Applied Statistics

Drawing Graphs

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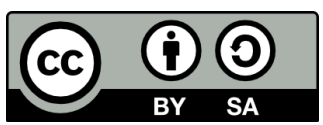
Portions of these notes were created from *Learning statistics with R* by Danielle Navarro, *Learning statistics with jamovi* by David Foxcroft, and *Introduction to Statistical Thinking* by Benjamin Yakir.



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- As you go about analysing data, it's important to draw "exploratory graphics" that help you learn about the data
- Here is an interesting story about the importance of visualising data ...

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- An english doctor named John Snow was skeptical of this theory and published an essay in 1849 called "On the Mode of Communication of Cholera"
- Snow argued that cholera was spread by contaminated water:

> *The views here explained open up to consideration a most important way in which the cholera may be widely disseminated, viz., by the emptying of sewers into the drinking water of the community*
>
> Snow, 1849, pg. 11

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> *On proceeding to the spot, I found that nearly all the deaths had taken place within a short distance of the (Broad Street) pump . . . With regard to the deaths occurring in the locality belonging to the pump, there were 61 instances in which I was informed that the deceased persons used to drink the pump-water from Broad Street, either constantly or occasionally ..... .*

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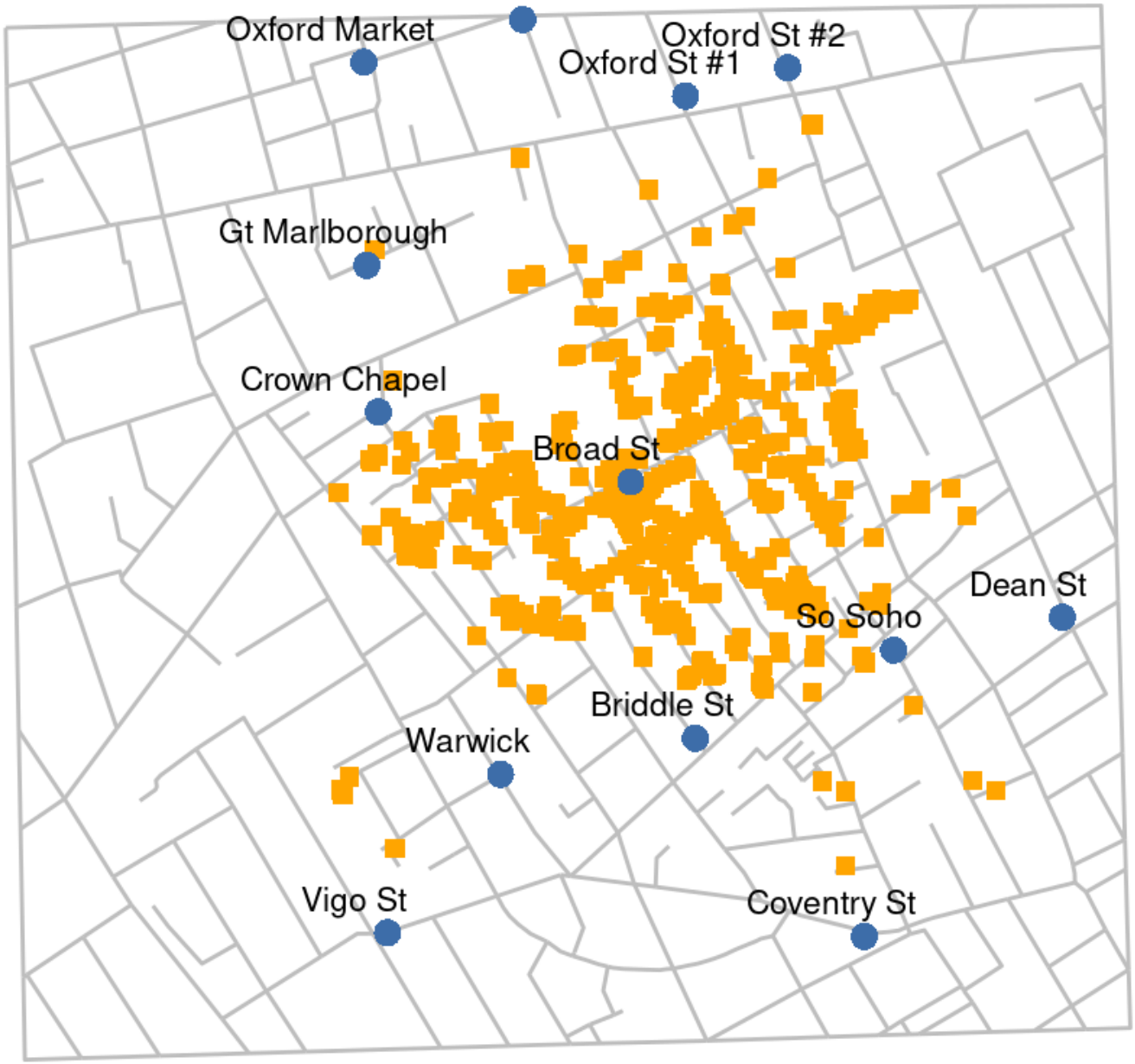

