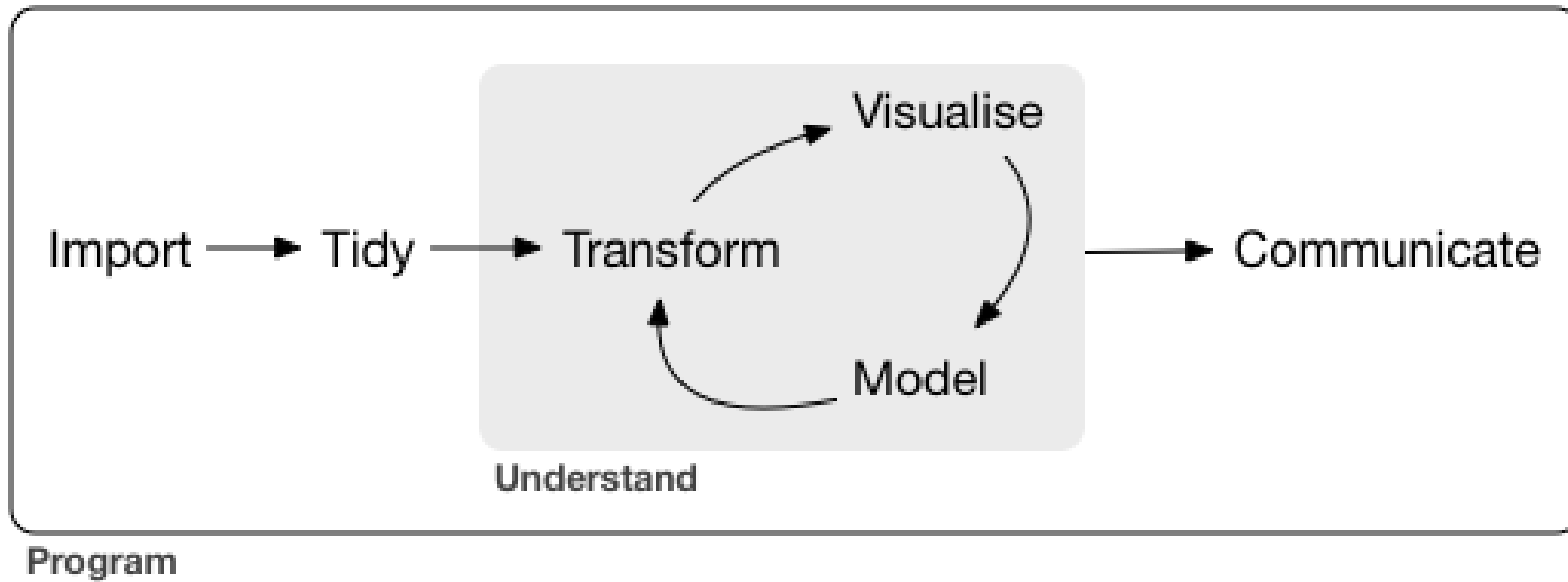
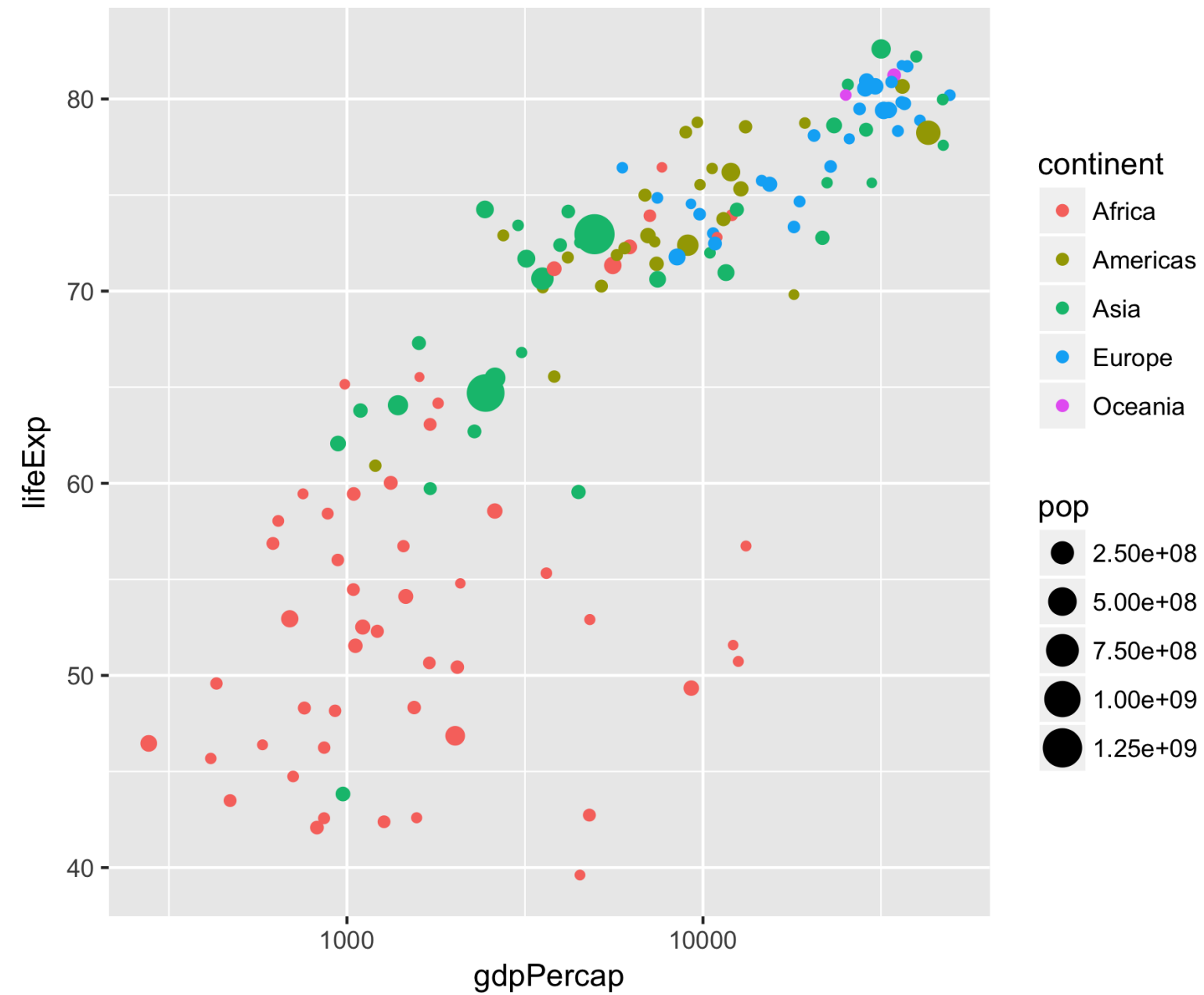
