

Lab5 Data Visualization w ggplot

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Using ggplot

```
#To use ggplot2, we first need to install it on our computers.  
#To do this we will use the function `install.packages(ggplot2)`.  
#Type it in Console! (one time install)
```

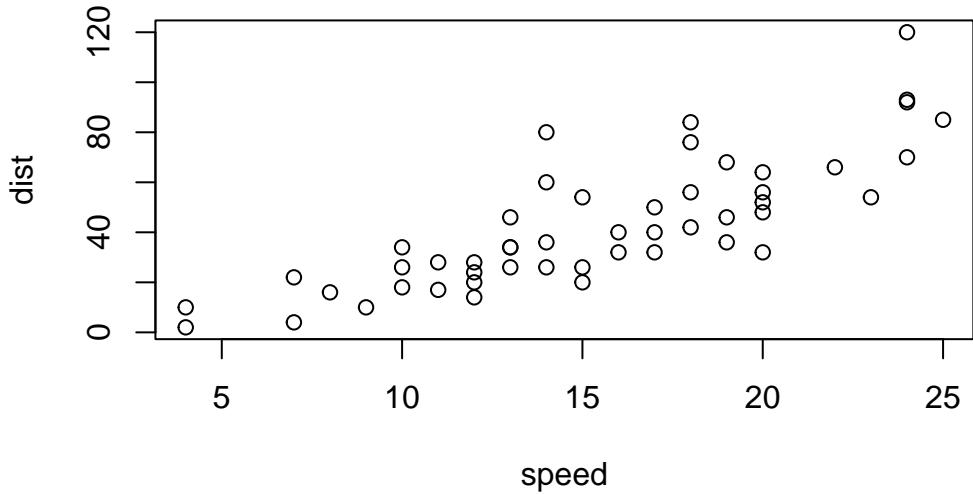
```
#Before I use any functions I have to load them up by calling library to start! like:
```

```
library(ggplot2)
```

```
head(cars, n=5)
```

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

```
# There is always the "base R" graphics system. i.e. `plot()`  
plot(cars)
```

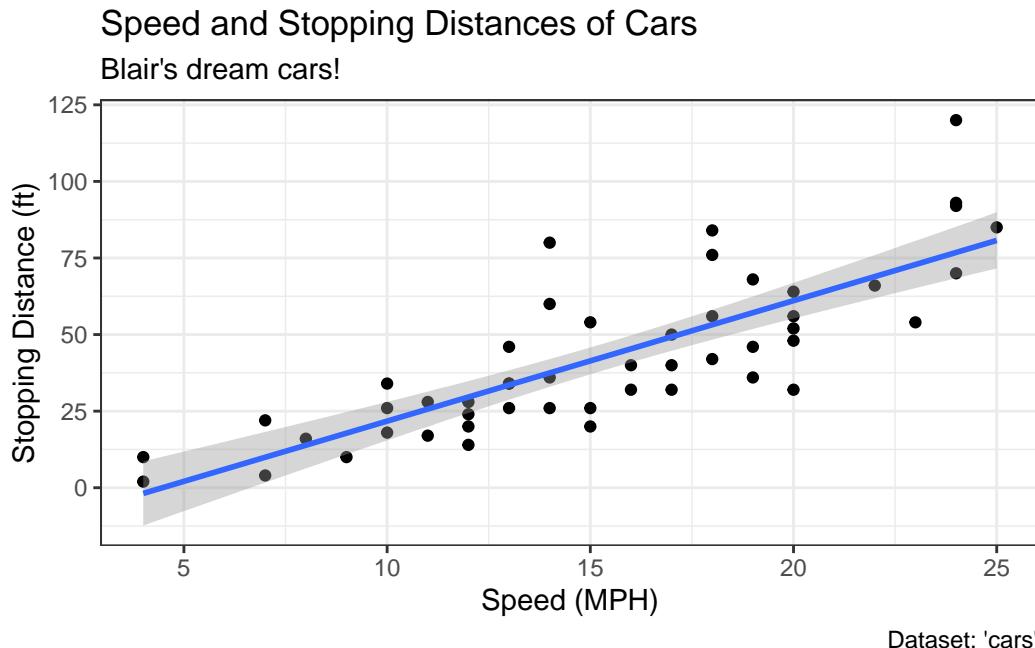


To use ggplot I need 3 things:

```
# 1. data (the stuff I wanna plot)
# 2. aesthetics aes() values - how data map to the points
# 3. geoms - how I wanna draw
```

```
# put plus at the end of lines
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 = "Blair's dream cars!",
       caption="Dataset: 'cars'") +
  geom_smooth(method = "lm") + #linear
  theme_bw() # The classic dark-on-light ggplot2 theme.
```

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



Dataset: '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
```

```
ncol(genes)
```

```
[1] 4
```

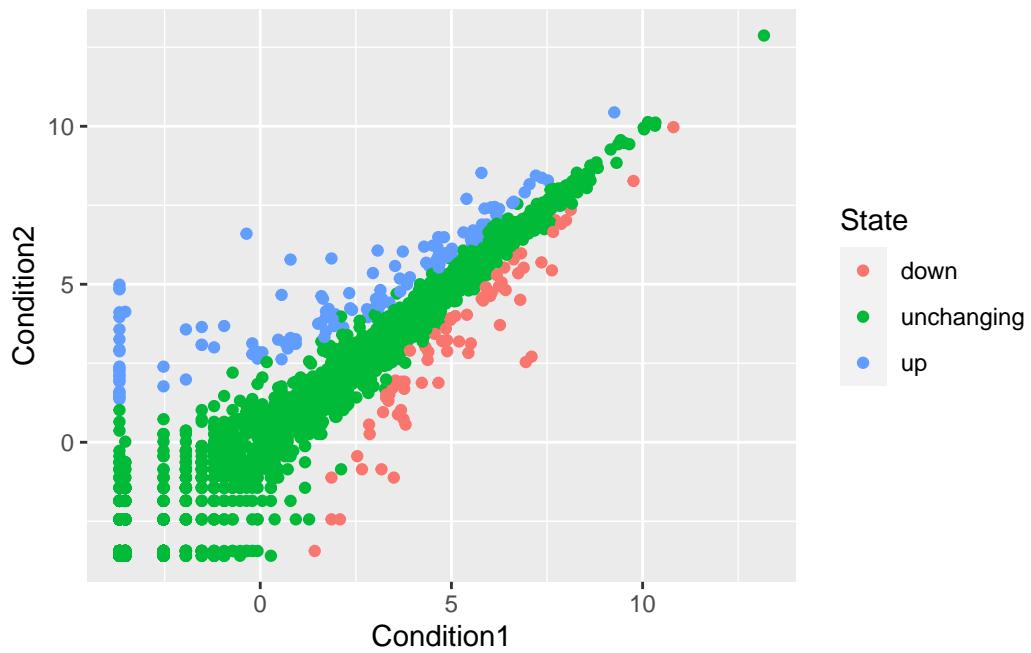
```
table(genes$State)
```

	down	unchanging	up
72		4997	
			127

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

	down	unchanging	up
1.39		96.17	
			2.44

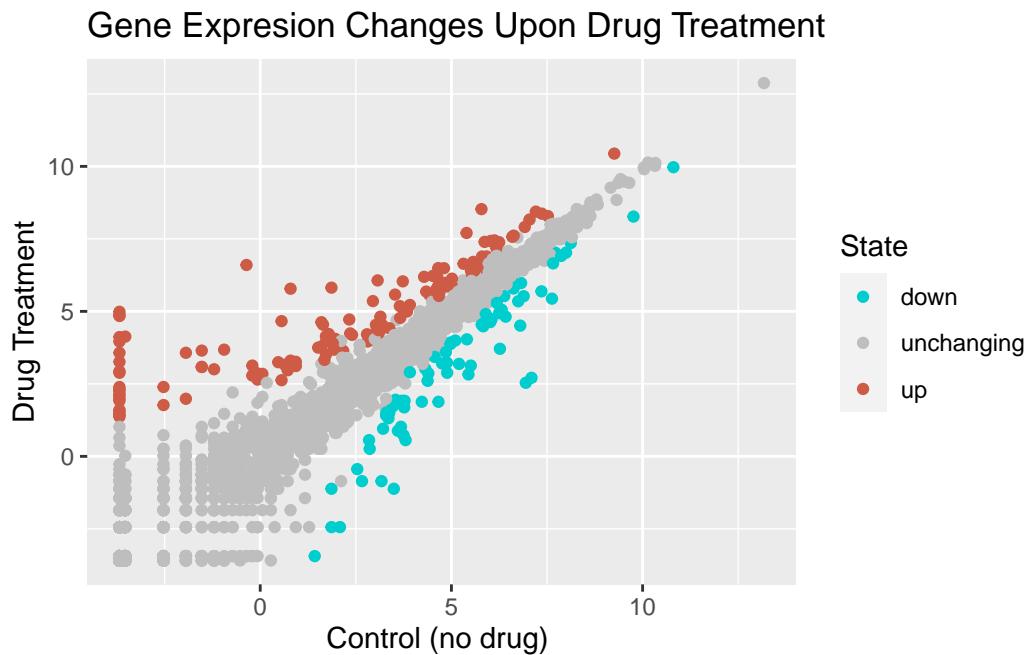
```
p <- ggplot(genes) +  
  aes(x=Condition1, y=Condition2, col=State) +  
  geom_point()  
p
```



```

p + scale_colour_manual( values=c("cyan3","gray","coral3") ) +
  labs(title="Gene Expression Changes Upon Drug Treatment",
       x="Control (no drug) ",
       y="Drug Treatment")

```



```

# install.packages("gapminder") in the Console
library(gapminder)
# File location online
url <- "https://raw.githubusercontent.com/jennybc/gapminder/master/inst/extdata/gapminder.csv"

gapminder <- read.delim(url)

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

```

Attaching package: 'dplyr'

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

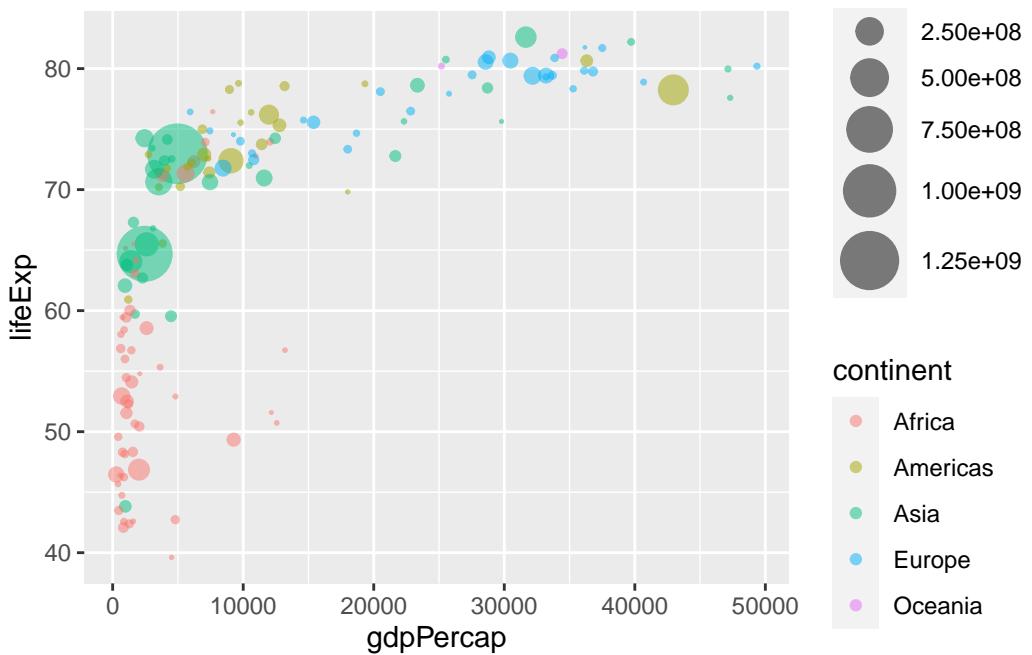
filter, lag

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

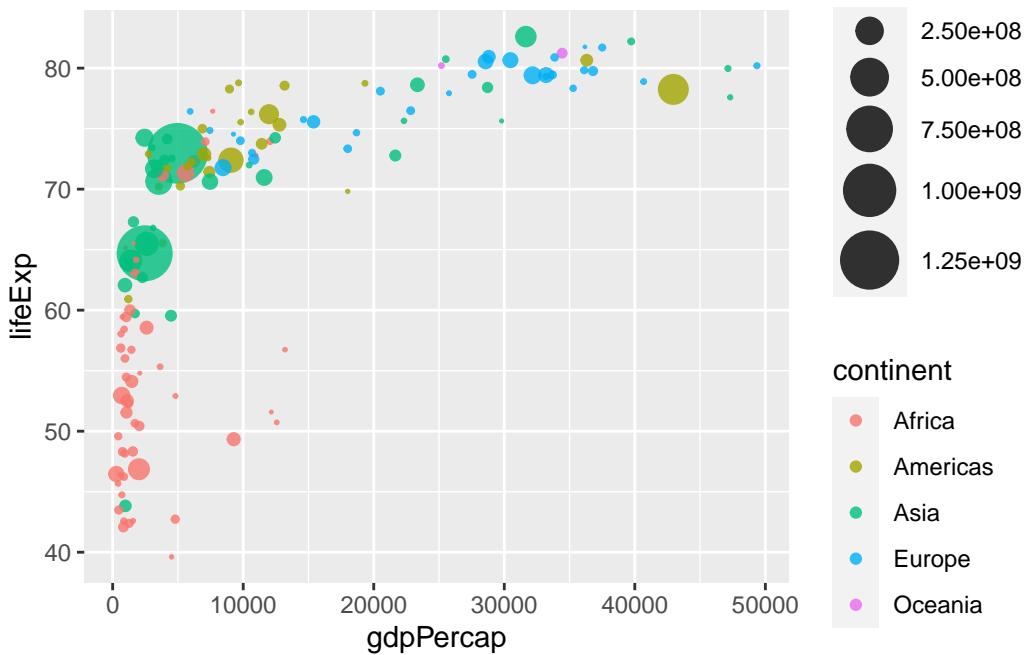
```
intersect, setdiff, setequal, union
```

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

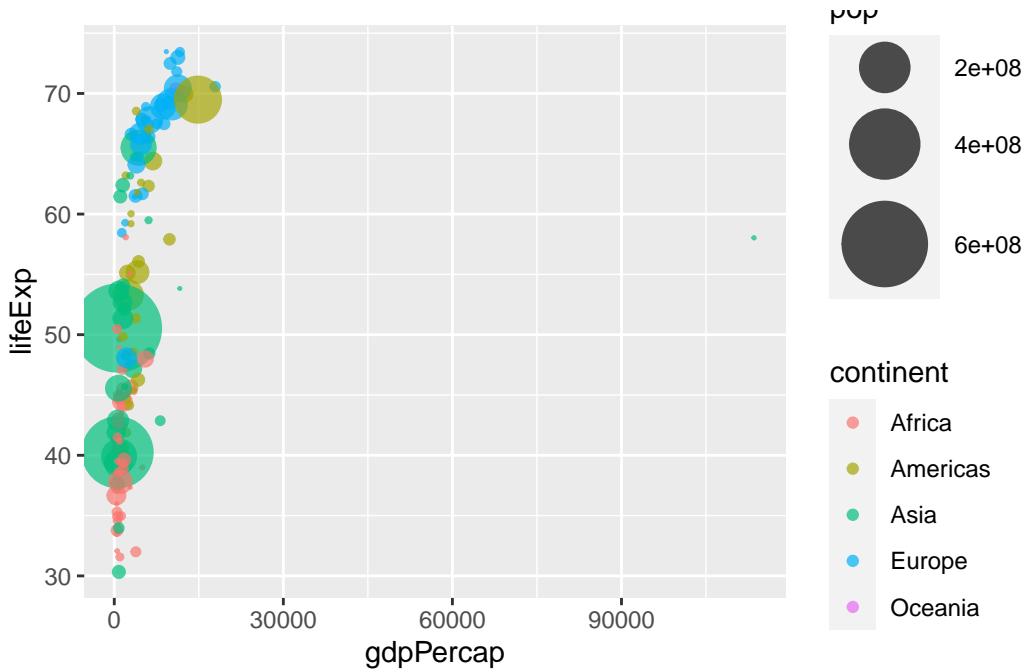
```
ggplot(gapminder_2007) +  
  aes(x=gdpPercap, y=lifeExp, color=continent, size=pop) +  
  geom_point(alpha=0.5) +  
  scale_size_area(max_size = 10)
```



```
ggplot(gapminder_2007) +  
  aes(x=gdpPercap, y=lifeExp, color=continent, size=pop) +  
  geom_point(alpha=0.8) +  
  scale_size_area(max_size = 10)
```



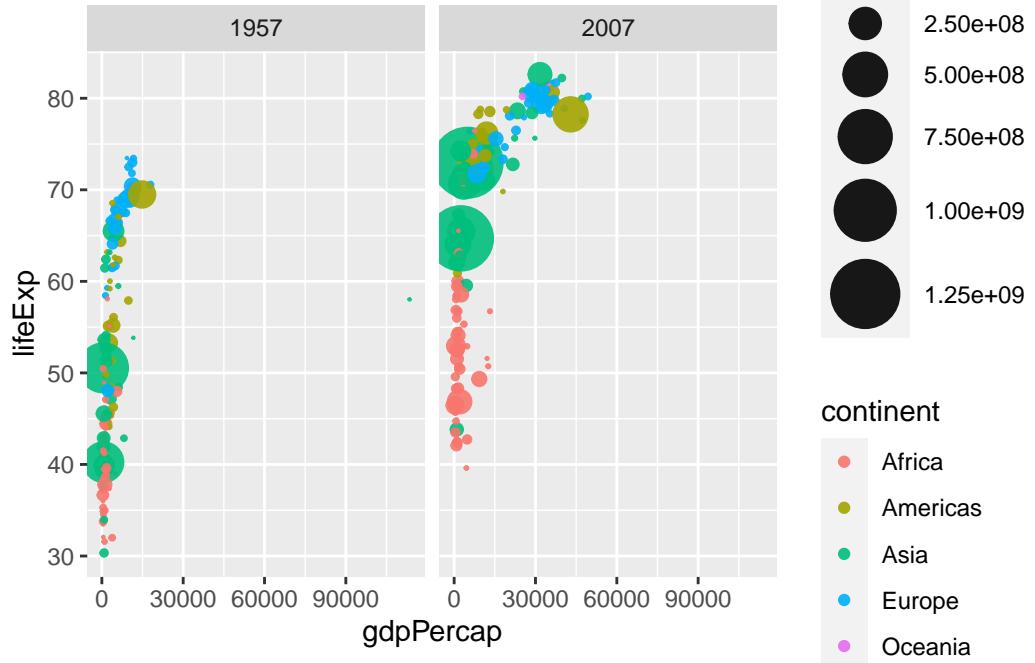
```
#Question 7: Can you adapt the code you have learned thus far to reproduce our gapminder
gapminder_1957 <- gapminder %>% filter(year==1957)
ggplot(gapminder_1957) +
  aes(x = gdpPercap, y = lifeExp, color=continent, size = pop) +
  geom_point(alpha=0.7) +
  scale_size_area(max_size = 15)
```



Comparing ggplots

```
#Comparing different years
gapminder_1957 <- gapminder %>% filter(year==1957 | year==2007)

ggplot(gapminder_1957) +
  geom_point(aes(x = gdpPercap, y = lifeExp, color=continent,
                 size = pop), alpha=0.9) +
  scale_size_area(max_size = 12) +
  facet_wrap(~year)
```

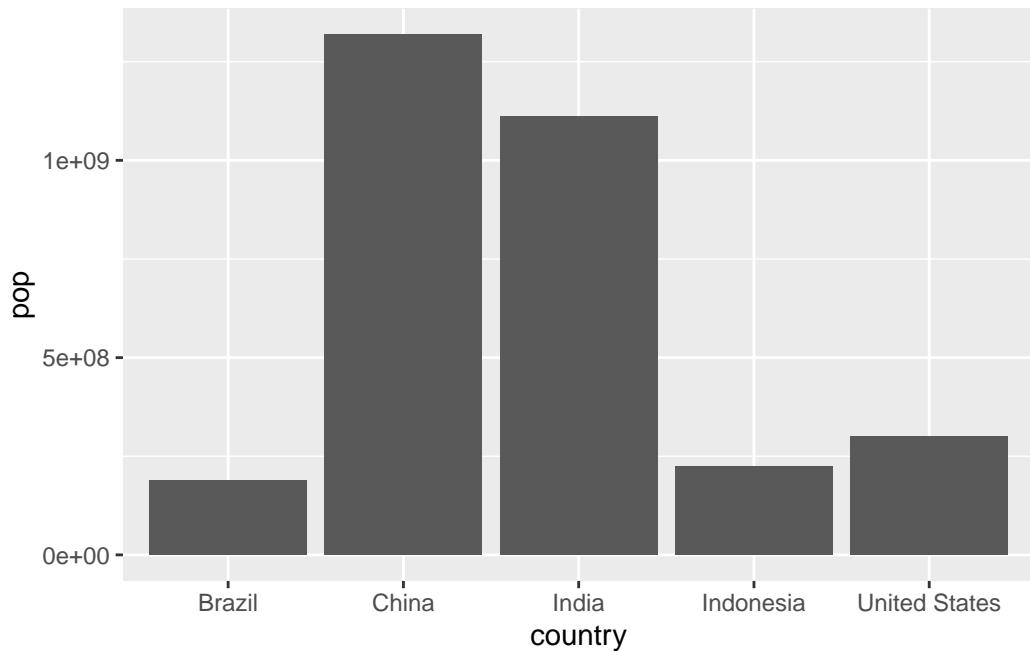


```
gapminder_top5 <- gapminder %>%
  filter(year==2007) %>%
  arrange(desc(pop)) %>%
  top_n(5, pop)
```

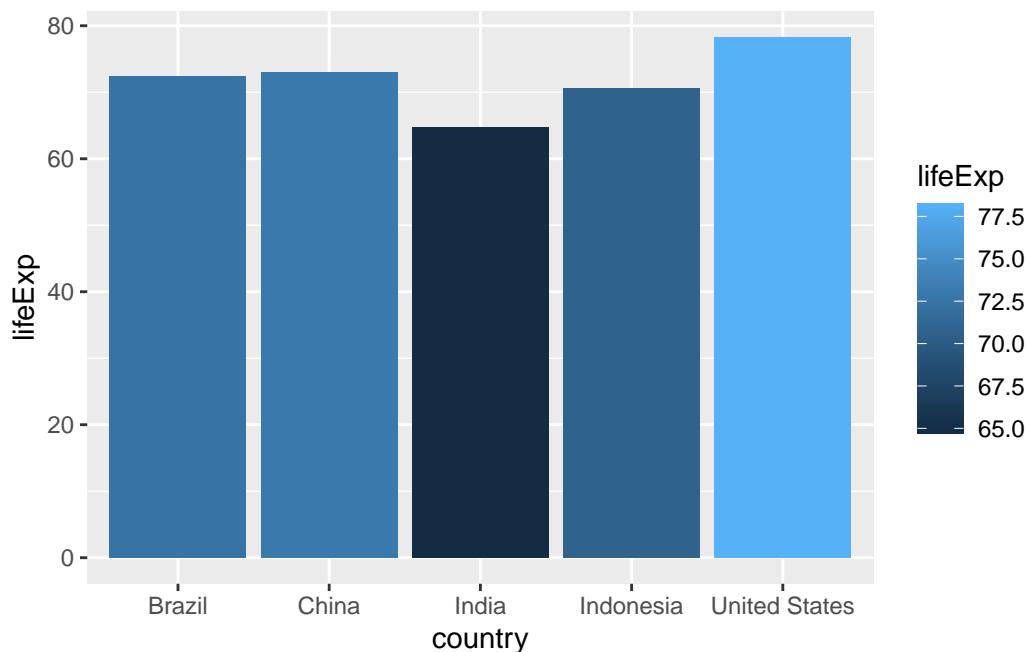
```
gapminder_top5
```

	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

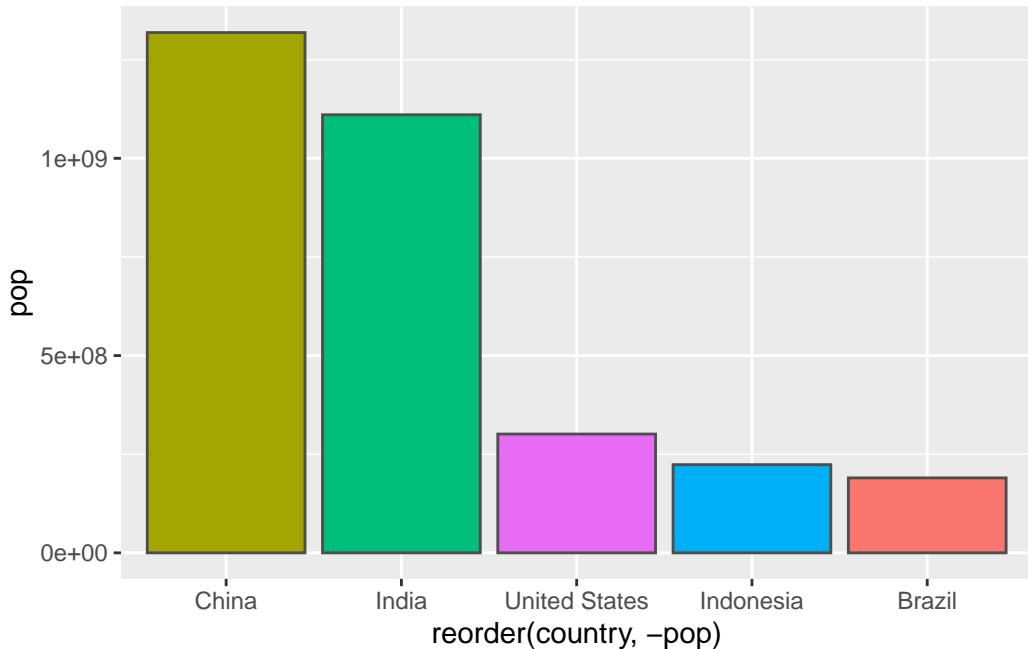
```
ggplot(gapminder_top5) +
  geom_col(aes(x = country, y = pop))
```



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



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



```
head(USArrests)
```

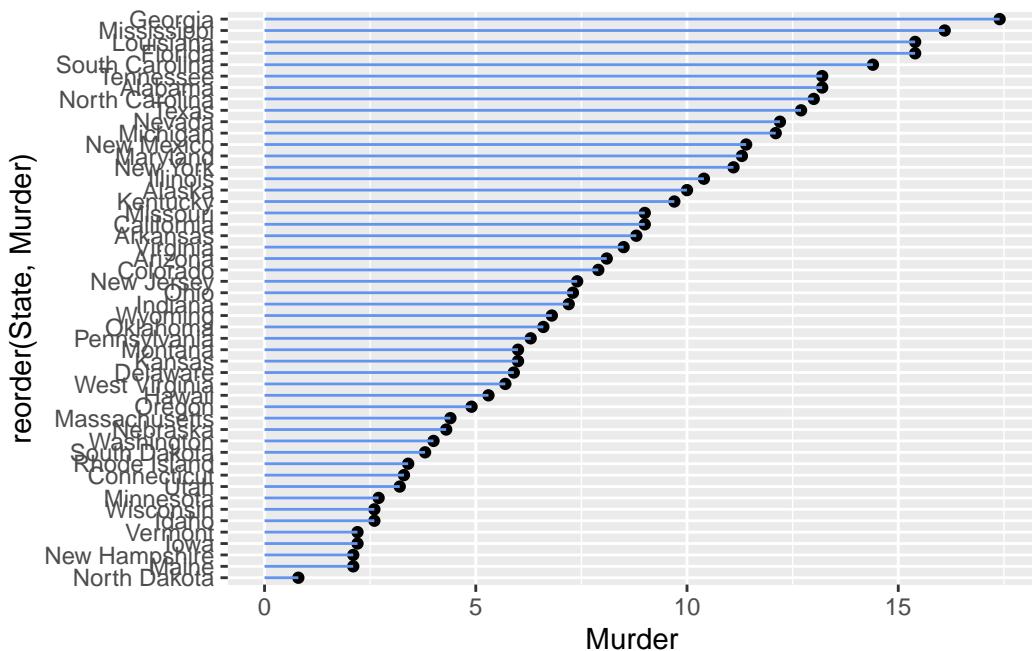
	Murder	Assault	UrbanPop	Rape
Alabama	13.2	236	58	21.2
Alaska	10.0	263	48	44.5
Arizona	8.1	294	80	31.0
Arkansas	8.8	190	50	19.5
California	9.0	276	91	40.6
Colorado	7.9	204	78	38.7

```
USArrests$State <- rownames(USArrests)  
ggplot(USArrests) +  
  aes(x=reorder(State, Murder), y=Murder) +  
  geom_point() +  
  geom_segment(aes(x=State, xend=State, y=0,
```