Cholera deaths in 1854 London

New location of the replica pump, the handle of which John Snow had removed (source: Wikimedia Commons)

Cholera deaths in 1854 London

John Snow pub, near the new location of the pump (source: Wikimedia Commons)

Types of graphs

- Histograms
- Boxplots
- Bar graphs
- Scatterplots

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- The bins are often of equal width, but they don't have to be
- The count is referred to as the **frequency** or **density** of the bin and is displayed as a vertical bar

Example: Time spent on social media

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- We then count the number of observations that fall within each bin:

Bin/Interval	**Count/Frequency**
$[2.5, 3.49)$	9
$[3.5, 4.49)$	32
$[4.5, 5.49)$	109
$[5.50, 6.49)$	180
$[6.50, 7.49)$	132
$[7.5, 8.49)$	34
$[8.5, 9.5]$	4

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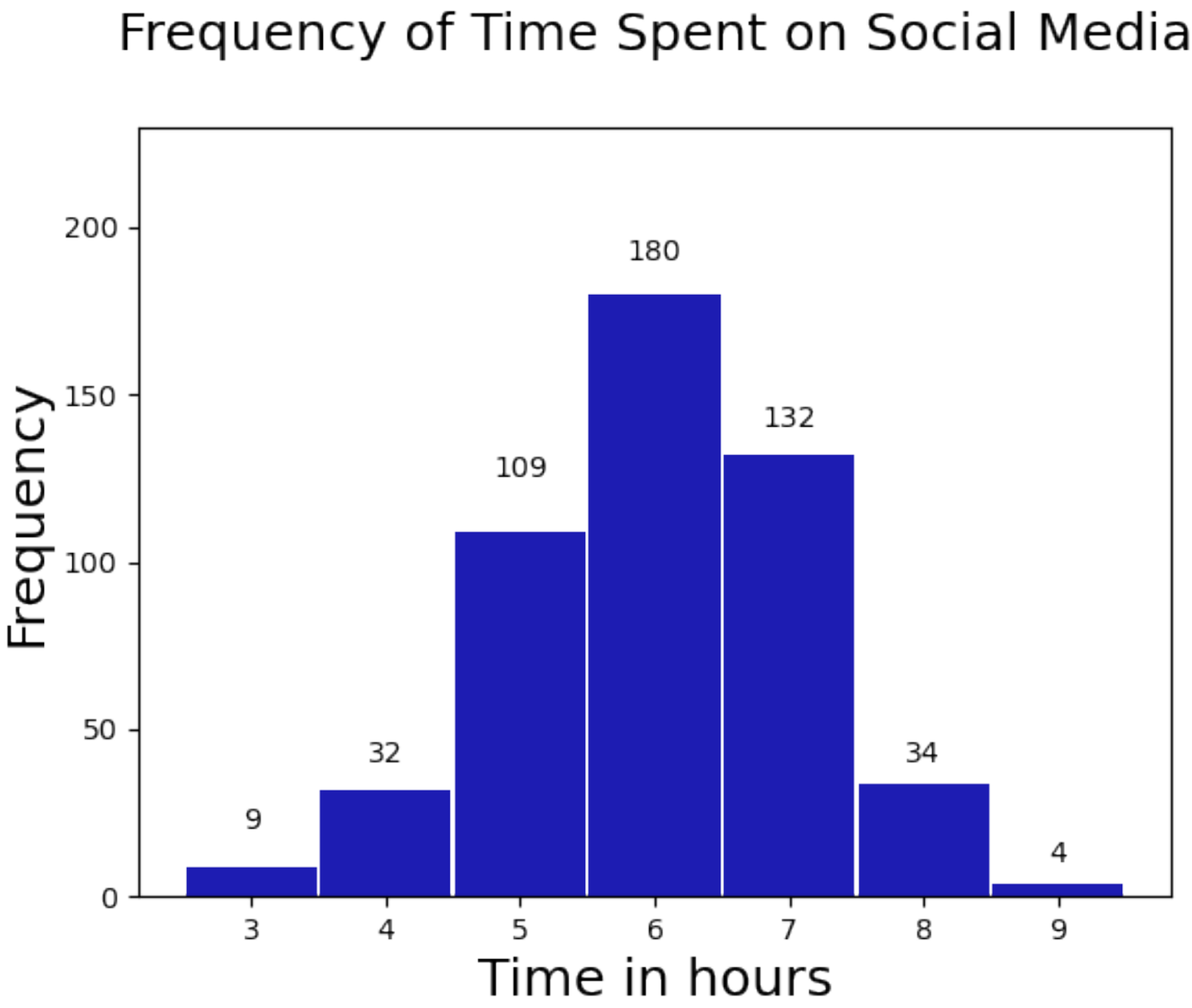

