

# class 05

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## Quarto

Quarto enables you to weave together content and executable code into a finished document.  
To learn more about Quarto see <https://quarto.org>.

```
##Using GGPlot
```

The ggplot package needs to be installed as it does not come in with R “out of the box”

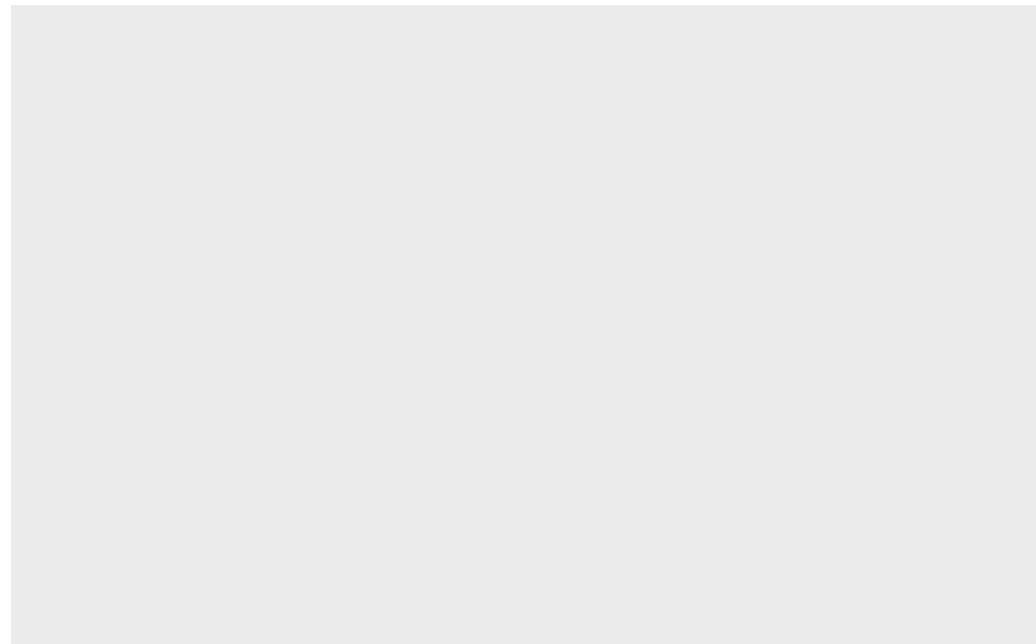
We use the ‘install.package()’ function to do this. head() only show the first 6 rows can use for large data sets.

```
head(cars)
```

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

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

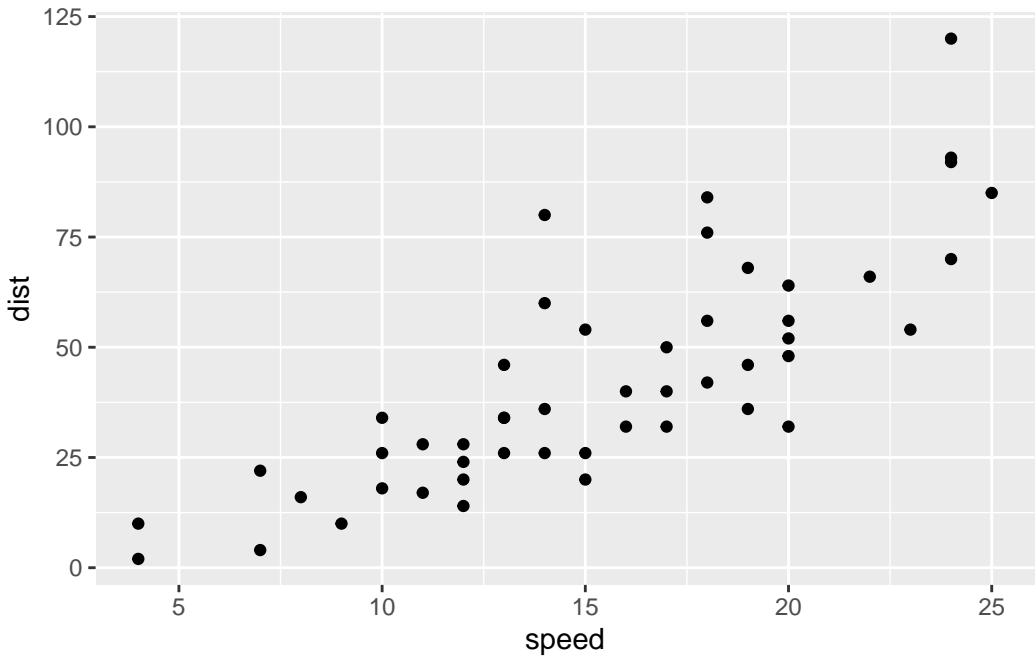
```
library(ggplot2)
ggplot()
```



All ggplot figures have at least 3 things:

- data (the stuff we want to plot)
- aesthetic mapping (aes values)
- geoms

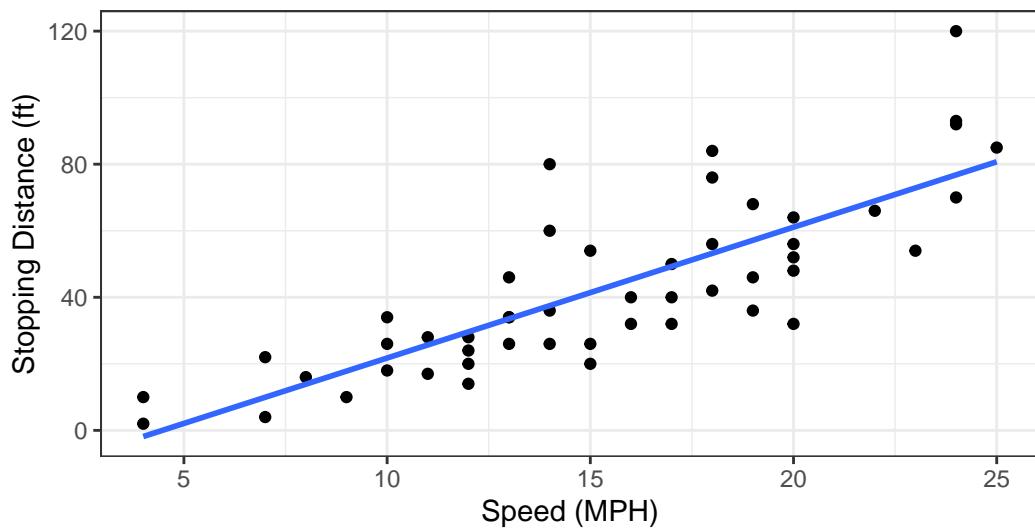
```
ggplot(cars)+  
  aes(x=speed, y=dist)+  
  geom_point()
```



```
ggplot(cars) +  
  aes(x=speed, y=dist) +  
  geom_point() +  
  labs(title="Speed and Stopping Distances of Cars",  
       x="Speed (MPH)",  
       y="Stopping Distance (ft)",  
       subtitle = "Your informative subtitle text here",  
       caption="Dataset: 'cars'") +  
  geom_smooth(method="lm", se=FALSE) +  
  theme_bw()  
  
`geom_smooth()` using formula = 'y ~ x'
```

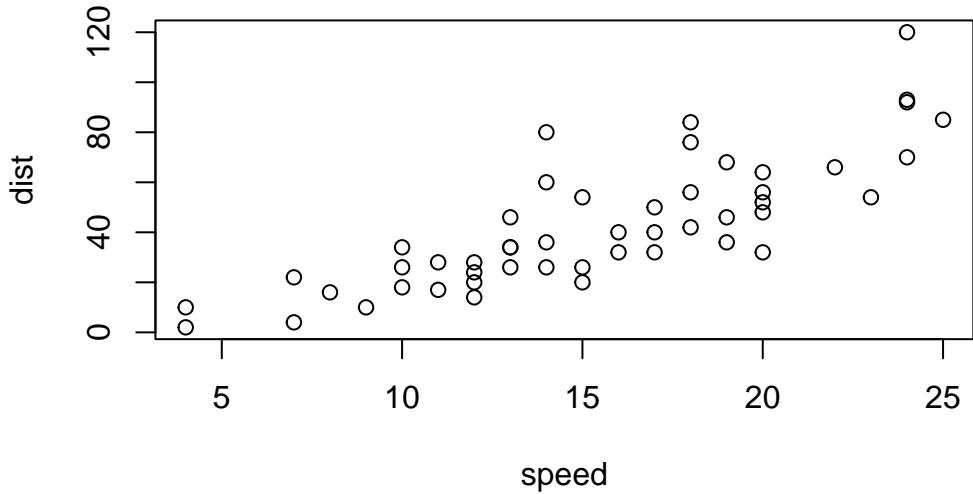
## Speed and Stopping Distances of Cars

Your informative subtitle text here



Dataset: 'cars'

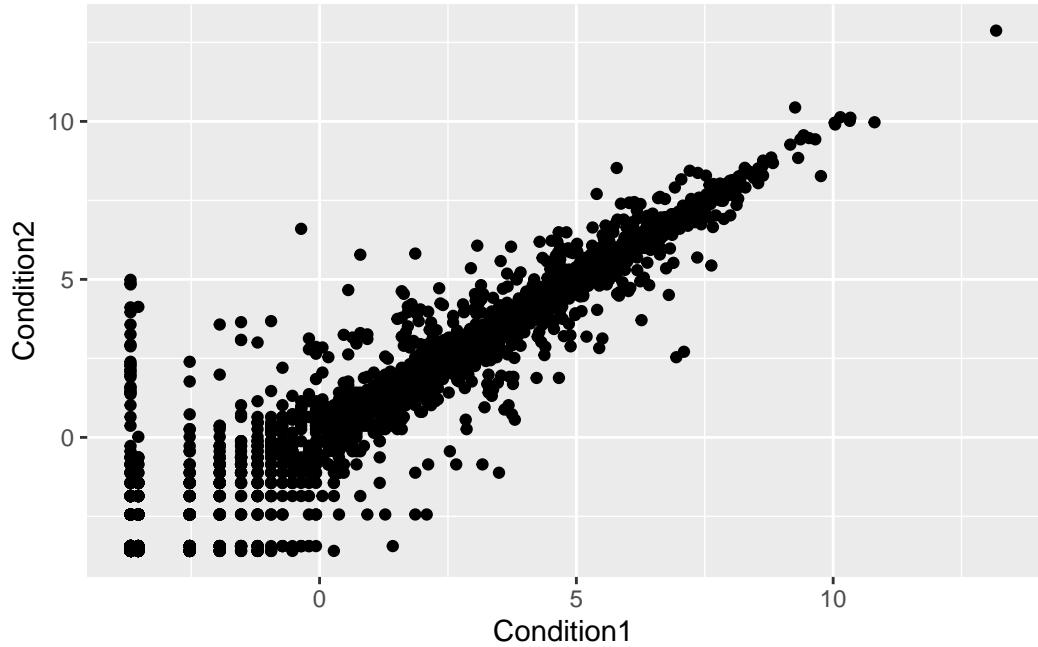
```
plot(cars)
```



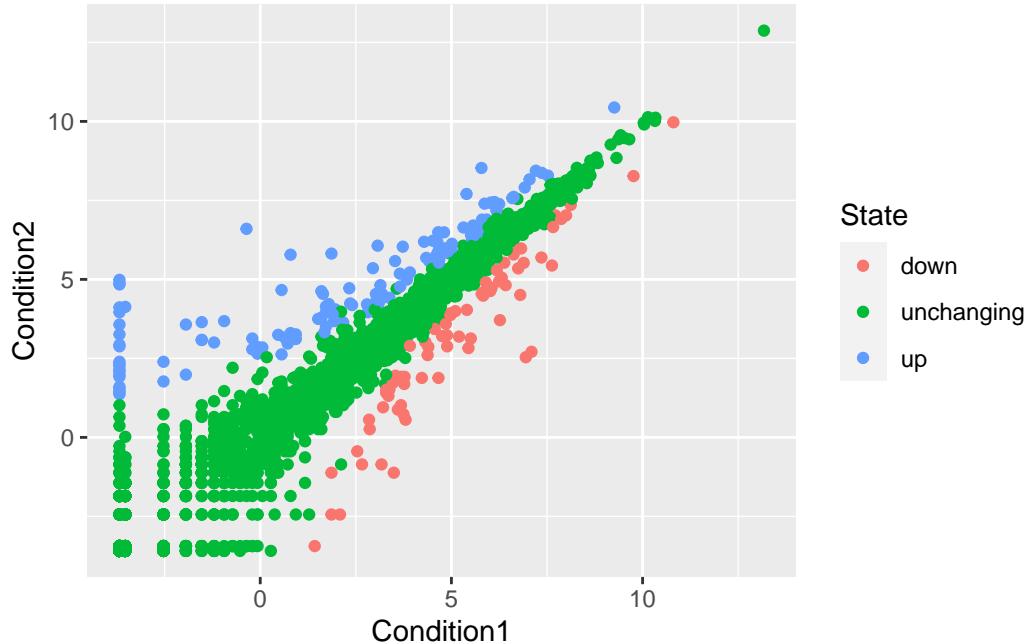
```
url <- "https://bioboot.github.io/bimm143_S20/class-material/up_down_expression.txt"
genes <- read.delim(url)
head(genes)
```

	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

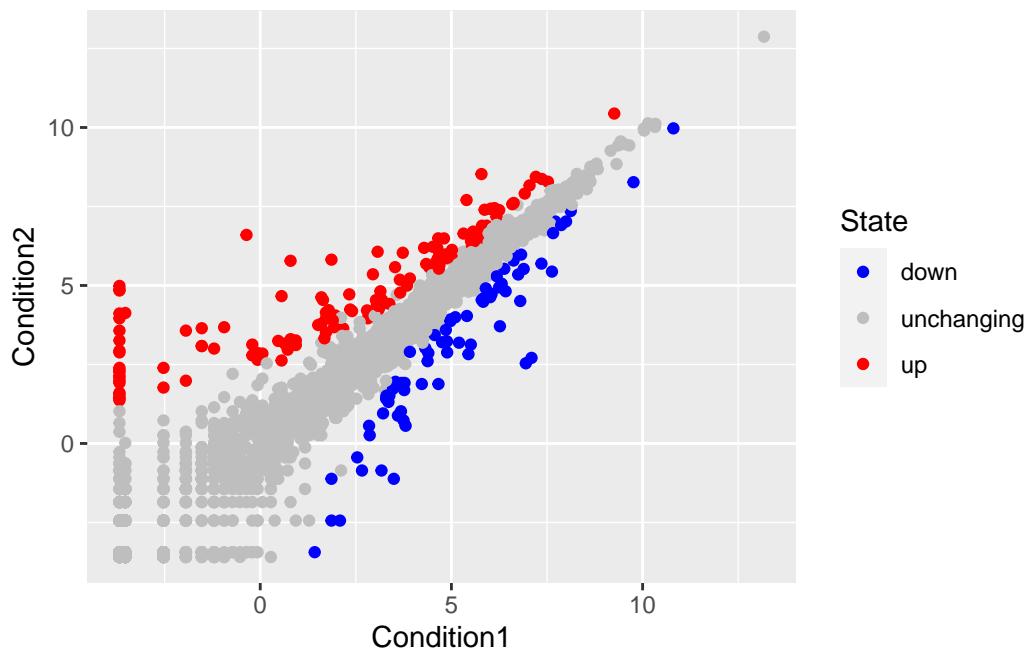
```
ggplot(genes) +
  aes(x=Condition1, y=Condition2) +
  geom_point()
```



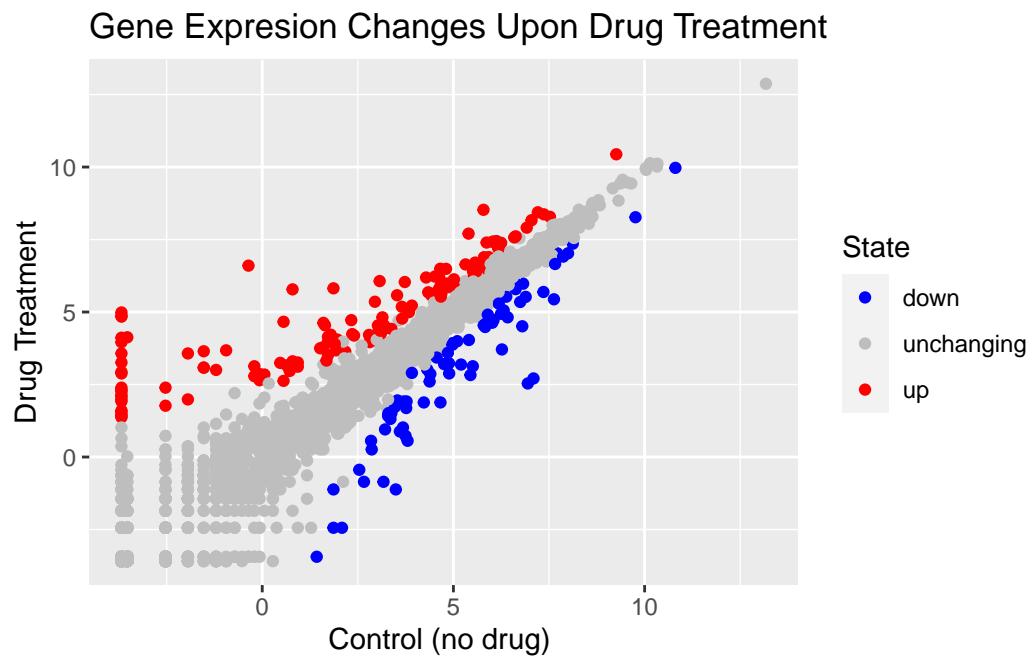
```
p <- ggplot(genes) +  
  aes(x=Condition1, y=Condition2, col=State) +  
  geom_point()  
p
```



```
p + scale_colour_manual( values=c("blue","gray","red") )
```

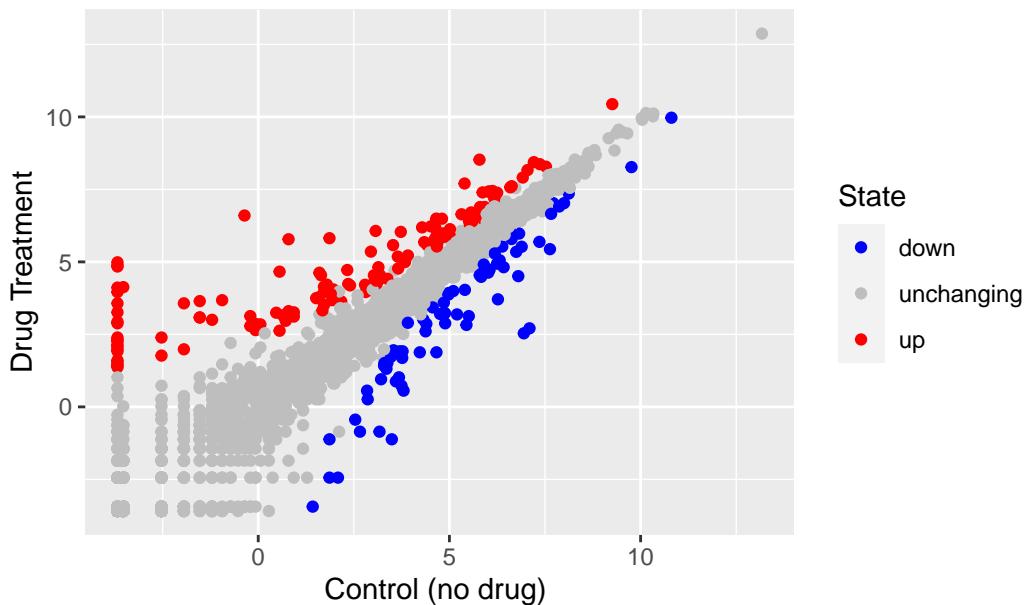


```
p + scale_colour_manual(values=c("blue","gray","red")) +
  labs(title="Gene Expression Changes Upon Drug Treatment",
       x="Control (no drug) ",
       y="Drug Treatment")
```



```
p + scale_colour_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)

# install.packages("dplyr") ## un-comment to install if needed
library(dplyr)
```

Attaching package: 'dplyr'

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

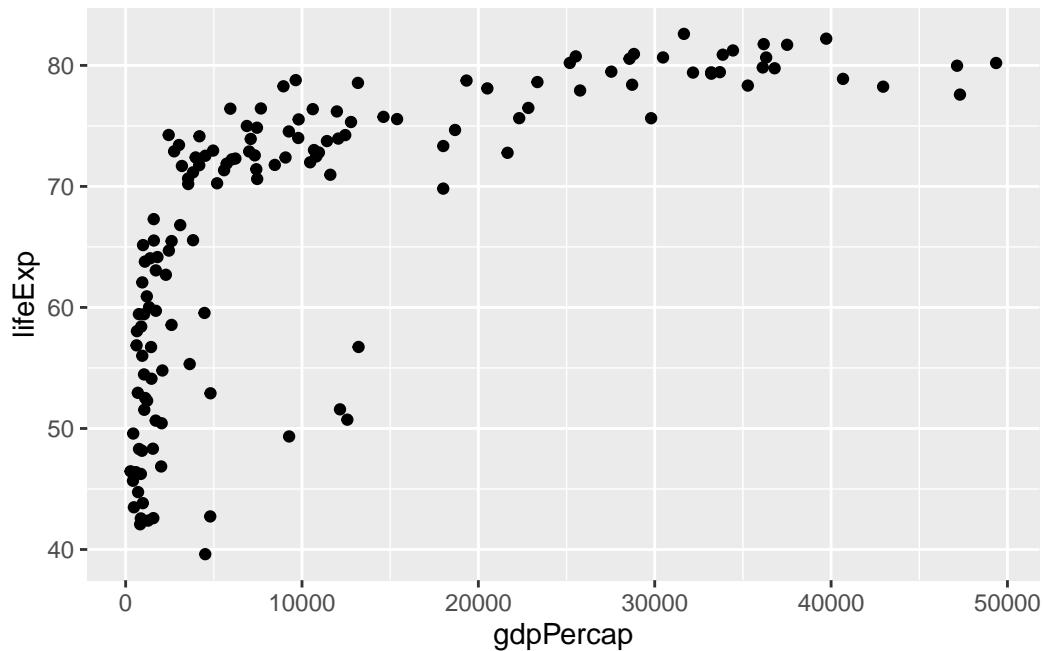
filter, lag

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

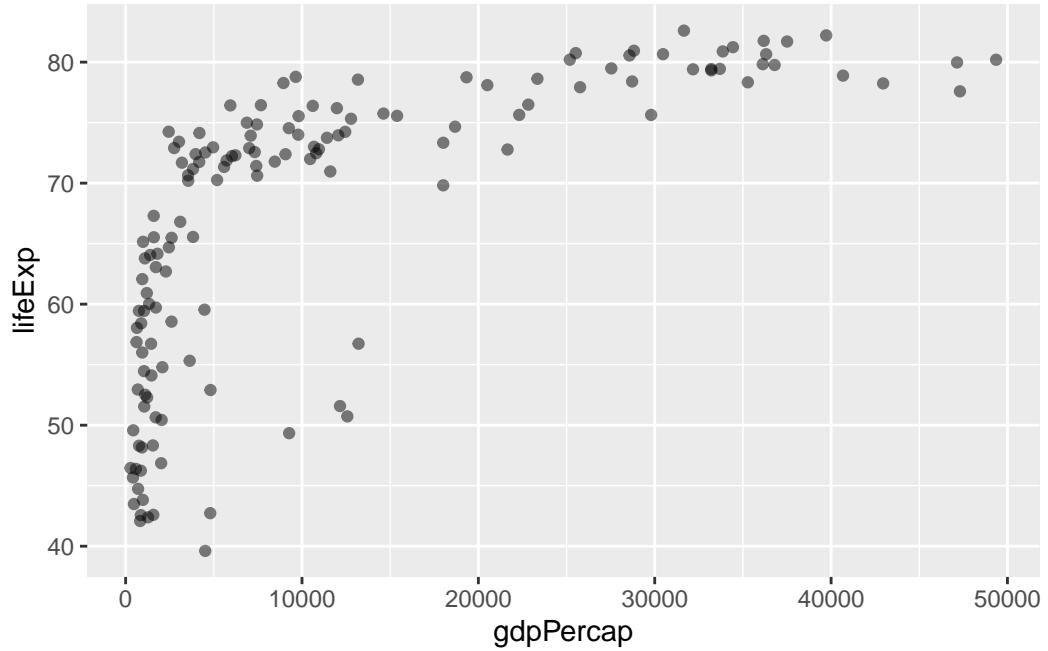
intersect, setdiff, setequal, union

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

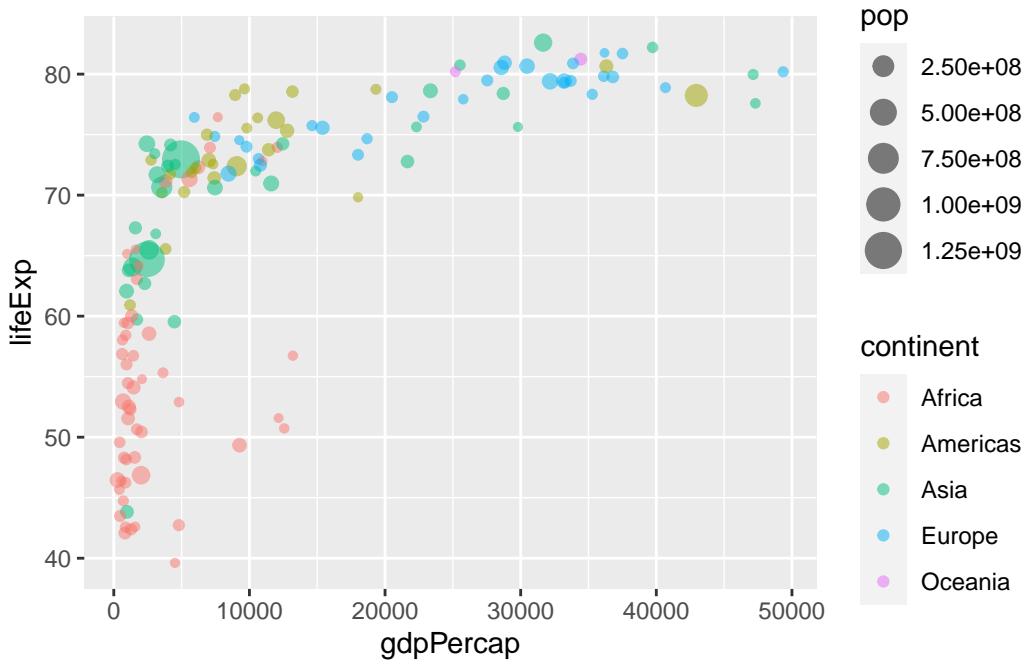
```
ggplot(gapminder_2007) +  
  aes(x=gdpPercap, y=lifeExp) +  
  geom_point()
```



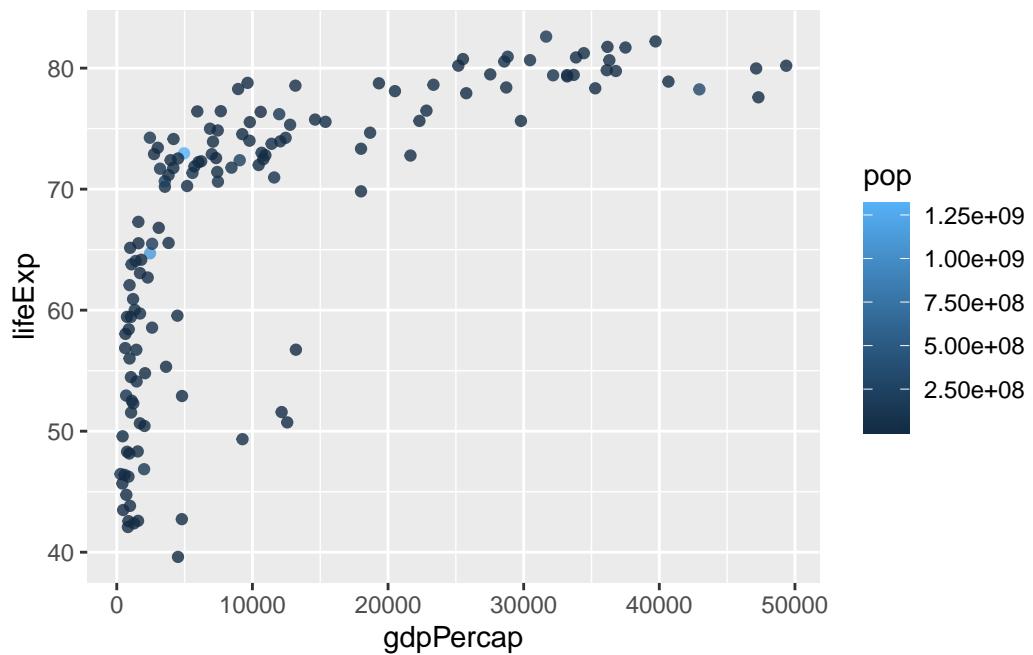
```
ggplot(gapminder_2007) +  
  aes(x=gdpPercap, y=lifeExp) +  
  geom_point(alpha=0.5)
```



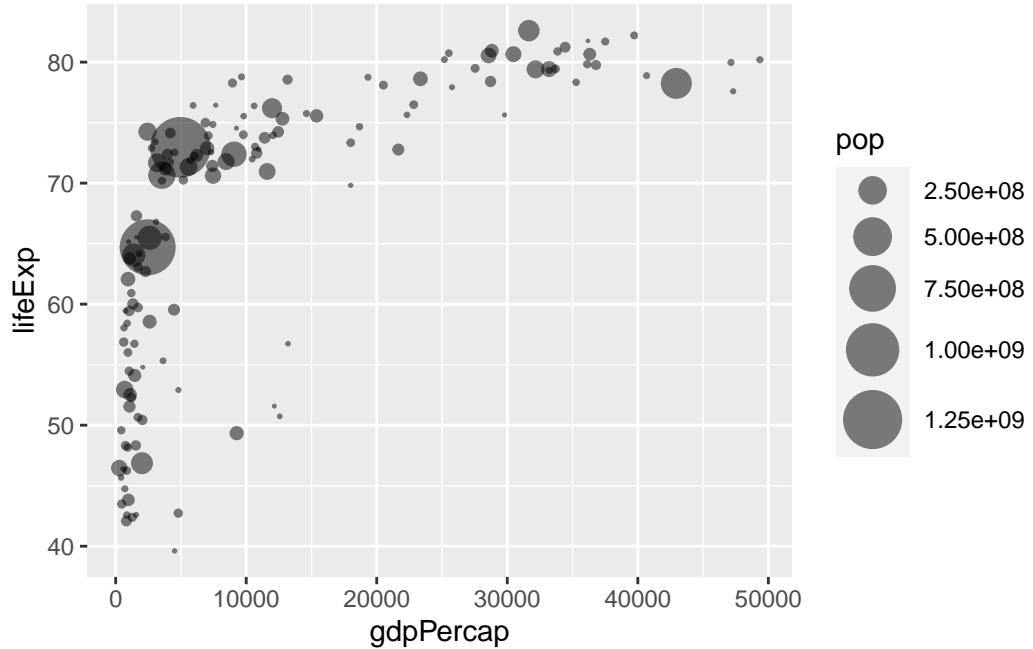
```
ggplot(gapminder_2007) +  
  aes(x=gdpPercap, y=lifeExp, color=continent, size=pop) +  
  geom_point(alpha=0.5)
```



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

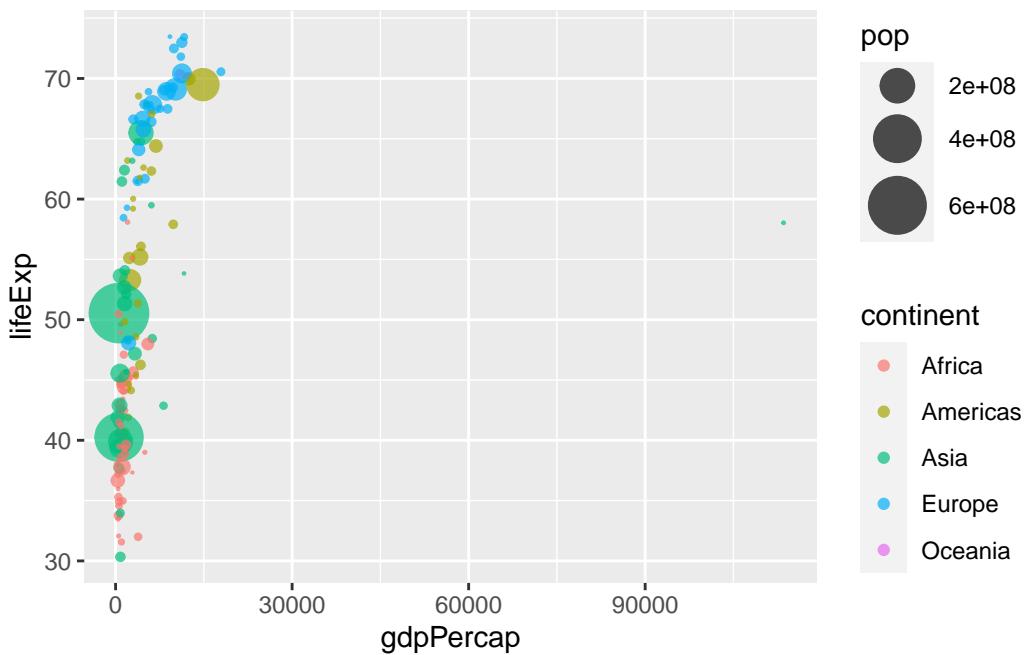


```
ggplot(gapminder_2007) +  
  geom_point(aes(x = gdpPerCap, y = lifeExp,  
                 size = pop), alpha=0.5) +  
  scale_size_area(max_size = 10)
```



```
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 = 10)
```

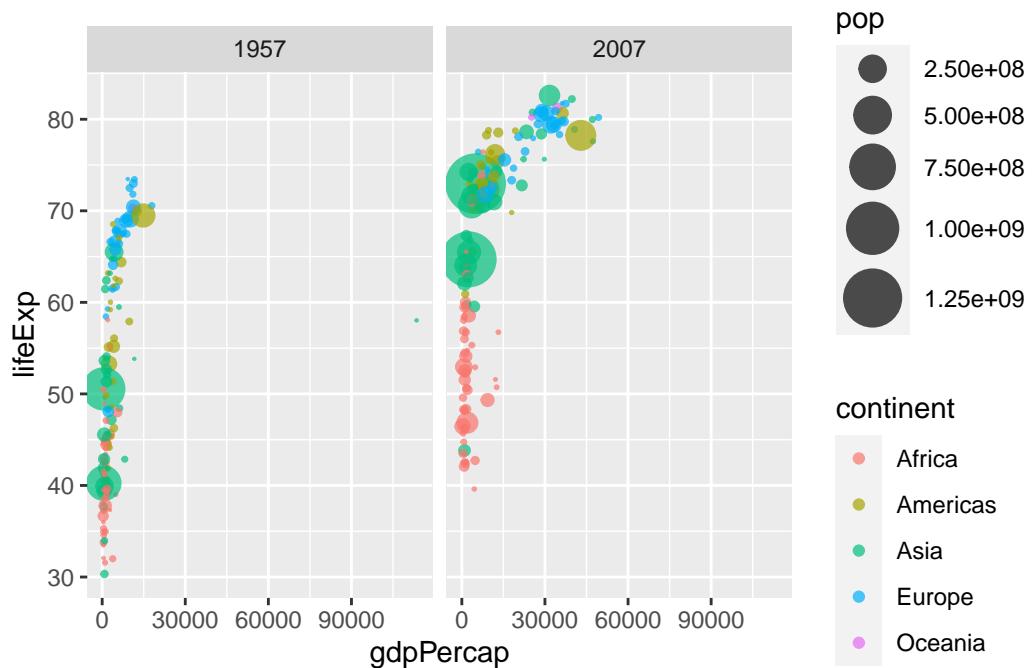


```

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)

```

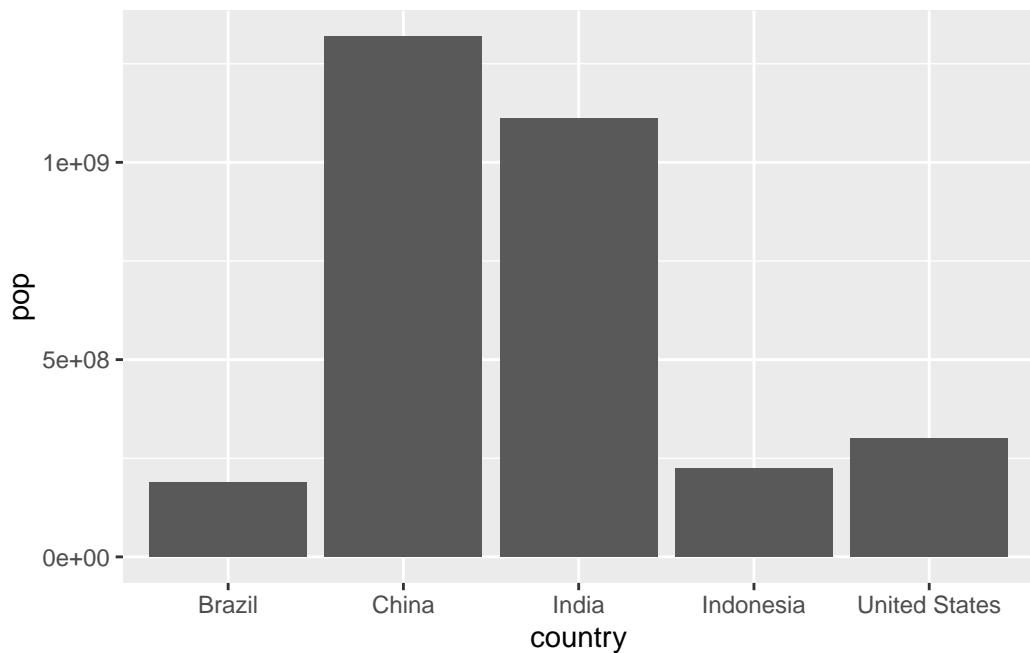


```
gapminder_top5 <- gapminder %>%
  filter(year==2007) %>%
  arrange(desc(pop)) %>%
  top_n(5, pop)
```

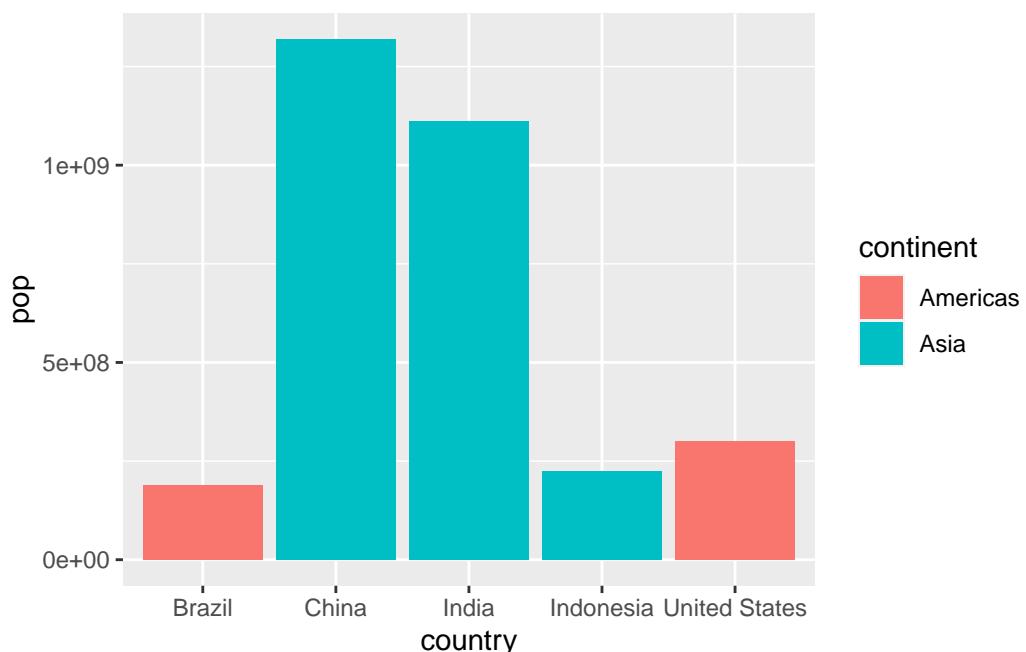
```
gapminder_top5
```

	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

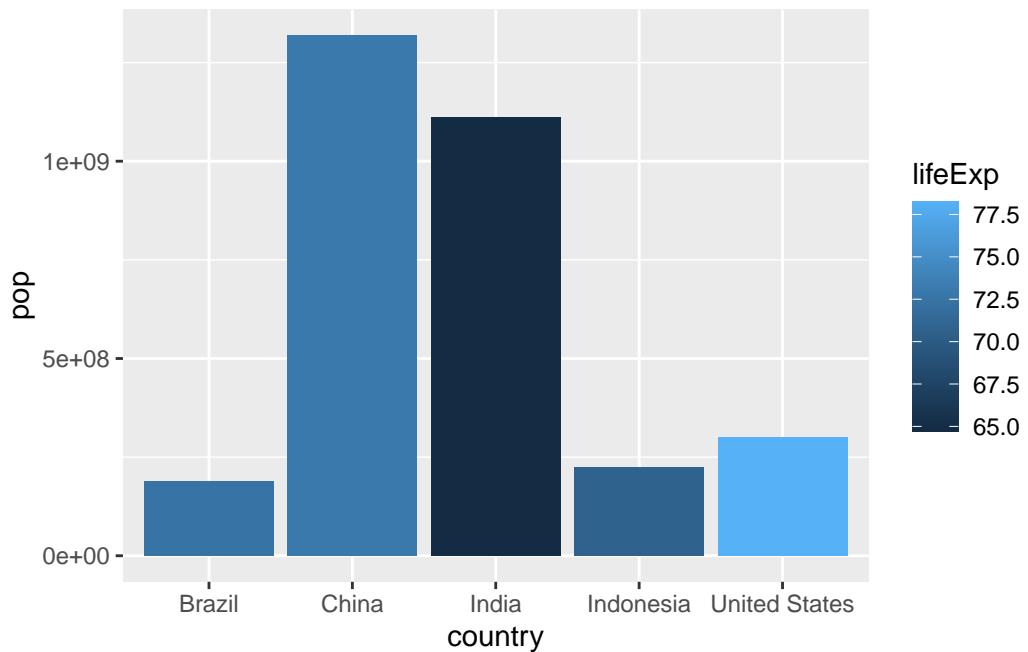
```
ggplot(gapminder_top5) +
  geom_col(aes(x = country, y = pop))
```



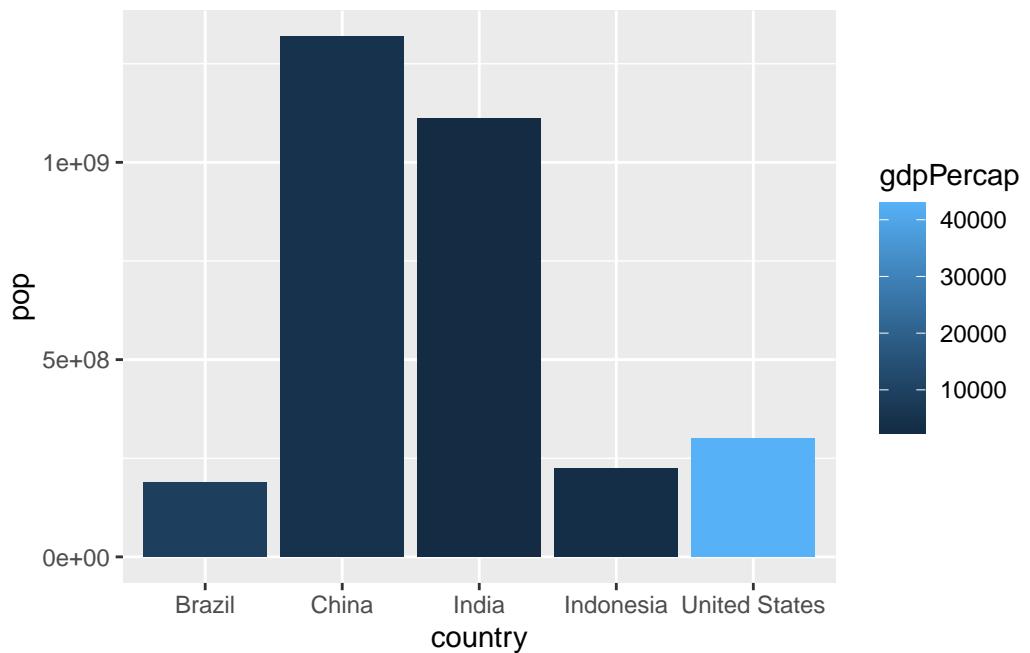
```
ggplot(gapminder_top5) +  
  geom_col(aes(x = country, y = pop, fill = continent))
```



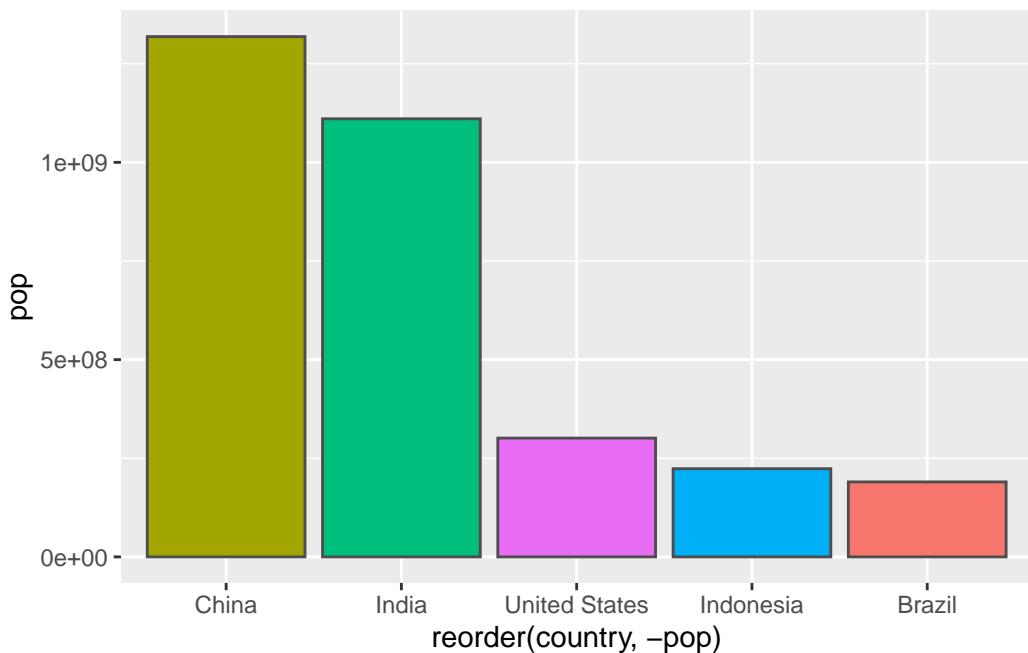
```
ggplot(gapminder_top5) +  
  geom_col(aes(x = country, y = pop, fill = lifeExp))
```



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



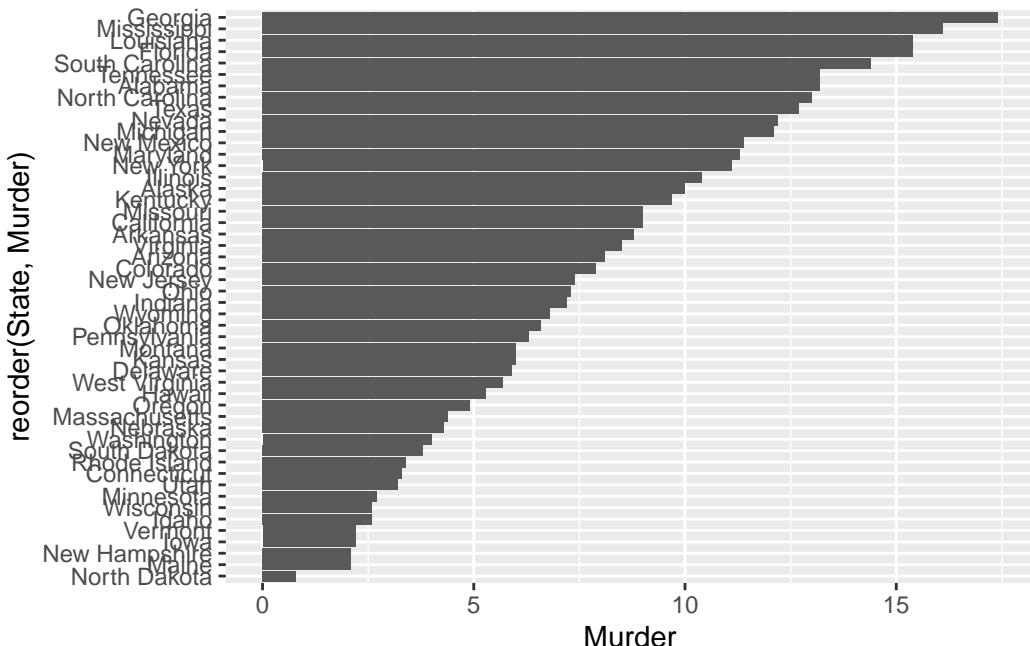
```
ggplot(gapminder_top5) +  
  aes(x=reorder(country, -pop), y=pop, fill=country) +  
  geom_col(col="gray30") +  
  guides(fill="none")
```



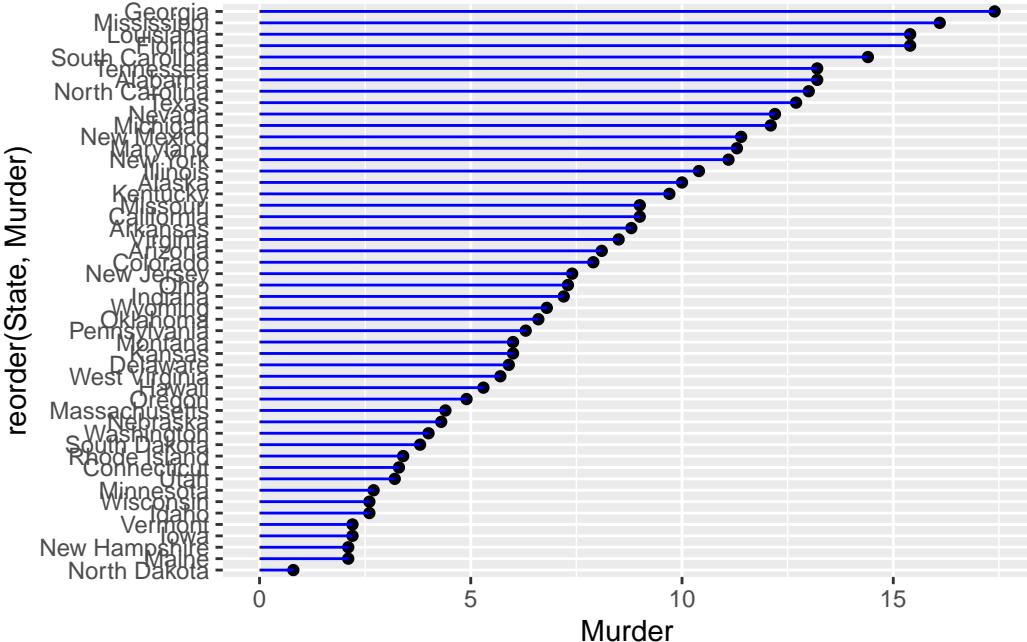
```
head(USArrests)
```

	Murder	Assault	UrbanPop	Rape
Alabama	13.2	236	58	21.2
Alaska	10.0	263	48	44.5
Arizona	8.1	294	80	31.0
Arkansas	8.8	190	50	19.5
California	9.0	276	91	40.6
Colorado	7.9	204	78	38.7

```
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'
```

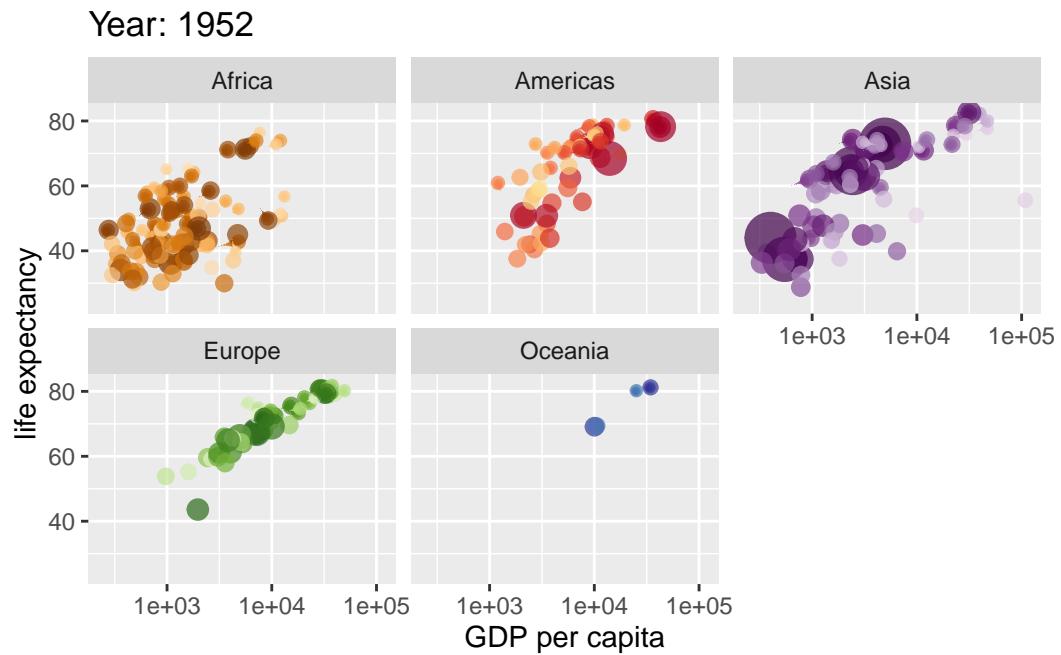
```
The following object is masked _by_ '.GlobalEnv':
```

```
gapminder
```

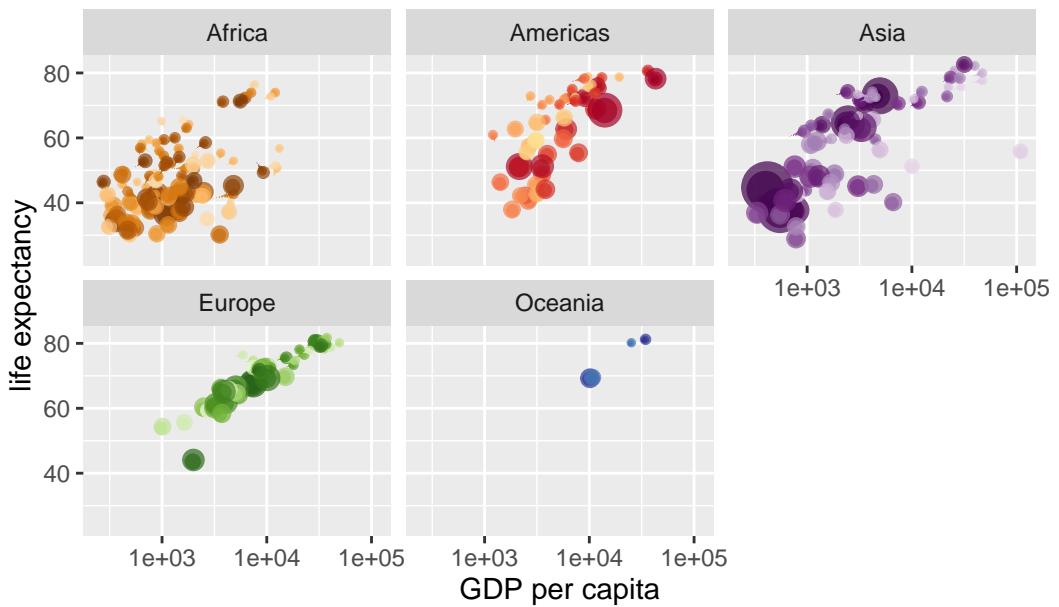
```
library(gganimate)
```

```
# Setup nice regular ggplot of the gapminder data
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
```

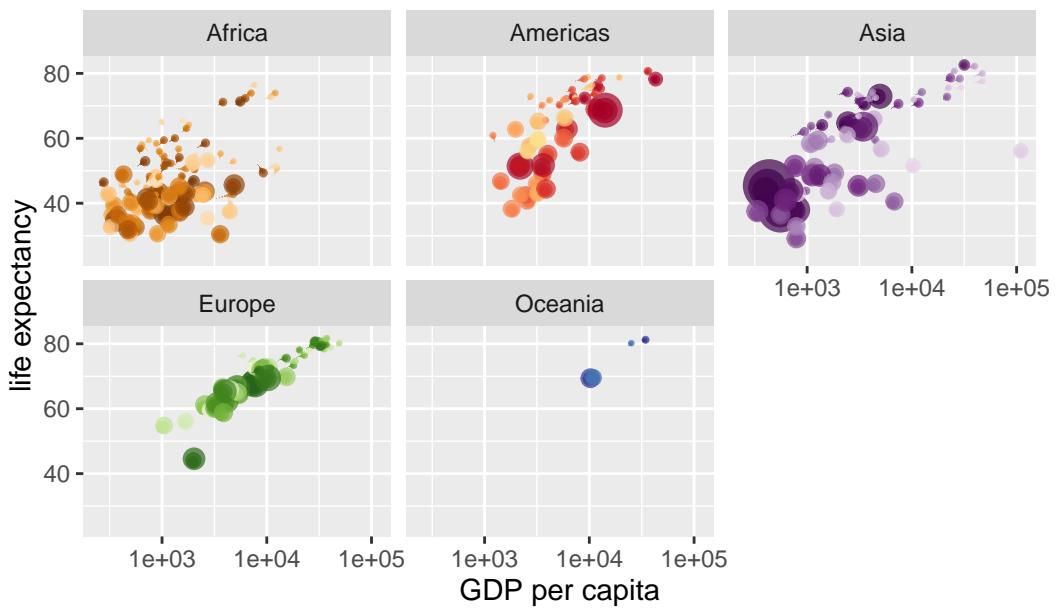
```
labs(title = 'Year: {frame_time}', x = 'GDP per capita', y = 'life expectancy') +  
transition_time(year) +  
shadow_wake(wake_length = 0.1, alpha = FALSE)
```