```

yend=Murder), color="cornflowerblue") +
coord_flip()

```



Animation

```

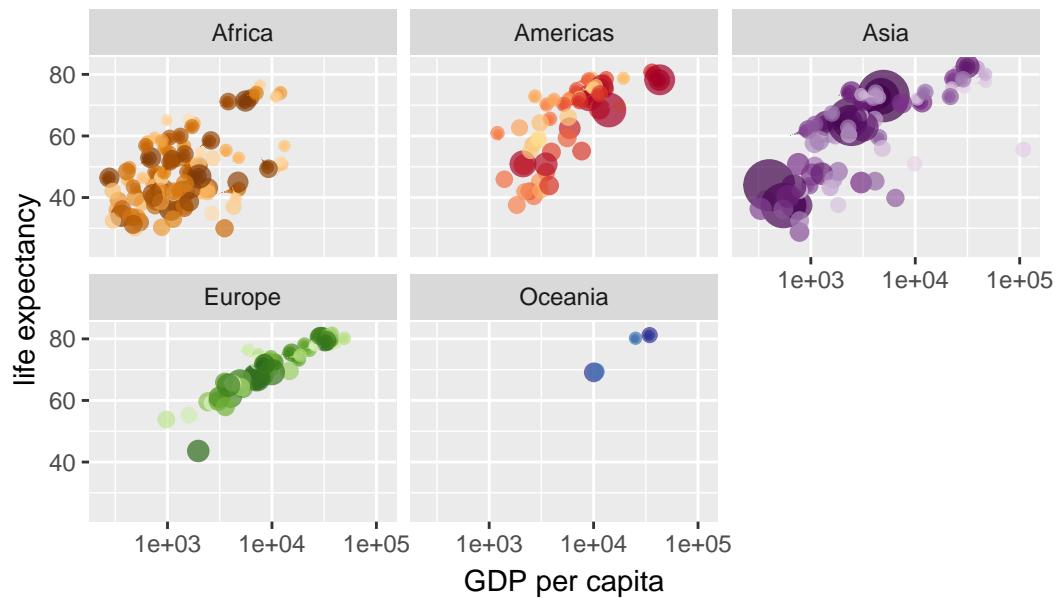
#\ eval: false
# install.packages("gganimate") and install.packages("gifsSKI") in the Console
library(gapminder)
library(gganimate)
library(ggplot2)

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) +
  labs(title = 'Year: {frame_time}', x = 'GDP per capita', y = 'life expectancy') +

