Data representation

Lecture 2

IFT6758, Fall 2020; Reading: IDS - Chapters 8, 9, 10

Extracting information from data

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"The greatest value of a picture is when it forces us to notice what we never expected to see."

PART-1: Visualizing data distributions

Types of variables

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  - **Numerical**: Height (continuous), Price (continuous), Population sizes (discrete)..
  - Discrete numeric data can be considered ordinal.
    - **Conventionally**, ordinal for variables belonging to a small number of different groups, with each group having many members: e.g.: the number of packs of cigarettes a person smokes a day, rounded to the closest pack
    - Discrete numerical for many groups with few cases in each group: the actual number of cigarettes in each pack

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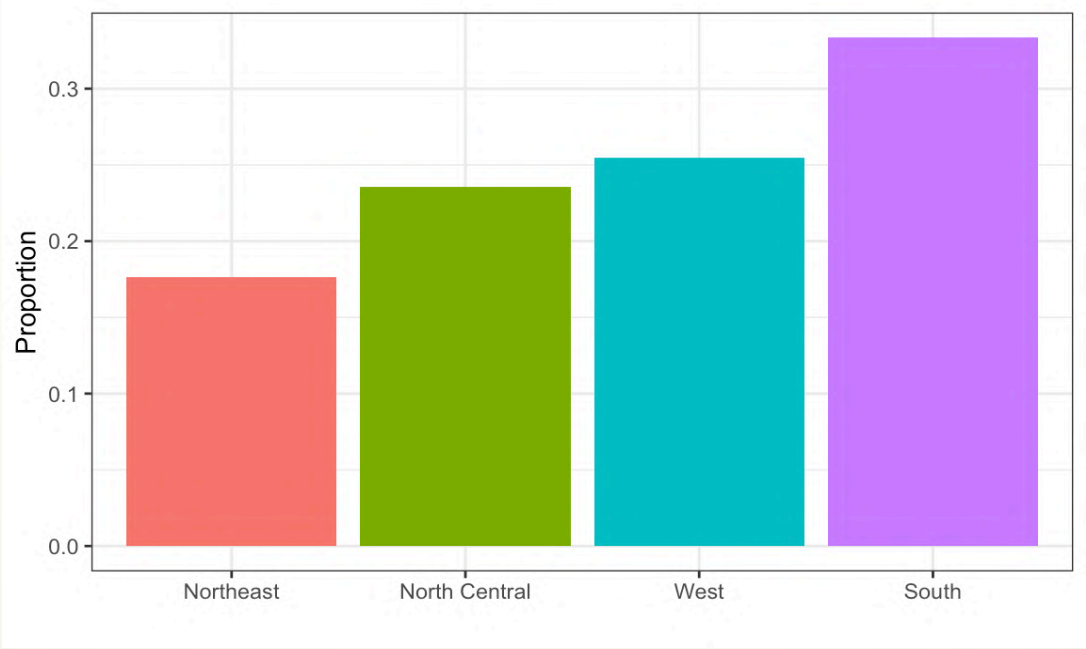

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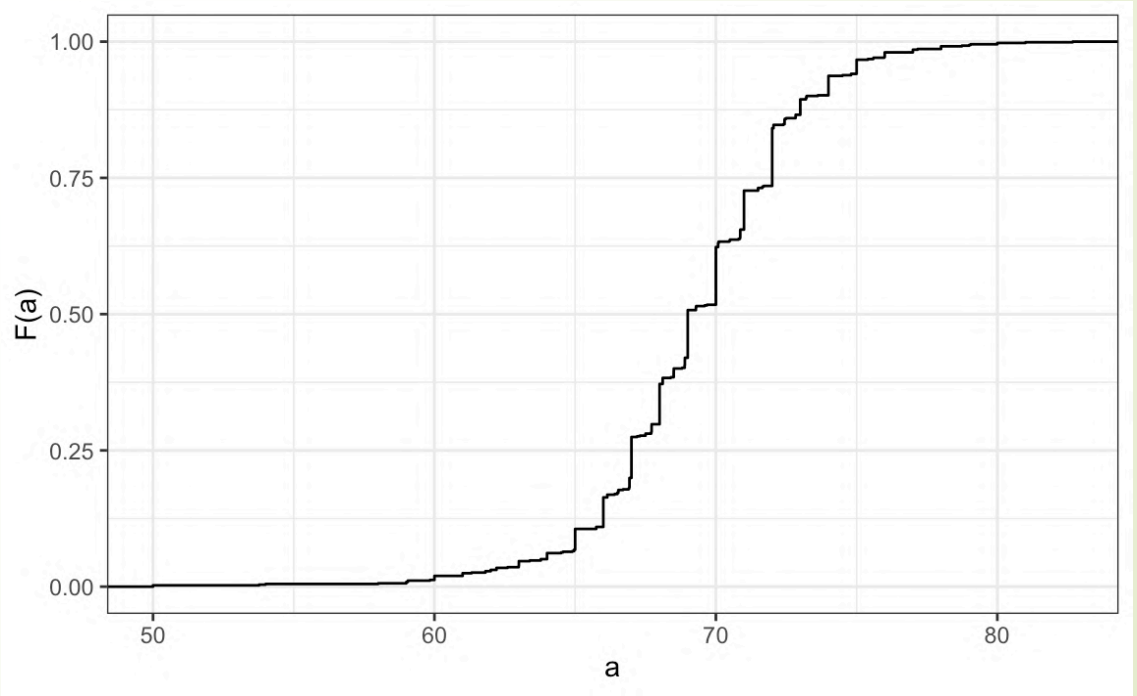
Male height data



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- Numerical variable: **cumulative distribution** is an effective summary
- In statistics, the following notation is used: $\boldsymbol{F(a) = \Pr(x \leq a)}$
- $\boldsymbol{F(66) = 0.164, F(72) = 0.841}$
- **Does not answer:**
  - At what value is the distribution centered?
  - Is the distribution symmetric?
  - What ranges contain 95% of the values?

Histograms

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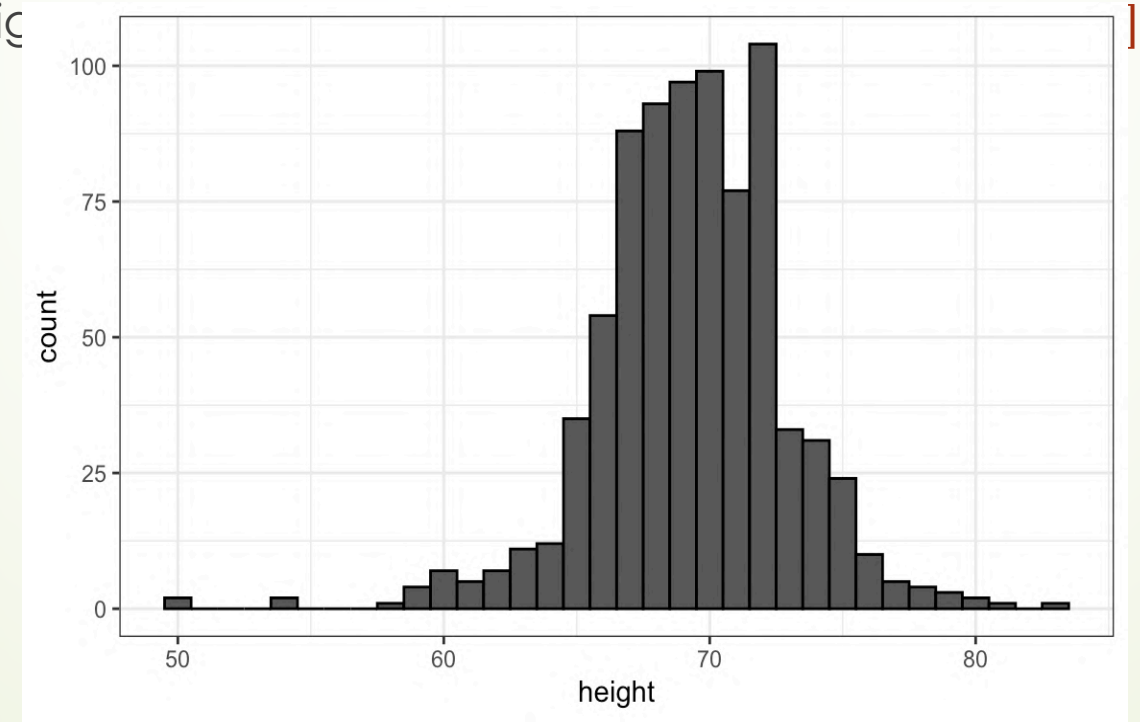
Histograms

- Divide the span of o*u9.5, 50.5 , 50.5, 51.5 , ..., (82.5, 83.5]*
- o non-overlapping **bins** of the same size
- For each bin, we count the number of values that fall in that interval
- Heig]