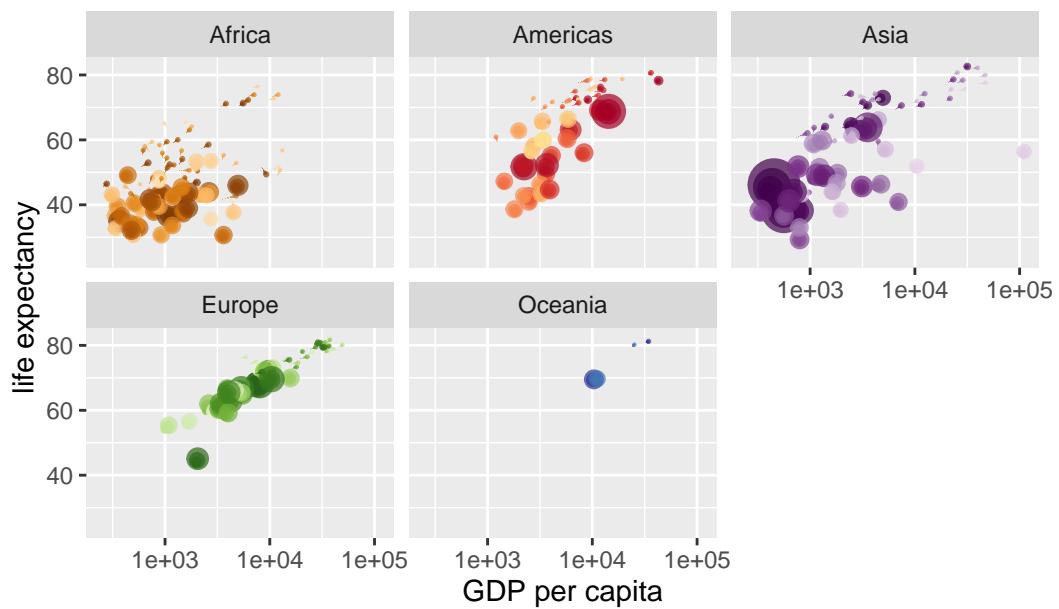
Year: 1953



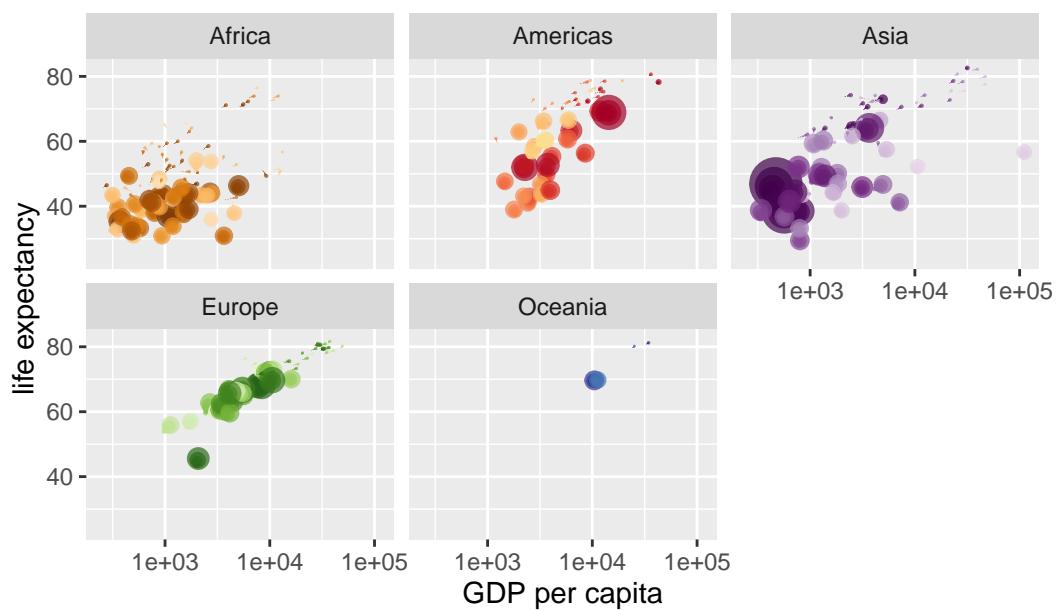
Year: 1953



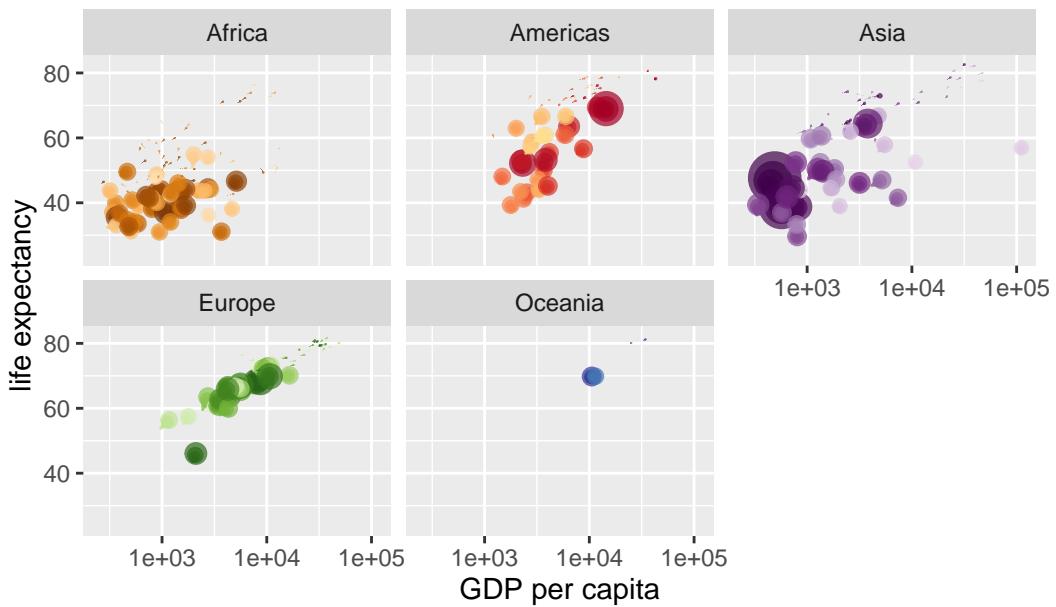
Year: 1954



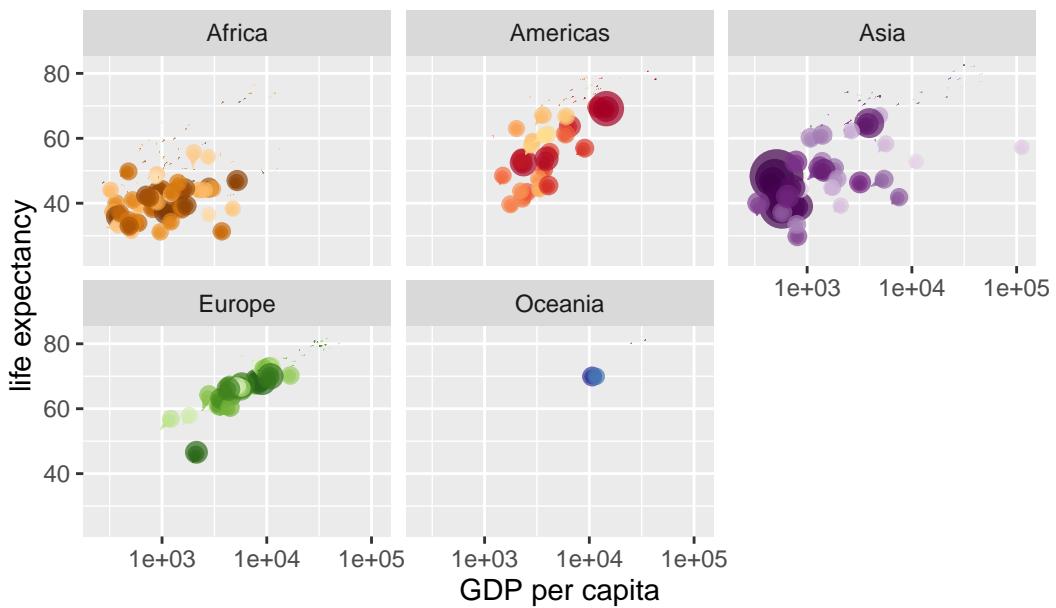
Year: 1954



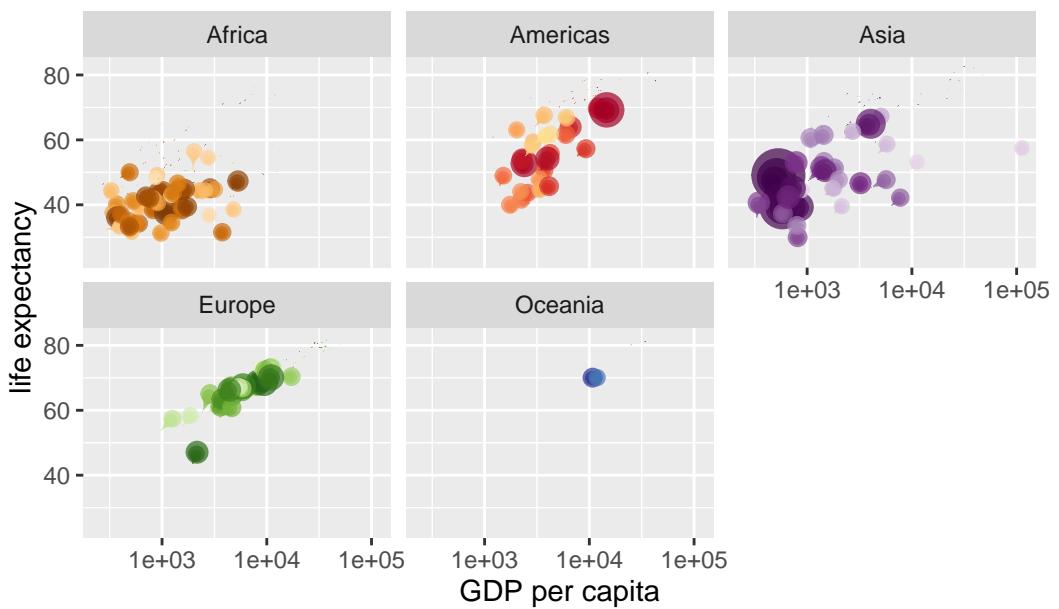
Year: 1955



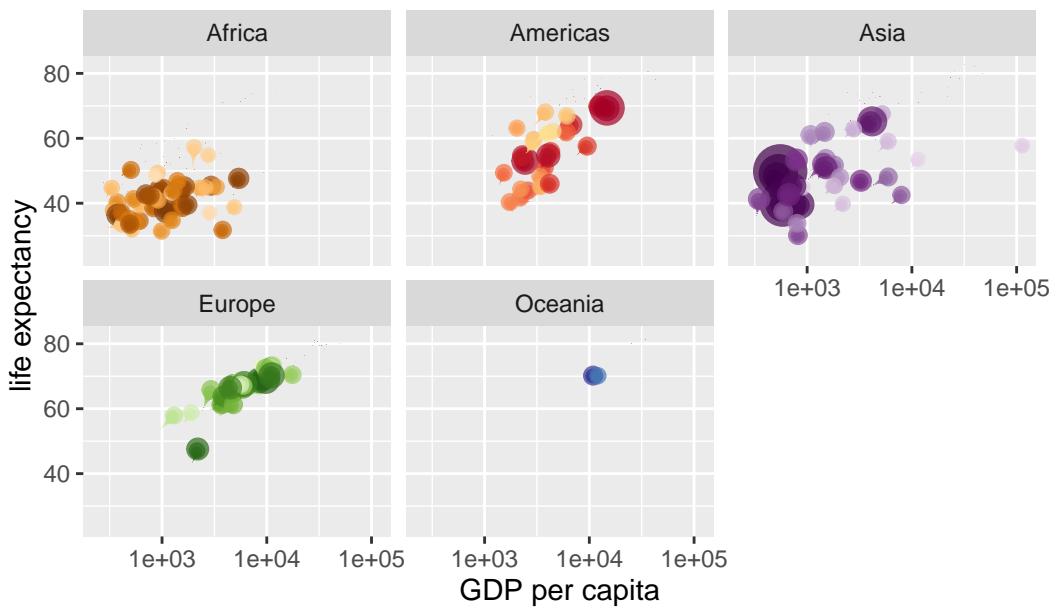
Year: 1955



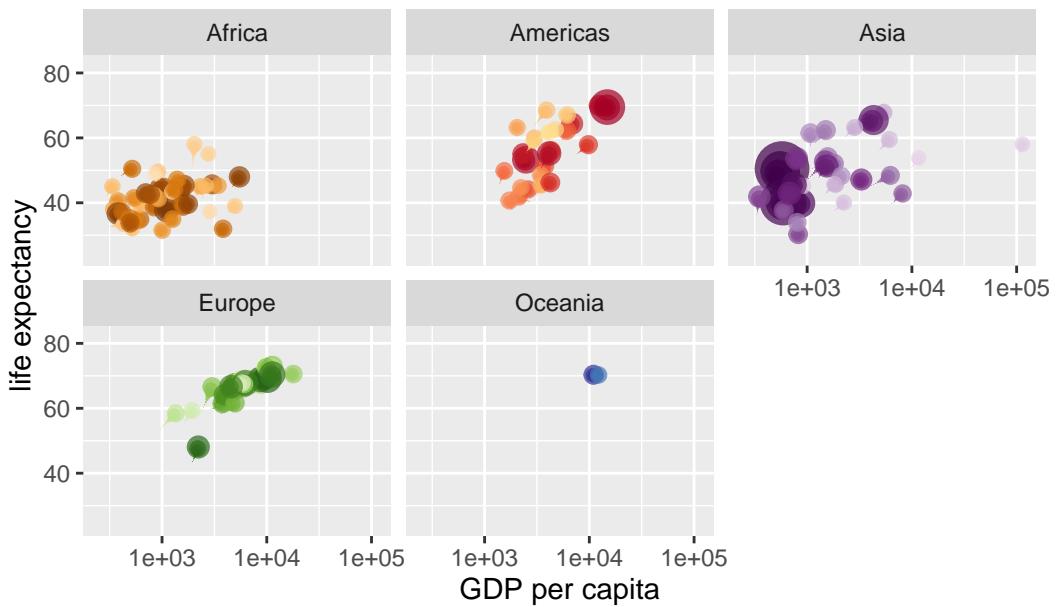
Year: 1956



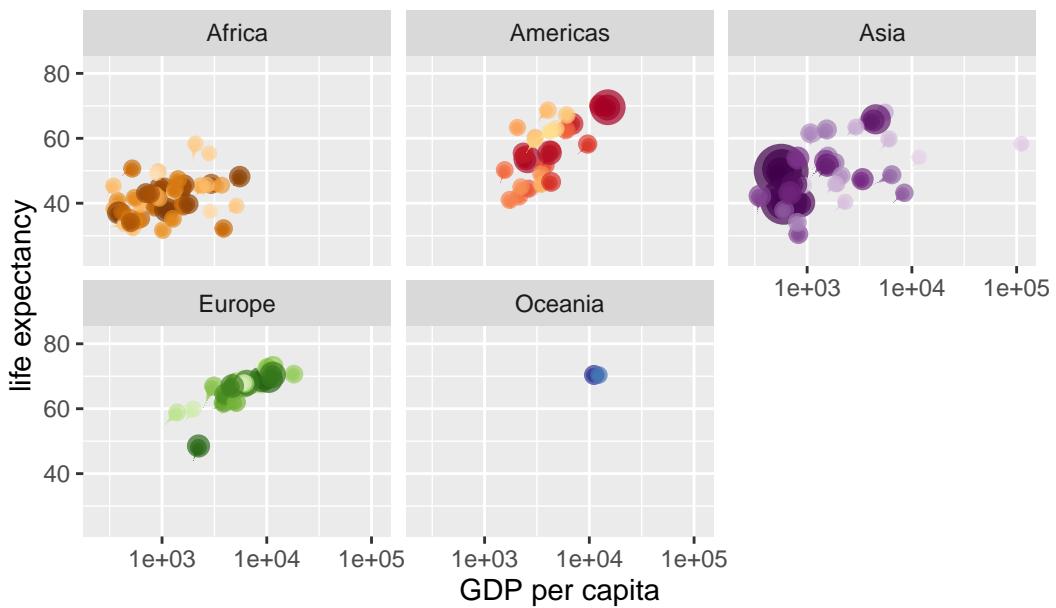
Year: 1956



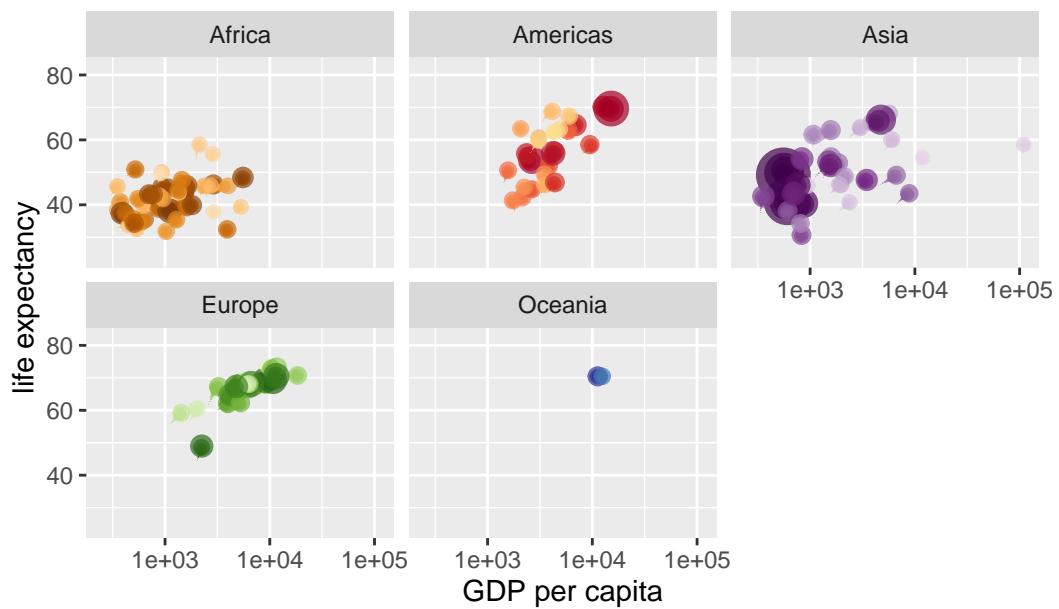
Year: 1957



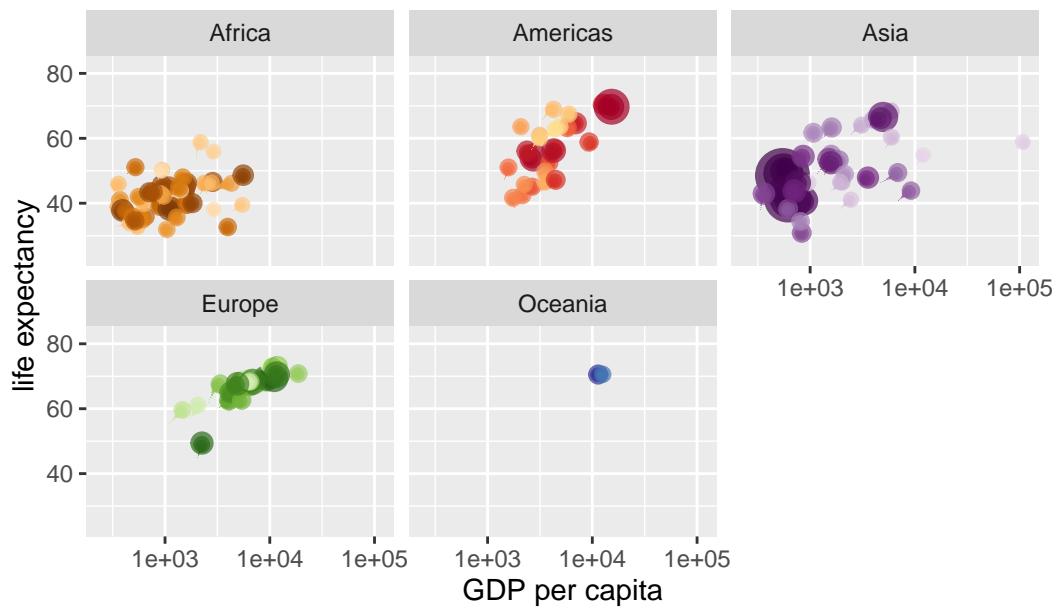
Year: 1958



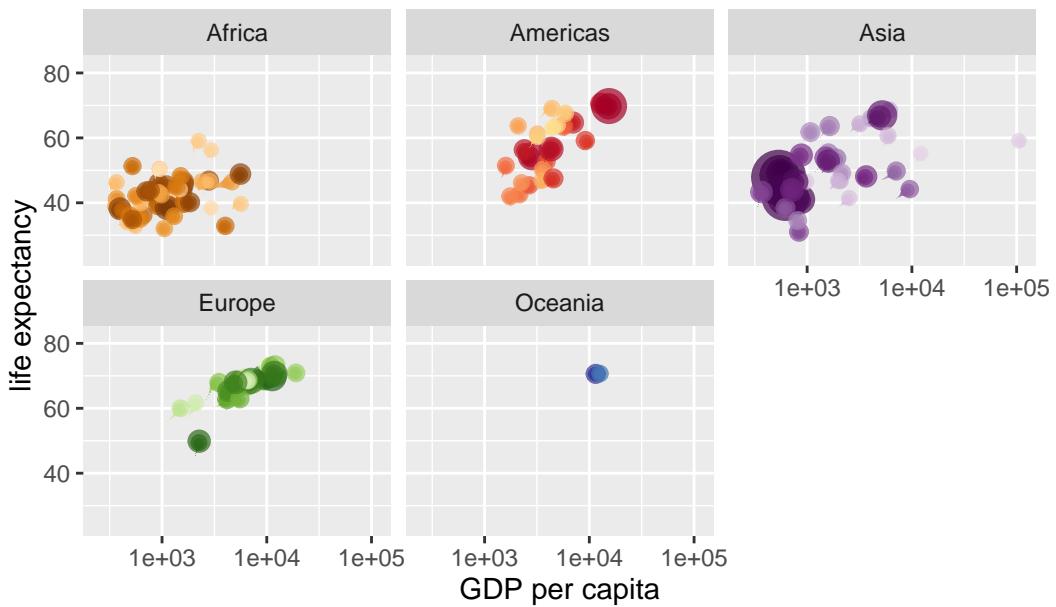
Year: 1958



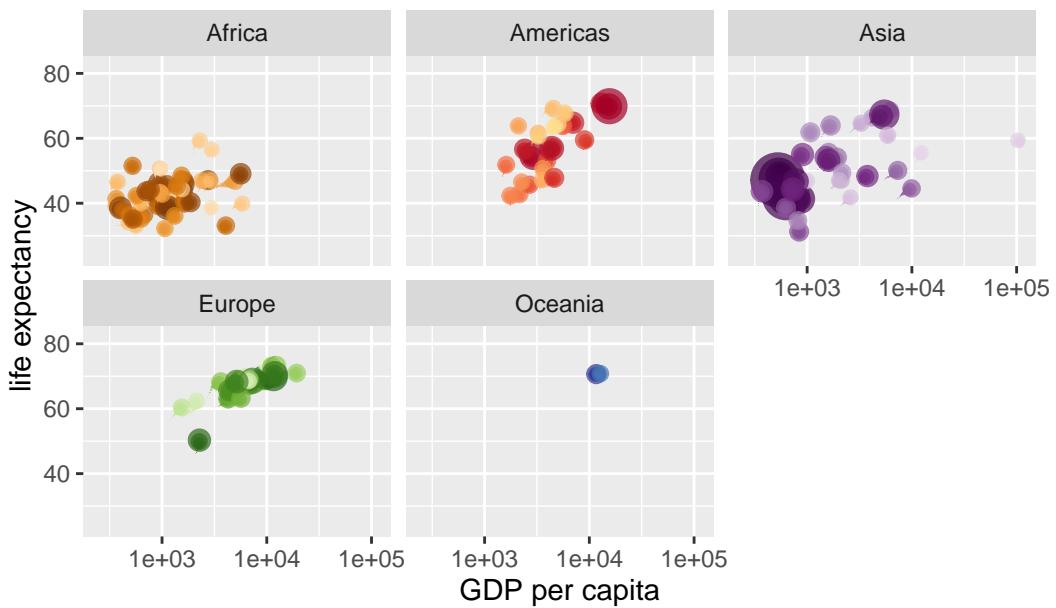
Year: 1959



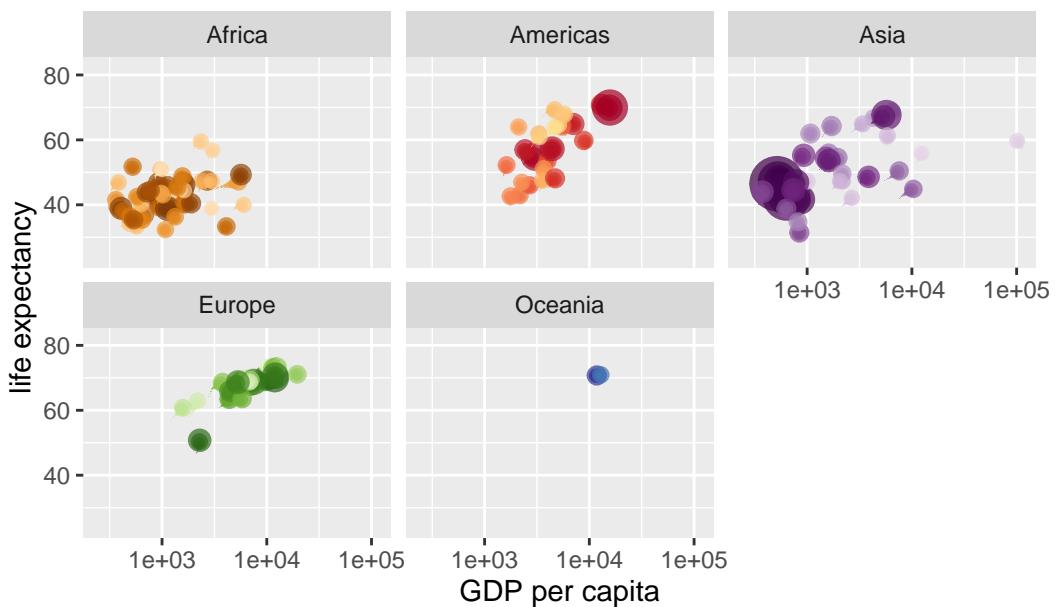
Year: 1959



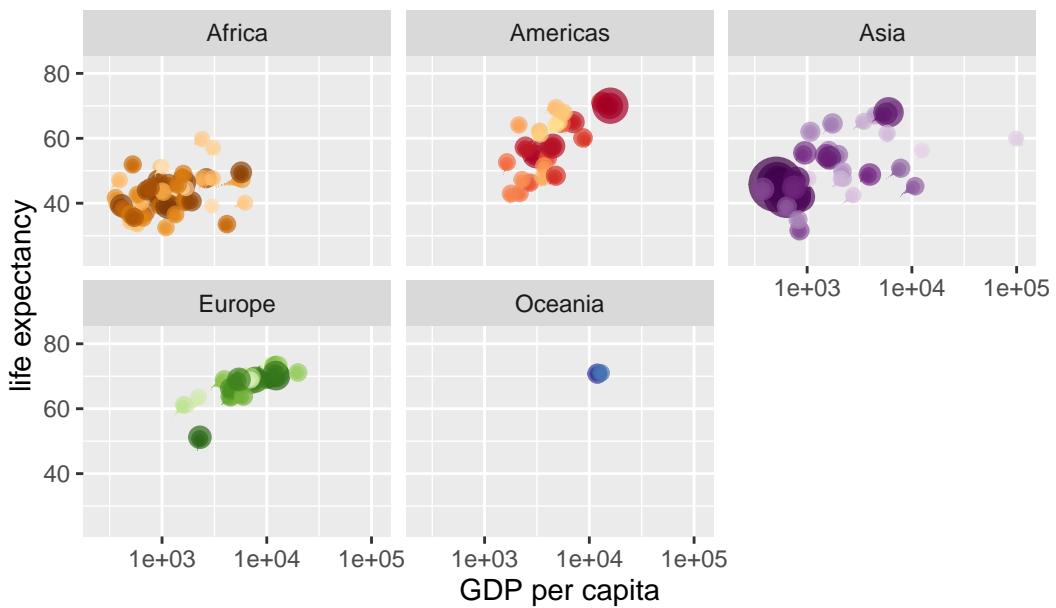
Year: 1960



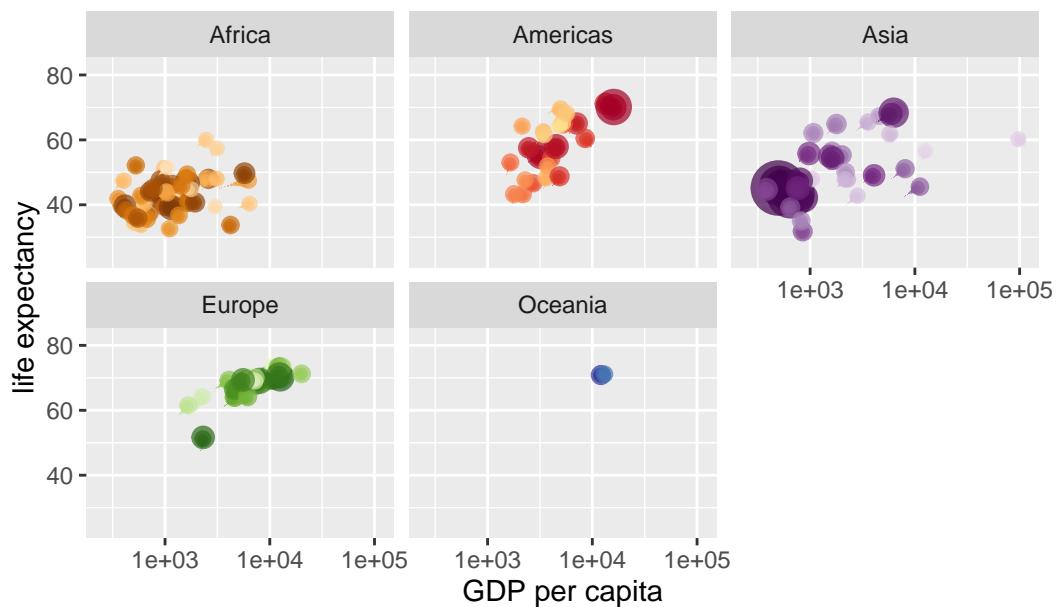
Year: 1960



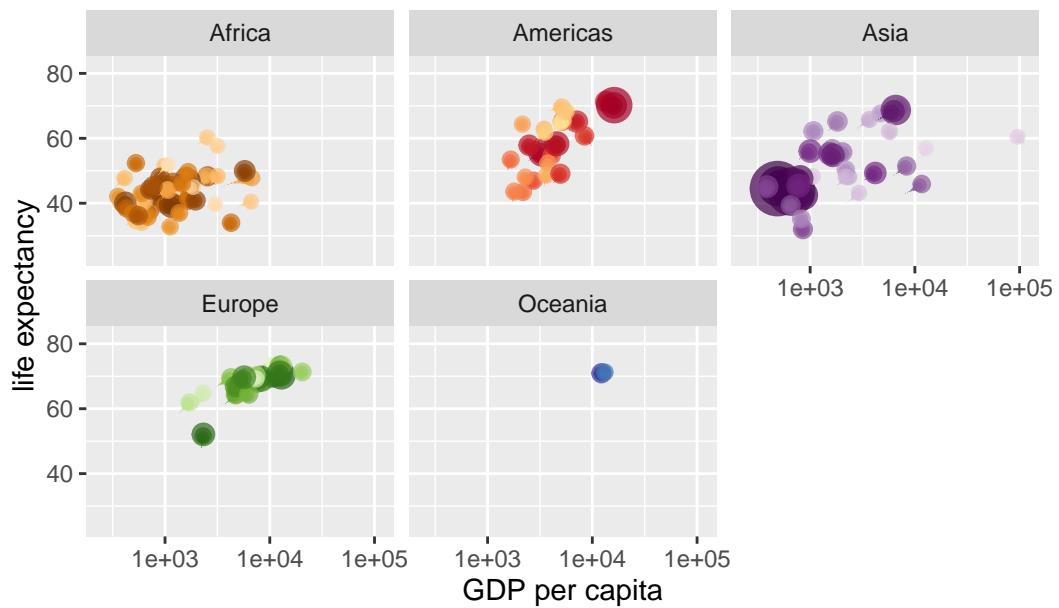
Year: 1961



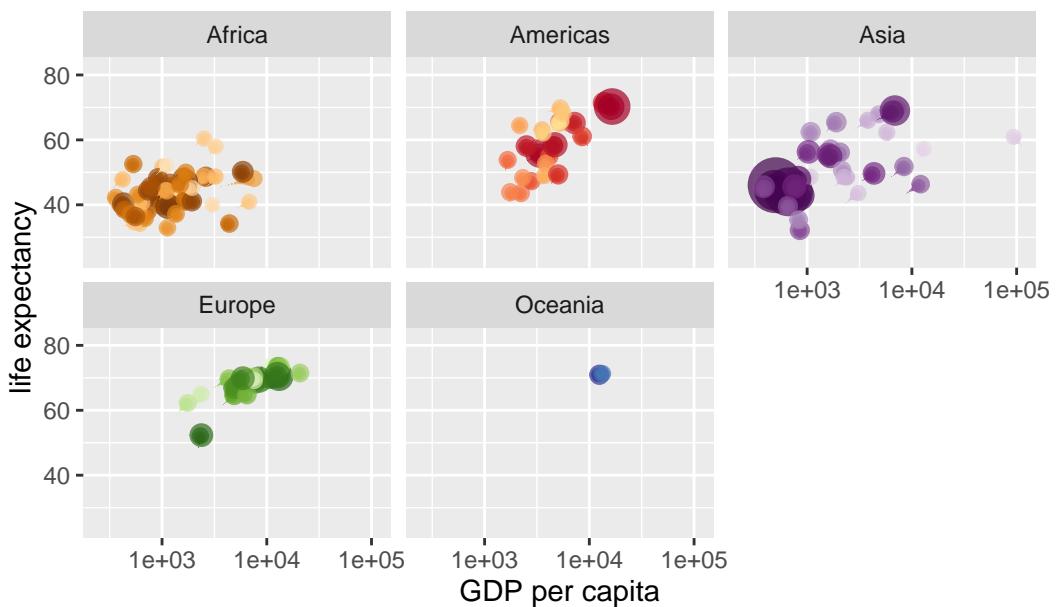
Year: 1961



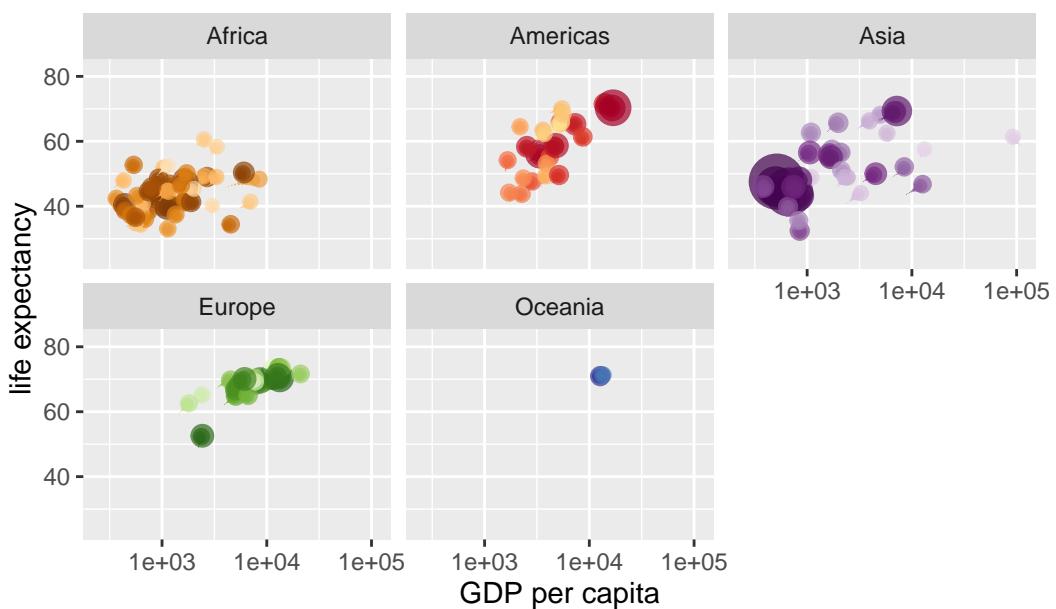
Year: 1962



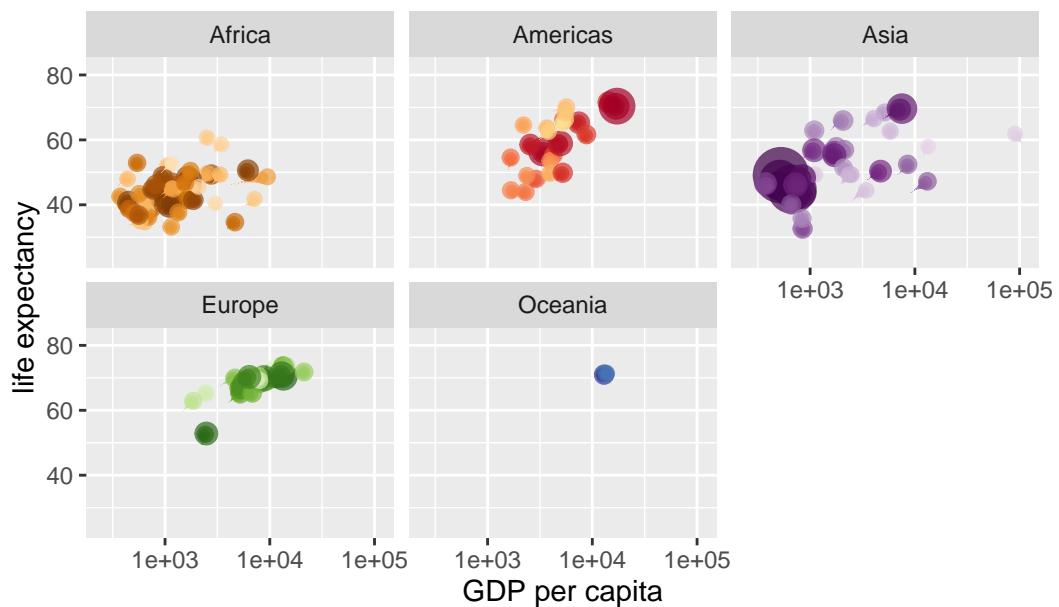
Year: 1963



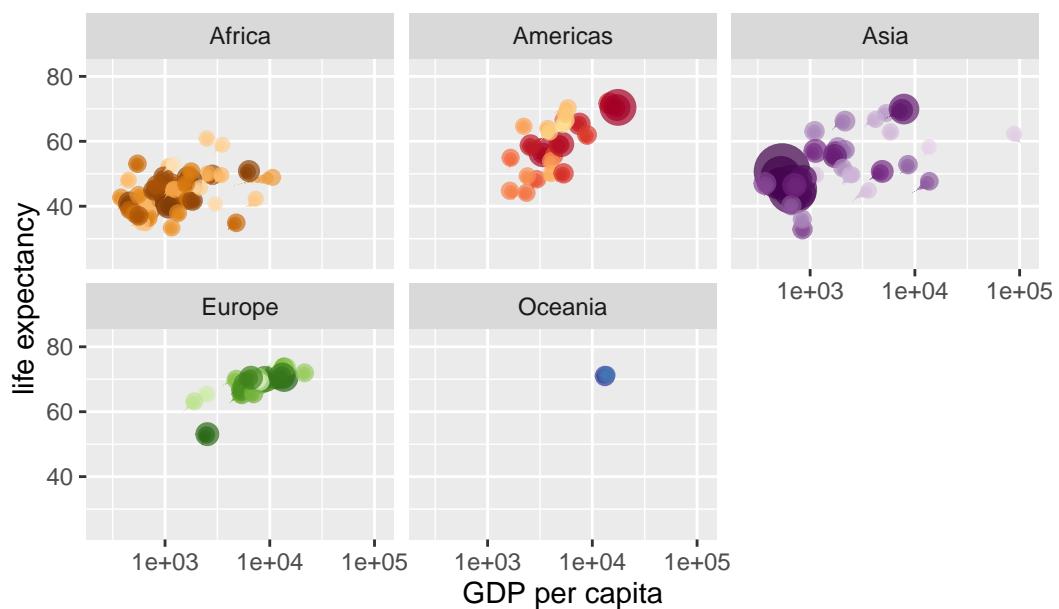
Year: 1963



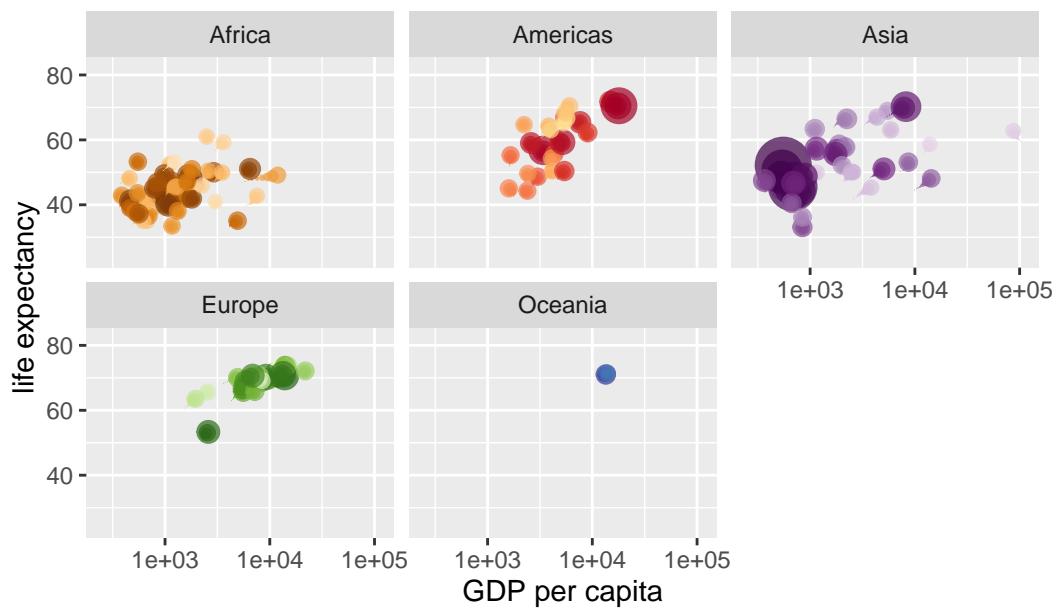
Year: 1964



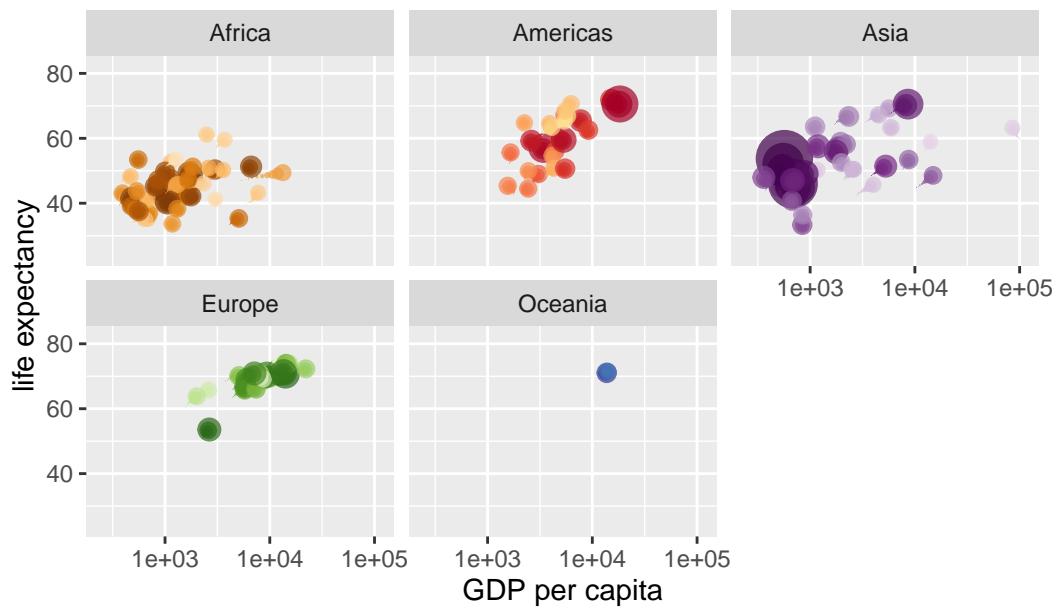
Year: 1964



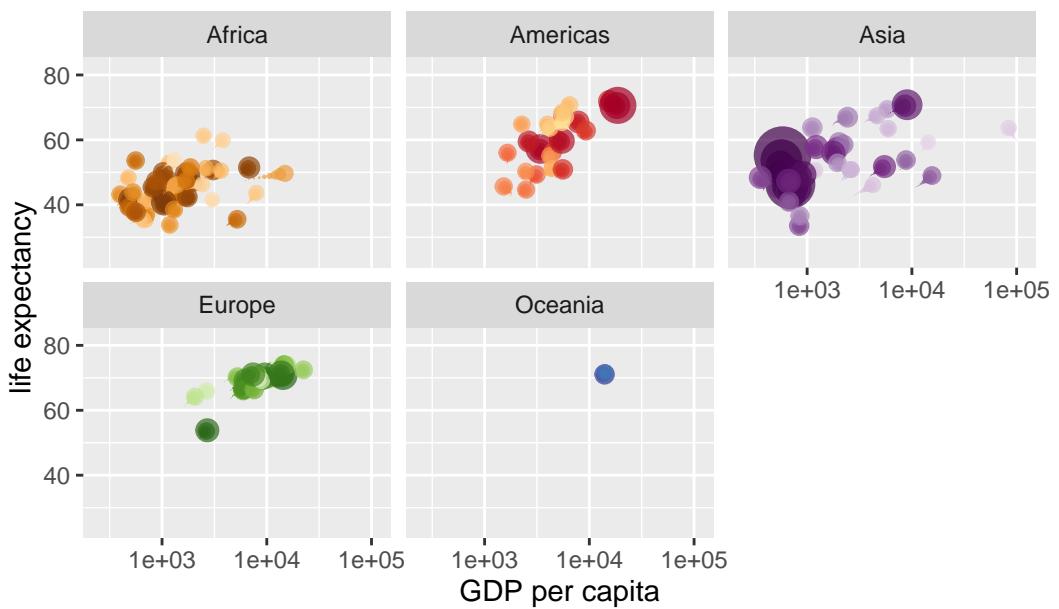
Year: 1965



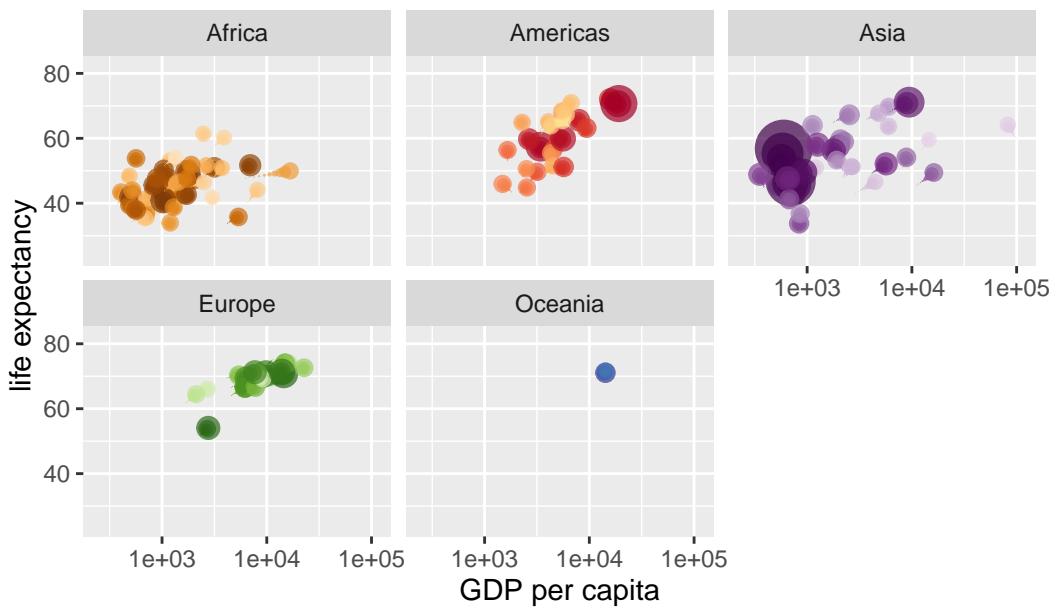
Year: 1965



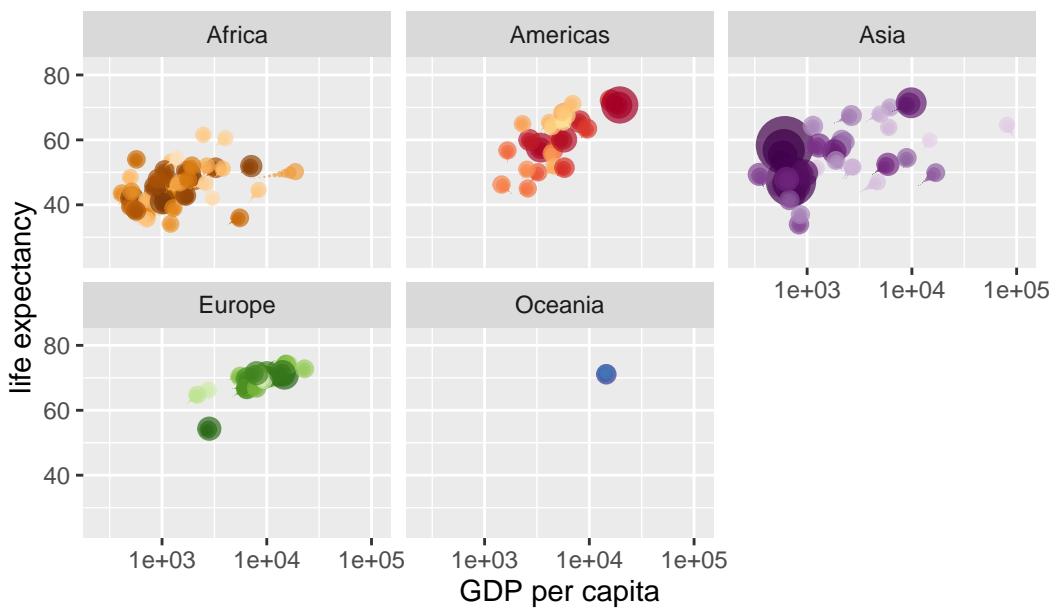
Year: 1966



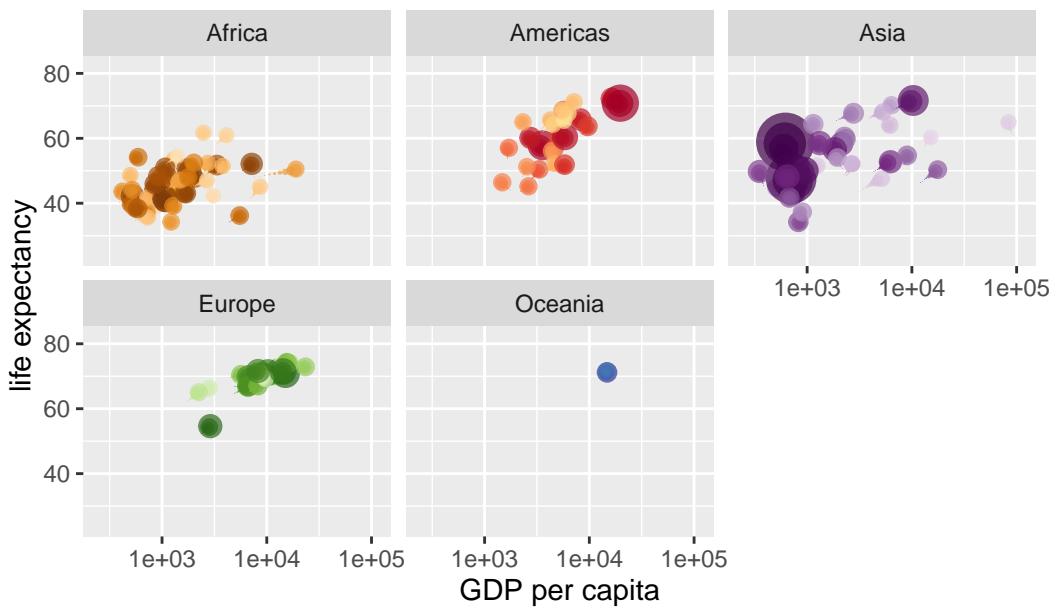
Year: 1966



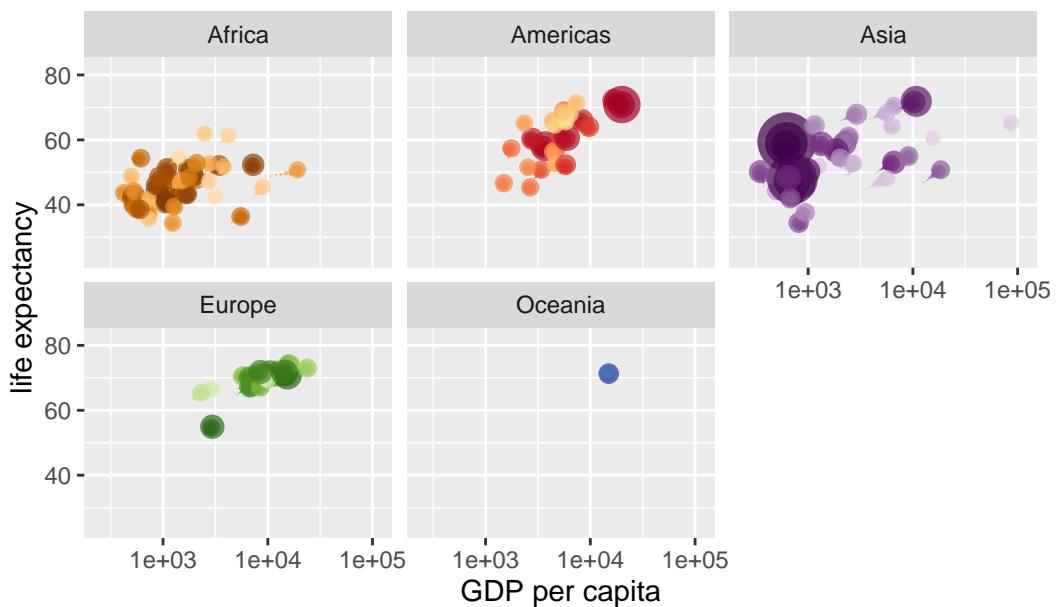
Year: 1967



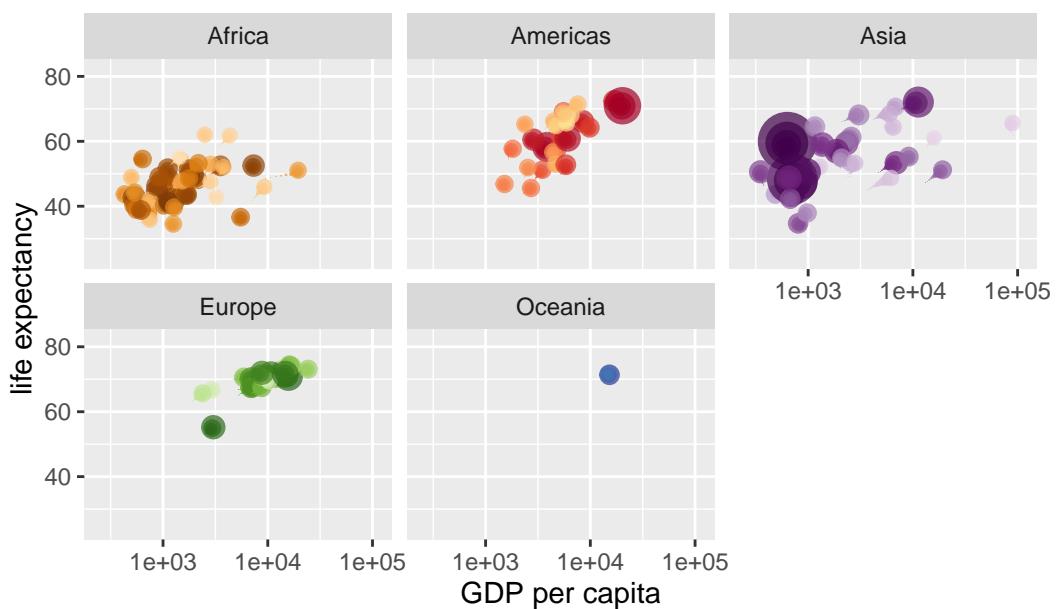
Year: 1968



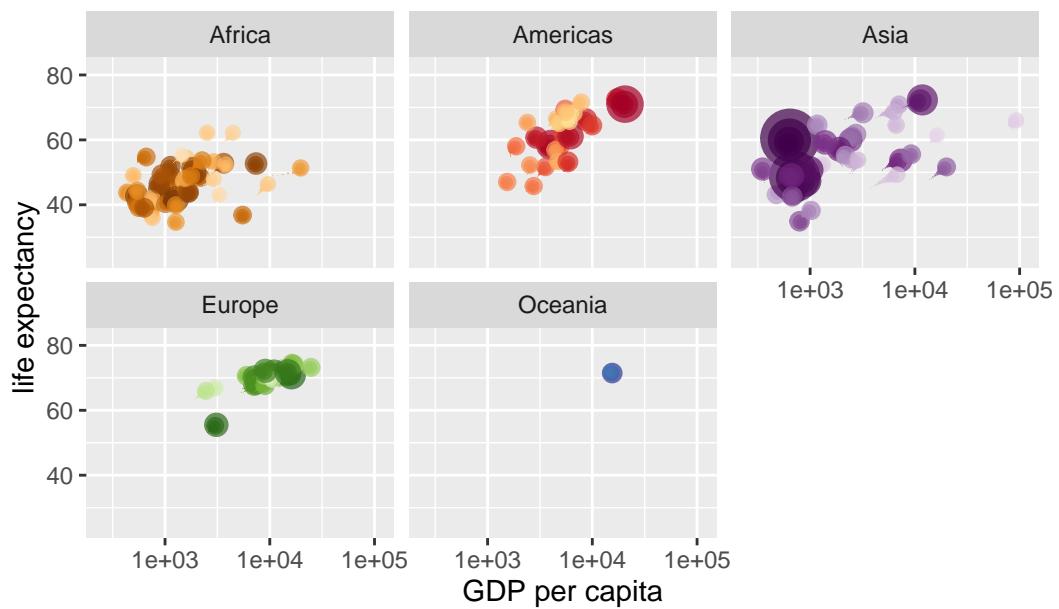
Year: 1968



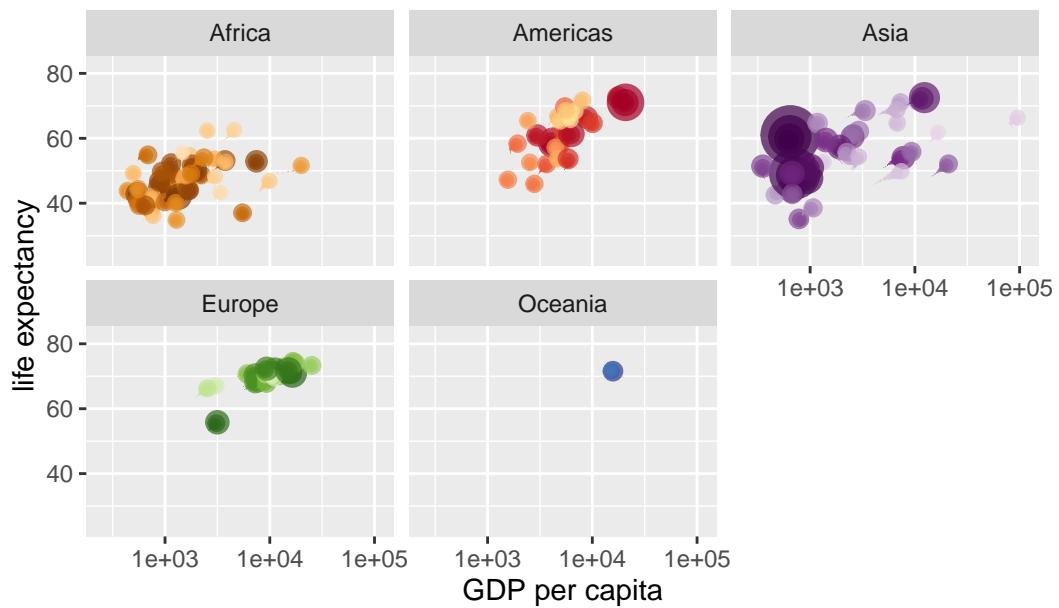
Year: 1969



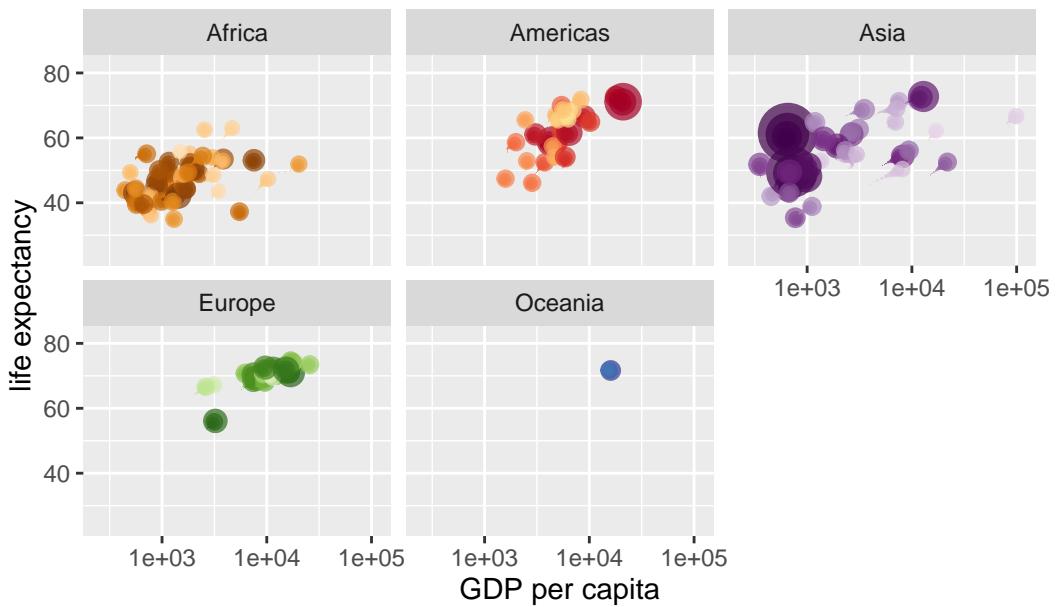
Year: 1969



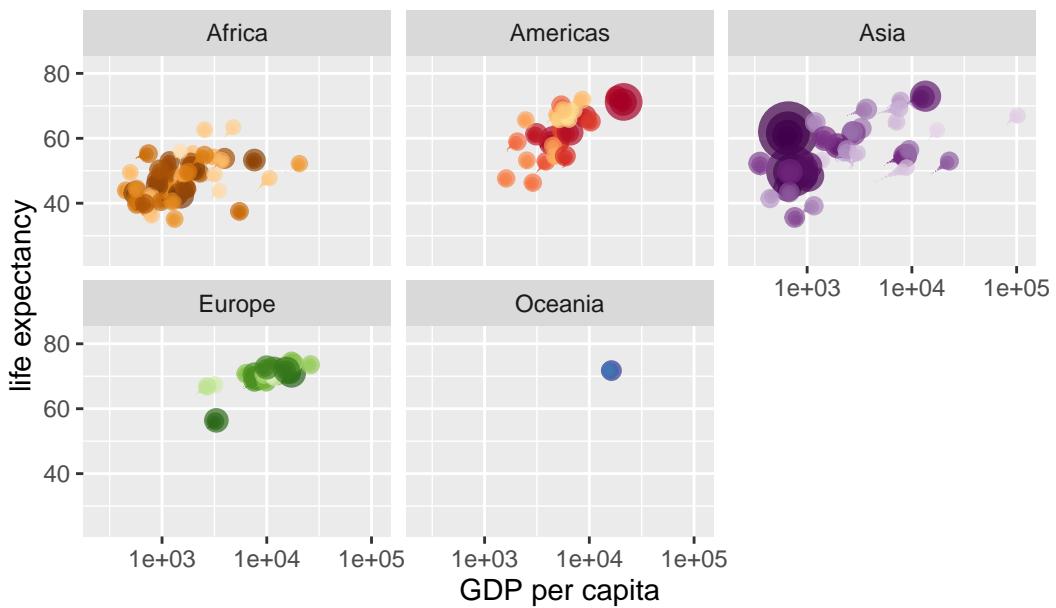
Year: 1970



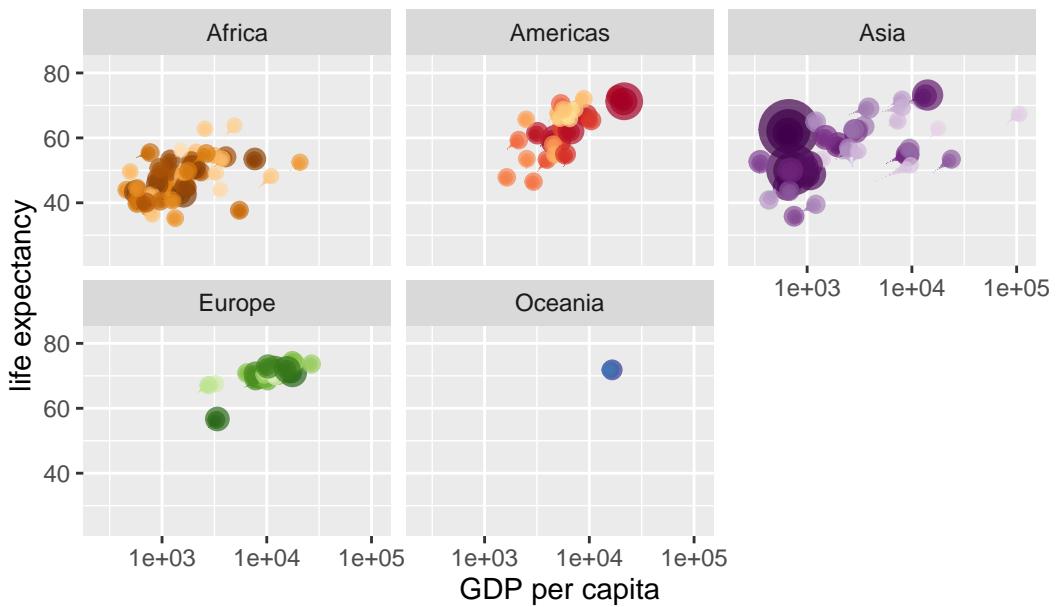
Year: 1970



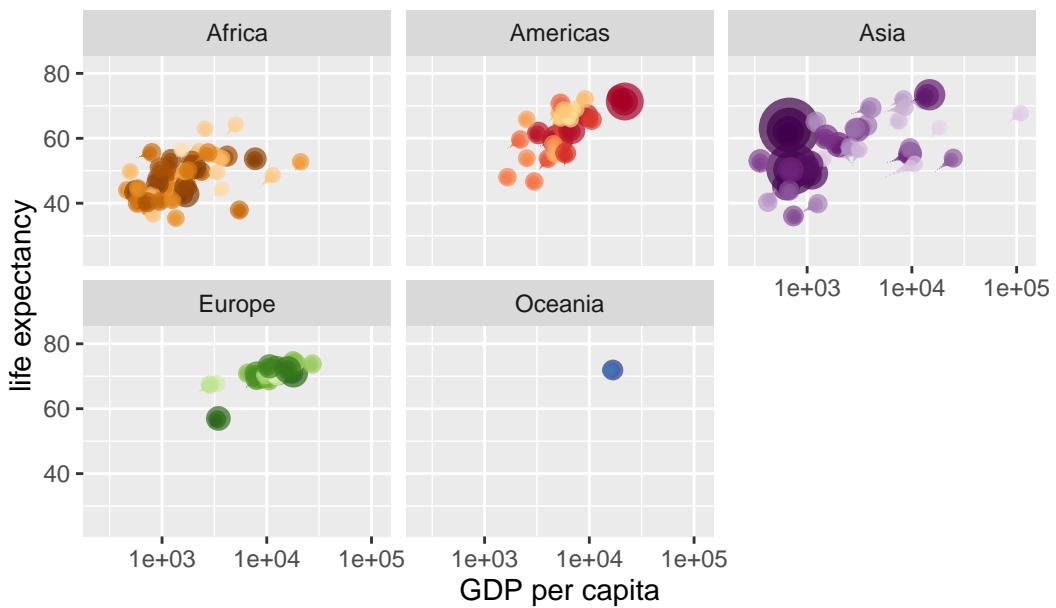
Year: 1971



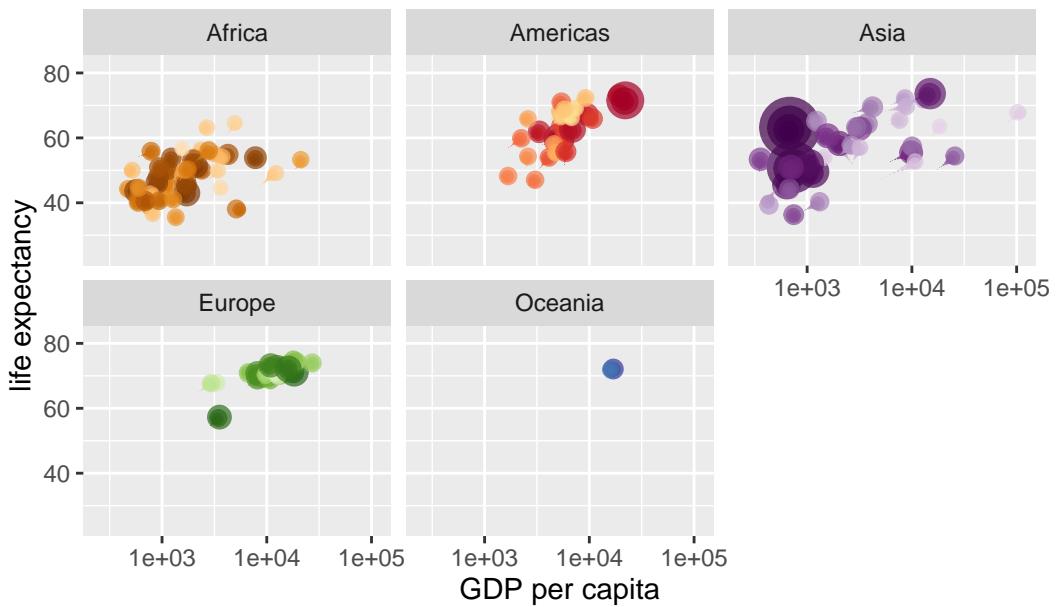
Year: 1971



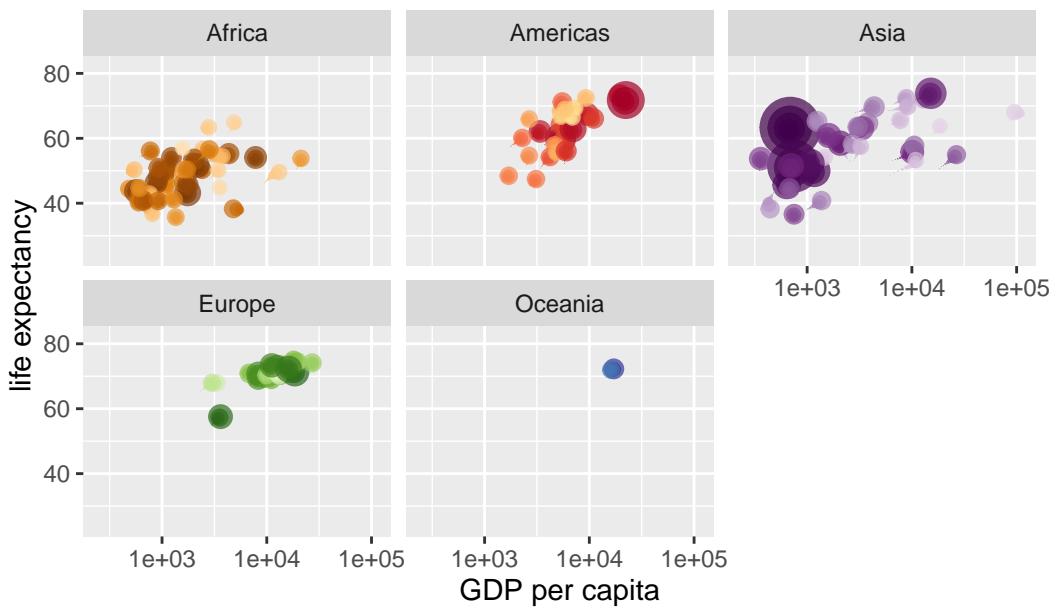
Year: 1972



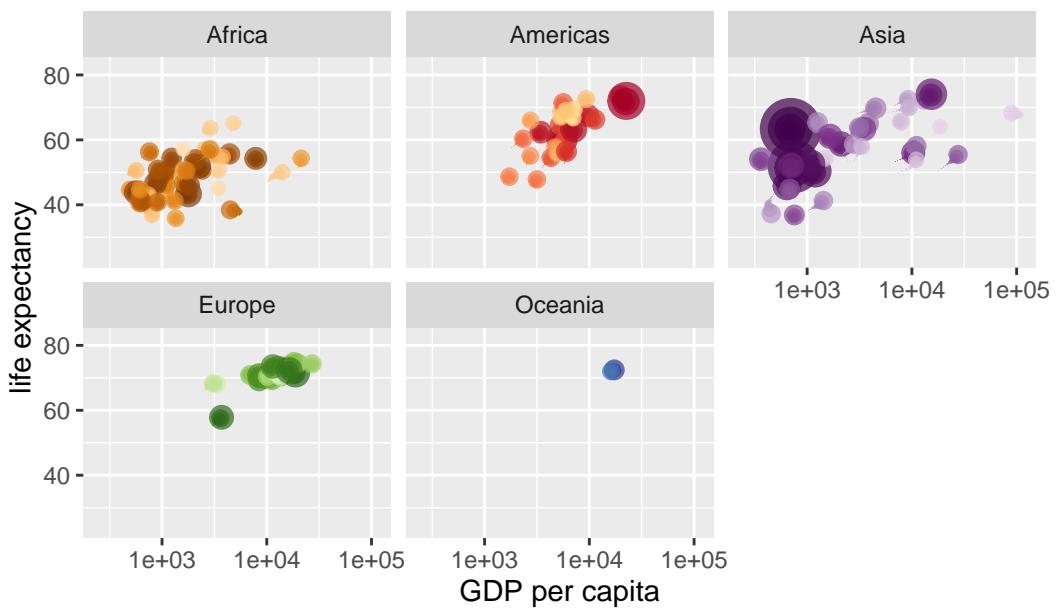
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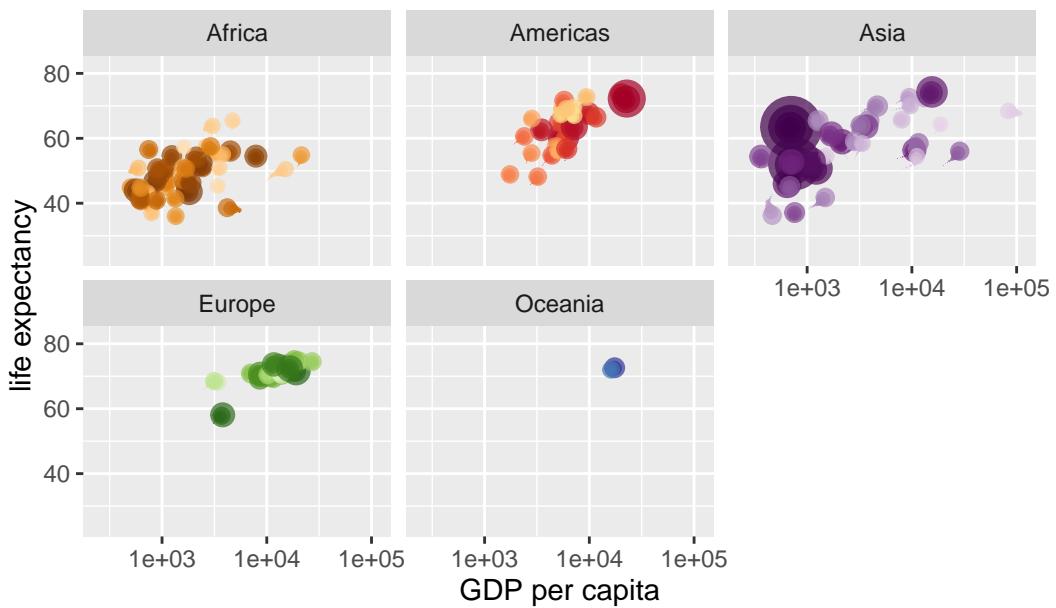
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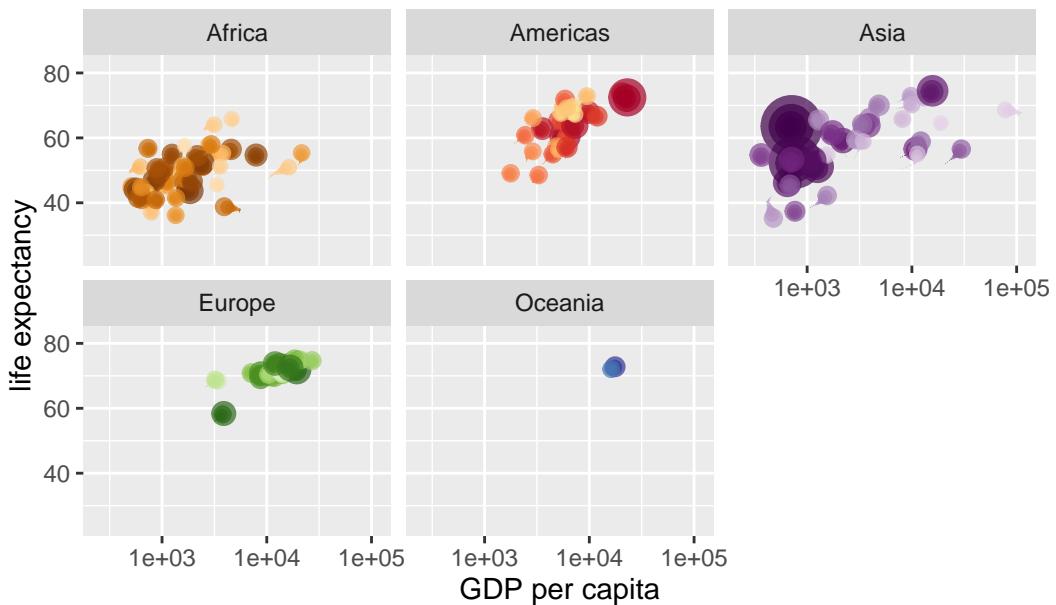
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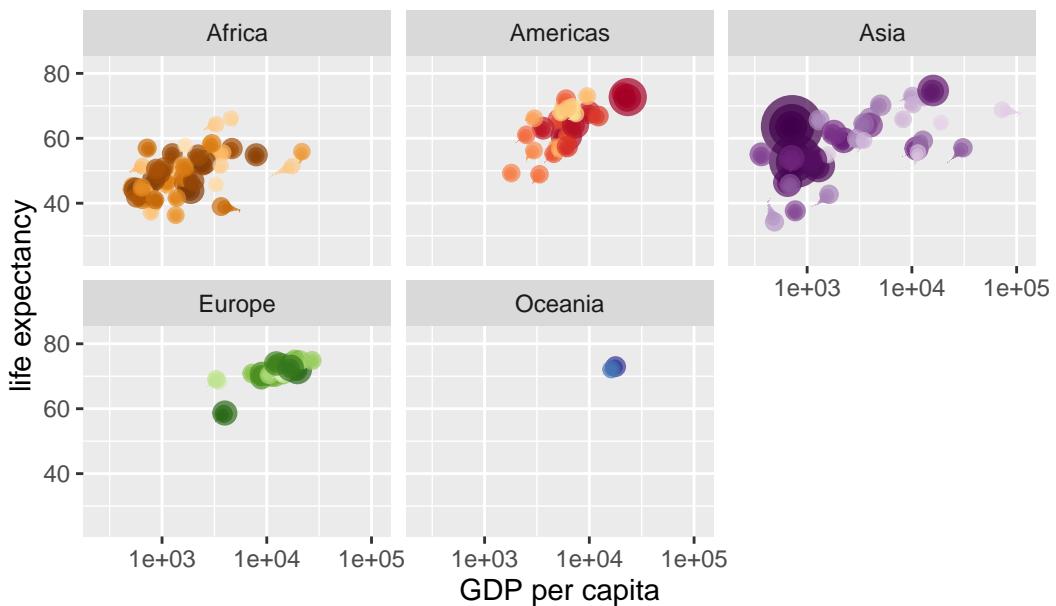
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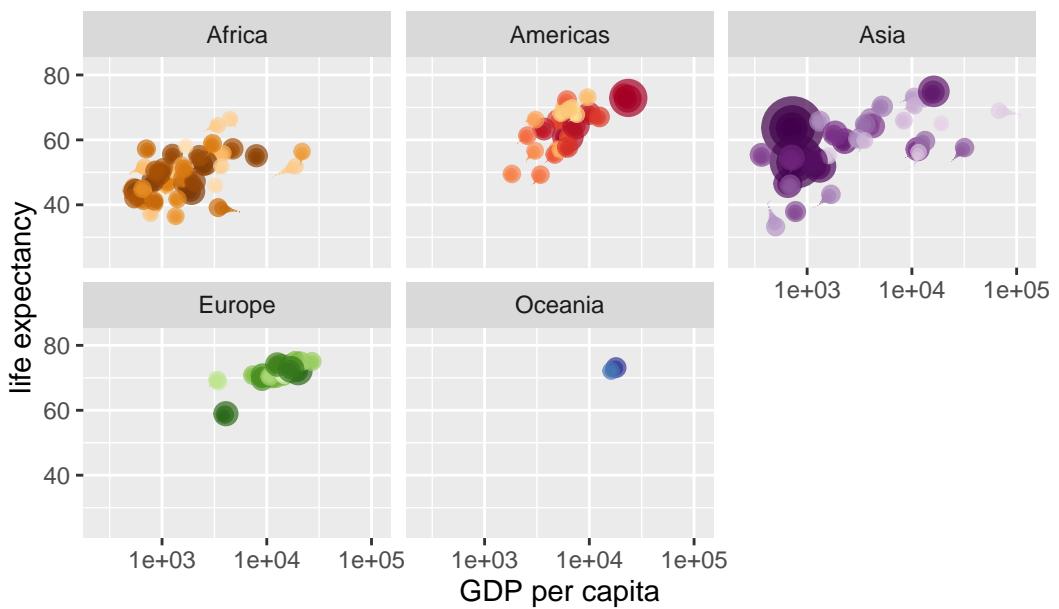
Year: 1975



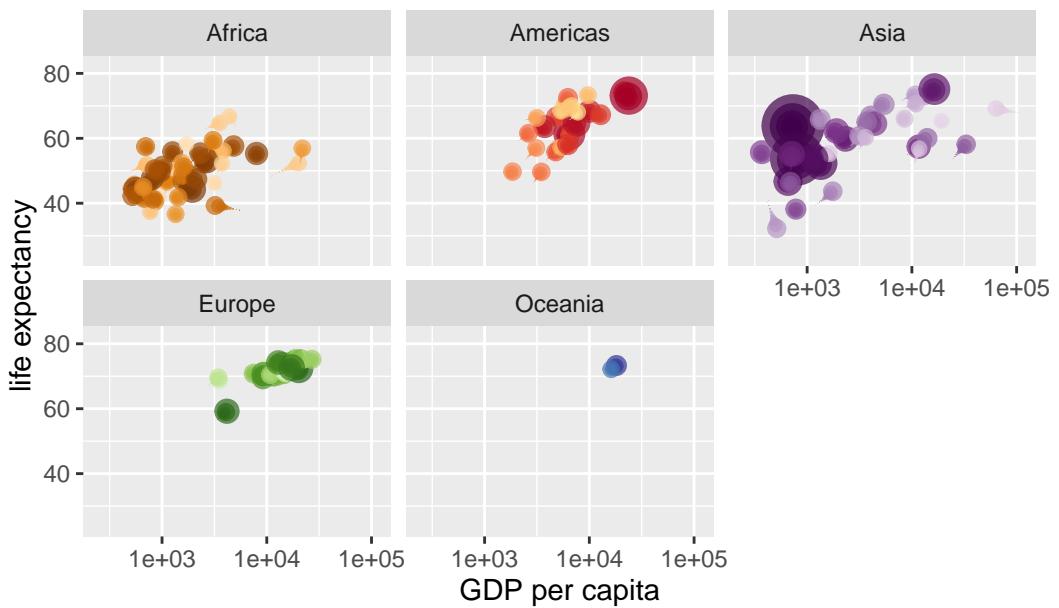
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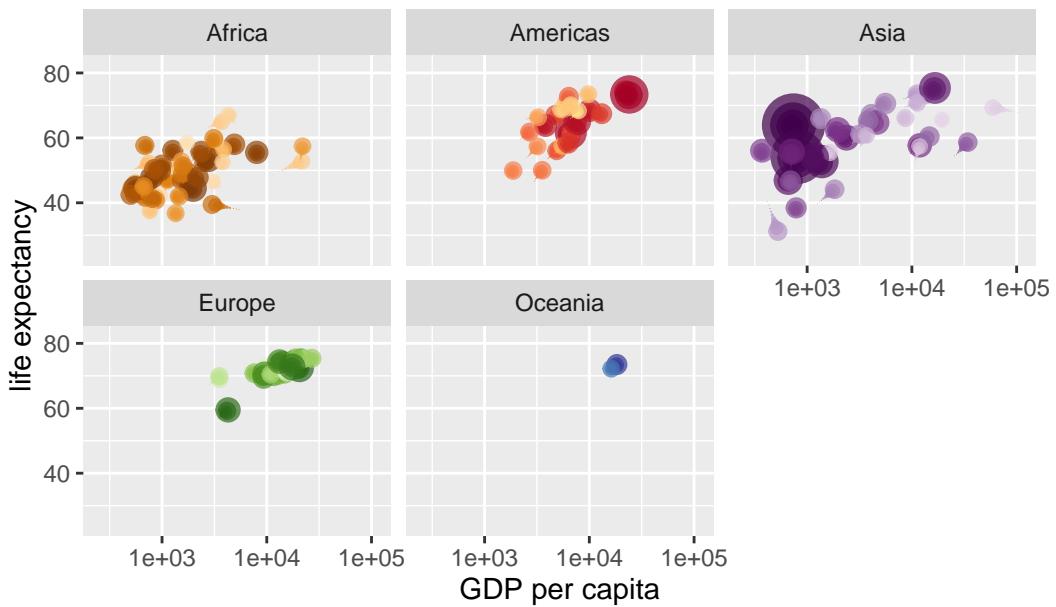
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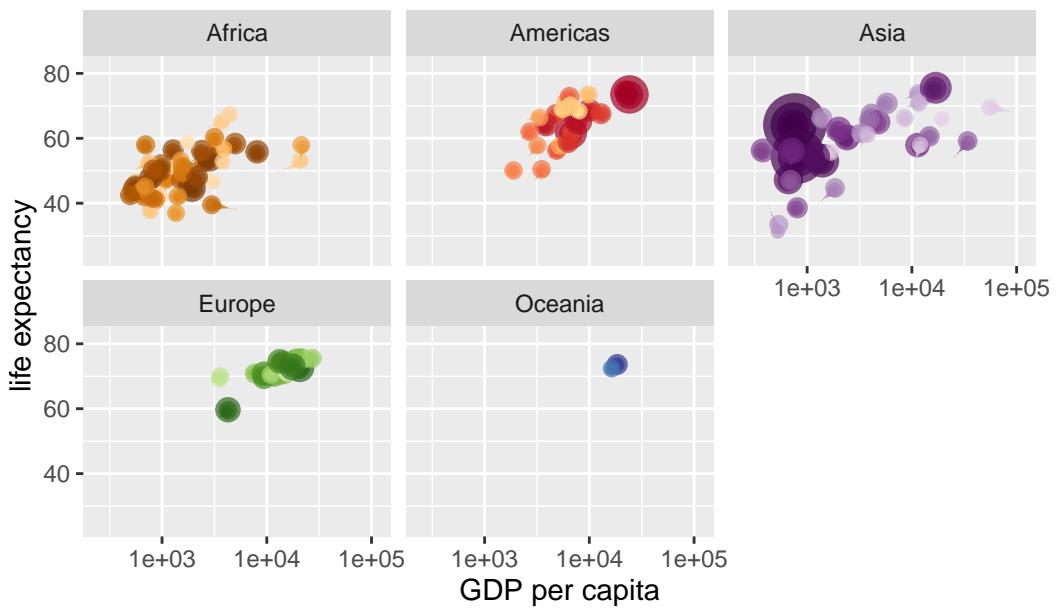
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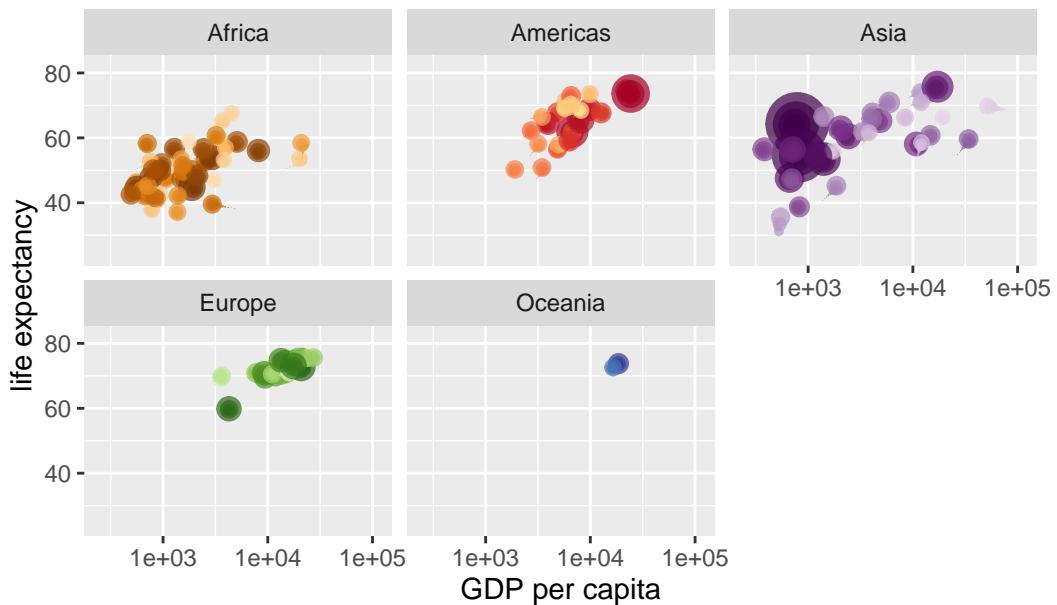
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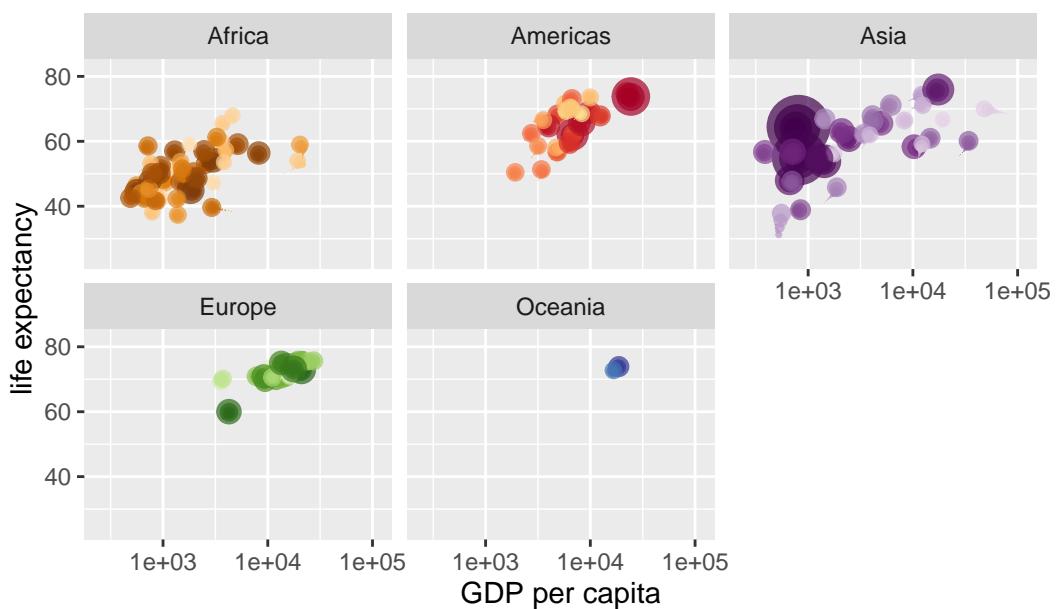
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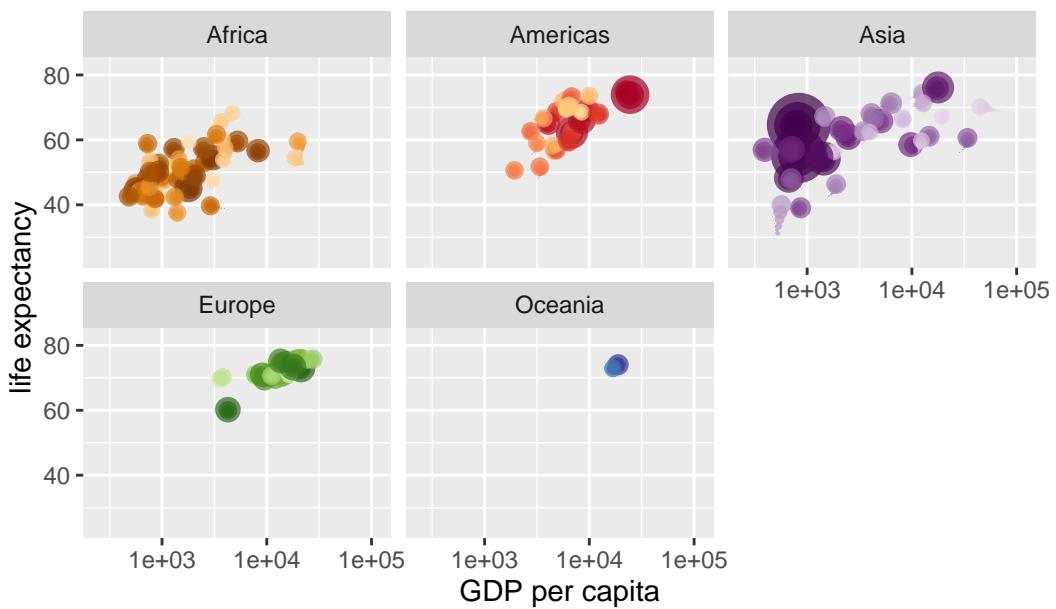
Year: 1978