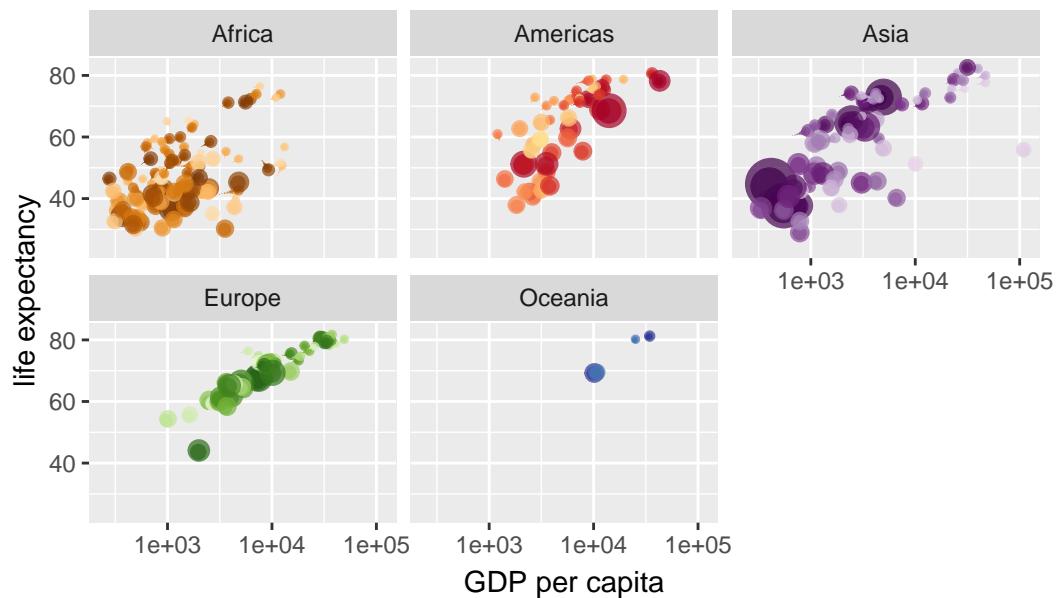
```

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

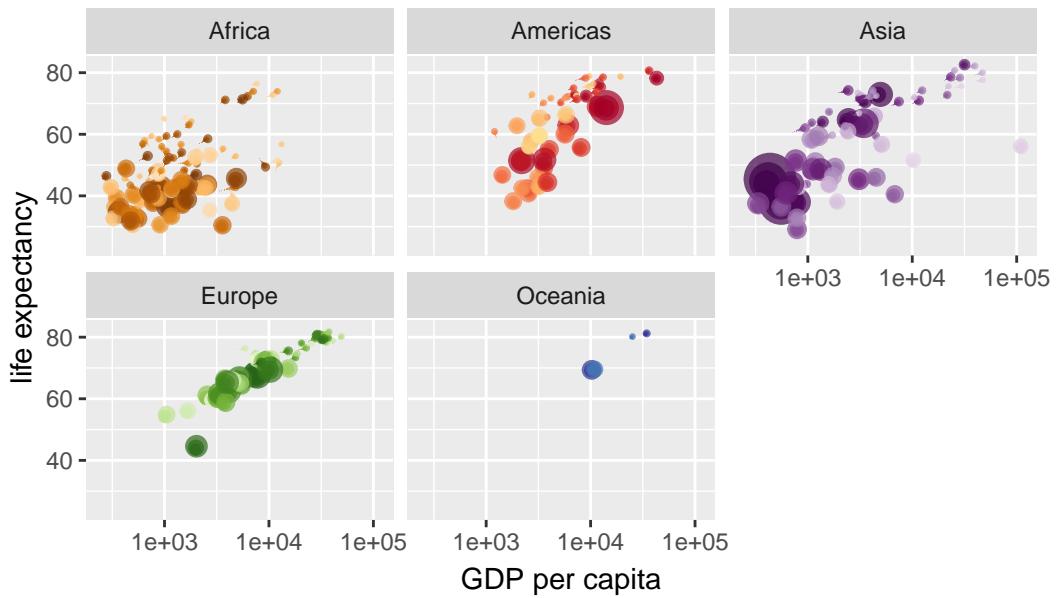
Year: 1952



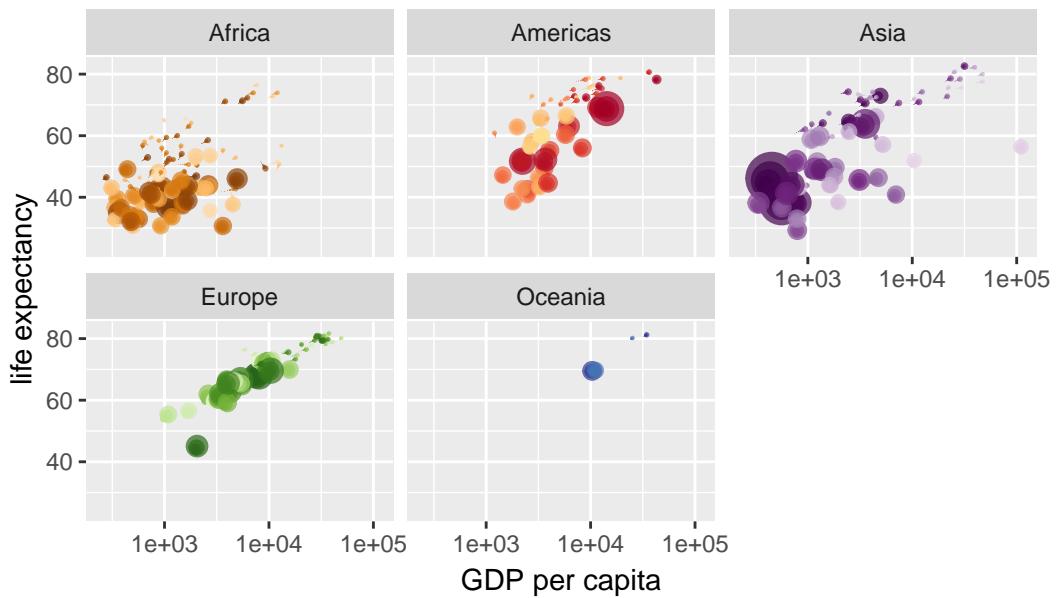
Year: 1953



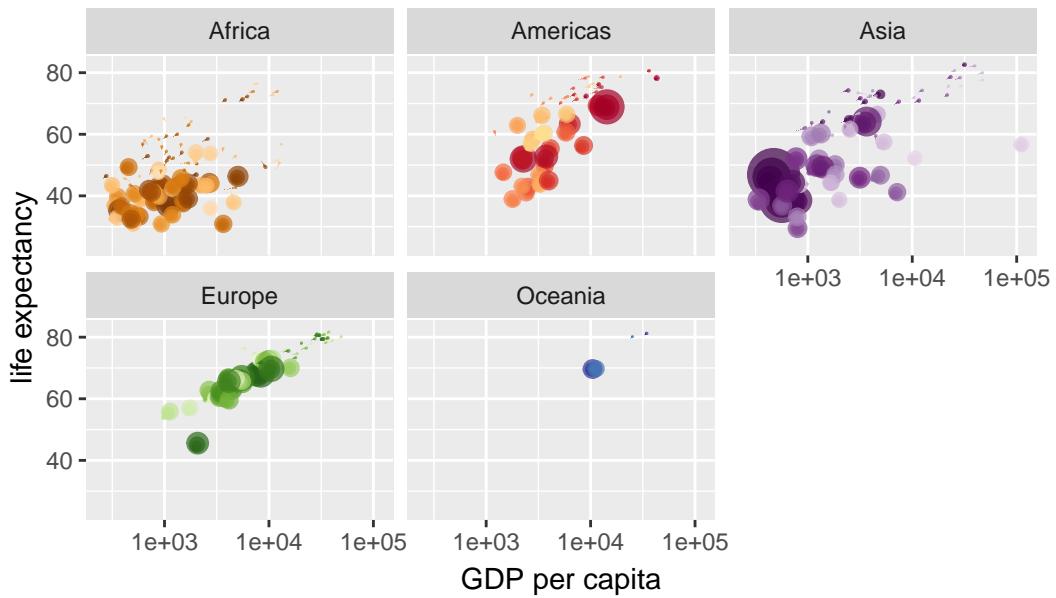
Year: 1953



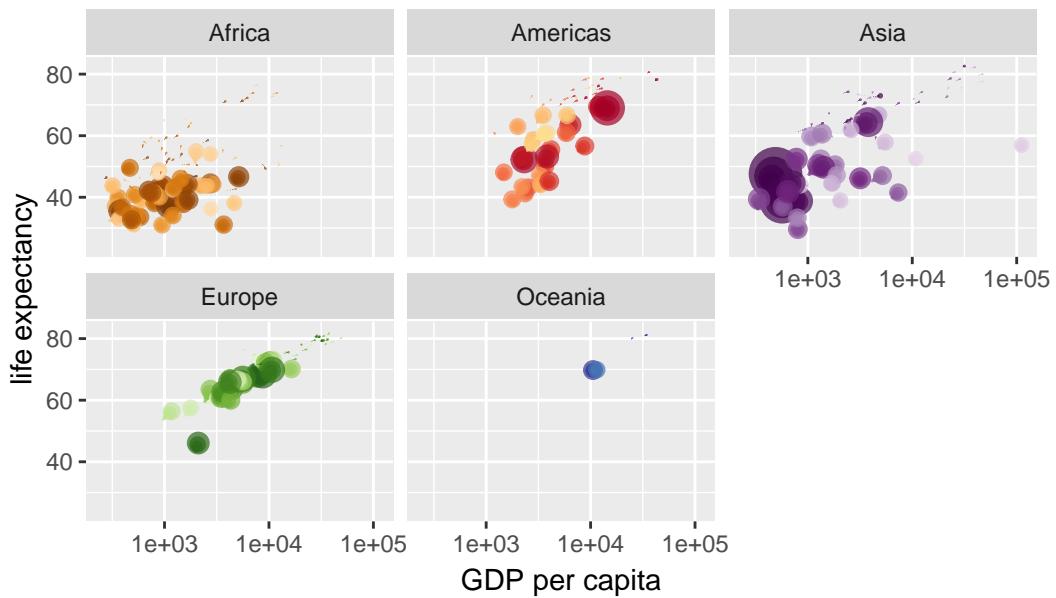
Year: 1954



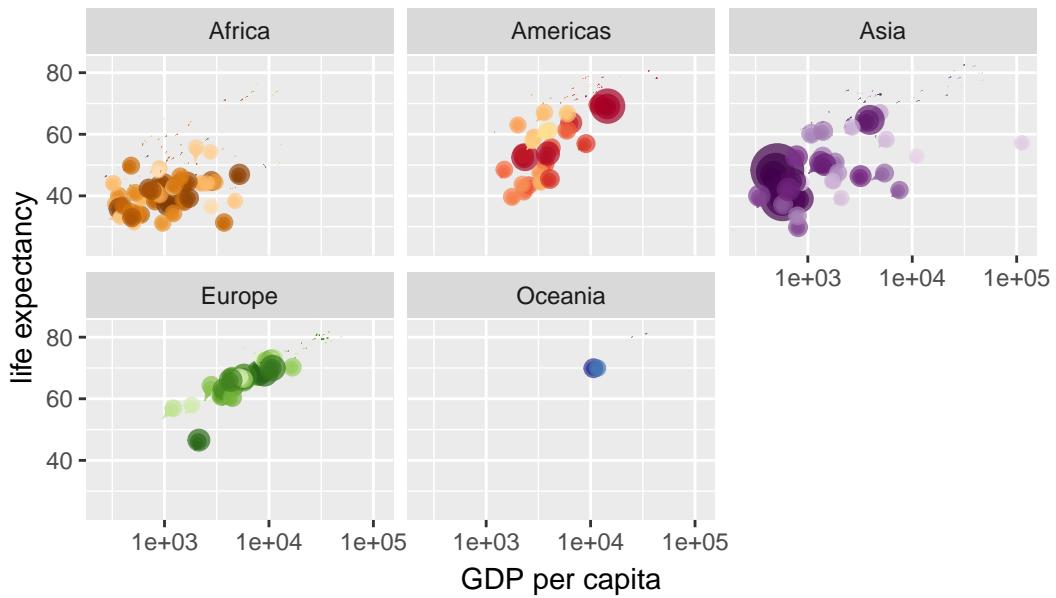
Year: 1954



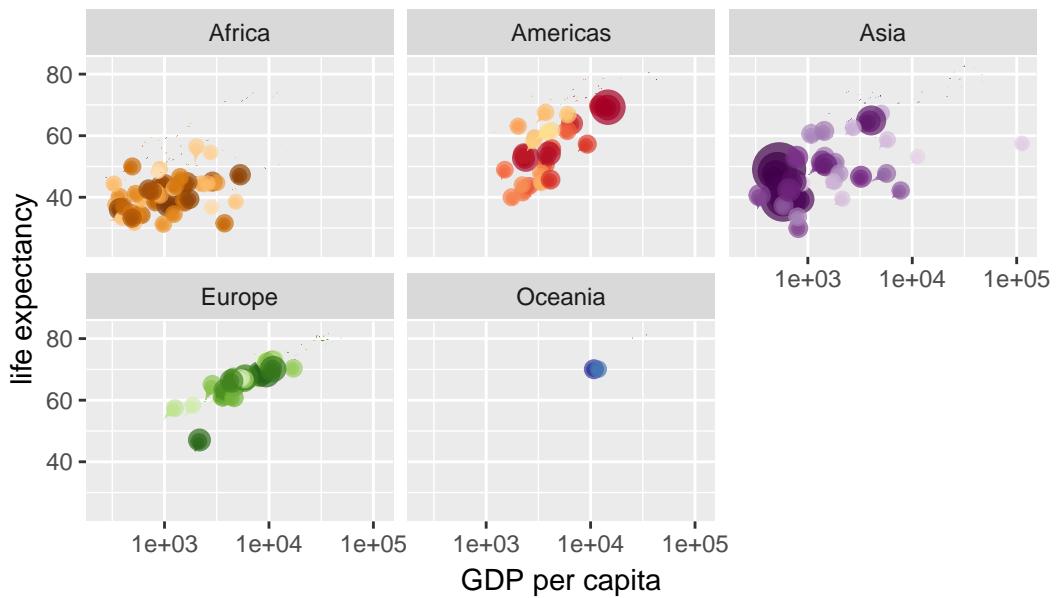
Year: 1955



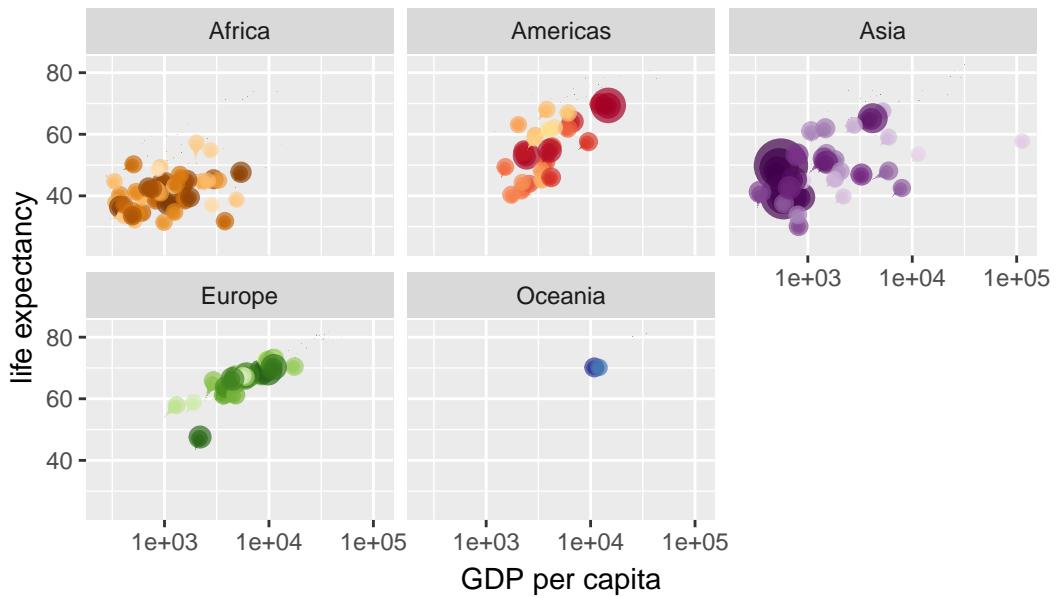
Year: 1955



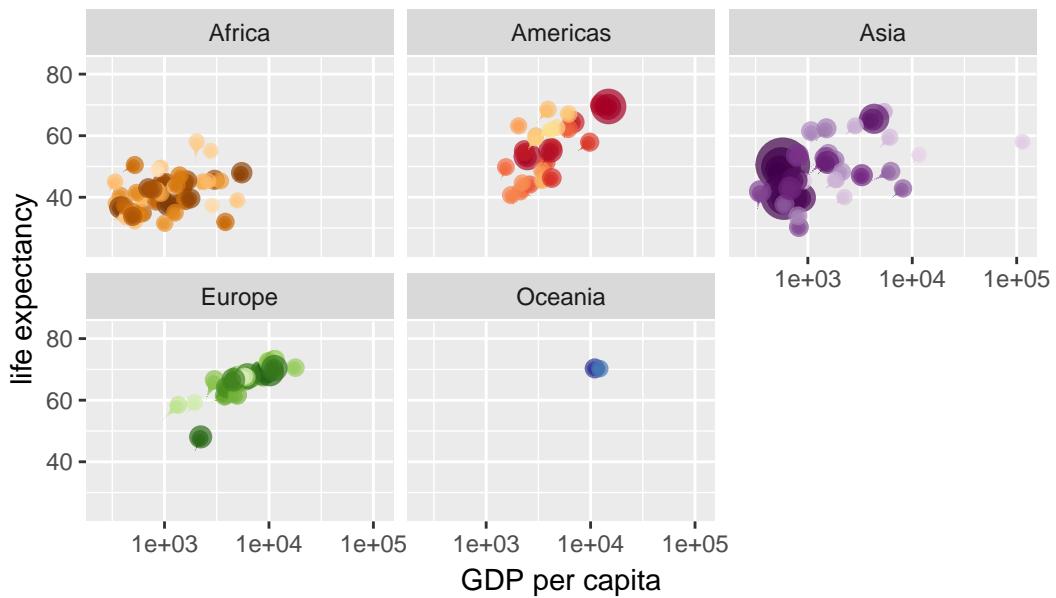
Year: 1956



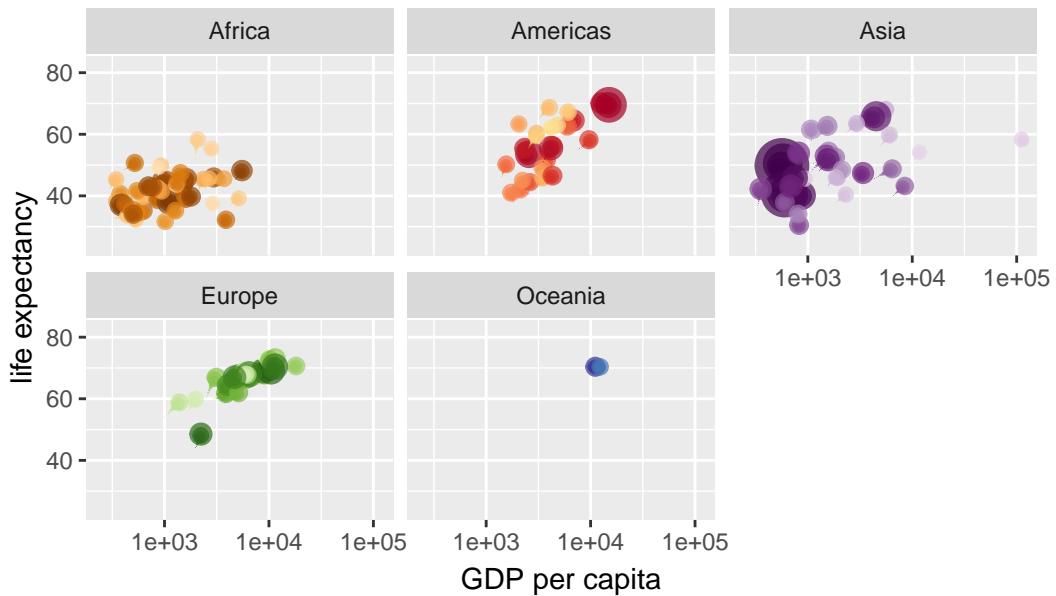
Year: 1956



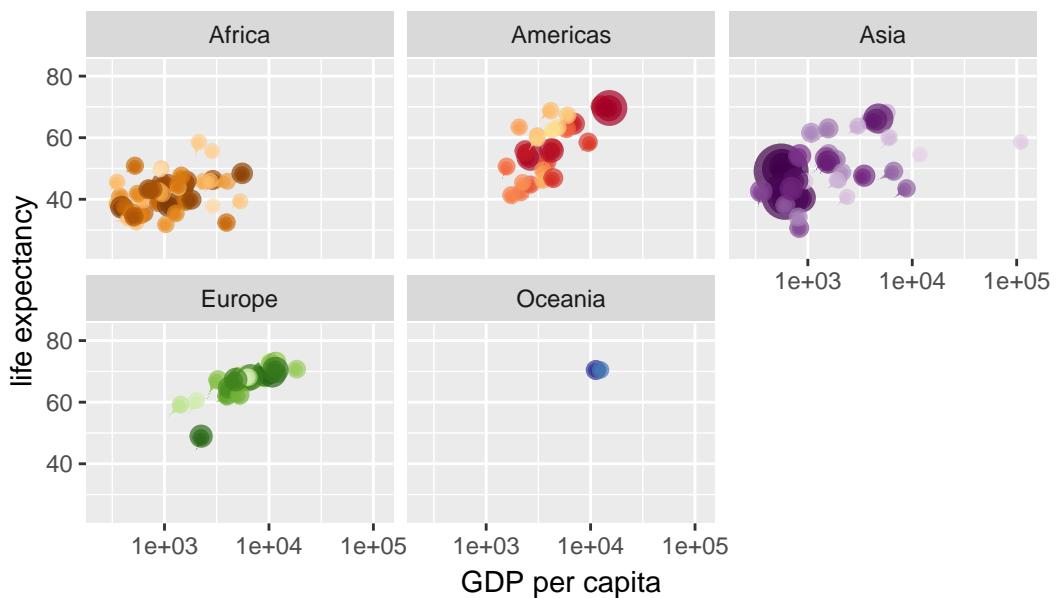
Year: 1957



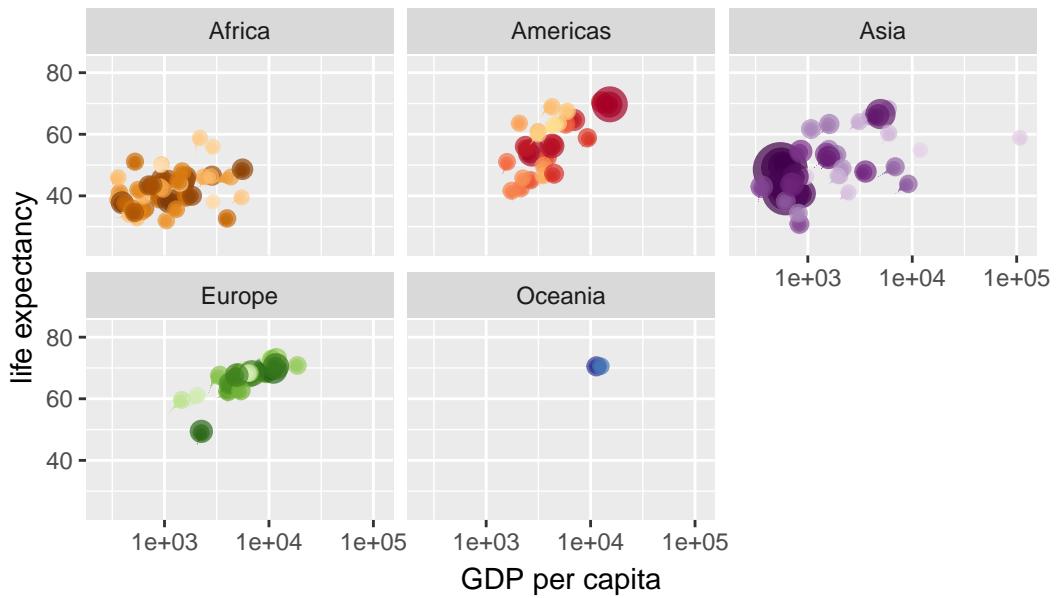
Year: 1958



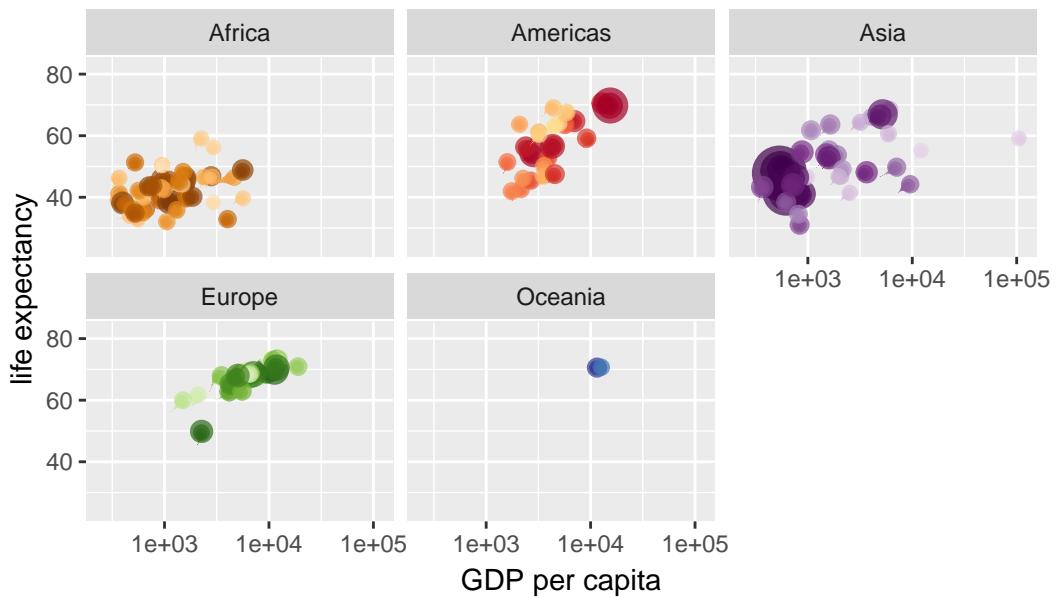
Year: 1958



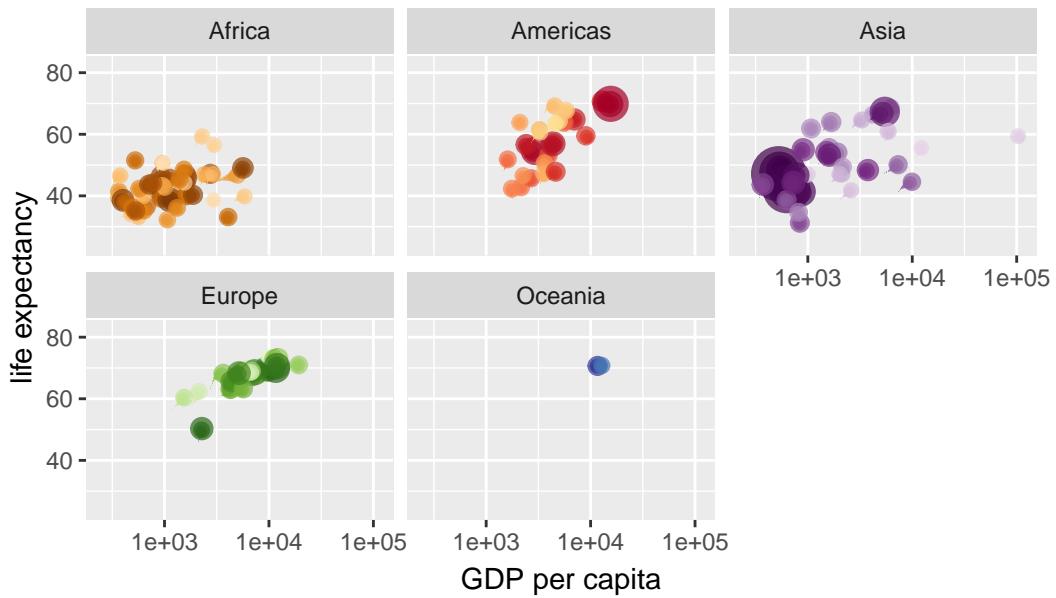
Year: 1959



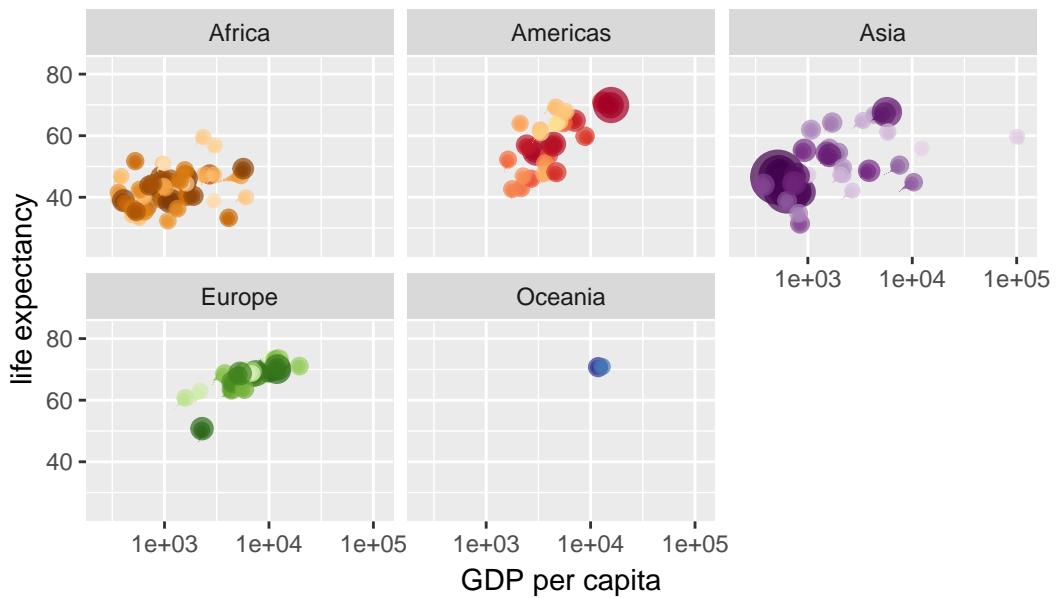
Year: 1959



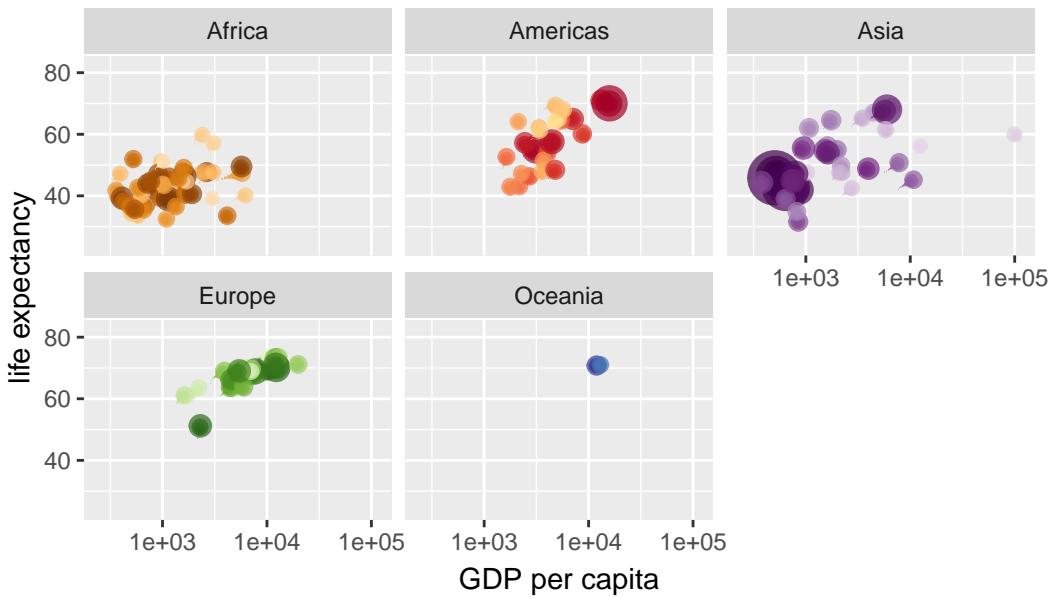
Year: 1960



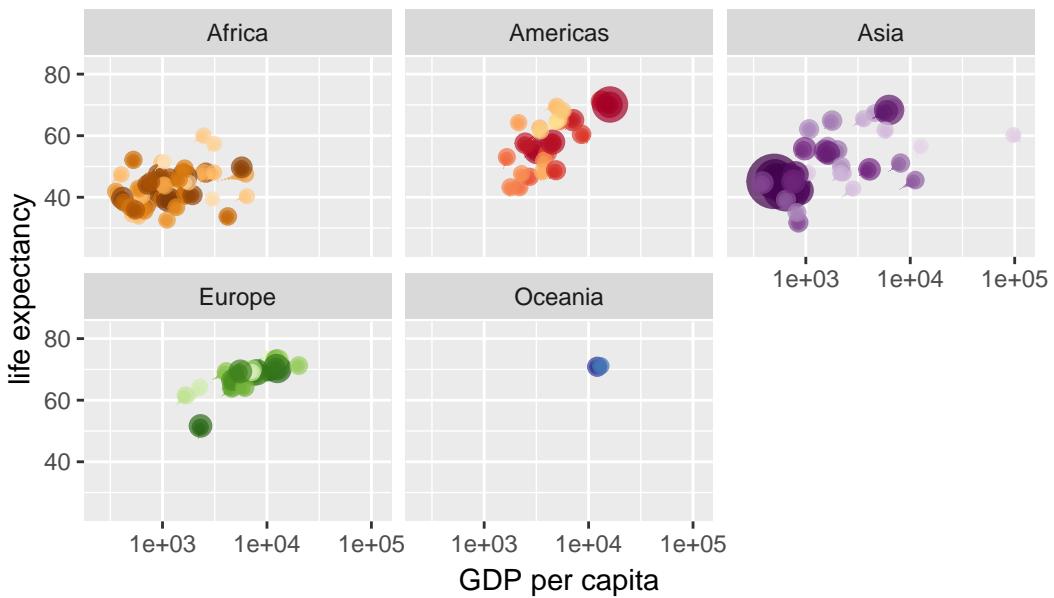
Year: 1960



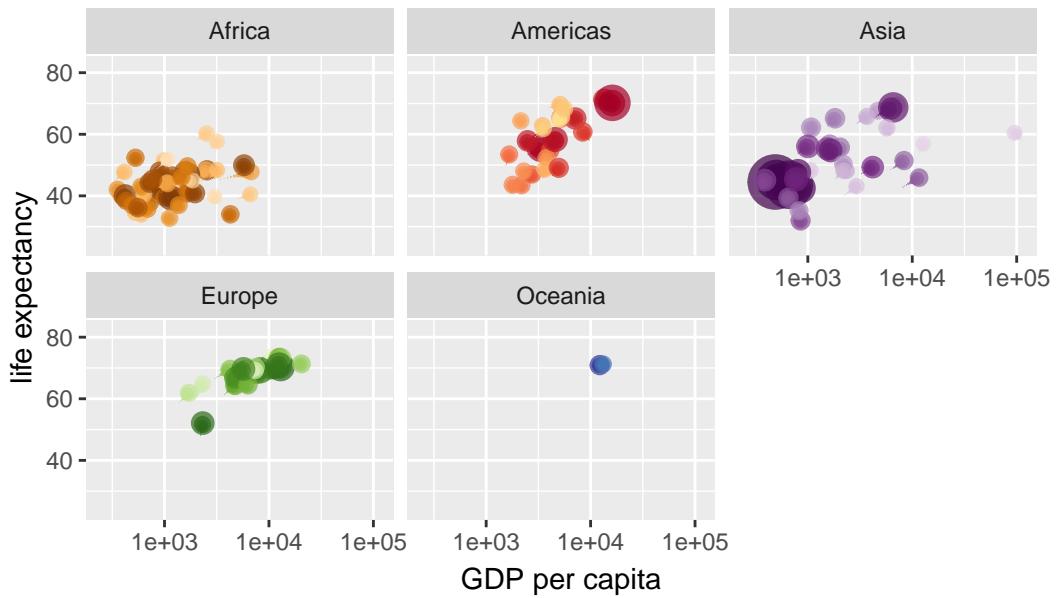
Year: 1961



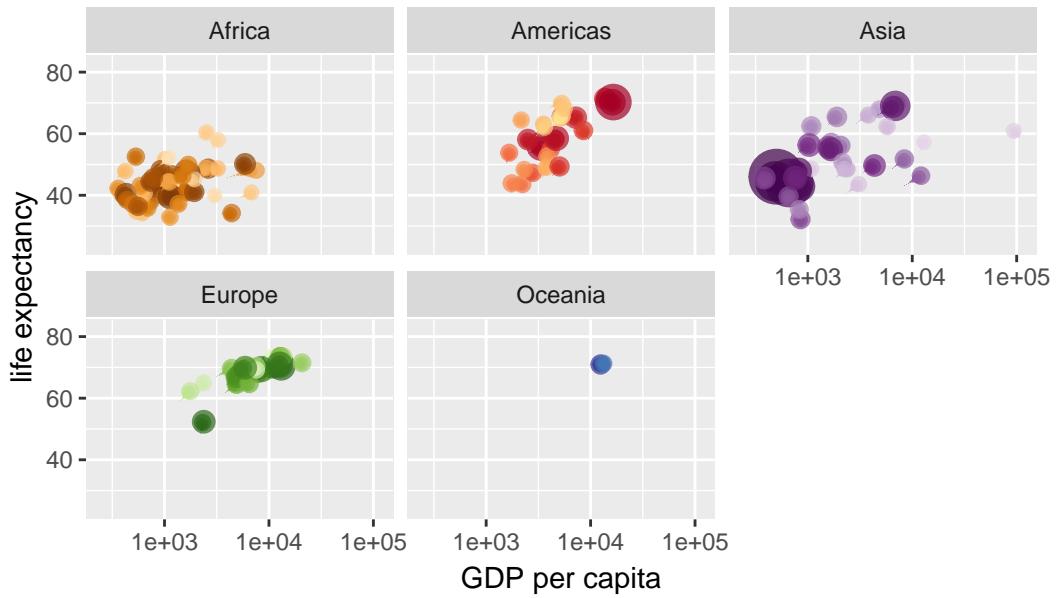
Year: 1961



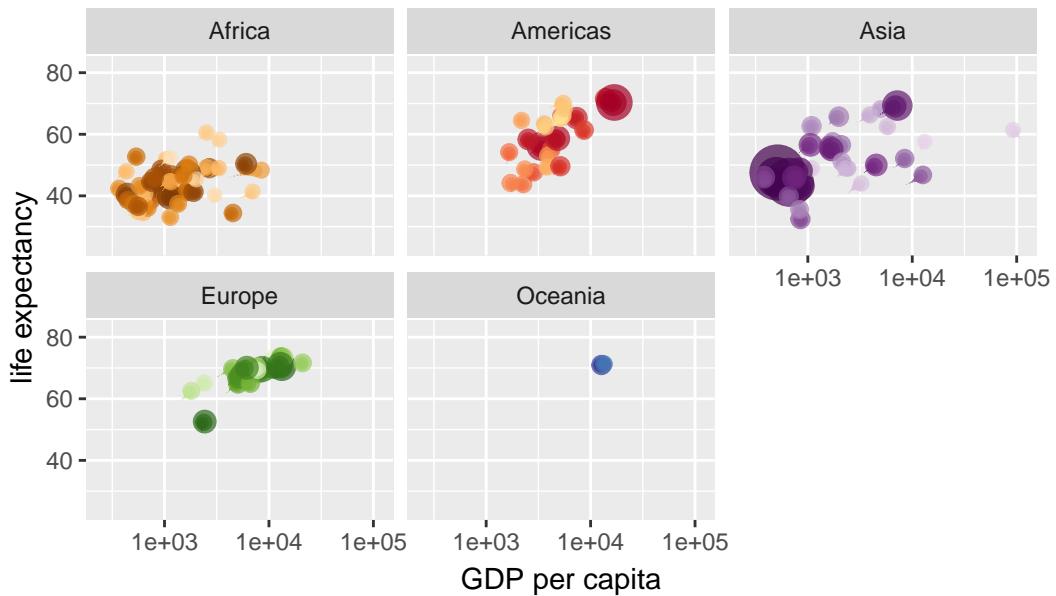
Year: 1962



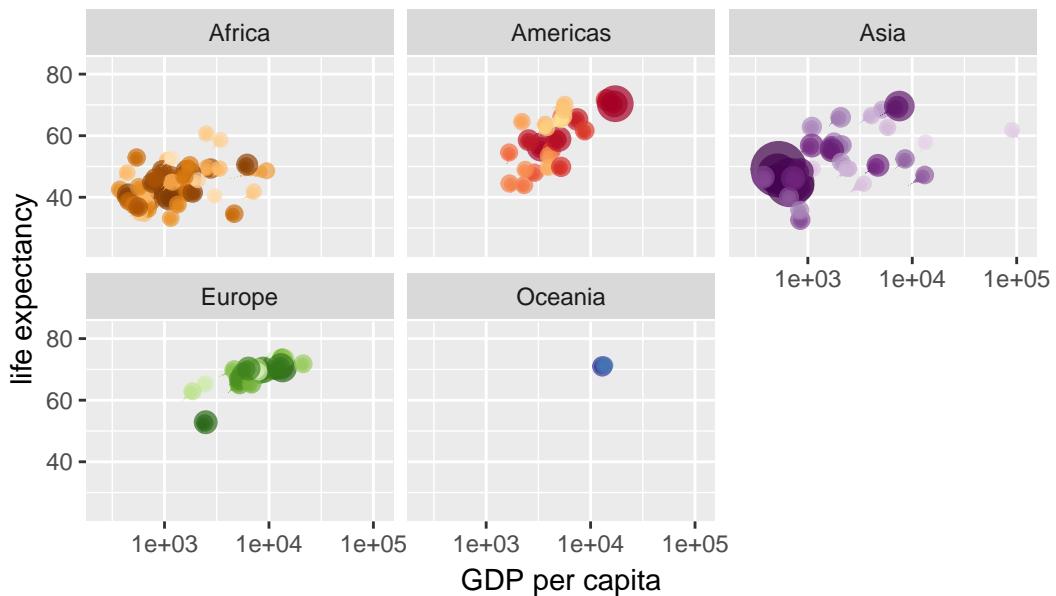
Year: 1963



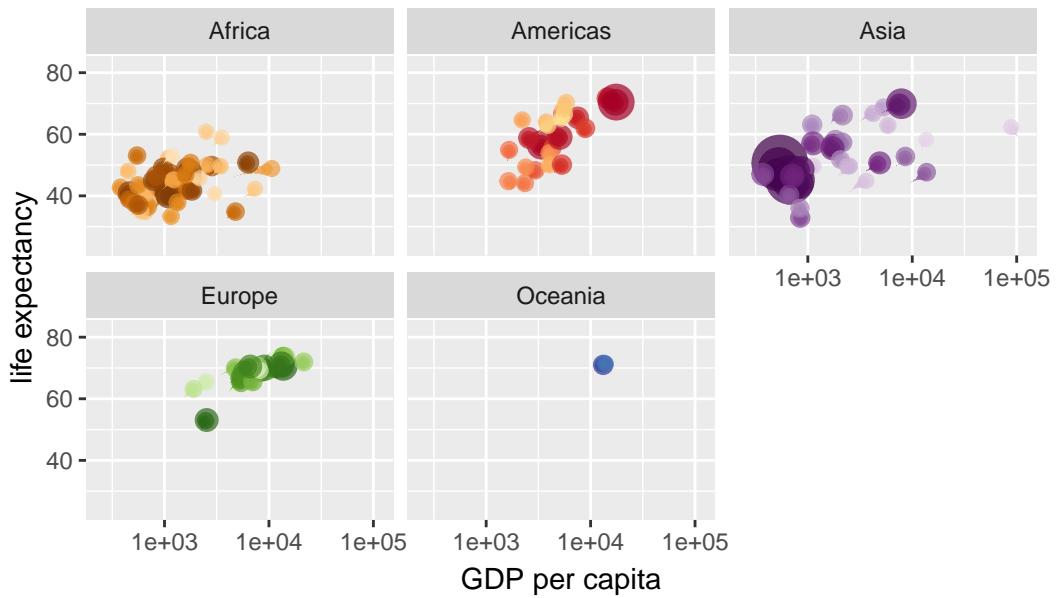
Year: 1963



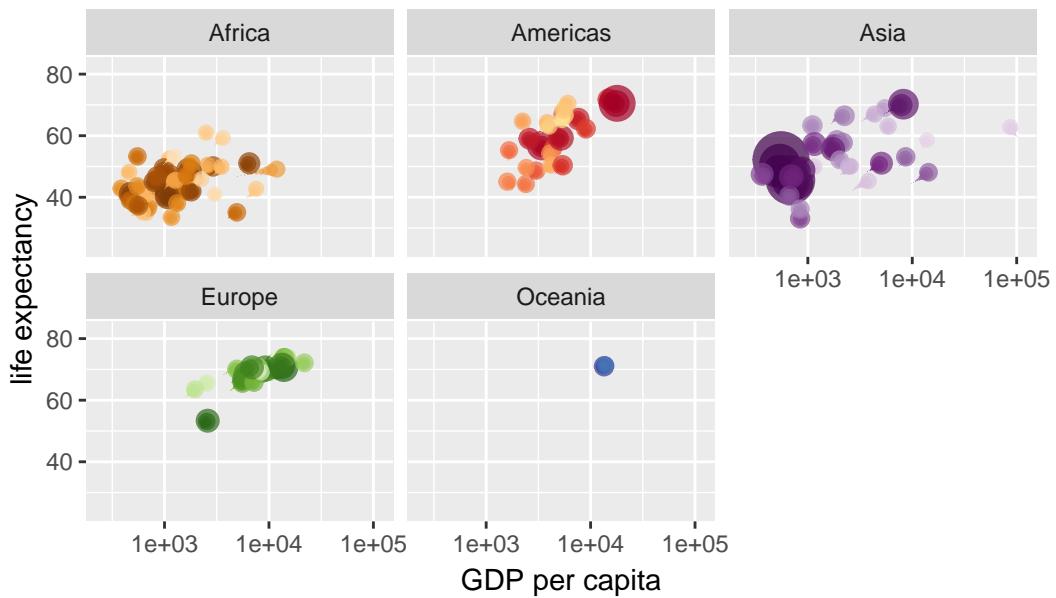
Year: 1964



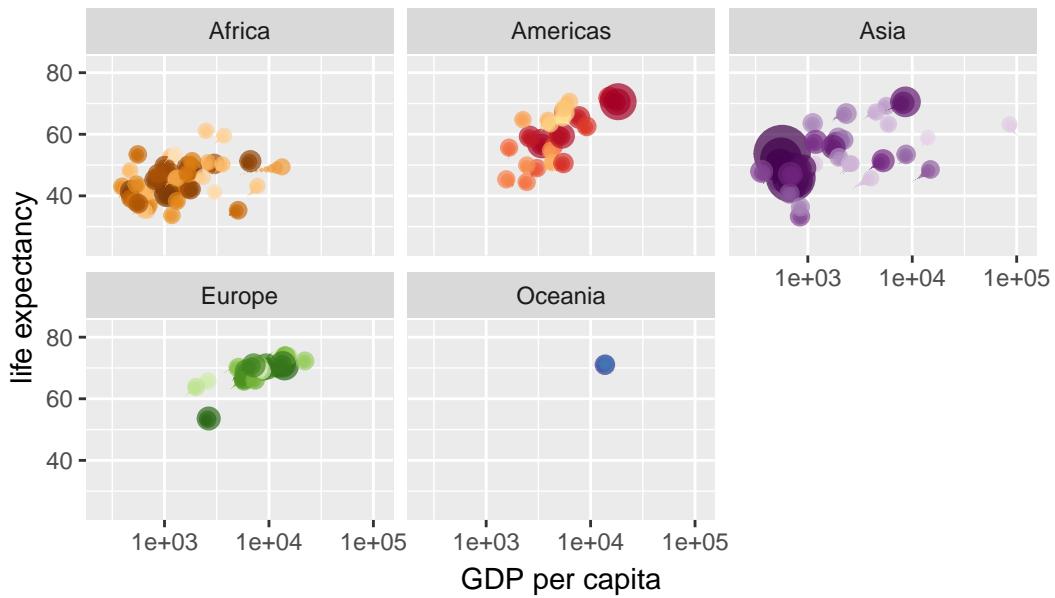