From histogram to smooth density

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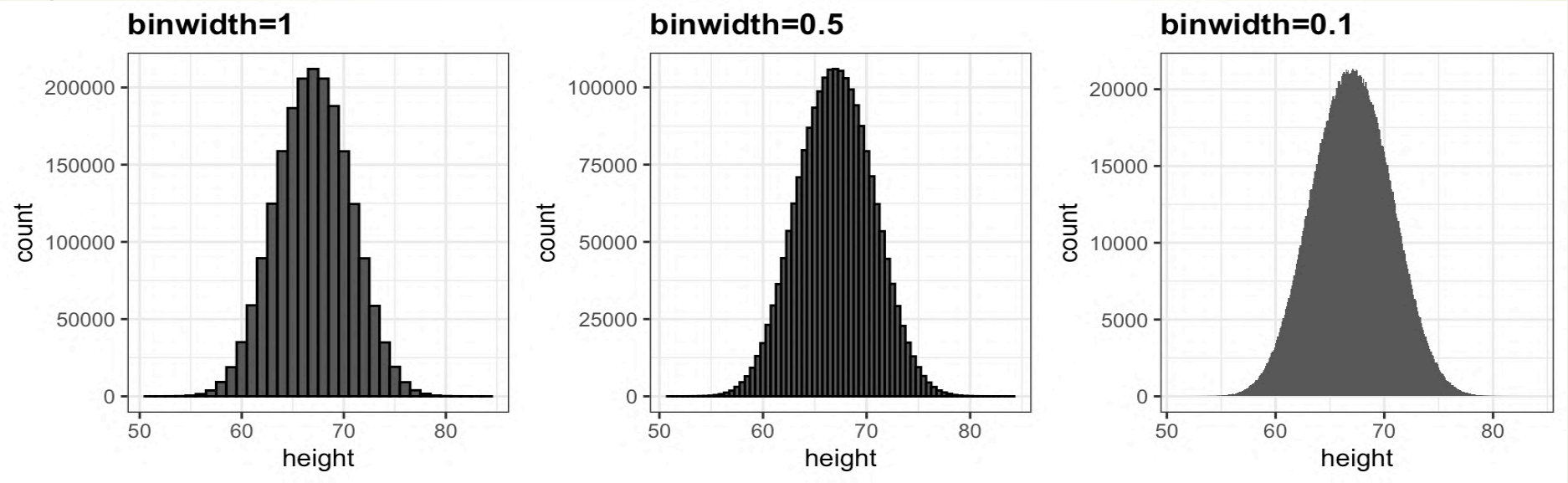
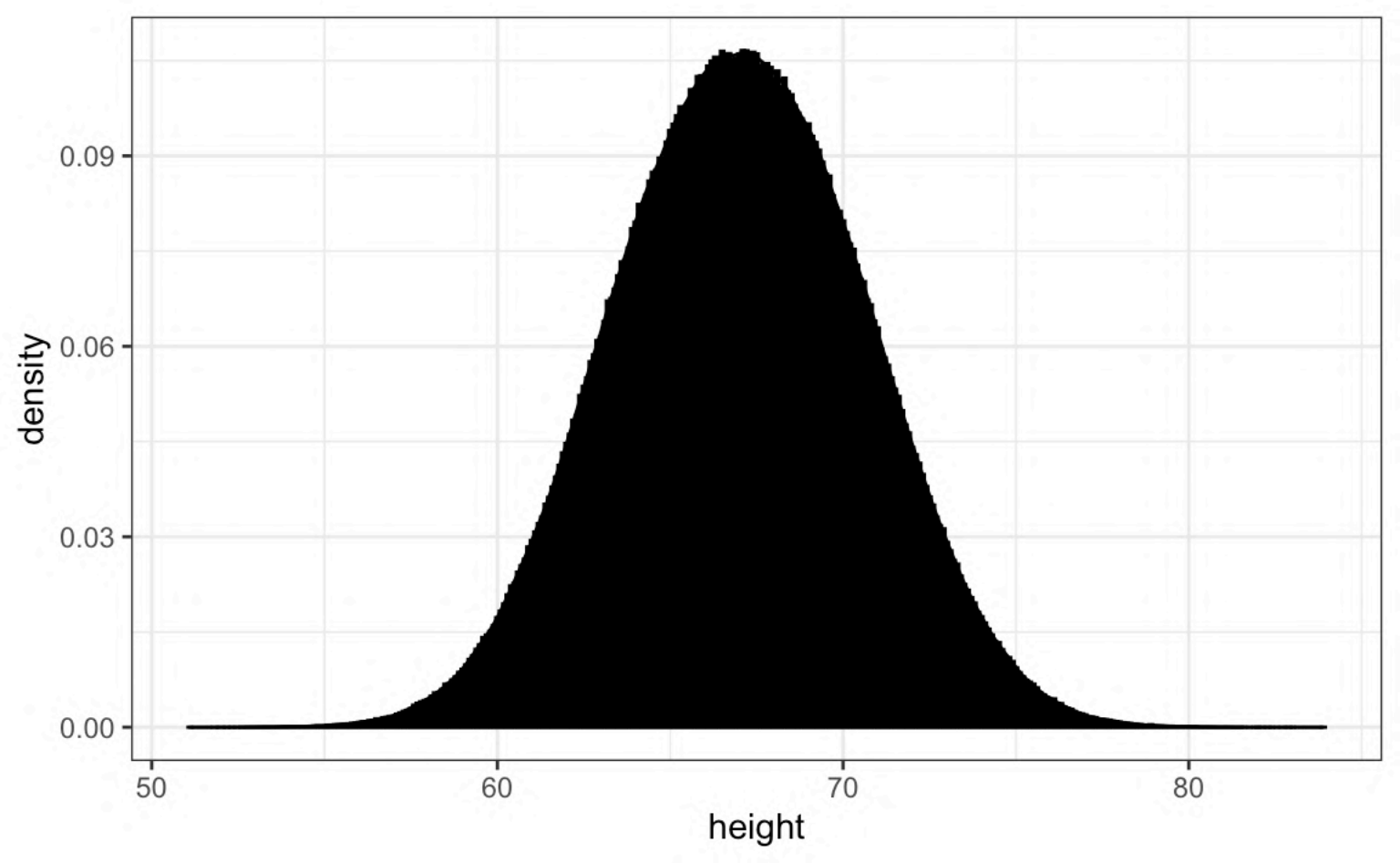
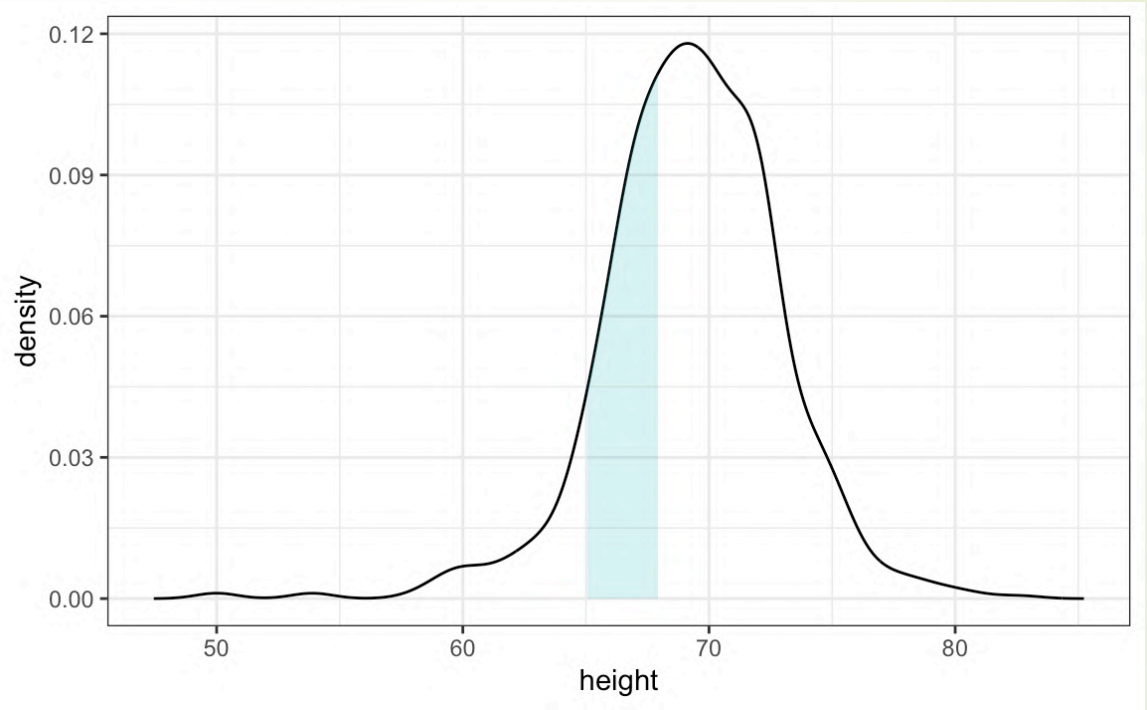


From histogram to smooth density

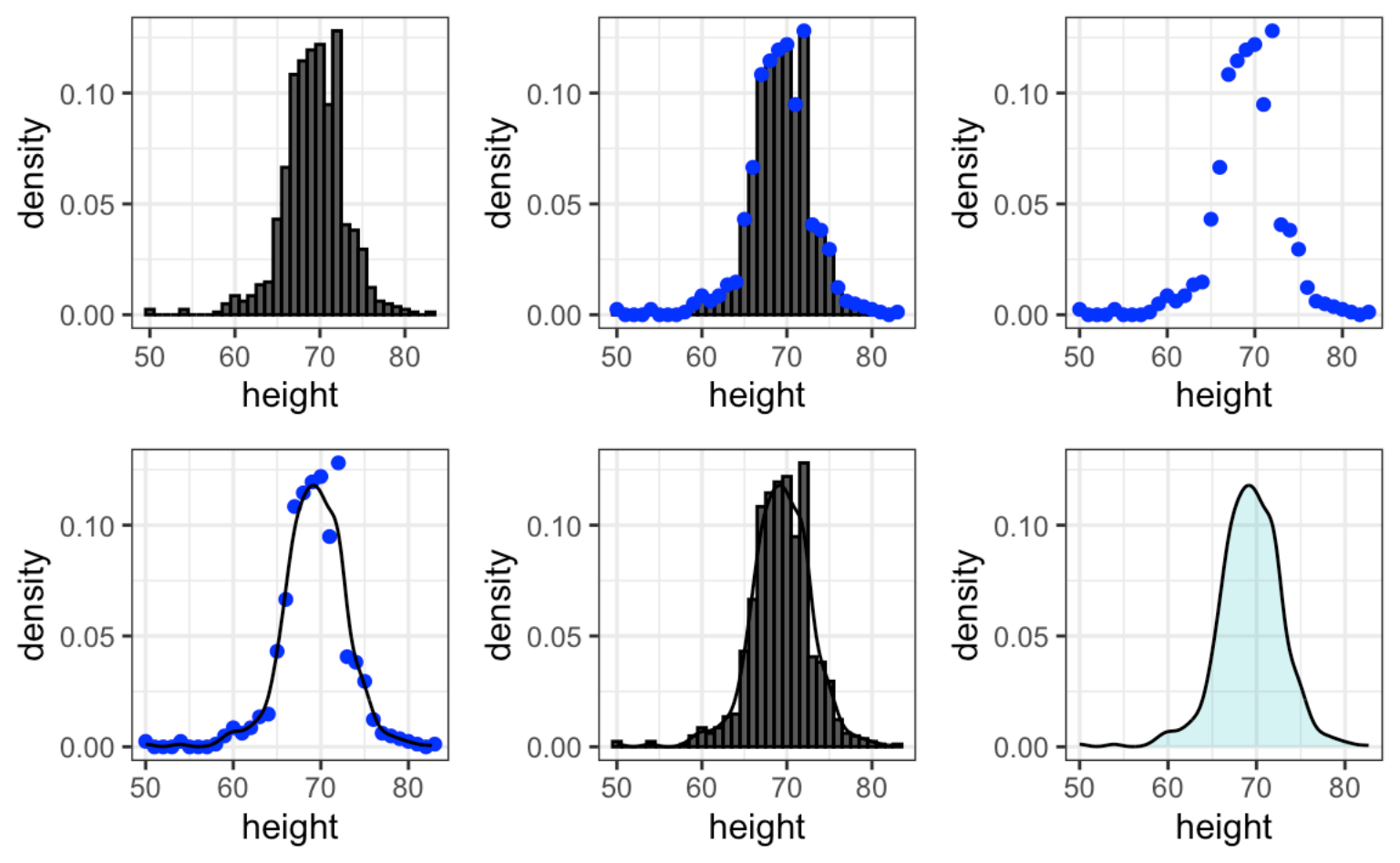


What is density?

- Proportion of values between 65 and 68
- **The proportion of this area** is about **0.3**, meaning that about **30%** of male heights are **between 65 and 68 inches.**

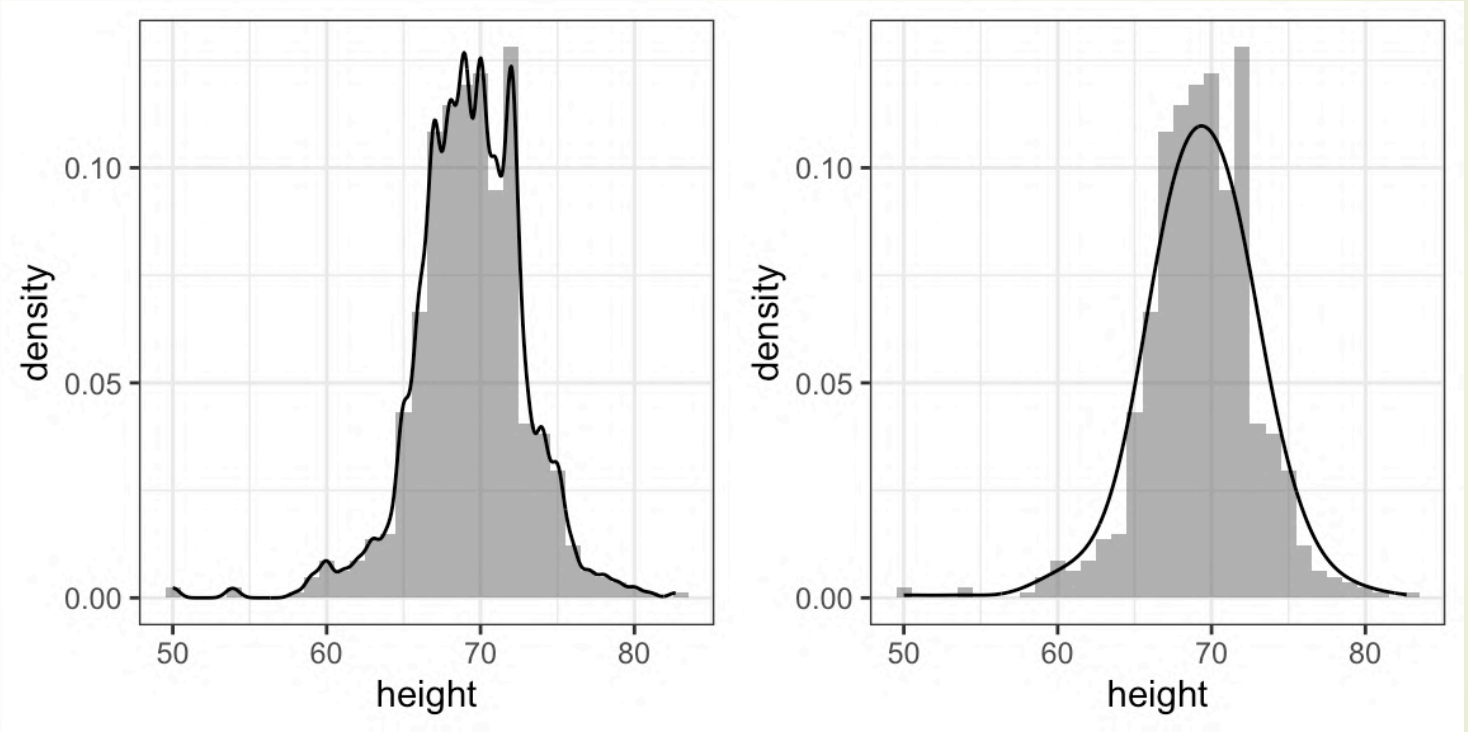


The transition to smoother density



Smoothness is relative

- Kernel Density Estimator
- Scipy, Scikit-Learn
- Smoothness varies with **Bandwidth**



