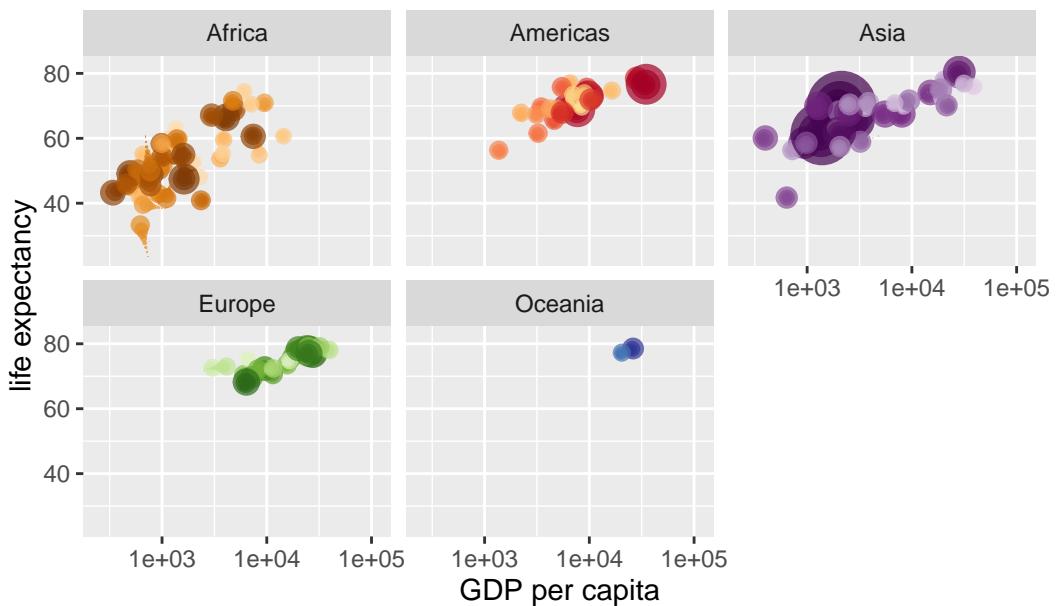
Year: 1995



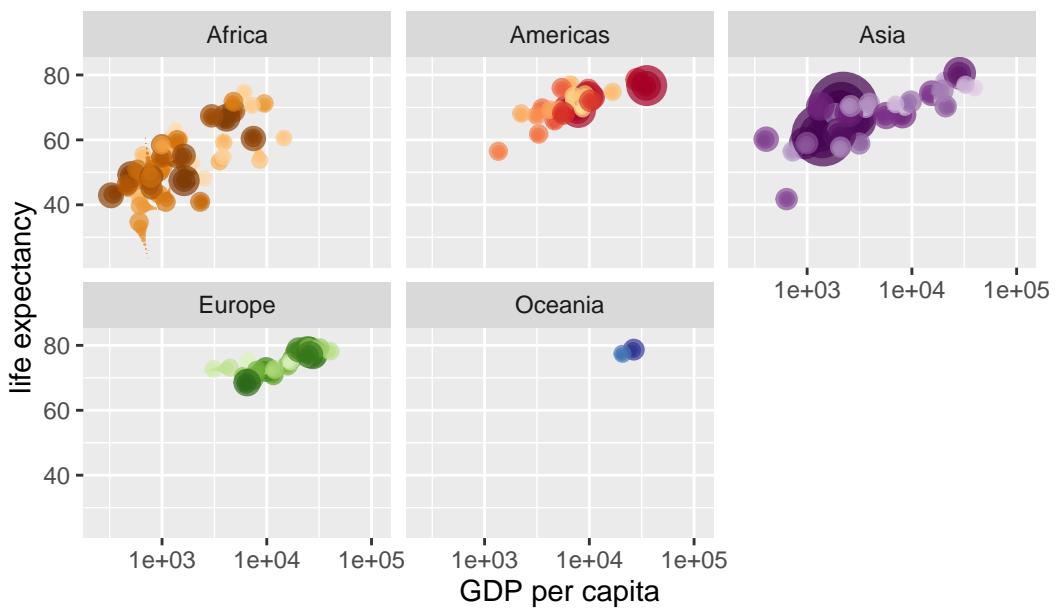
Year: 1995



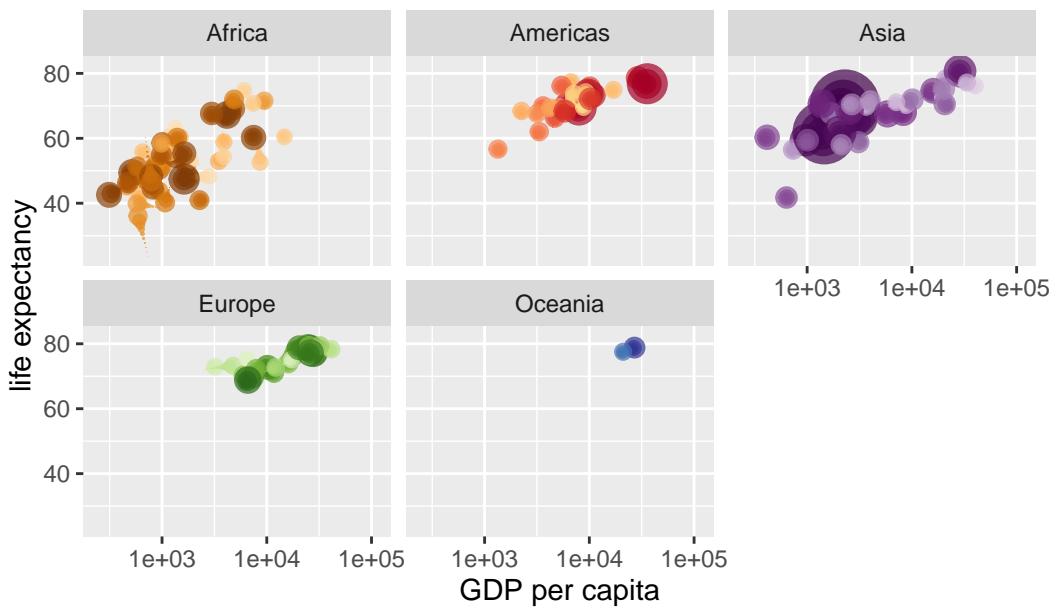
Year: 1996



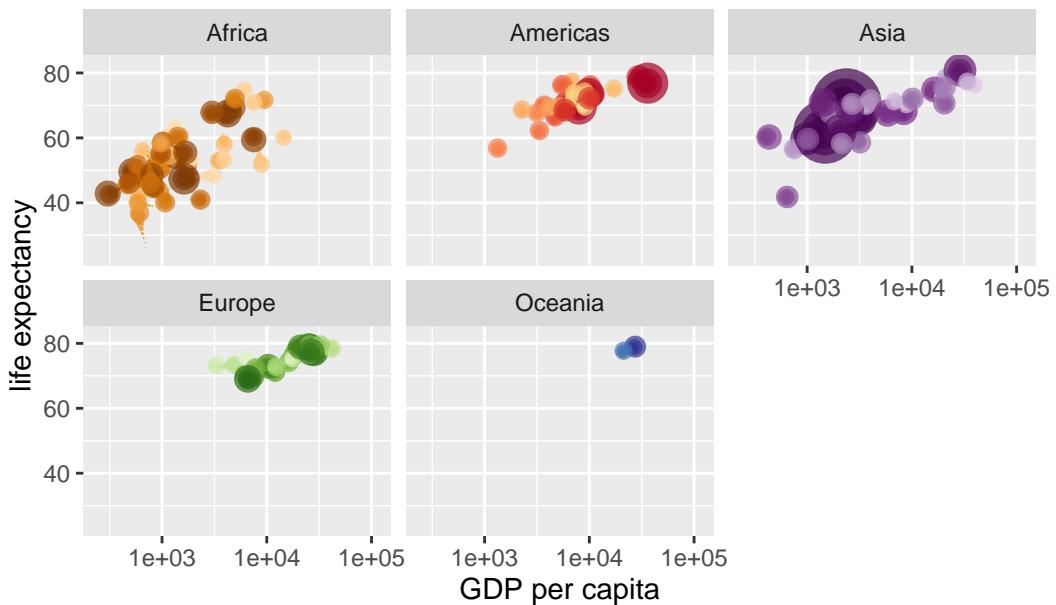
Year: 1996



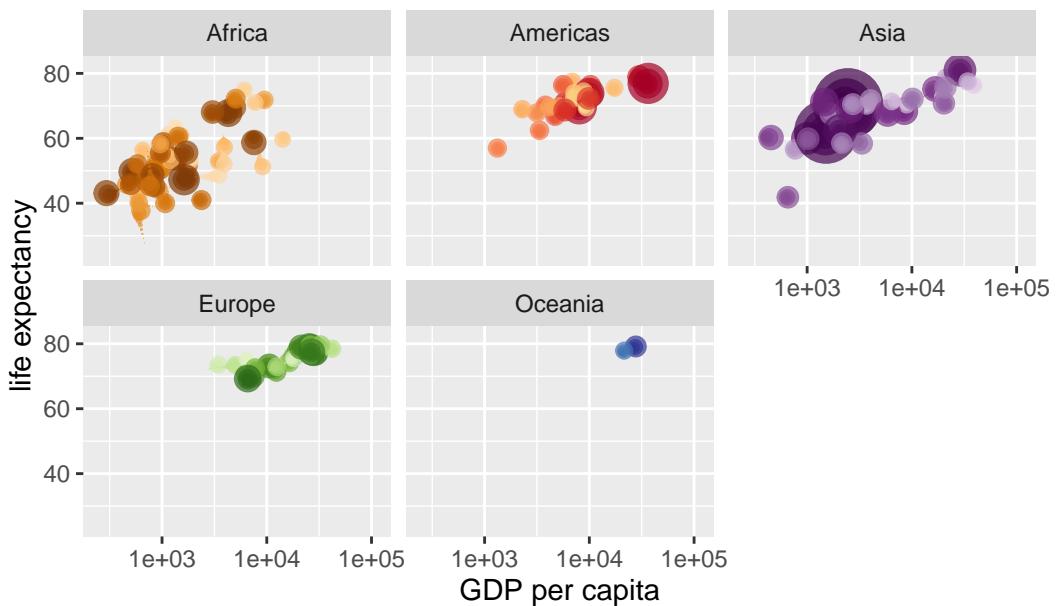
Year: 1997



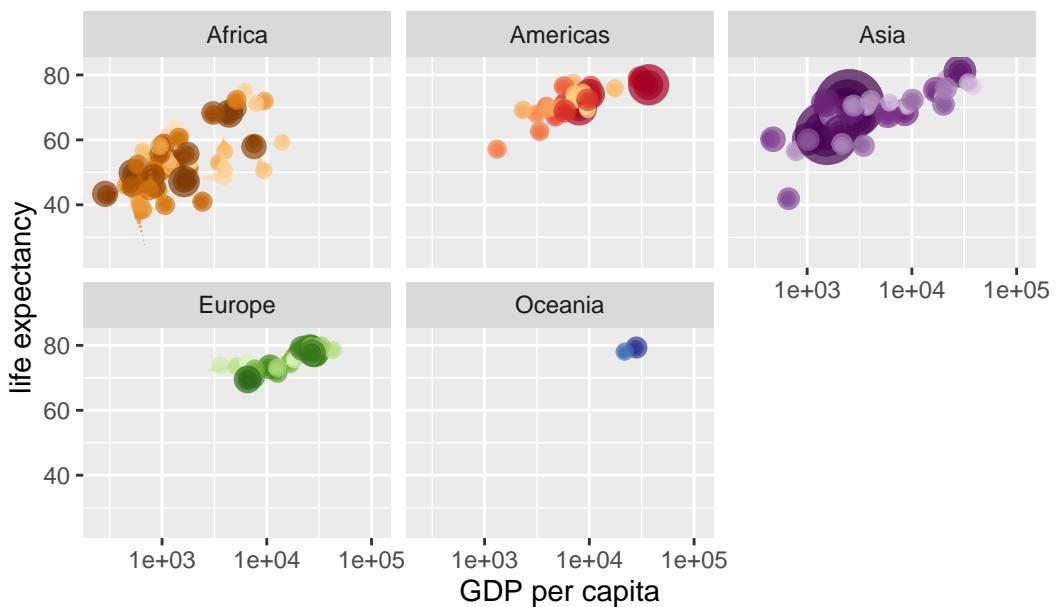
Year: 1998



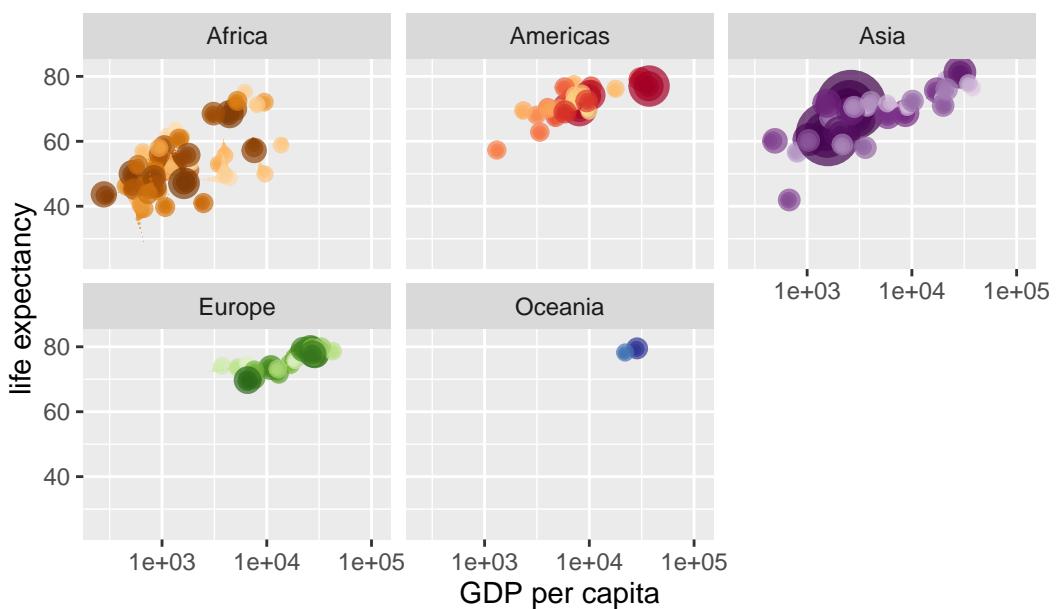
Year: 1998