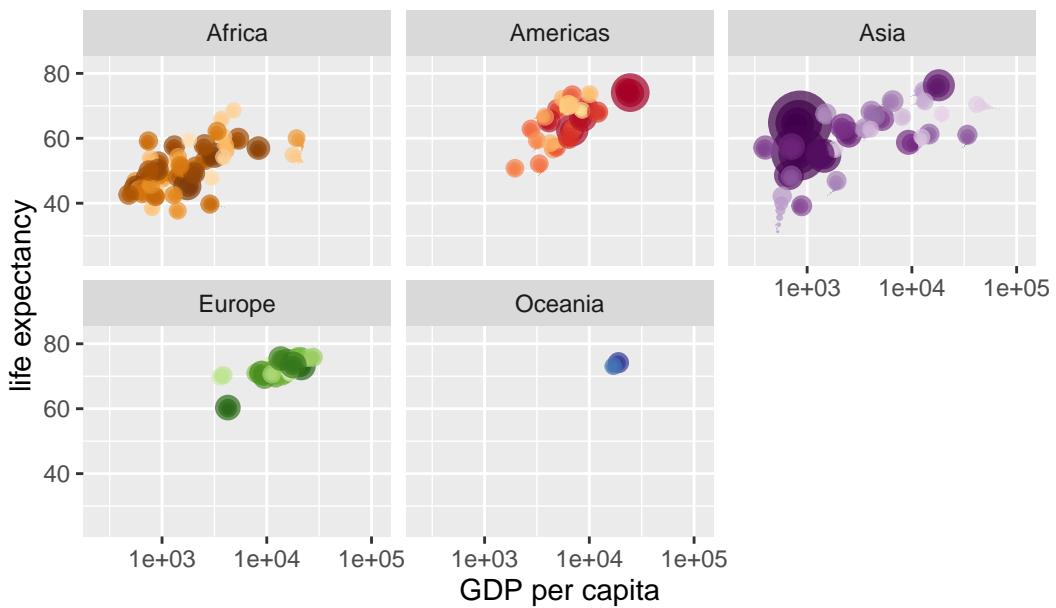
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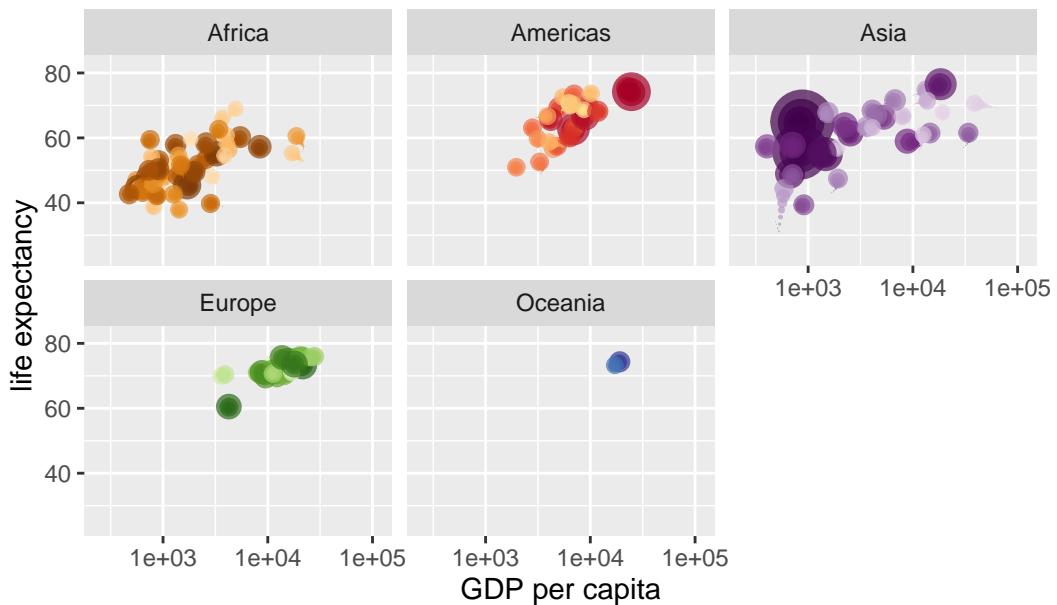
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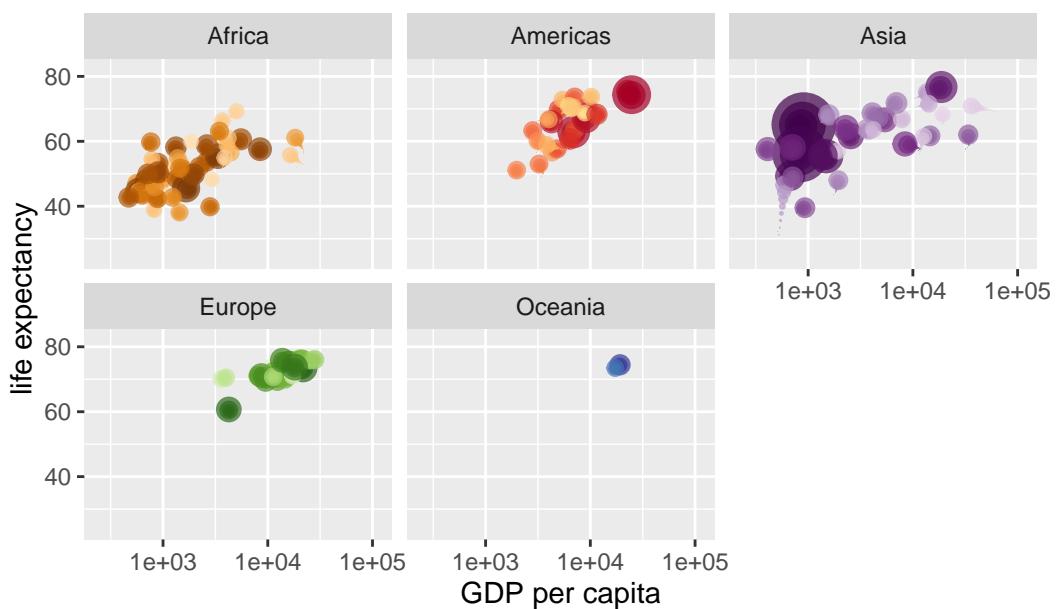
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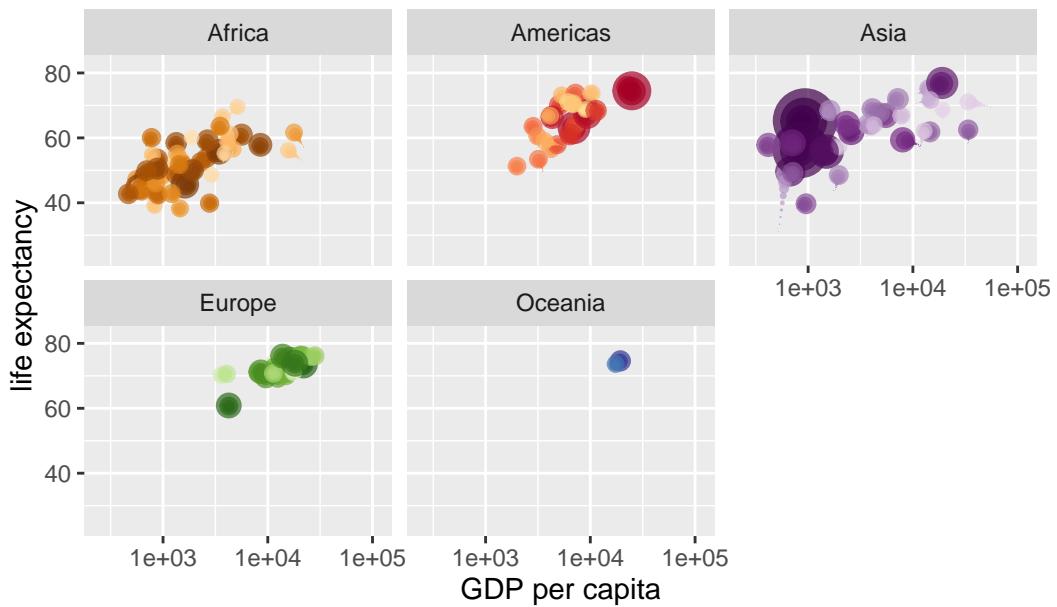
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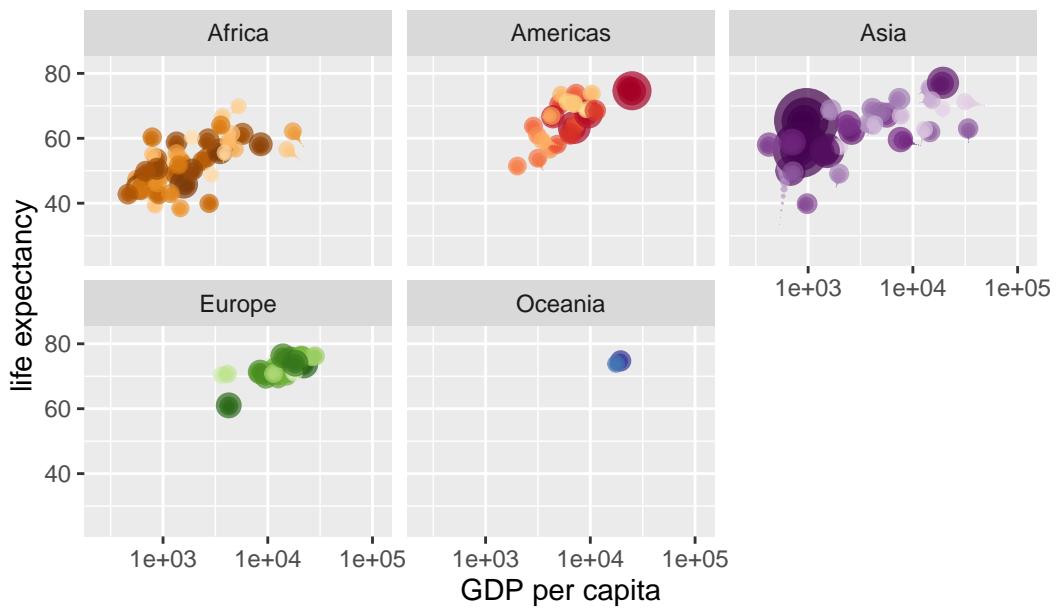
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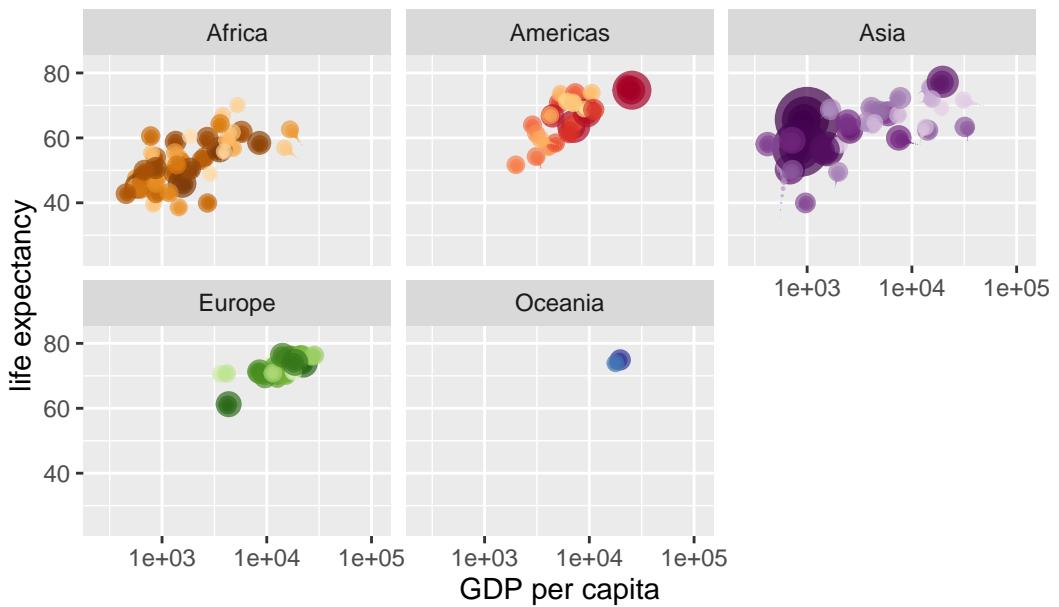
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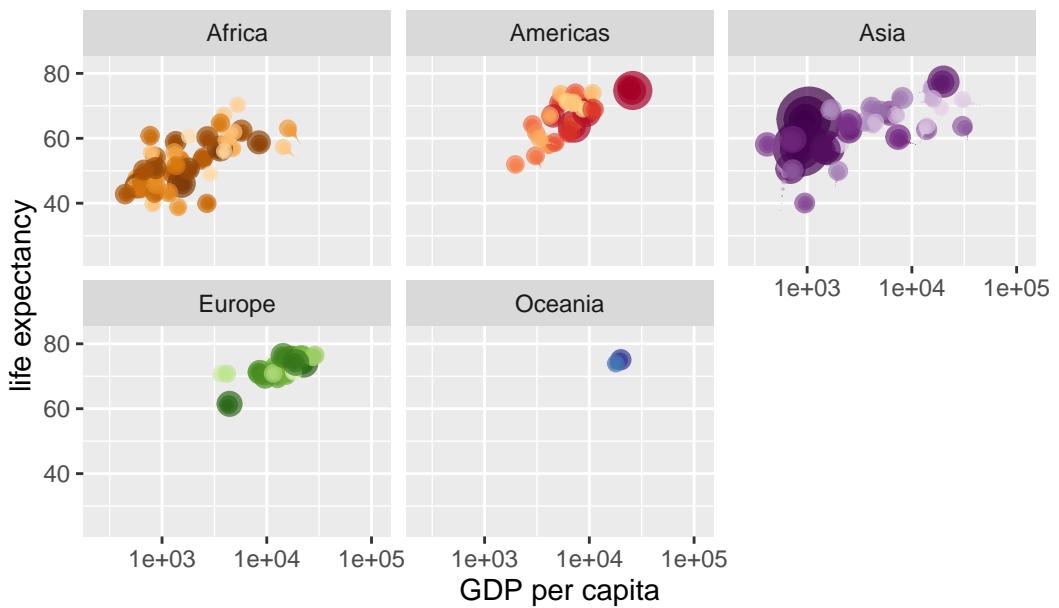
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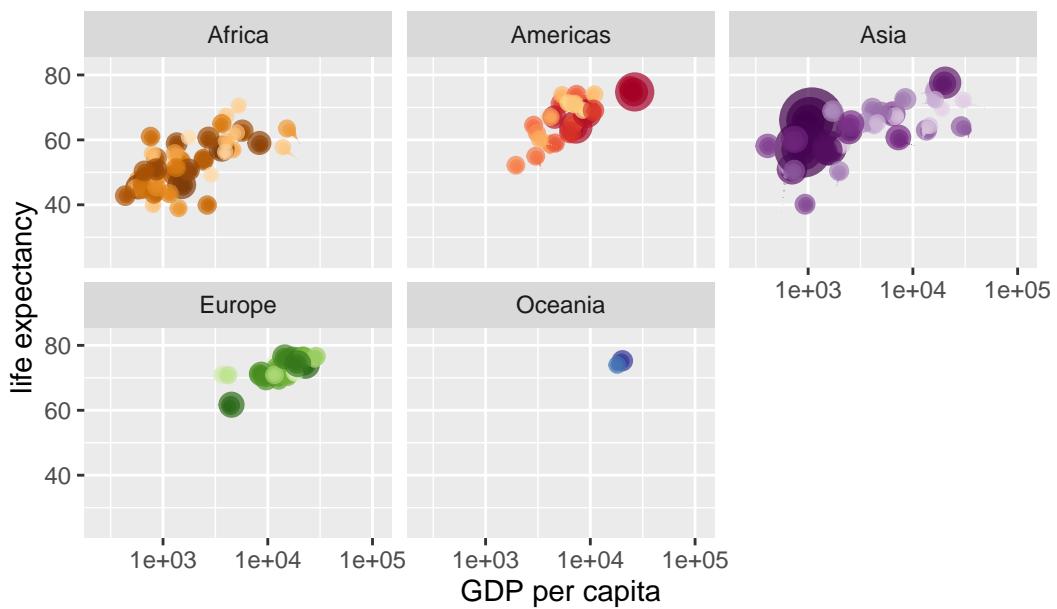
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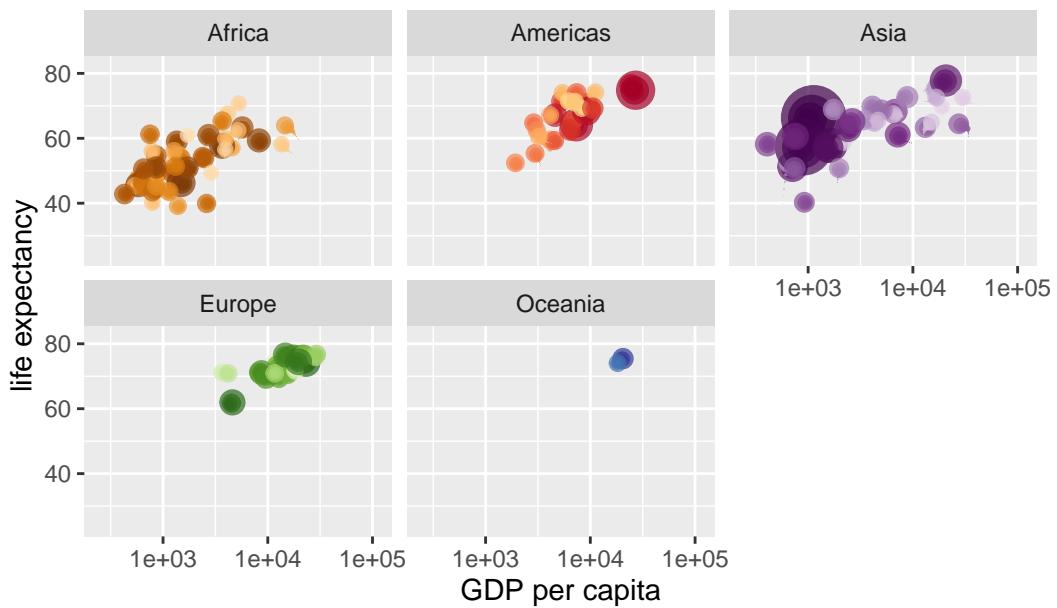
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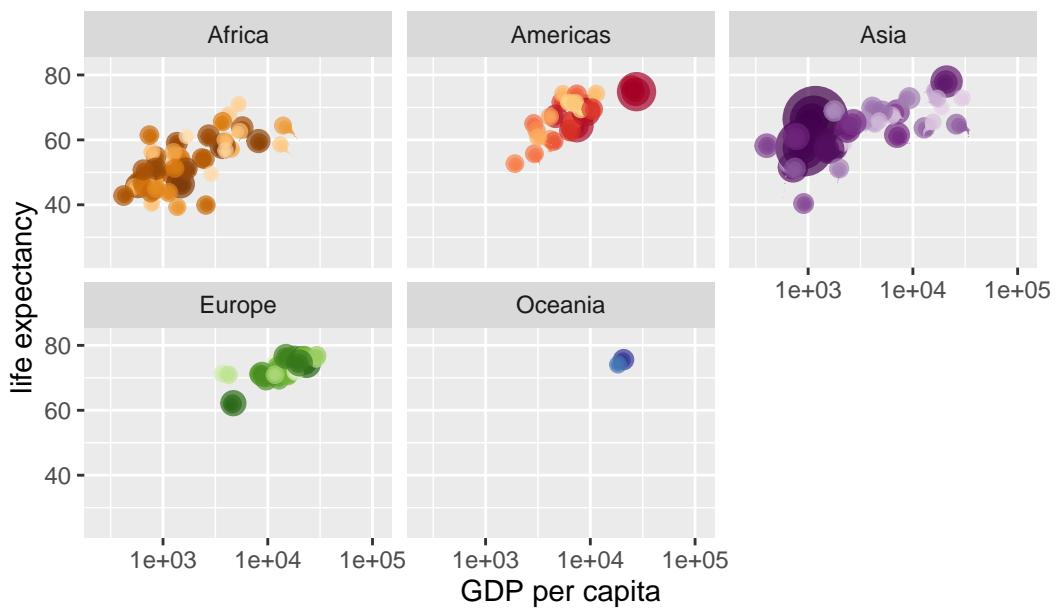
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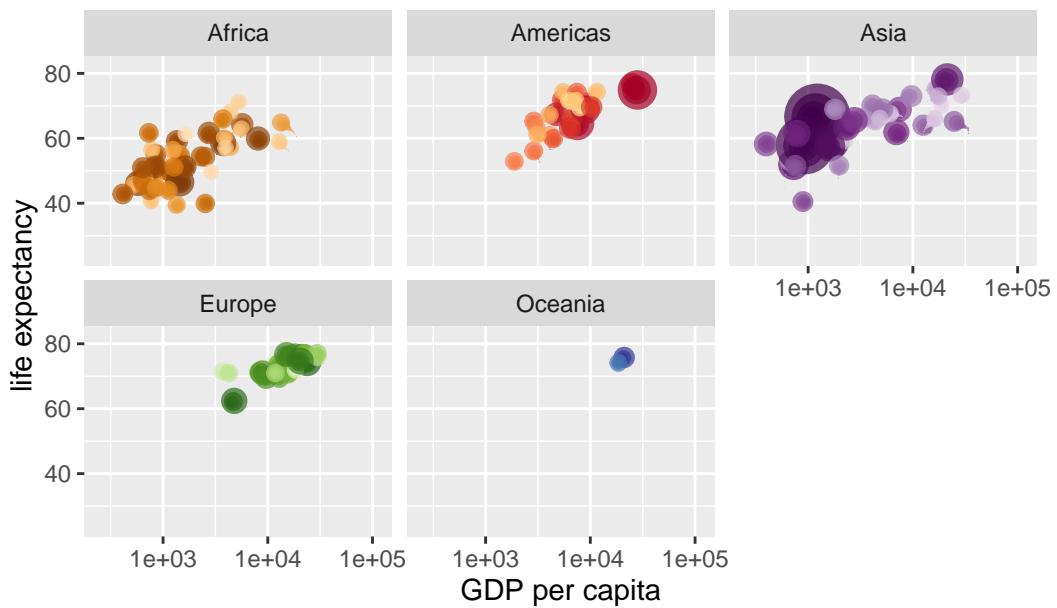
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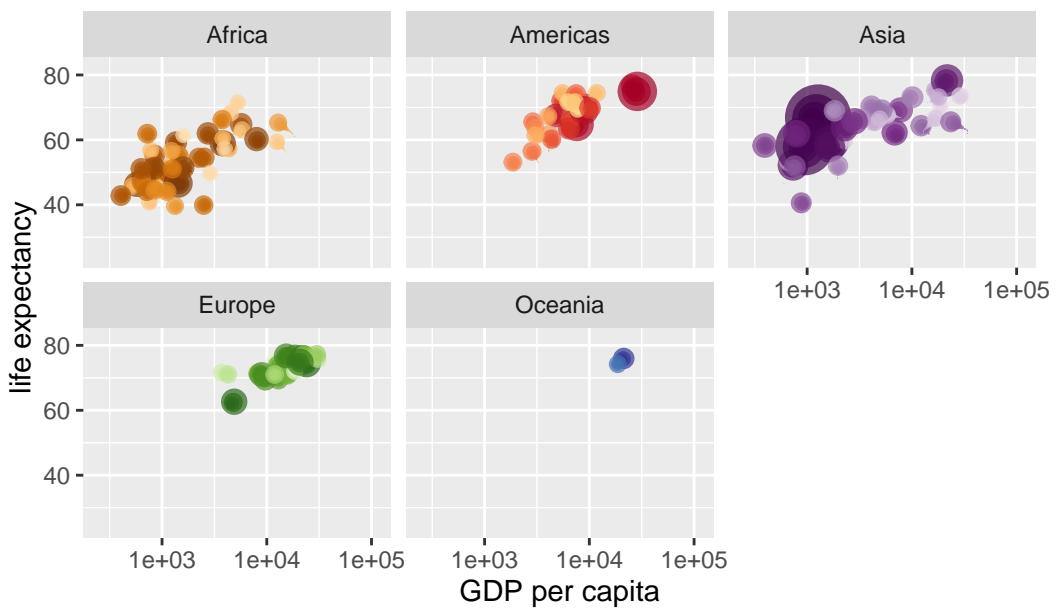
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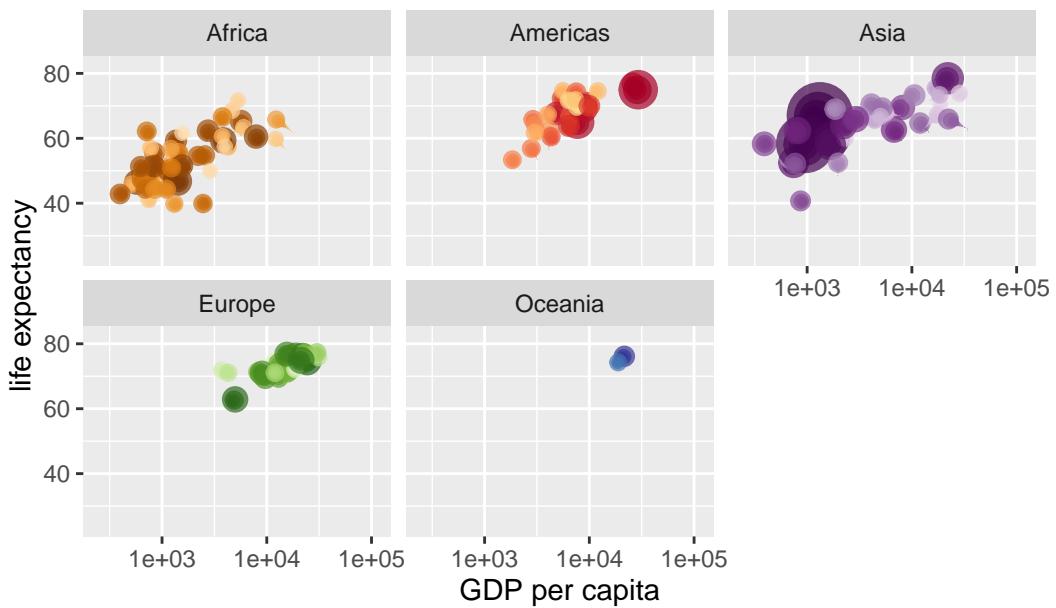
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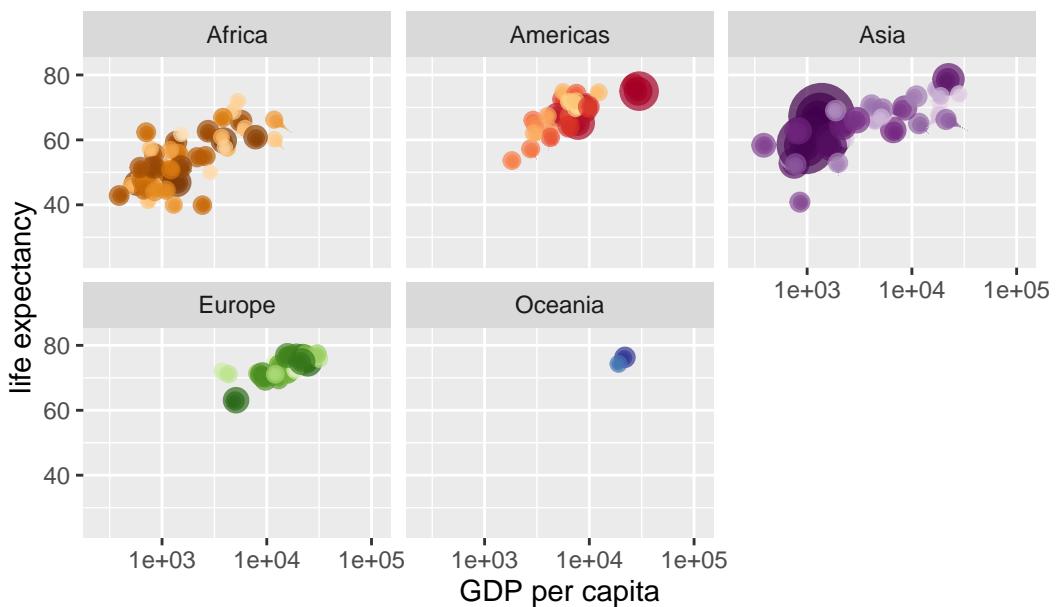
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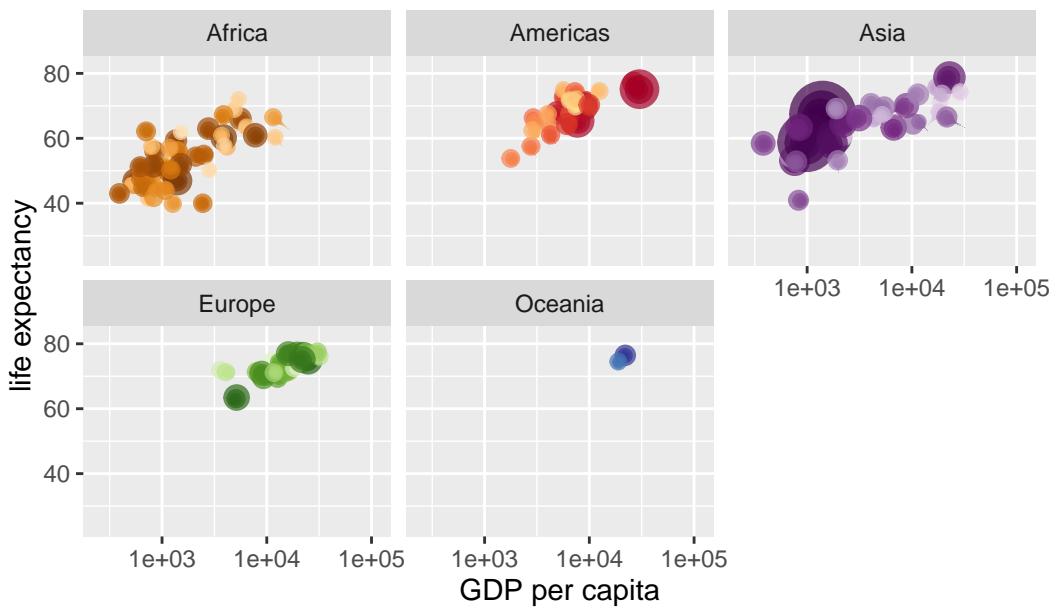
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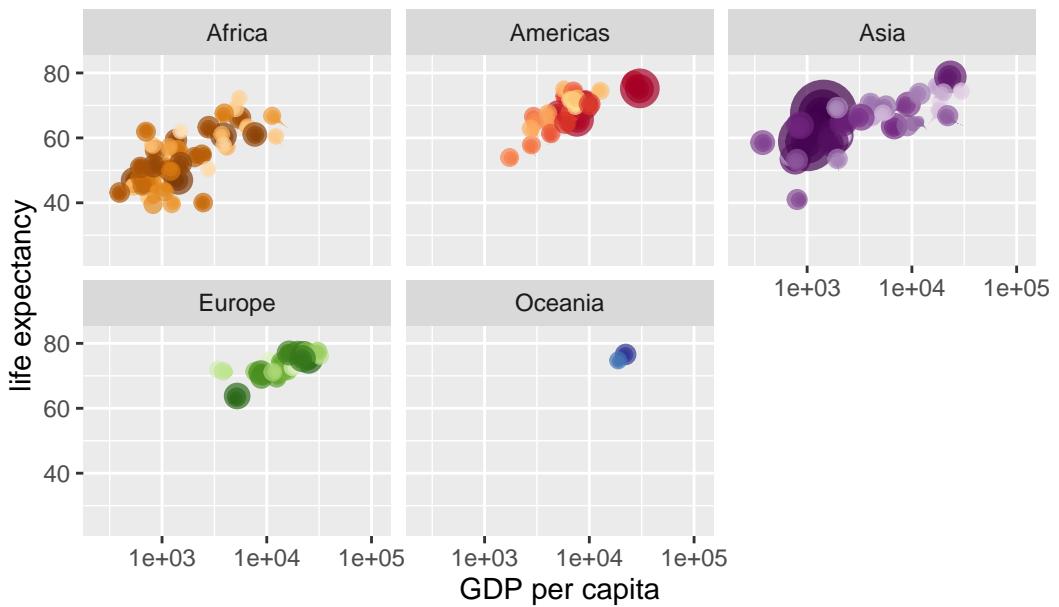
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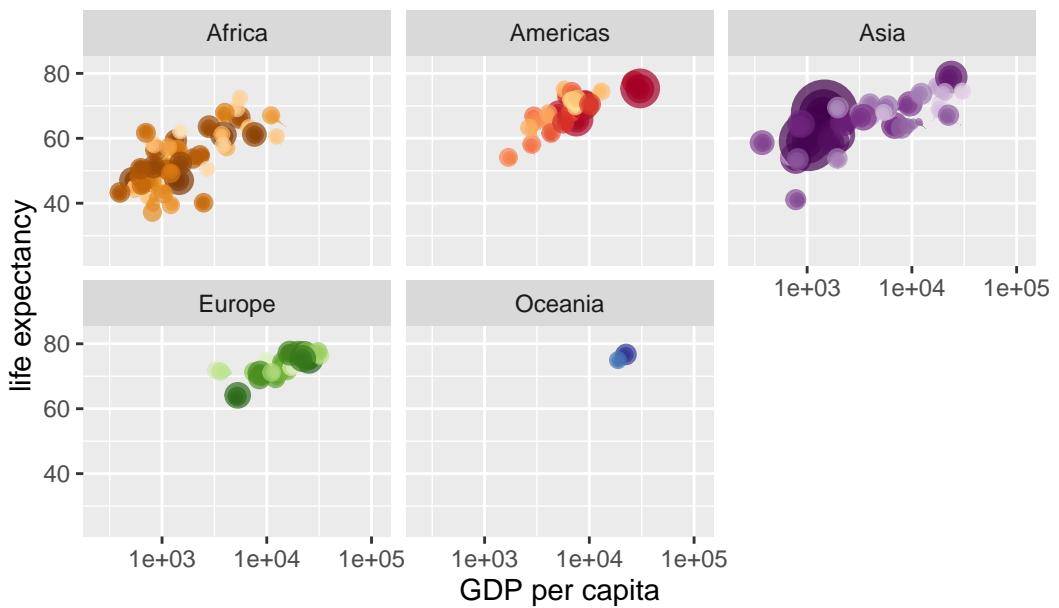
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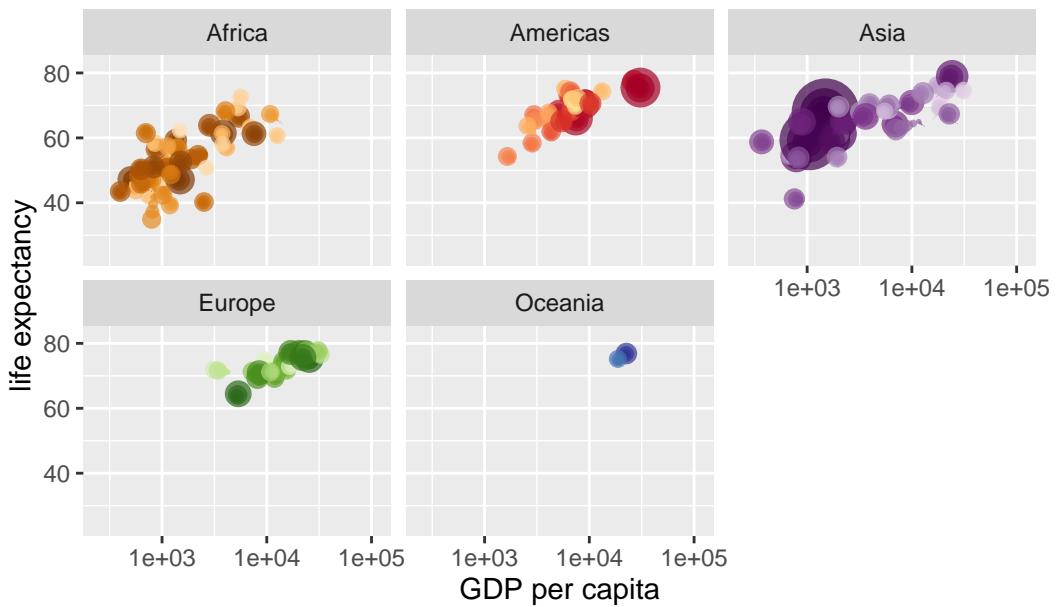
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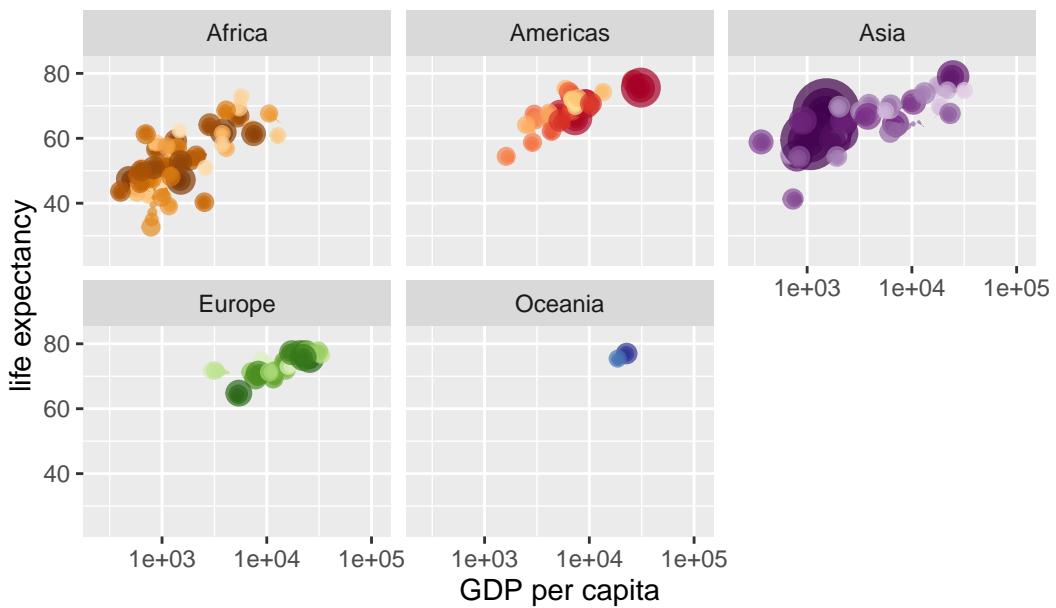
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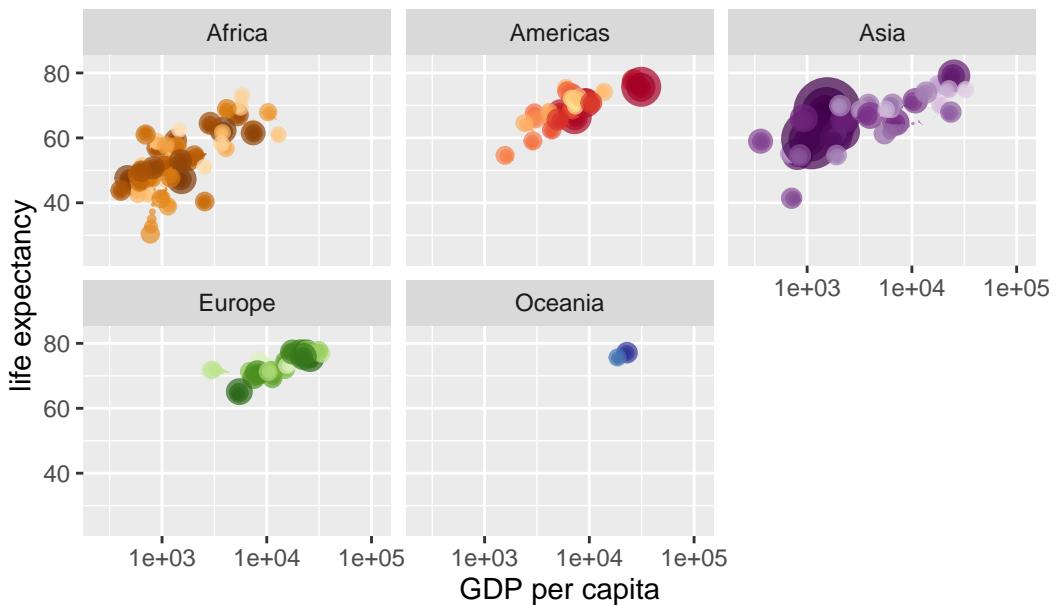
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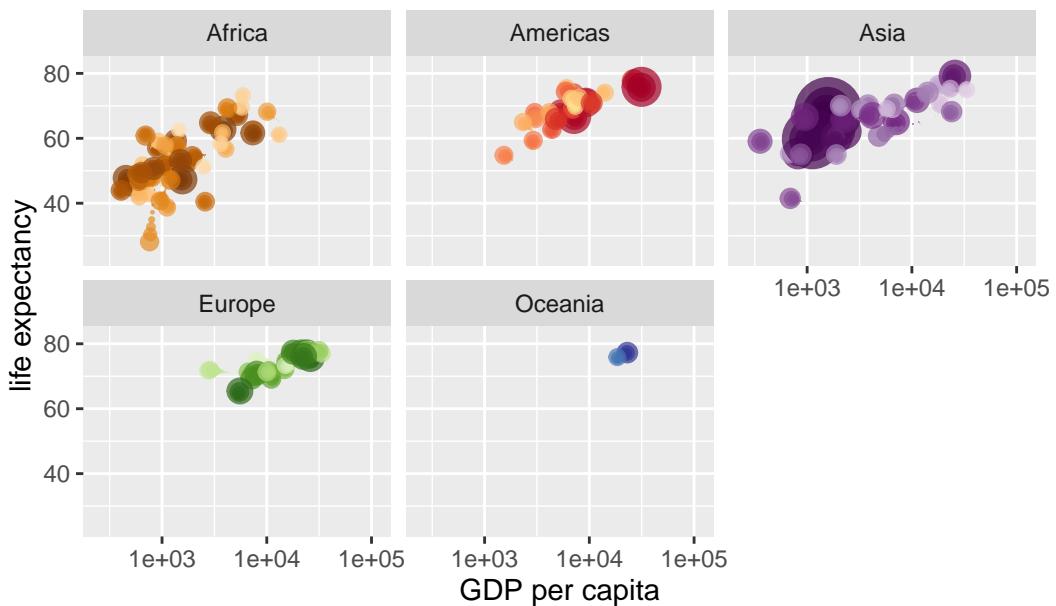
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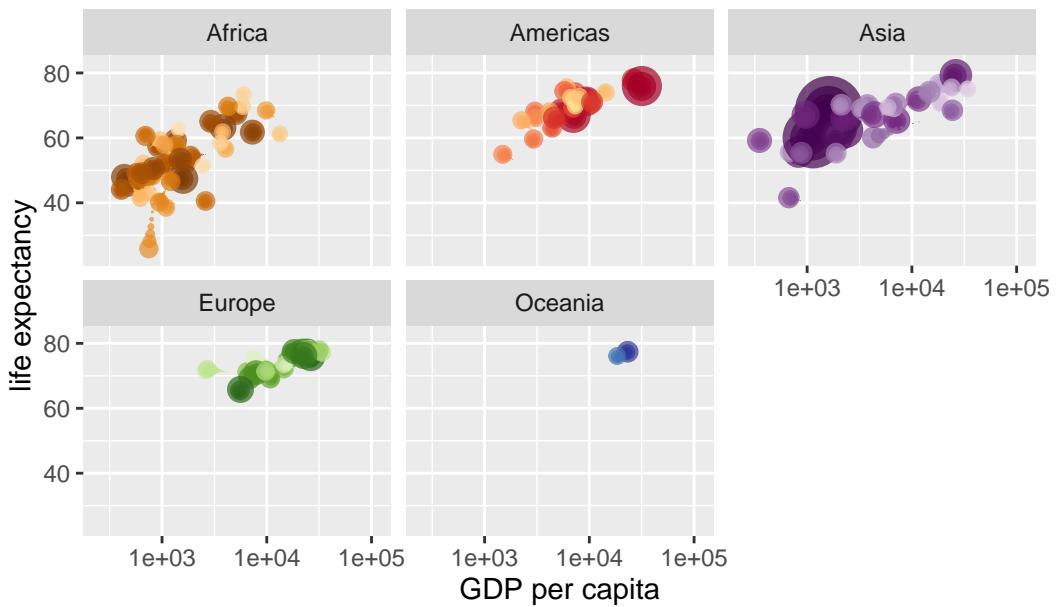
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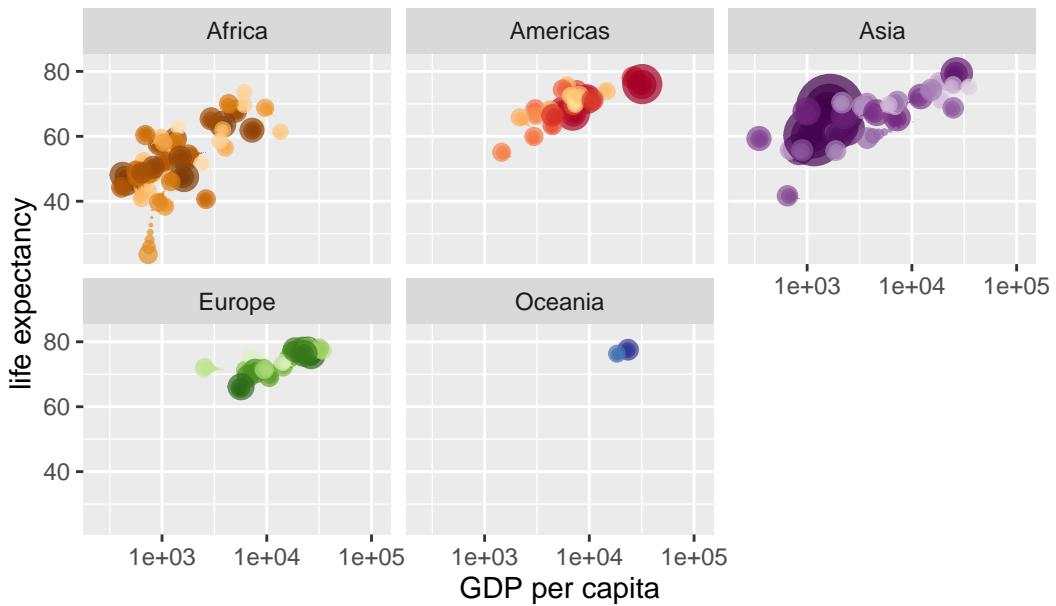
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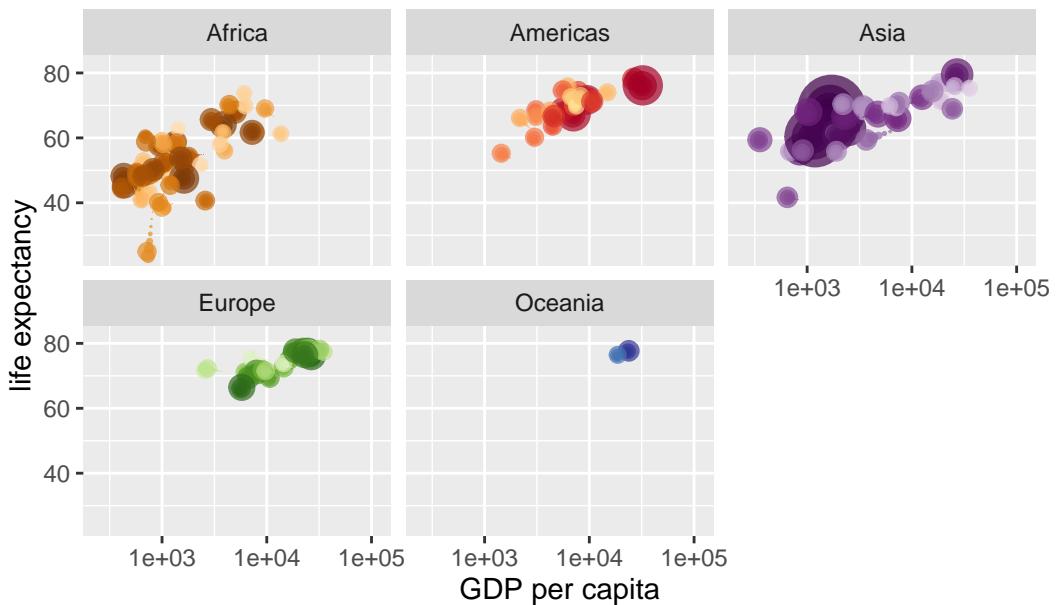
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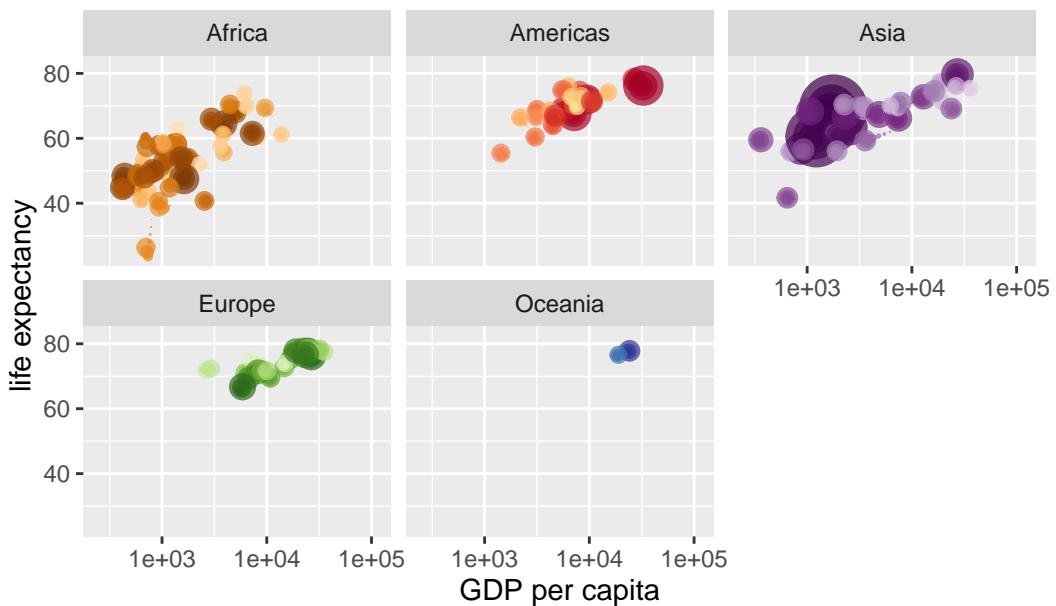
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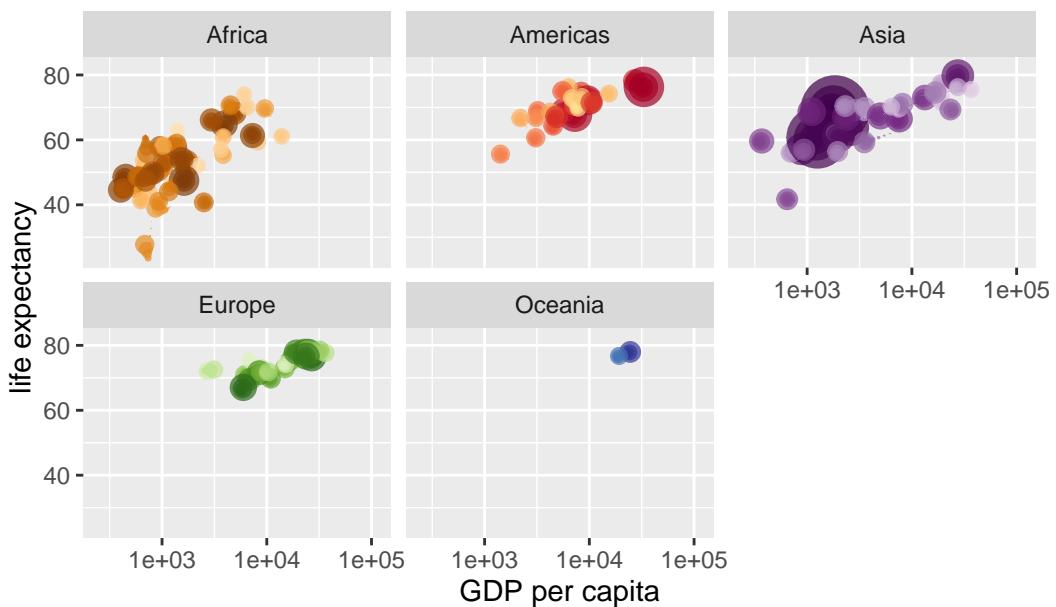
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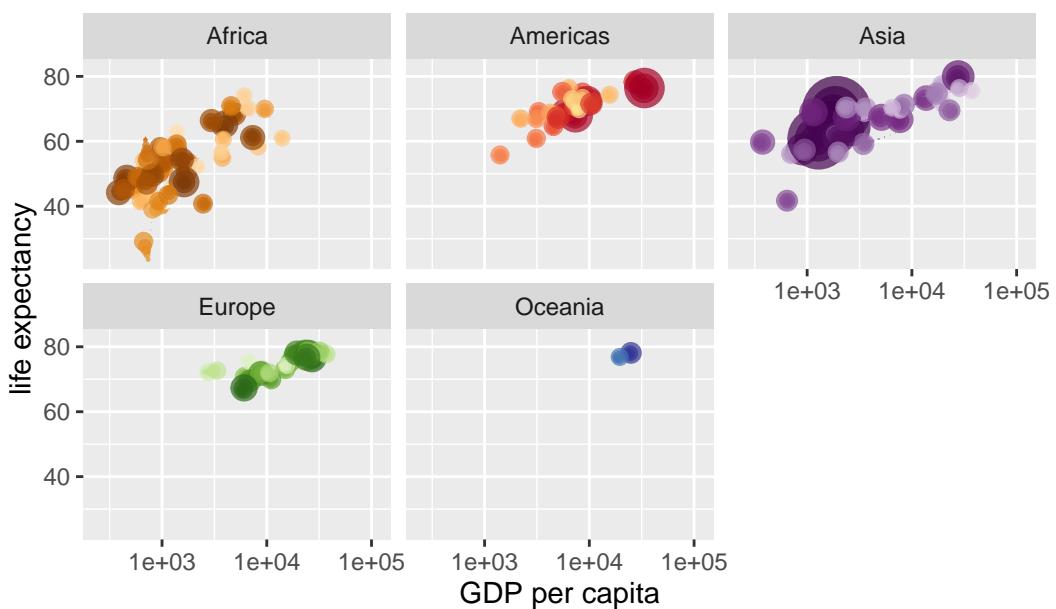
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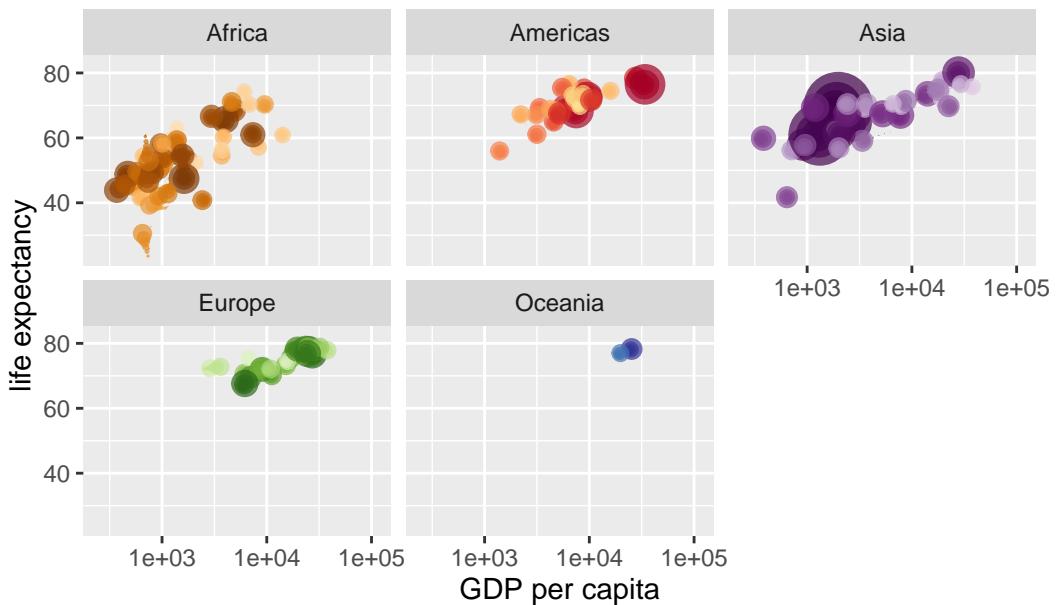
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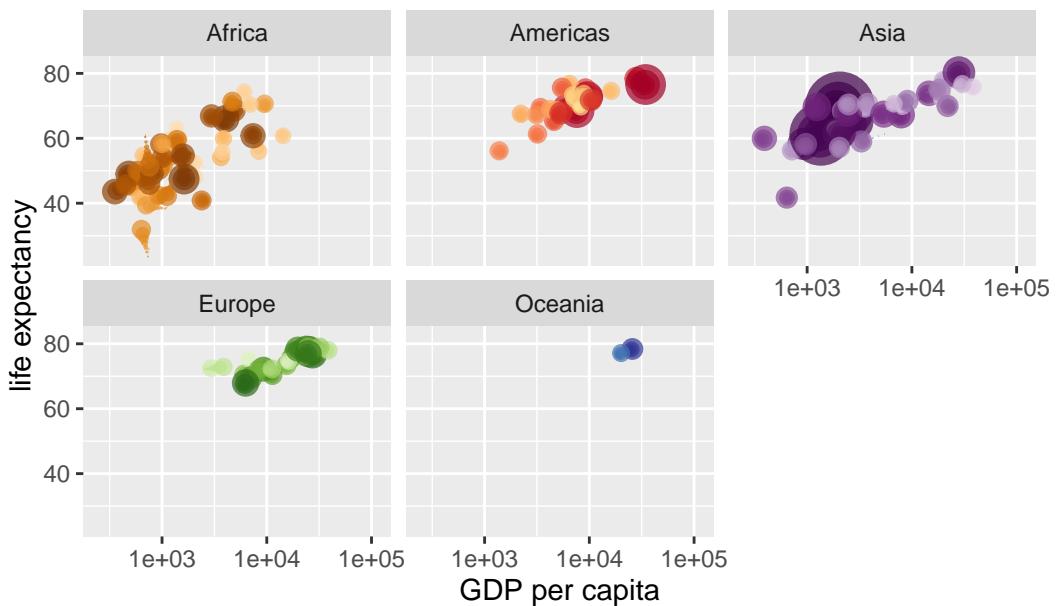
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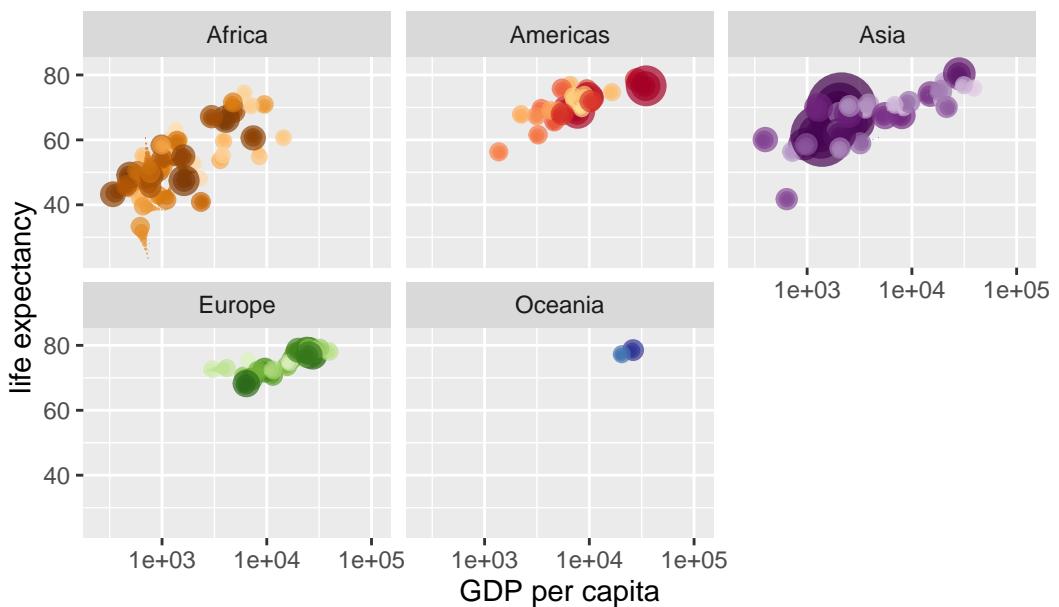
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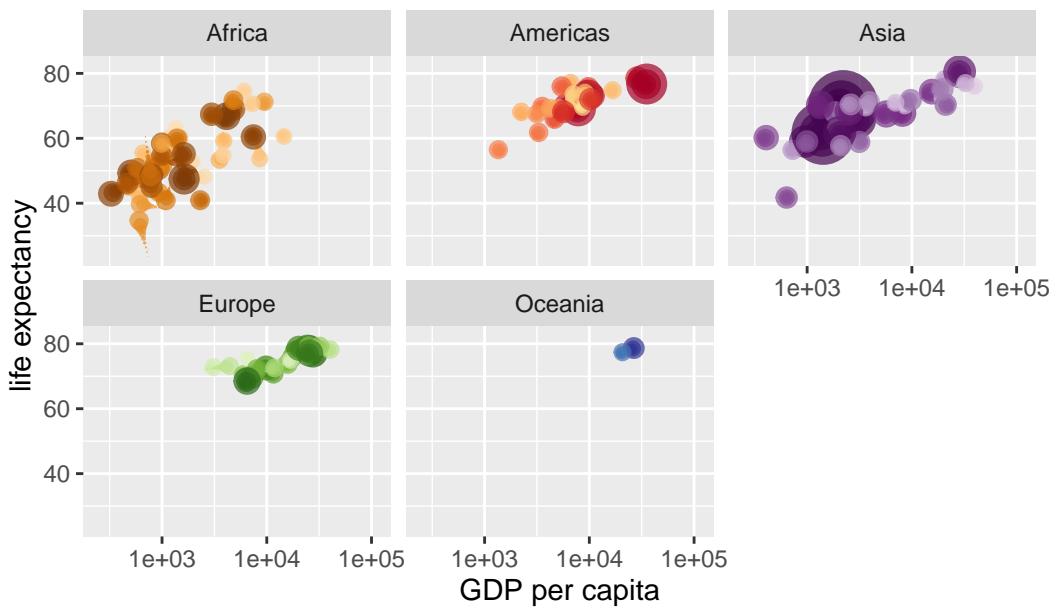
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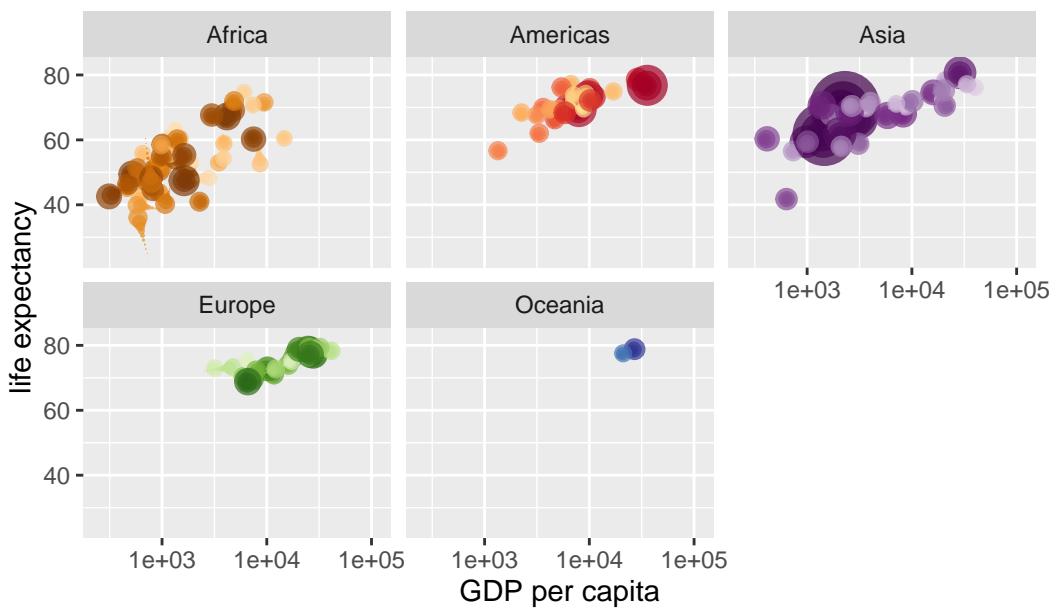
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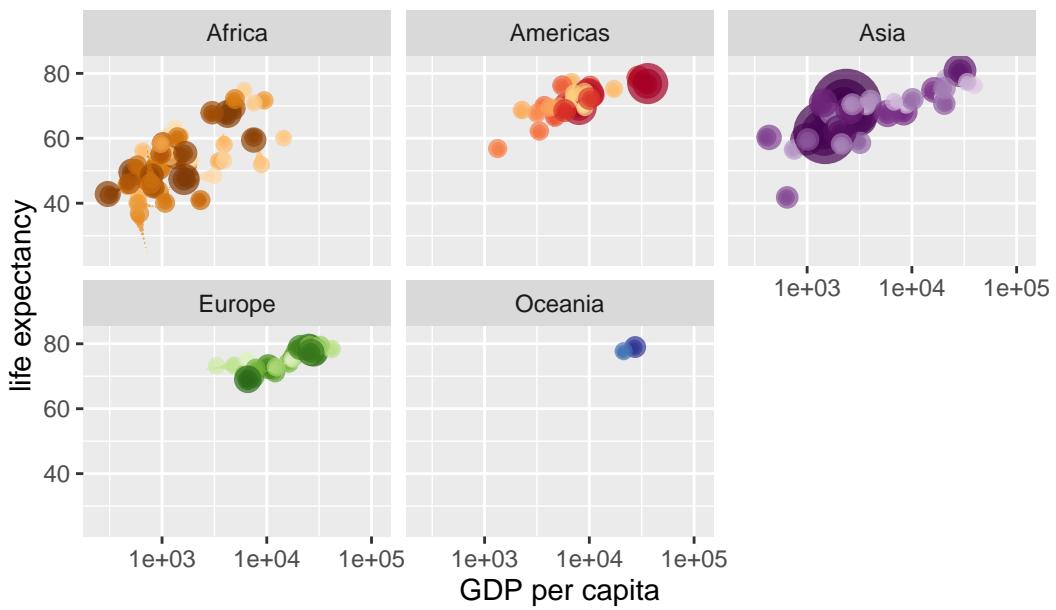
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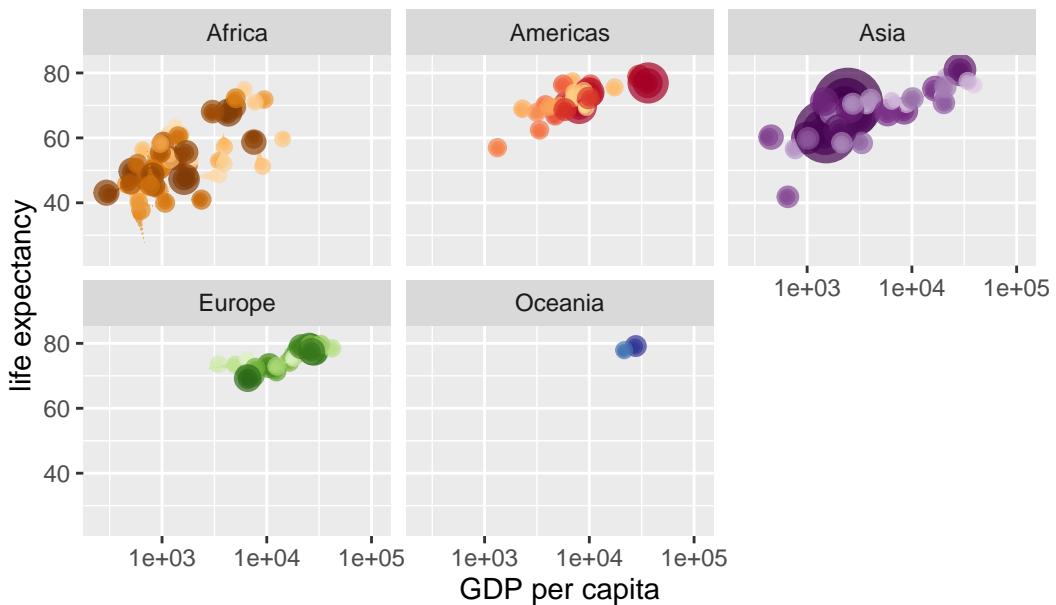
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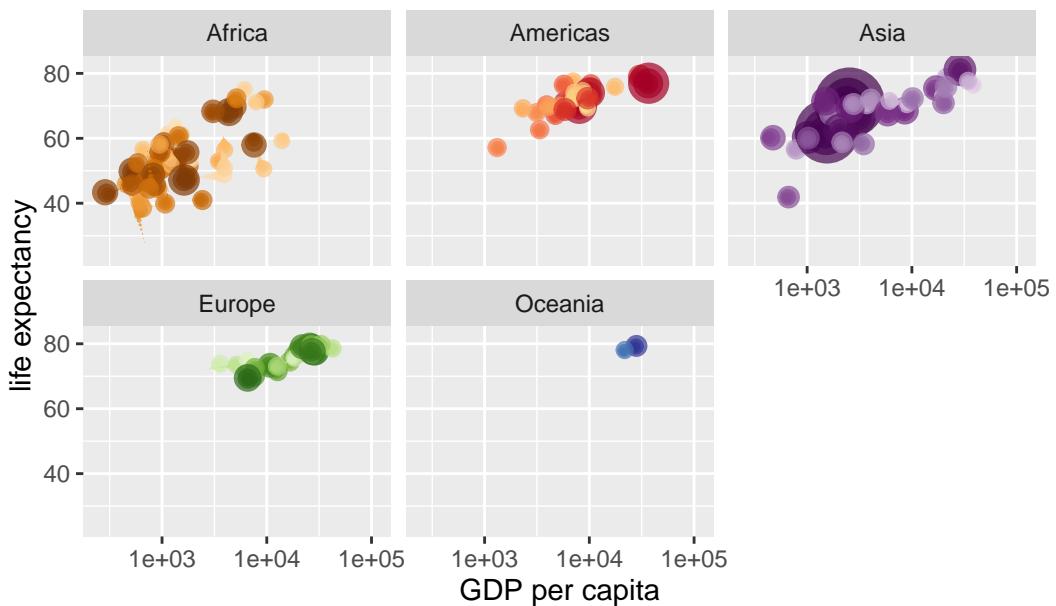
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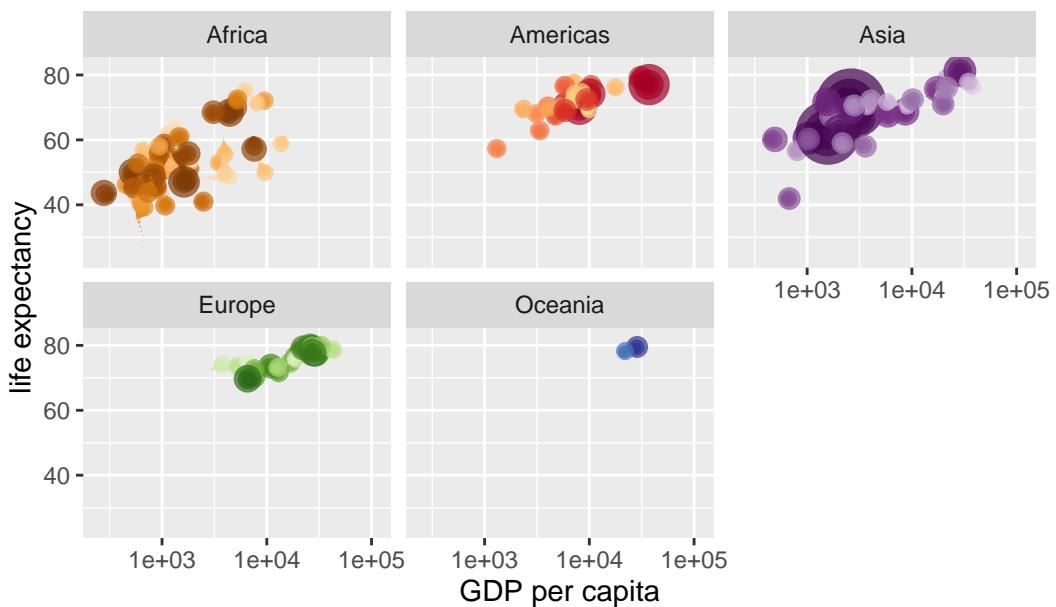
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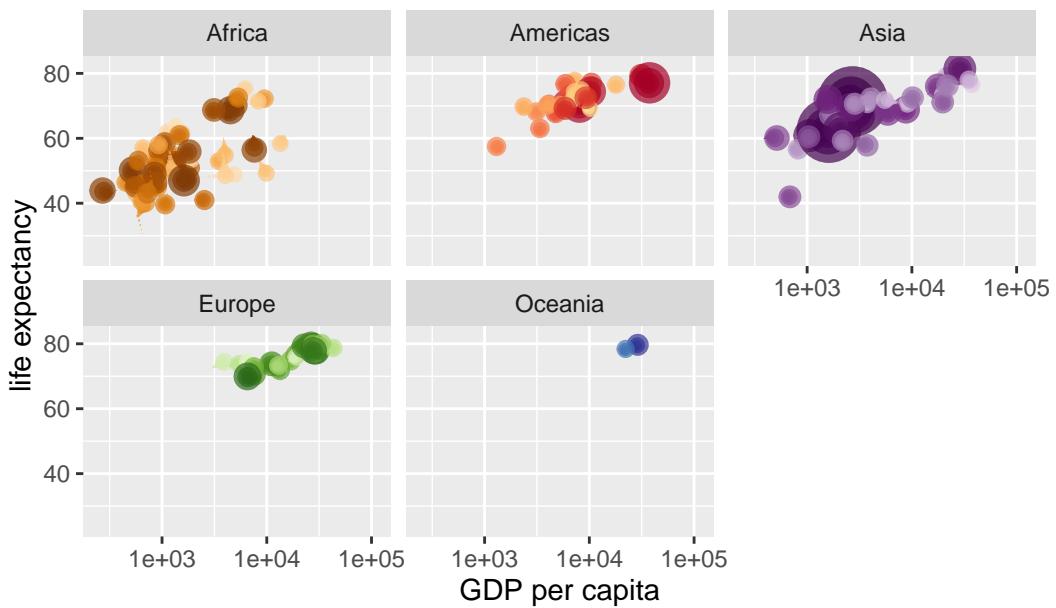
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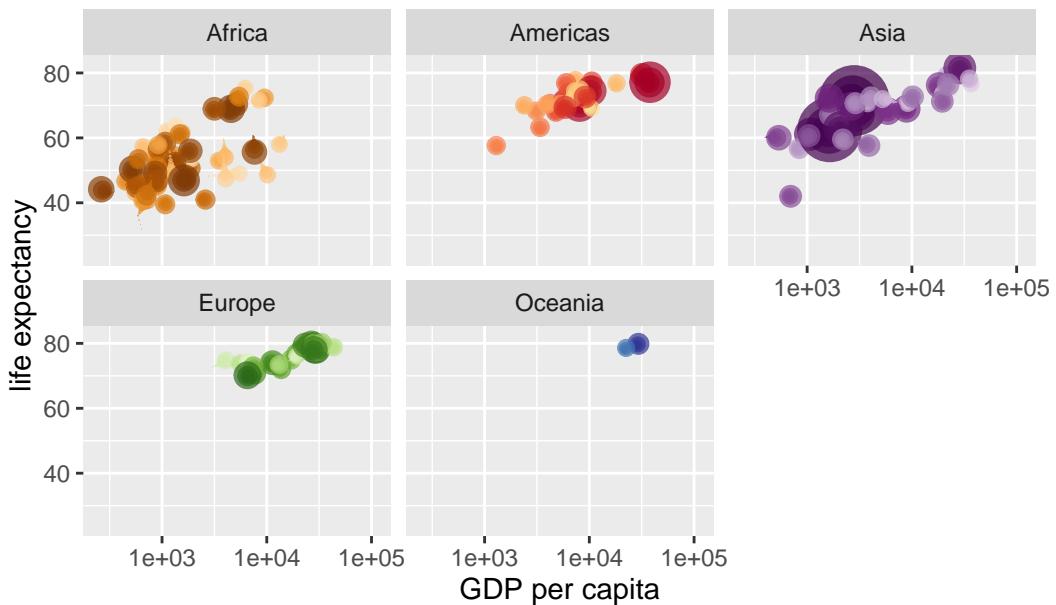
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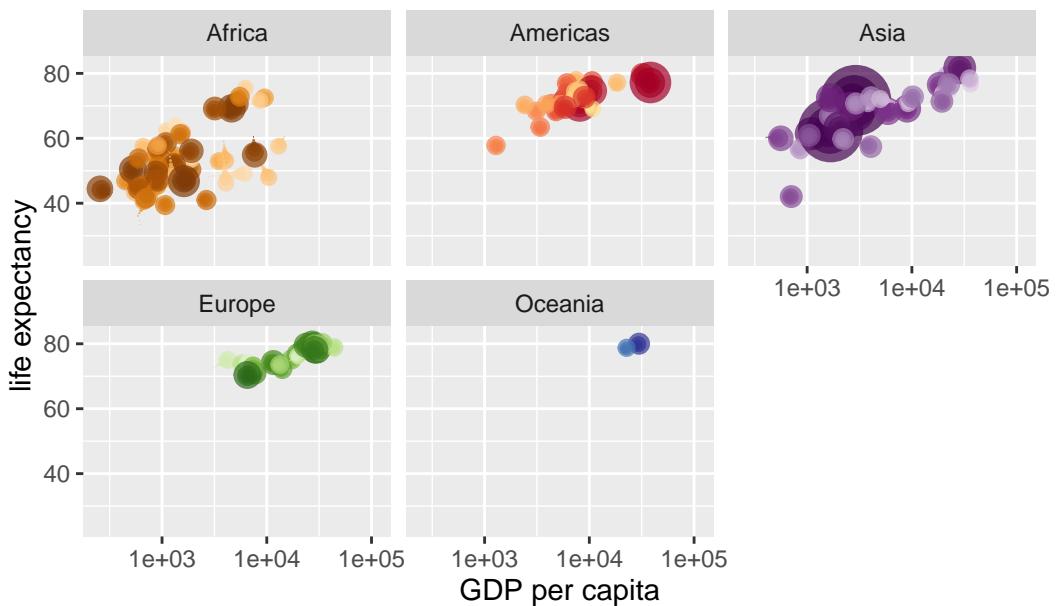
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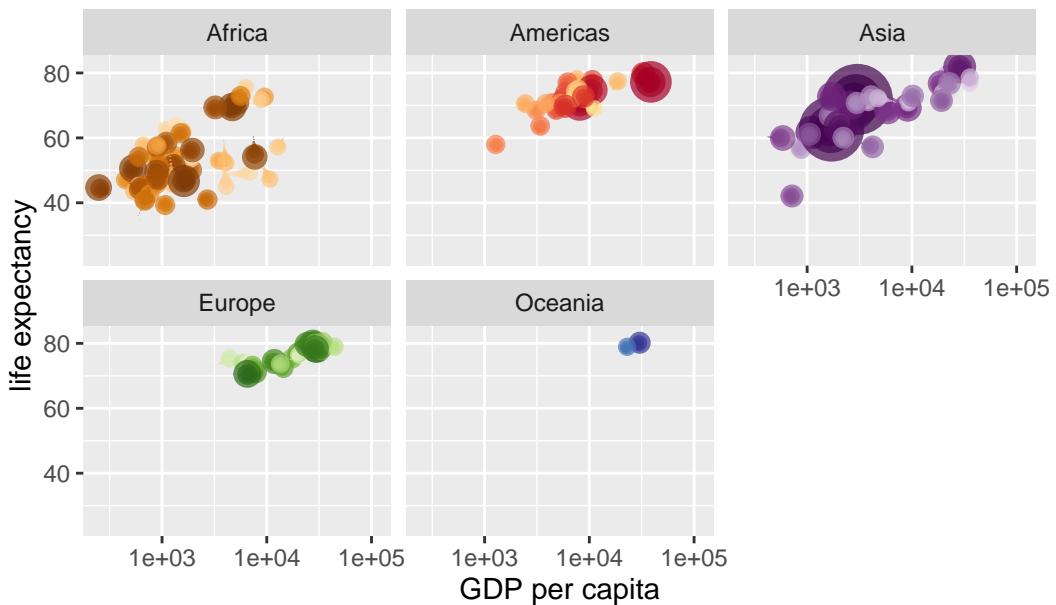
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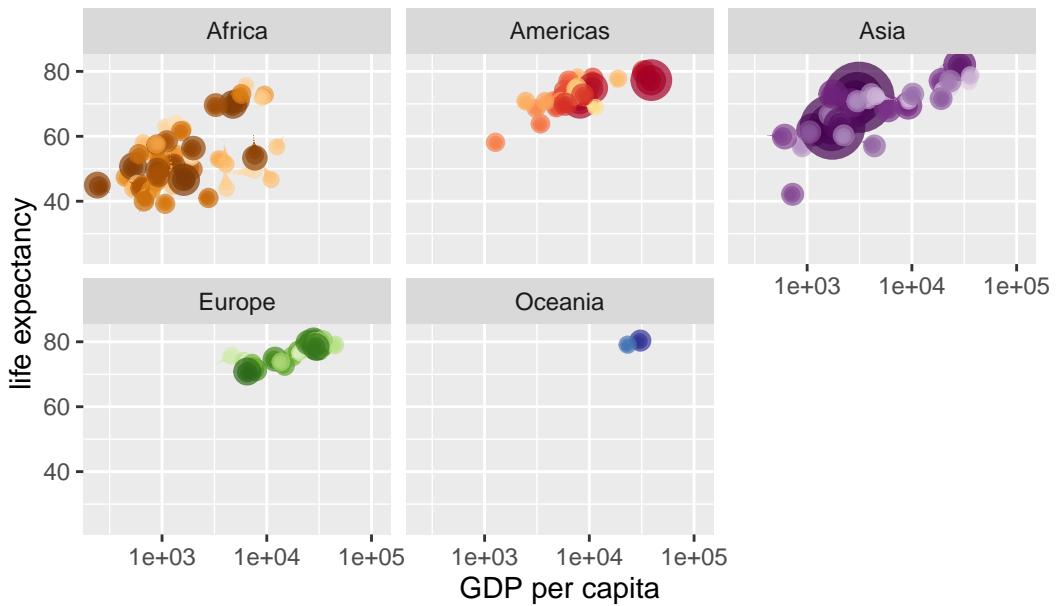
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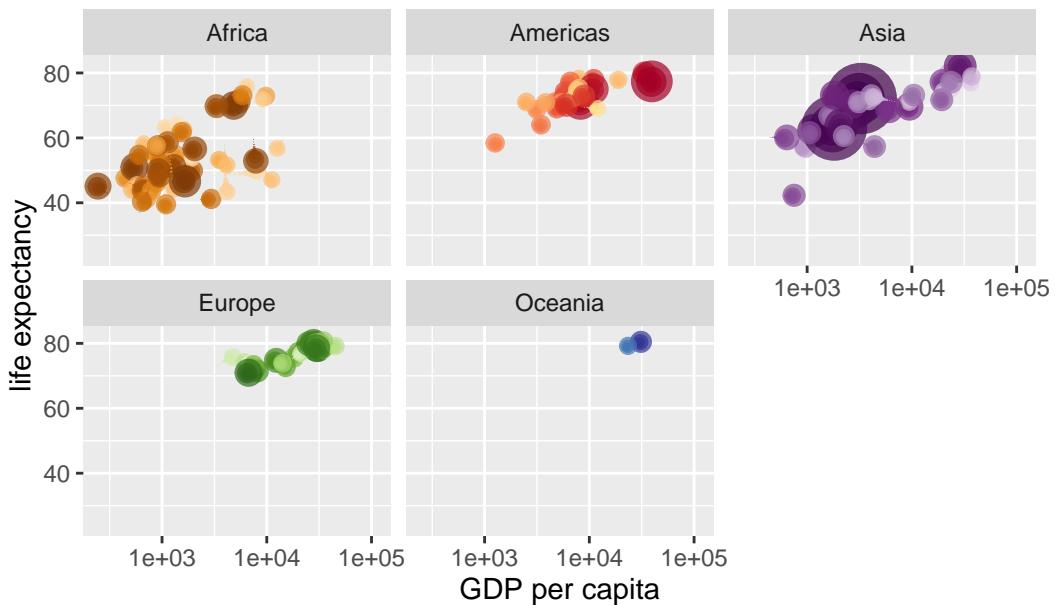
Year: 2001