Boxplots

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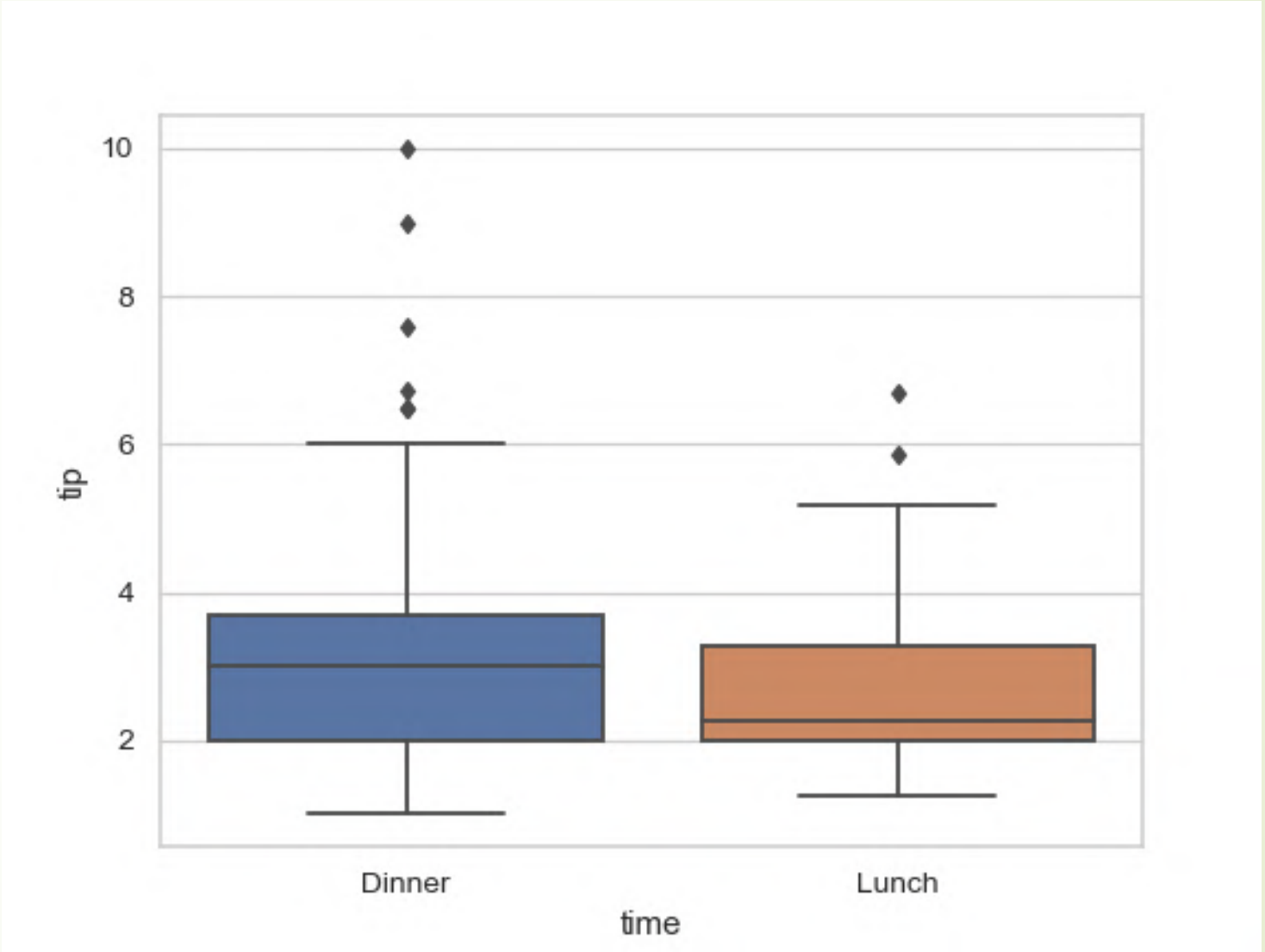
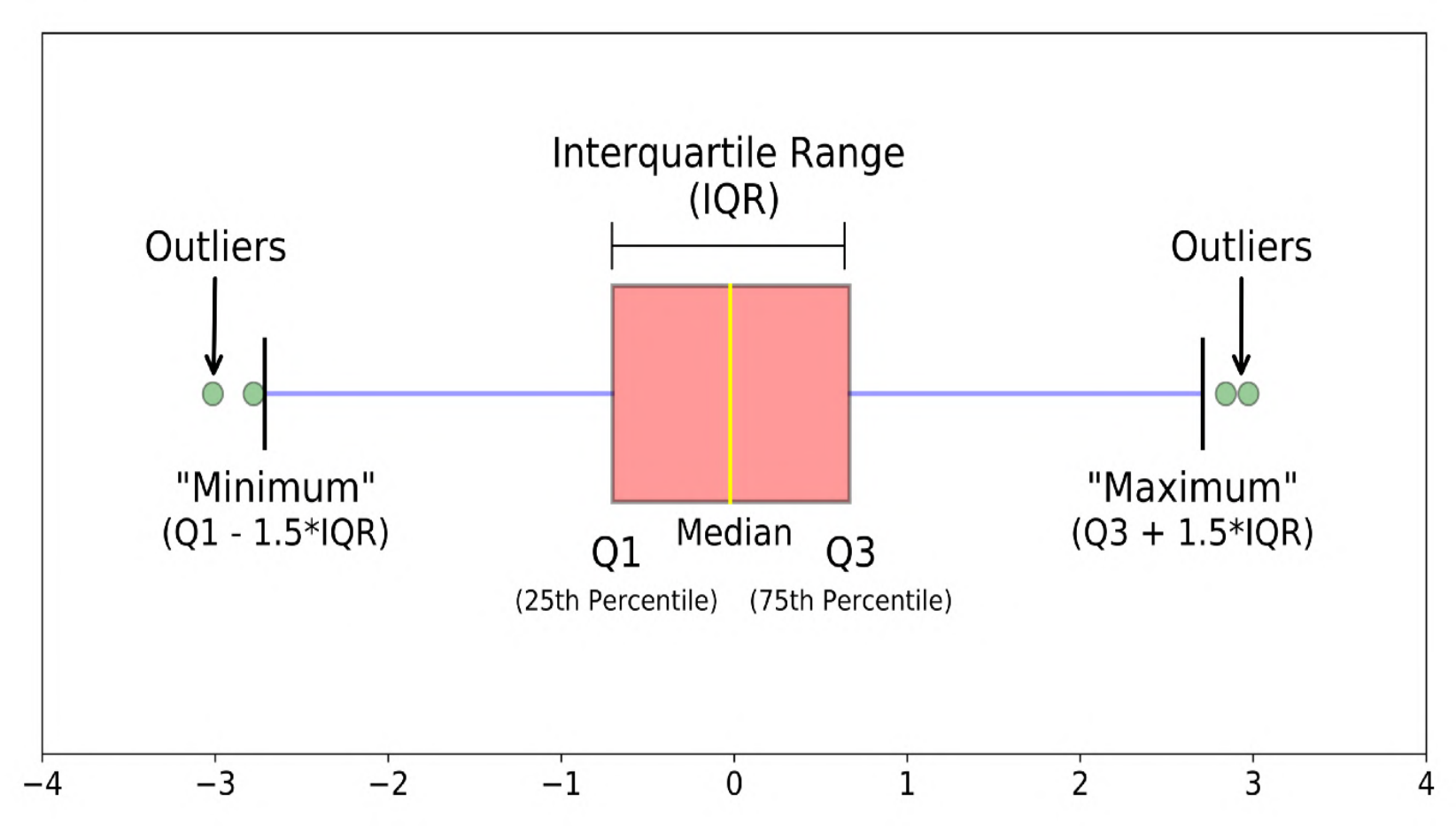
- Matplotlib, Seaborn



Boxplots

- Matplotlib, Seaborn
- Helps detecting outliers



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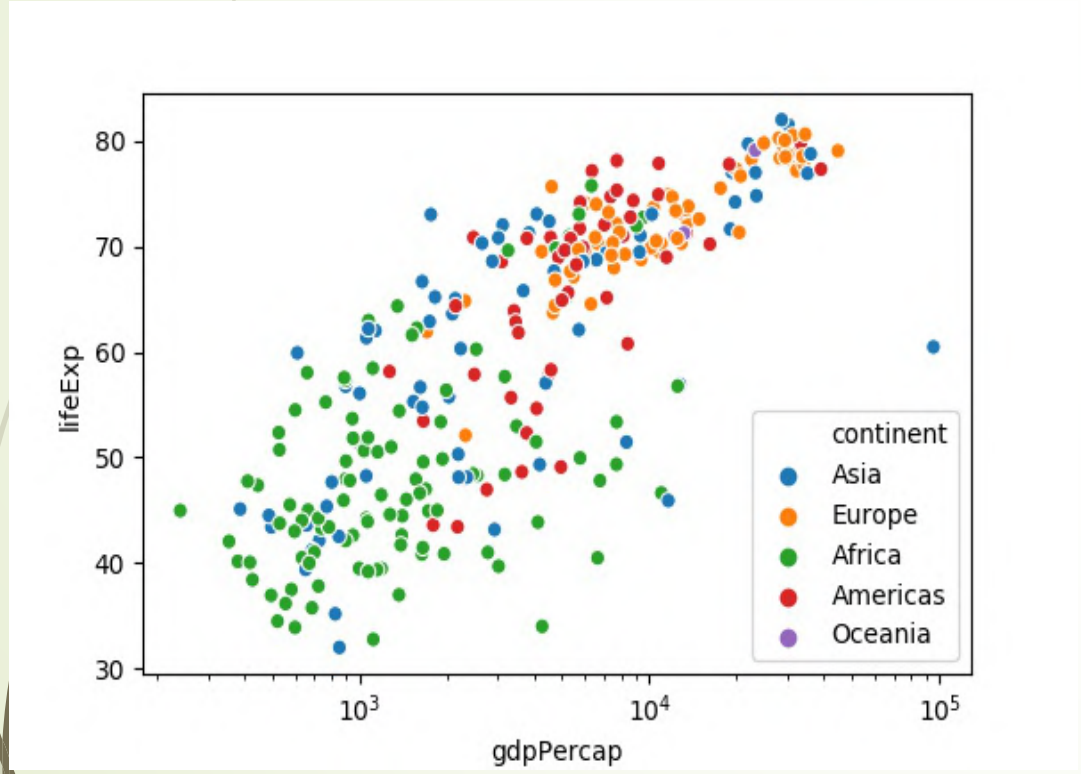