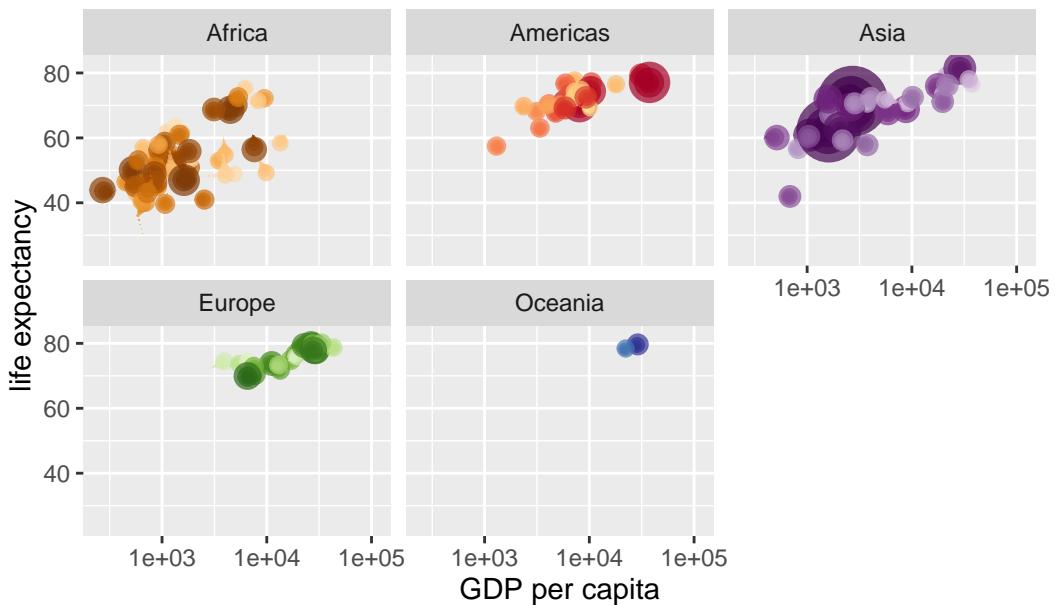
Year: 1999



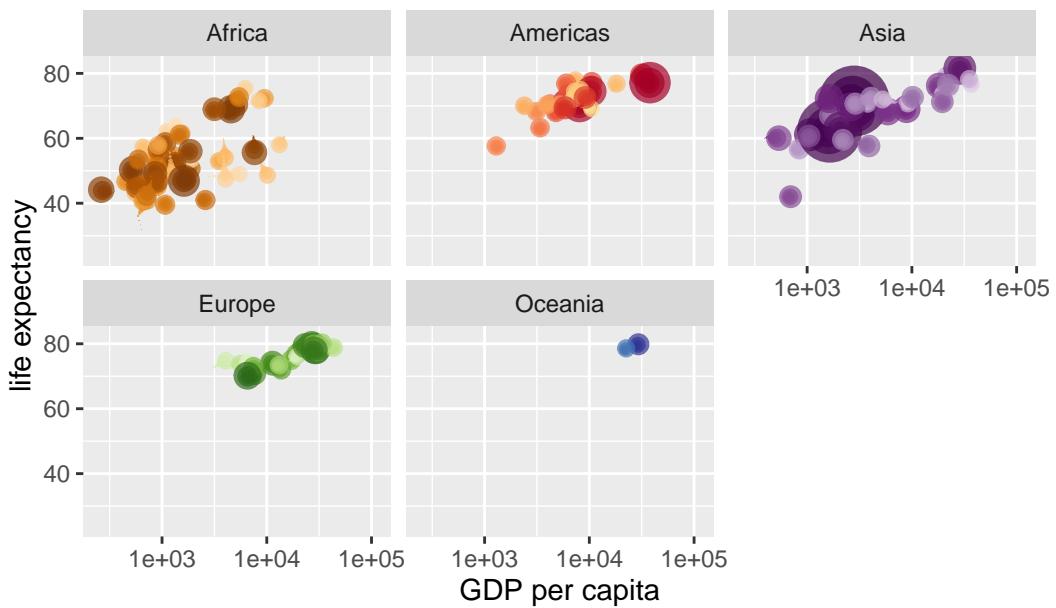
Year: 1999



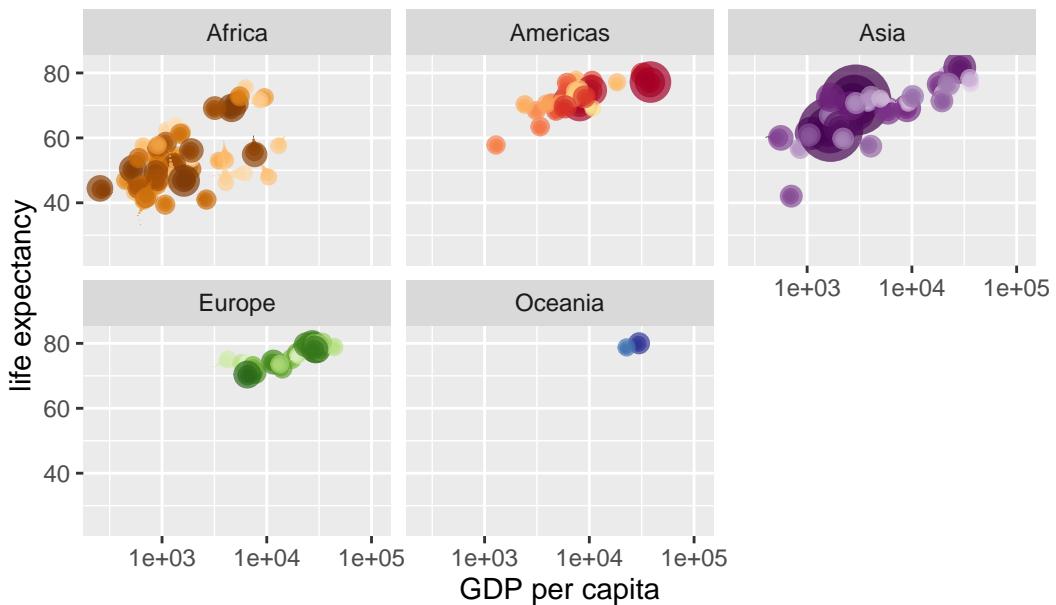
Year: 2000



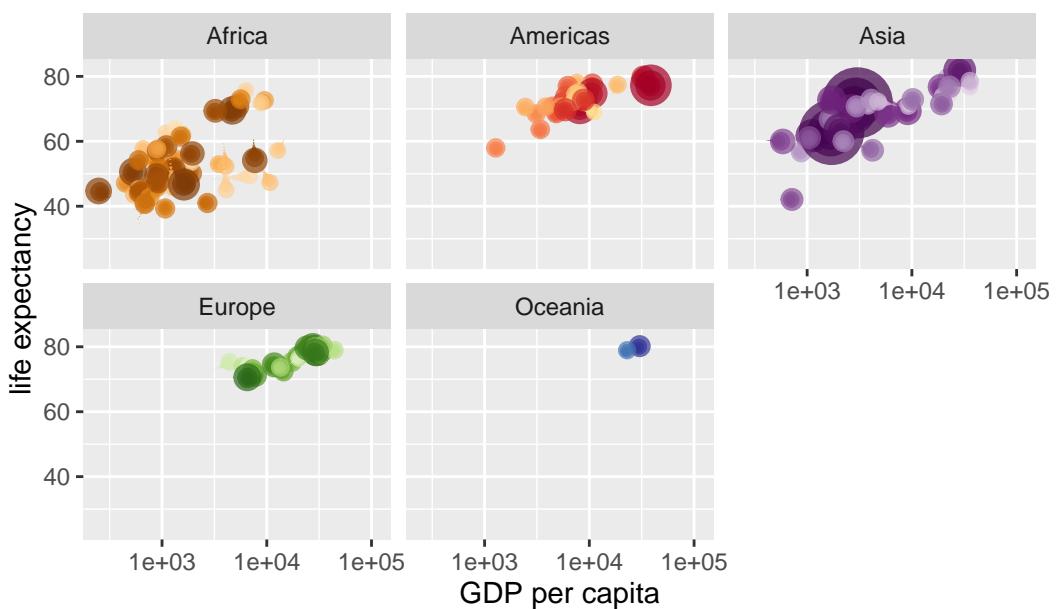
Year: 2000



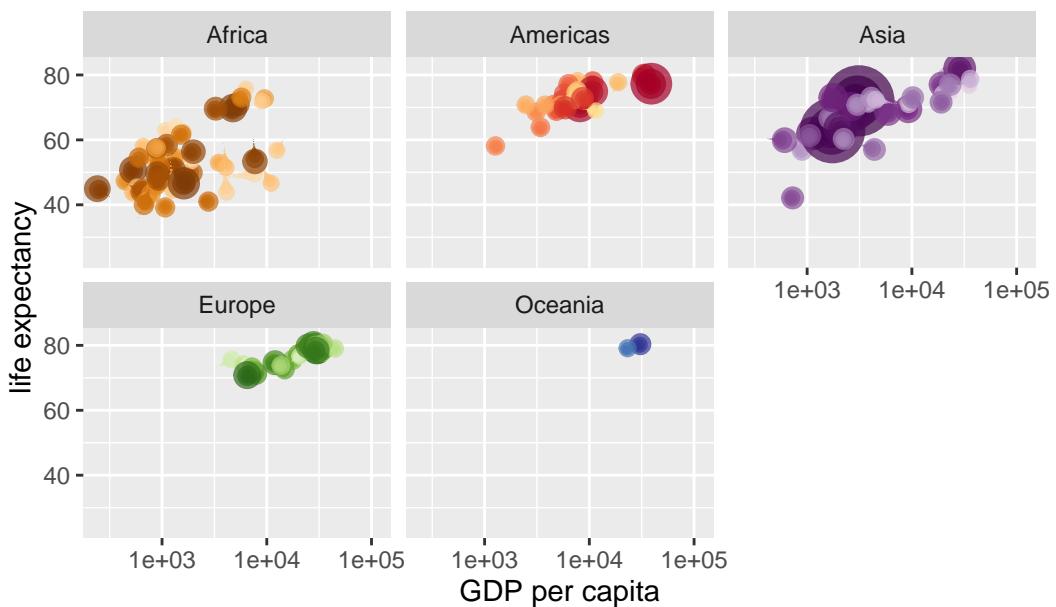
Year: 2001



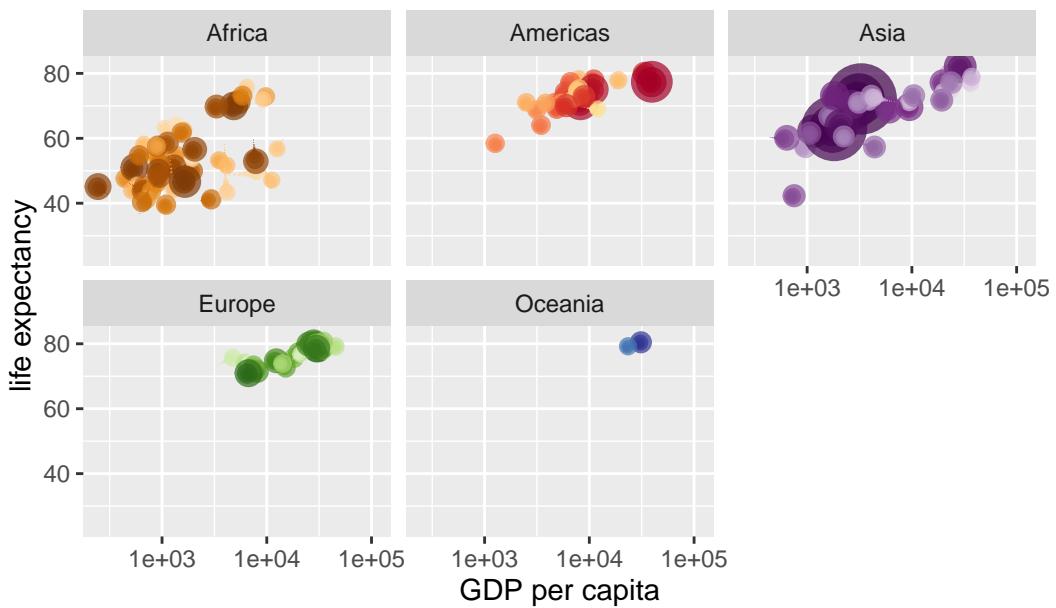
Year: 2001



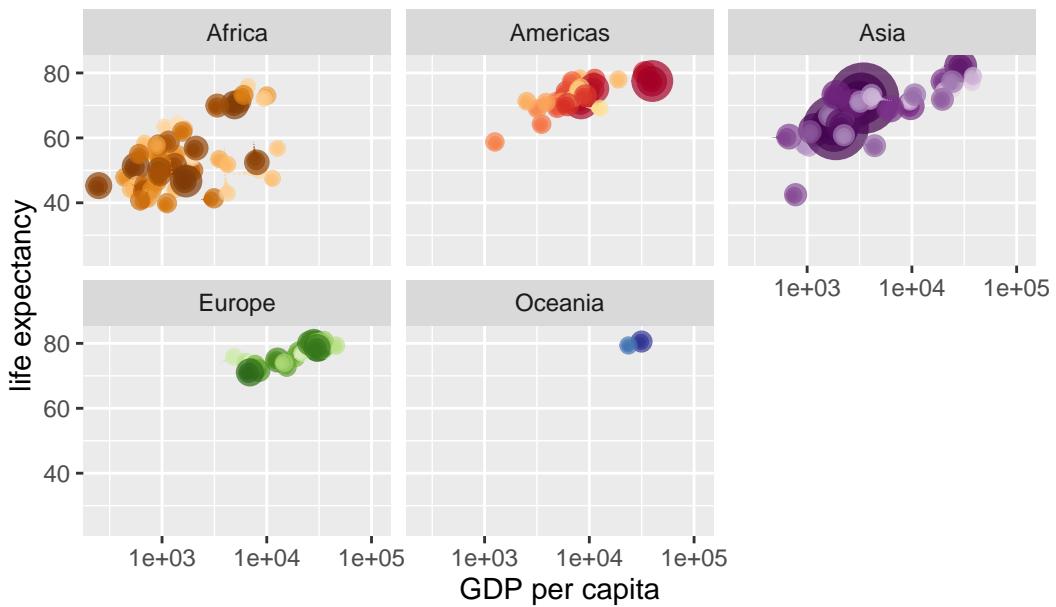
Year: 2002