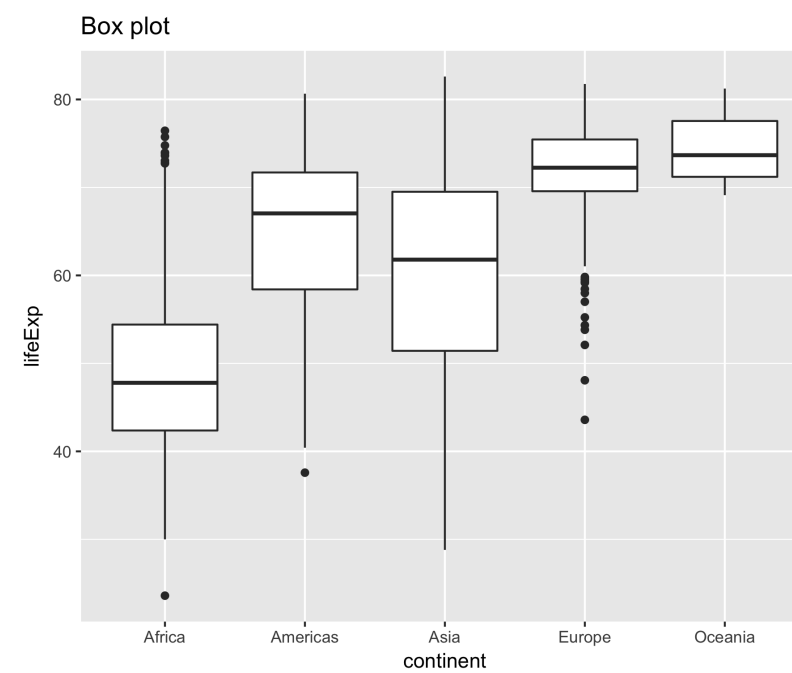
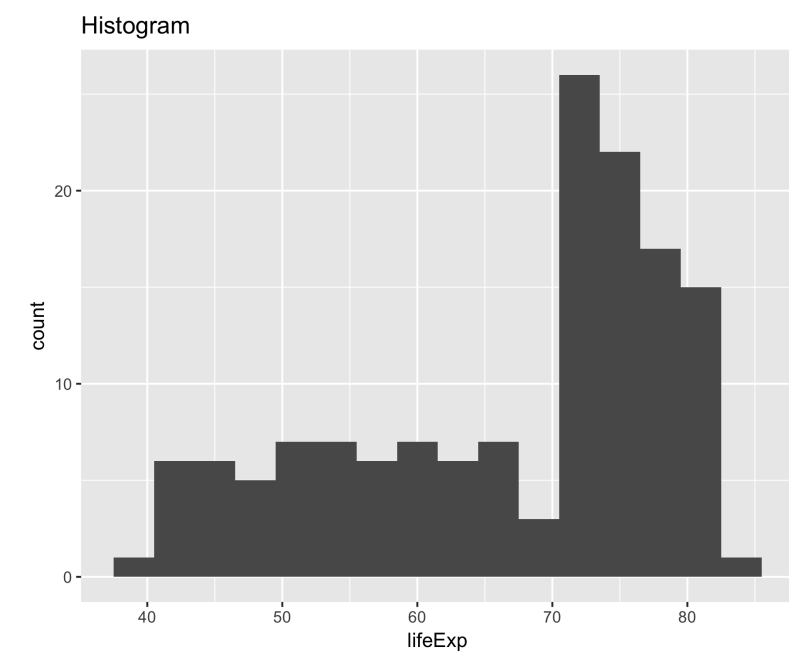