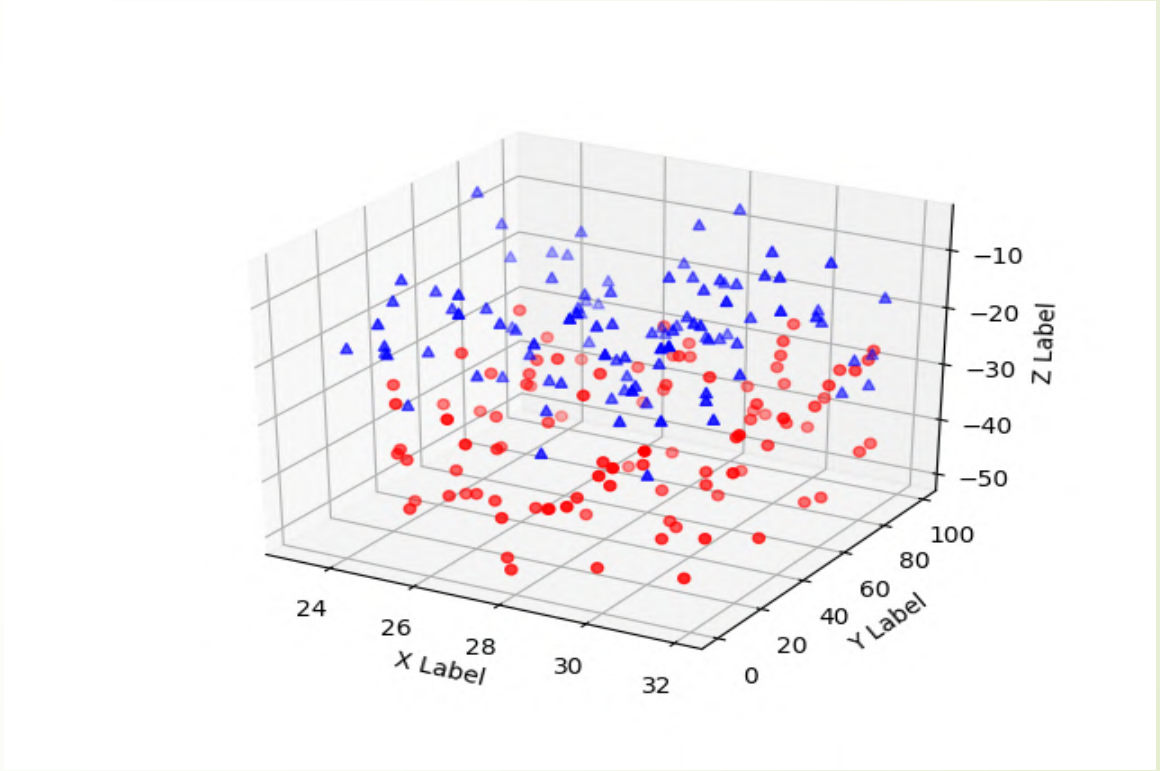

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- **E.g. Scatterplot**
  - **Matplotlib, Seaborn**

PART-2: Data visualization in practice

An example: Gapminder data

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- Independent Swedish foundation with huge **global datasets** based on reliable statistics; develops data visualization tools; Gapminder homepage

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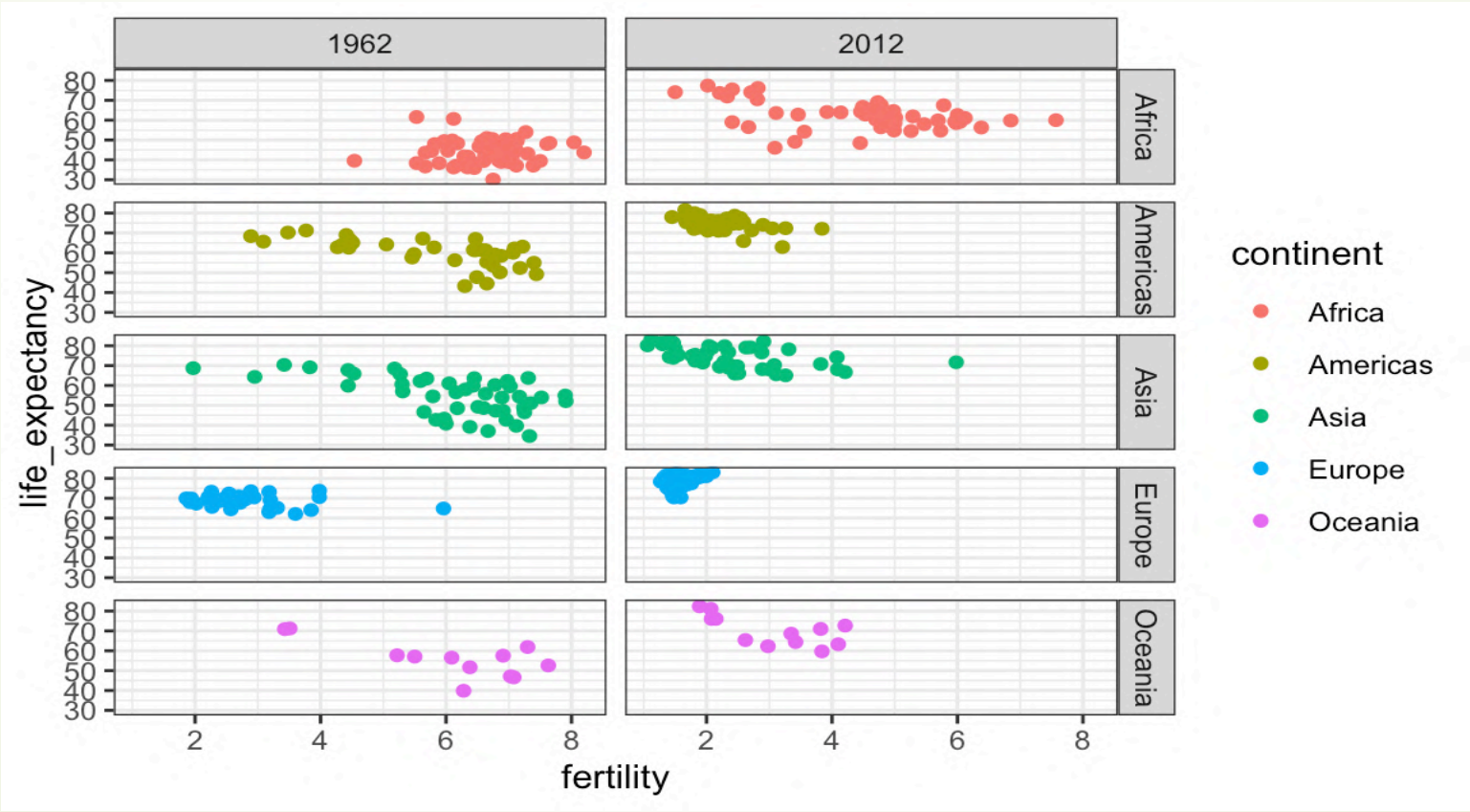

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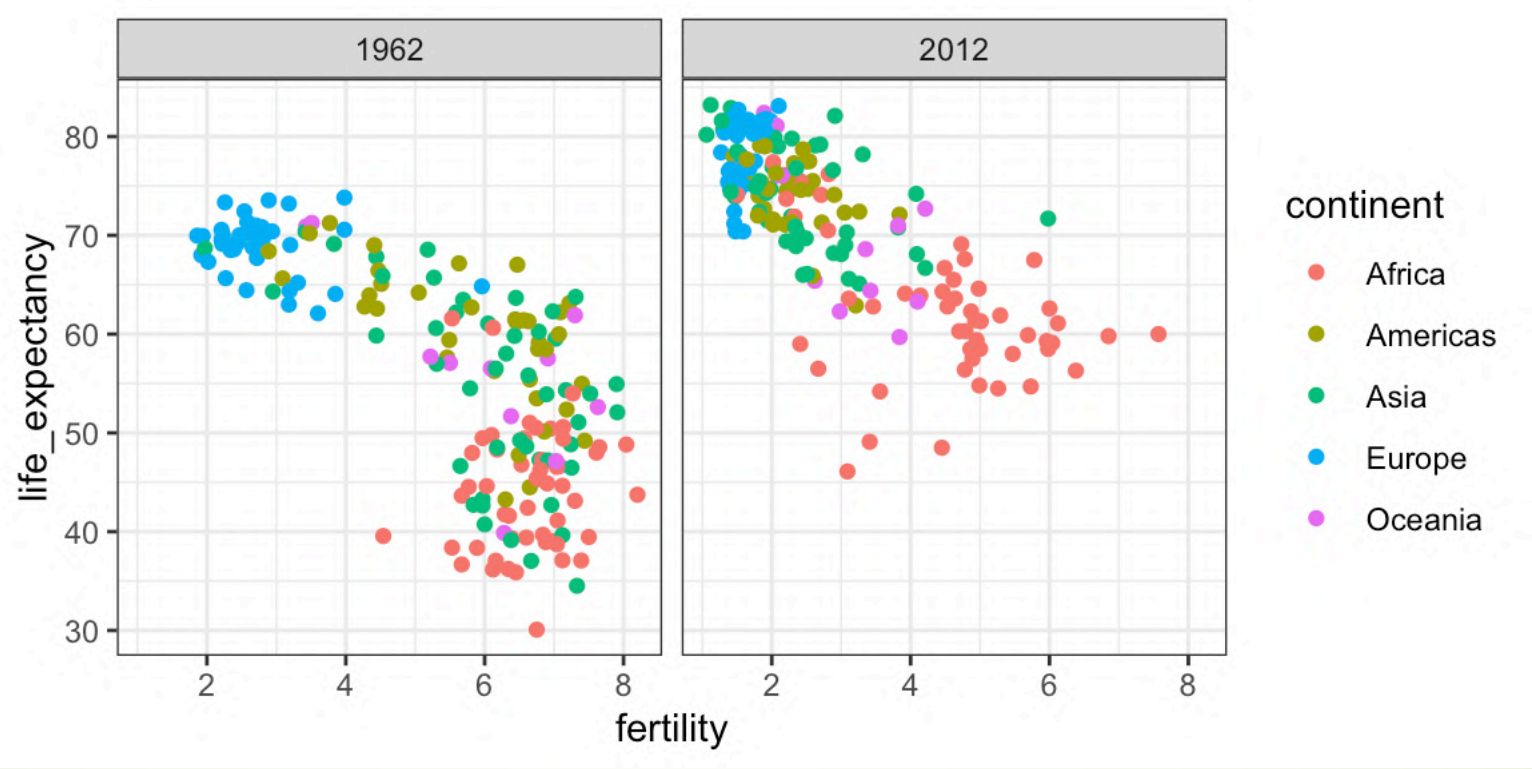