Year: 1964



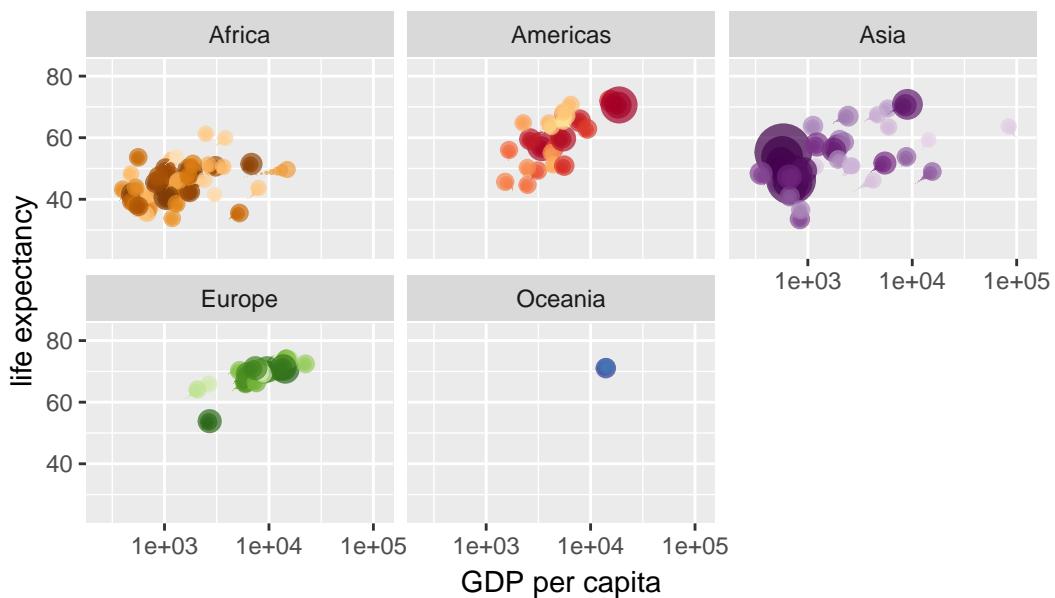
Year: 1965



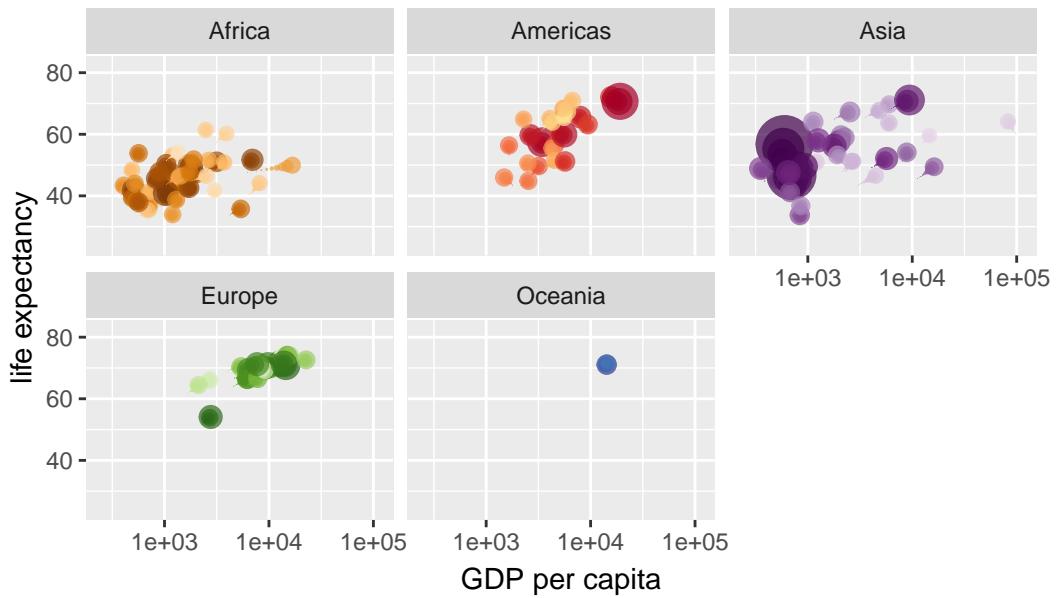
Year: 1965



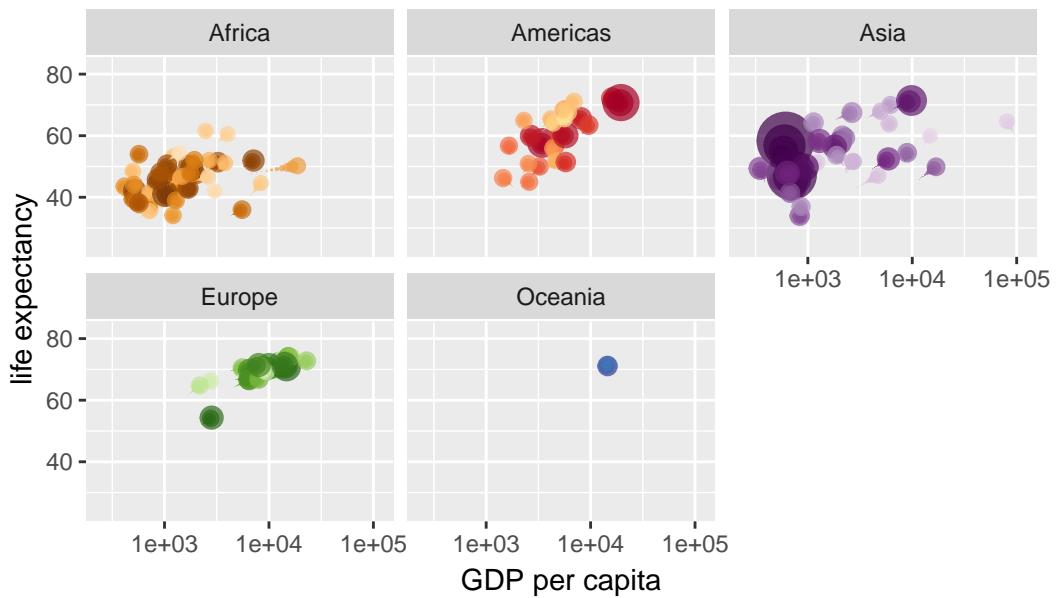
Year: 1966



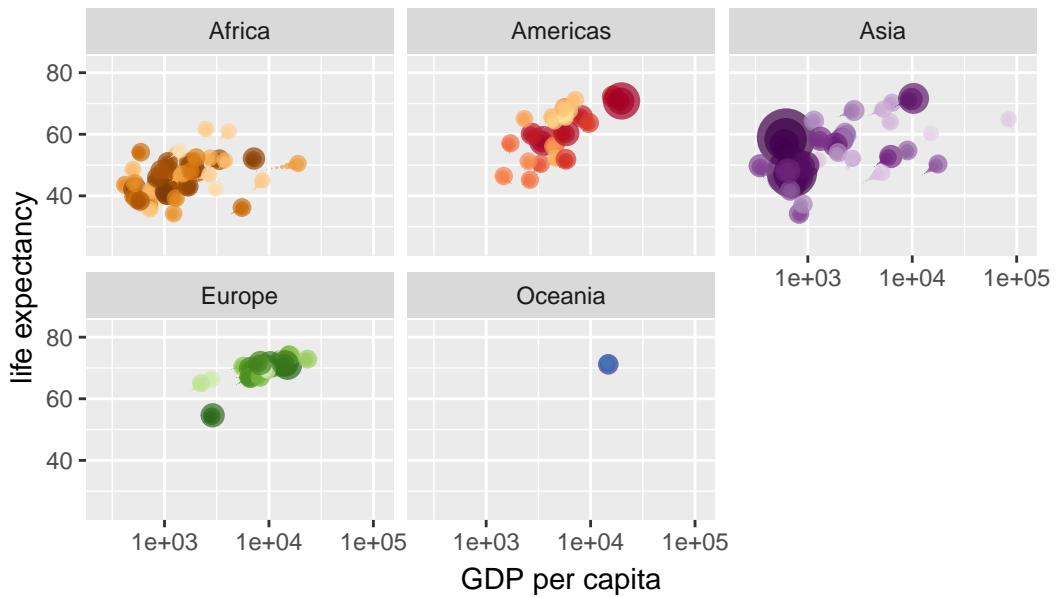
Year: 1966



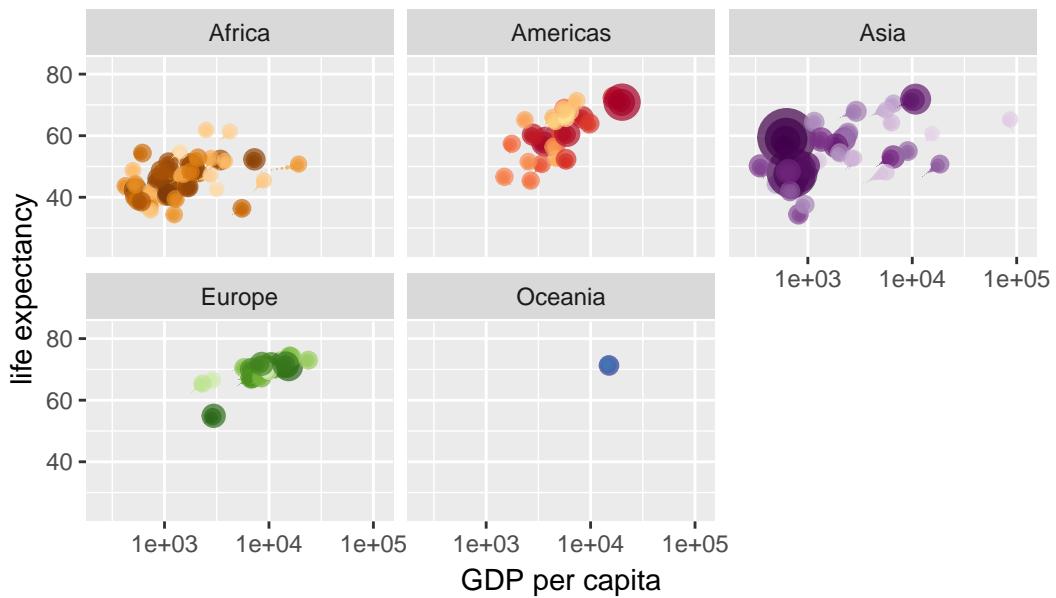
Year: 1967



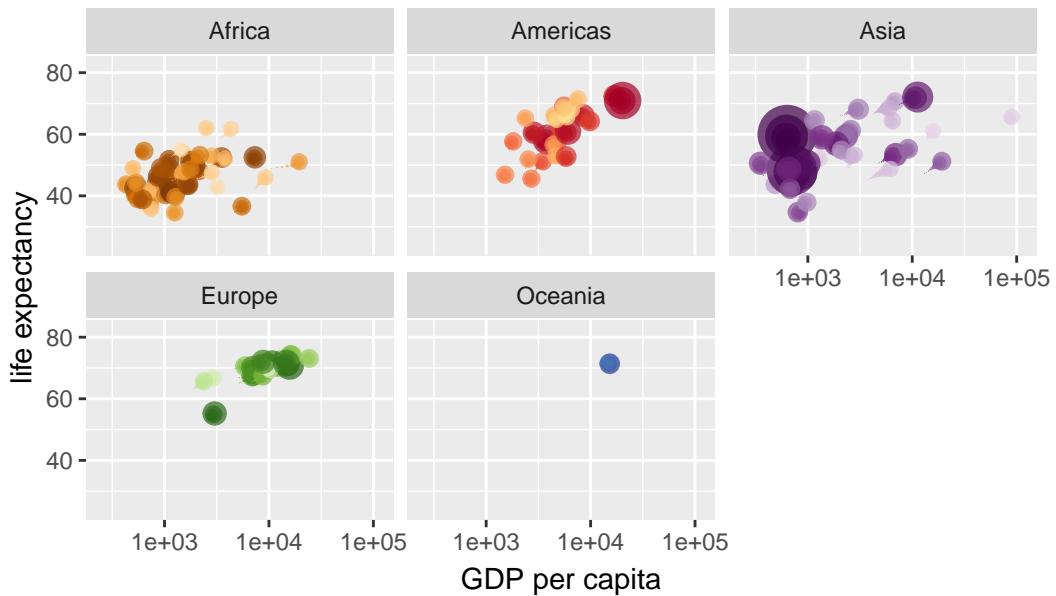
Year: 1968



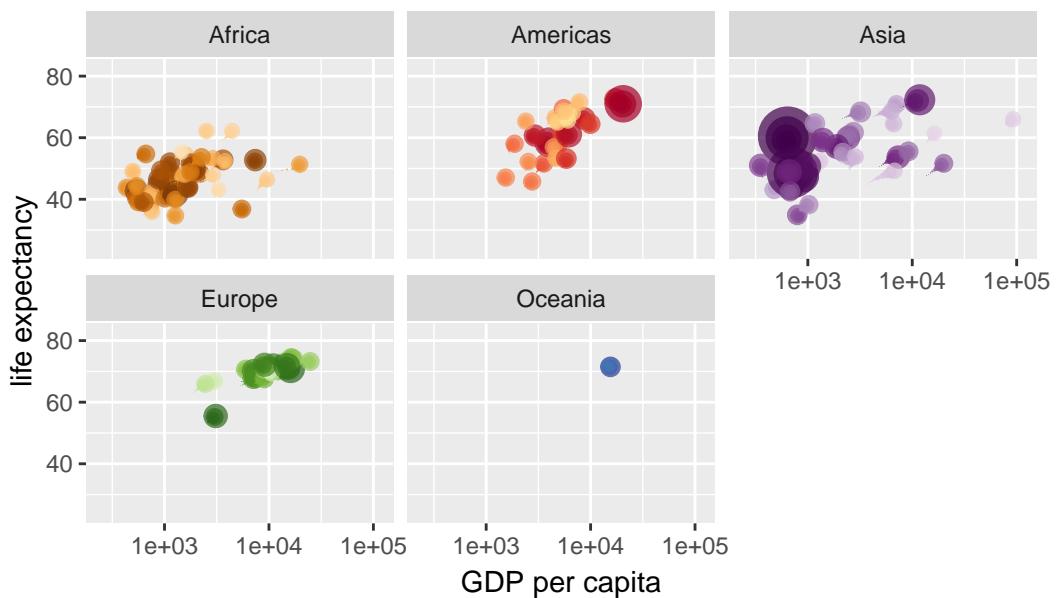
Year: 1968



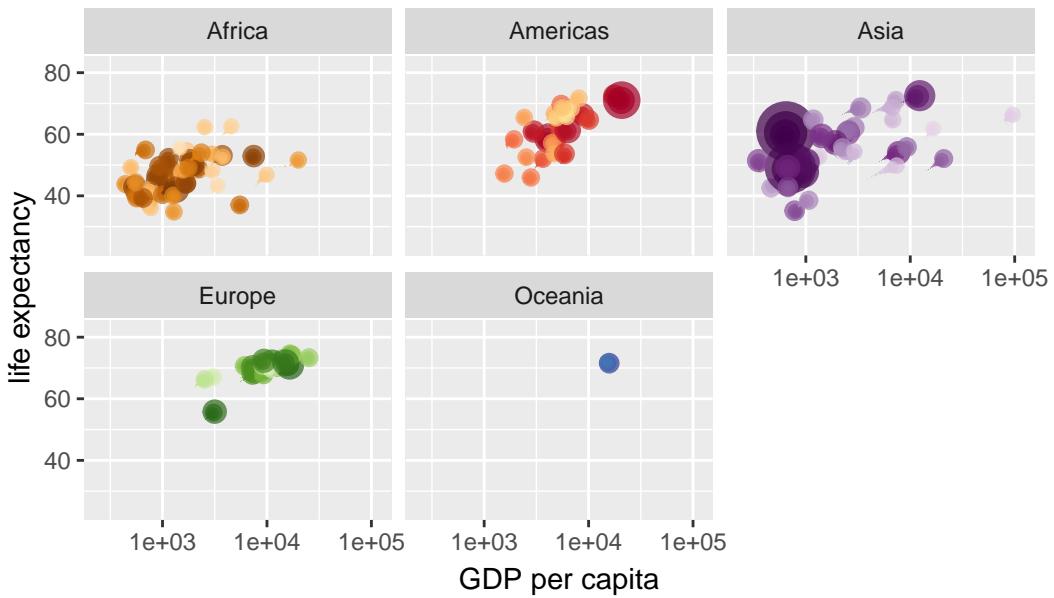
Year: 1969



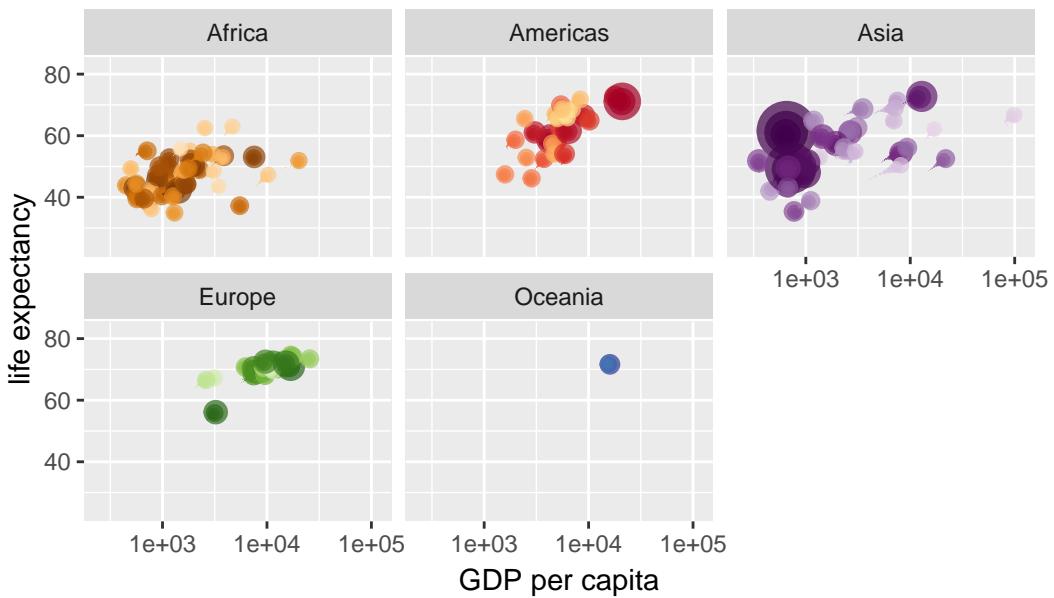
Year: 1969



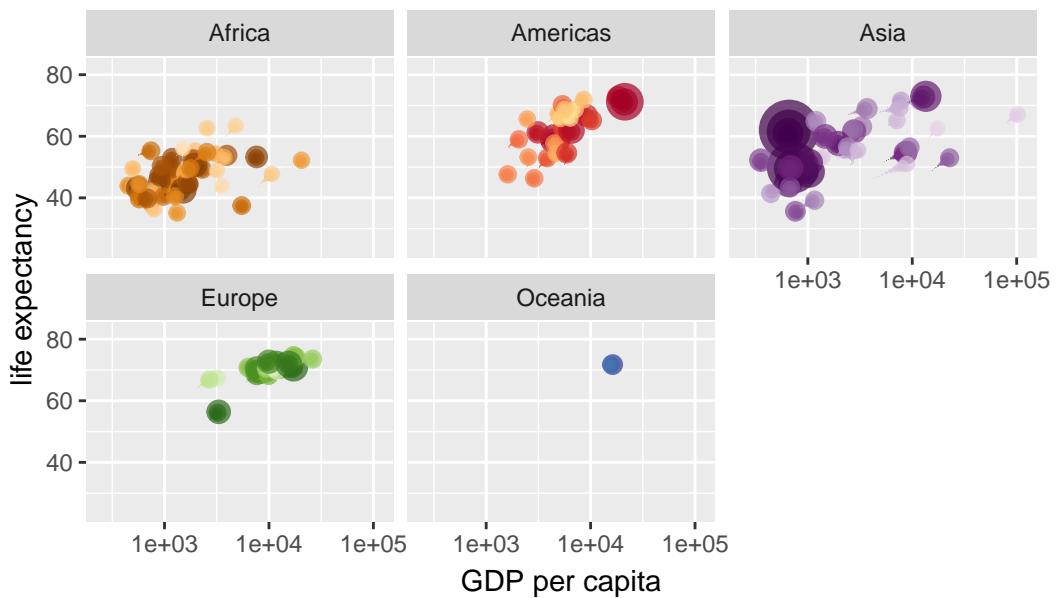
Year: 1970



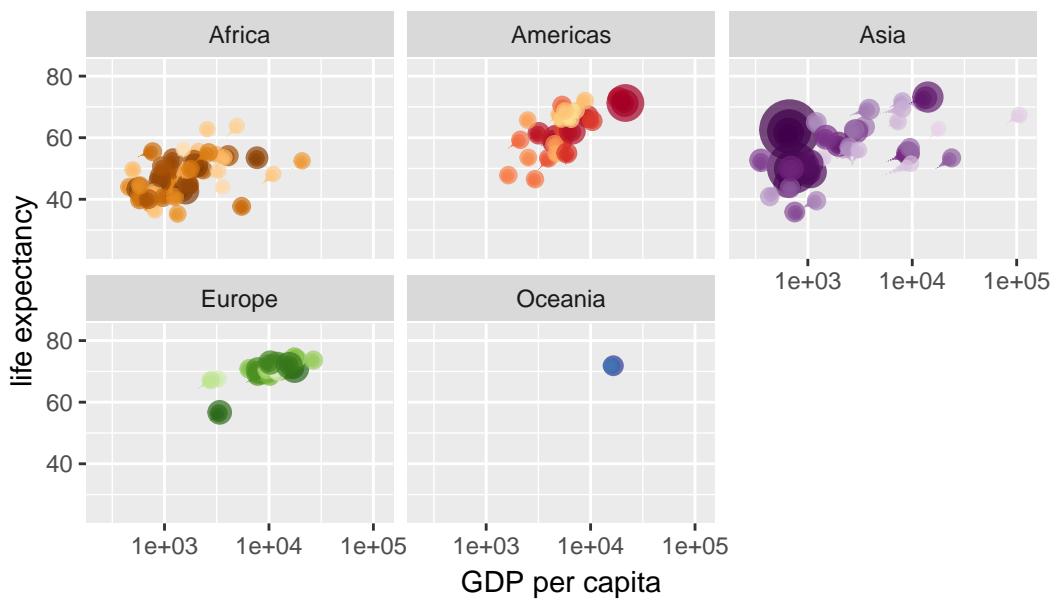
Year: 1970



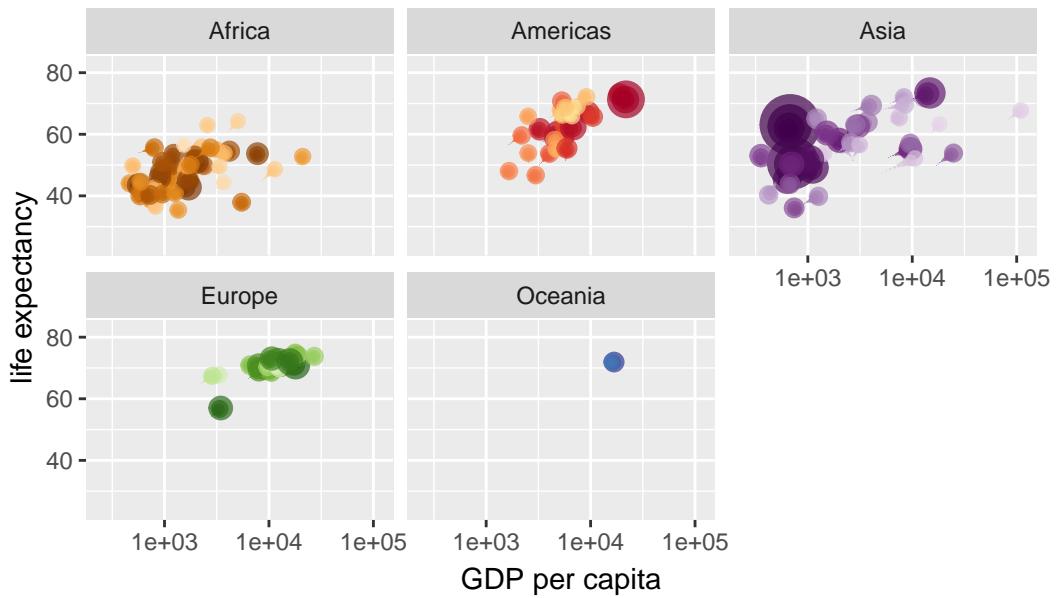
Year: 1971



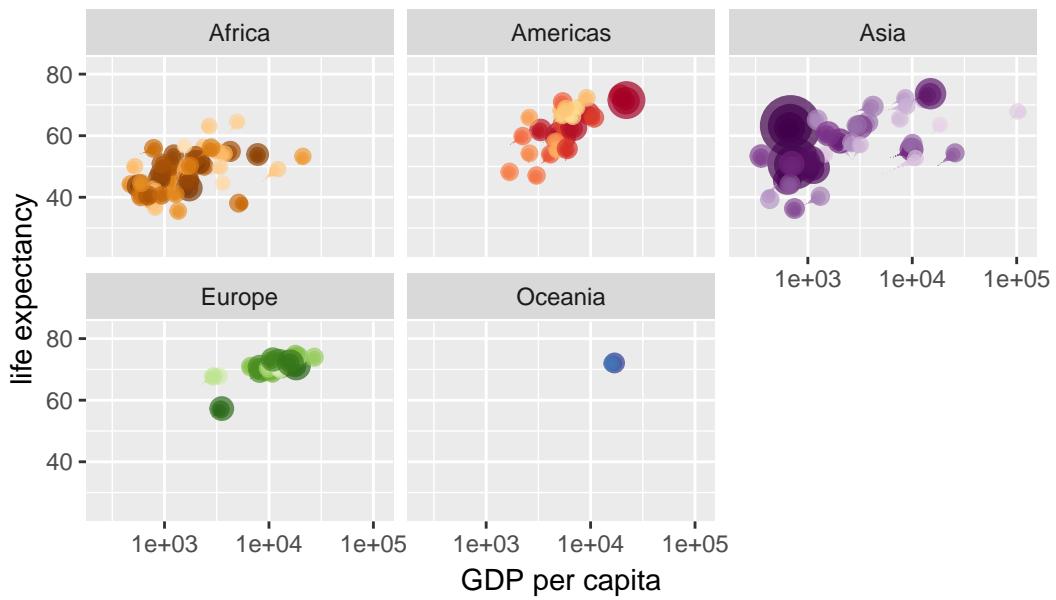
Year: 1971



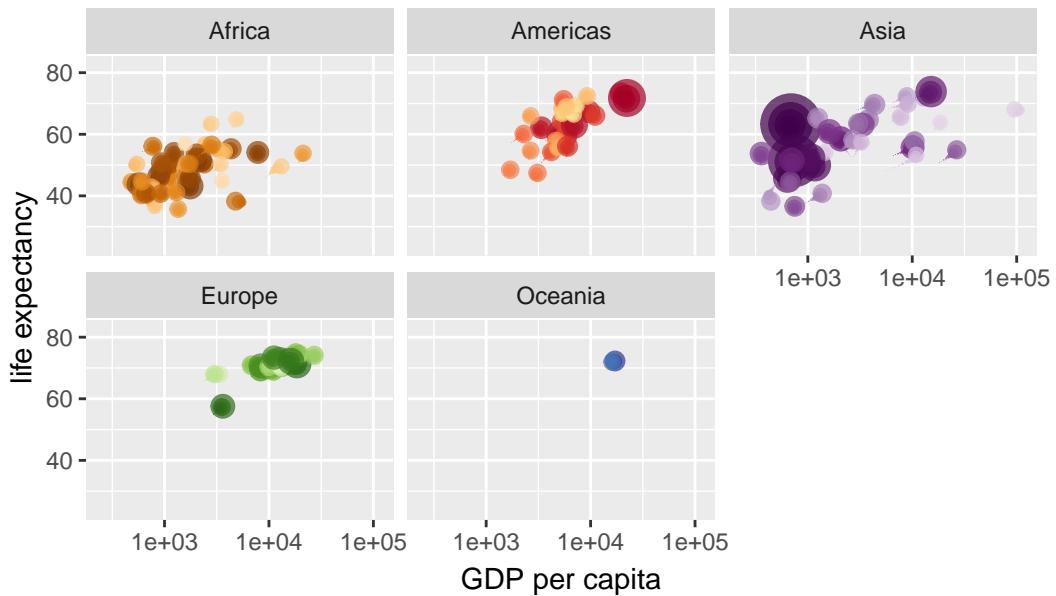
Year: 1972



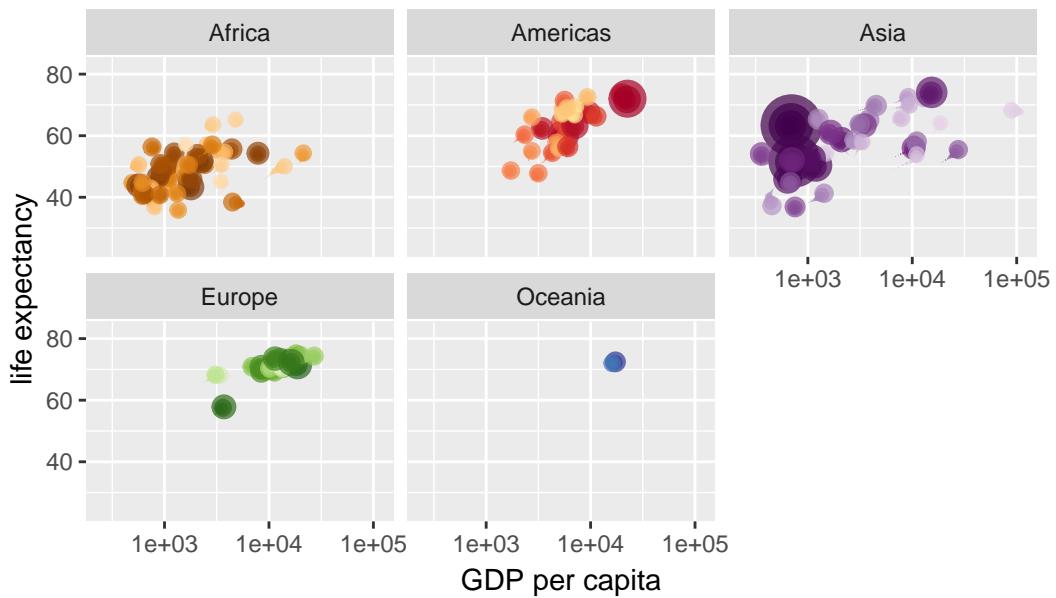
Year: 1973



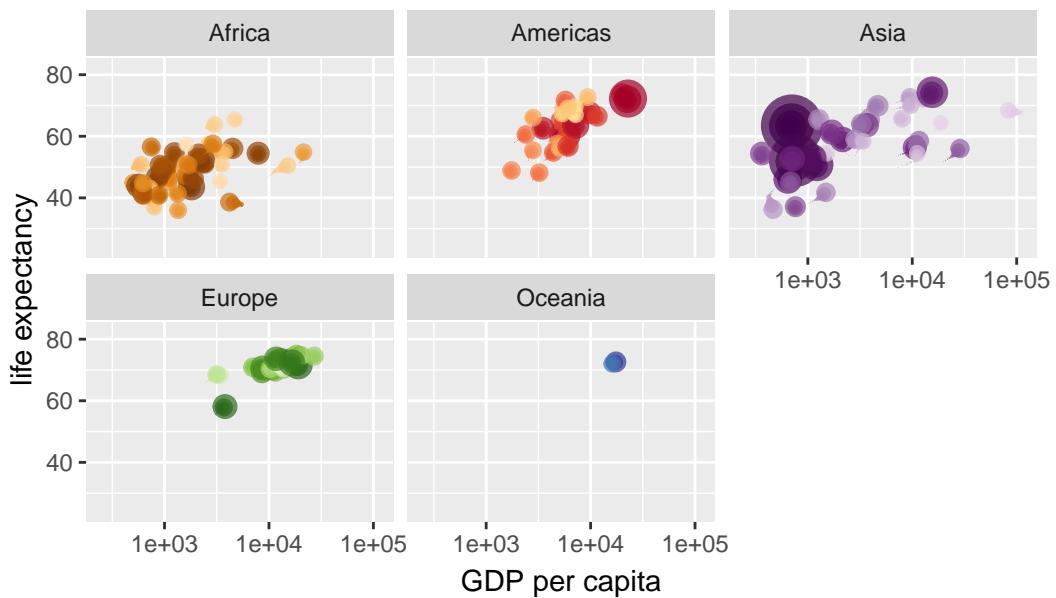
Year: 1973



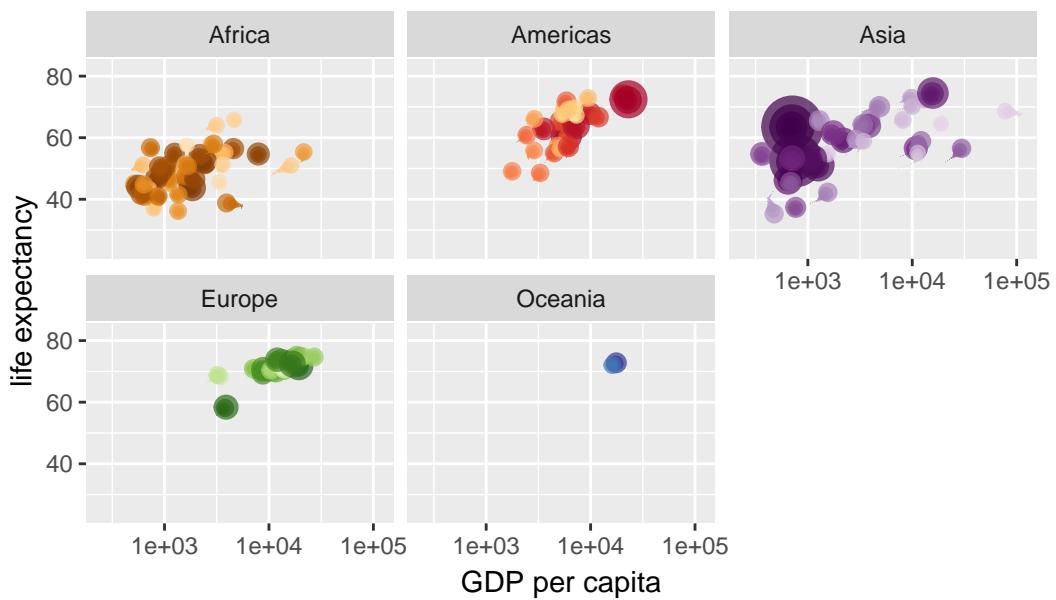
Year: 1974



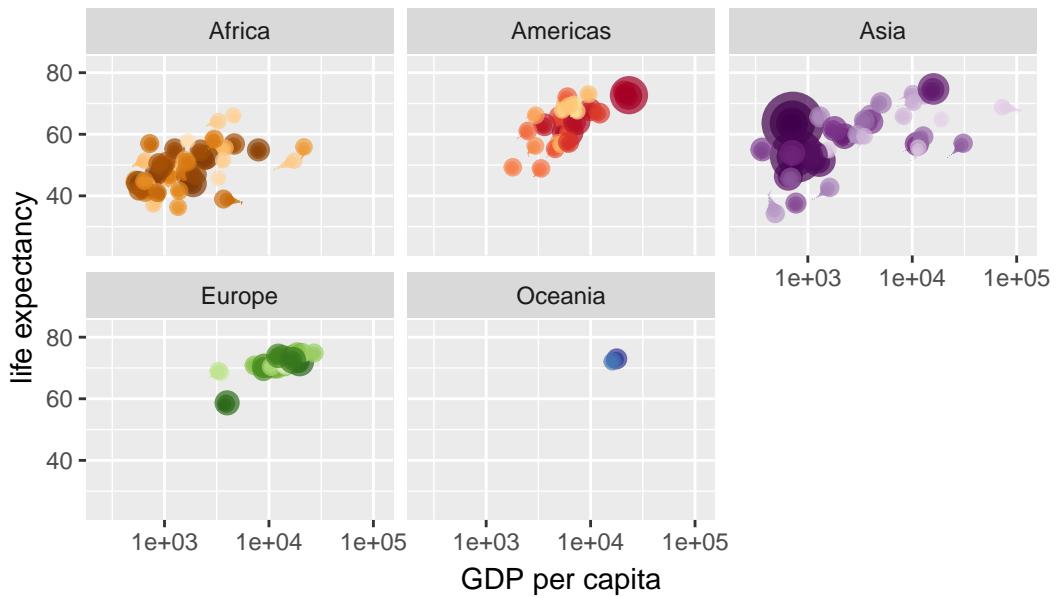
Year: 1974



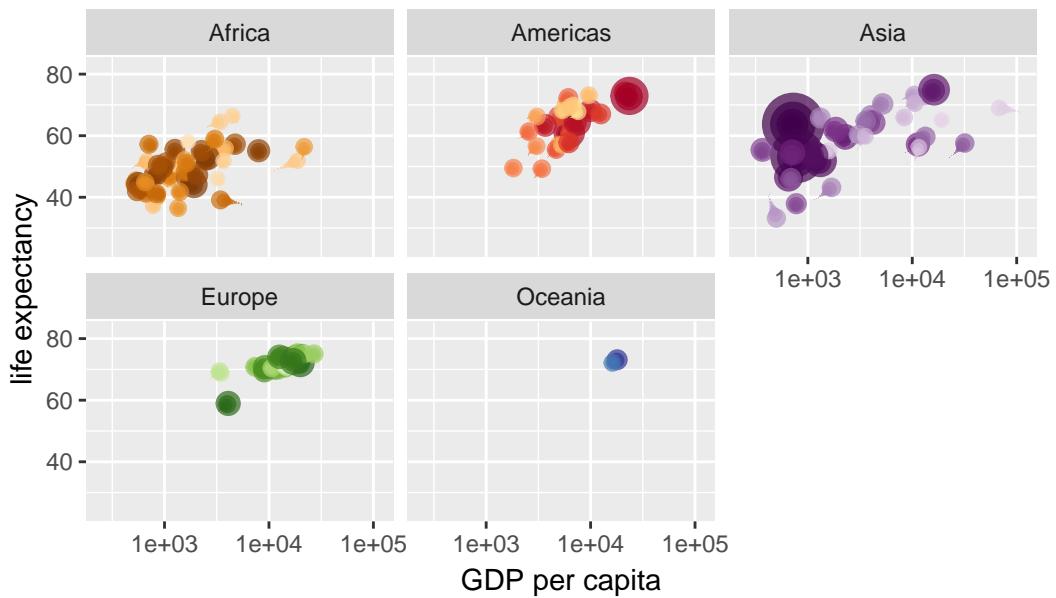
Year: 1975



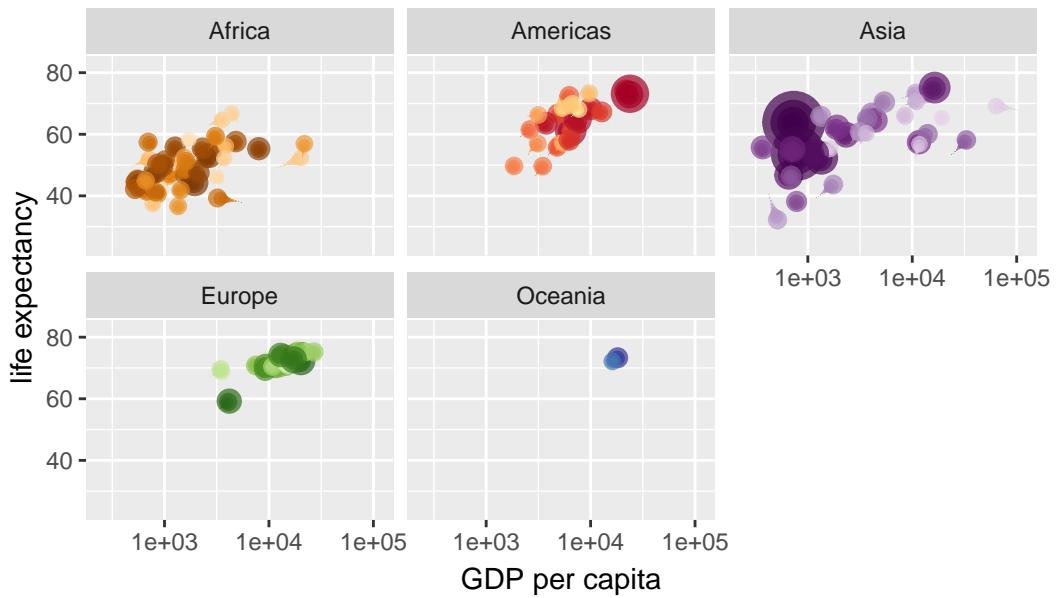
Year: 1975



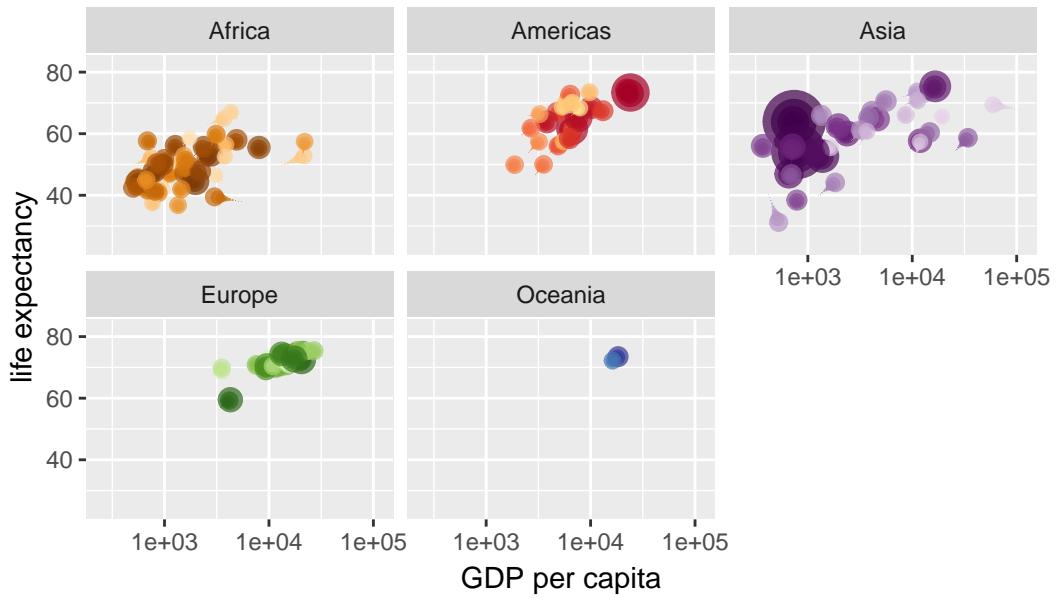
Year: 1976



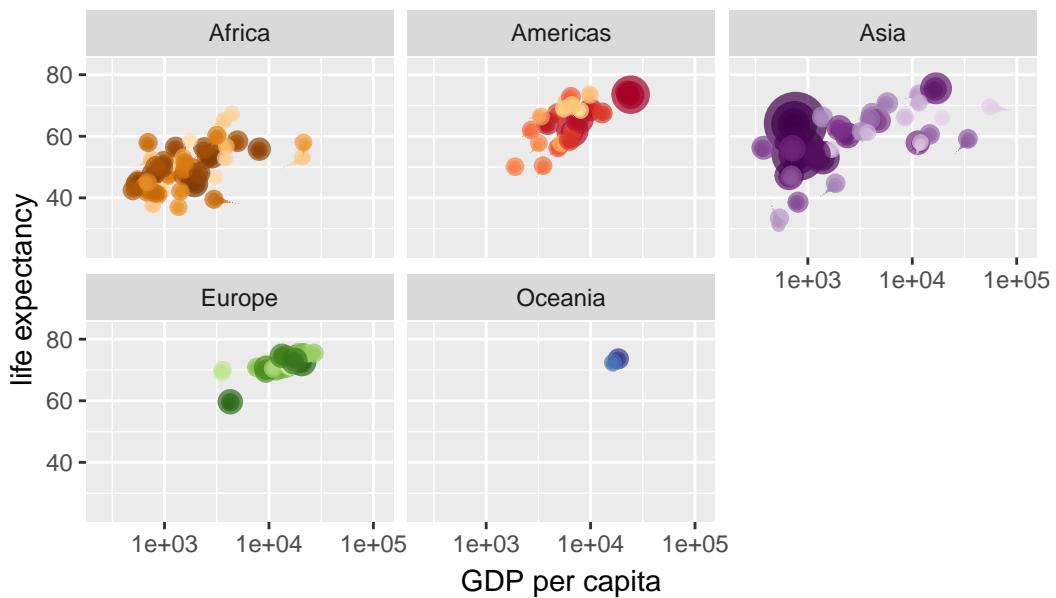
Year: 1976



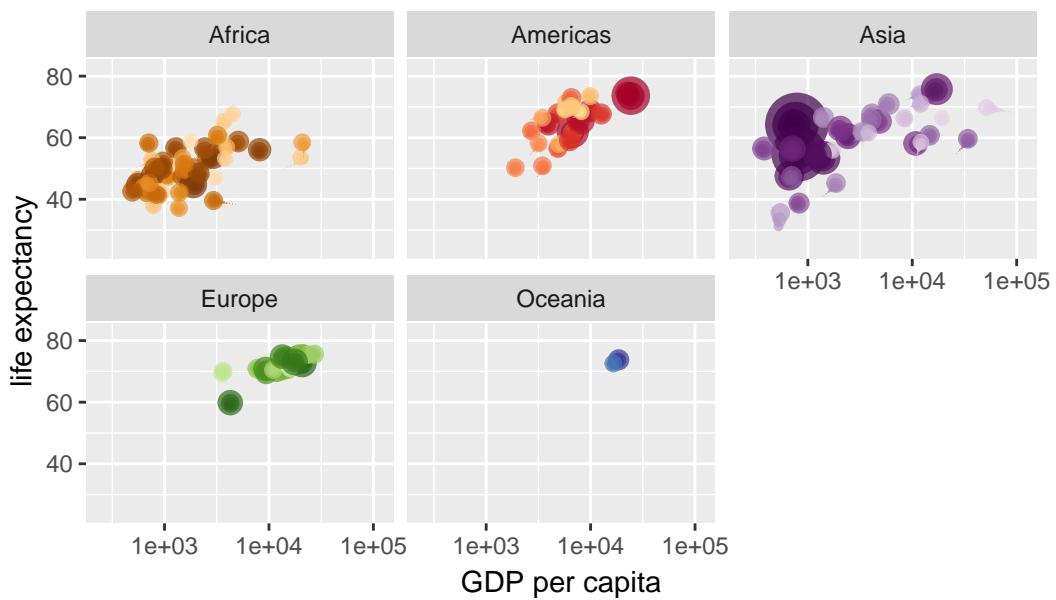
Year: 1977



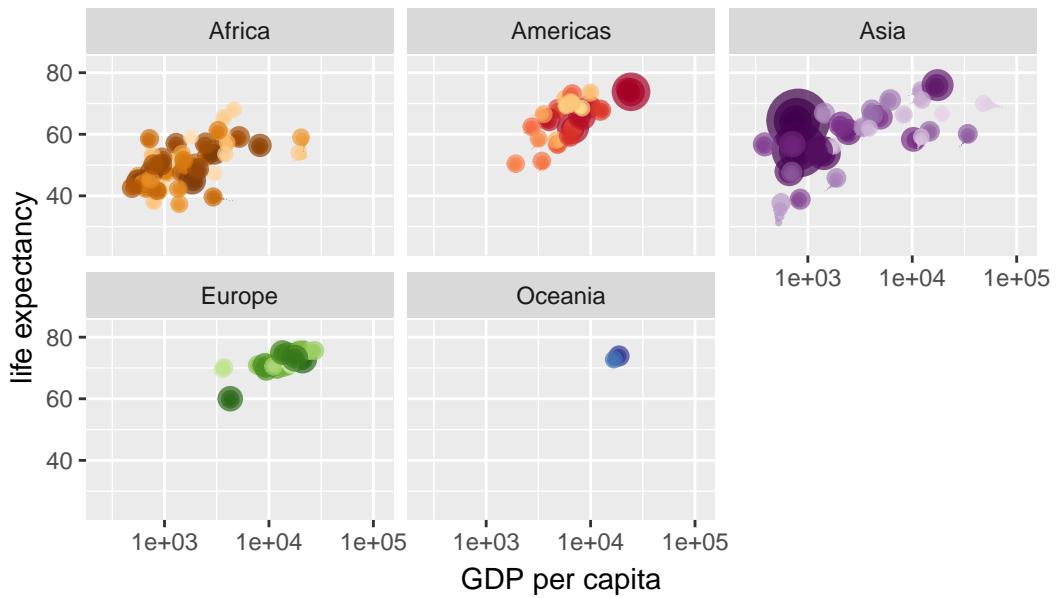
Year: 1978



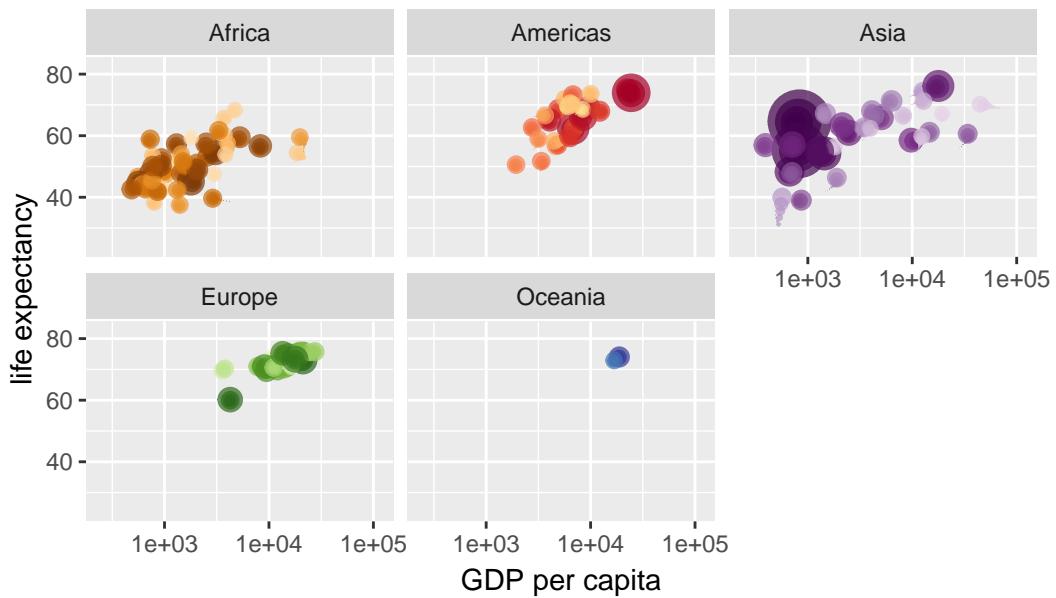