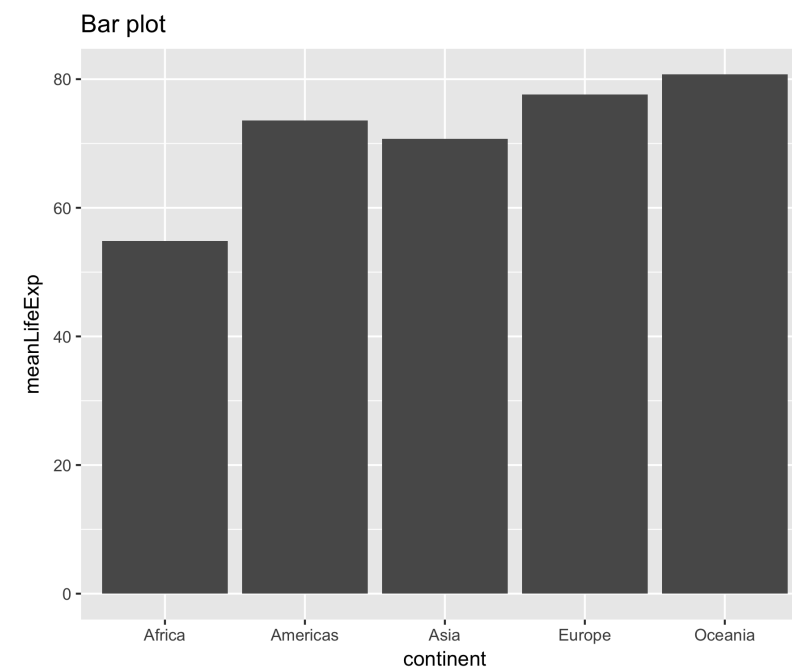
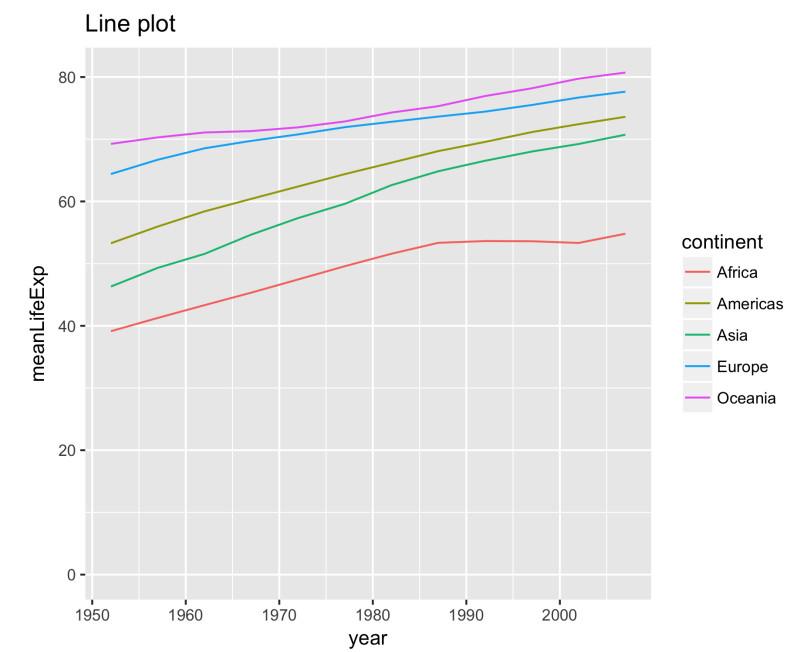