Time series plots

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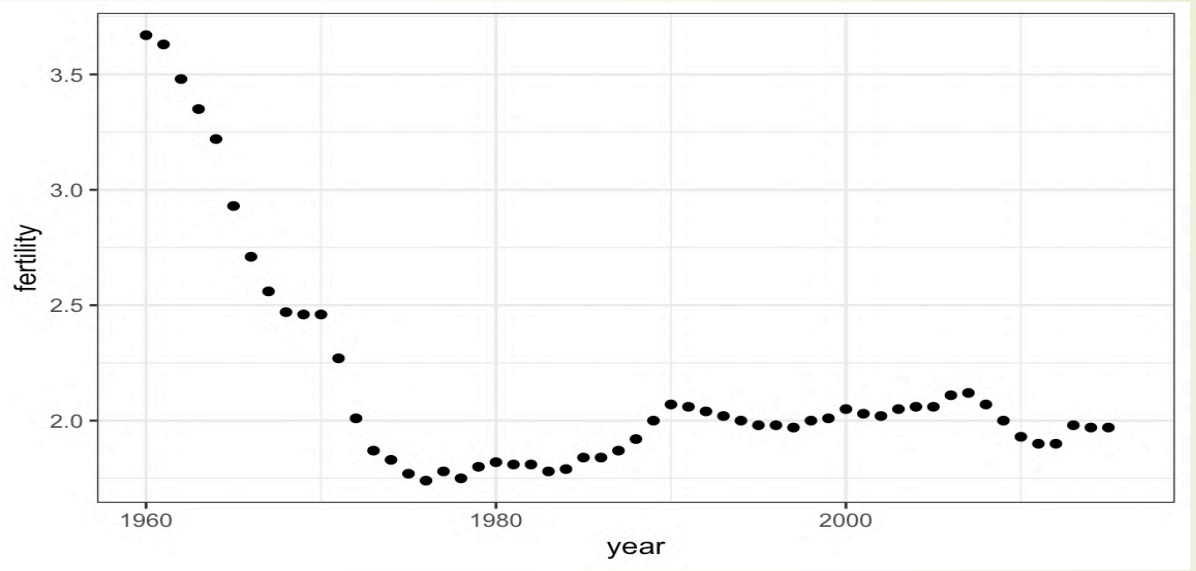
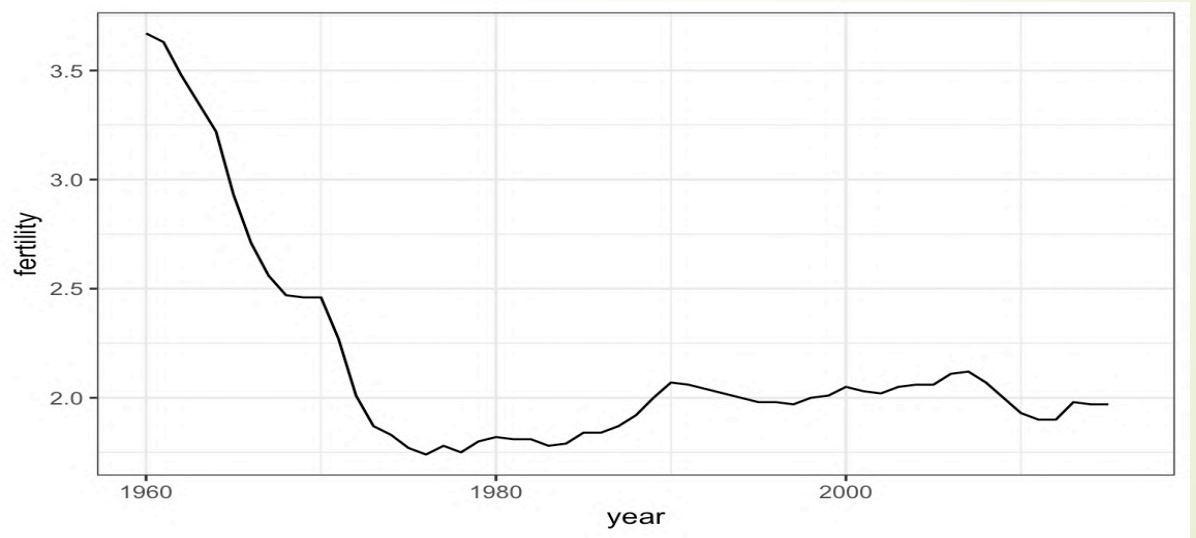
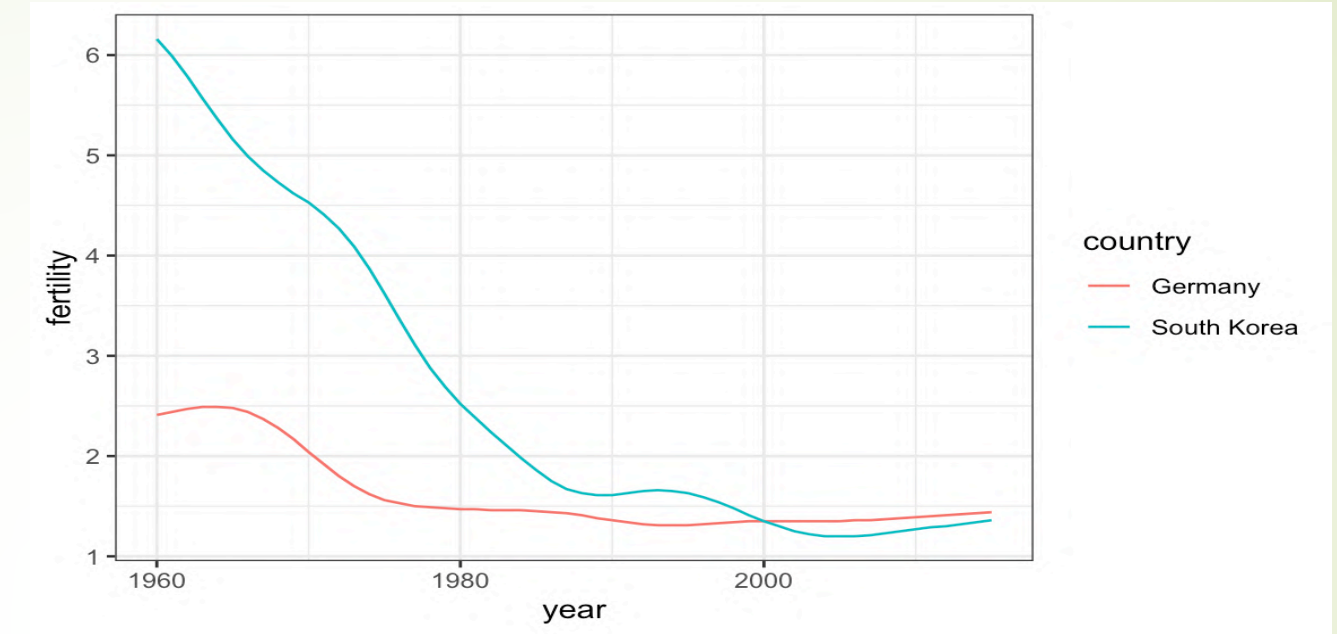
- Use different line styles

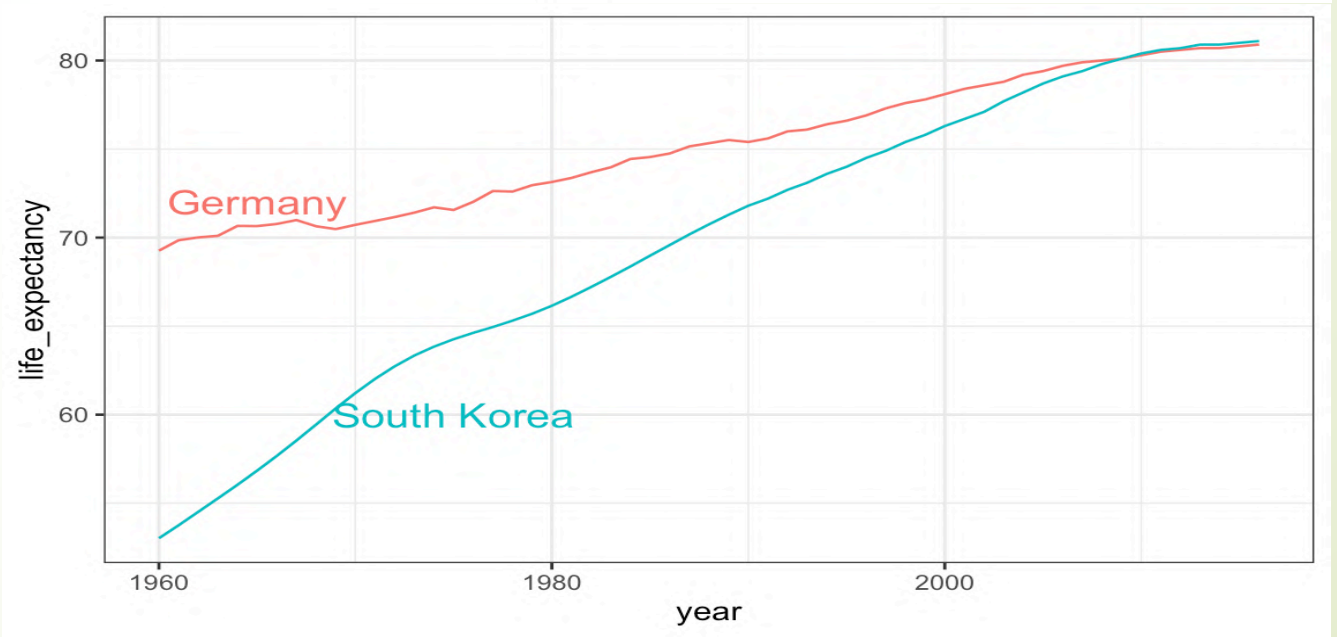




Time series plots

- Use different line styles
- Use colors and legends





PART-3: Data transformation

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- Example: Histogram of US per-day income in 1970

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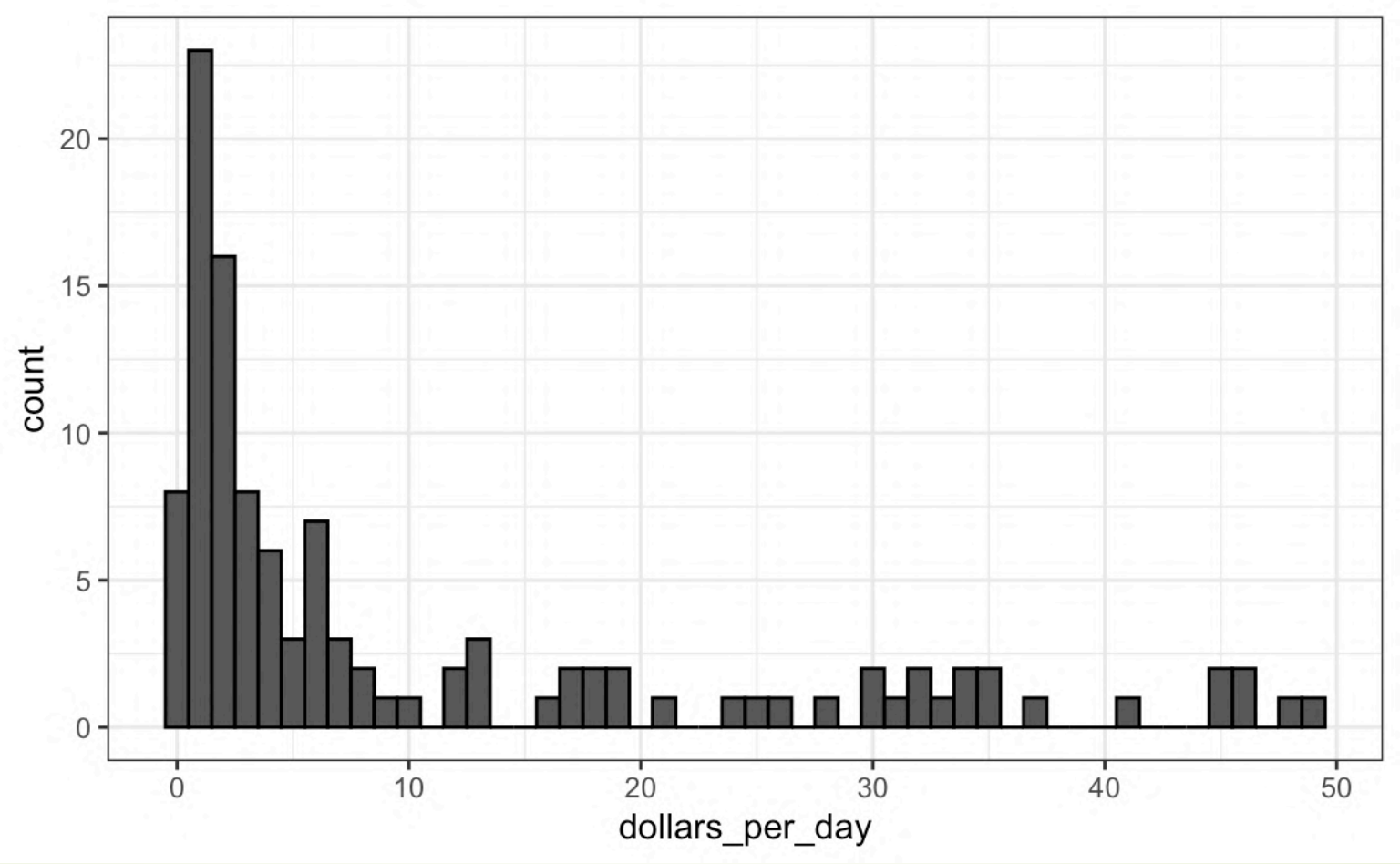