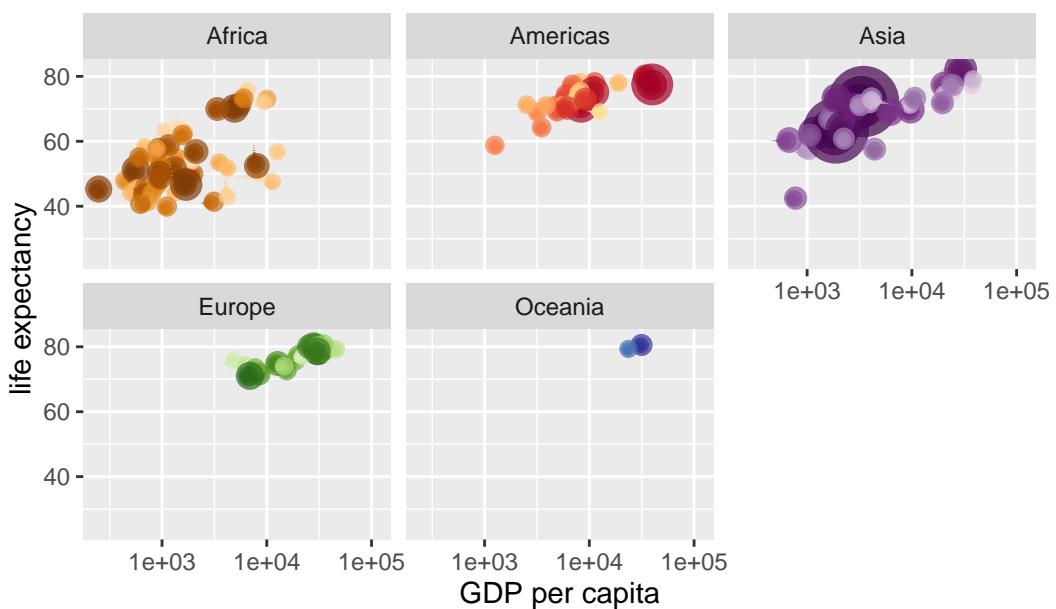
Year: 2002



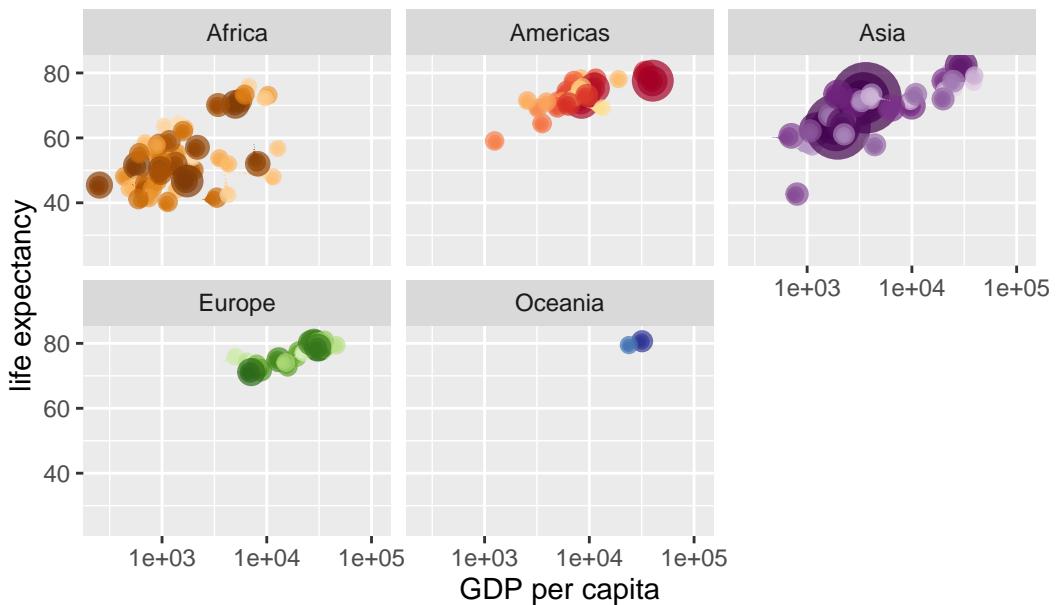
Year: 2003



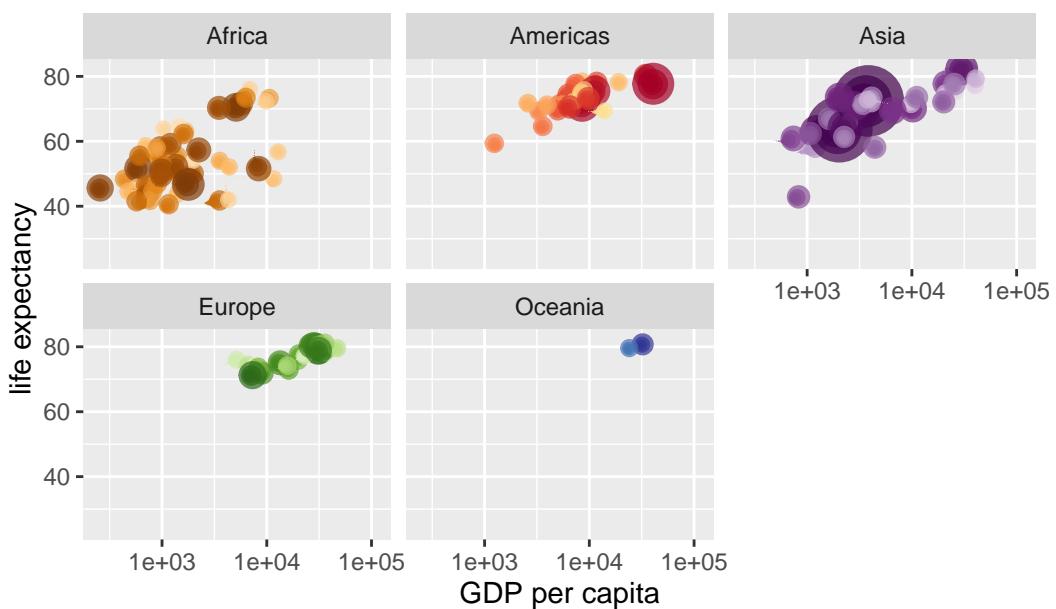
Year: 2003



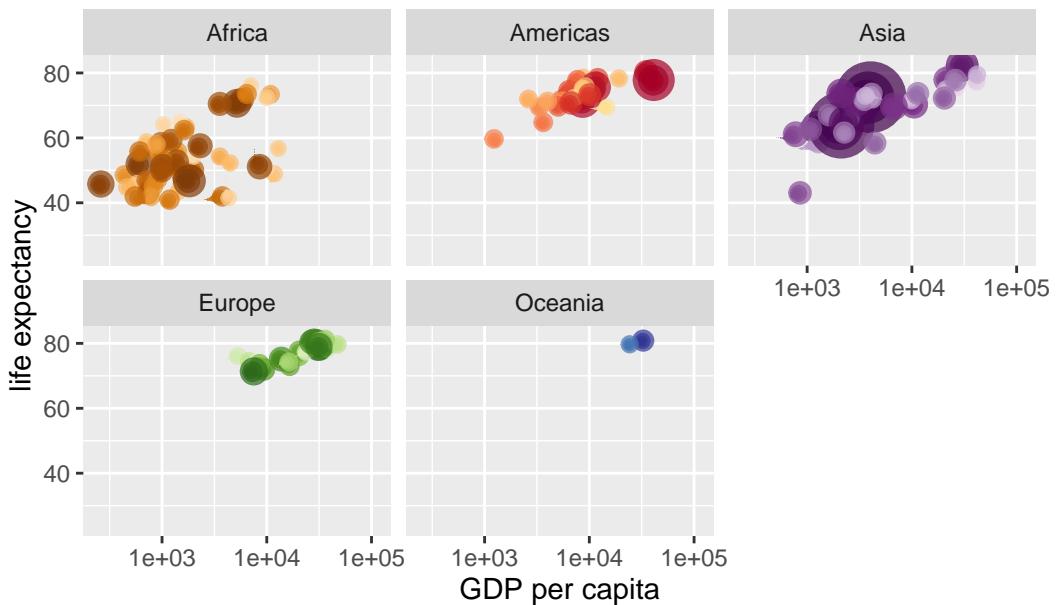
Year: 2004



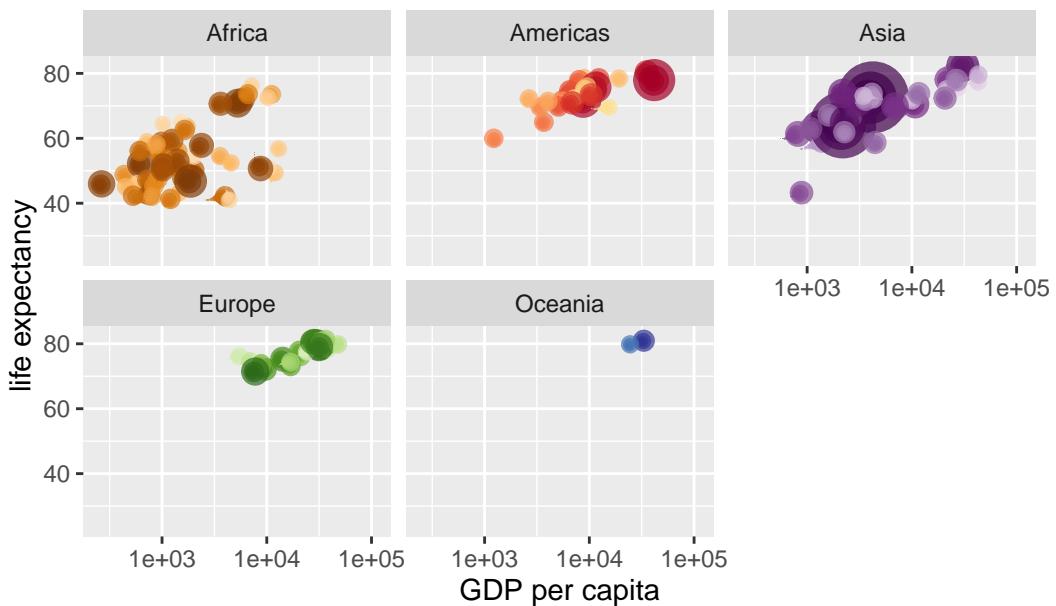
Year: 2004



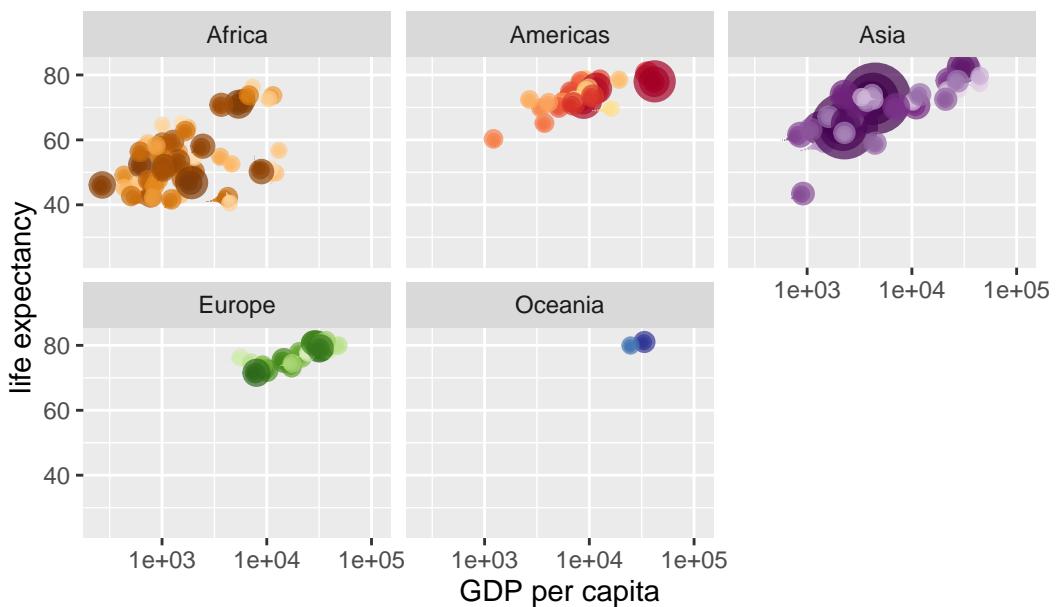
Year: 2005



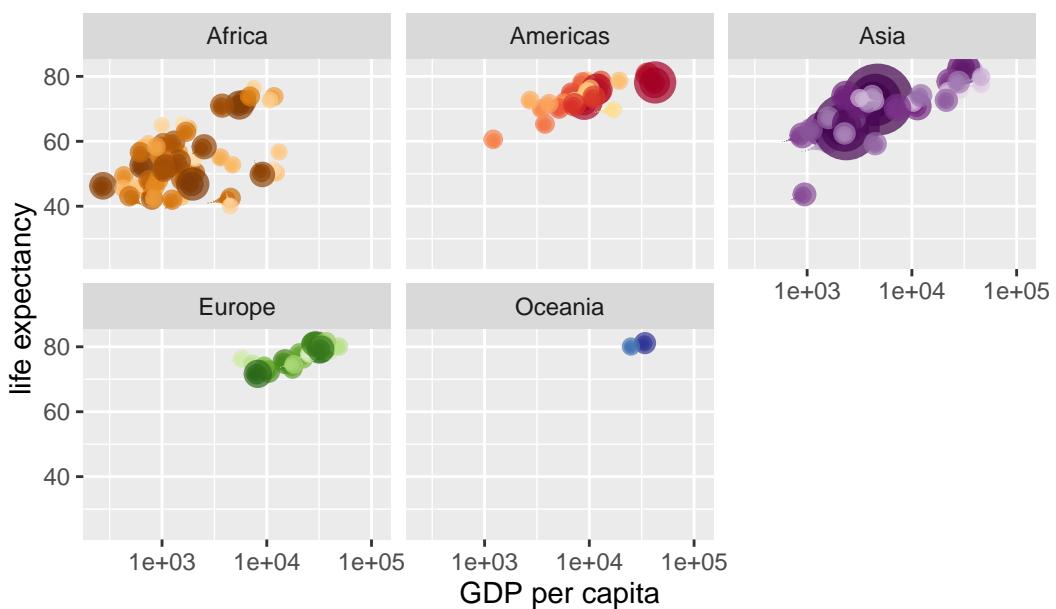
Year: 2005

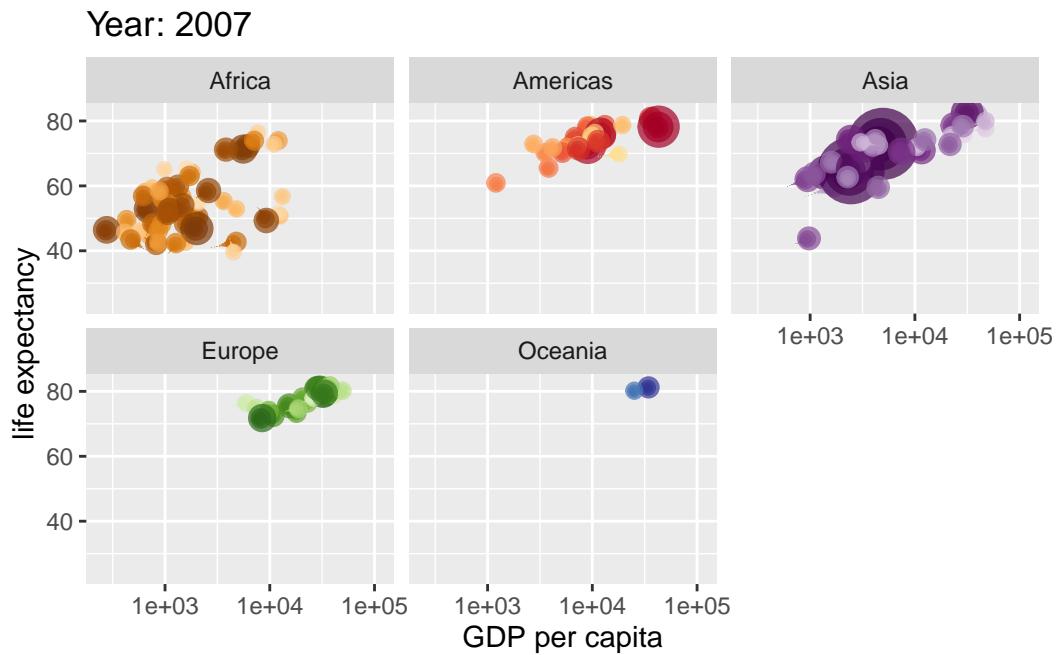


Year: 2006



Year: 2006





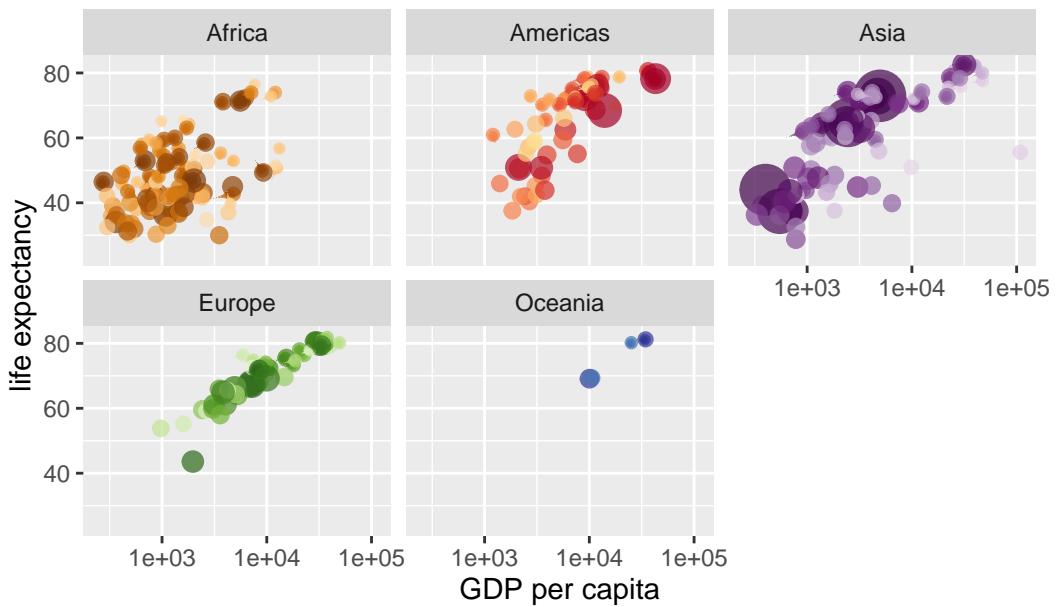
```

library(gapminder)
library(gganimate)

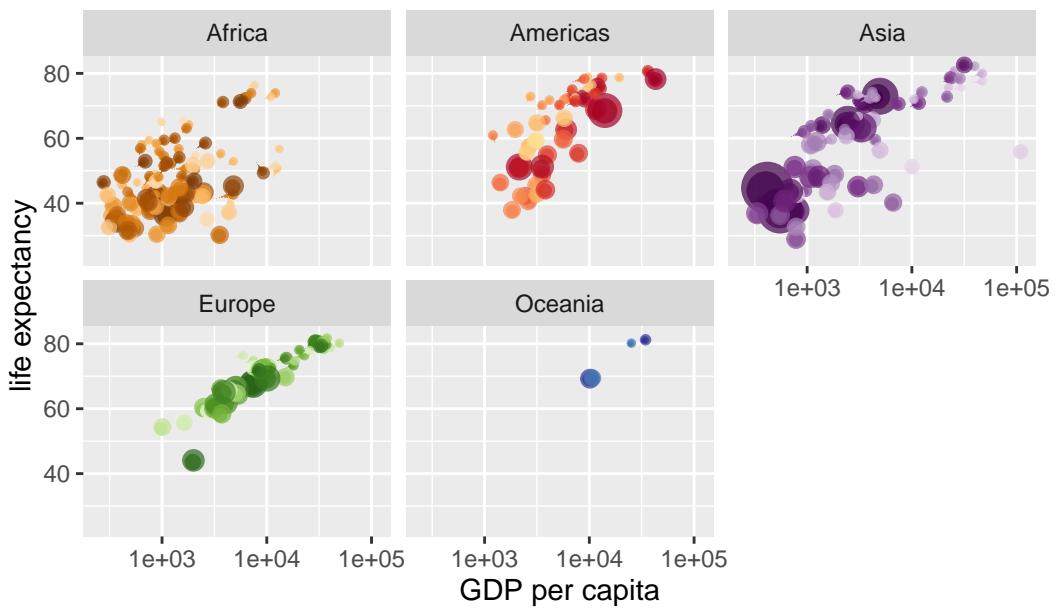
# Setup nice regular ggplot of the gapminder data
ggplot(gapminder, aes(gdpPercap, lifeExp, size = pop, colour = country)) +
  geom_point(alpha = 0.7, show.legend = FALSE) +
  scale_colour_manual(values = country_colors) +
  scale_size(range = c(2, 12)) +
  scale_x_log10() +
  # Facet by continent
  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)

```

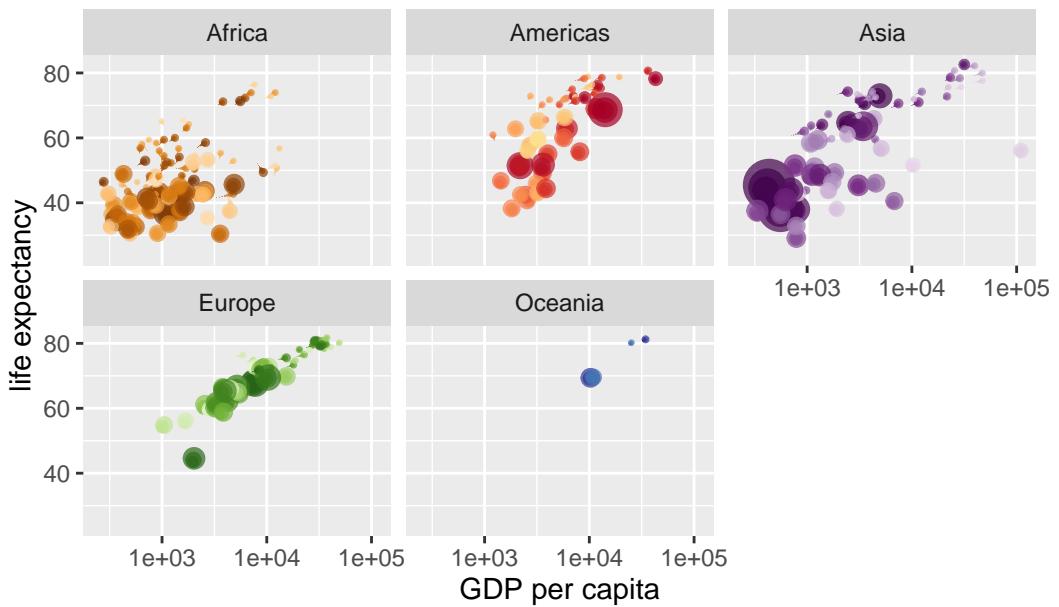
Year: 1952



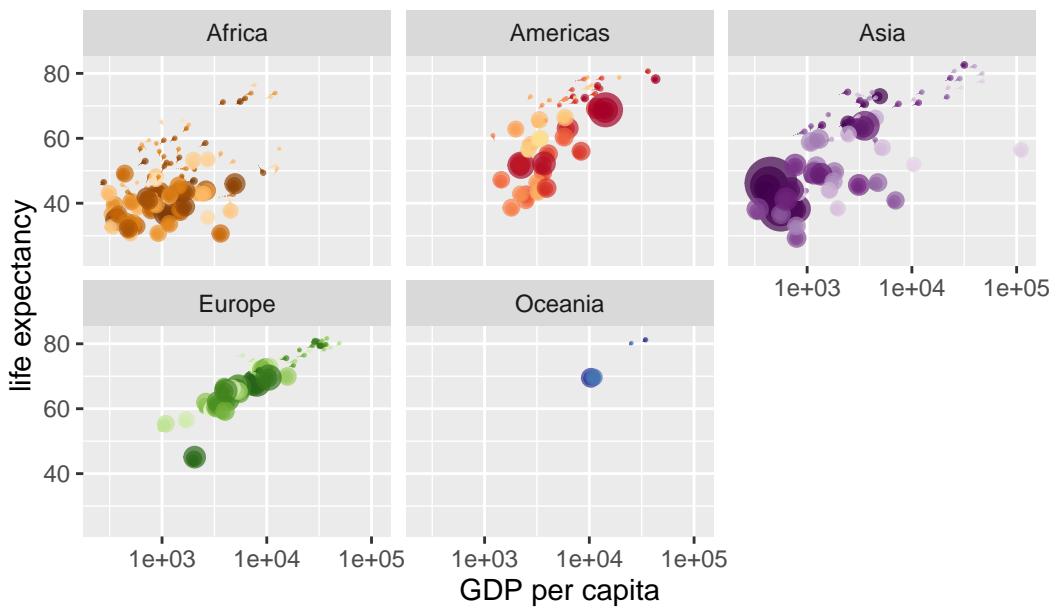
Year: 1953



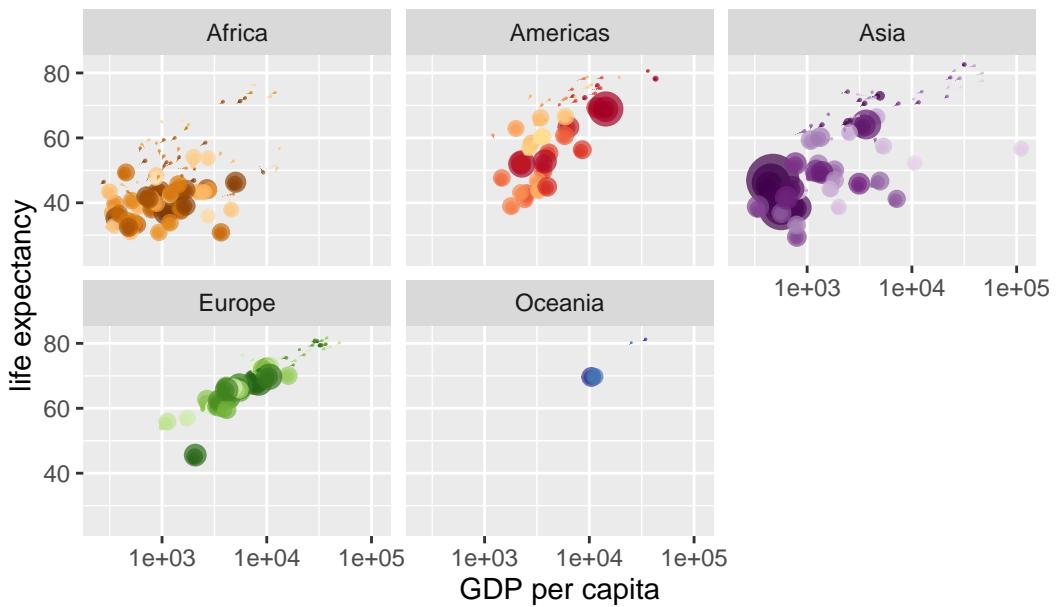
Year: 1953



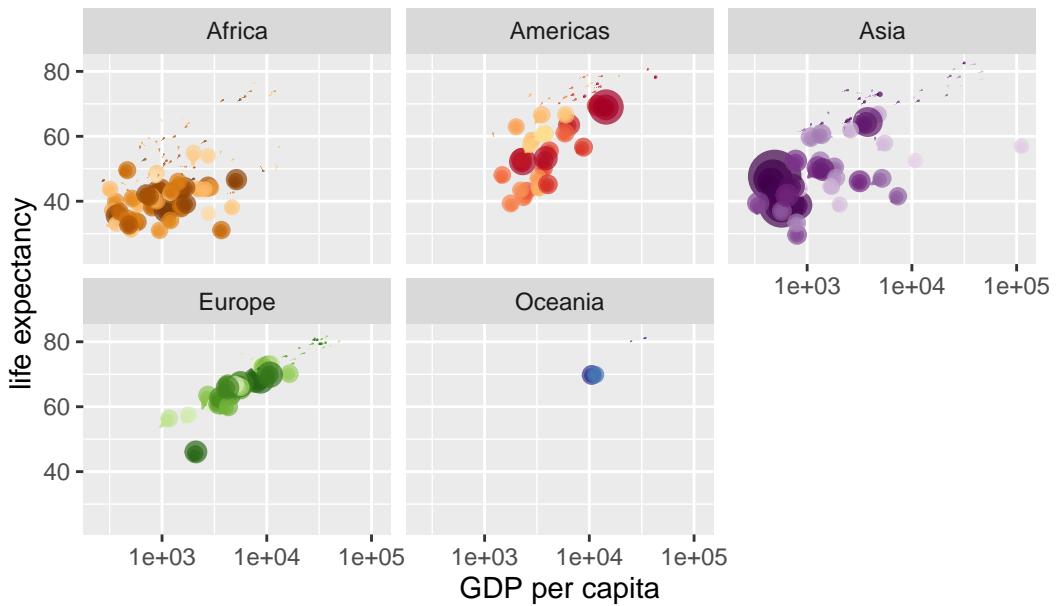
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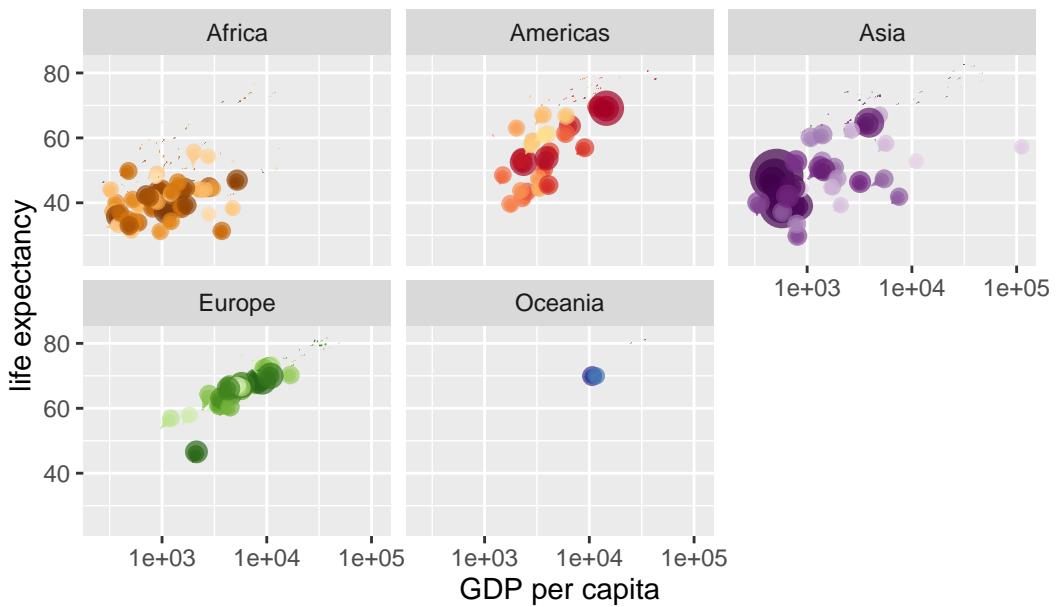
Year: 1954



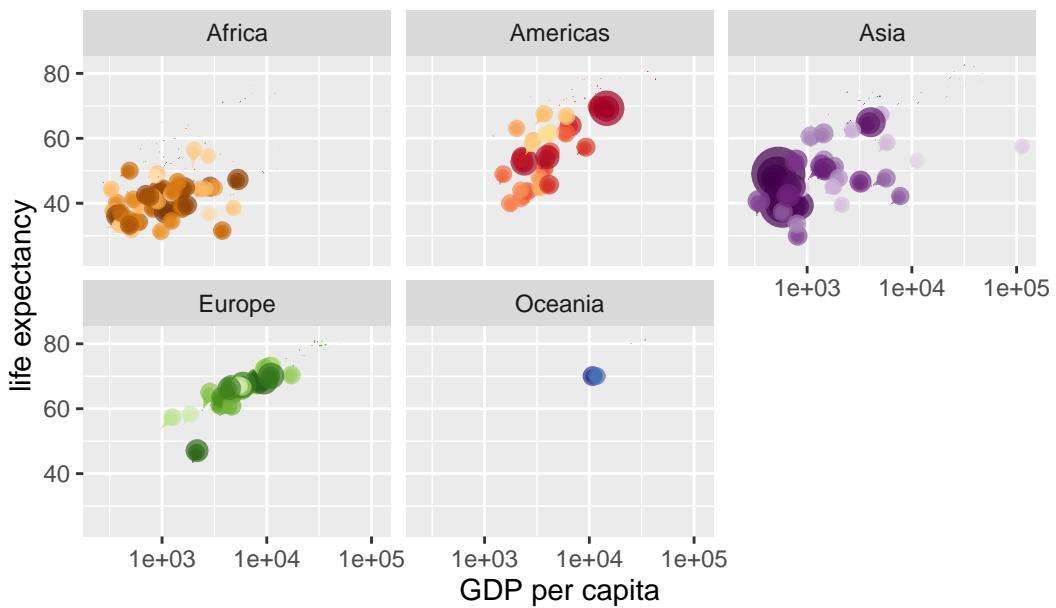
Year: 1955



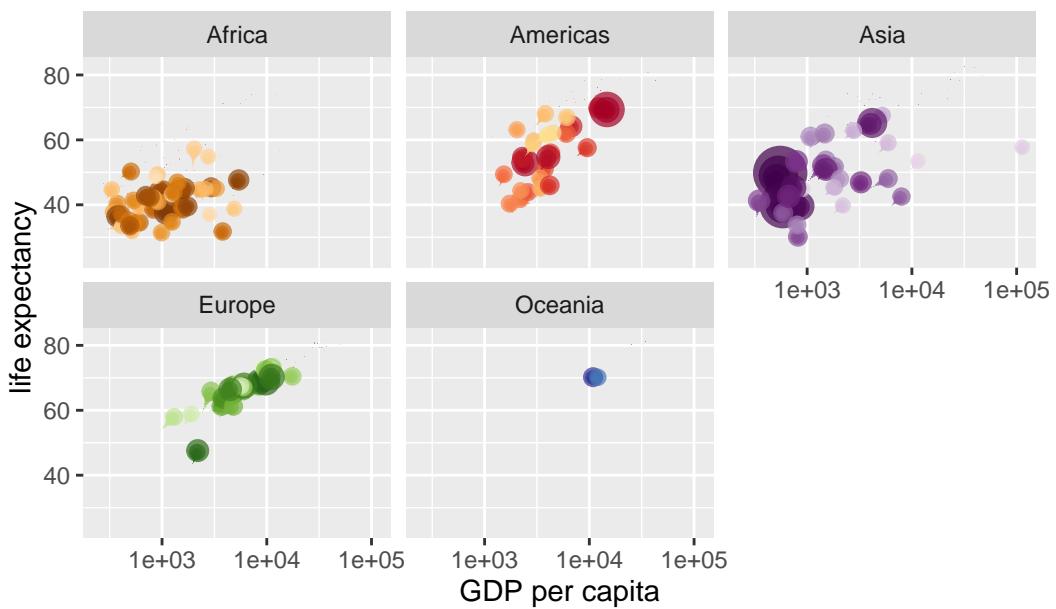
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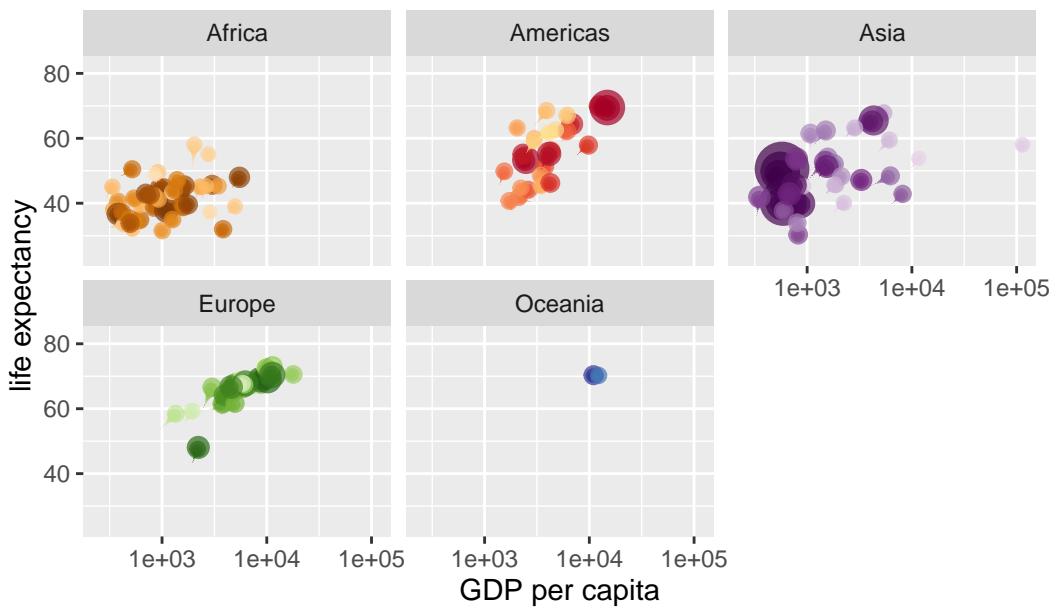
Year: 1956



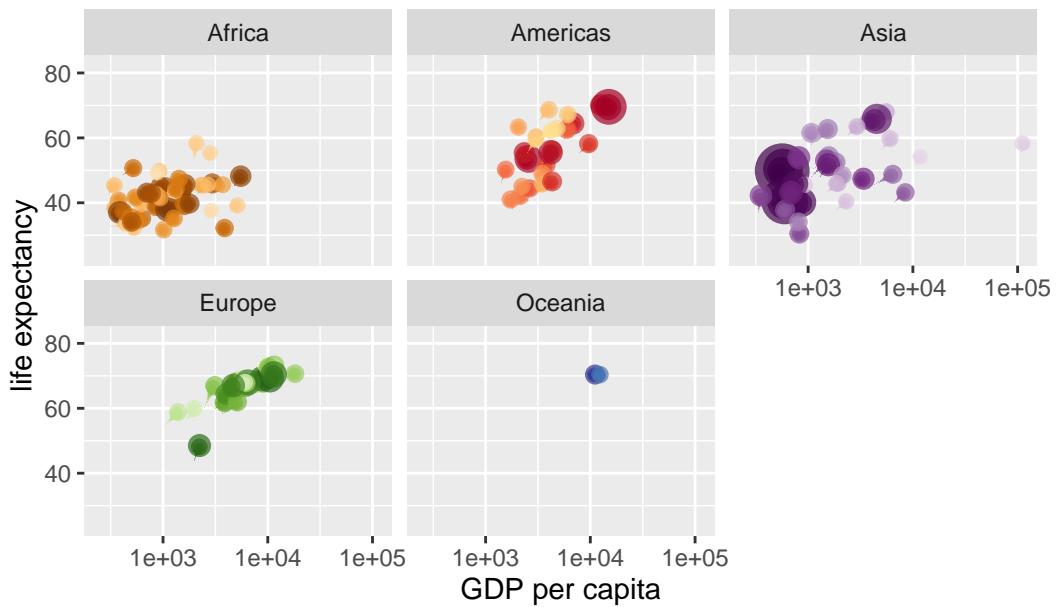
Year: 1956



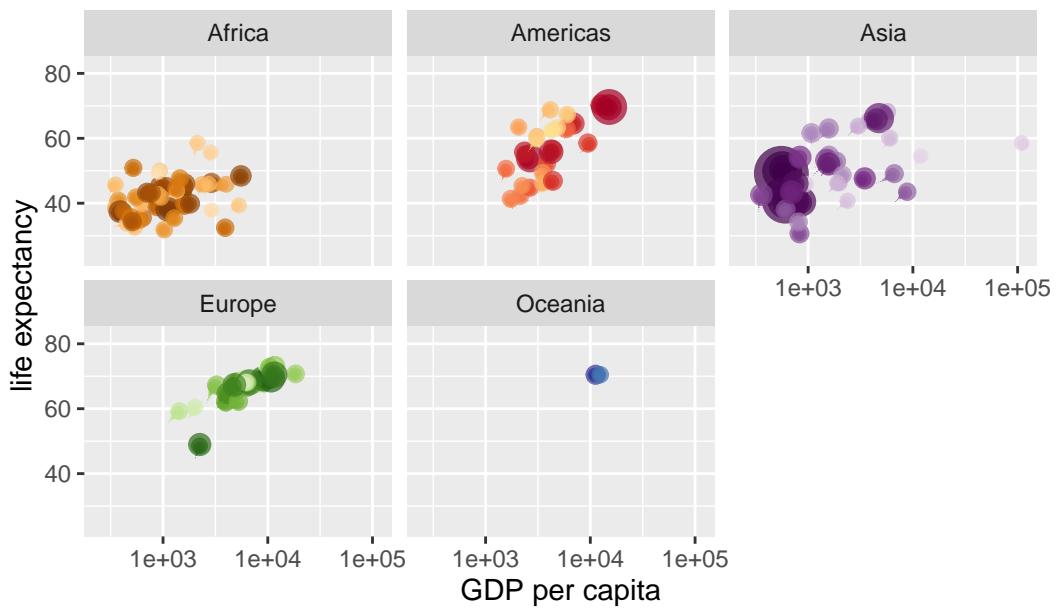
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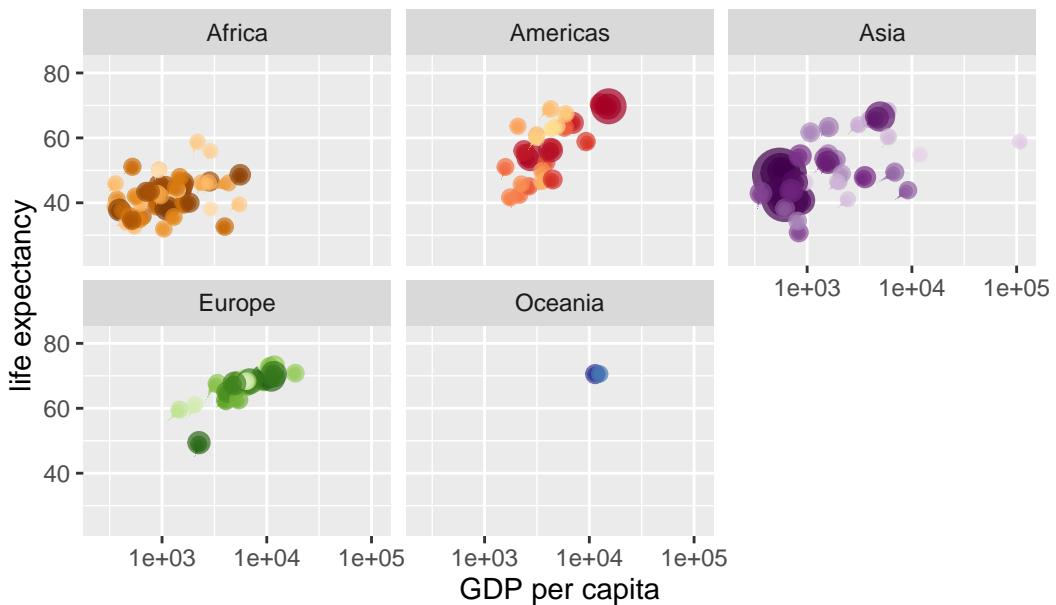
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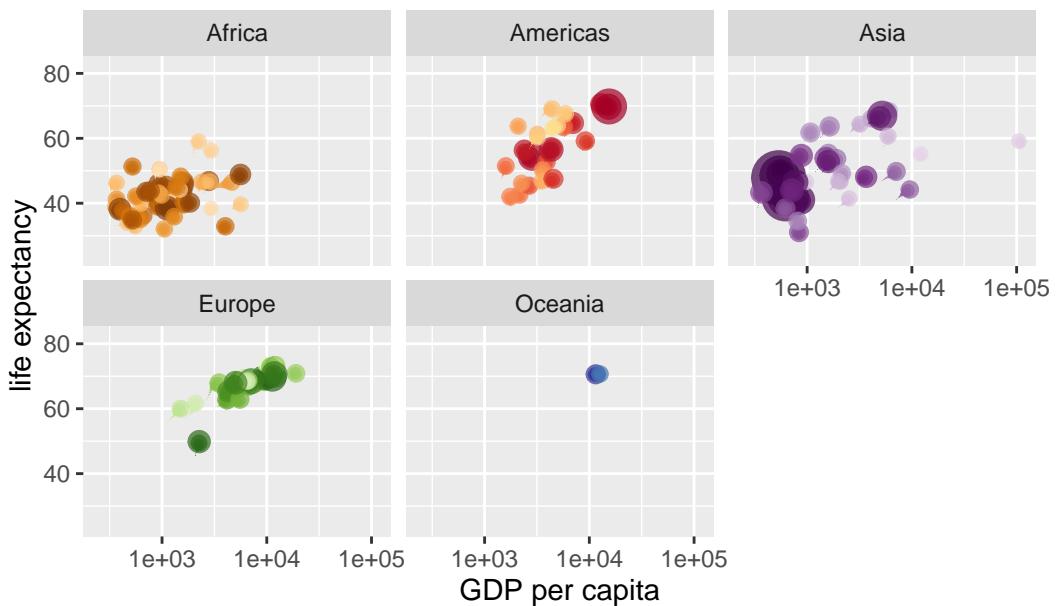
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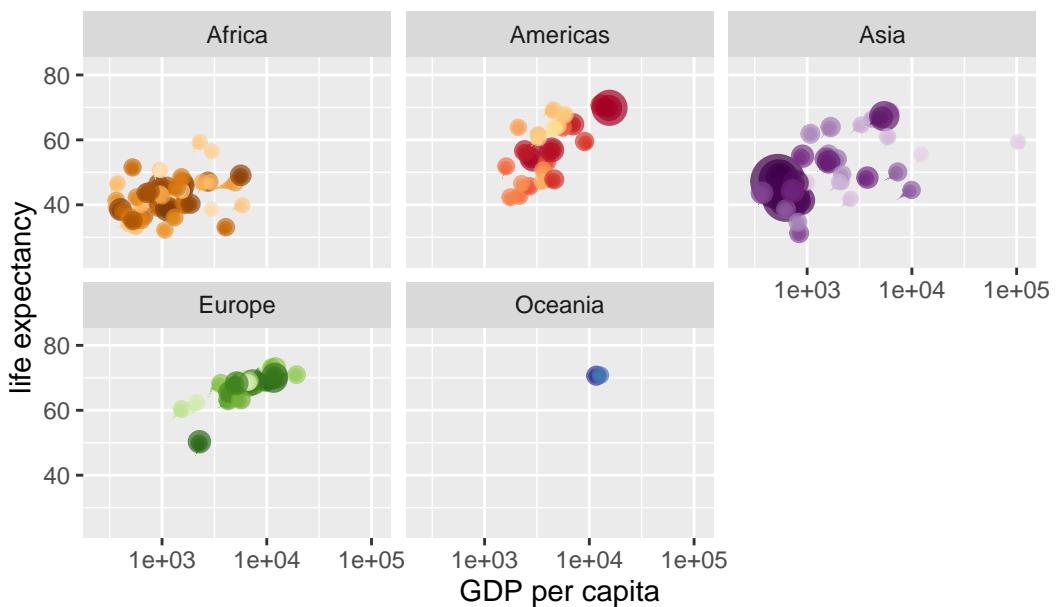
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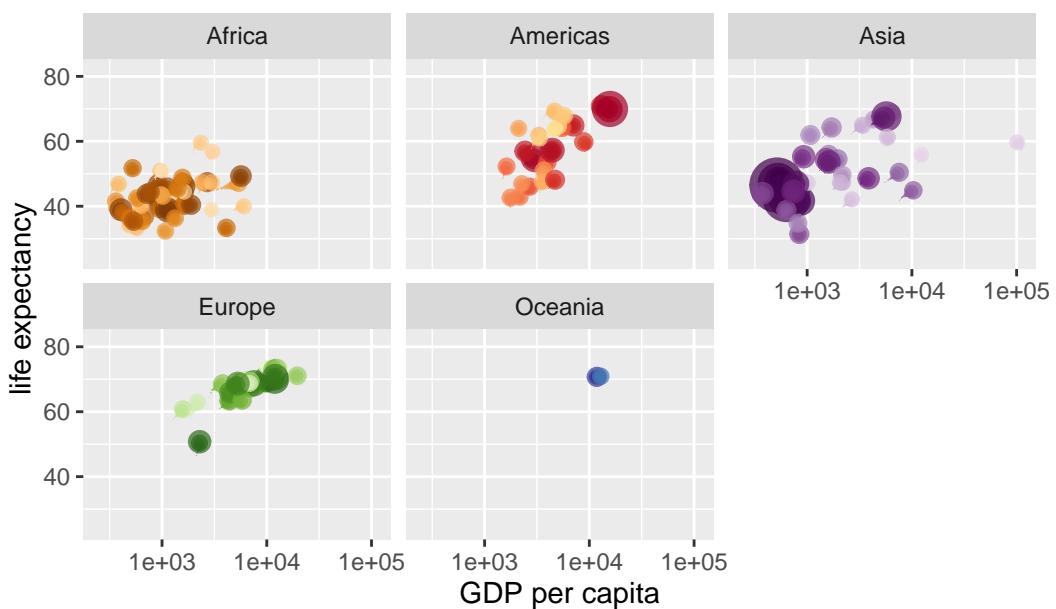
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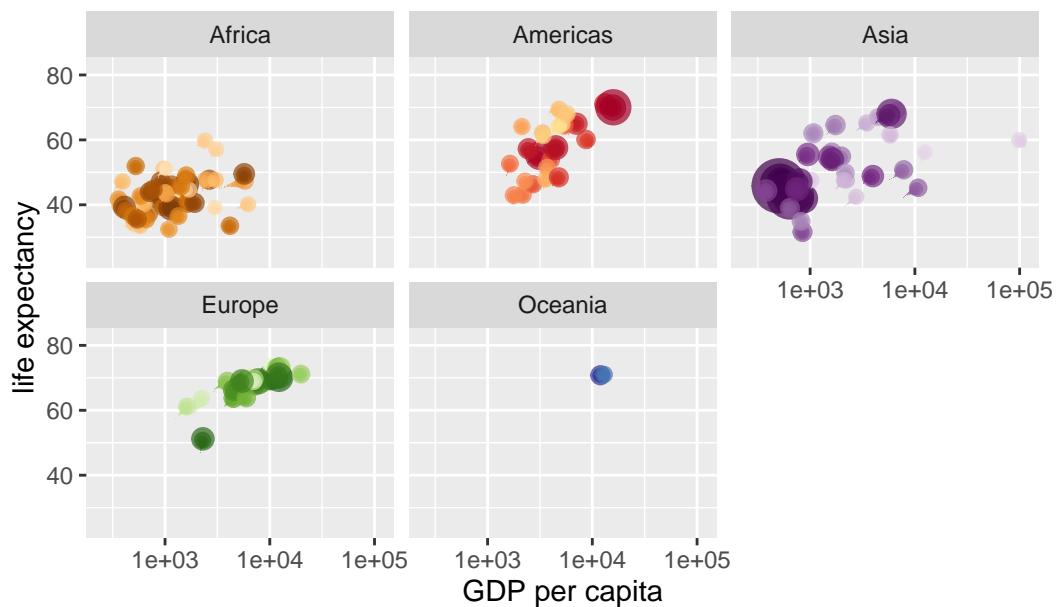
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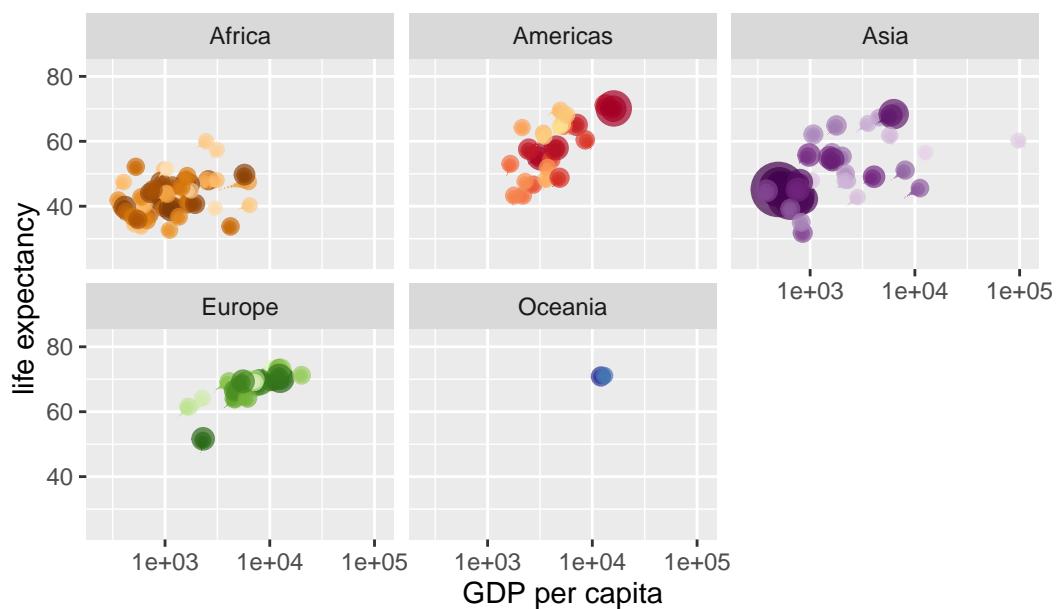
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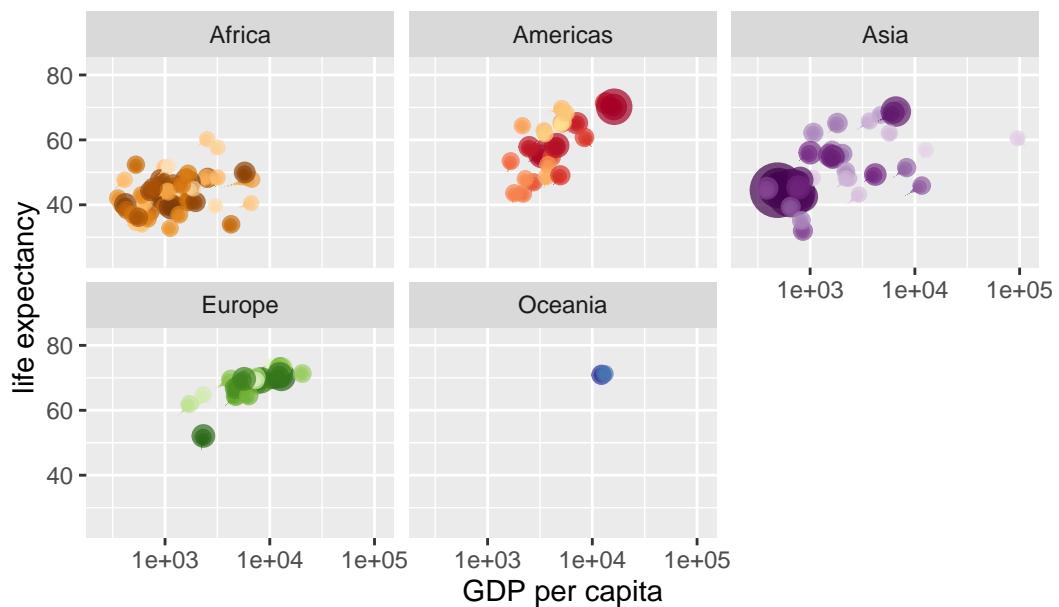
Year: 1961