# Tidyverse



# Gapminder





# Loading packages

```
library(gapminder)
```

```
library(dplyr)
```

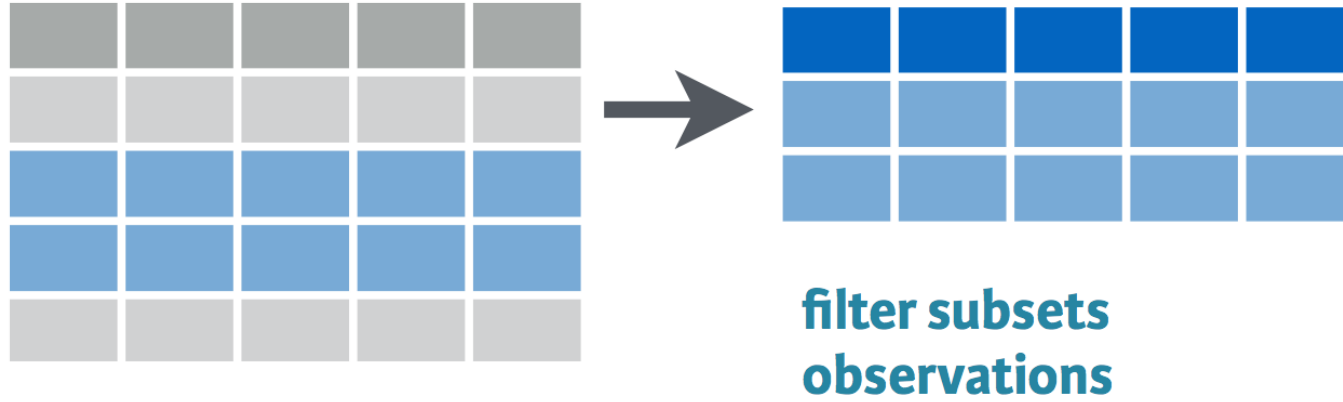
# The gapminder dataset

gapminder

```
# A tibble: 1,704 x 6
  country continent year lifeExp      pop gdpPercap
  <fctr>    <fctr> <int>   <dbl>    <dbl>    <dbl>
1 Afghanistan      Asia  1952  28.801  8425333  779.4453
2 Afghanistan      Asia  1957  30.332  9240934  820.8530
3 Afghanistan      Asia  1962  31.997 10267083  853.1007
4 Afghanistan      Asia  1967  34.020 11537966  836.1971
5 Afghanistan      Asia  1972  36.088 13079460  739.9811
6 Afghanistan      Asia  1977  38.438 14880372  786.1134
7 Afghanistan      Asia  1982  39.854 12881816  978.0114
8 Afghanistan      Asia  1987  40.822 13867957  852.3959
9 Afghanistan      Asia  1992  41.674 16317921  649.3414
10 Afghanistan      Asia  1997  41.763 22227415  635.3414
# ... with 1,694 more rows
```

# The filter verb

**filter()**



# Filtering for one year

```
gapminder %>%  
  filter(year == 2007)
```

```
# A tibble: 142 x 6  
  country continent  year lifeExp      pop  gdpPercap  
  <fctr>    <fctr> <int>   <dbl>    <dbl>    <dbl>  
1 Afghanistan      Asia  2007  43.828  31889923  974.5803  
2  Albania      Europe  2007  76.423   3600523  5937.0295  
3  Algeria      Africa  2007  72.301  33333216  6223.3675  
4  Angola      Africa  2007  42.731  12420476  4797.2313  
5  Argentina  Americas  2007  75.320  40301927 12779.3796  
6  Australia  Oceania   2007  81.235  20434176 34435.3674  
7  Austria      Europe  2007  79.829   8199783 36126.4927  
8  Bahrain      Asia    2007  75.635    708573 29796.0483  
9  Bangladesh      Asia  2007  64.062 150448339 1391.2538  
10 Belgium      Europe  2007  79.441  10392226 33692.6051  
# ... with 132 more rows
```