Year: 1978



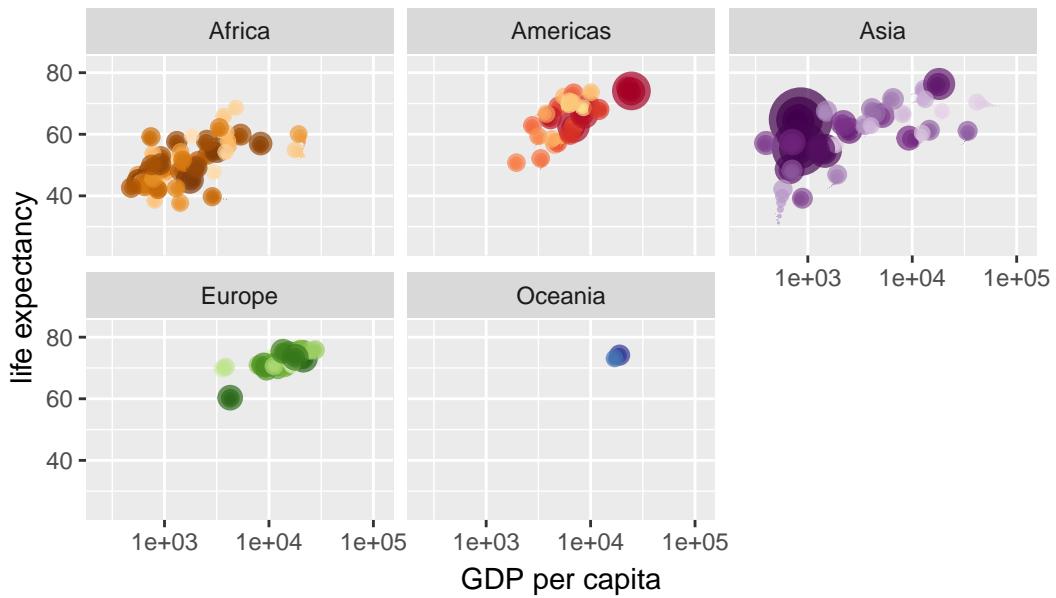
Year: 1979



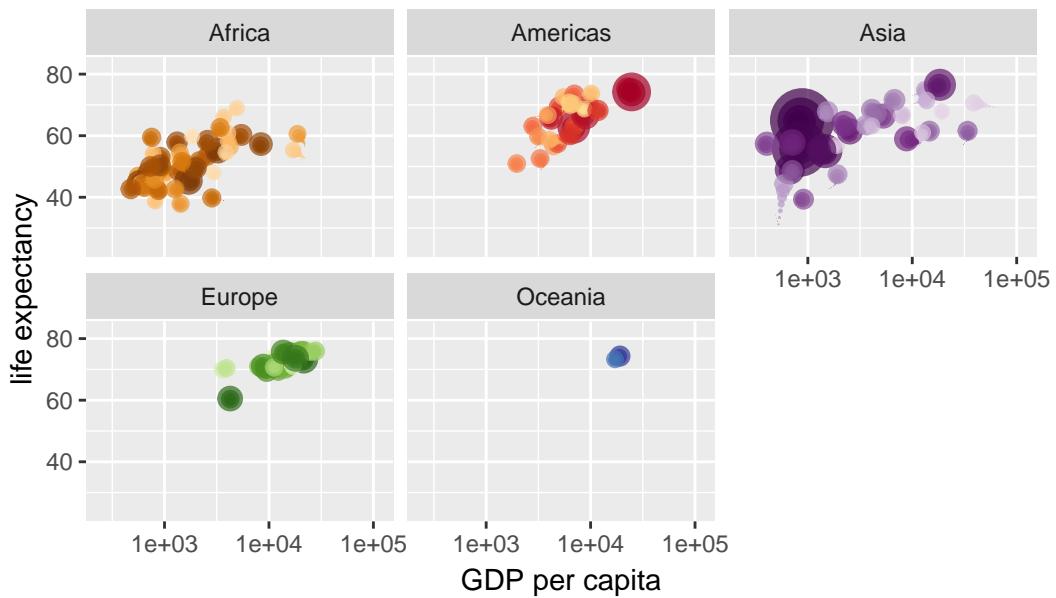
Year: 1979



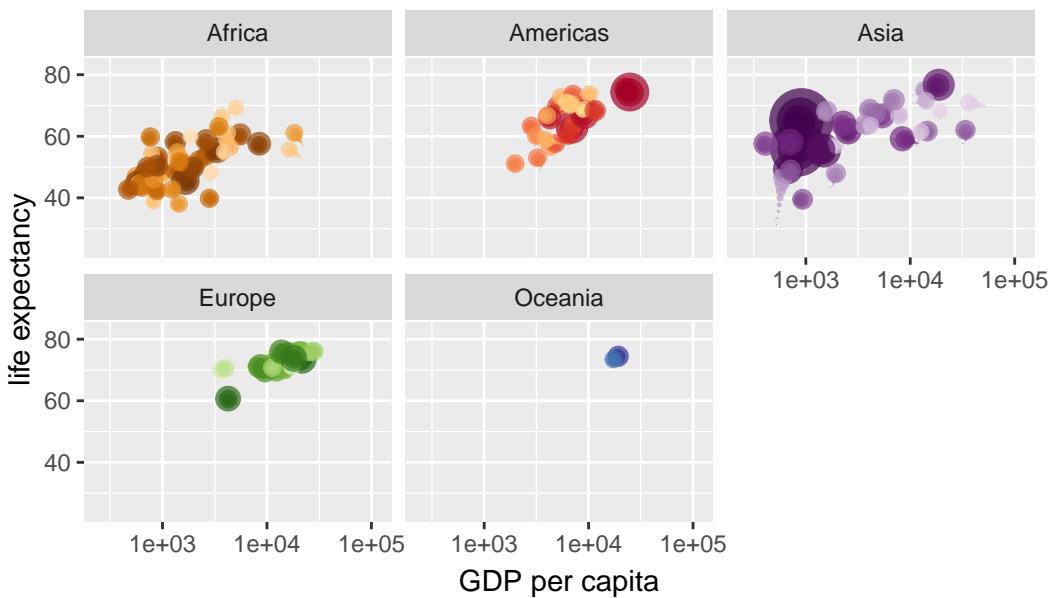
Year: 1980



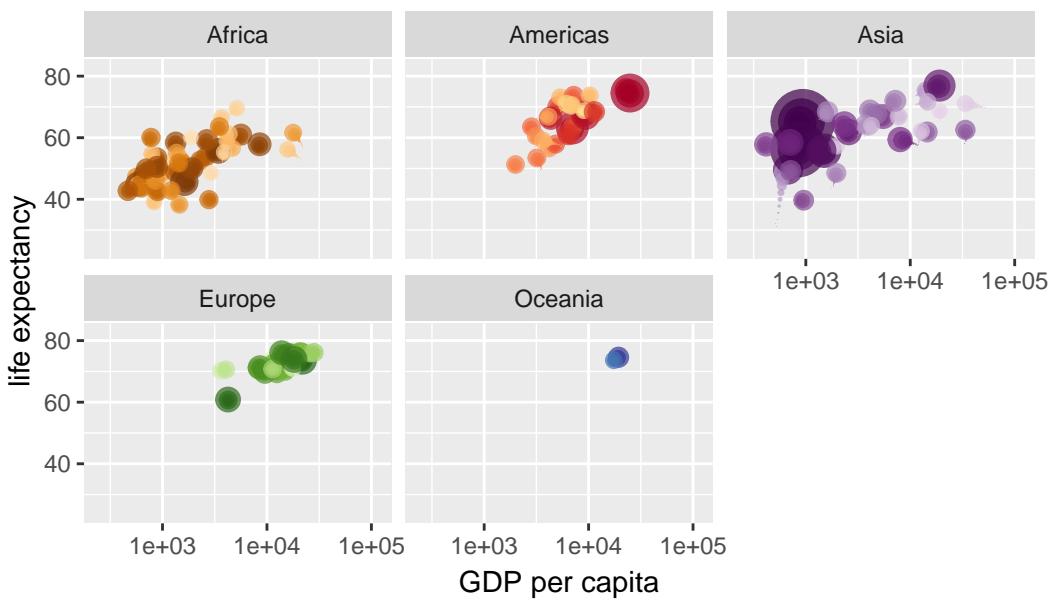
Year: 1980



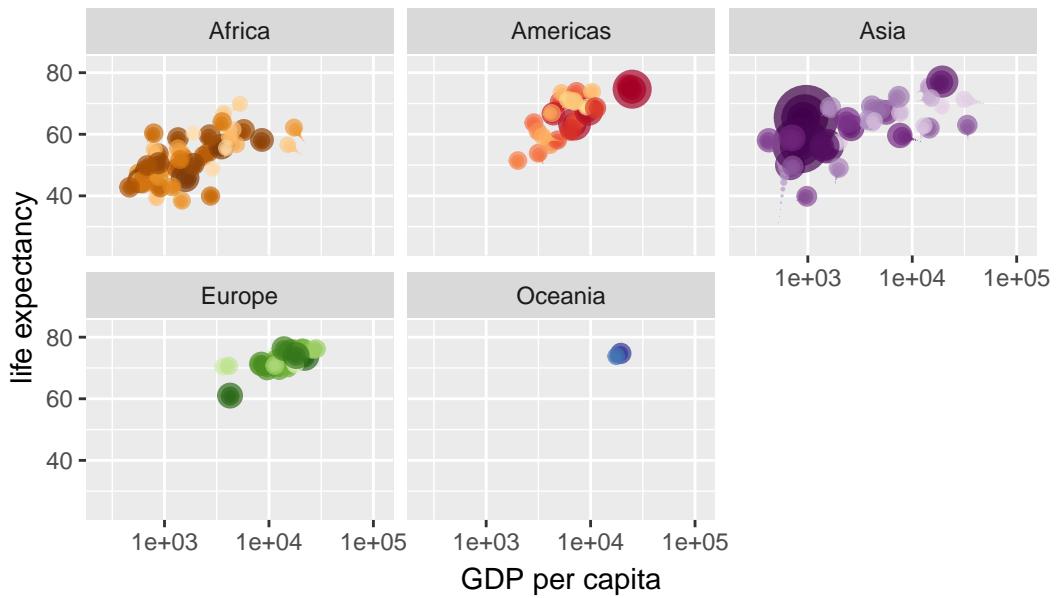
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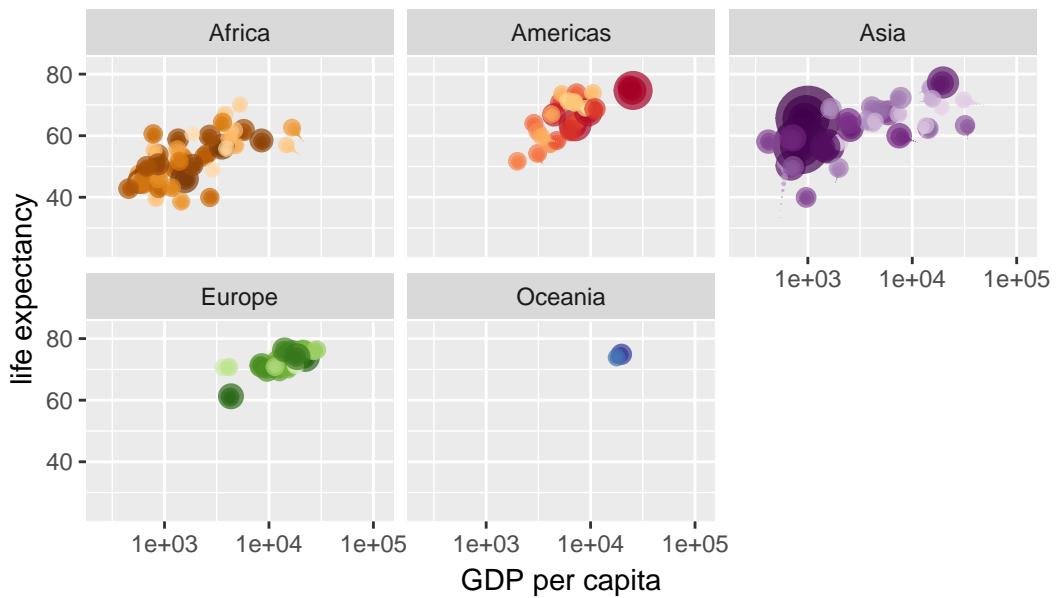
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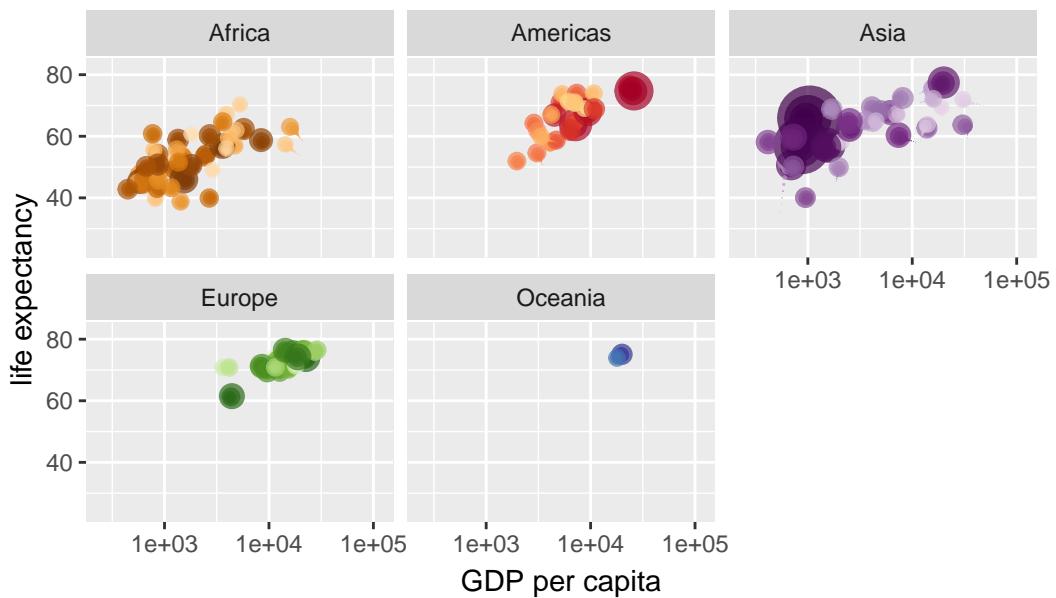
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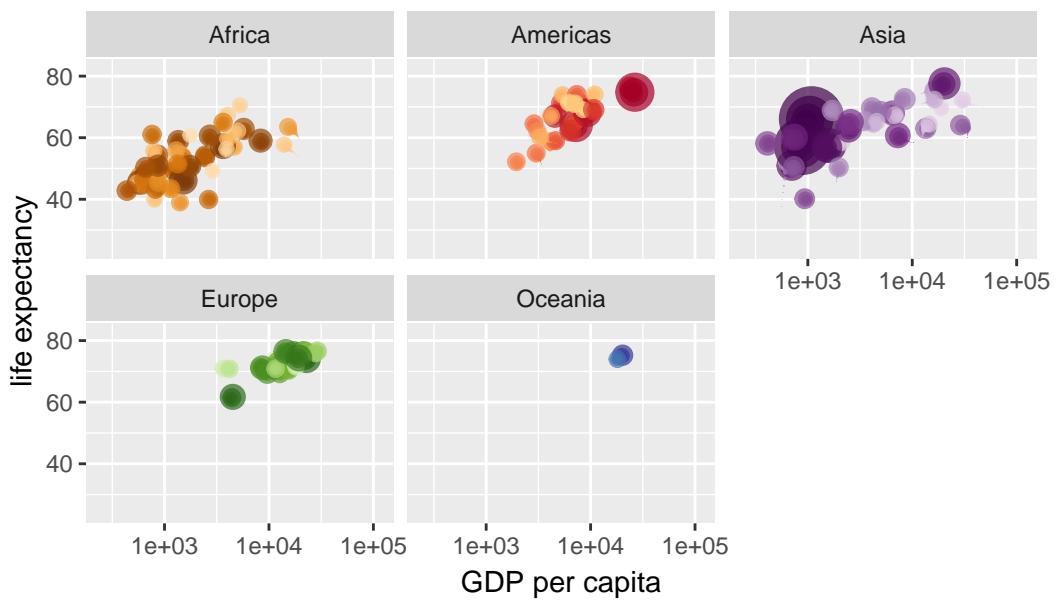
Year: 1983



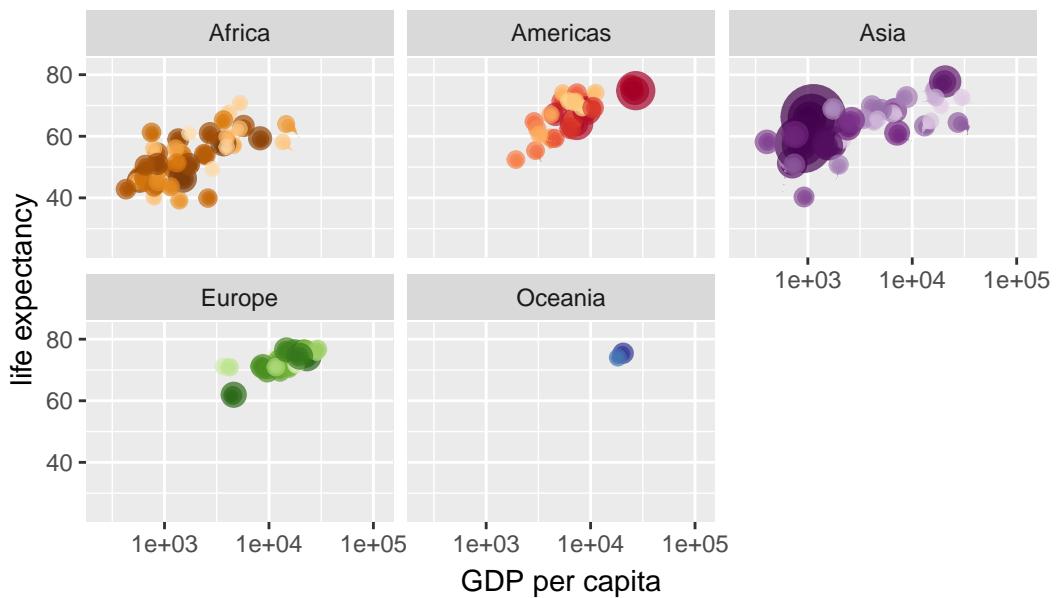
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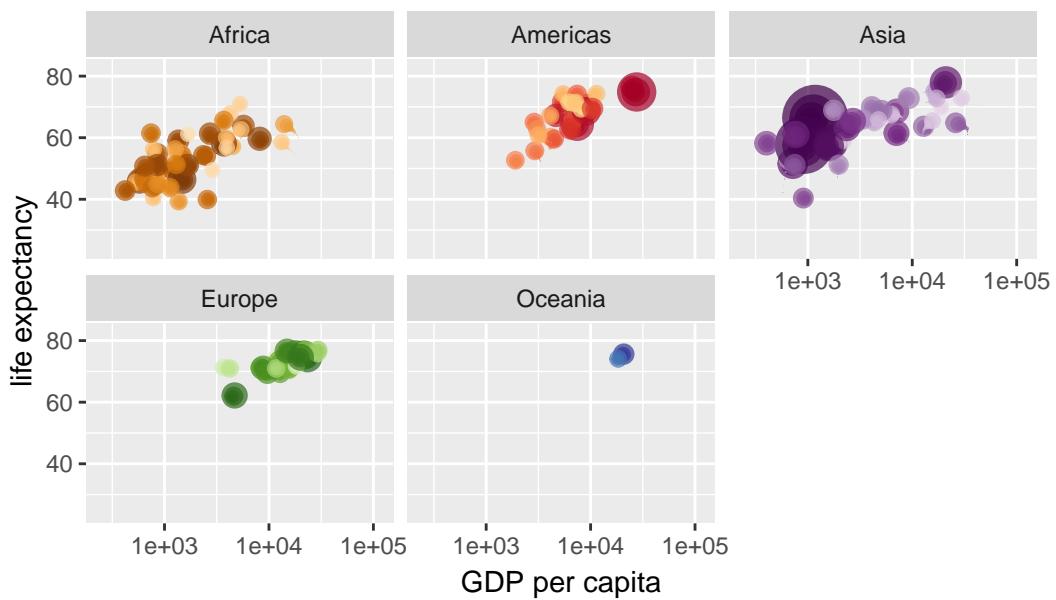
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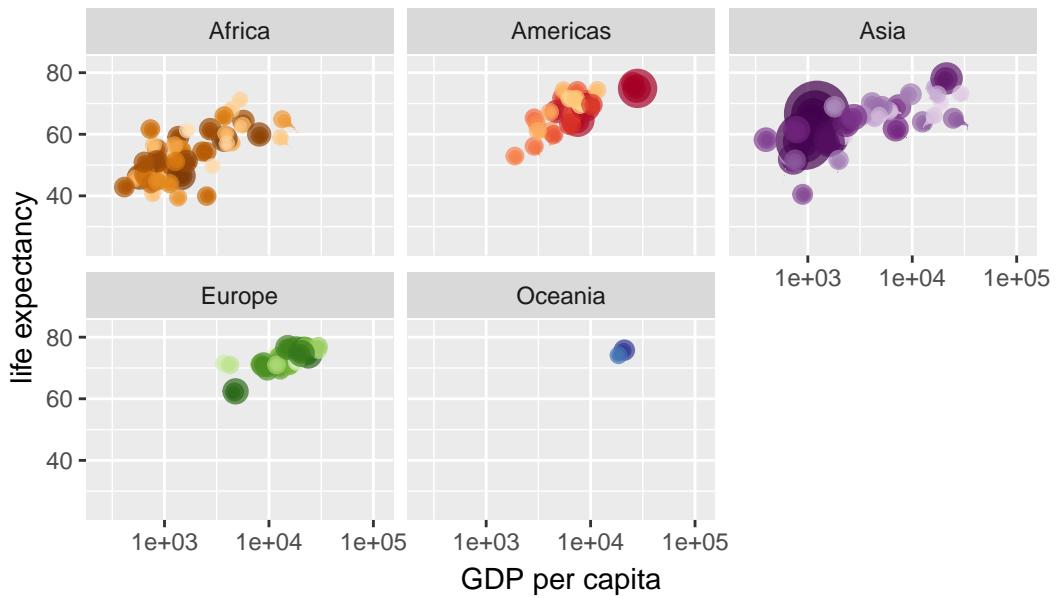
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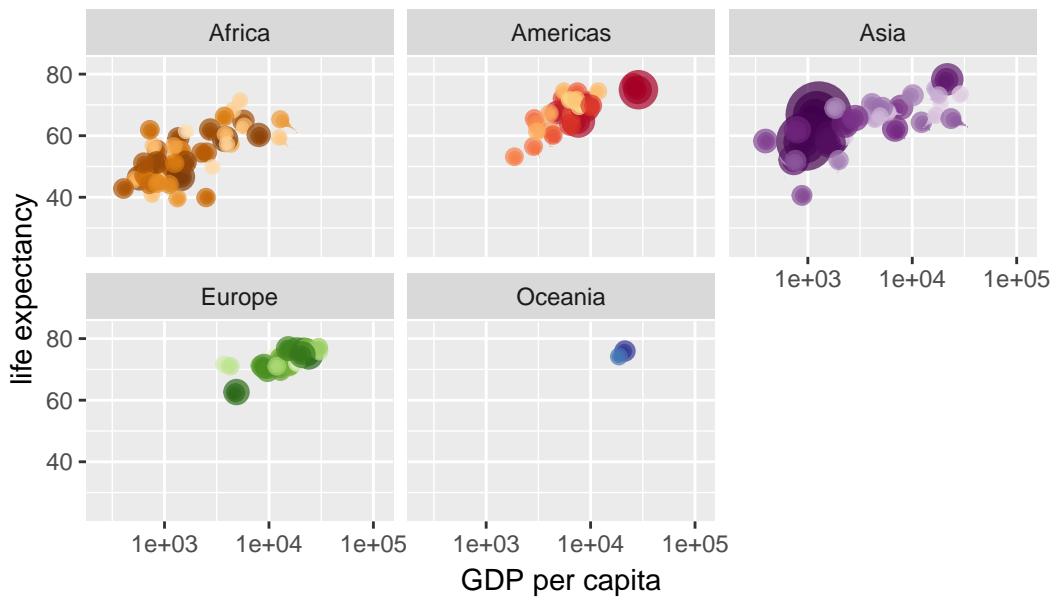
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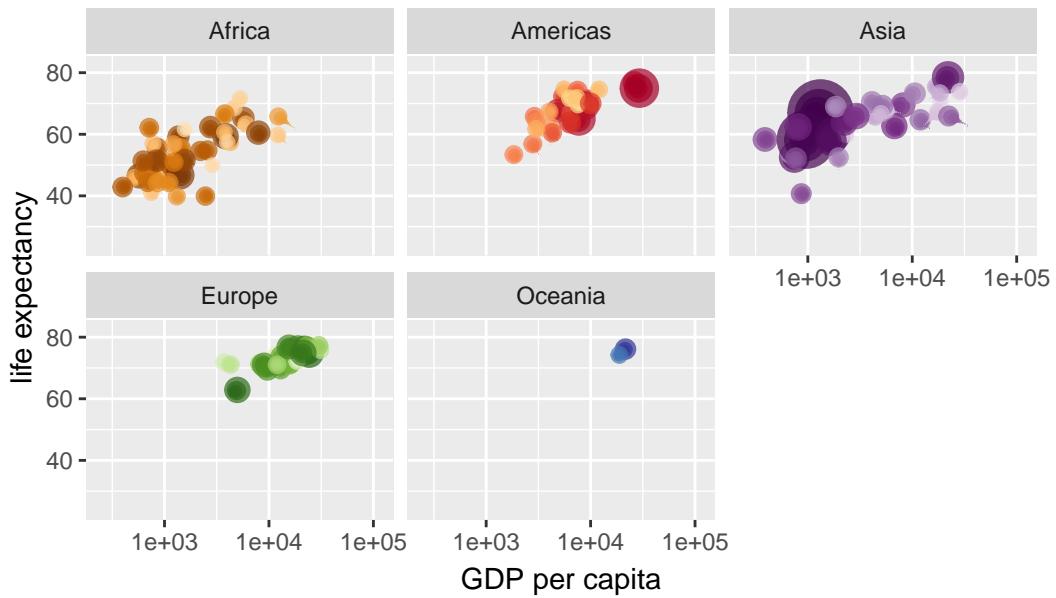
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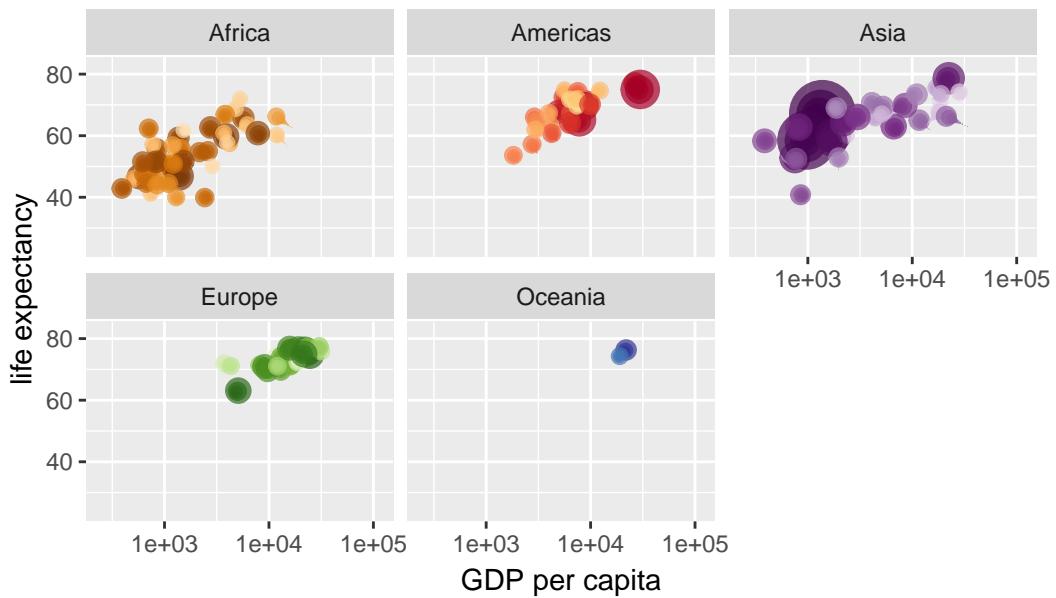
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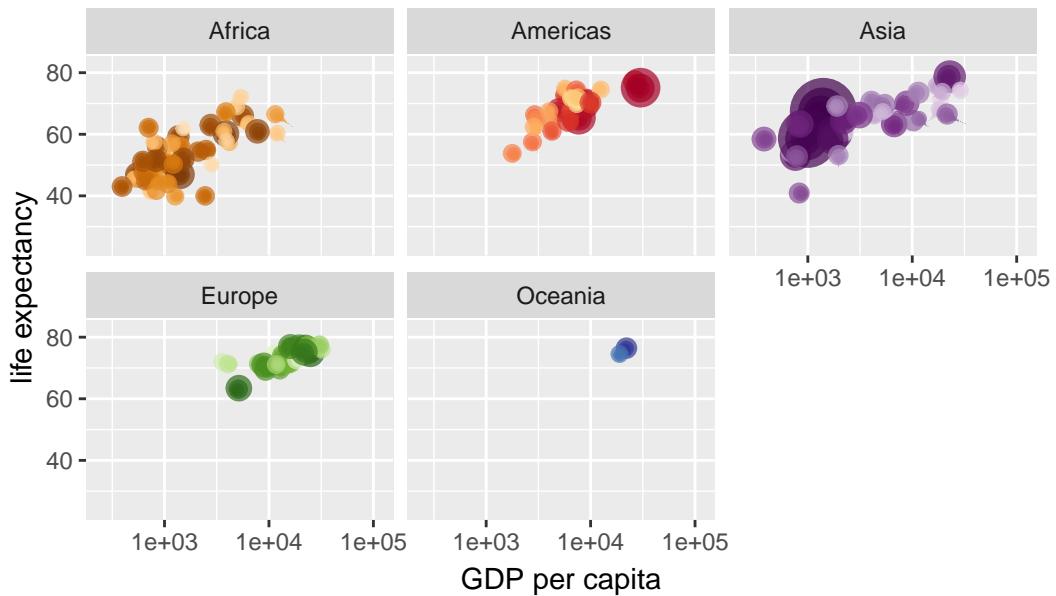
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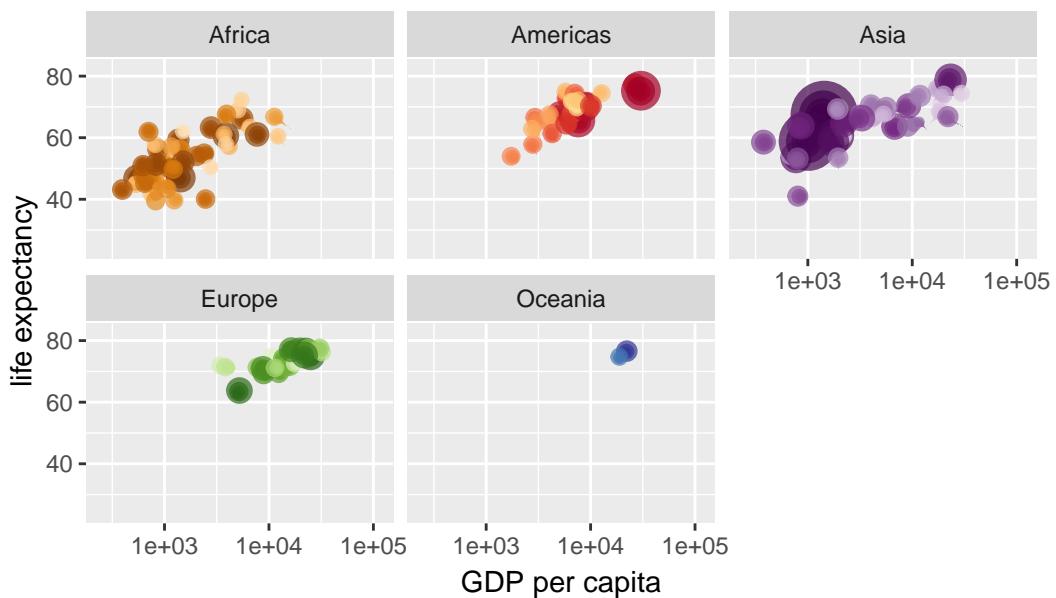
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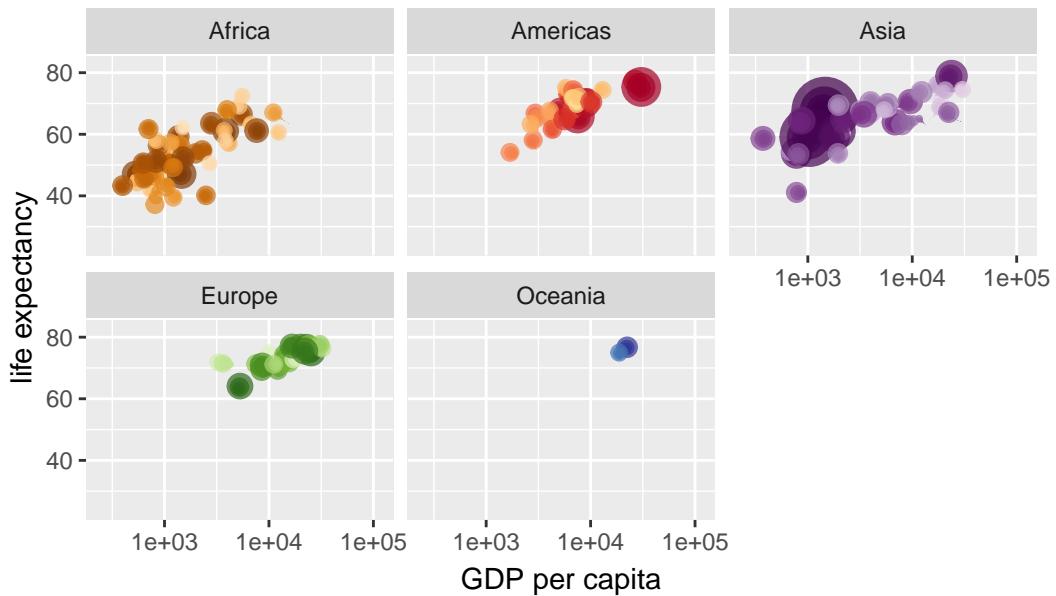