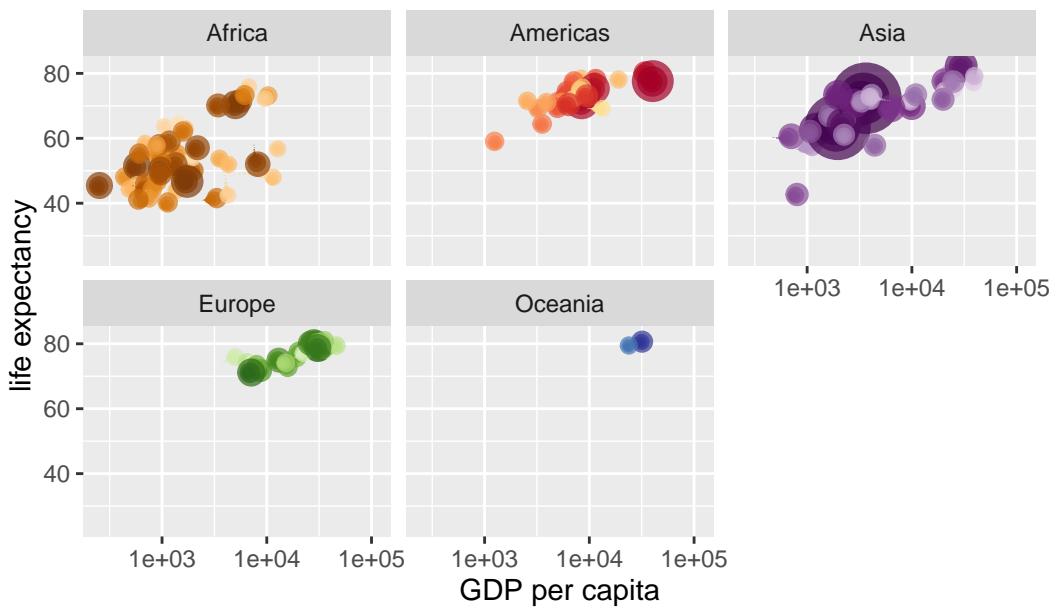
Year: 2003



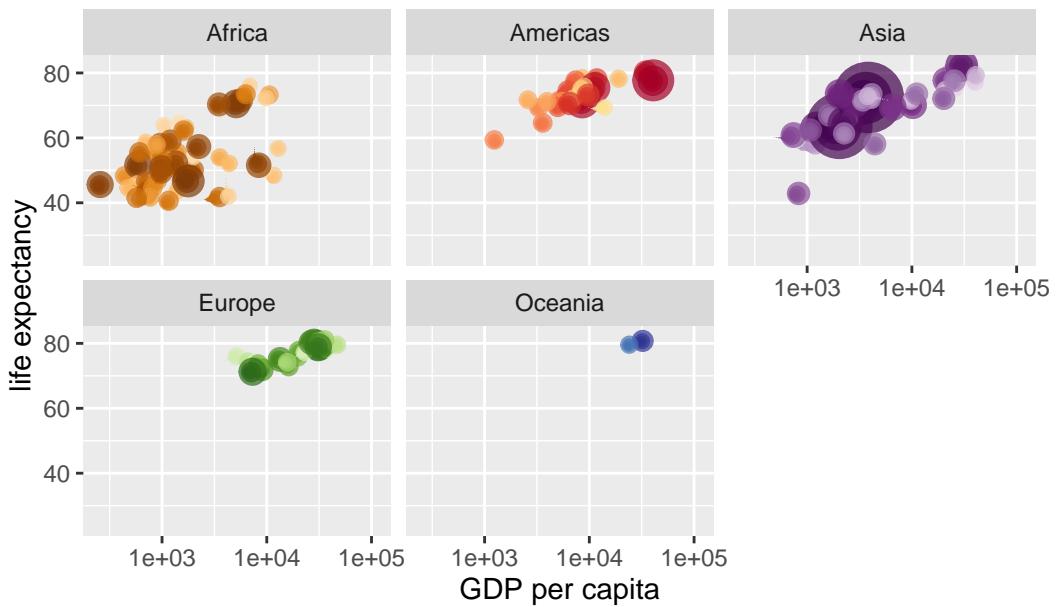
Year: 2003



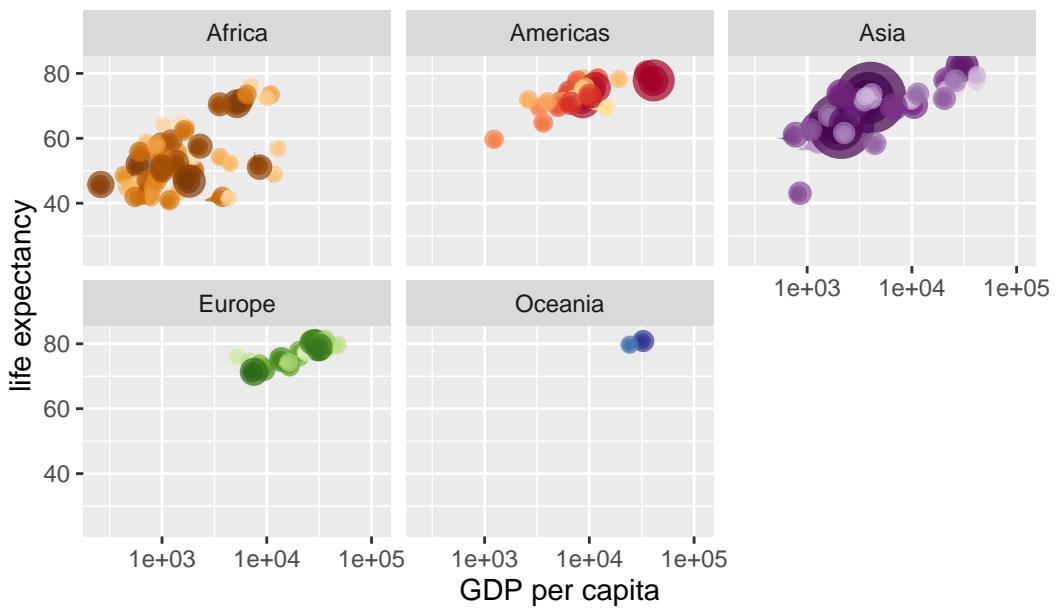
Year: 2004



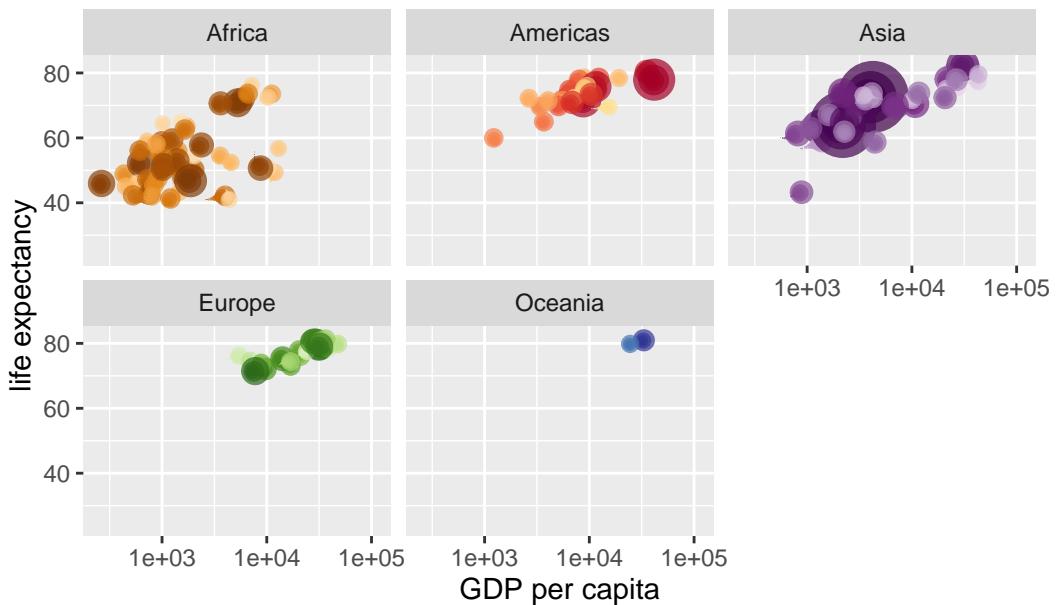
Year: 2004



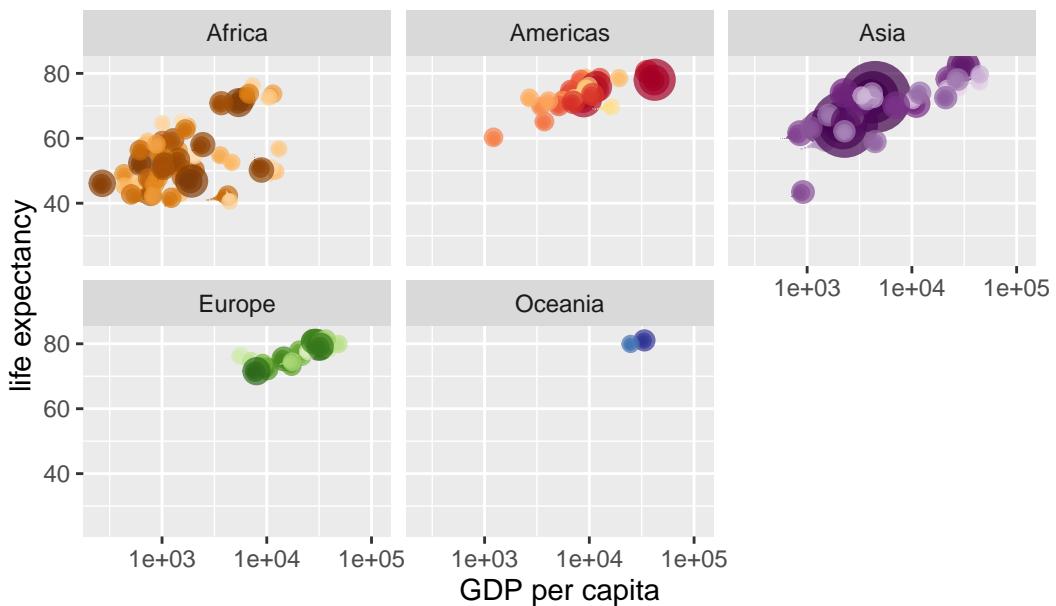
Year: 2005



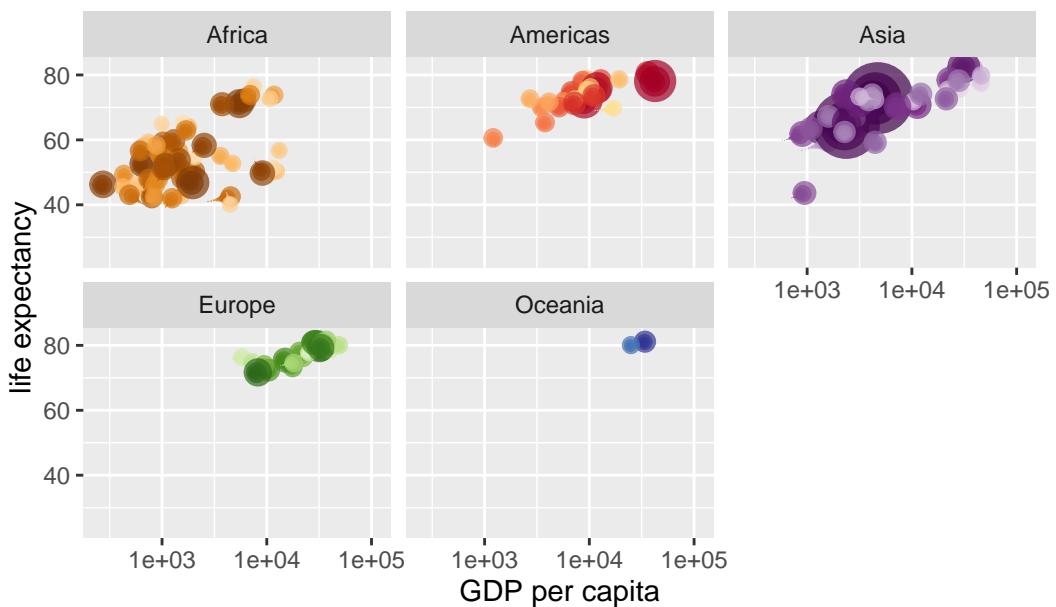
Year: 2005



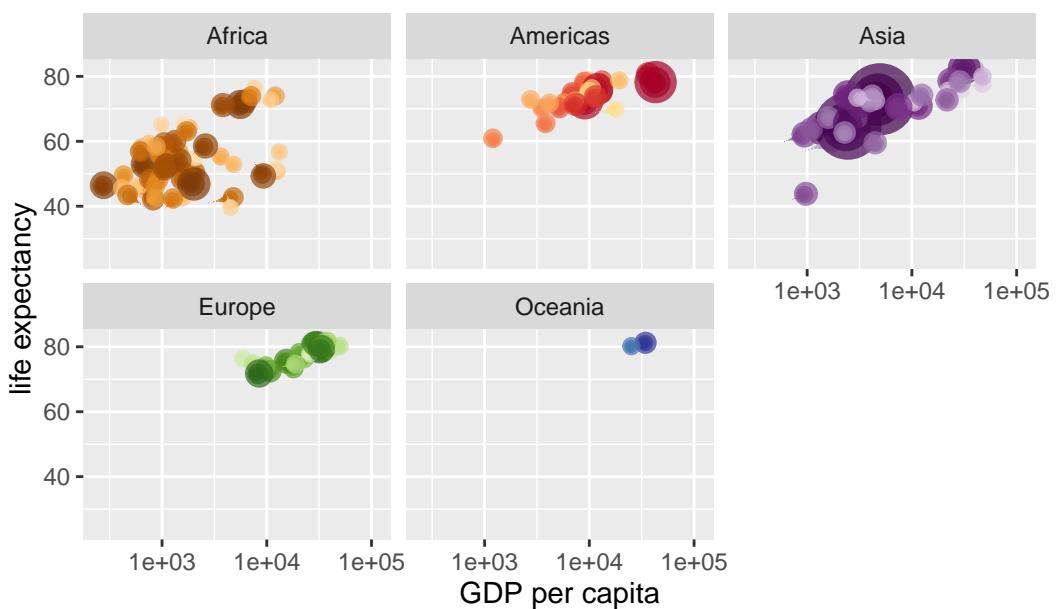
Year: 2006



Year: 2006