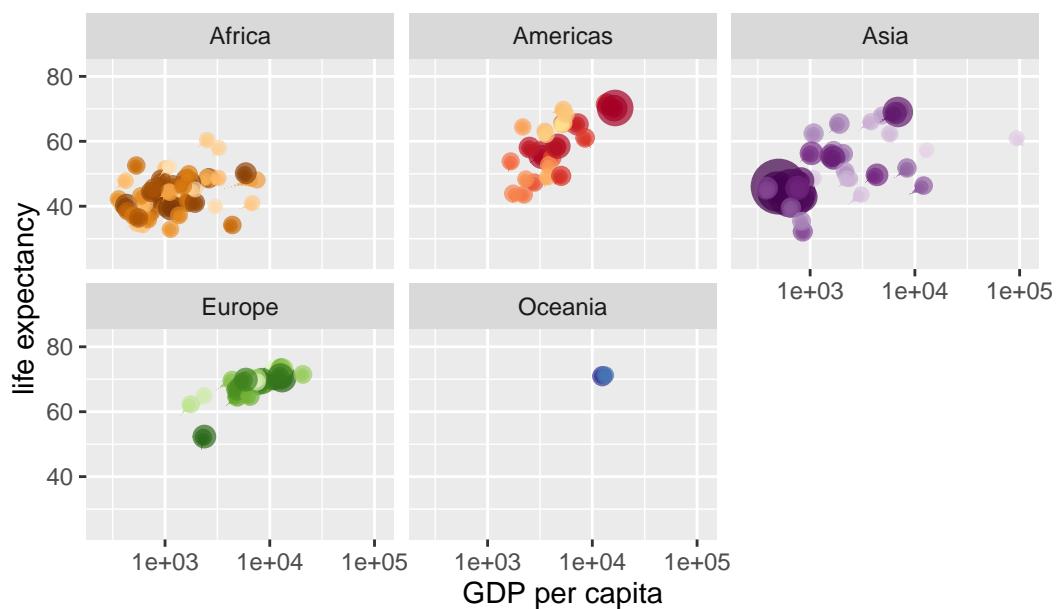
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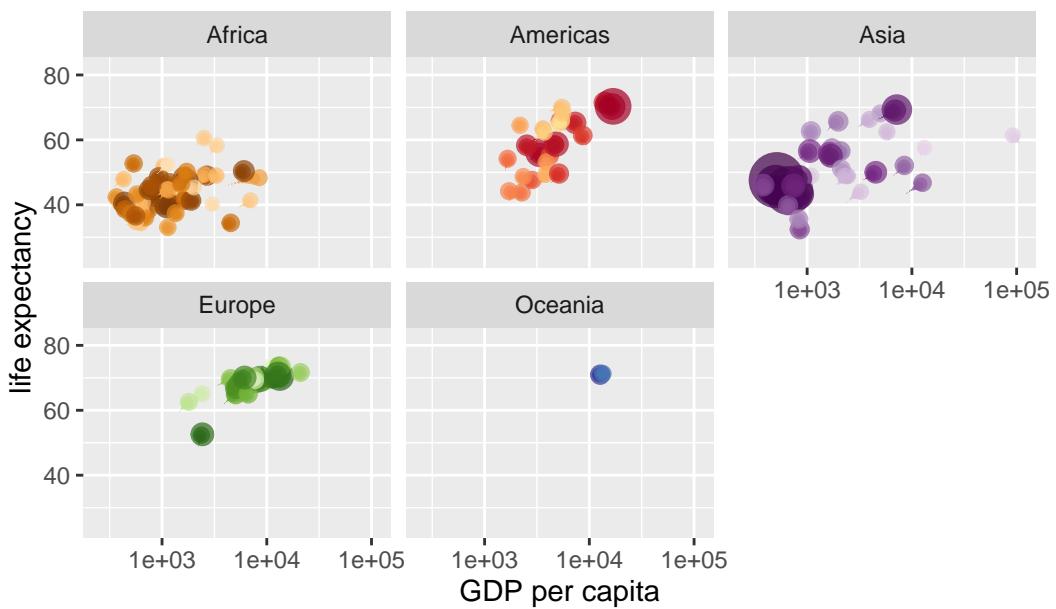
Year: 1962



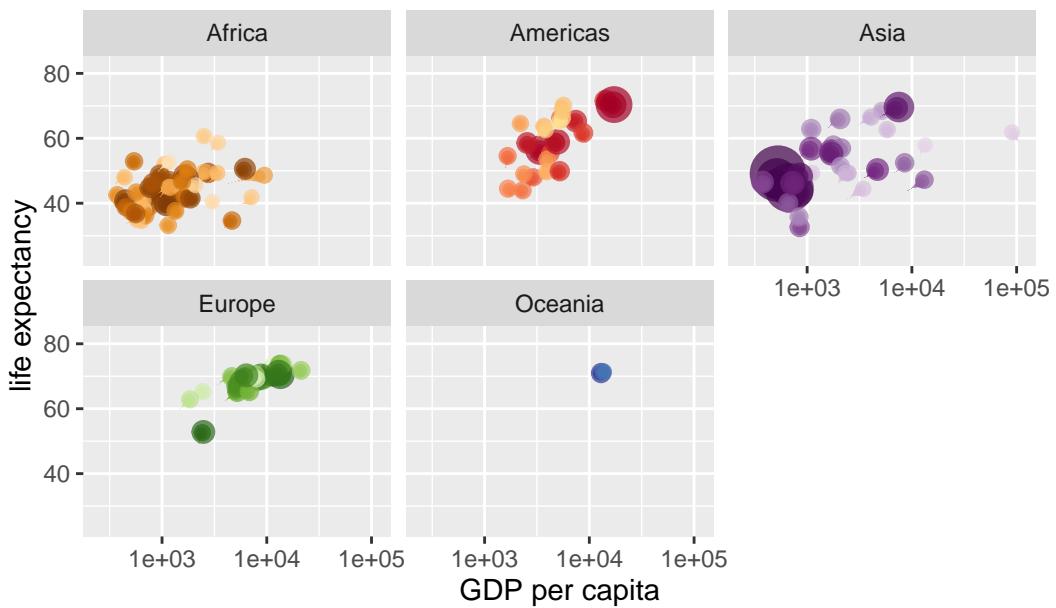
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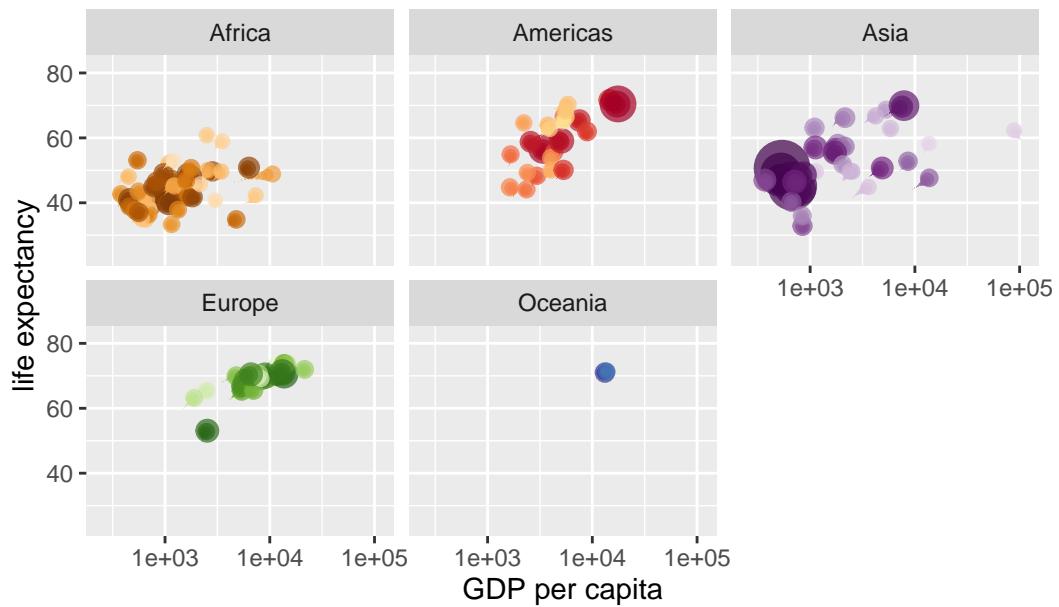
Year: 1963



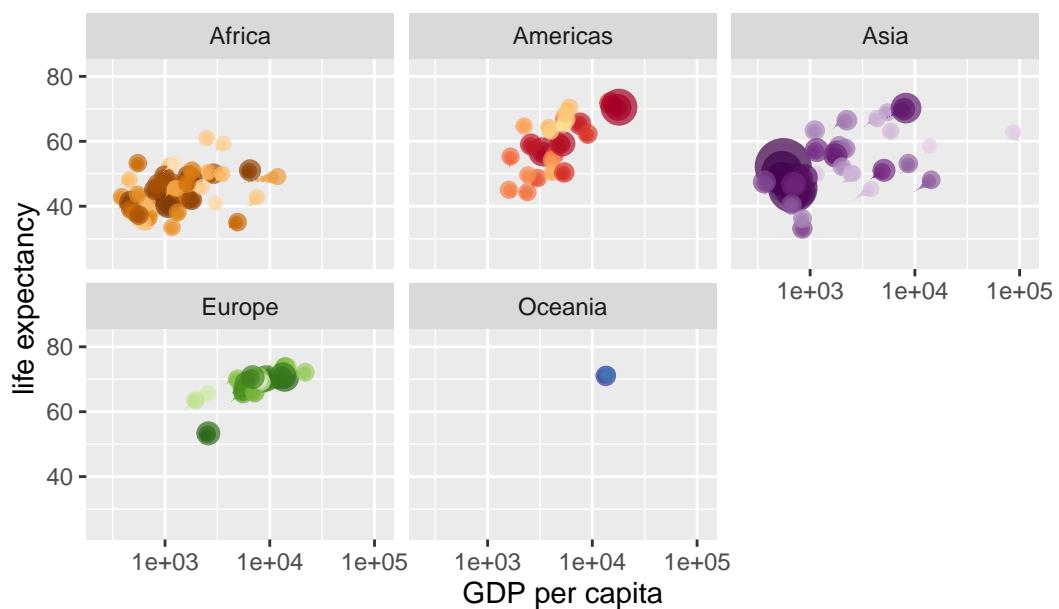
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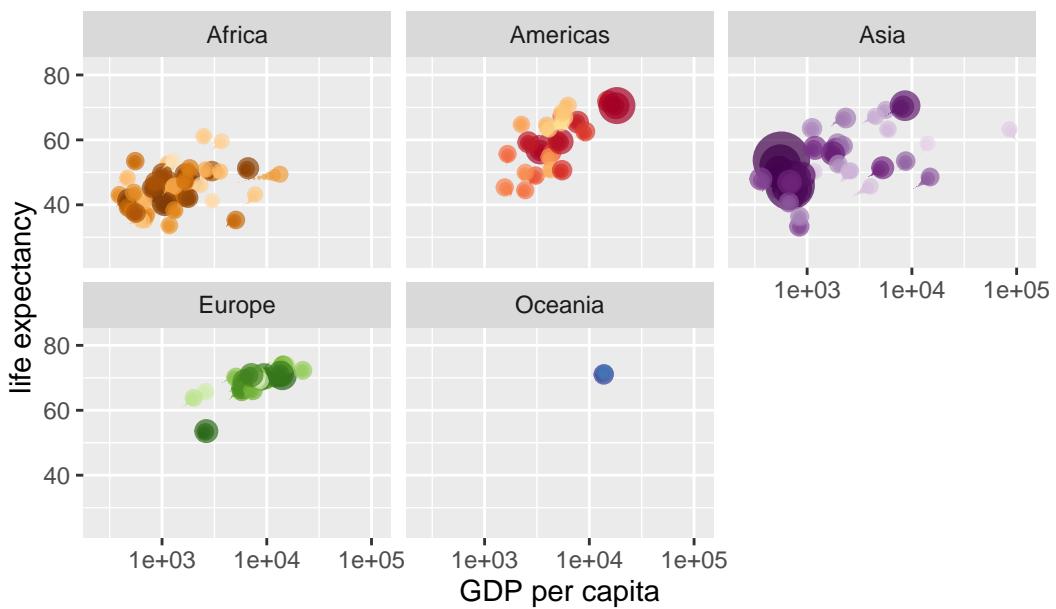
Year: 1964



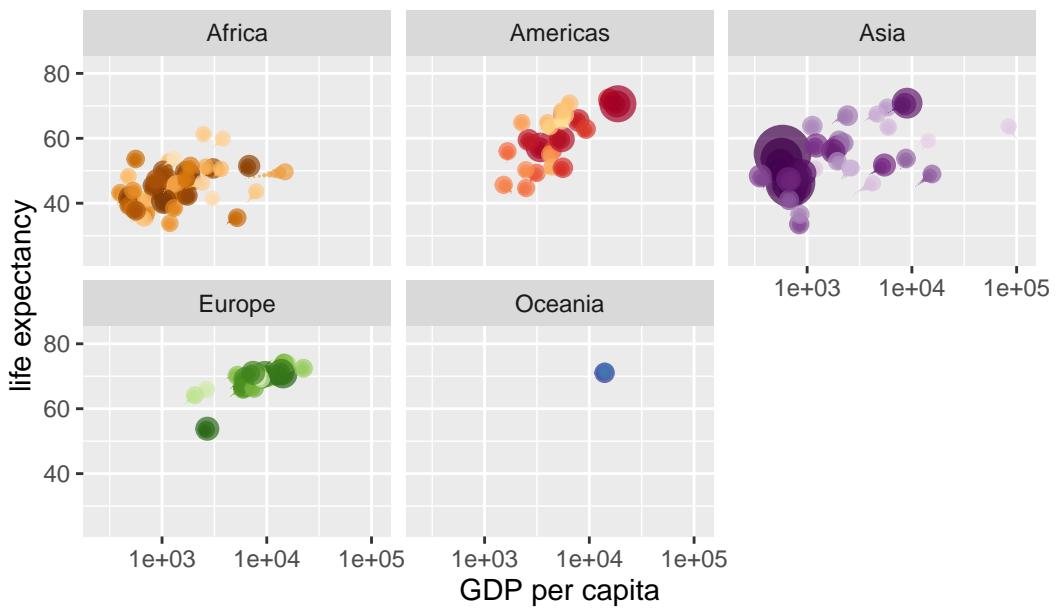
Year: 1965



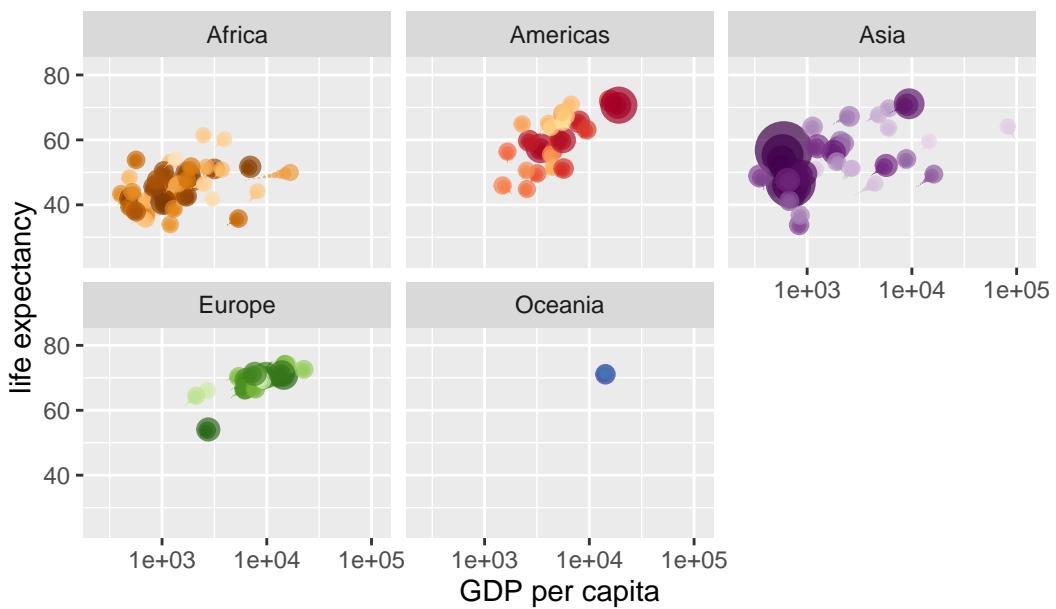
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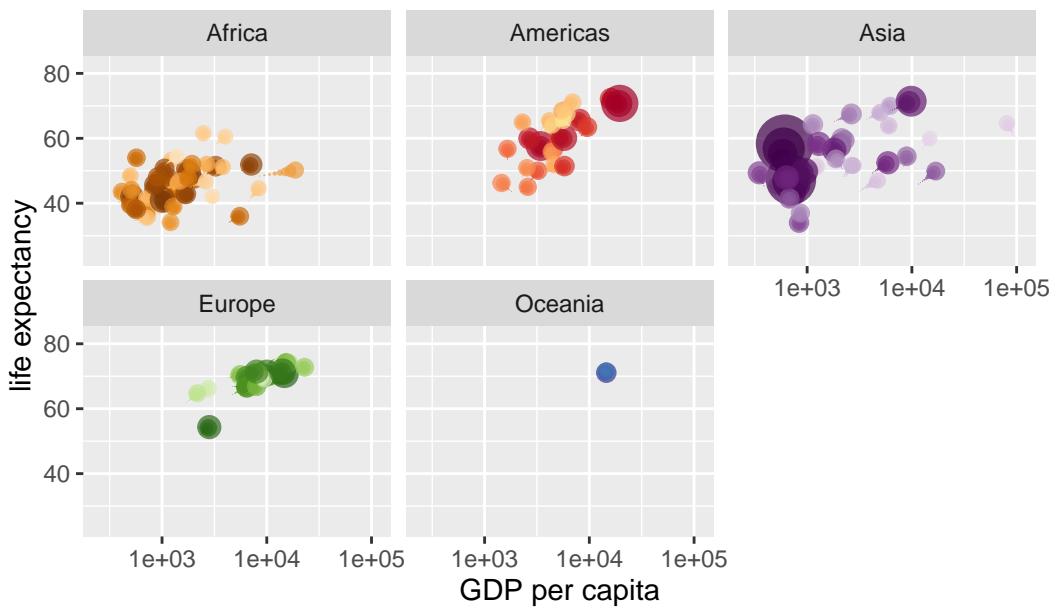
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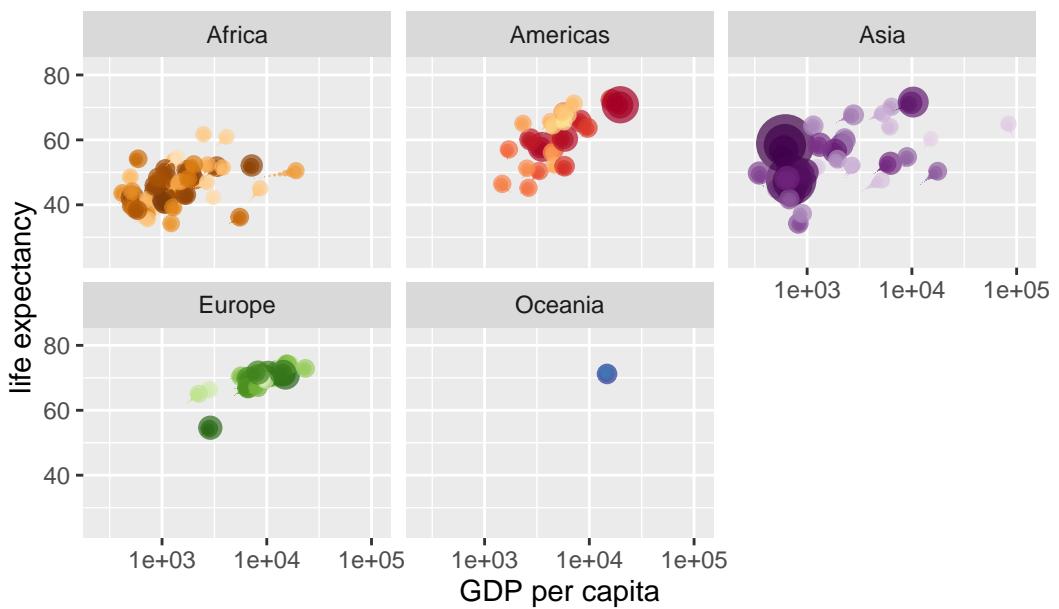
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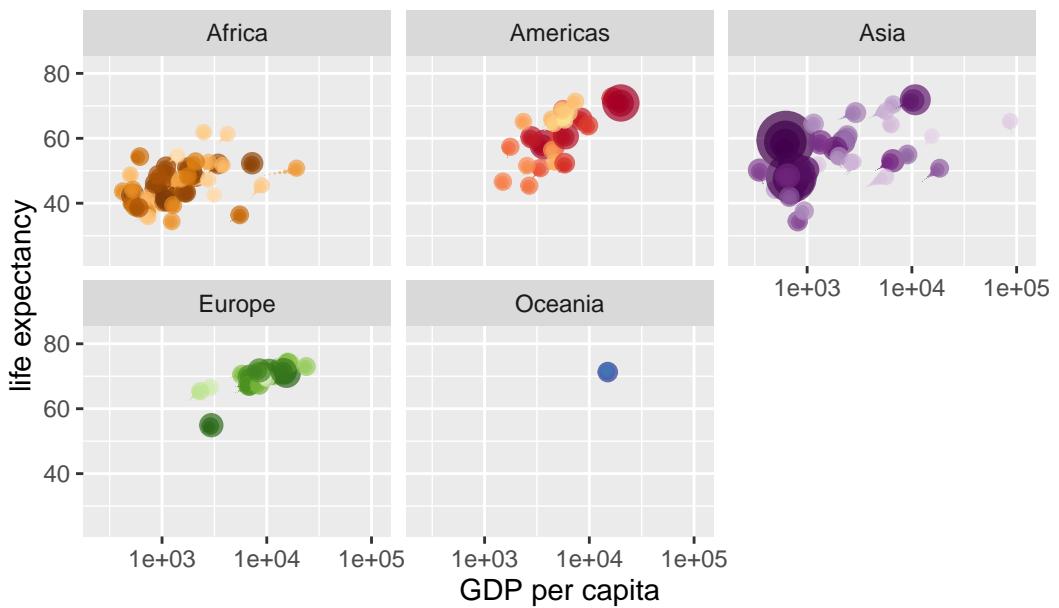
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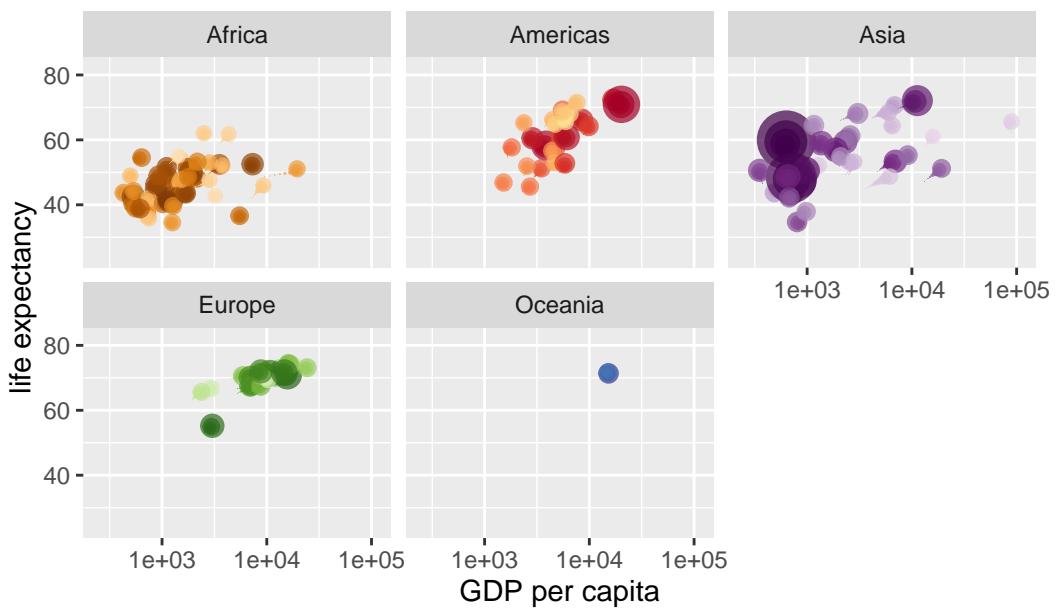
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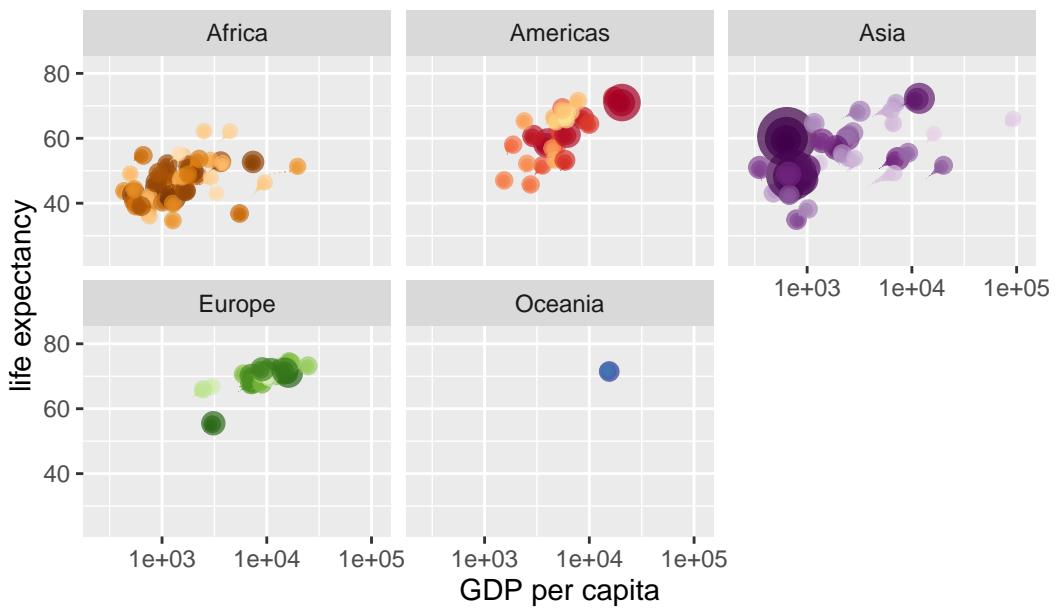
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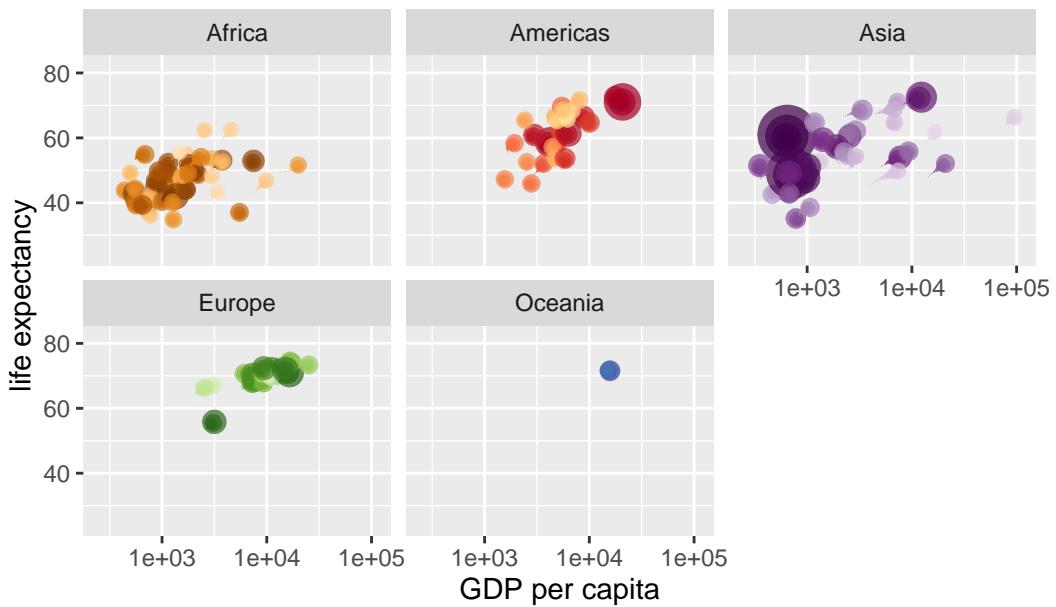
Year: 1969



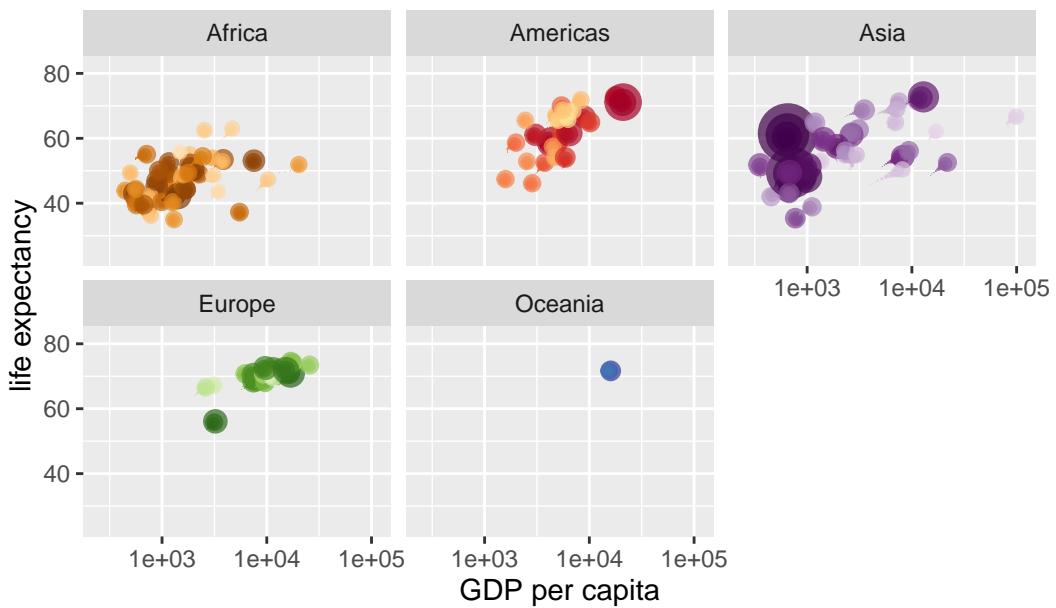
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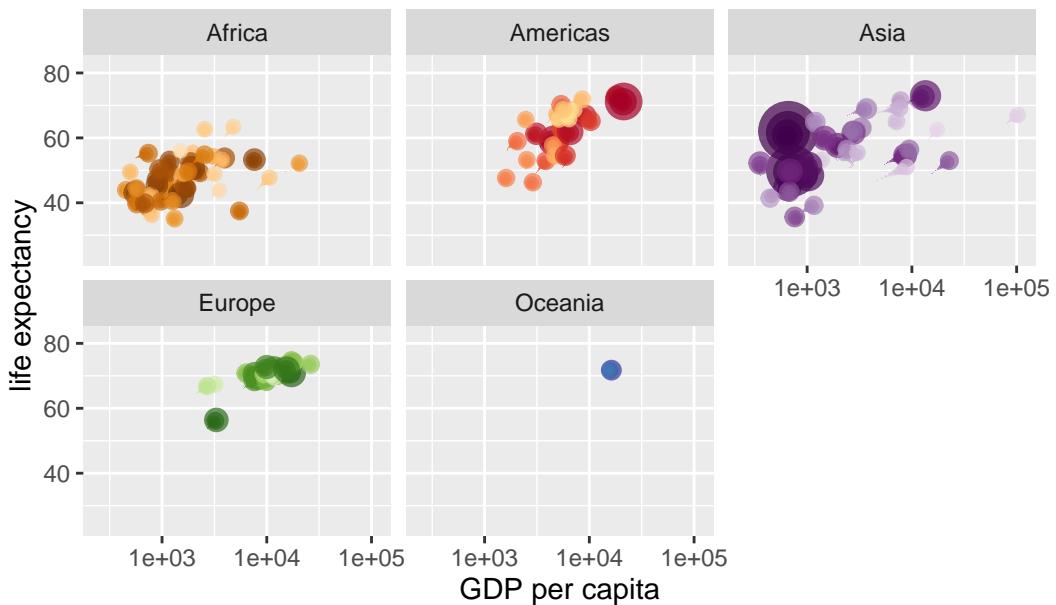
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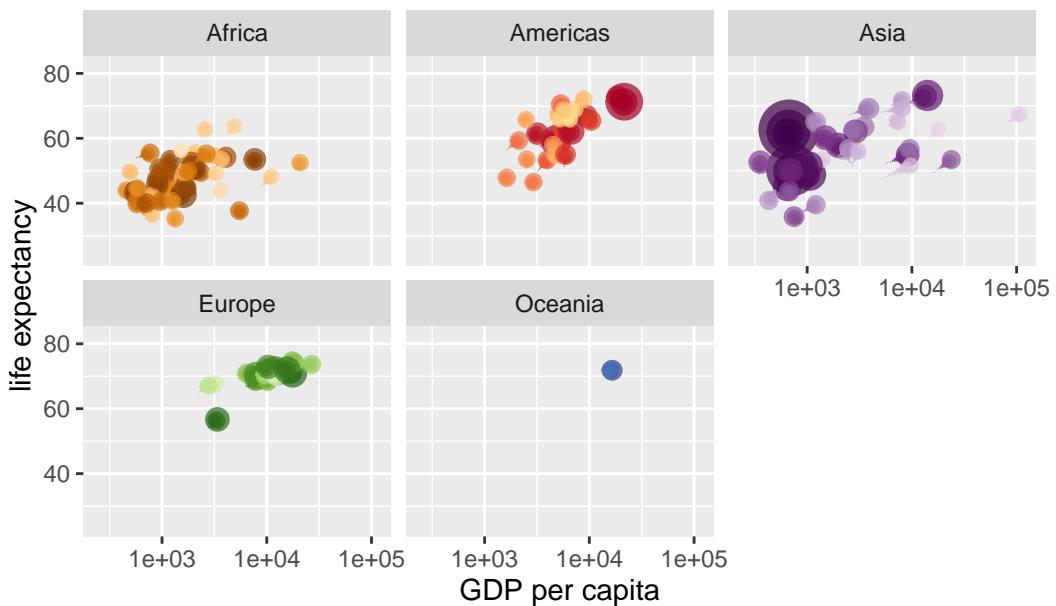
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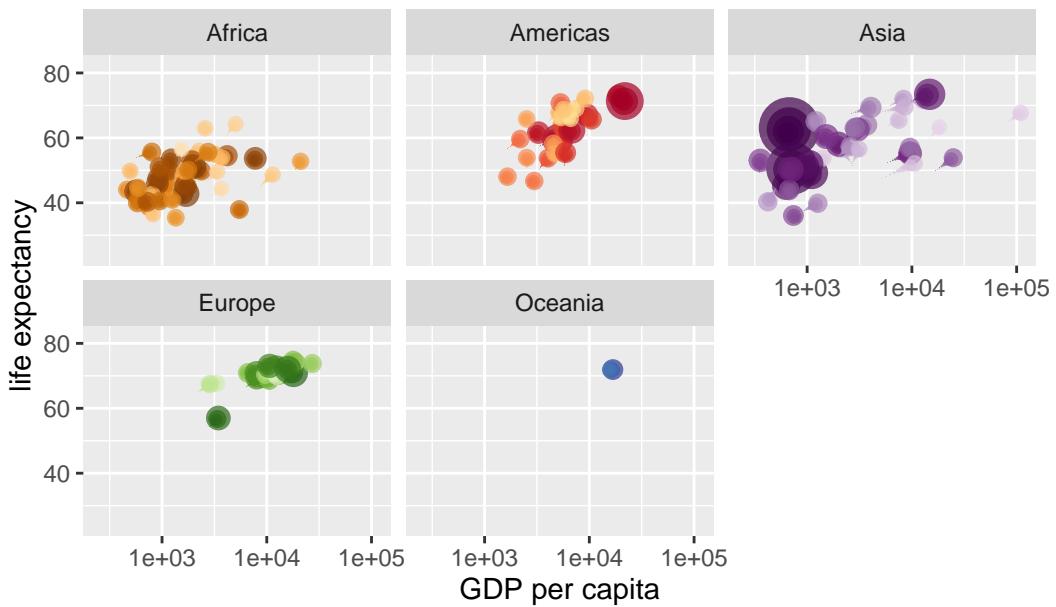
Year: 1971



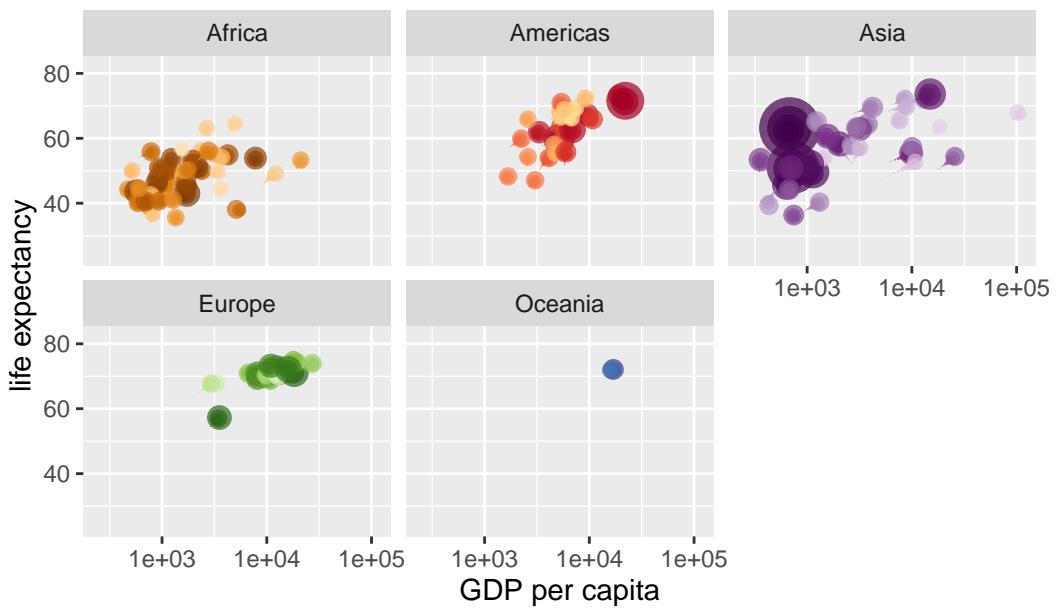
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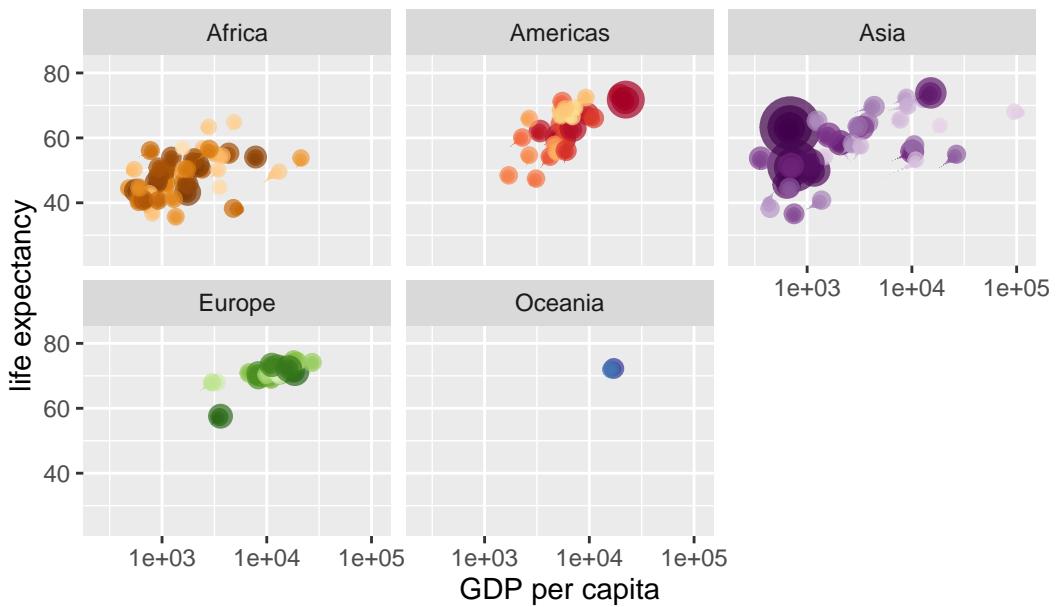
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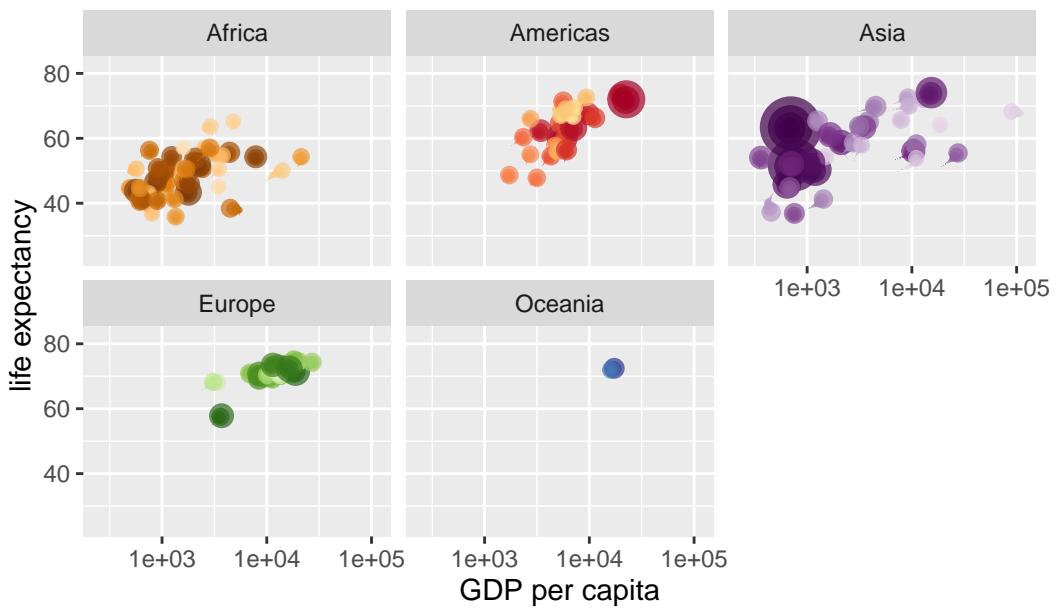
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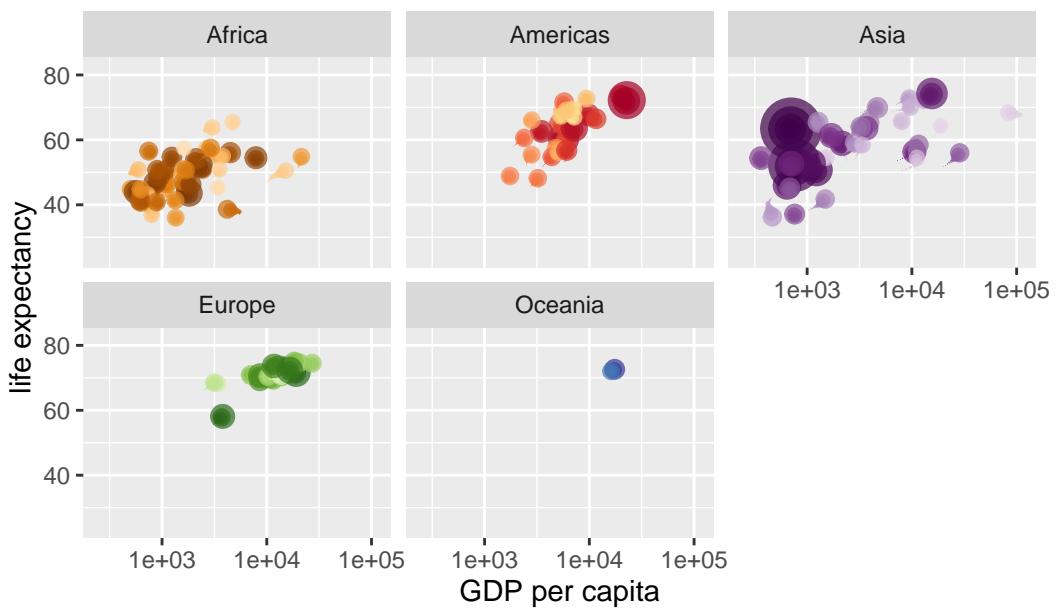
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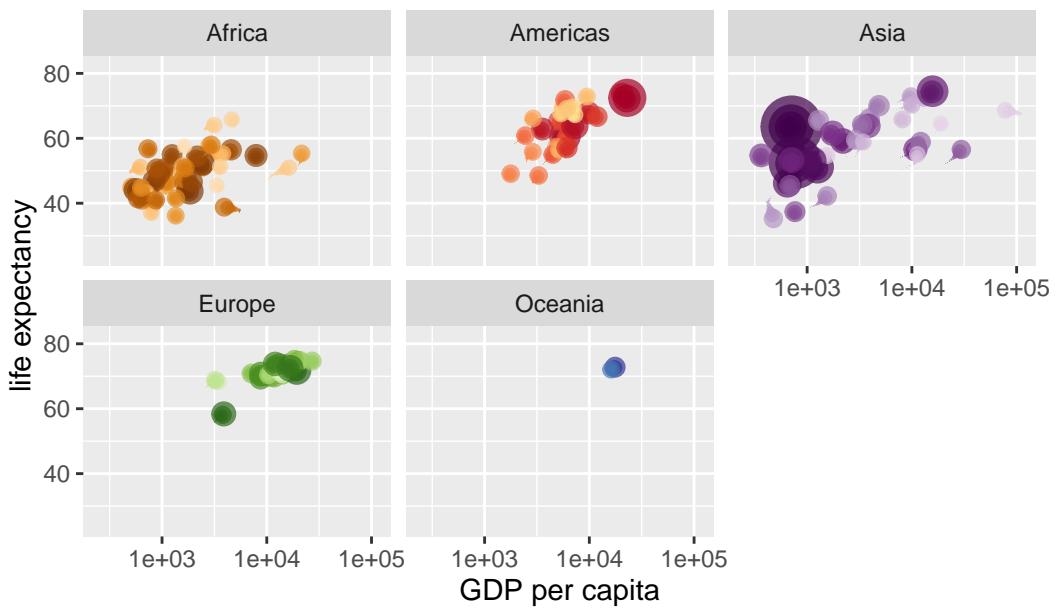
Year: 1974