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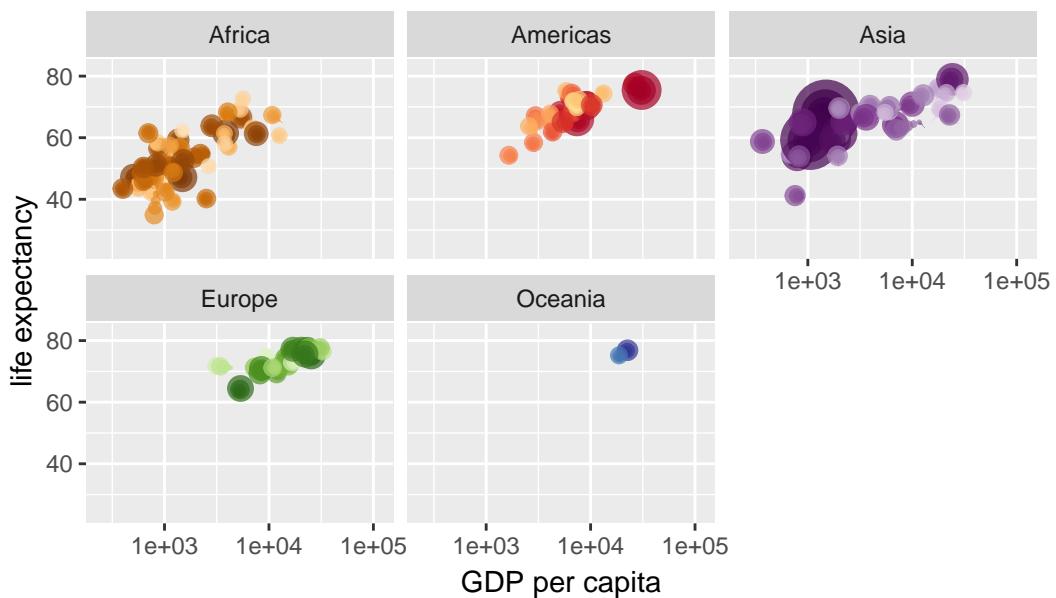
Year: 1988



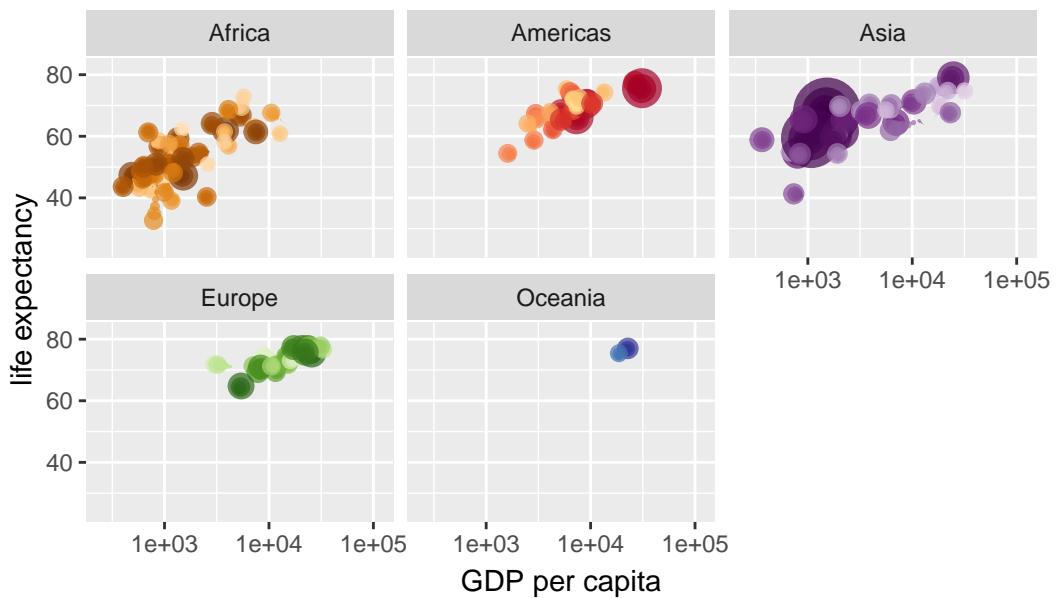
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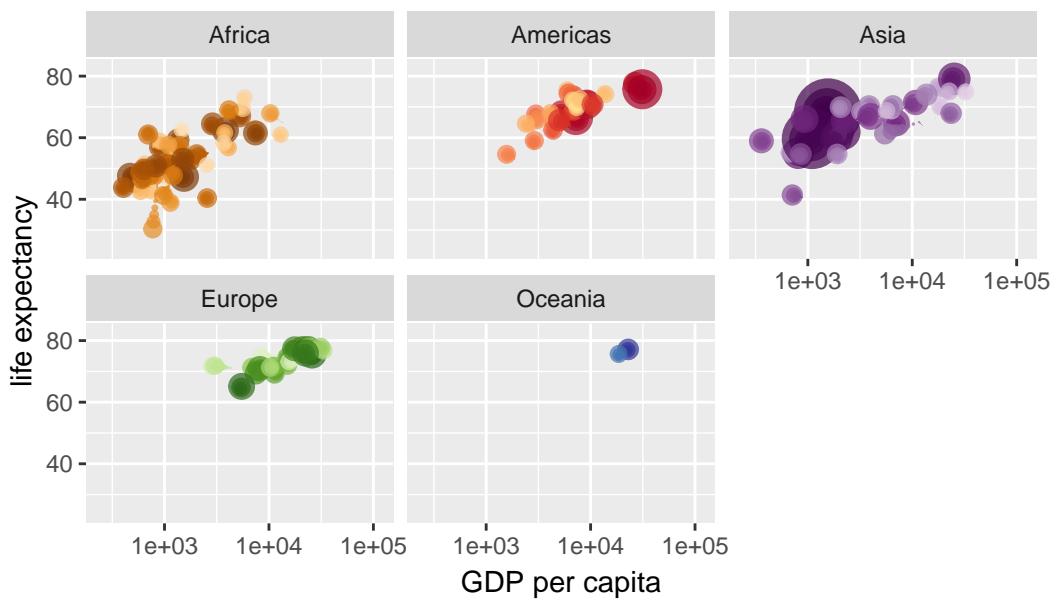
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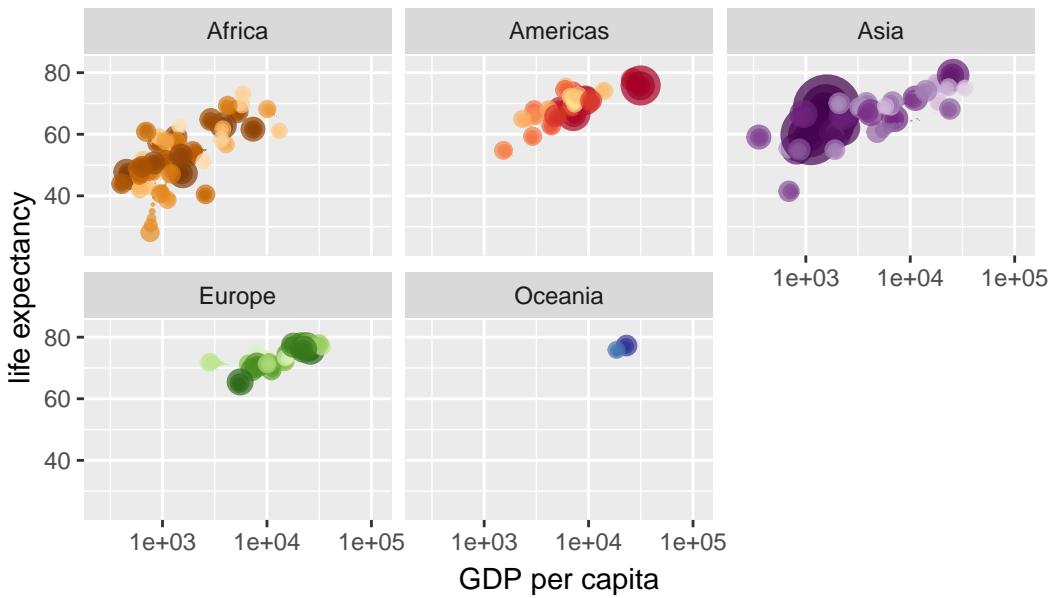
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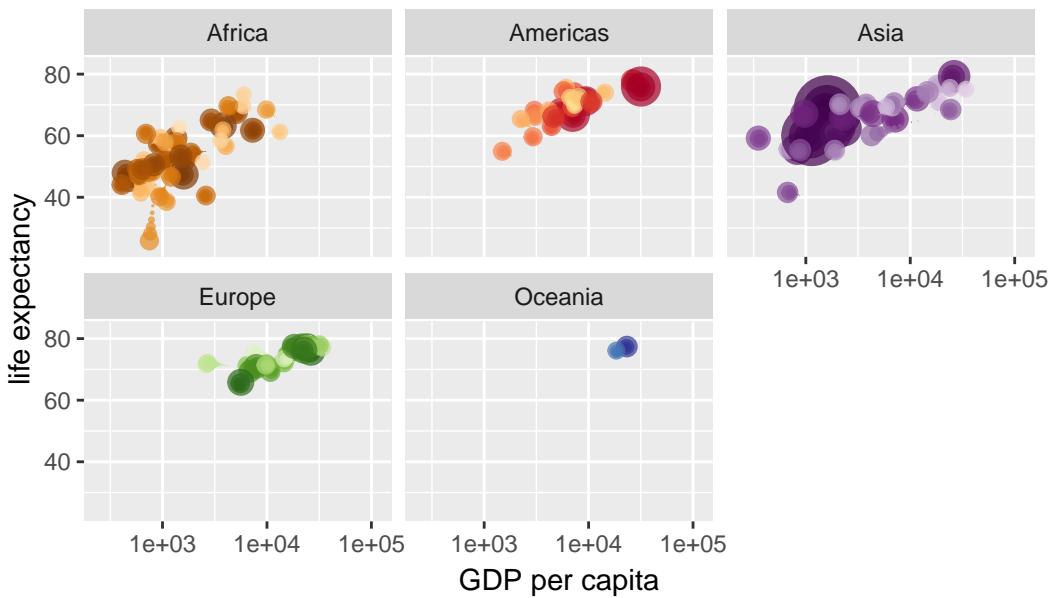
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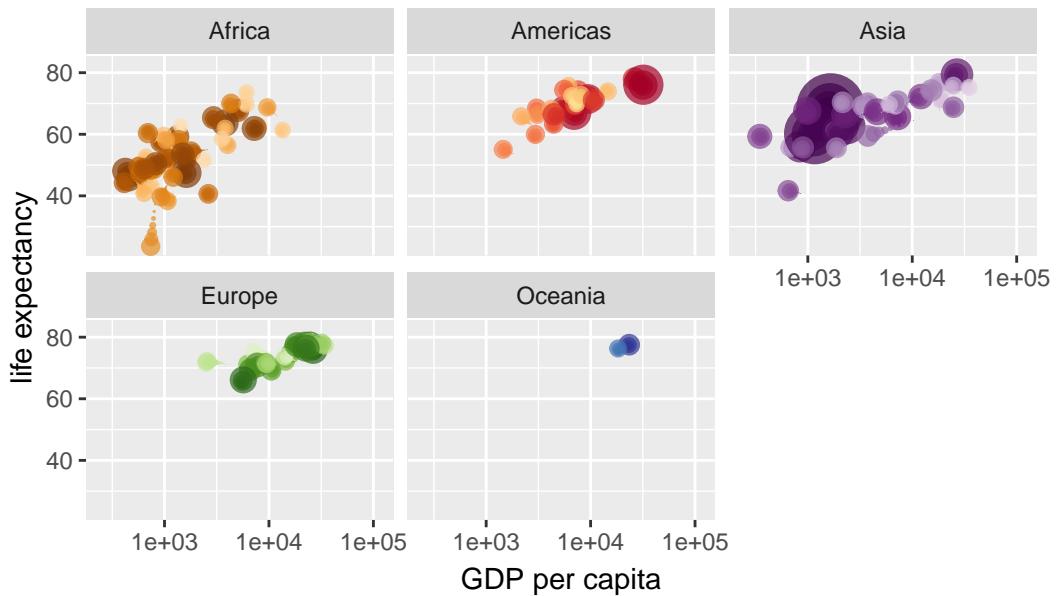
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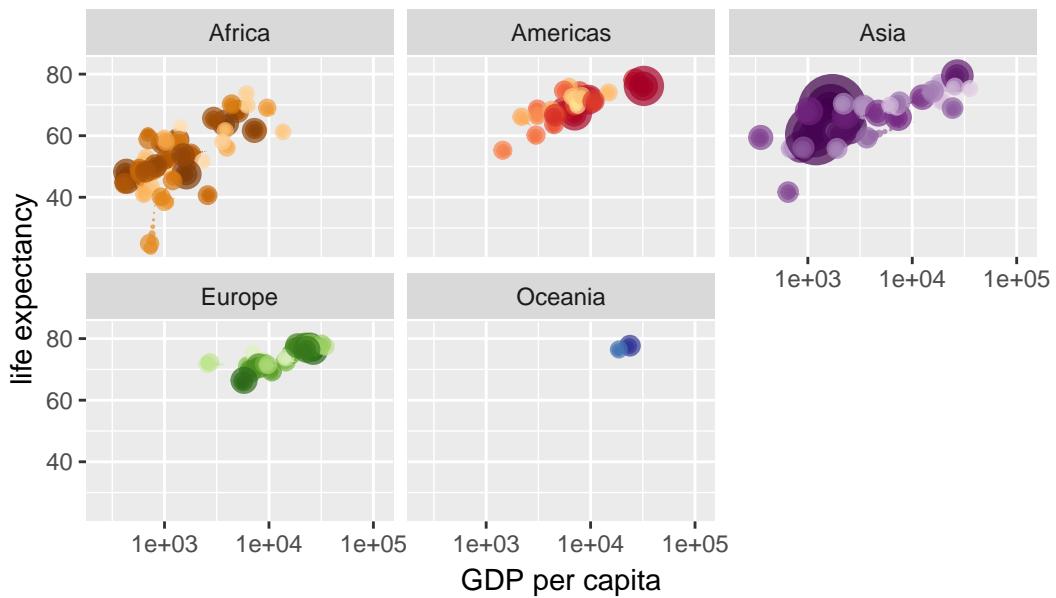
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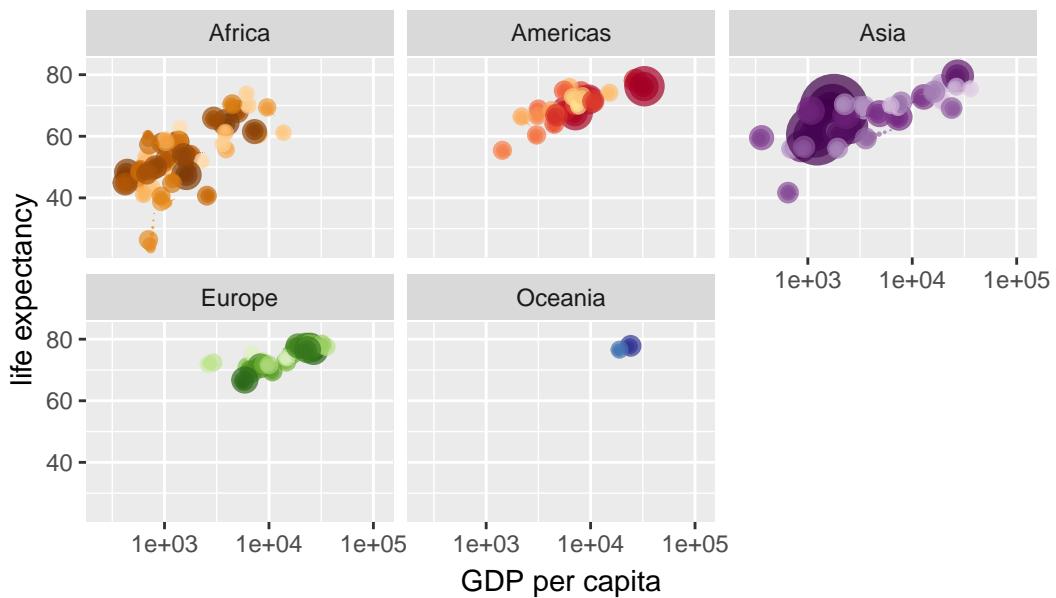
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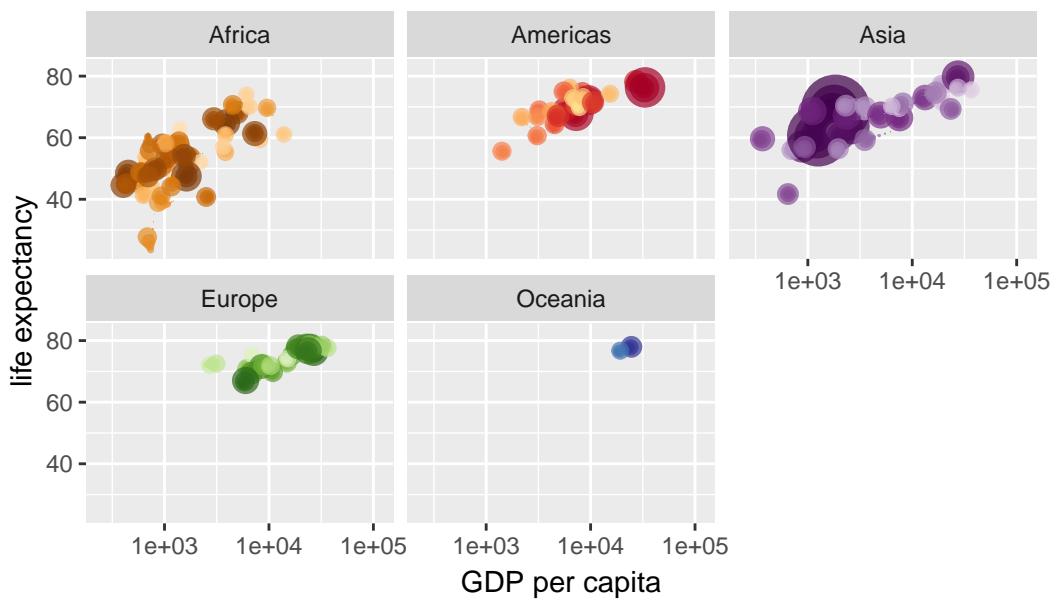
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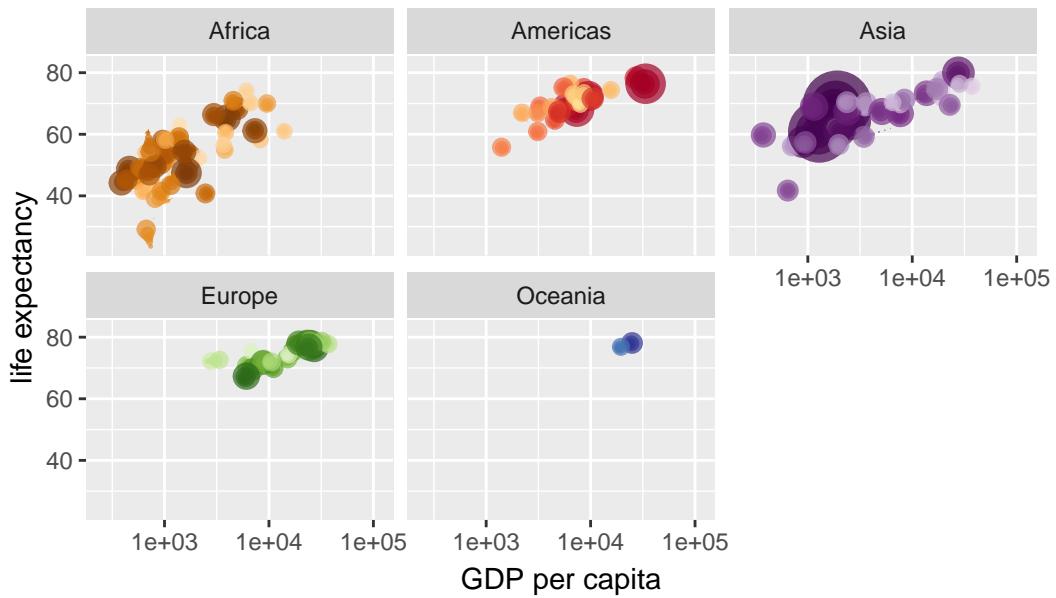
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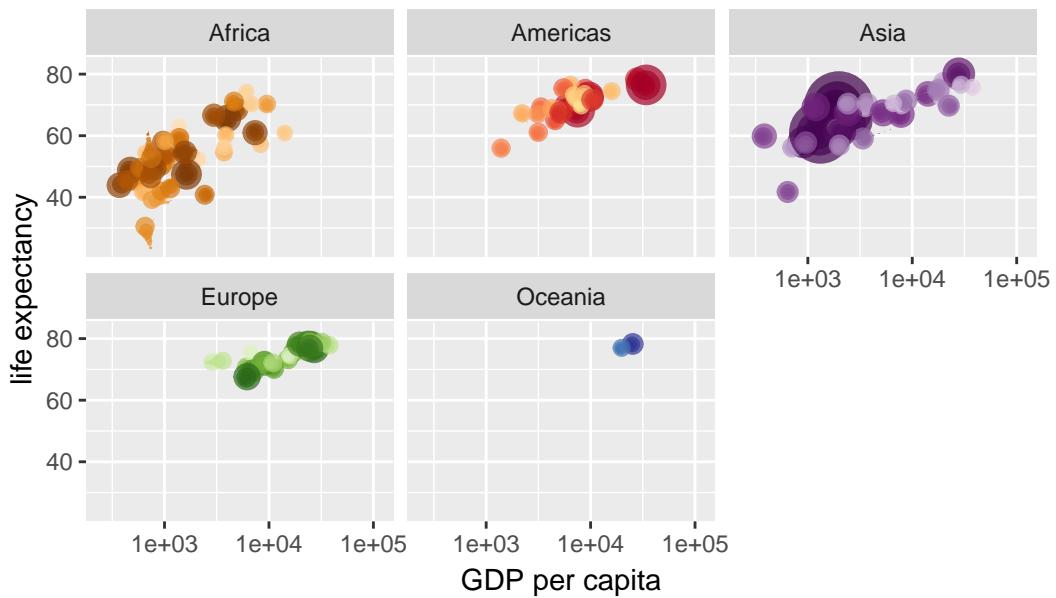
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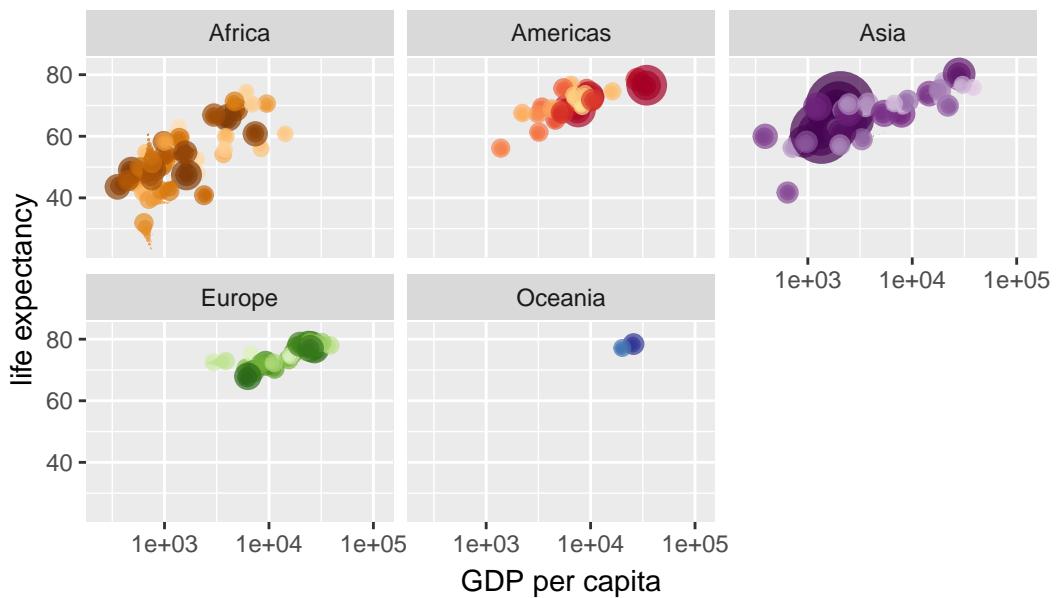
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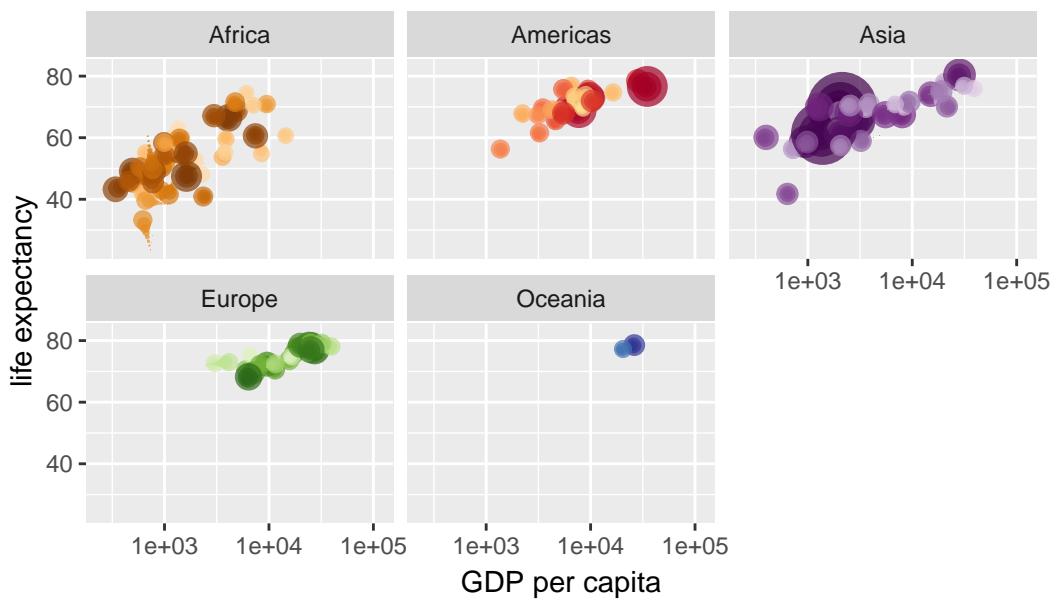
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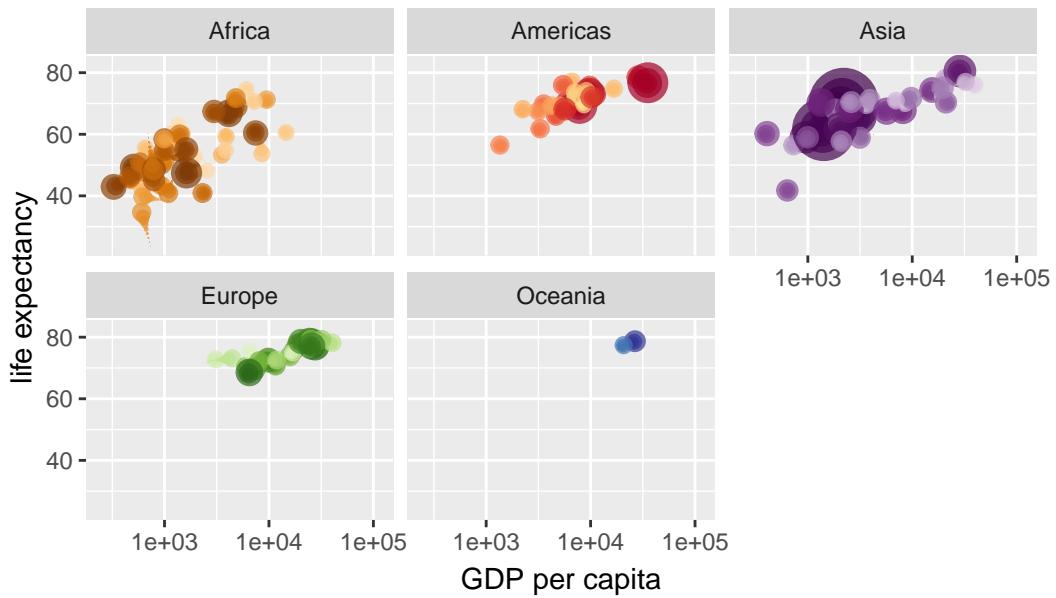
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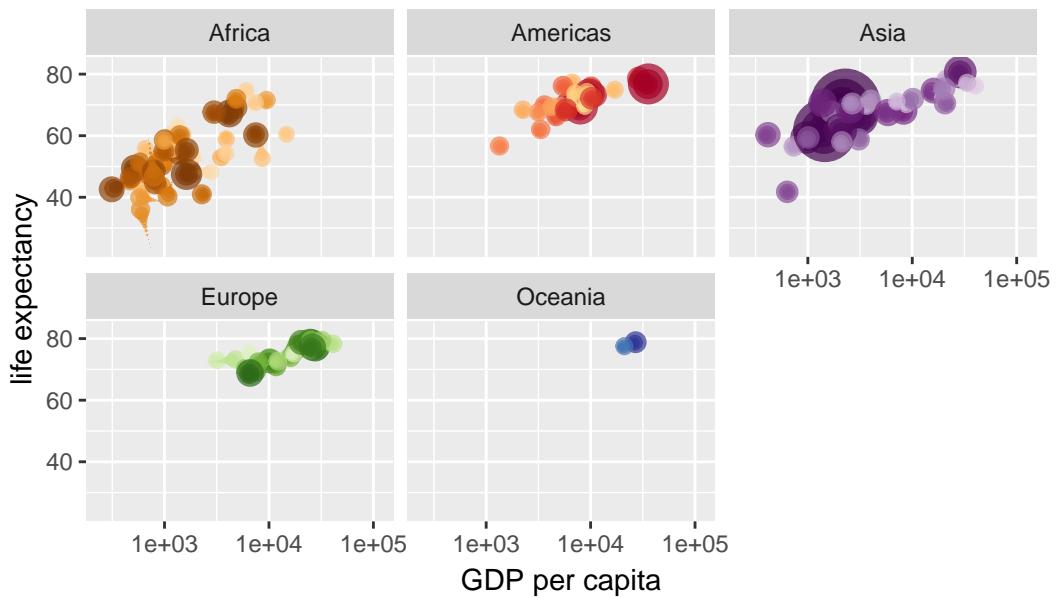