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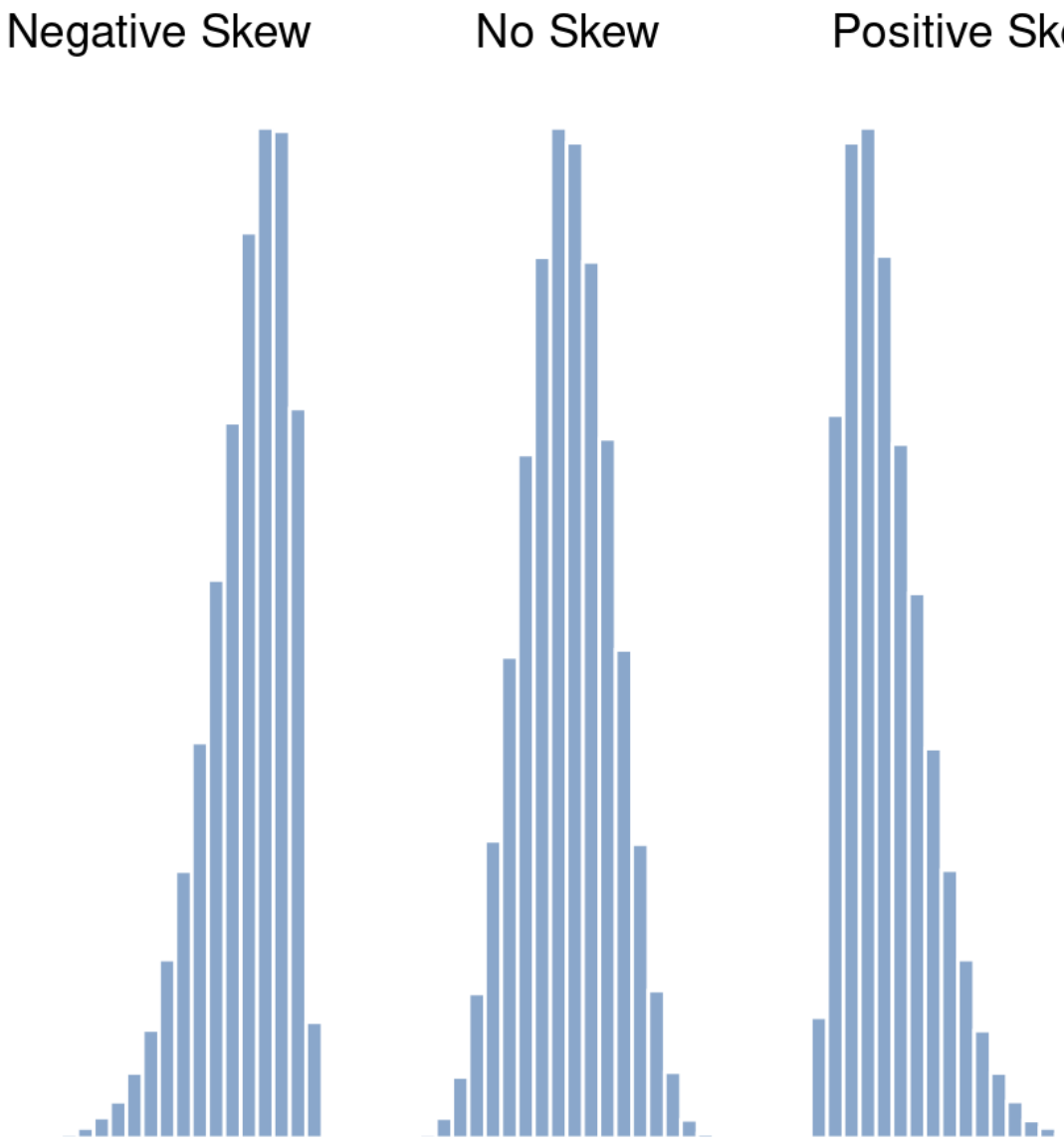