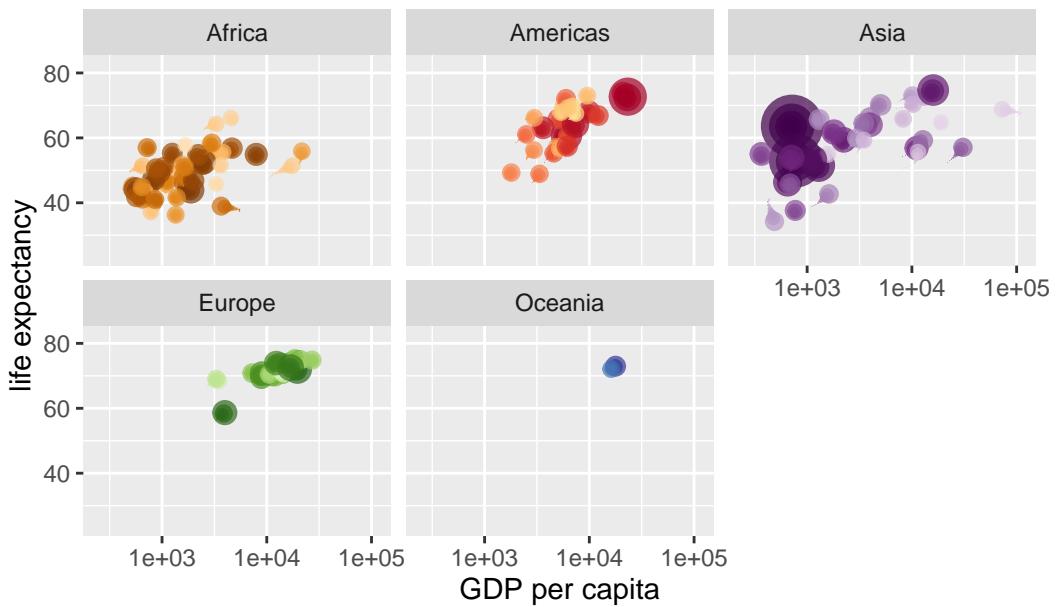
Year: 1974



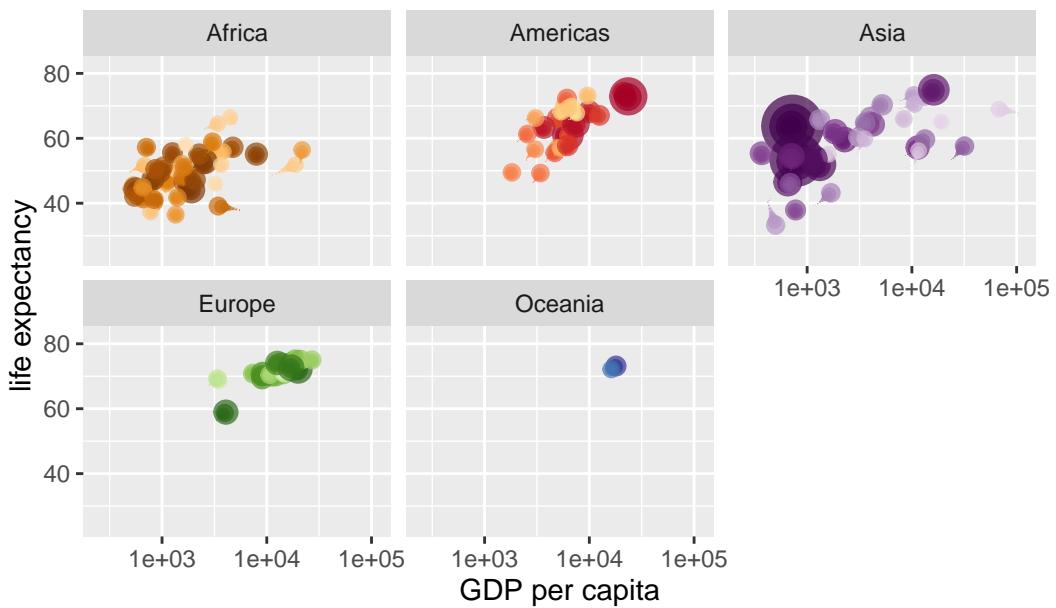
Year: 1975



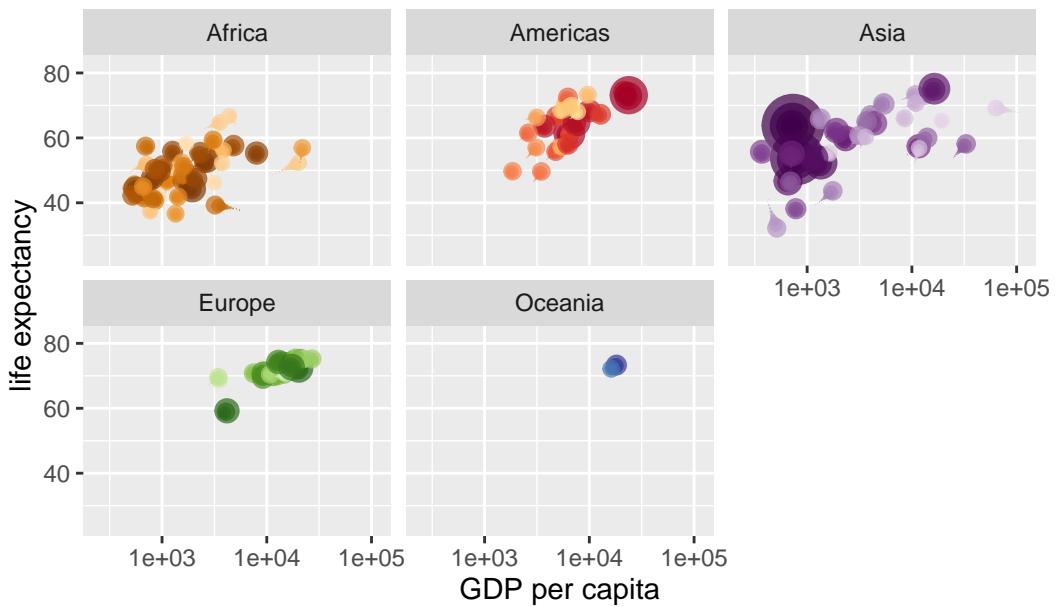
Year: 1975



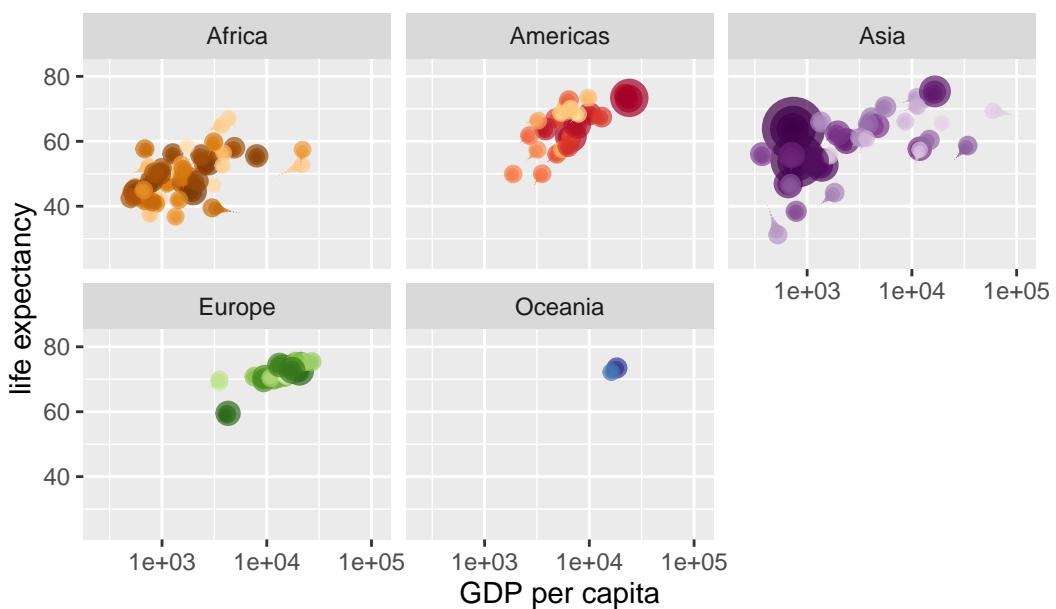
Year: 1976



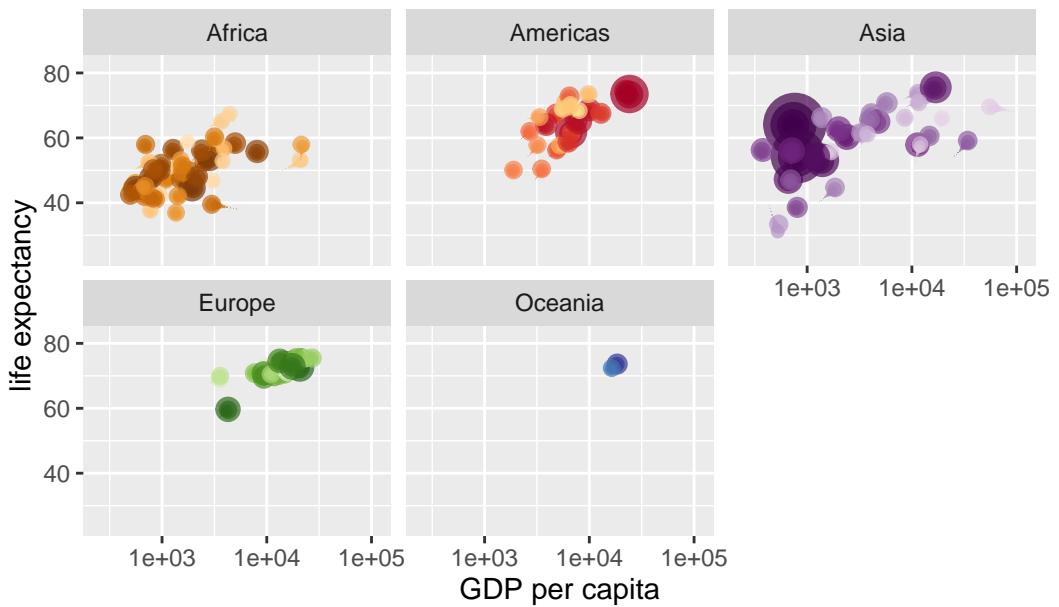
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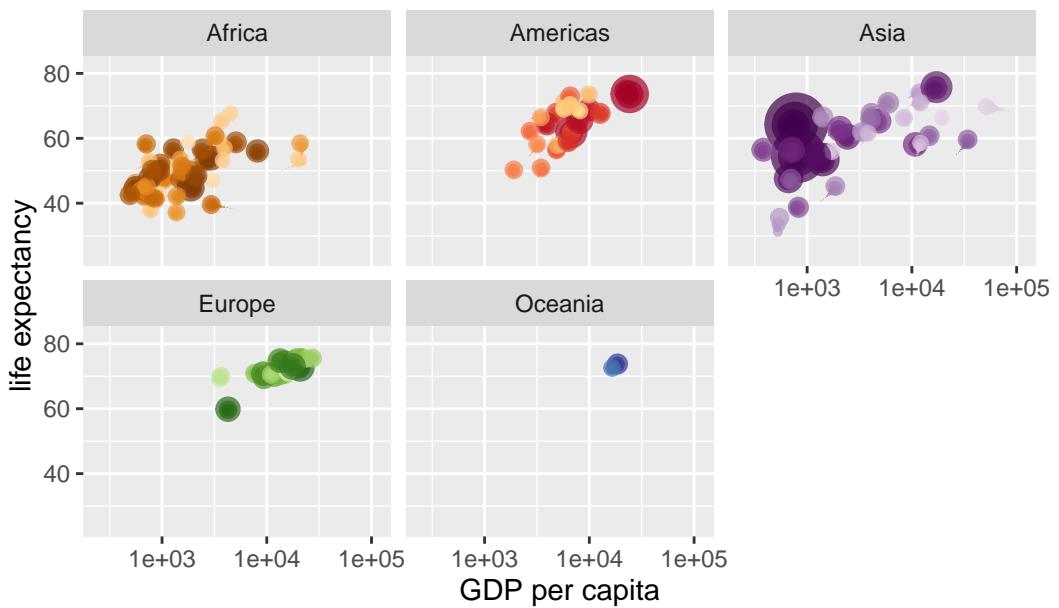
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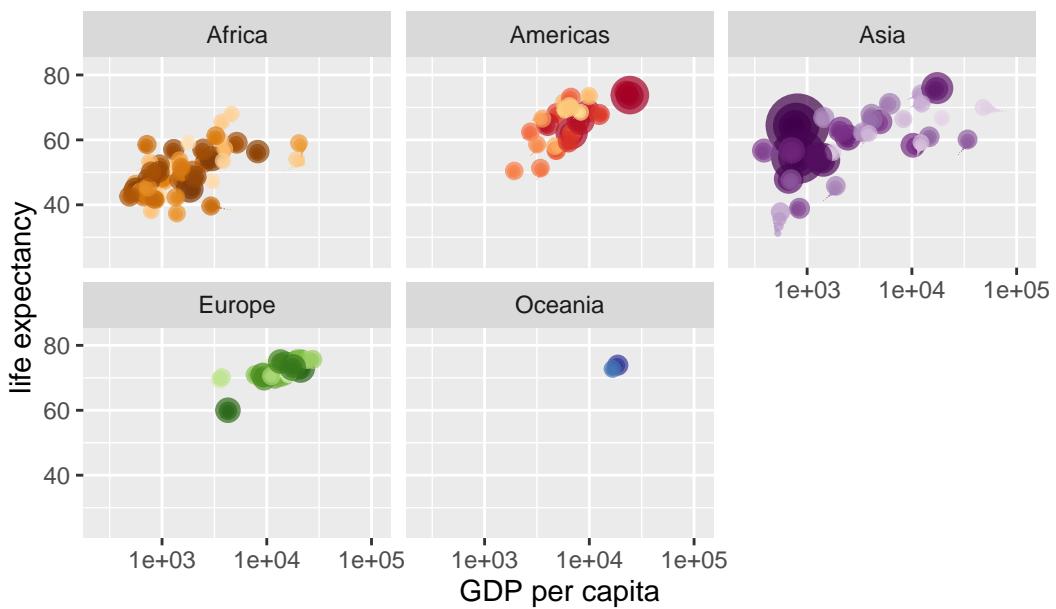
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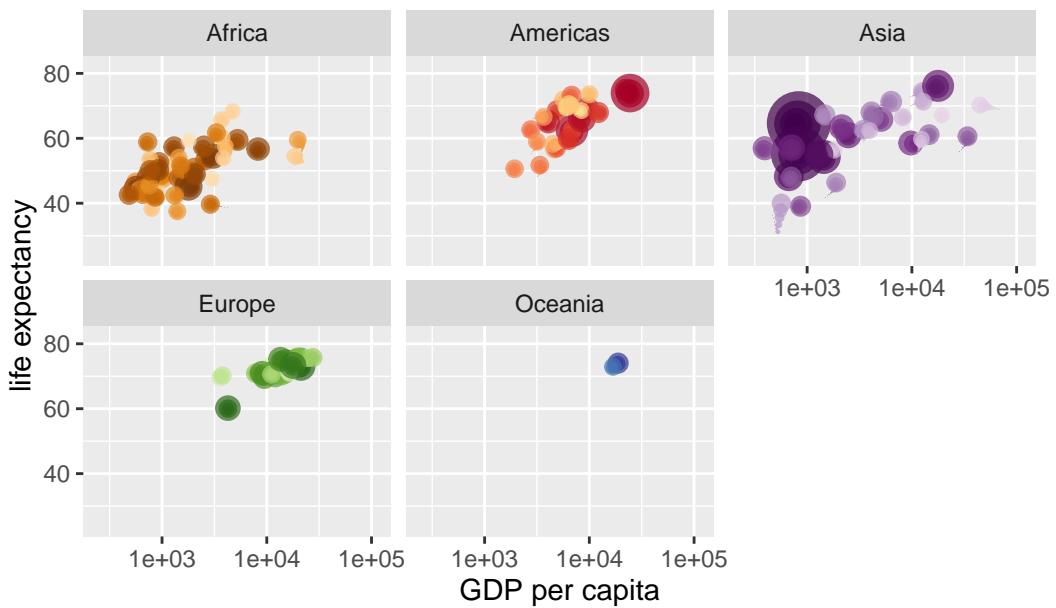
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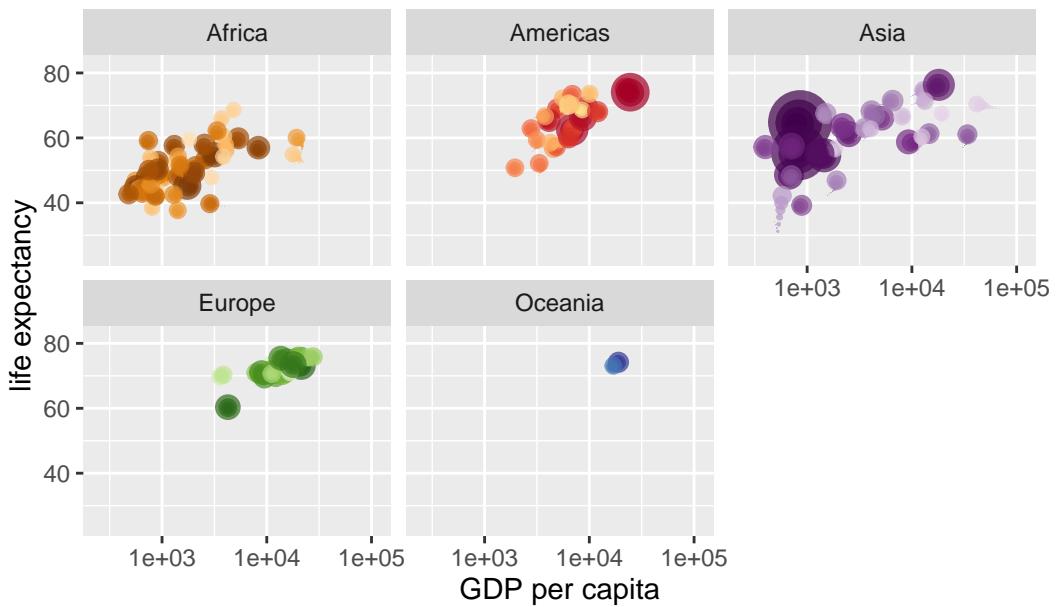
Year: 1979