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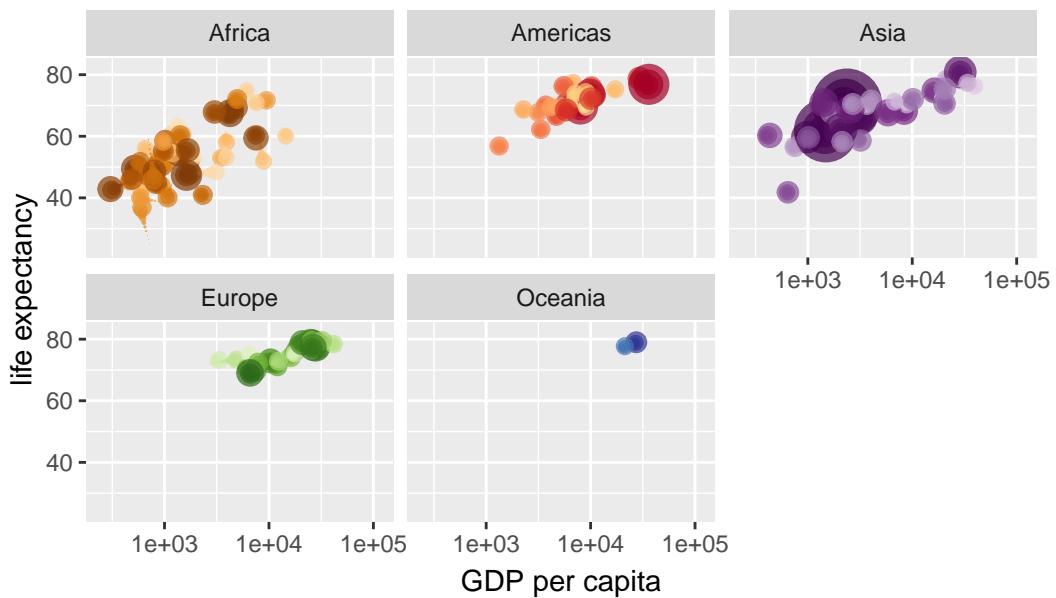
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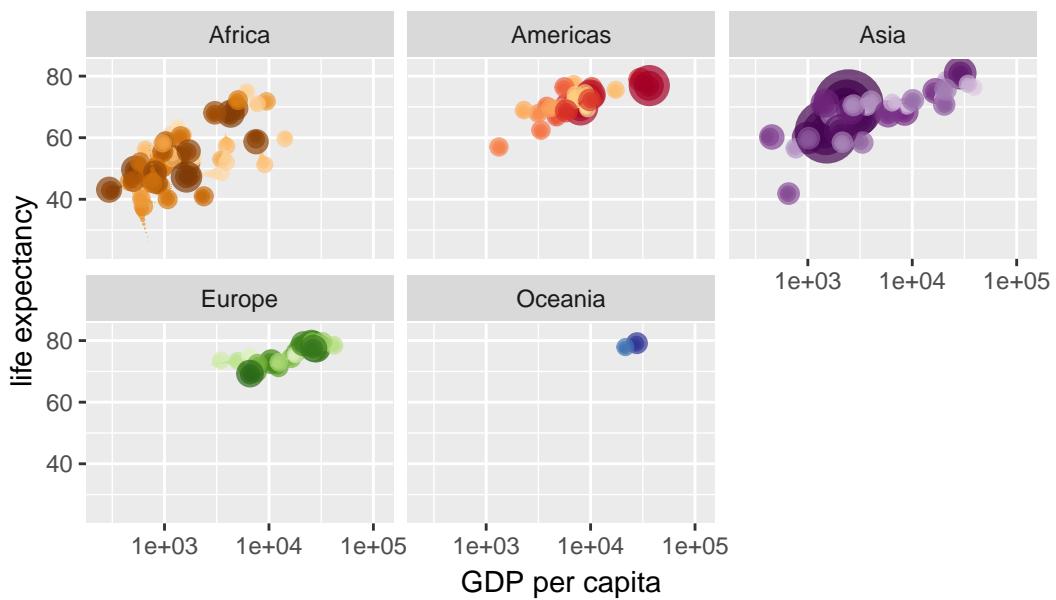
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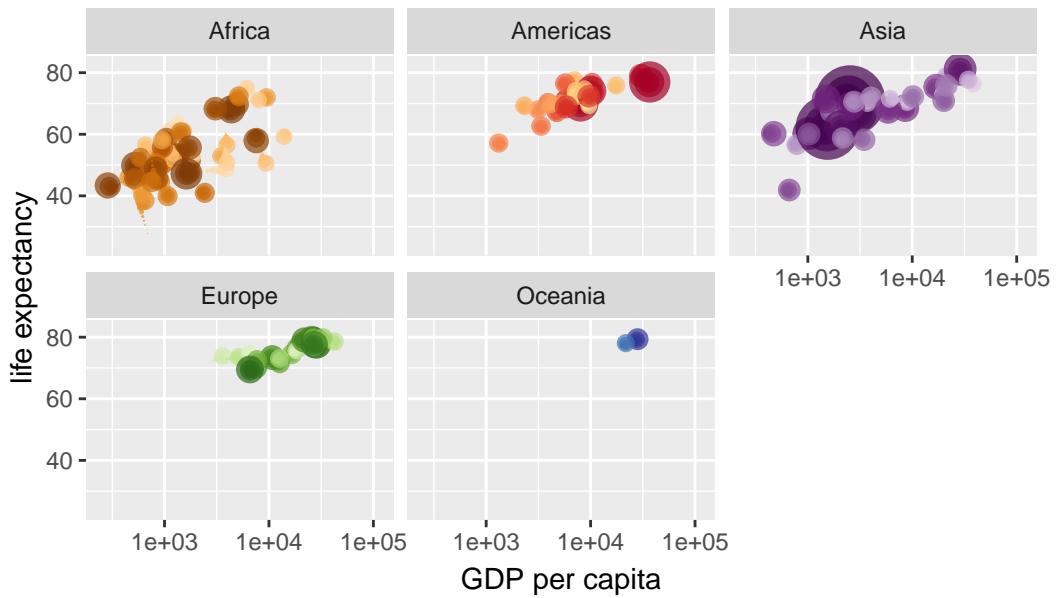
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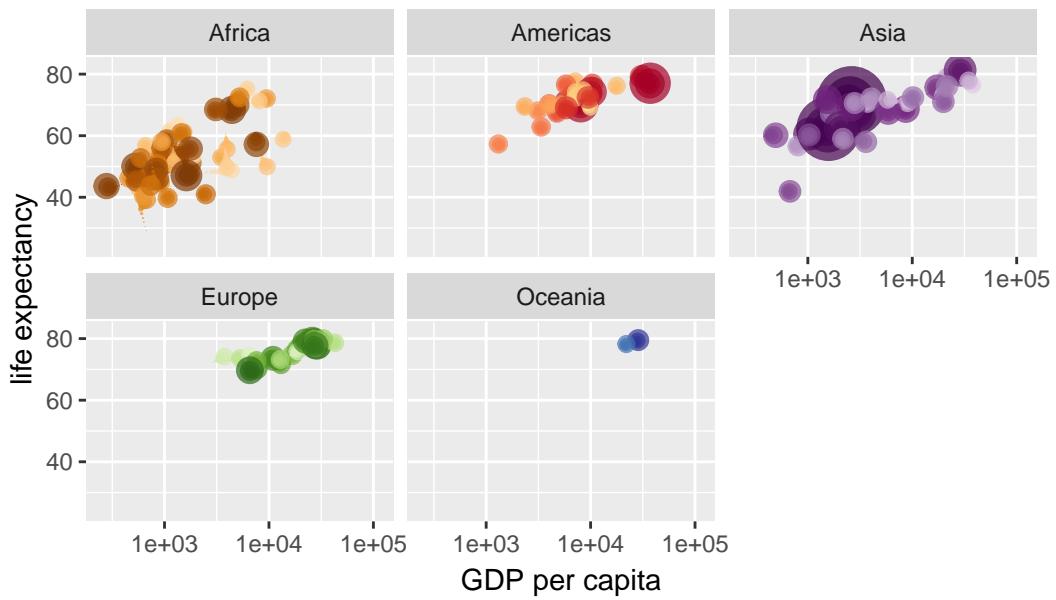
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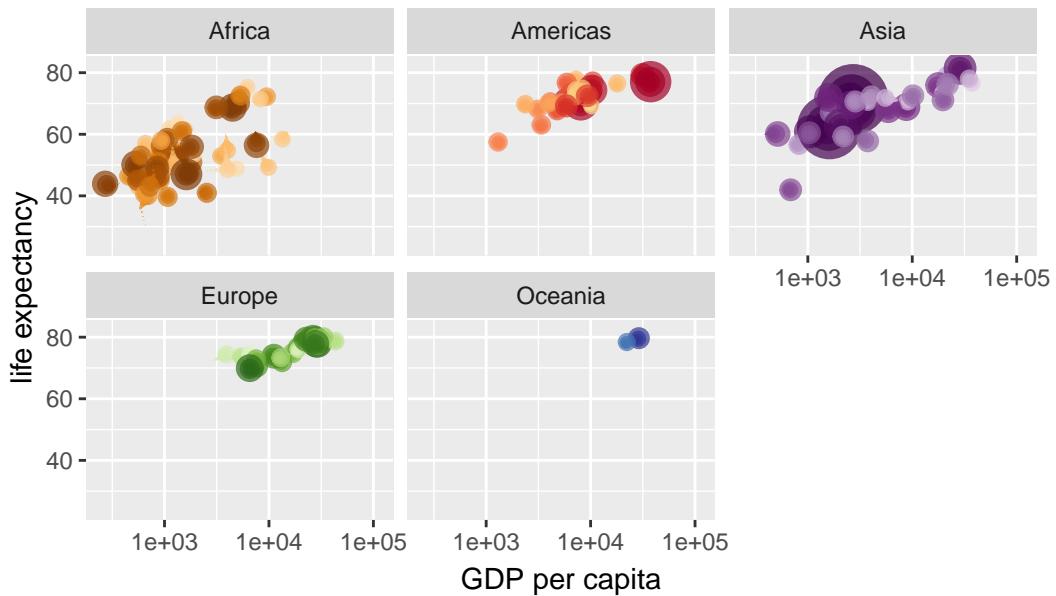
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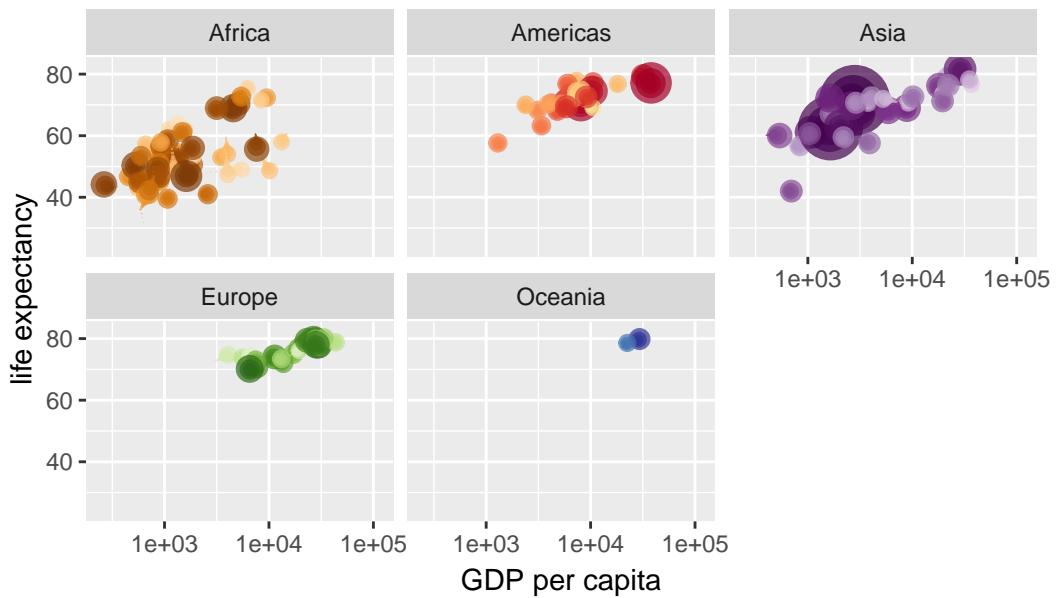
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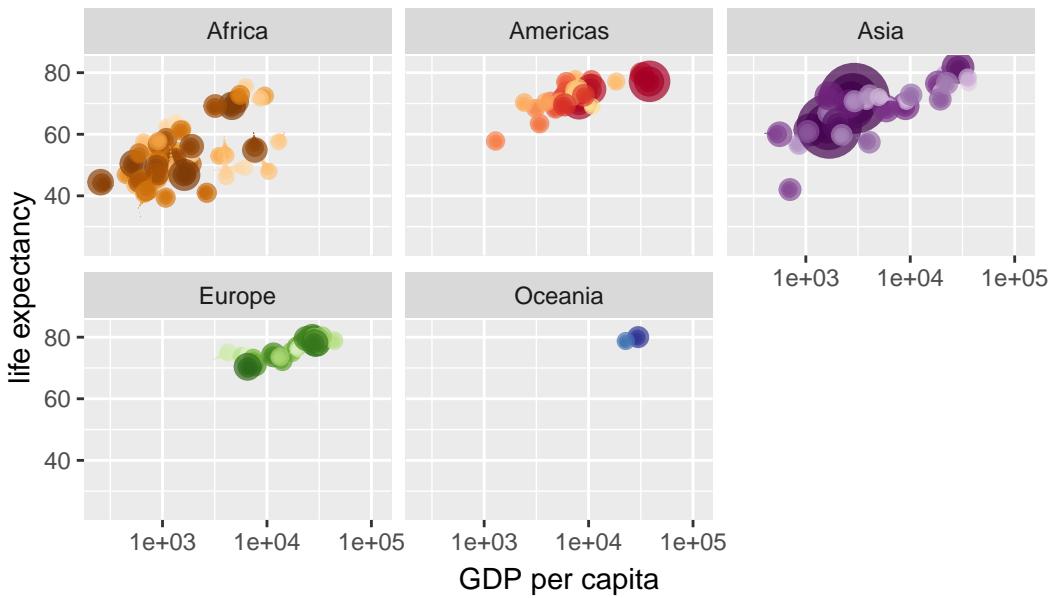
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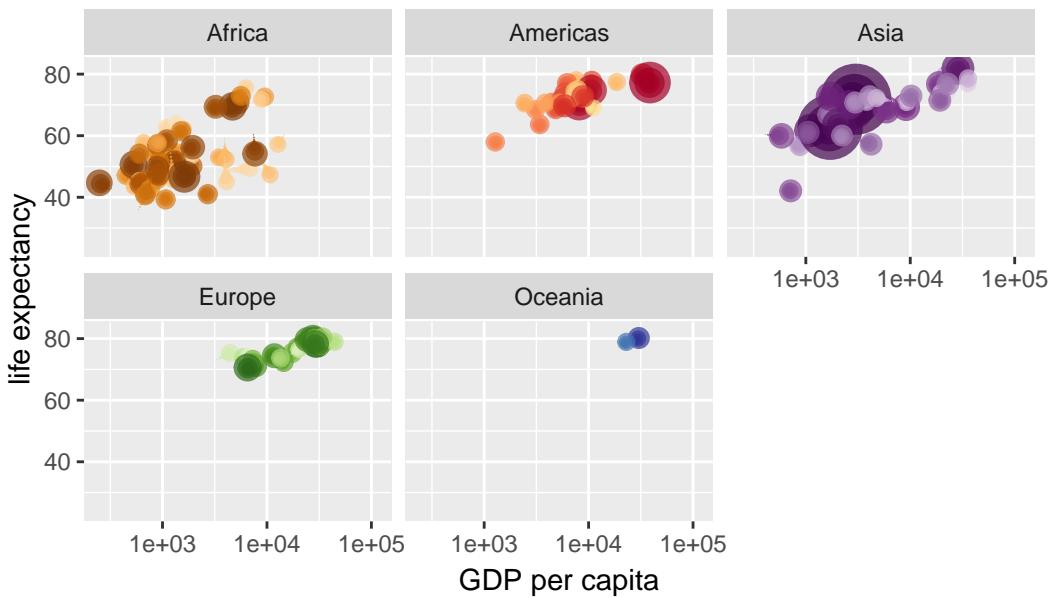
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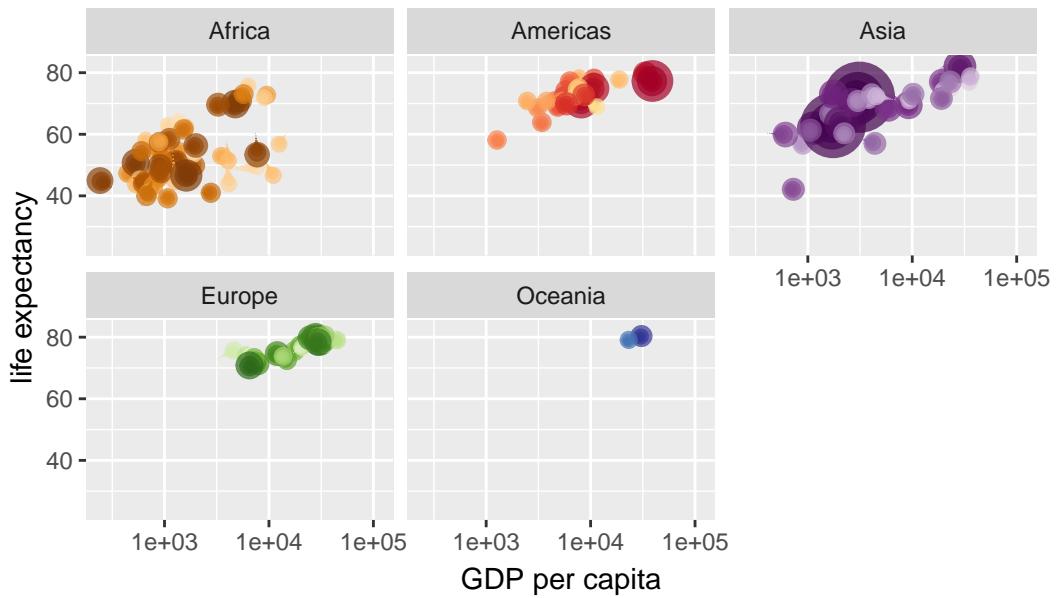
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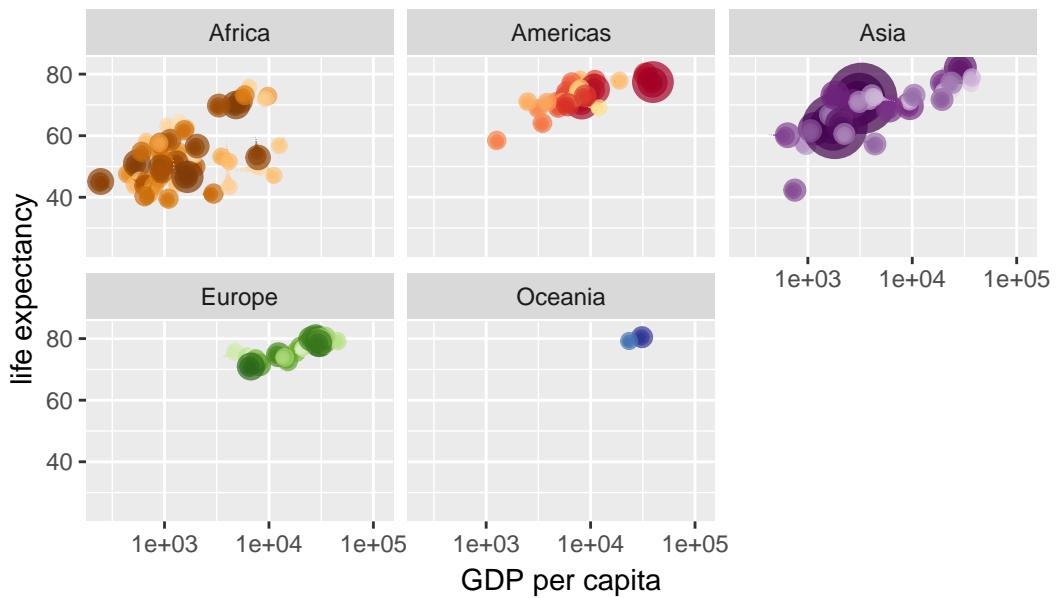
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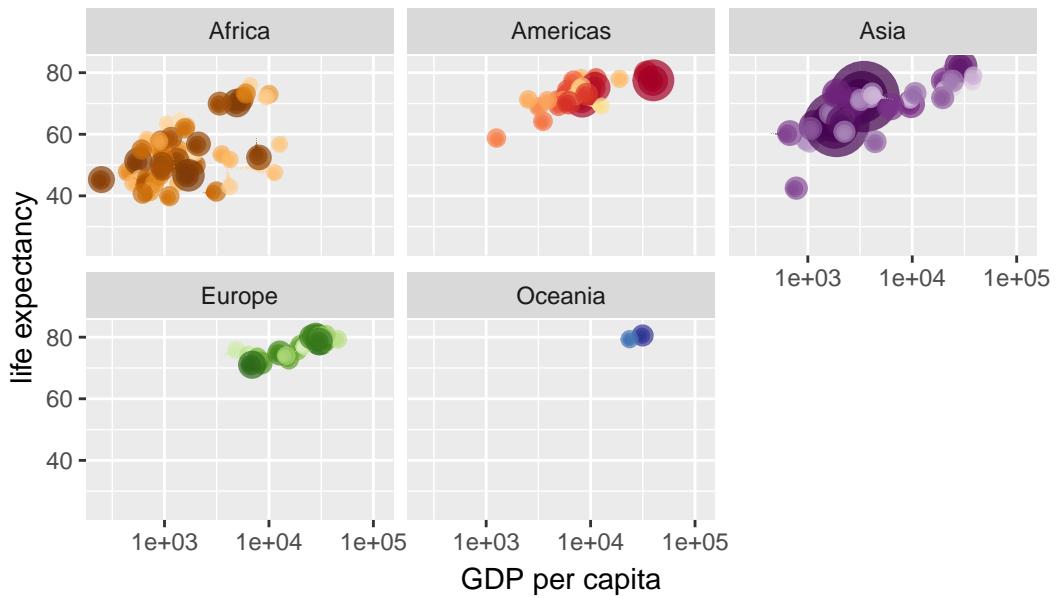
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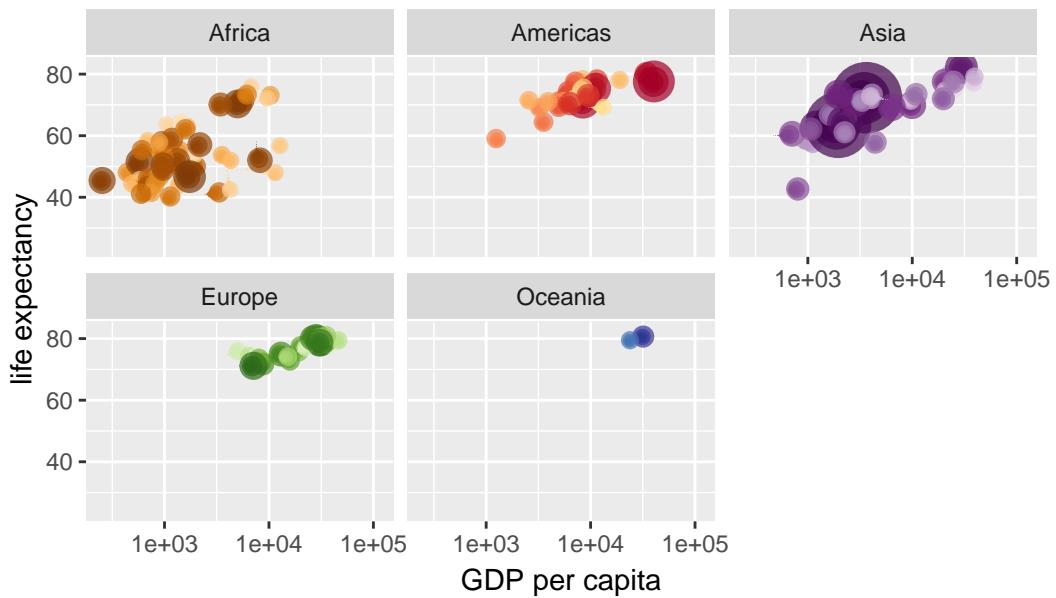
Year: 2003



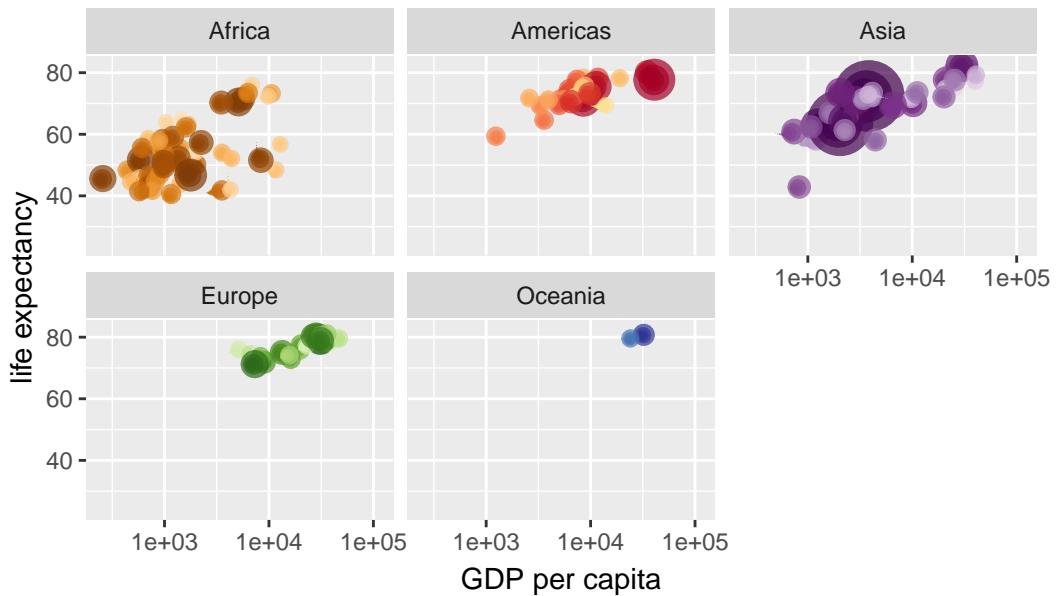
Year: 2003



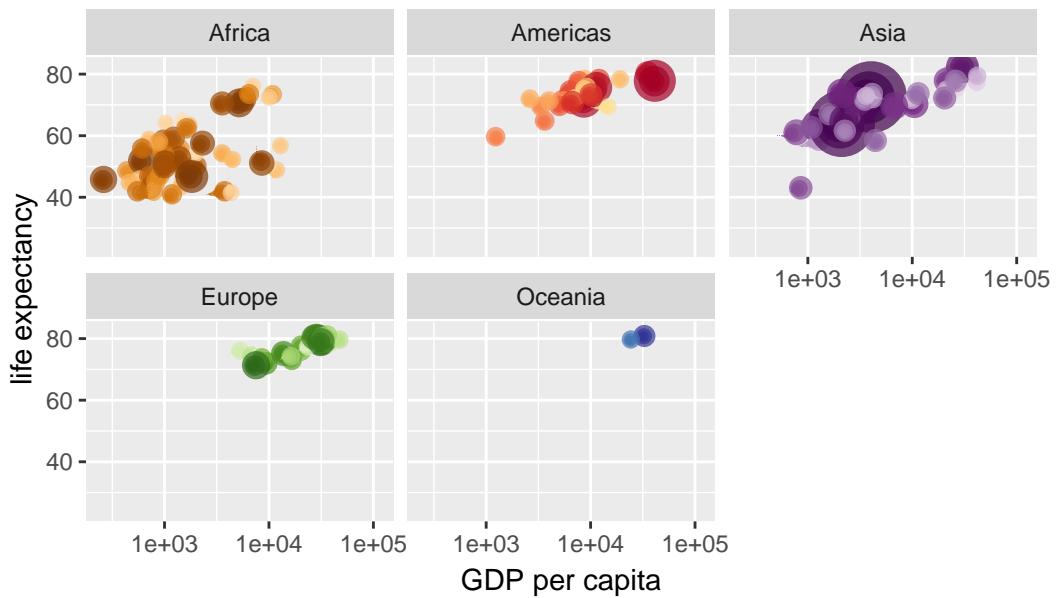
Year: 2004



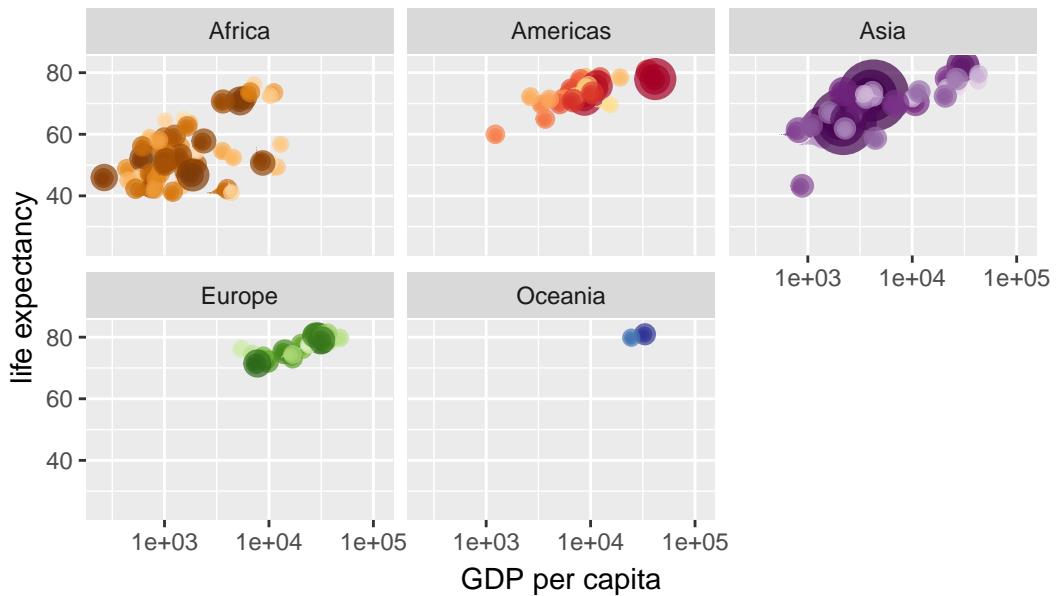
Year: 2004