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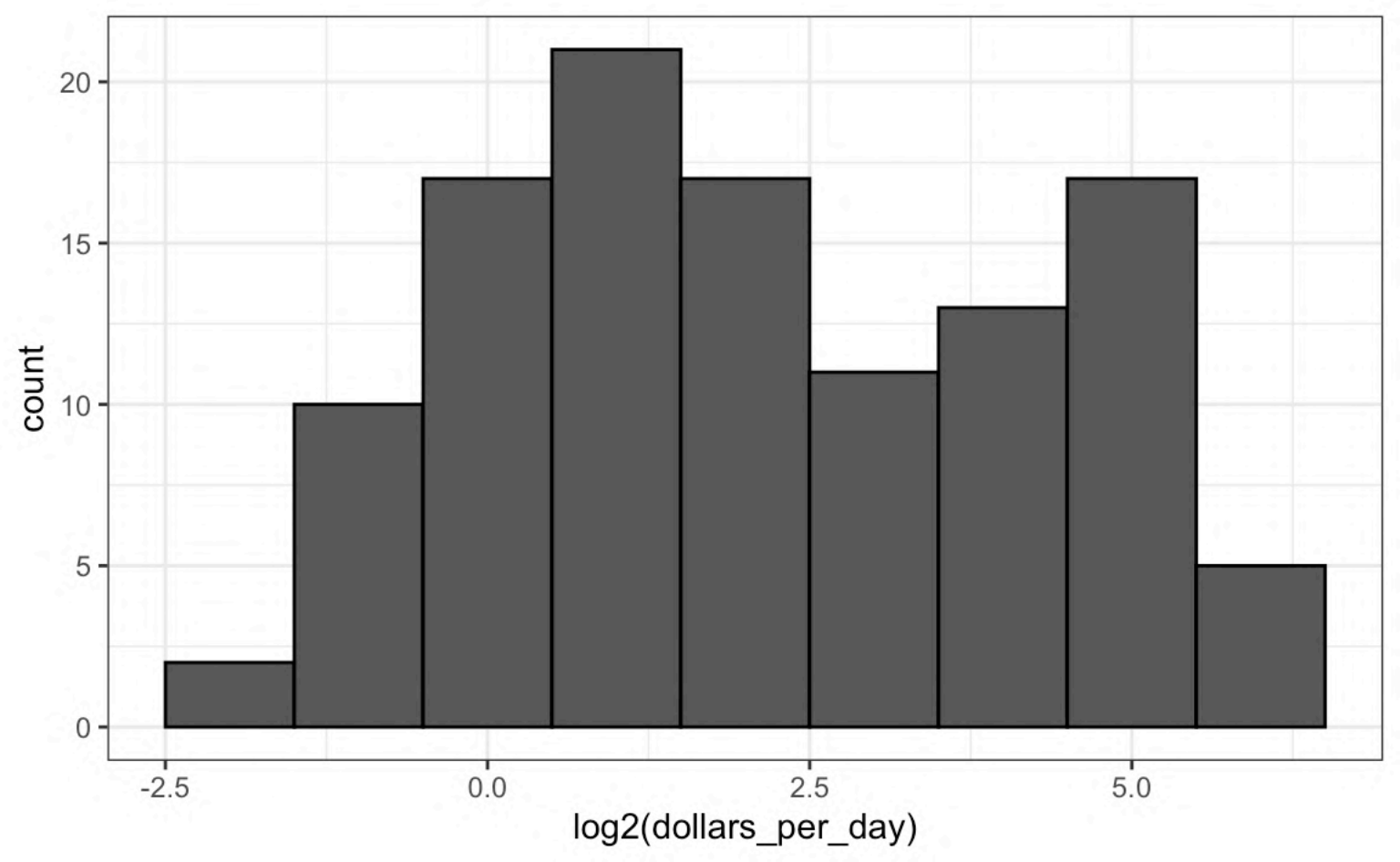

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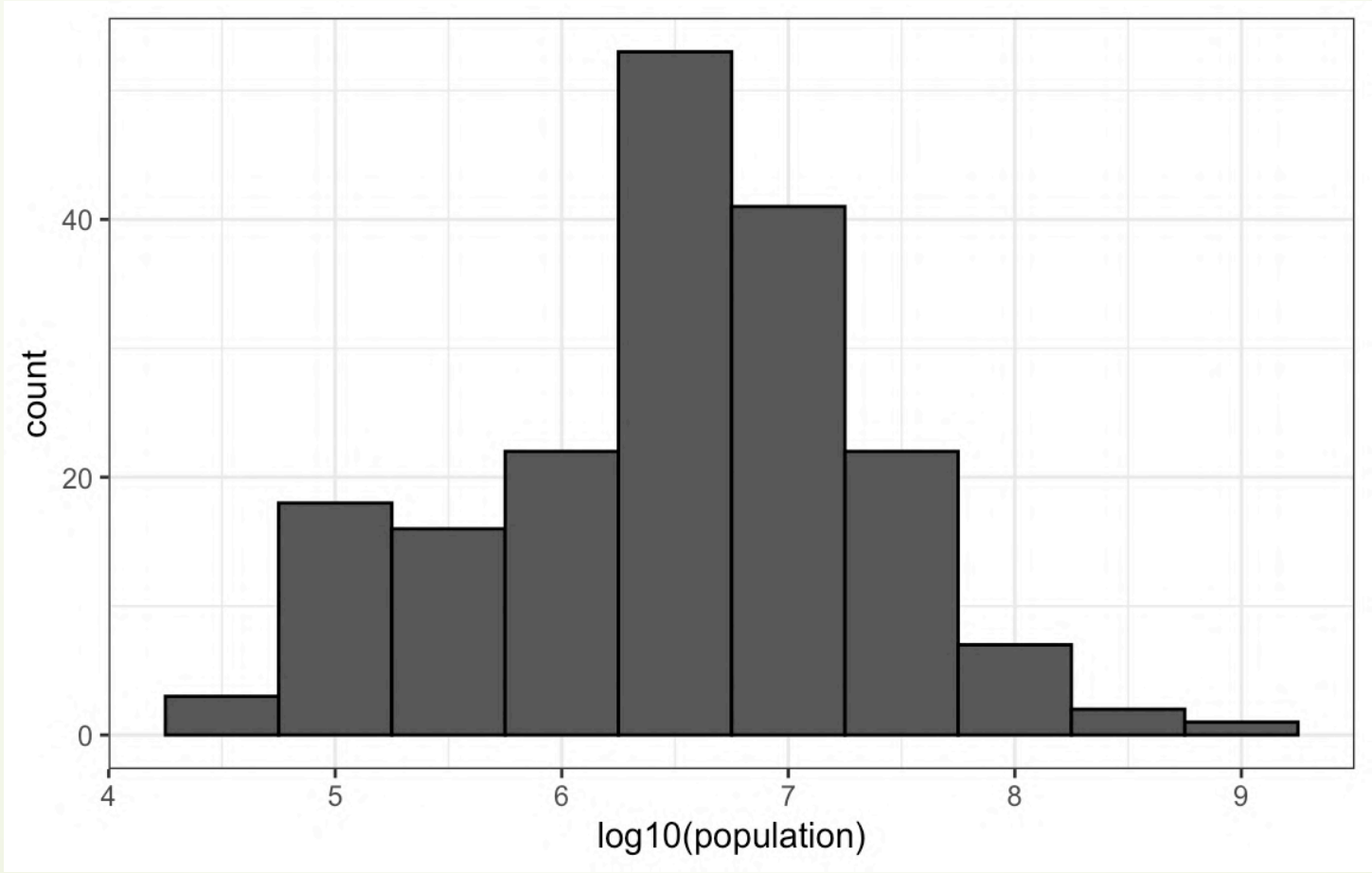
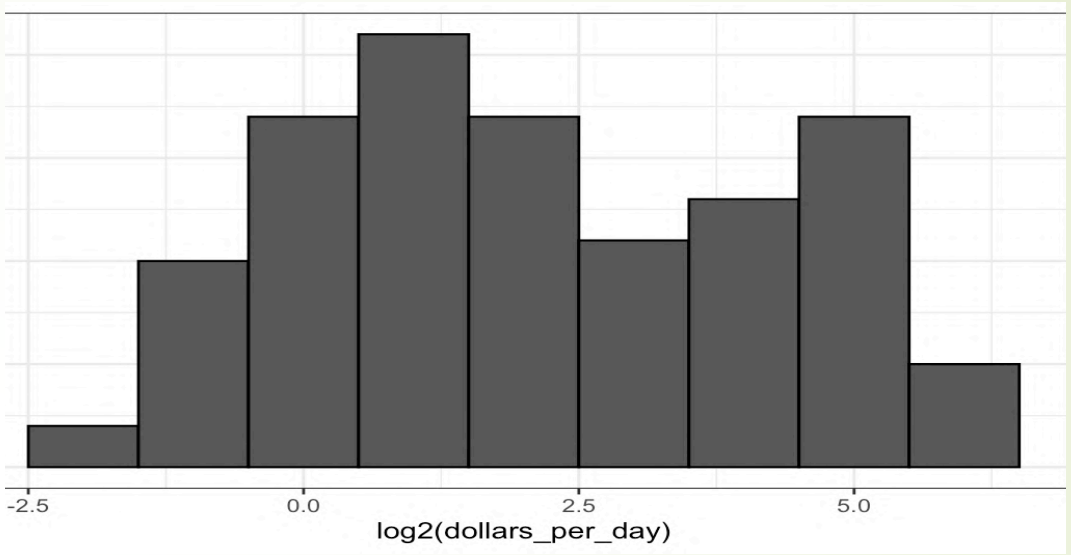
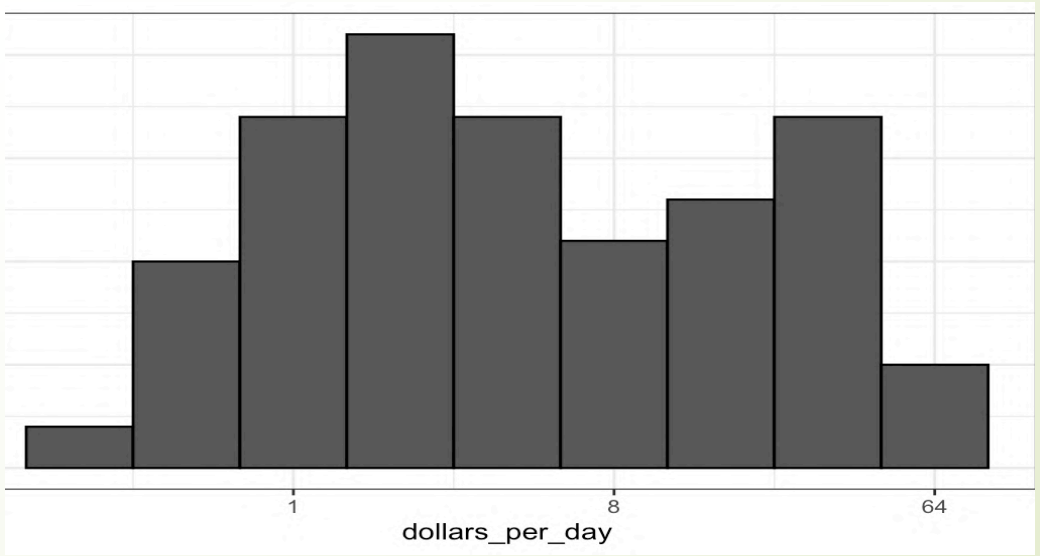


Transform value or scale?