Year: 2007



```

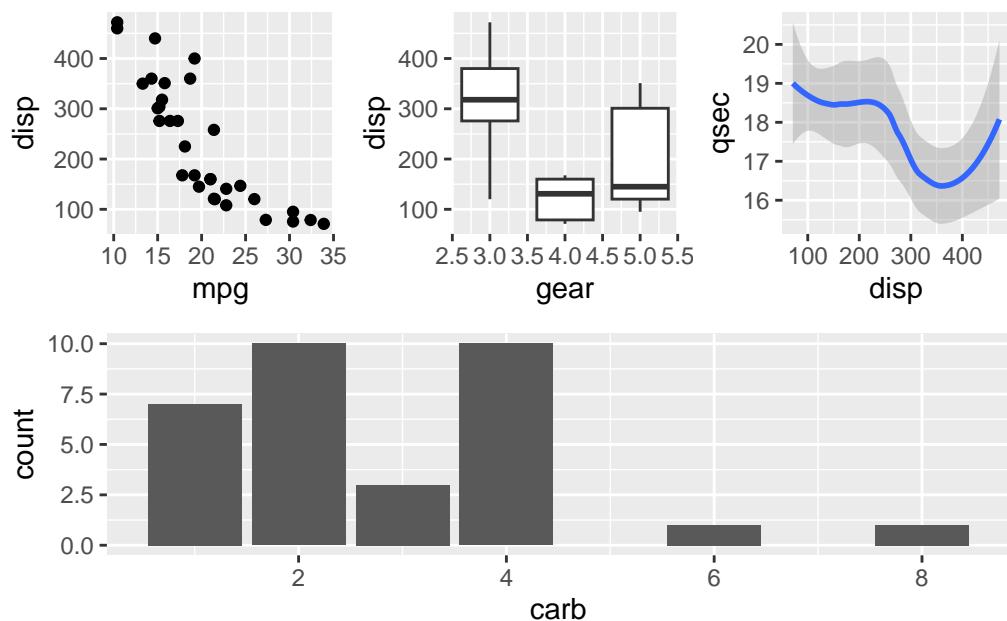
library(patchwork)

p1 <- ggplot(mtcars) + geom_point(aes(mpg, disp))
p2 <- ggplot(mtcars) + geom_boxplot(aes(gear, disp, group = gear))
p3 <- ggplot(mtcars) + geom_smooth(aes(disp, qsec))
p4 <- ggplot(mtcars) + geom_bar(aes(carb))

(p1 | p2 | p3) /
  p4

```

``geom_smooth()` using method = 'loess' and formula = 'y ~ x'`