# Filtering for one country

```
gapminder %>%  
  filter(country == "United States")
```

```
# A tibble: 12 x 6
```

	country	continent	year	lifeExp	pop	gdpPercap
	<fctr>	<fctr>	<int>	<dbl>	<dbl>	<dbl>
1	United States	Americas	1952	68.440	157553000	13990.48
2	United States	Americas	1957	69.490	171984000	14847.13
3	United States	Americas	1962	70.210	186538000	16173.15
4	United States	Americas	1967	70.760	198712000	19530.37
5	United States	Americas	1972	71.340	209896000	21806.04
6	United States	Americas	1977	73.380	220239000	24072.63
7	United States	Americas	1982	74.650	232187835	25009.56
8	United States	Americas	1987	75.020	242803533	29884.35
9	United States	Americas	1992	76.090	256894189	32003.93
10	United States	Americas	1997	76.810	272911760	35767.43
11	United States	Americas	2002	77.310	287675526	39097.10
12	United States	Americas	2007	78.242	301139947	42951.65



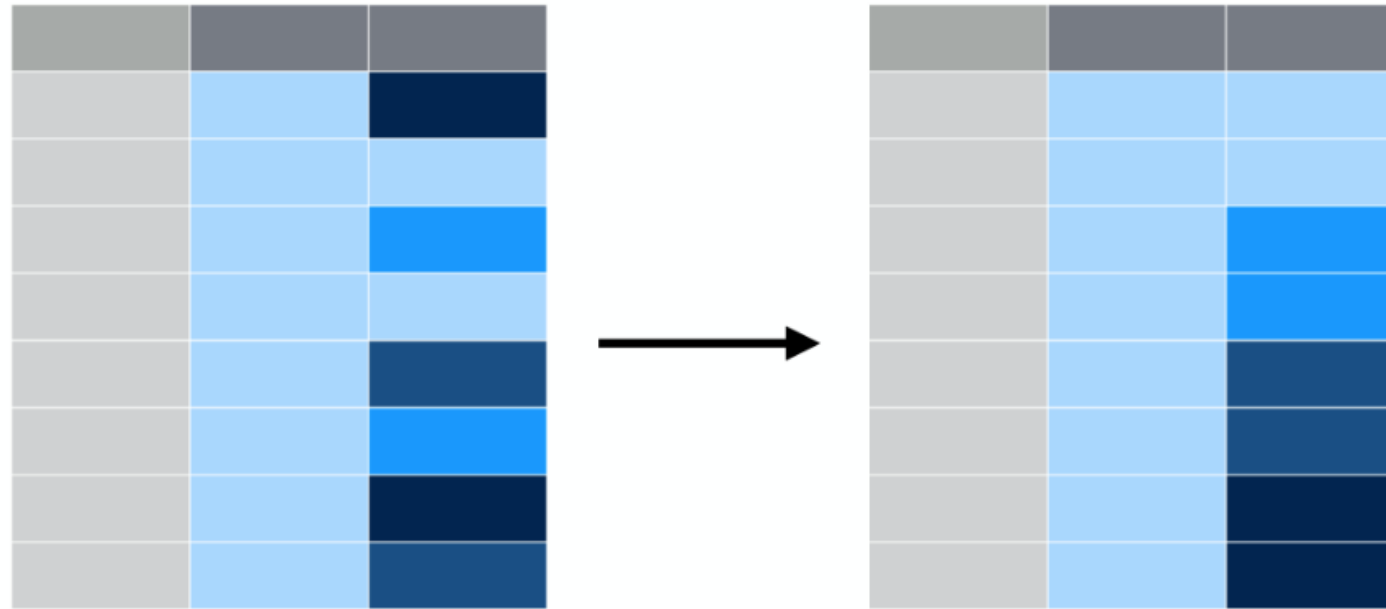
# Filtering for two variables

```
gapminder %>%  
  filter(year == 2007, country == "United States")
```

```
# A tibble: 1 x 6  
  country continent  year lifeExp      pop gdpPercap  
  <fctr>    <fctr> <int>   <dbl>    <dbl>    <dbl>  
1 United States Americas  2007  78.242 301139947 42951.65
```