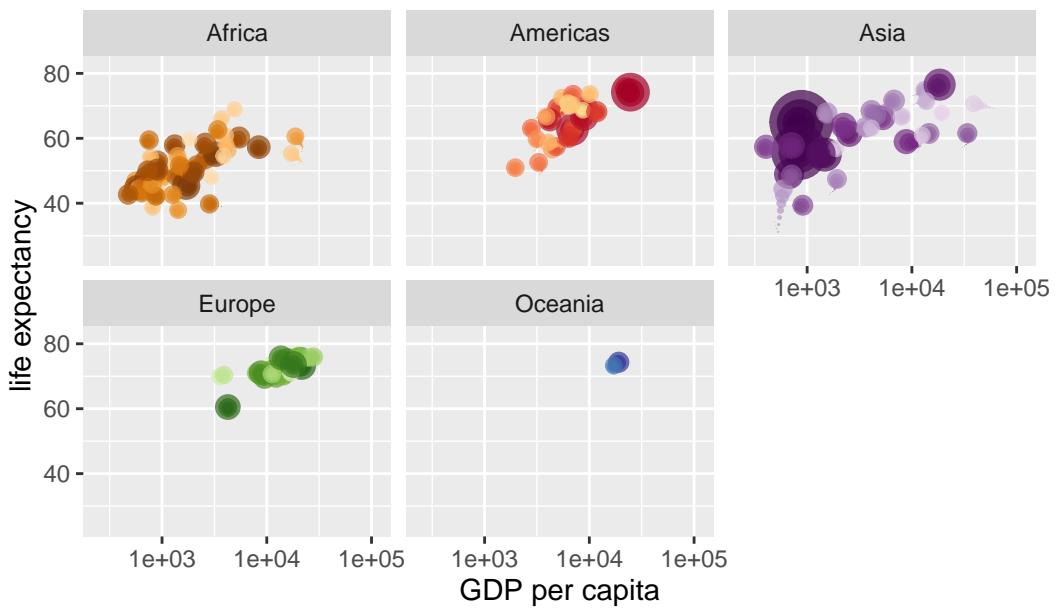
Year: 1979



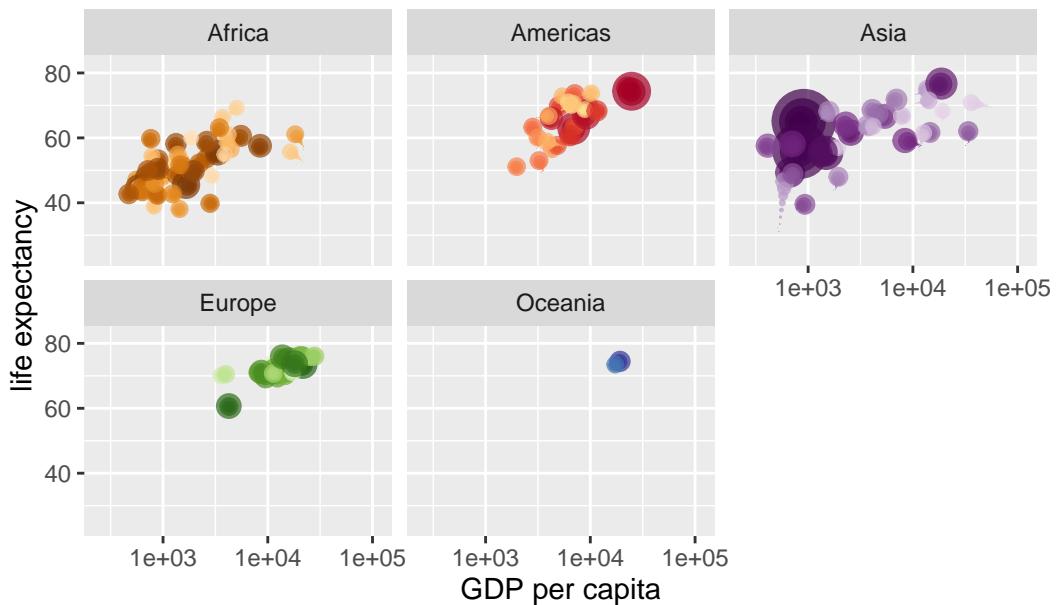
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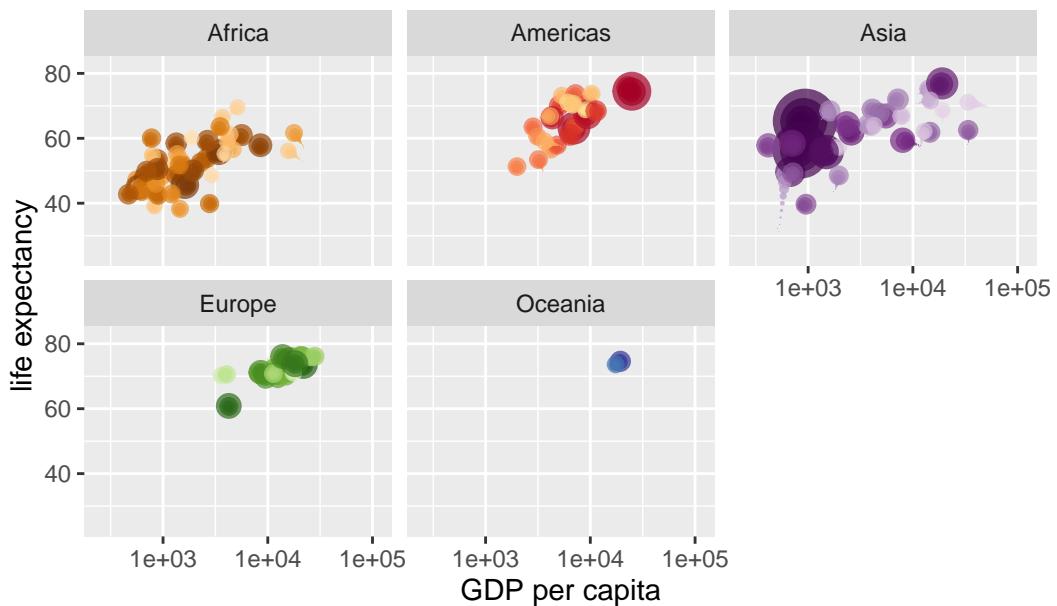
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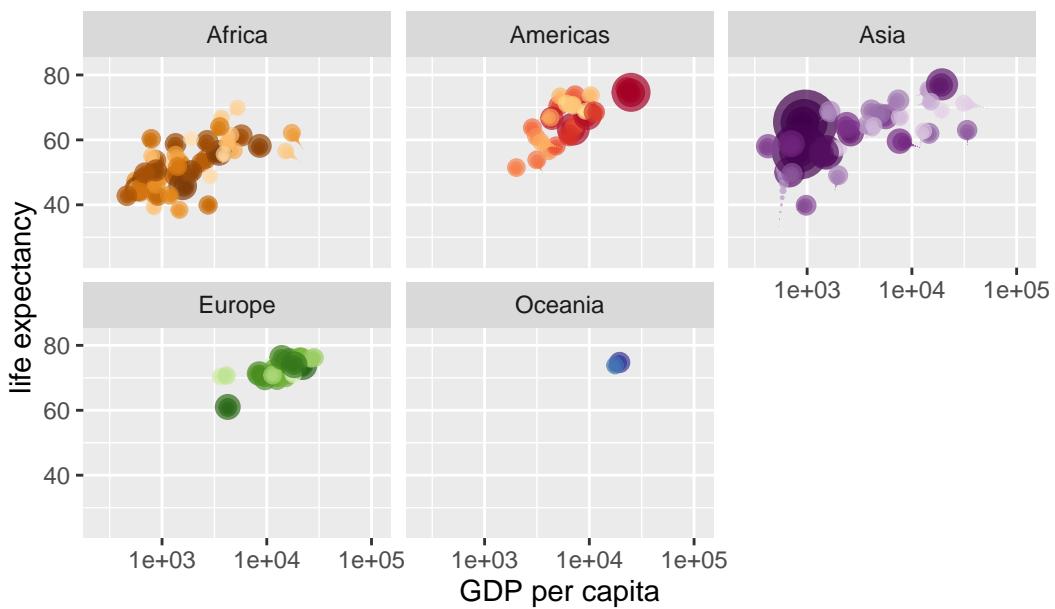
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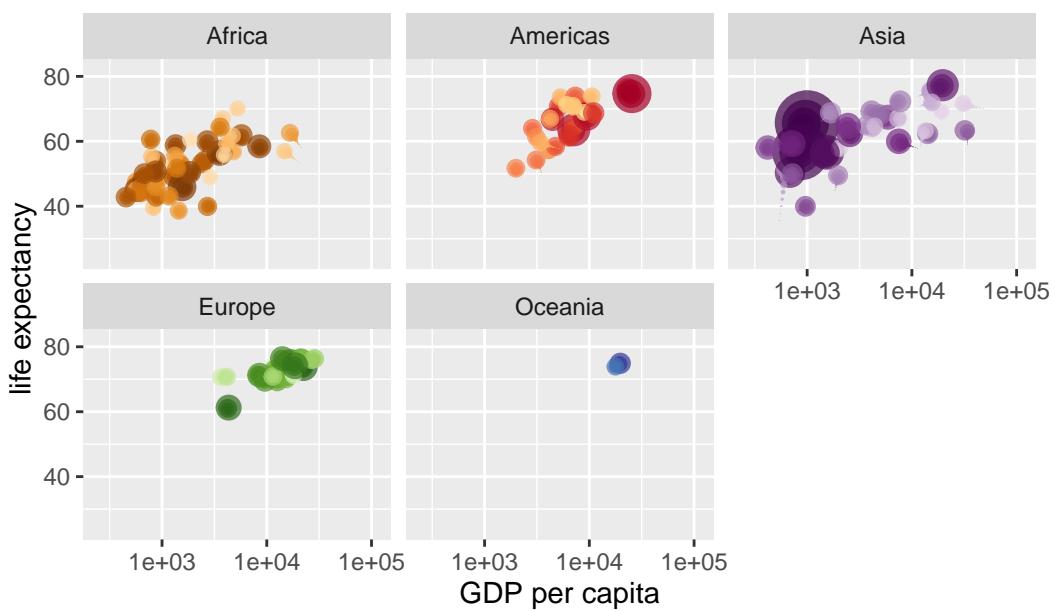
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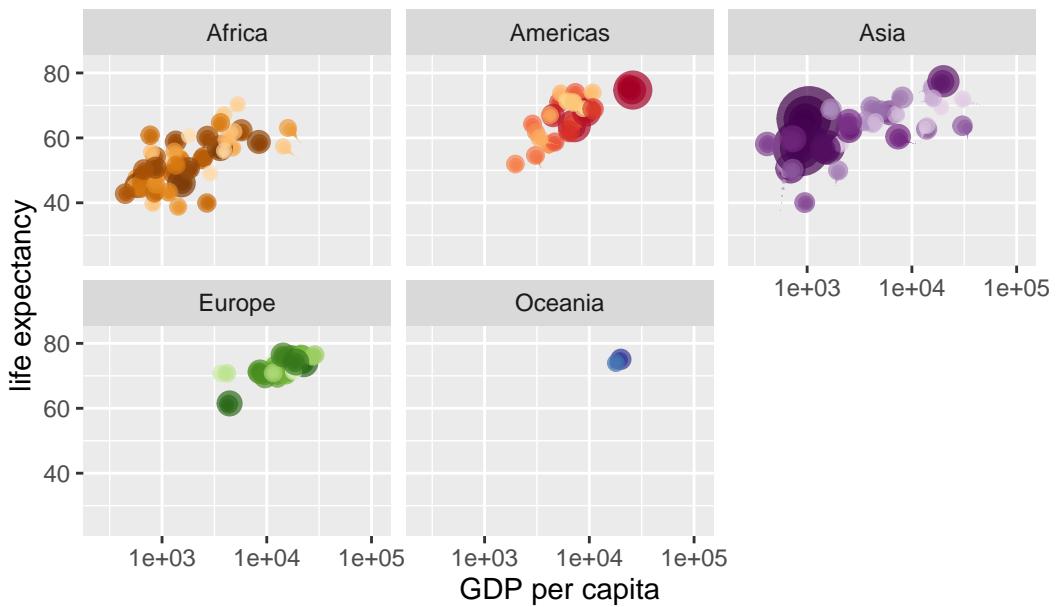
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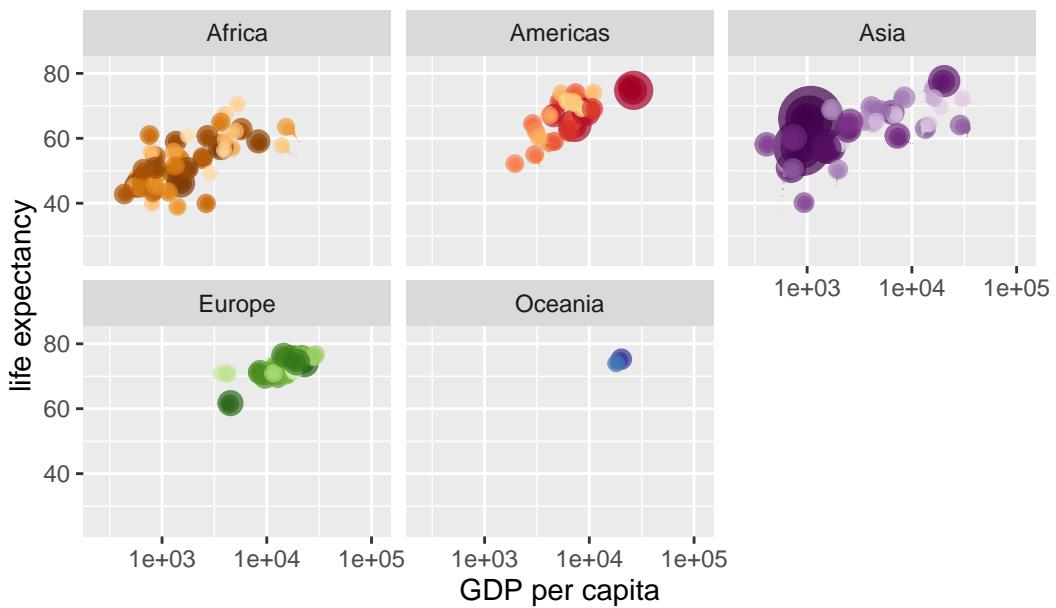
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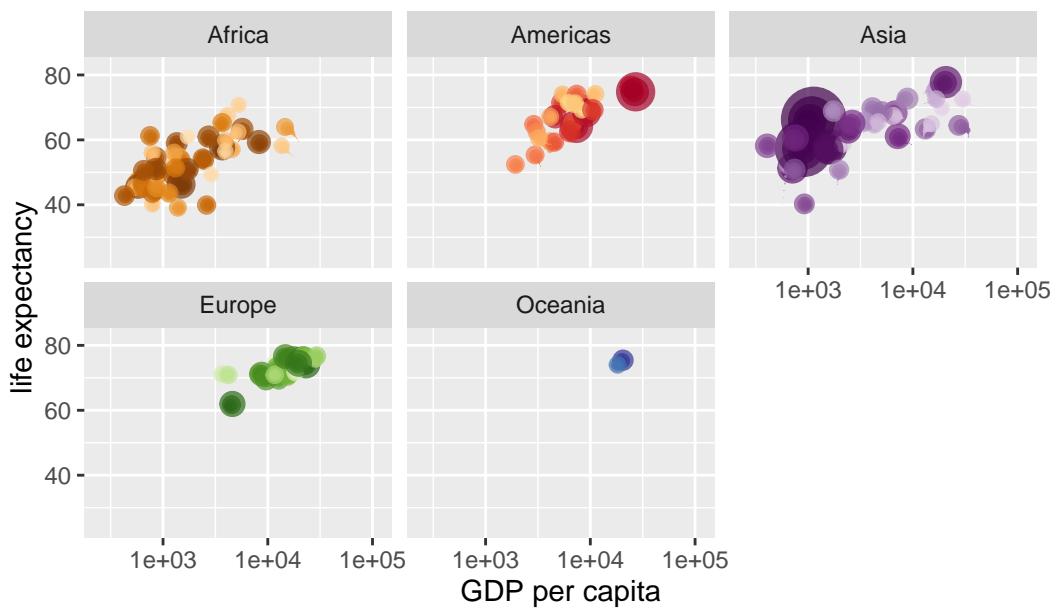
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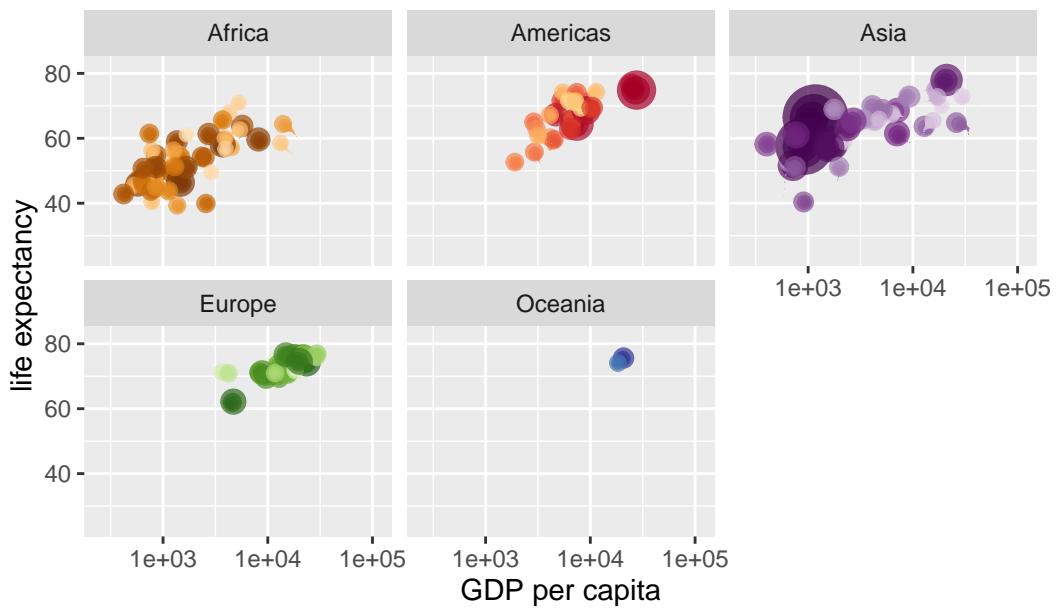
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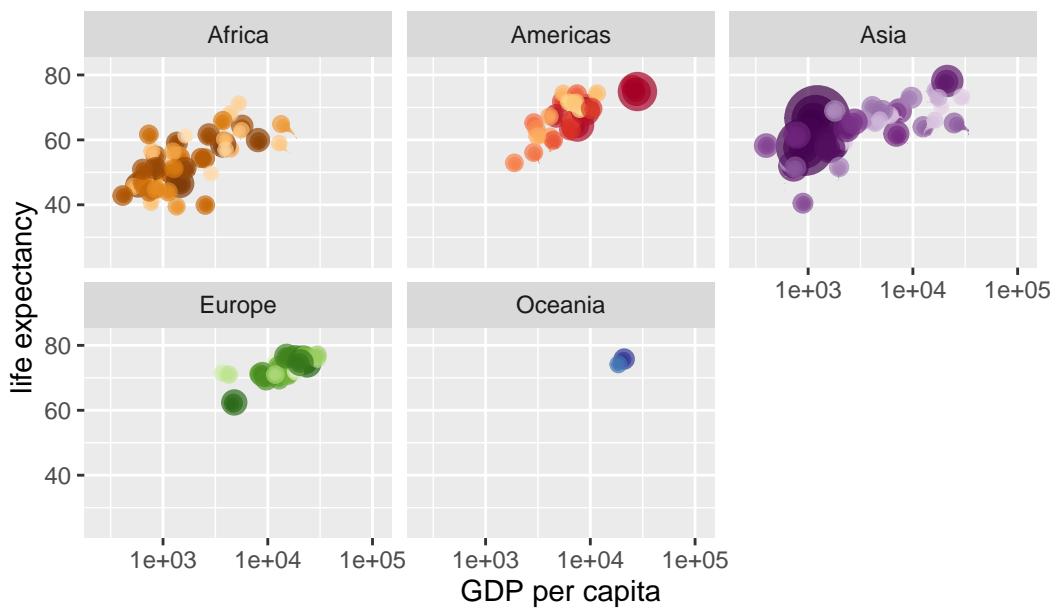
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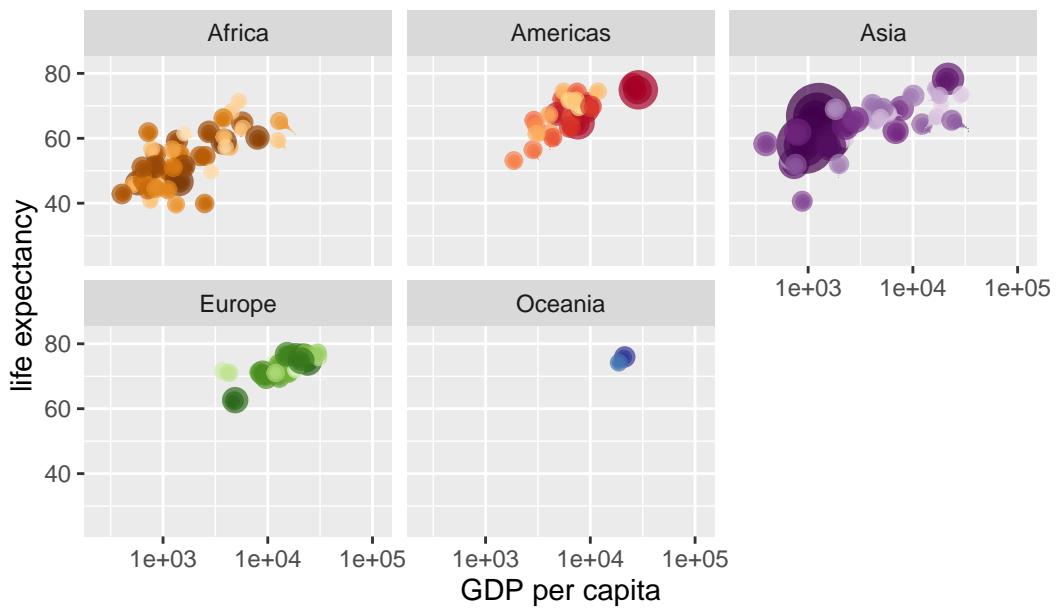
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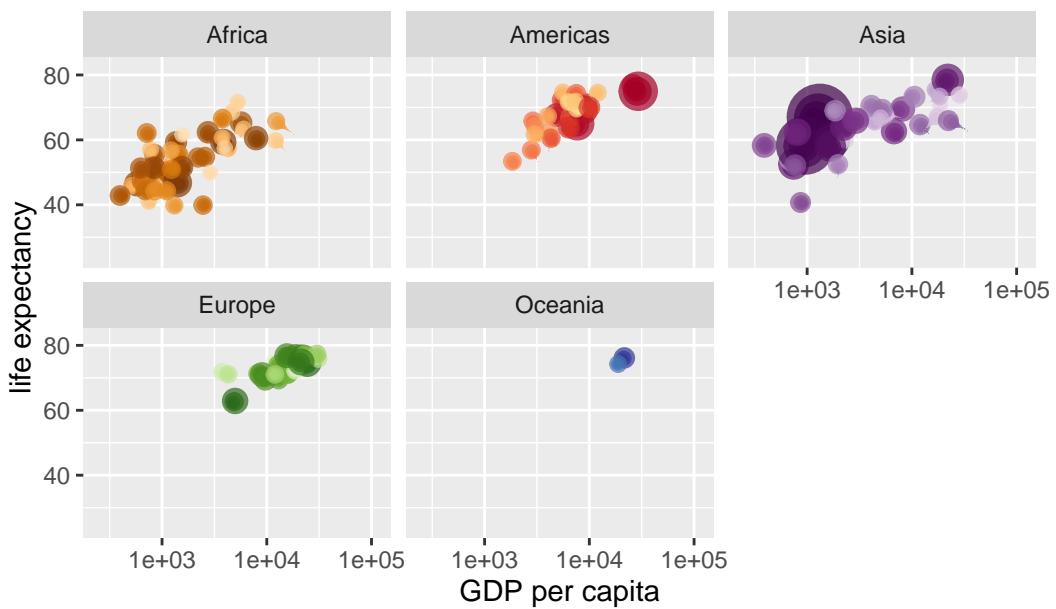
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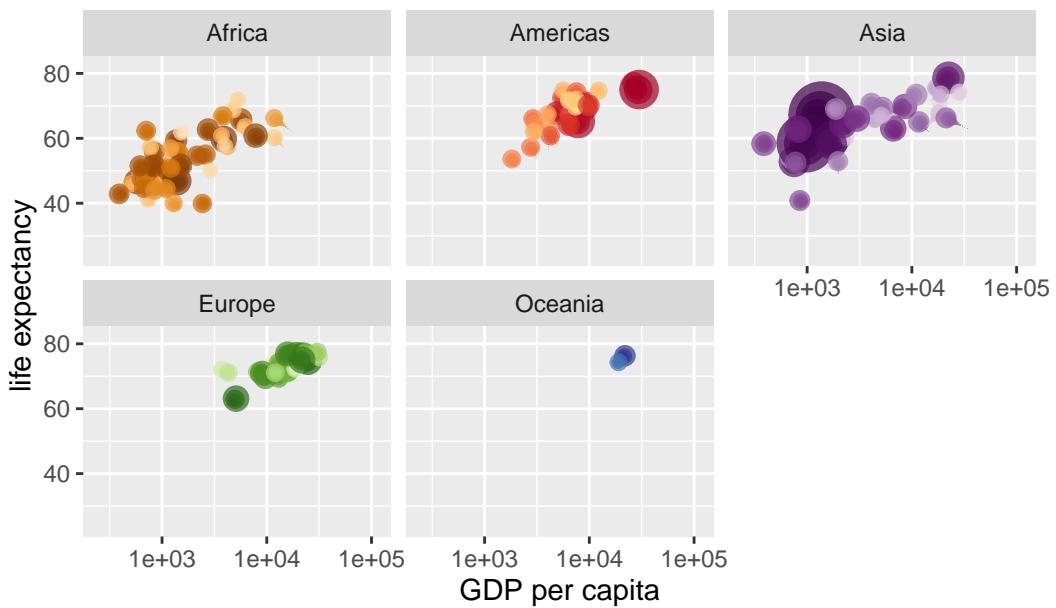
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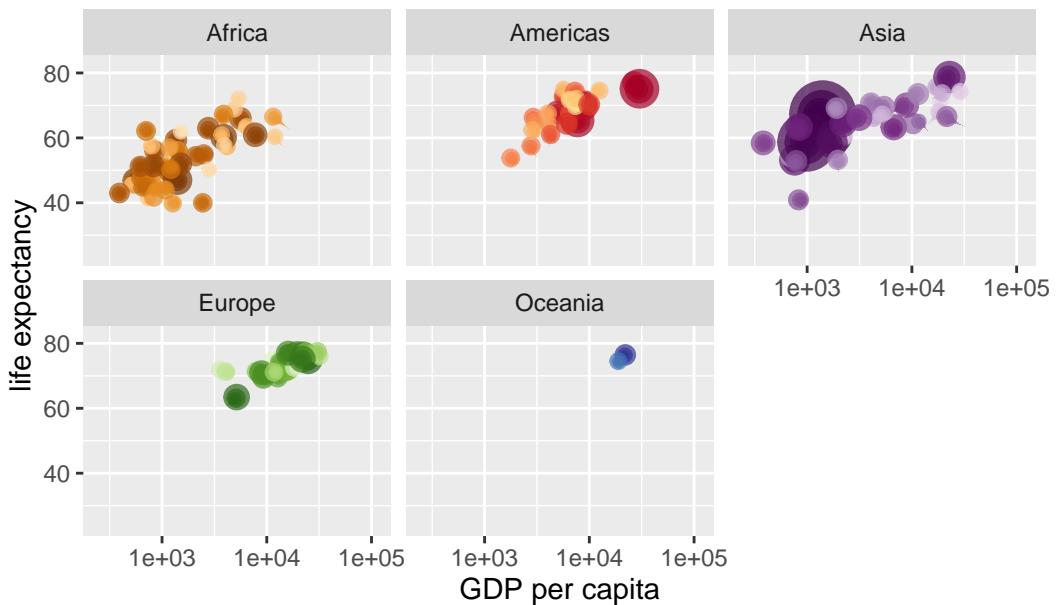
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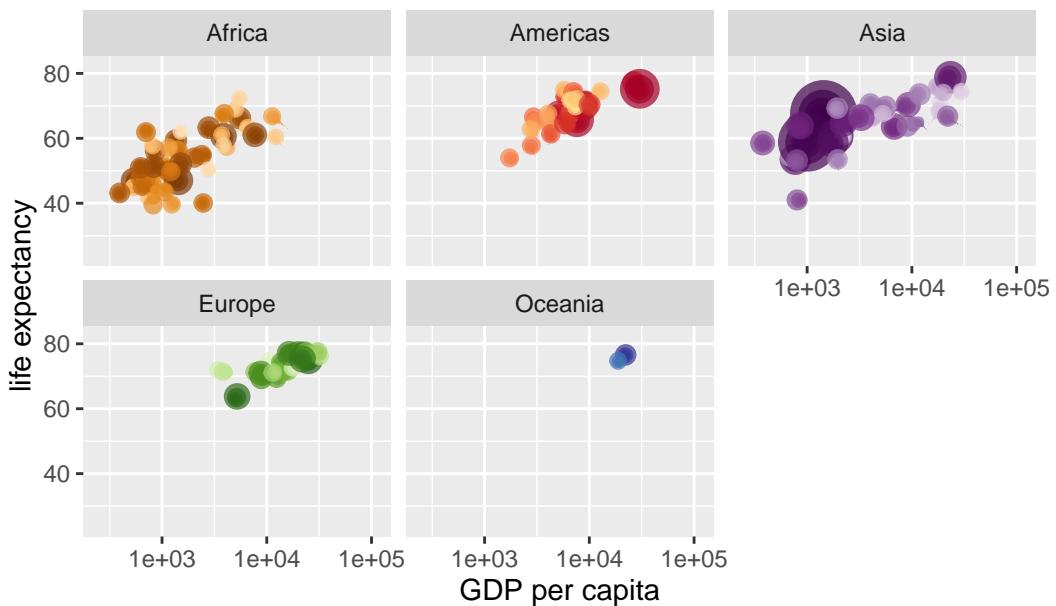
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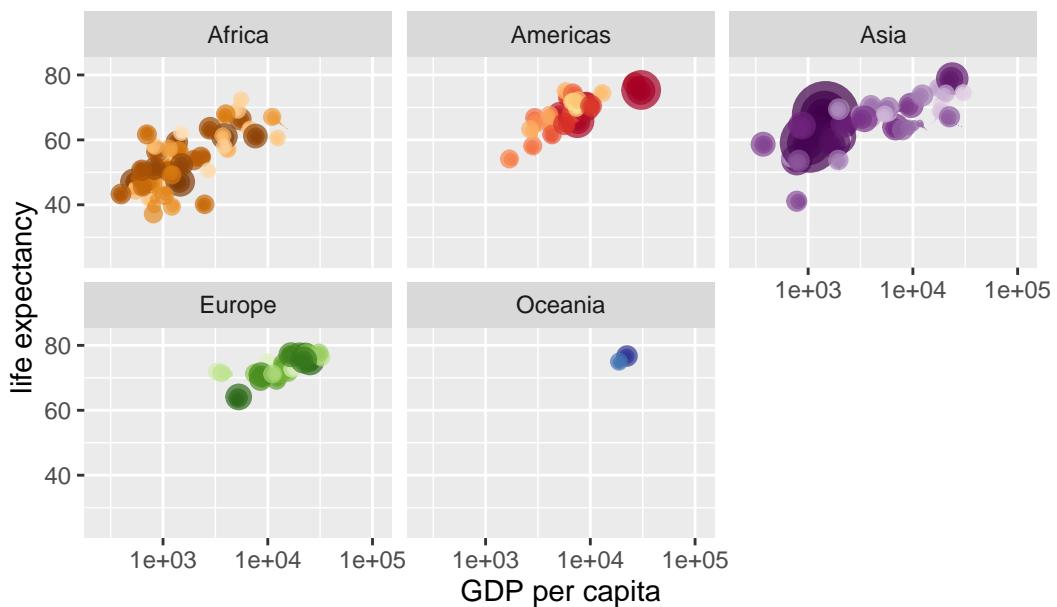
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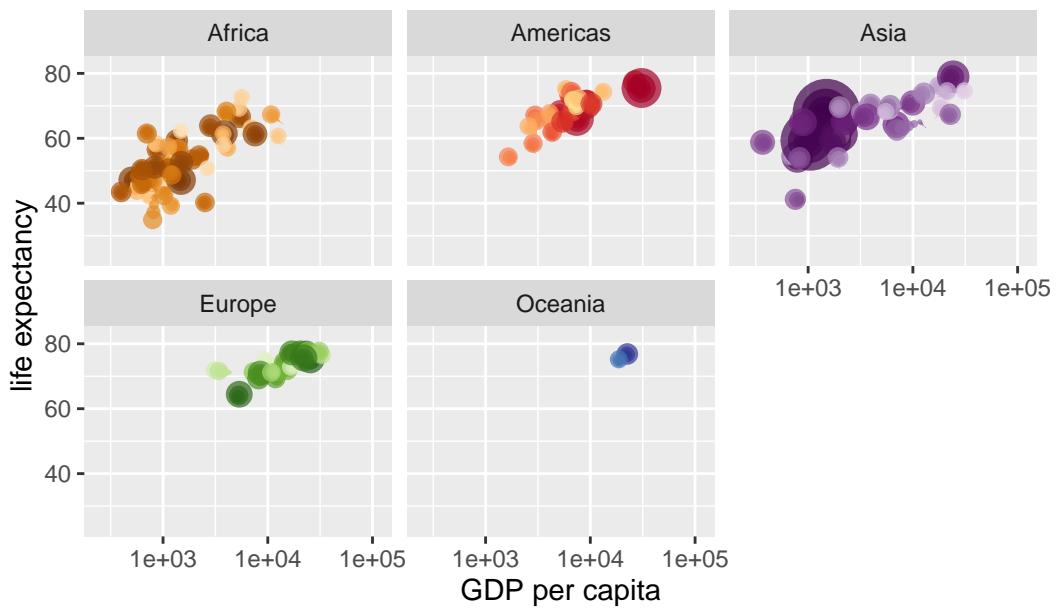
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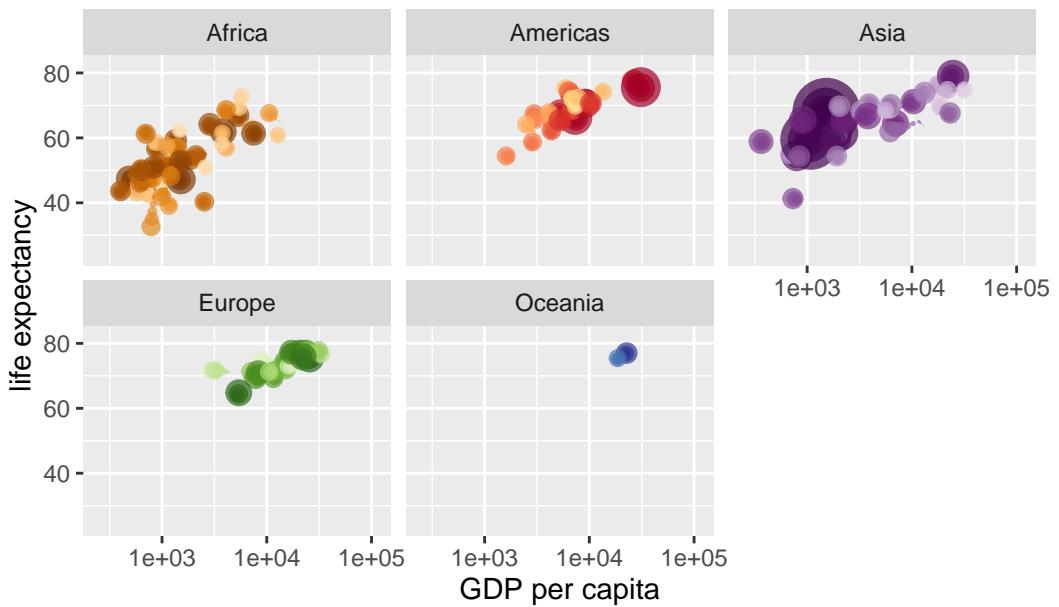
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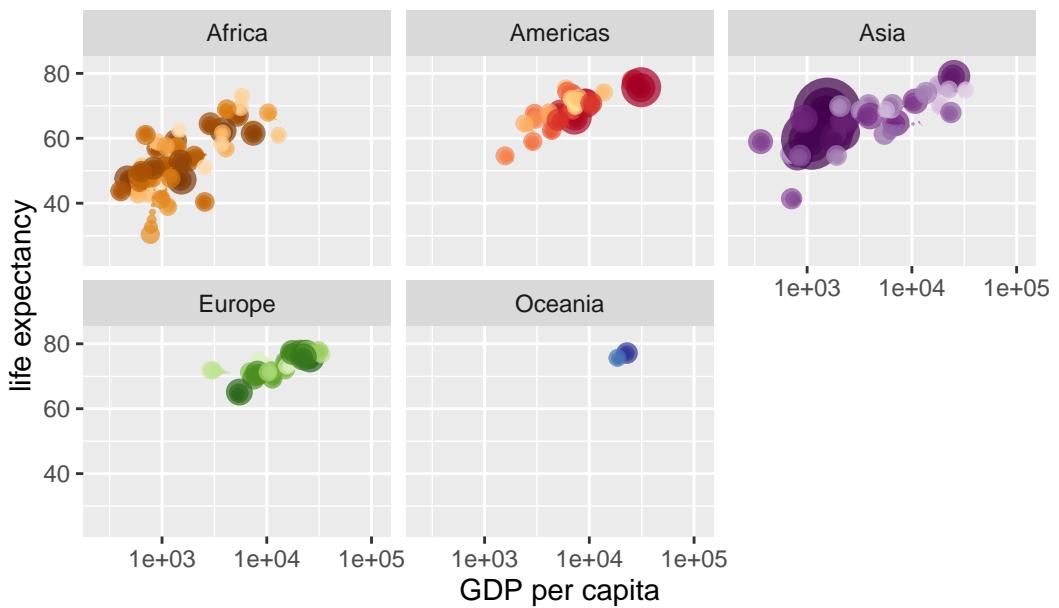
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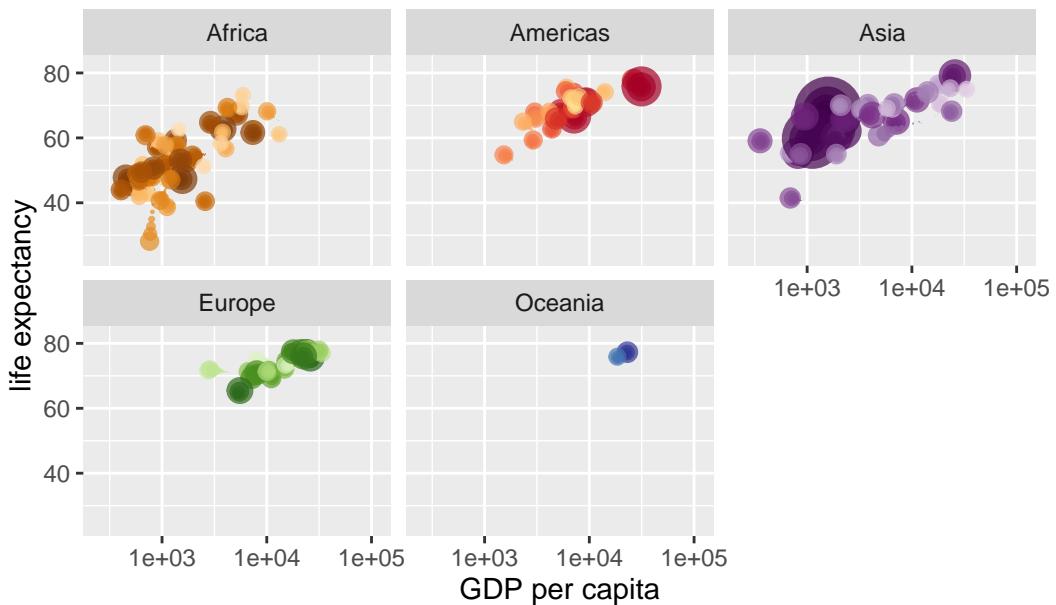
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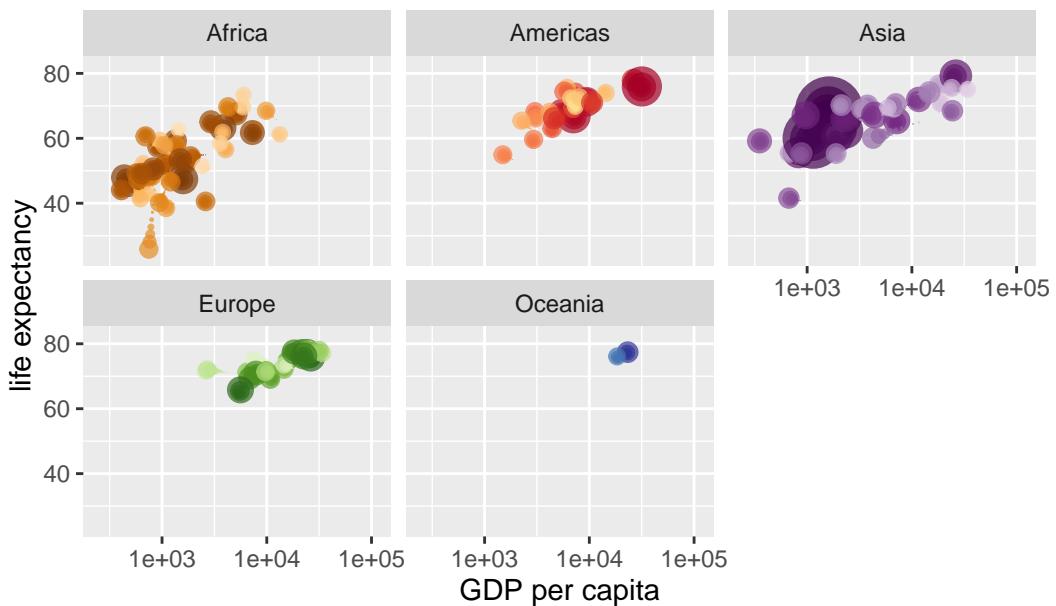
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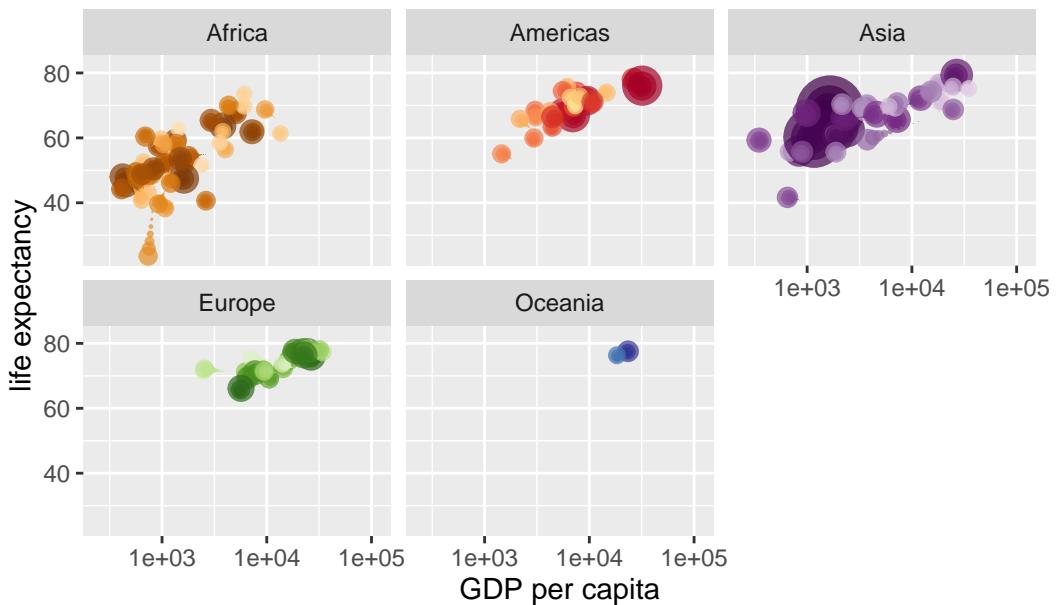
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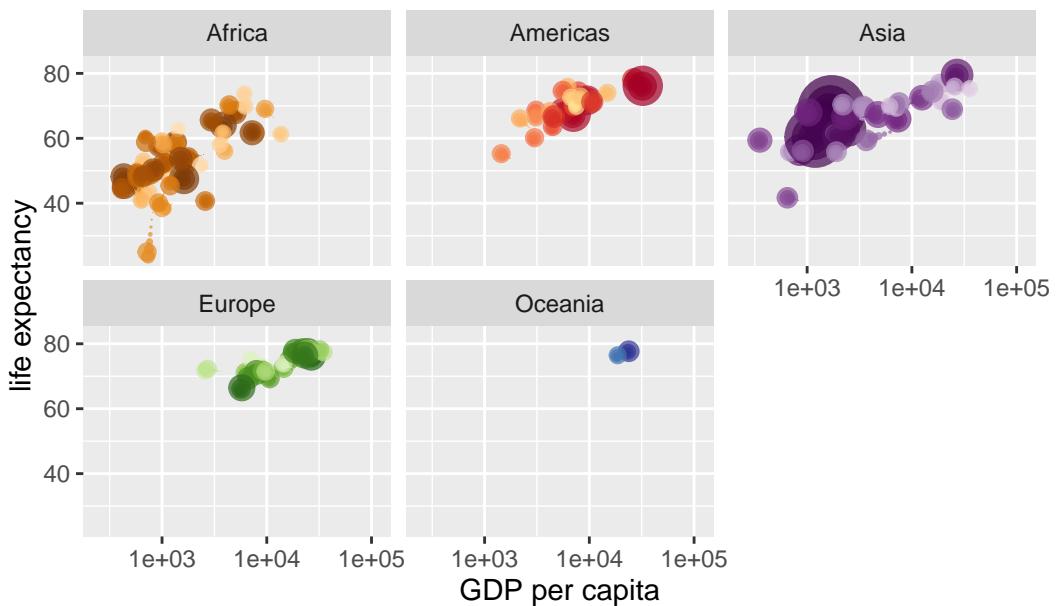
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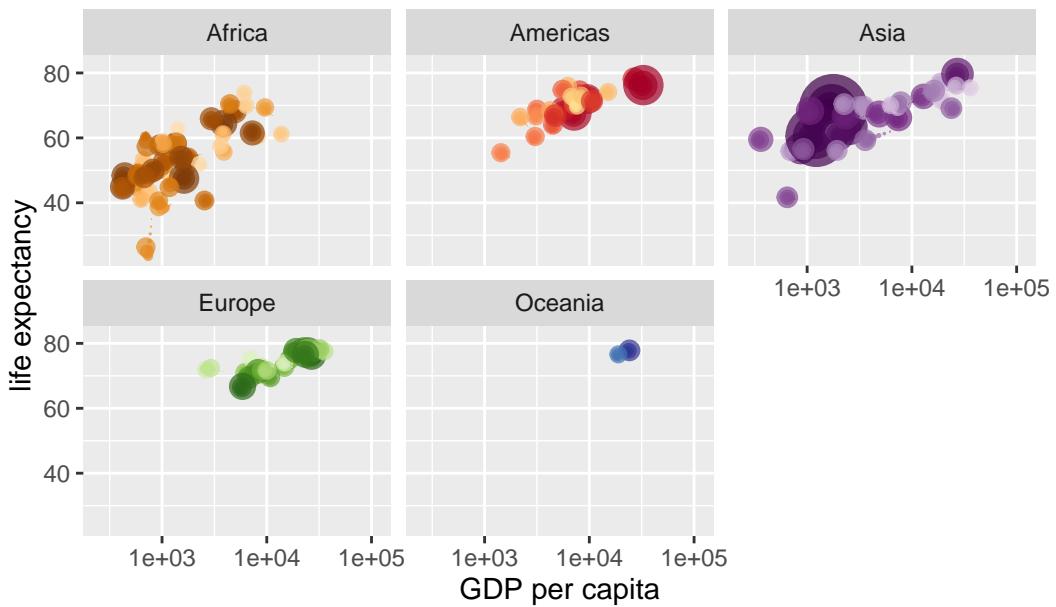
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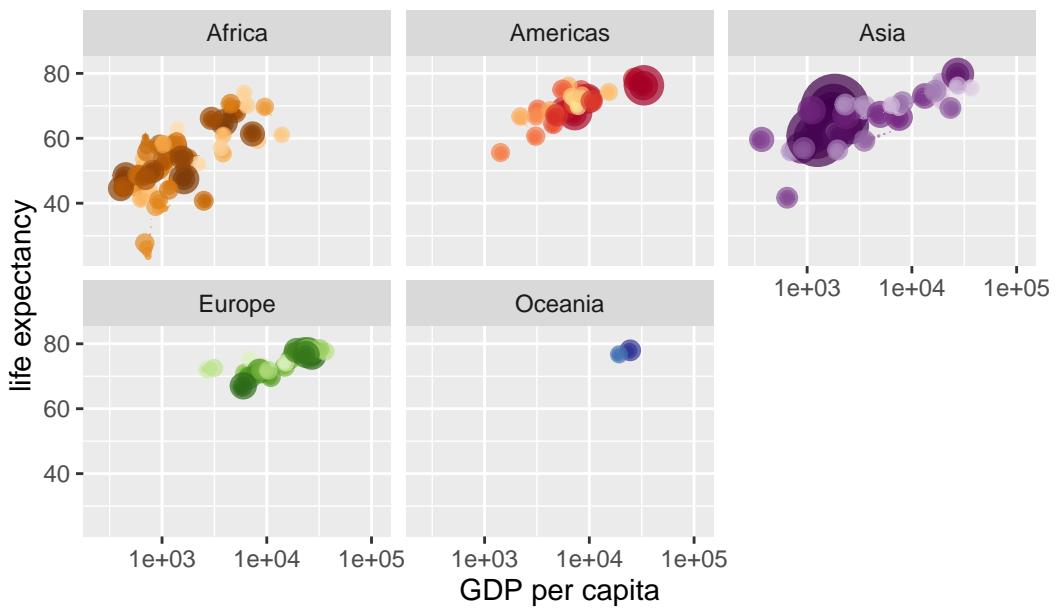
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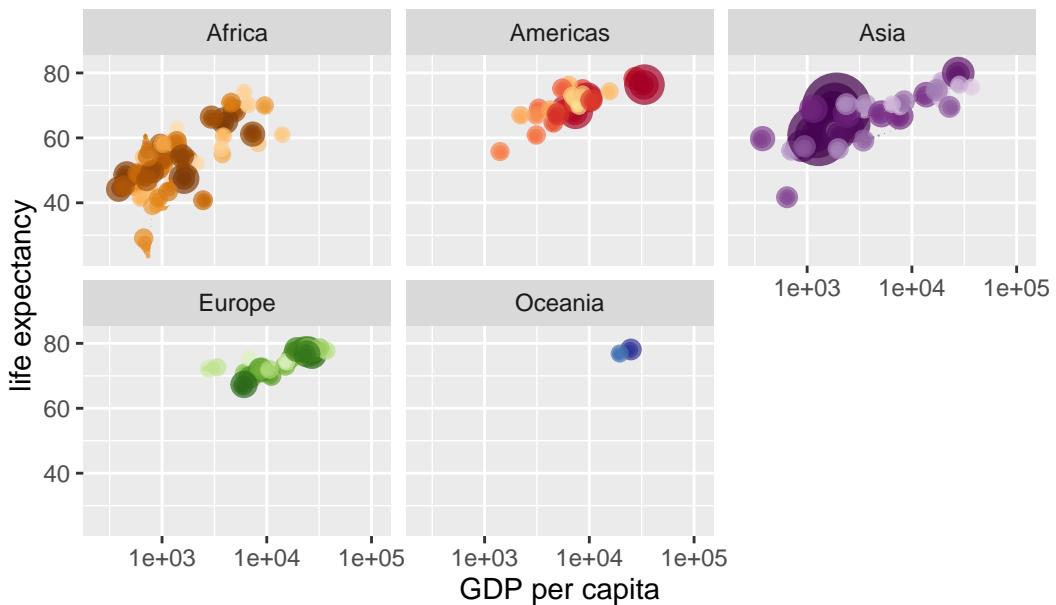
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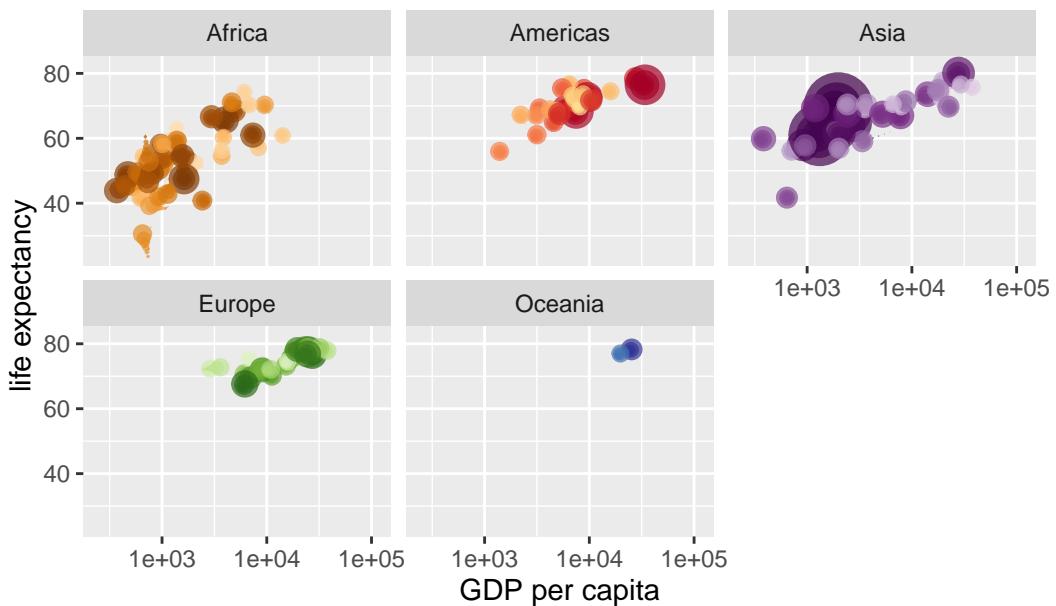
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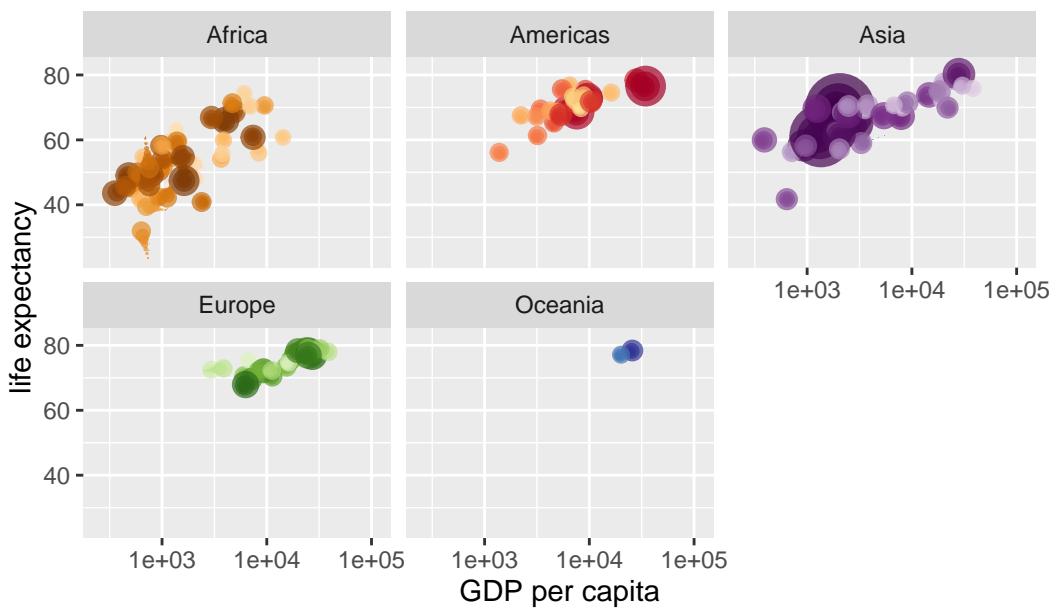