```
sessionInfo()
```

R version 4.3.1 (2023-06-16)  
 Platform: aarch64-apple-darwin20 (64-bit)  
 Running under: macOS Monterey 12.4

Matrix products: default  
 BLAS: /Library/Frameworks/R.framework/Versions/4.3-arm64/Resources/lib/libRblas.0.dylib

```
LAPACK: /Library/Frameworks/R.framework/Versions/4.3-arm64/Resources/lib/libRlapack.dylib; 

locale:
[1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8

time zone: America/Los_Angeles
tzcode source: internal

attached base packages:
[1] stats      graphics   grDevices utils      datasets   methods    base

other attached packages:
[1] patchwork_1.1.3 gganimate_1.0.8 gapminder_1.0.0 dplyr_1.1.3
[5] ggplot2_3.4.4

loaded via a namespace (and not attached):
 [1] Matrix_1.5-4.1     gtable_0.3.4       jsonlite_1.8.7    compiler_4.3.1
 [5] crayon_1.5.2       tidyselect_1.2.0   splines_4.3.1     progress_1.2.2
 [9] scales_1.2.1       yaml_2.3.7        fastmap_1.1.1     lattice_0.21-8
[13] R6_2.5.1           labeling_0.4.3    generics_0.1.3    knitr_1.44
[17] tibble_3.2.1       munsell_0.5.0     pillar_1.9.0      rlang_1.1.1
[21] utf8_1.2.3          stringi_1.7.12   xfun_0.40        cli_3.6.1
[25] mgcv_1.8-42         tweenr_2.0.2     withr_2.5.1      magrittr_2.0.3
[29] digest_0.6.33       grid_4.3.1        hms_1.1.3        nlme_3.1-162
[33] lifecycle_1.0.3     prettyunits_1.2.0 vctrs_0.6.3      evaluate_0.22
[37] glue_1.6.2           farver_2.1.1     gifski_1.12.0-2 fansi_1.0.5
[41] colorspace_2.1-0    rmarkdown_2.25   tools_4.3.1      pkgconfig_2.0.3
[45] htmltools_0.5.6.1
```