- Transforming scale sometimes provides better interpretation





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PART-4: Principles of Data Visualization

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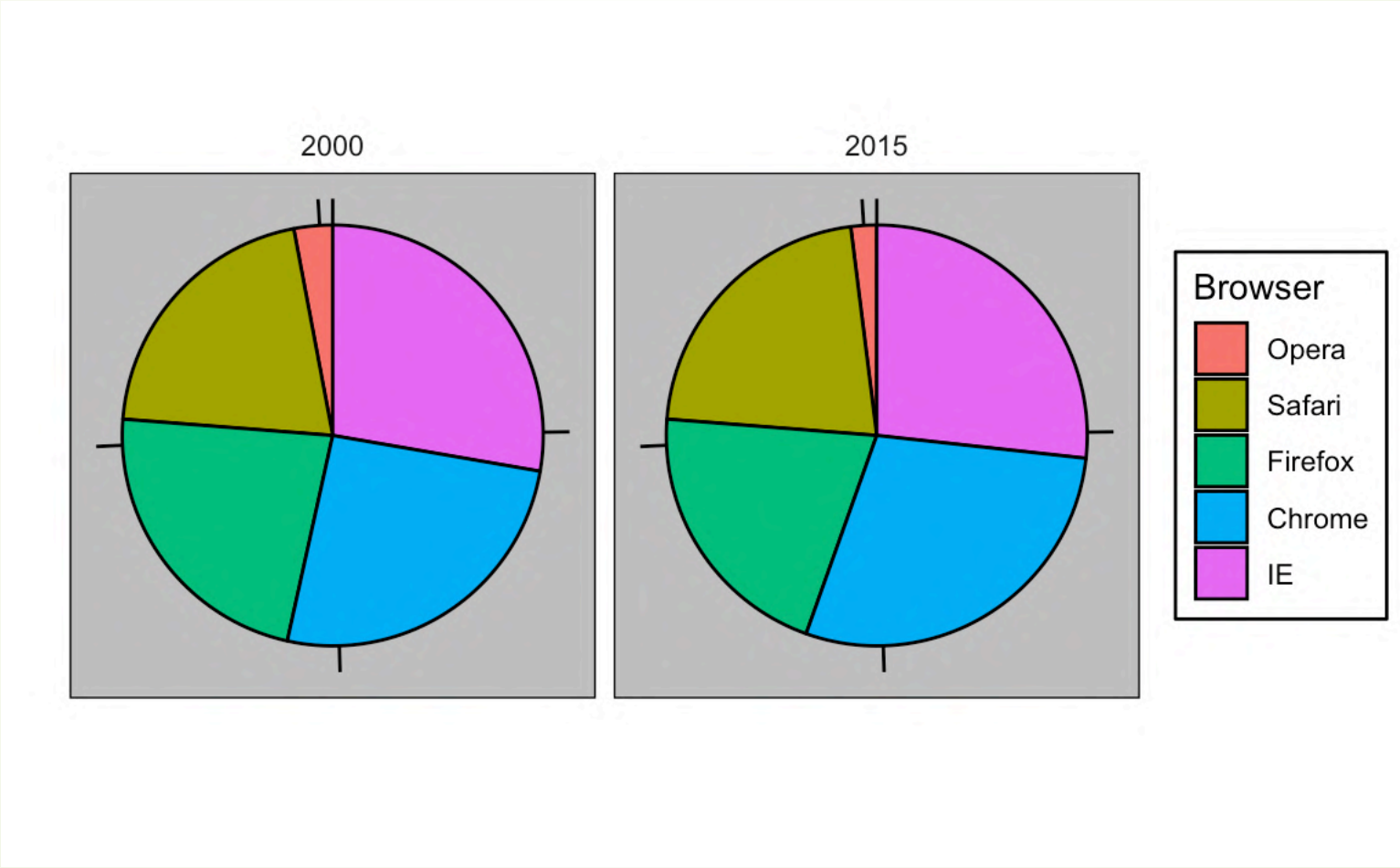

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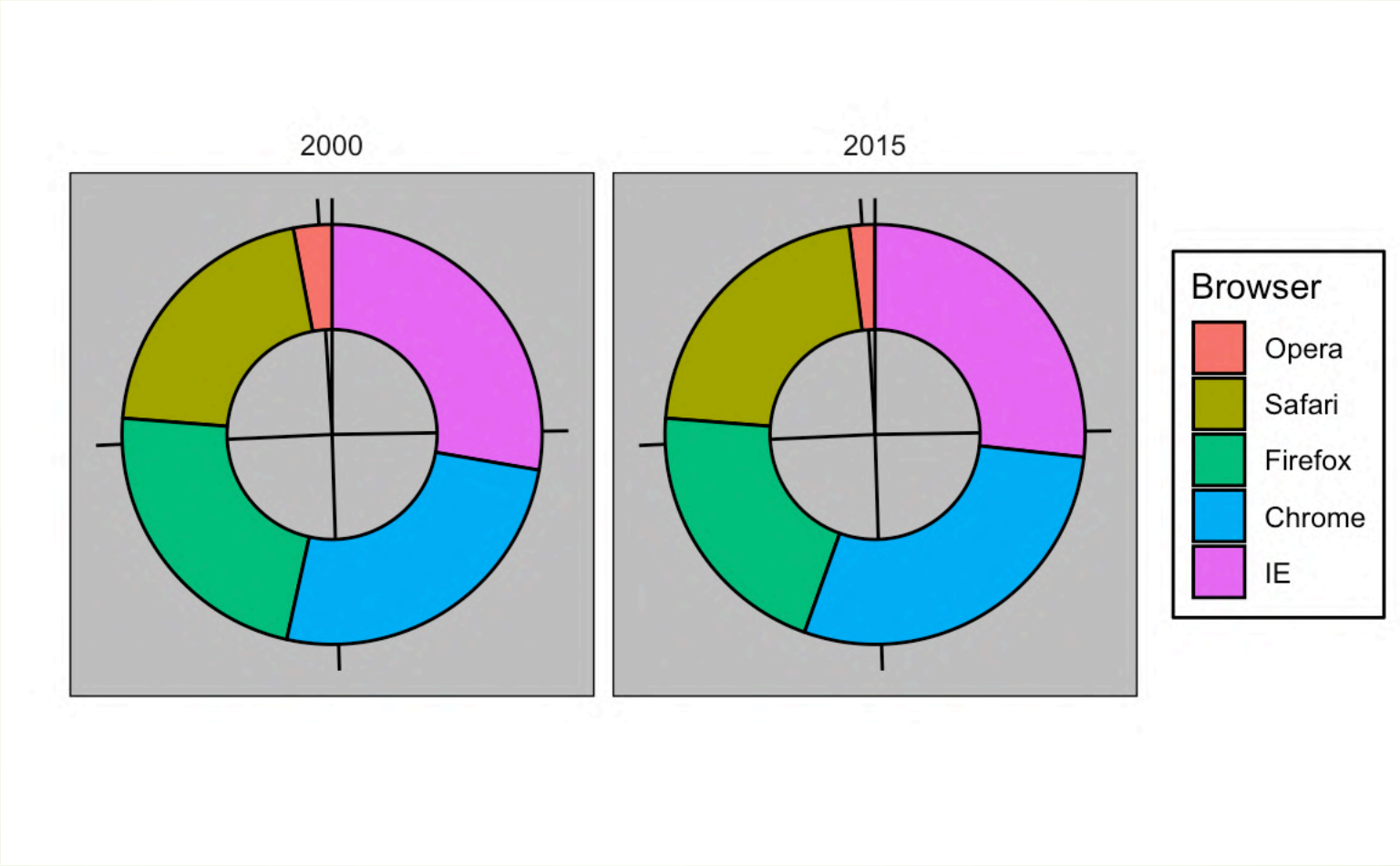

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Browser	2000	2015
Opera	3	2
Safari	21	22
Firefox	23	21
Chrome	26	29
IE	28	27

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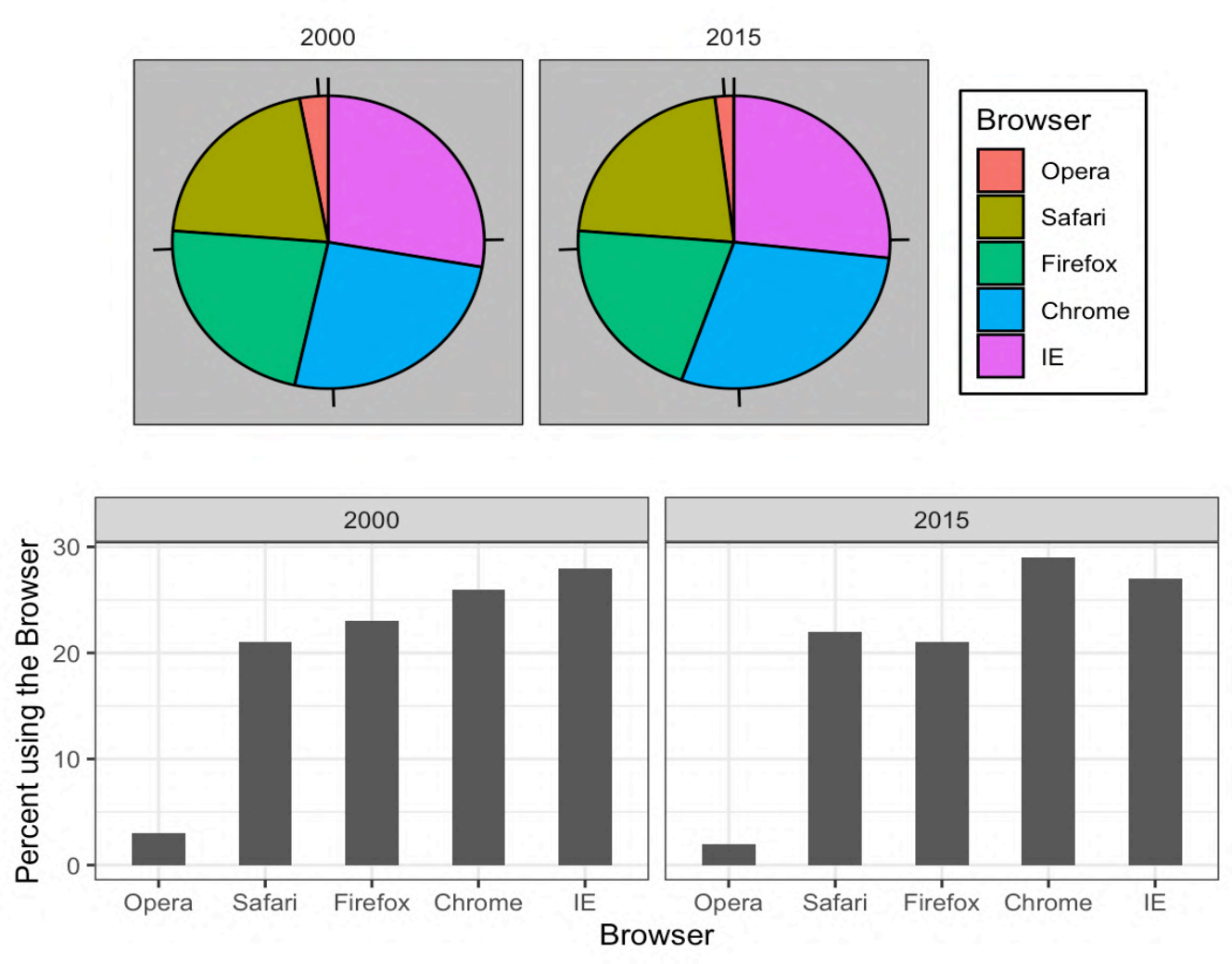

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Important to include when **comparison is made based on length**

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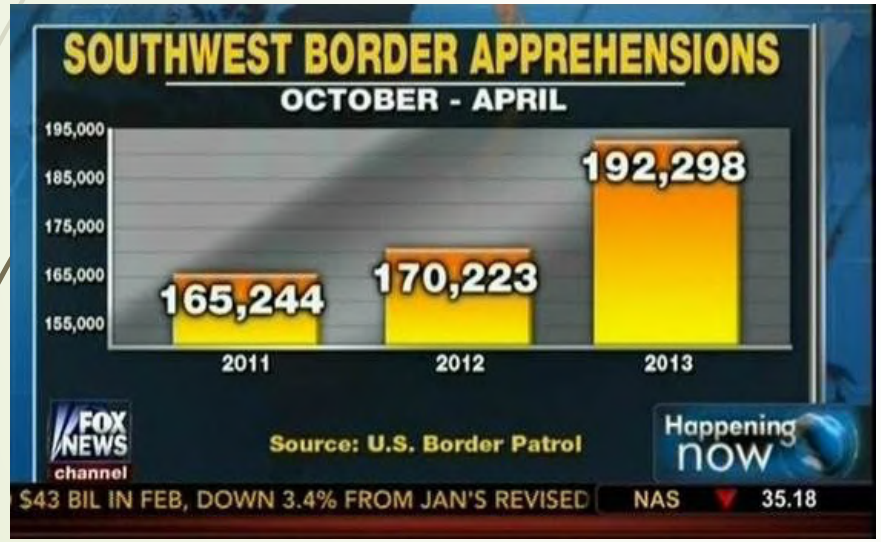
(Source: Fox News, via Media Matters)