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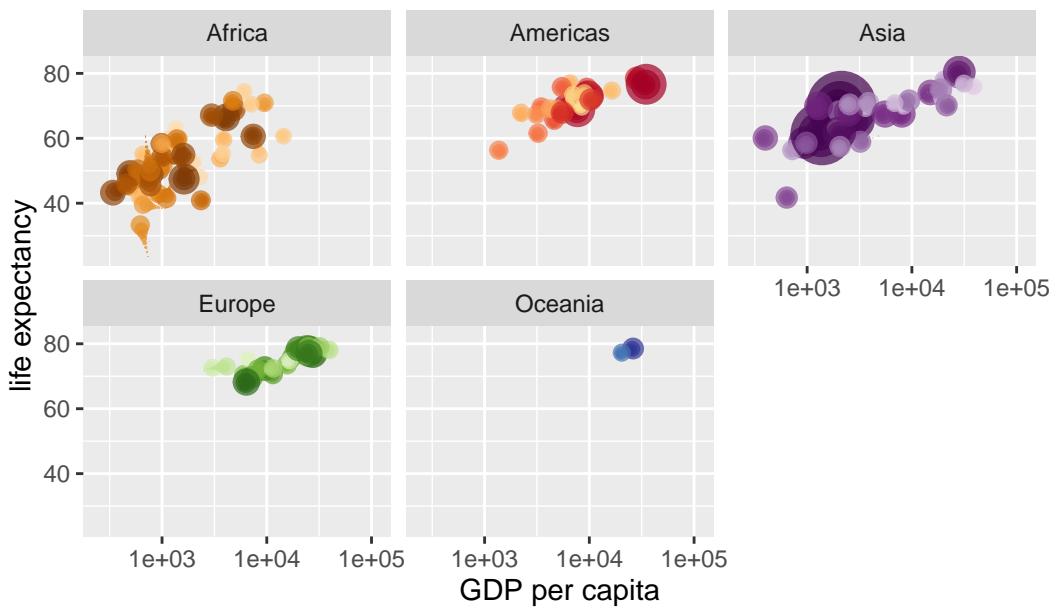
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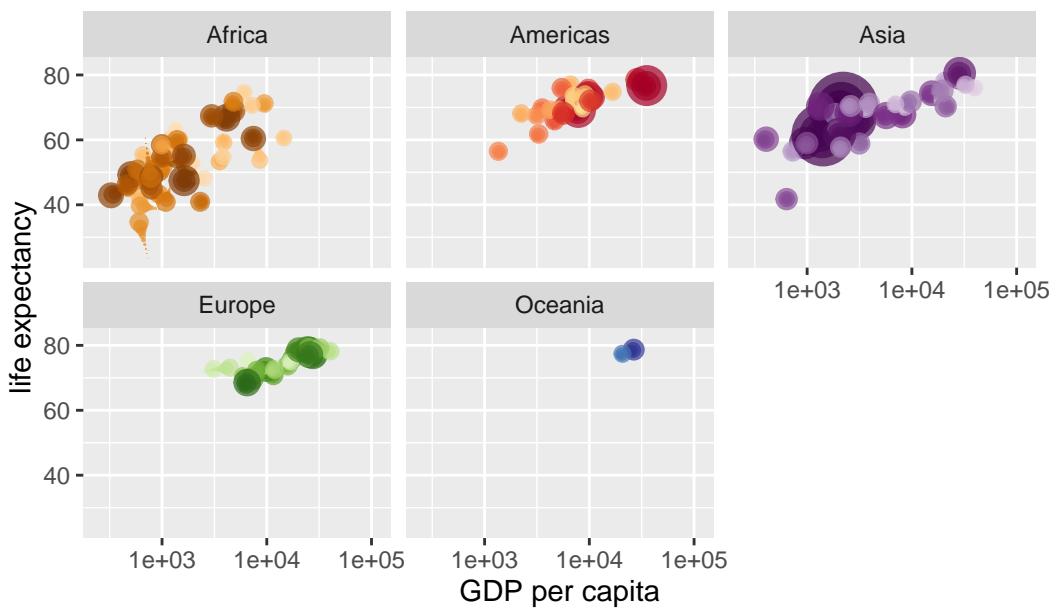
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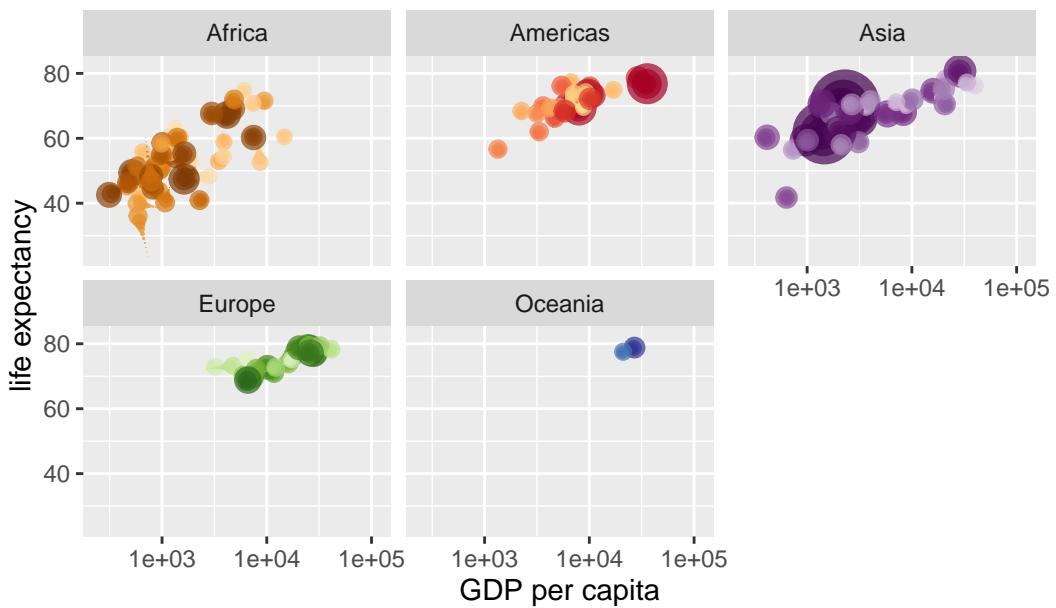
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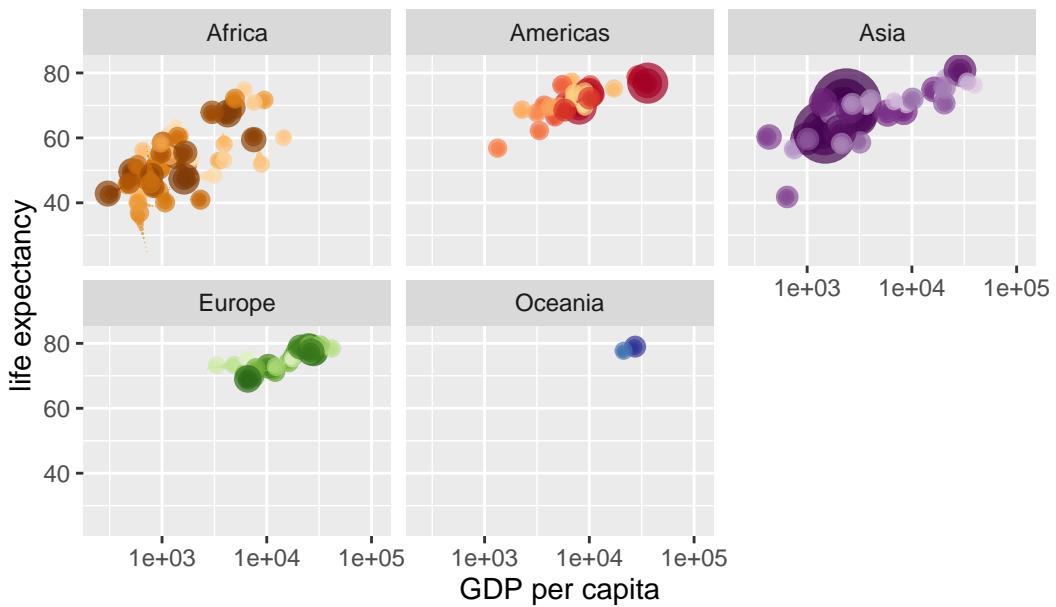
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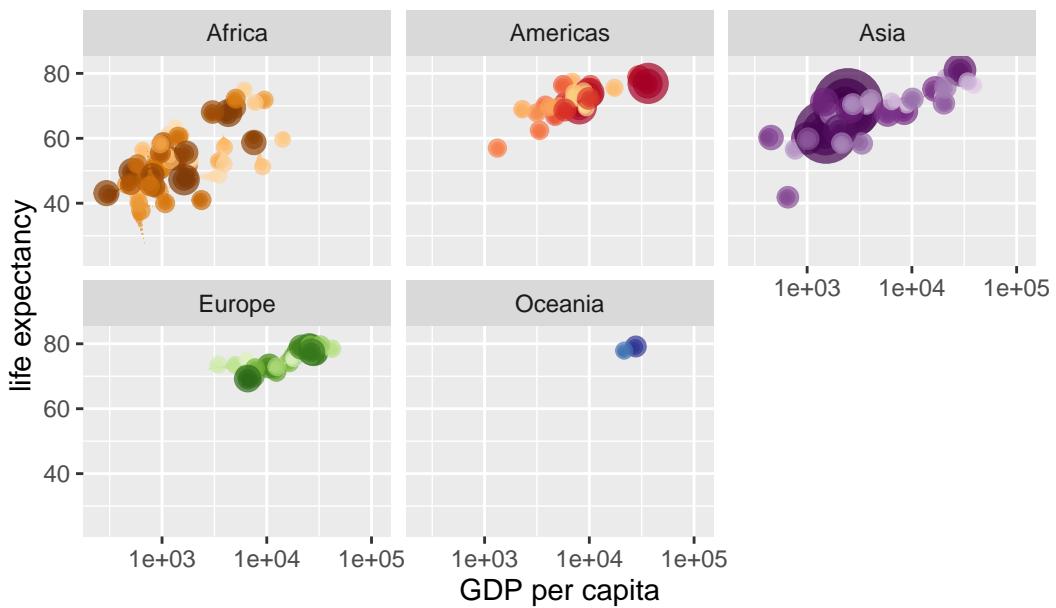
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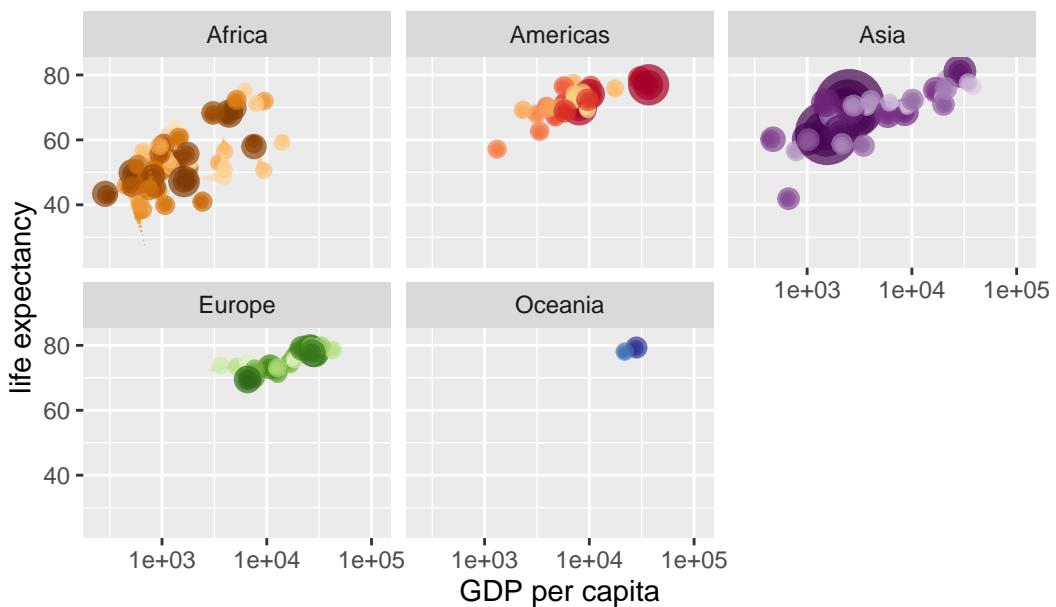
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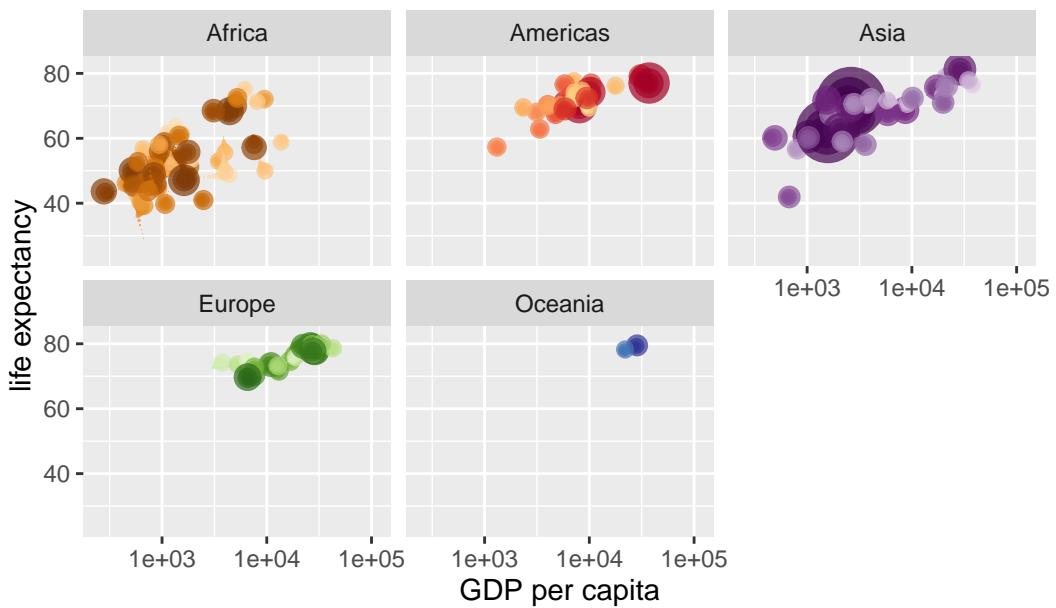
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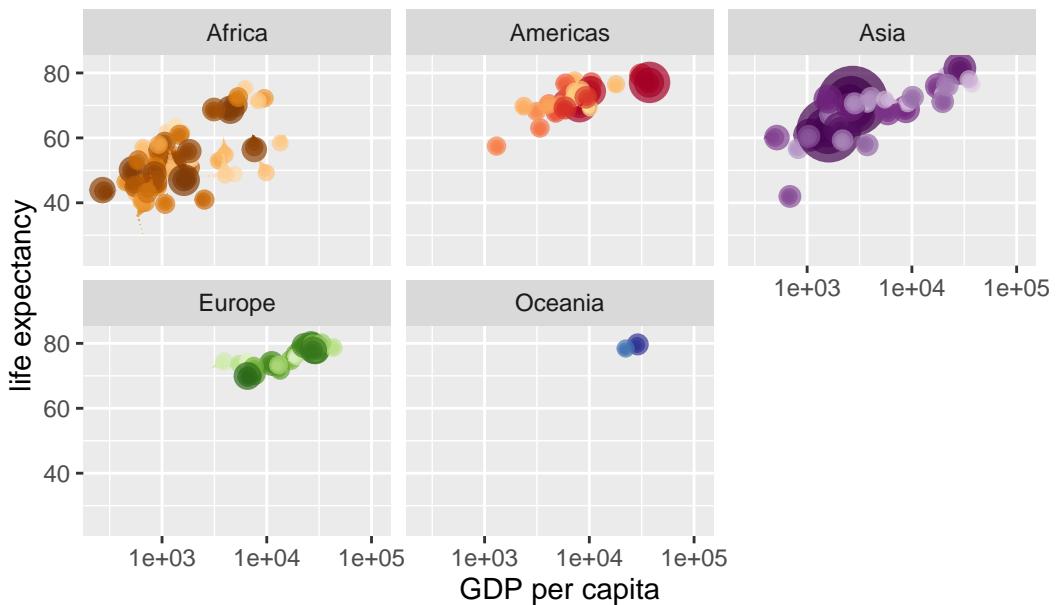
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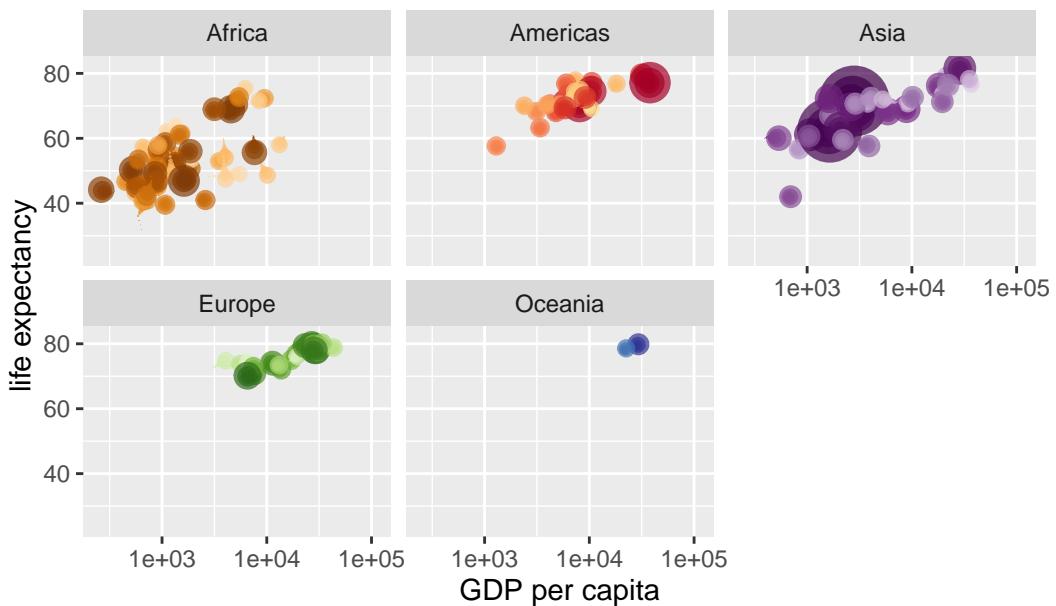
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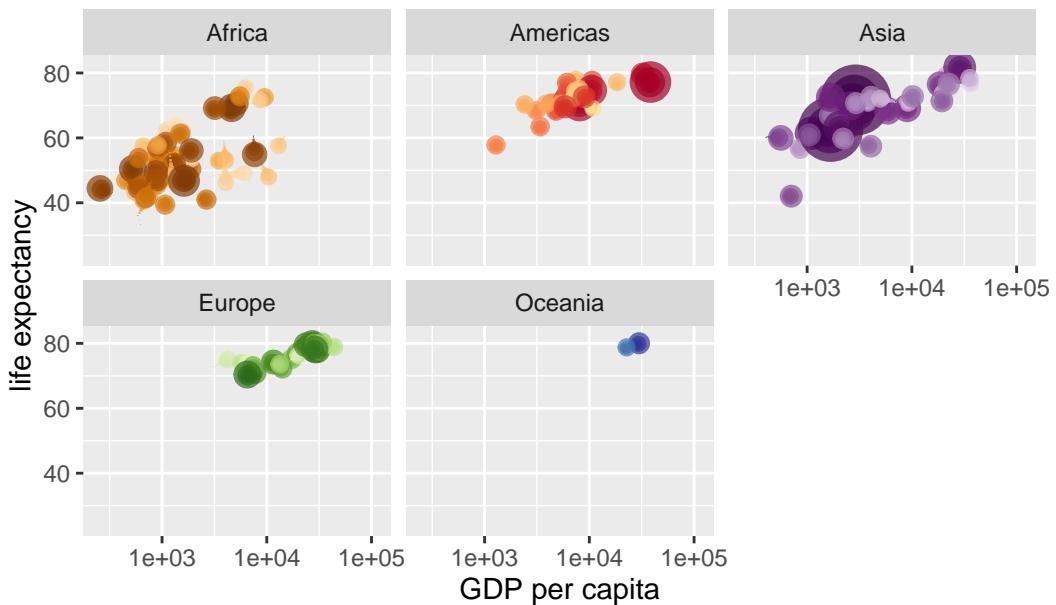
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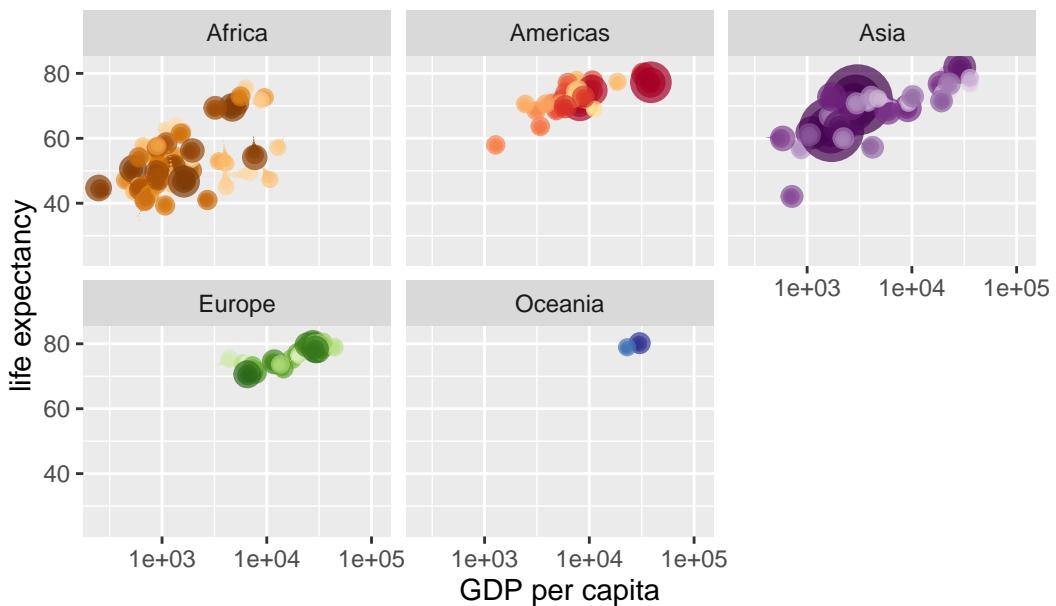
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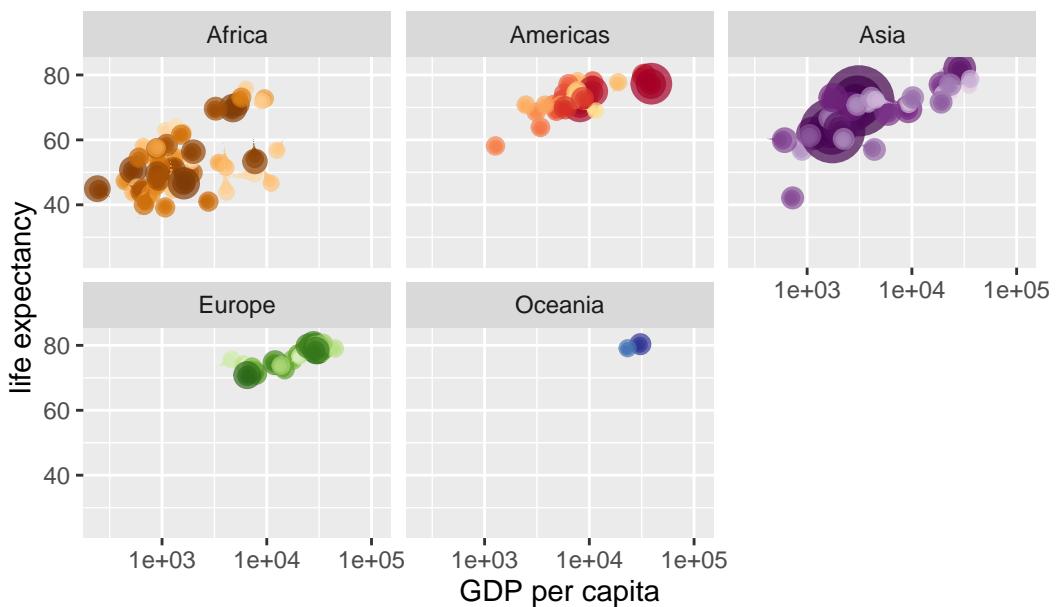
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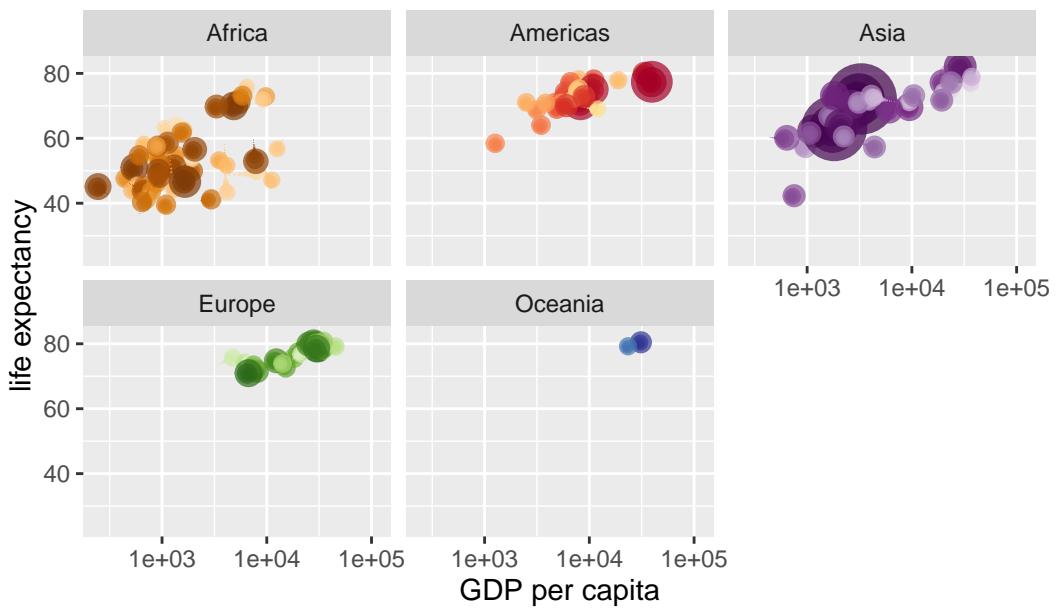
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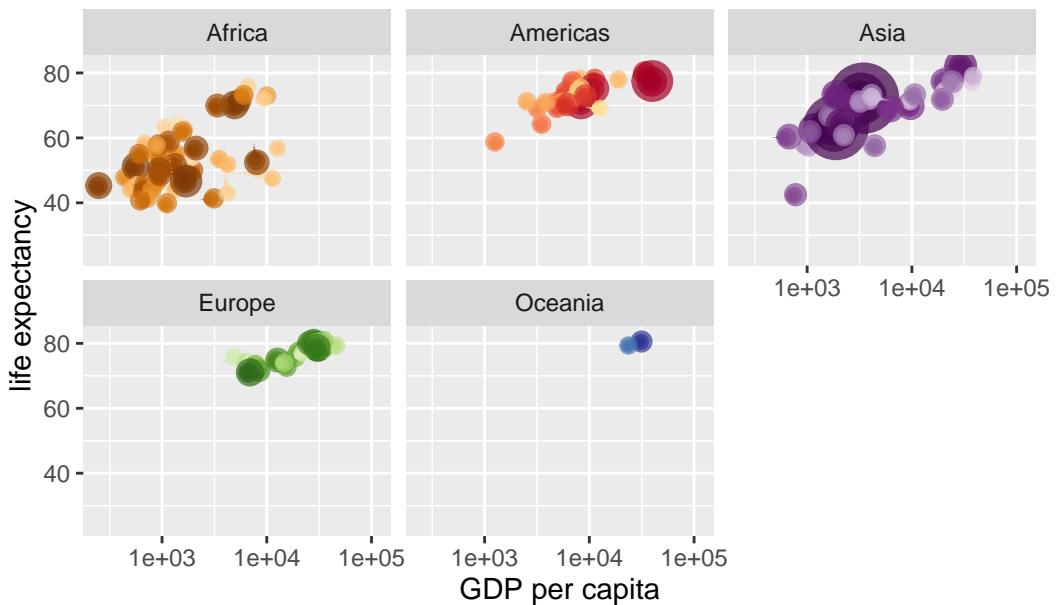
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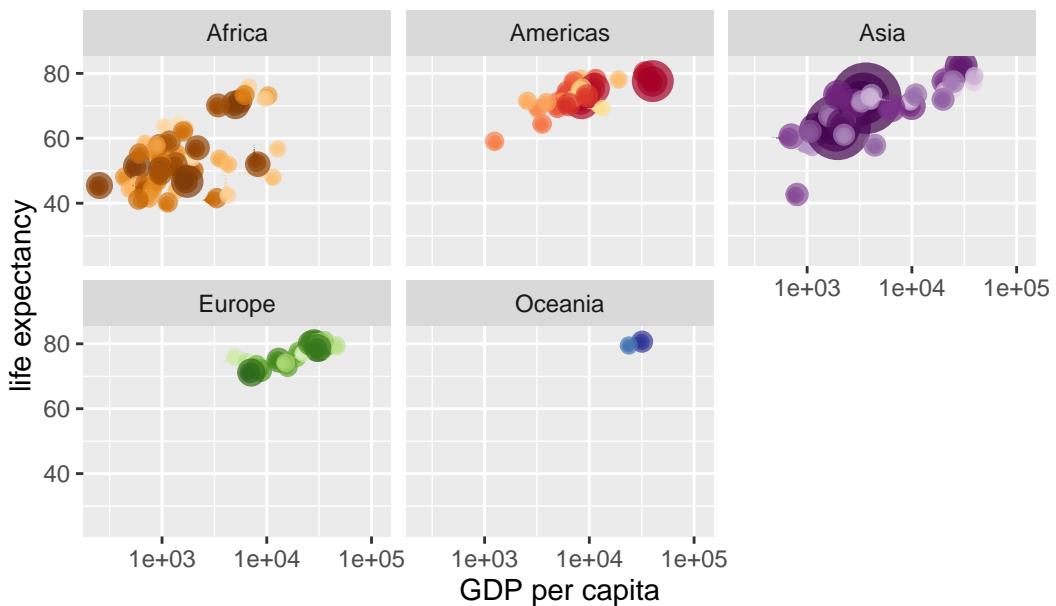
Year: 2003



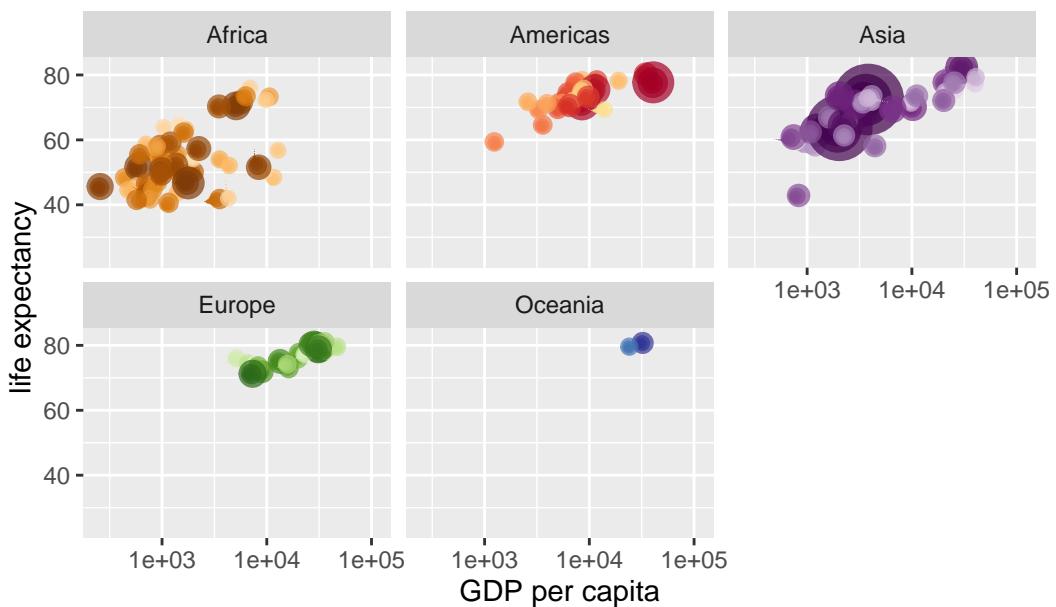
Year: 2003



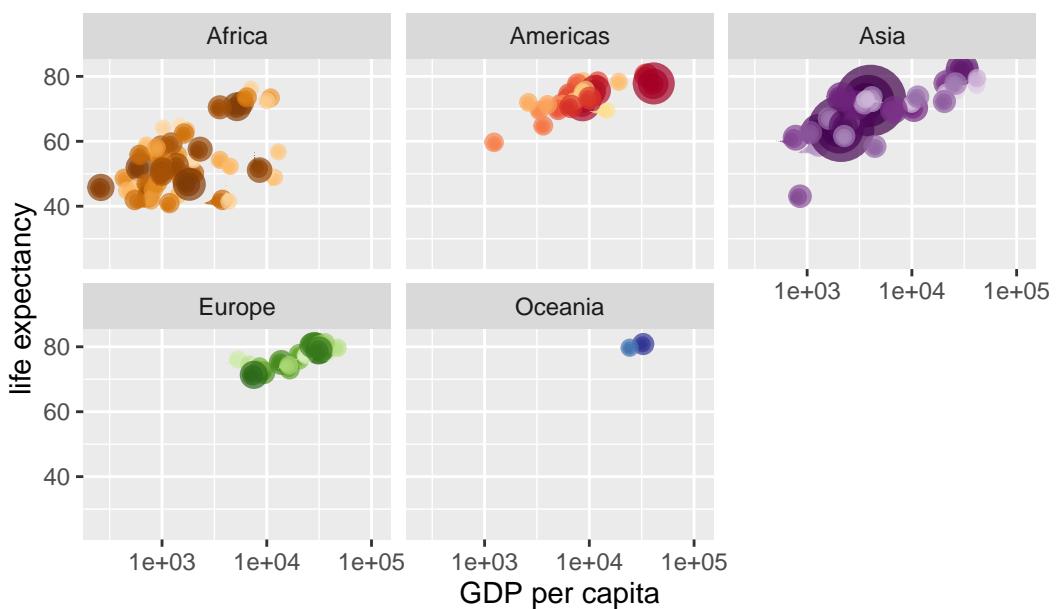
Year: 2004



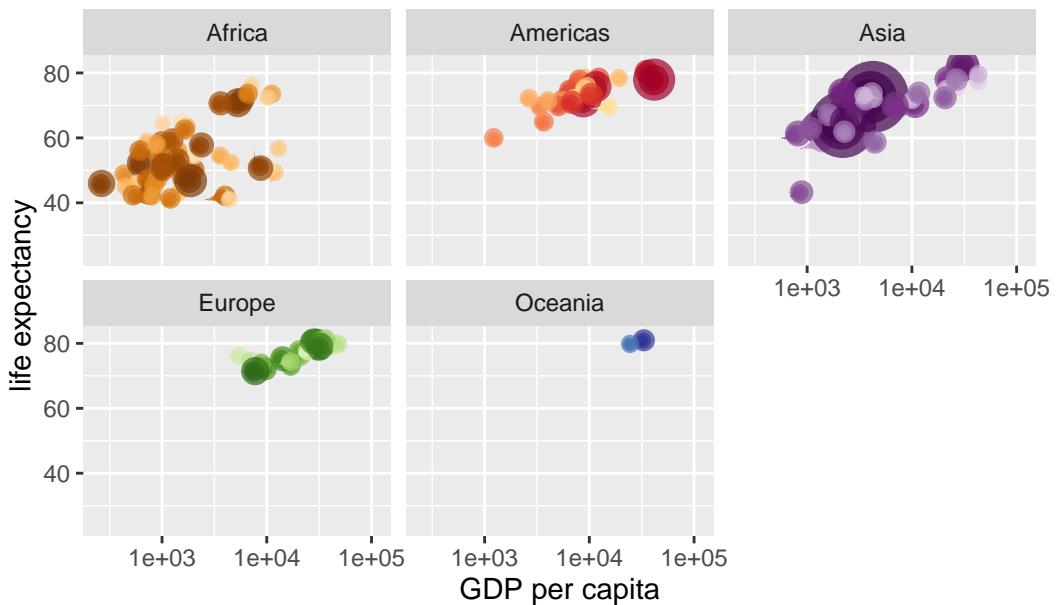
Year: 2004



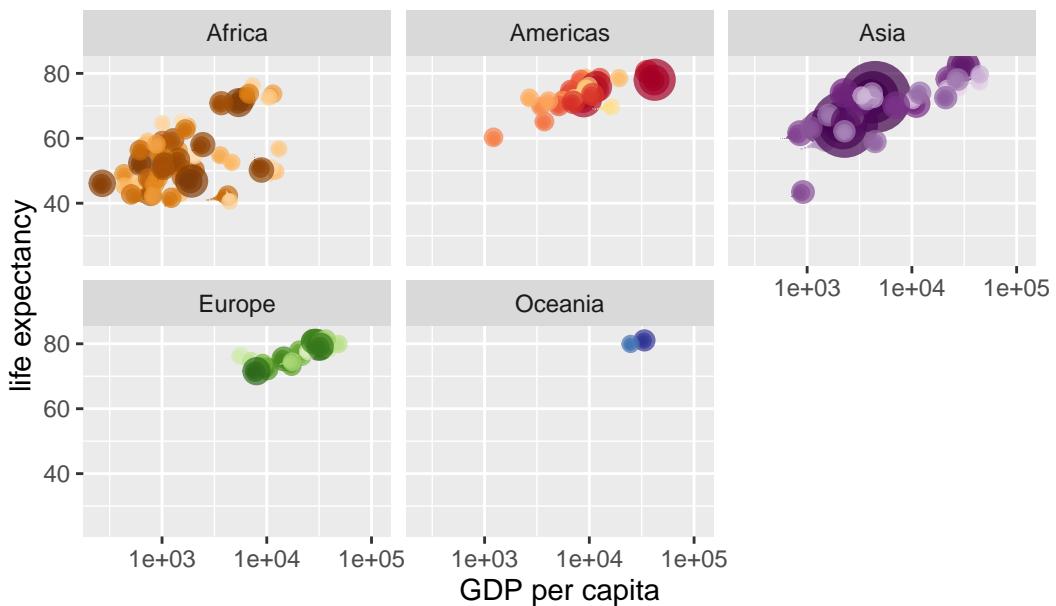
Year: 2005



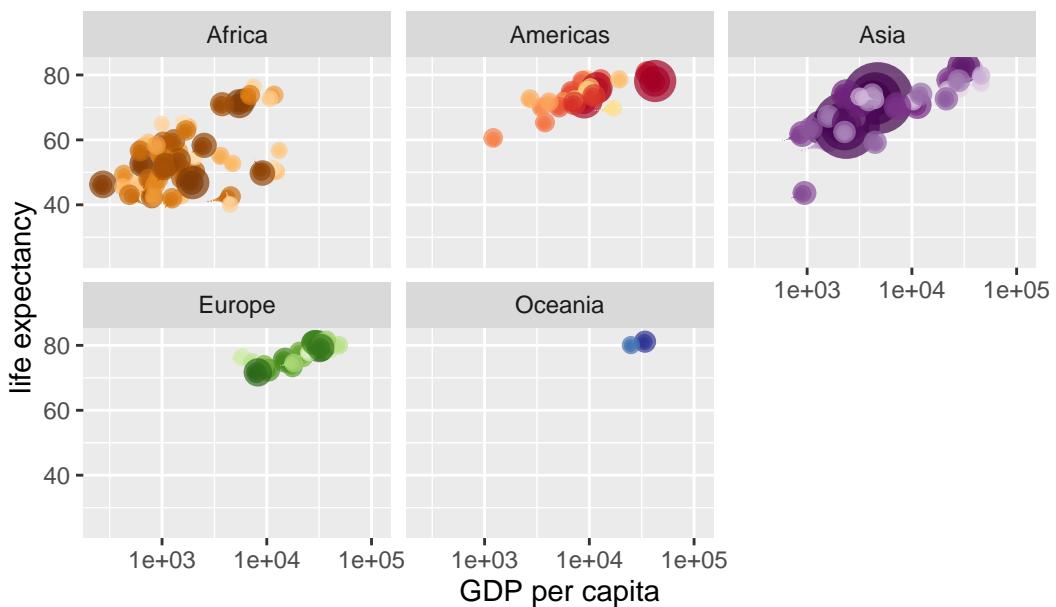
Year: 2005



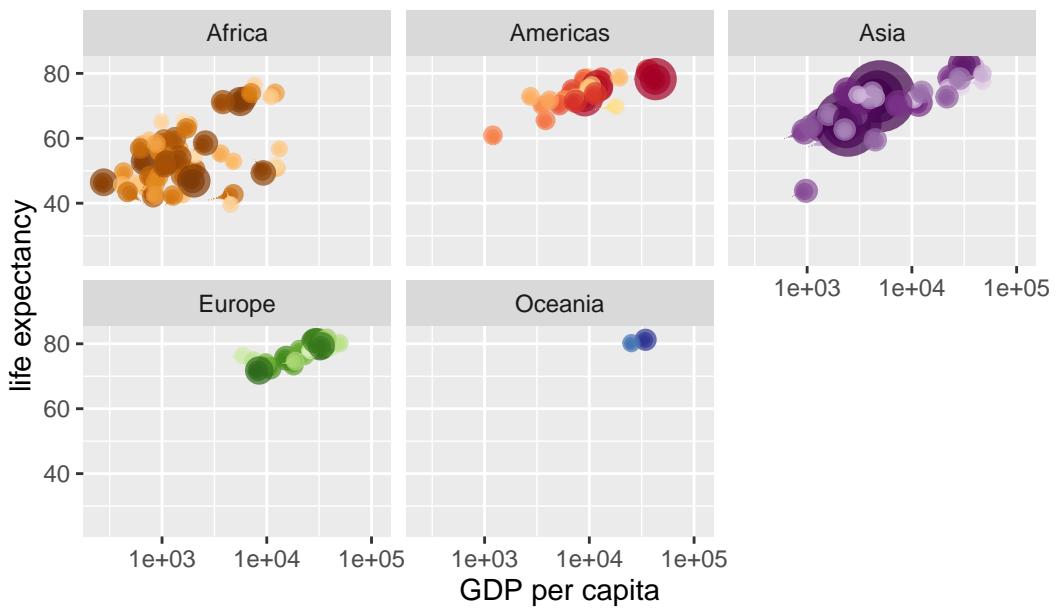
Year: 2006



Year: 2006



Year: 2007



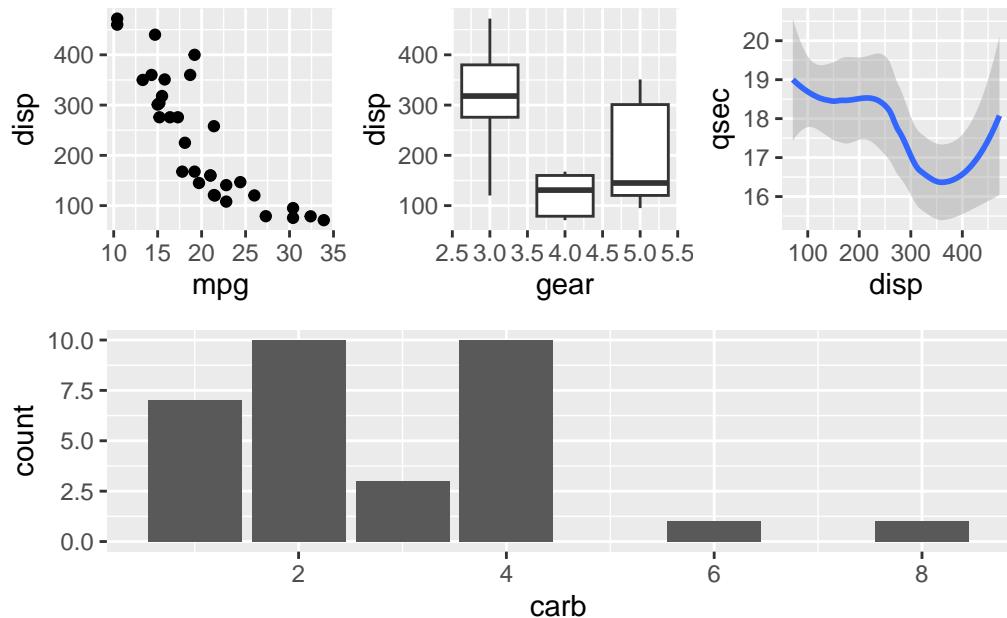
```

library(patchwork)

# Setup some example plots
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))

# Use patchwork to combine them here:
(p1 | p2 | p3) /
  p4
`geom_smooth()` using method = 'loess' and formula = 'y ~ x'

```



```
#install.packages("dplyr")
```

## Running Code

When you click the **Render** button a document will be generated that includes both content and the output of embedded code. You can embed code like this:

```
1 + 1
```

```
[1] 2
```

You can add options to executable code like this

```
[1] 4
```

The `echo: false` option disables the printing of code (only output is displayed).