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- Thin vertical lines called the **whiskers** extend from the box to a lower and upper value
- The lower and upper values could be:
  - lower = min and upper = max, or
  - lower = $Q_1 - 1.5 \times IQR$ and upper = $Q_3 + 1.5 \times IQR$ (the default)
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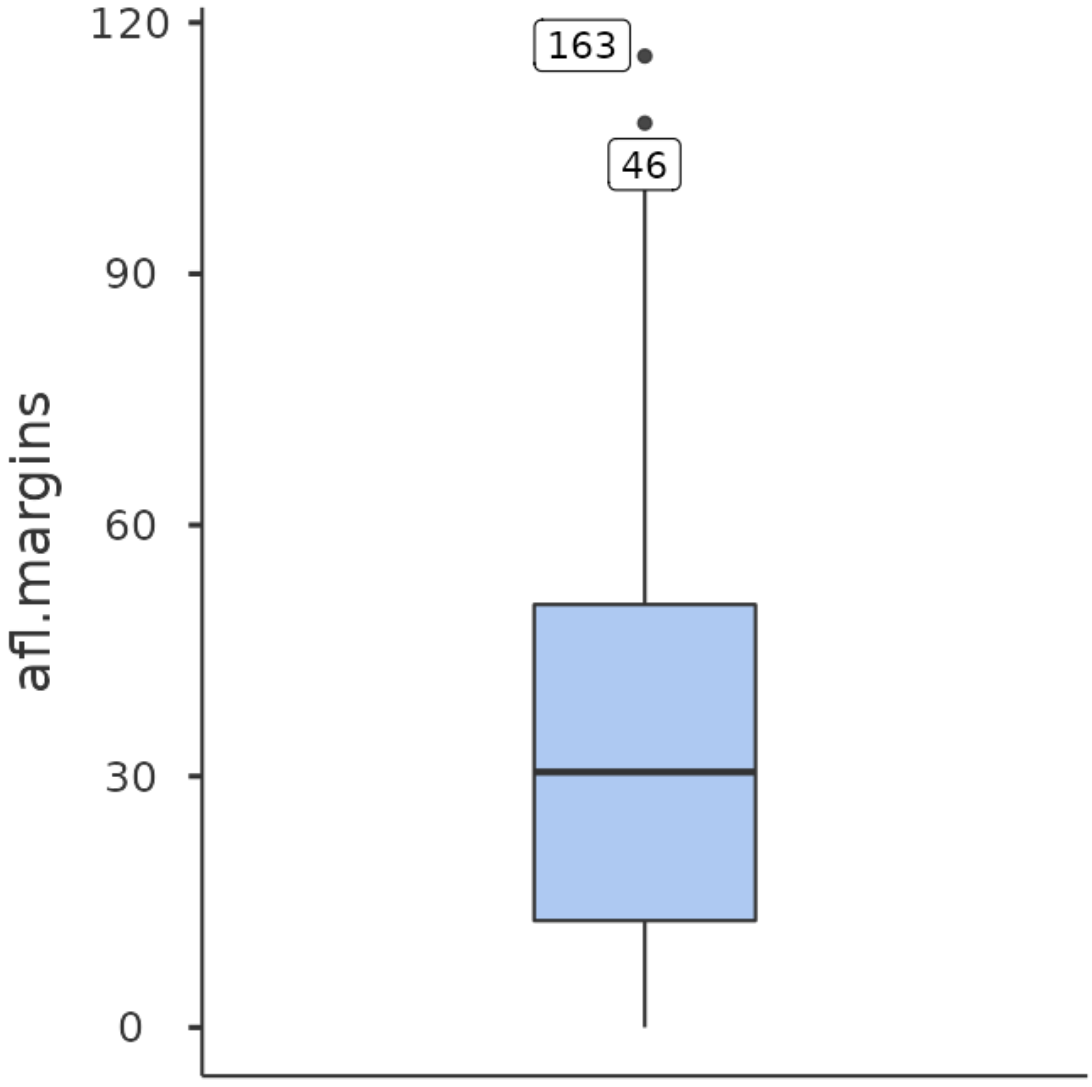
- Any values outside the whiskers are plotted as individual points and are called **outliers**

Example: Boxplots



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- The bars can be plotted vertically or horizontally

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