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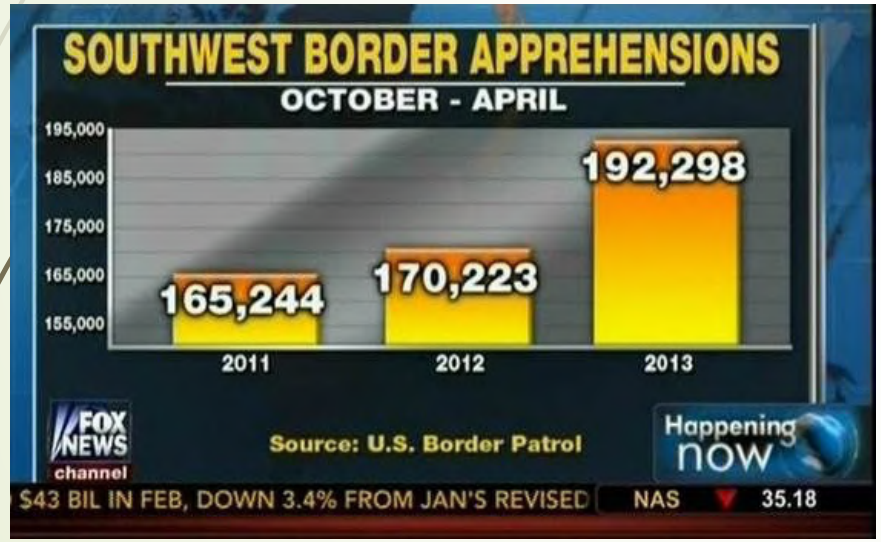

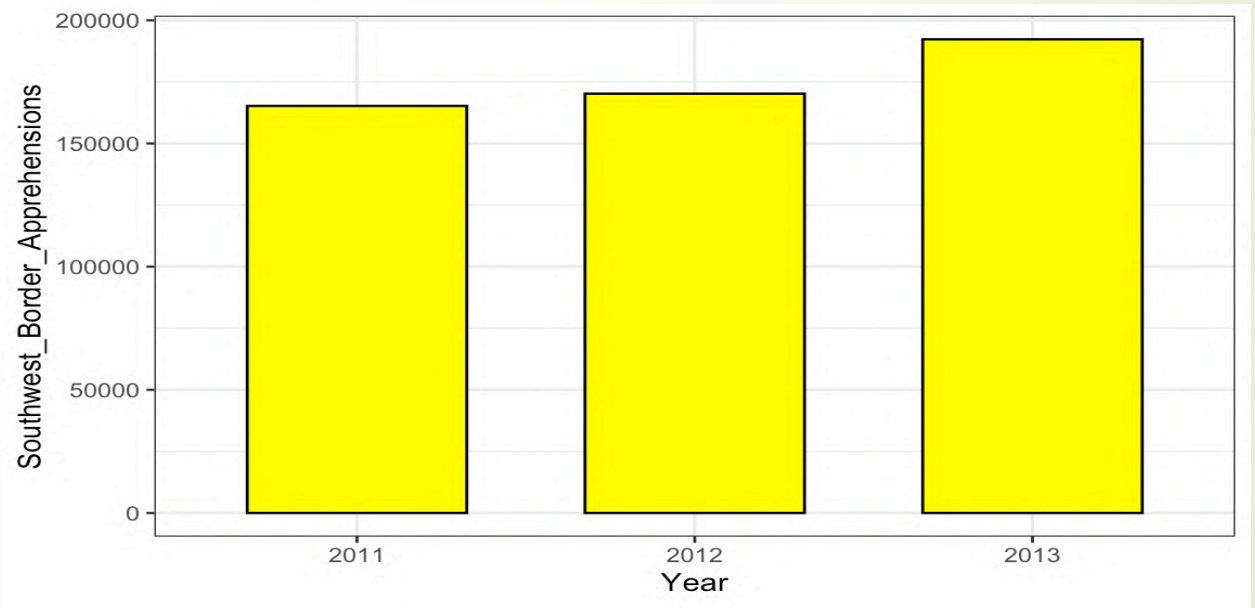

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- **Not important** when **position is used for comparison**

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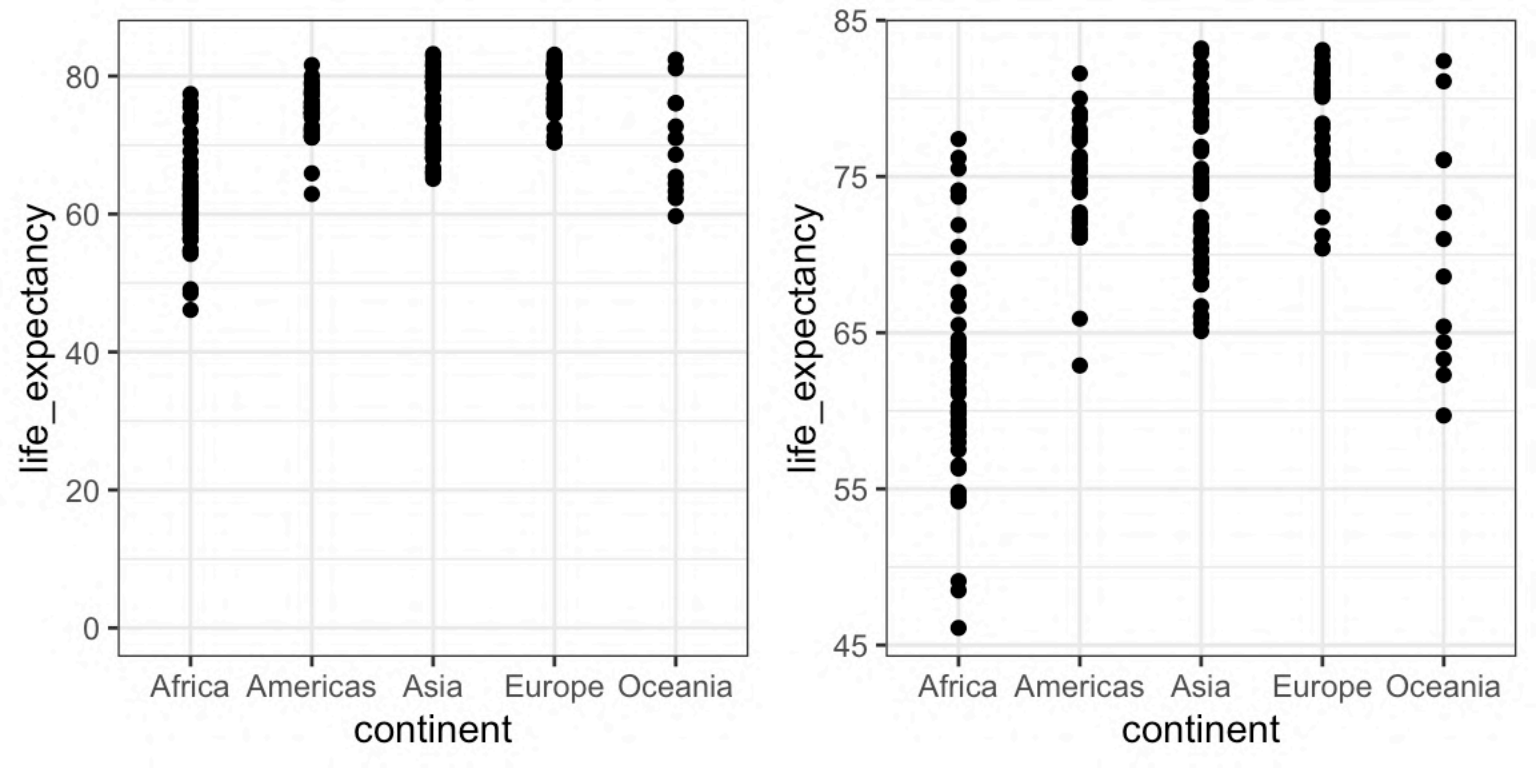

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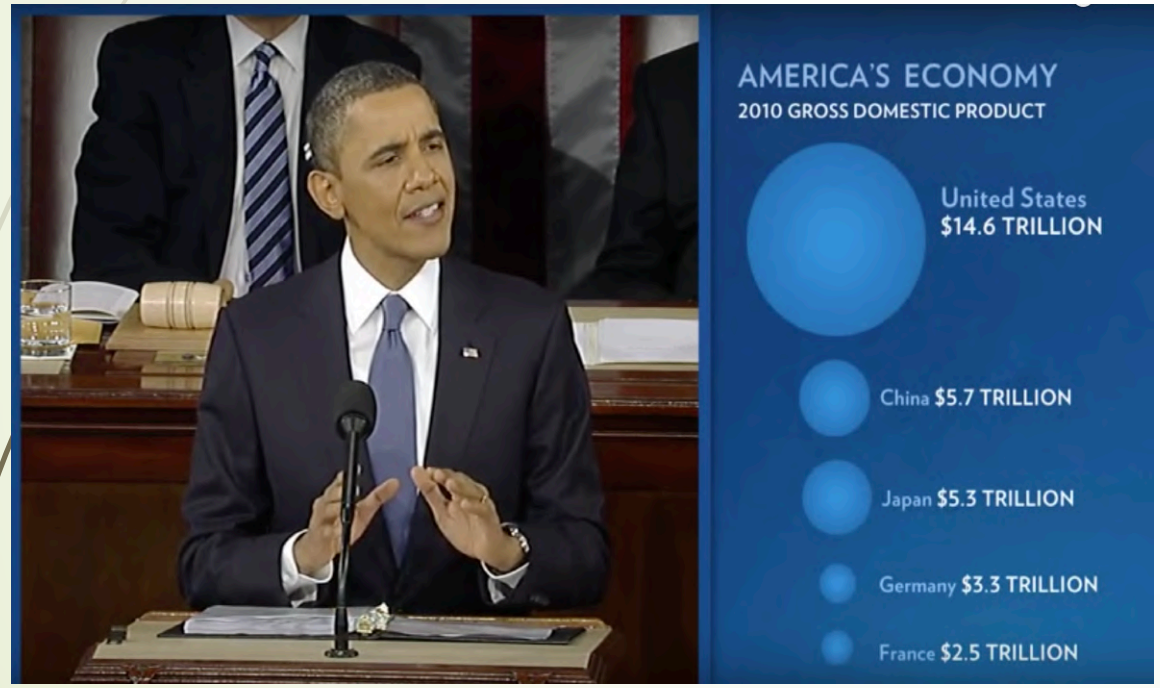

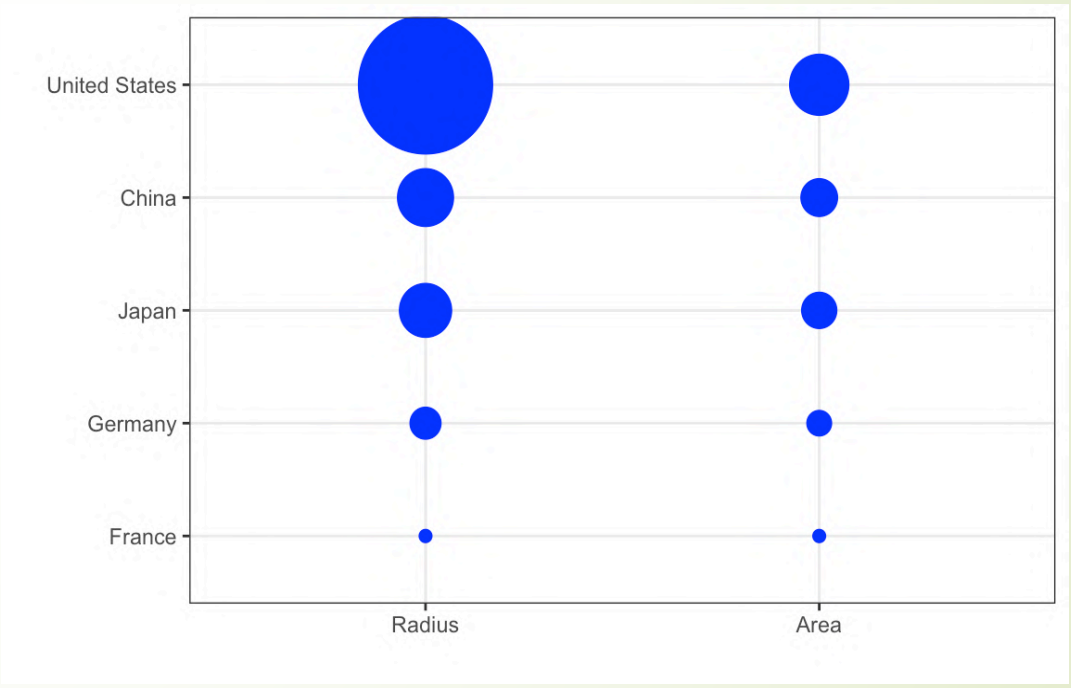

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