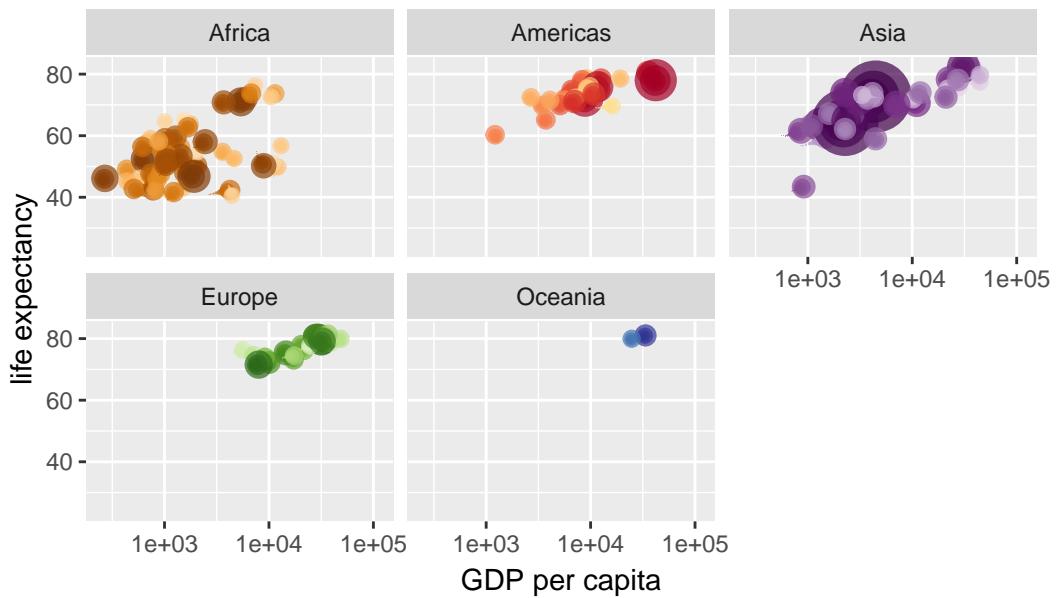
Year: 2005



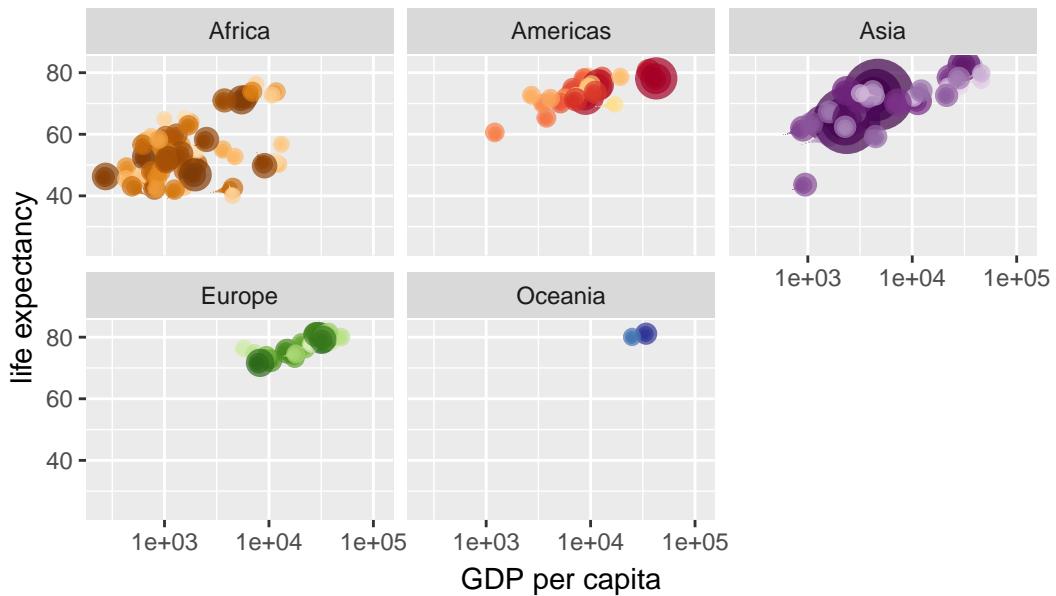
Year: 2005



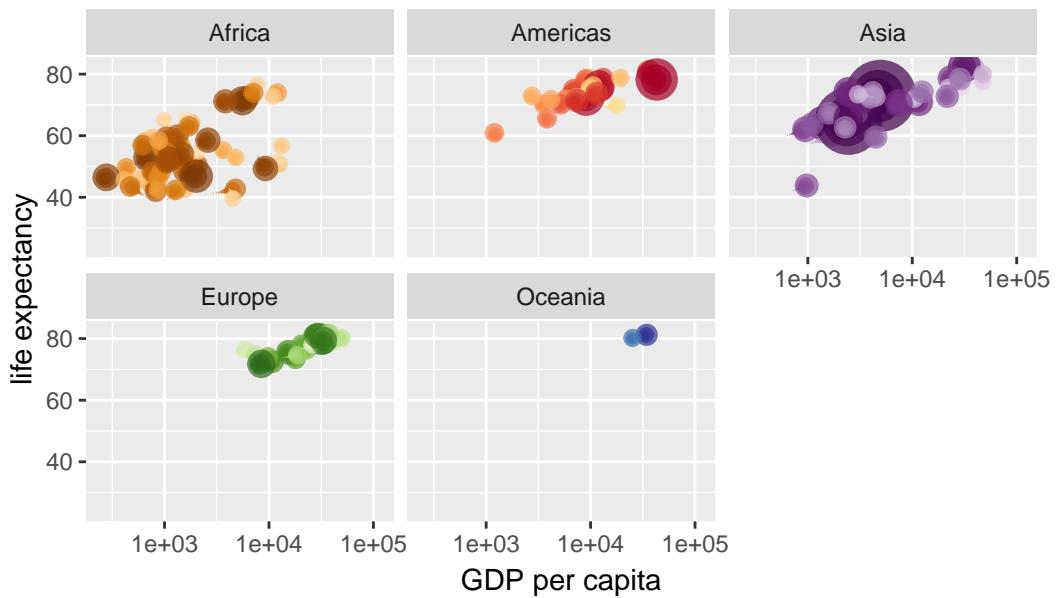
Year: 2006



Year: 2006



Year: 2007

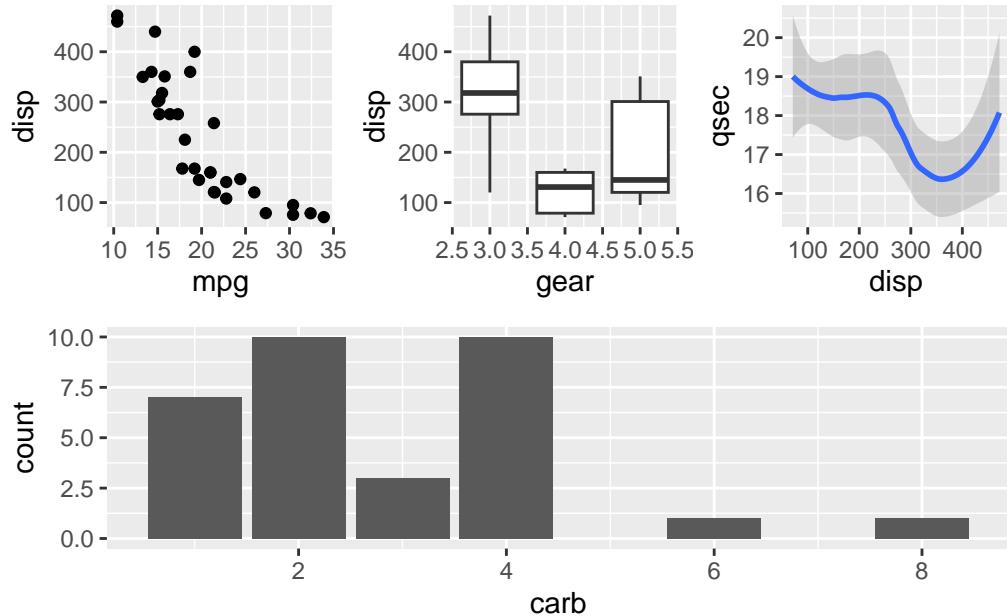


```
#install.packages('patchwork') in the Console
library(patchwork)

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))

# Combining gglots
(p1 | p2 | p3) / p4
```

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



```
sessionInfo()
```

```
R version 4.3.1 (2023-06-16 ucrt)
Platform: x86_64-w64-mingw32/x64 (64-bit)
Running under: Windows 11 x64 (build 22621)
```

```

Matrix products: default

locale:
[1] LC_COLLATE=English_United States.utf8
[2] LC_CTYPE=English_United States.utf8
[3] LC_MONETARY=English_United States.utf8
[4] LC_NUMERIC=C
[5] LC_TIME=English_United States.utf8

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 dplyr_1.1.3      gapminder_1.0.0
[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   crayon_1.5.2
[5] compiler_4.3.1    tidyselect_1.2.0  progress_1.2.2    splines_4.3.1
[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] tweenr_2.0.2     withr_2.5.1    magrittr_2.0.3   mgcv_1.8-42
[29] digest_0.6.33    grid_4.3.1      hms_1.1.3       lifecycle_1.0.3
[33] nlme_3.1-162    prettyunits_1.2.0 vctrs_0.6.4     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

```