# The arrange verb

`arrange()` sorts a  
table based on a  
variable



# Sorting with arrange

```
gapminder %>%  
  arrange(gdpPercap)
```

```
# A tibble: 1,704 x 6  
  country continent year lifeExp      pop gdpPercap  
  <fctr>    <fctr> <int>   <dbl>    <dbl>    <dbl>  
1 Congo, Dem. Rep. Africa  2002  44.966 55379852  241.1659  
2 Congo, Dem. Rep. Africa  2007  46.462 64606759  277.5519  
3 Lesotho      Africa  1952  42.138  748747   298.8462  
4 Guinea-Bissau Africa  1952  32.500  580653   299.8503  
5 Congo, Dem. Rep. Africa  1997  42.587 47798986  312.1884  
6 Eritrea      Africa  1952  35.928 1438760   328.9406  
7 Myanmar      Asia   1952  36.319 20092996  331.0000  
8 Lesotho      Africa  1957  45.047  813338   335.9971  
9 Burundi      Africa  1952  39.031 2445618   339.2965  
10 Eritrea      Africa  1957  38.047 1542611   344.1619  
# ... with 1,694 more rows
```

# Sorting in descending order

```
gapminder %>%  
  arrange(desc(gdpPercap))
```

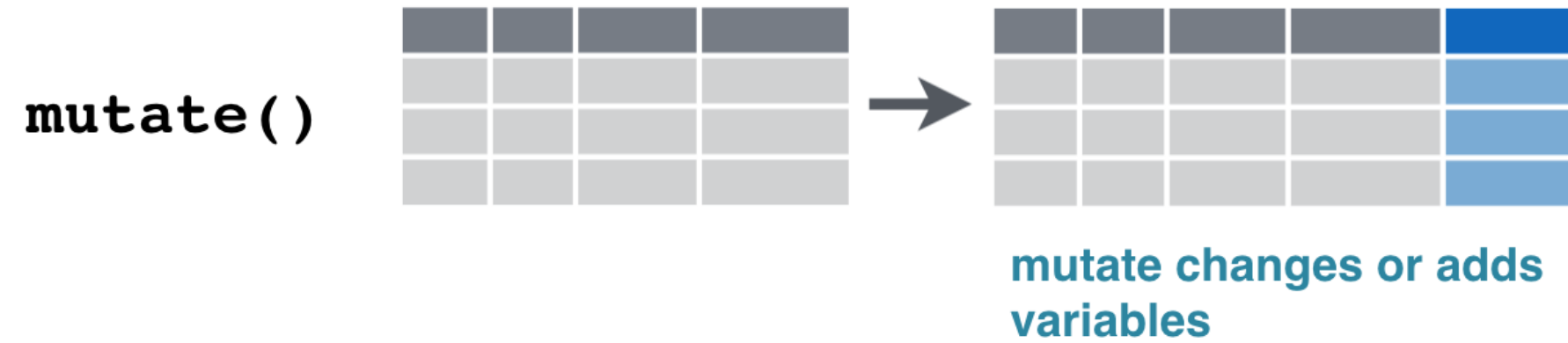
```
# A tibble: 1,704 x 6  
  country continent year lifeExp    pop gdpPercap  
  <fctr>    <fctr> <int>   <dbl> <dbl>    <dbl>  
1   Kuwait      Asia  1957  58.033 212846 113523.13  
2   Kuwait      Asia  1972  67.712 841934 109347.87  
3   Kuwait      Asia  1952  55.565 160000 108382.35  
4   Kuwait      Asia  1962  60.470 358266 95458.11  
5   Kuwait      Asia  1967  64.624 575003 80894.88  
6   Kuwait      Asia  1977  69.343 1140357 59265.48  
7   Norway      Europe 2007  80.196 4627926 49357.19  
8   Kuwait      Asia  2007  77.588 2505559 47306.99  
9 Singapore      Asia  2007  79.972 4553009 47143.18  
10  Norway      Europe 2002  79.050 4535591 44683.98  
# ... with 1,694 more rows
```

# Filtering then arranging

```
gapminder %>%  
  filter(year == 2007) %>%  
  arrange(desc(gdpPercap))
```

```
# A tibble: 142 x 6  
  country continent year lifeExp      pop gdpPercap  
  <fctr>    <fctr> <int>   <dbl>    <dbl>    <dbl>  
1    Norway    Europe  2007  80.196  4627926  49357.19  
2    Kuwait     Asia  2007  77.588  2505559  47306.99  
3   Singapore     Asia  2007  79.972  4553009  47143.18  
4 United States Americas  2007  78.242 301139947  42951.65  
5    Ireland    Europe  2007  78.885  4109086  40676.00  
6 Hong Kong, China Asia  2007  82.208  6980412  39724.98  
7   Switzerland Europe  2007  81.701  7554661  37506.42  
8   Netherlands Europe  2007  79.762 16570613  36797.93  
9    Canada    Americas  2007  80.653 33390141  36319.24  
10    Iceland    Europe  2007  81.757  301931  36180.79  
# ... with 132 more rows
```

# The mutate verb



# Using mutate to change a variable

```
gapminder %>%  
  mutate(pop = pop / 1000000)
```

```
# A tibble: 1,704 x 6  
  country continent  year lifeExp      pop gdpPercap  
  <fctr>    <fctr> <int>   <dbl>    <dbl>    <dbl>  
1 Afghanistan      Asia  1952  28.801  8.425333  779.4453  
2 Afghanistan      Asia  1957  30.332  9.240934  820.8530  
3 Afghanistan      Asia  1962  31.997 10.267083  853.1007  
4 Afghanistan      Asia  1967  34.020 11.537966  836.1971  
5 Afghanistan      Asia  1972  36.088 13.079460  739.9811  
6 Afghanistan      Asia  1977  38.438 14.880372  786.1134  
7 Afghanistan      Asia  1982  39.854 12.881816  978.0114  
8 Afghanistan      Asia  1987  40.822 13.867957  852.3959  
9 Afghanistan      Asia  1992  41.674 16.317921  649.3414  
10 Afghanistan     Asia  1997  41.763 22.227415  635.3414  
# ... with 1,694 more rows
```

# Using mutate to add a new variable

```
gapminder %>%  
  mutate(gdp = gdpPercap * pop)
```

```
# A tibble: 1,704 x 7  
  country continent year lifeExp      pop gdpPercap      gdp  
  <fctr>    <fctr> <int>   <dbl>   <dbl>    <dbl>    <dbl>  
1 Afghanistan      Asia  1952  28.801  8425333  779.4453 6567086330  
2 Afghanistan      Asia  1957  30.332  9240934  820.8530 7585448670  
3 Afghanistan      Asia  1962  31.997 10267083  853.1007 8758855797  
4 Afghanistan      Asia  1967  34.020 11537966  836.1971 9648014150  
5 Afghanistan      Asia  1972  36.088 13079460  739.9811 9678553274  
6 Afghanistan      Asia  1977  38.438 14880372  786.1134 11697659231  
7 Afghanistan      Asia  1982  39.854 12881816  978.0114 12598563401  
8 Afghanistan      Asia  1987  40.822 13867957  852.3959 11820990309  
9 Afghanistan      Asia  1992  41.674 16317921  649.3414 10595901589  
10 Afghanistan     Asia  1997  41.763 22227415  635.3414 14121995875  
# ... with 1,694 more rows
```



# Combining verbs

```
gapminder %>%  
  mutate(gdp = gdpPercap * pop) %>%  
  filter(year == 2007) %>%  
  arrange(desc(gdp))
```

```
# A tibble: 142 x 7  
  country continent year lifeExp      pop gdpPercap      gdp  
  <fctr>    <fctr> <int>   <dbl>    <dbl>    <dbl>    <dbl>  
1 United States Americas 2007  78.242 301139947 42951.653 1.293446e+13  
2 China      Asia    2007  72.961 1318683096 4959.115 6.539501e+12  
3 Japan      Asia    2007  82.603 127467972 31656.068 4.035135e+12  
4 India      Asia    2007  64.698 1110396331 2452.210 2.722925e+12  
5 Germany    Europe 2007  79.406 82400996 32170.374 2.650871e+12  
6 United Kingdom Europe 2007  79.425 60776238 33203.261 2.017969e+12  
7 France     Europe 2007  80.657 61083916 30470.017 1.861228e+12  
8 Brazil     Americas 2007  72.390 190010647 9065.801 1.722599e+12  
9 Italy      Europe 2007  80.546 58147733 28569.720 1.661264e+12  
10 Mexico    Americas 2007  76.195 108700891 11977.575 1.301973e+12  
# ... with 132 more rows
```