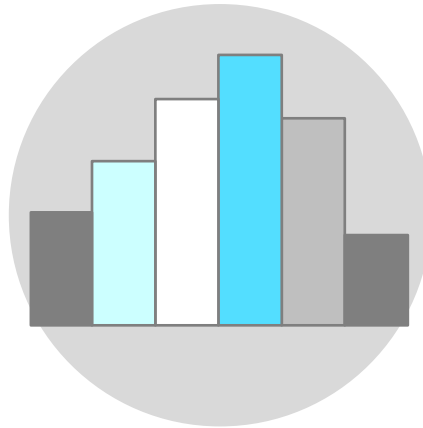


Continuous Improvement Toolkit

Histogram

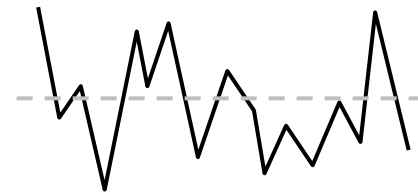
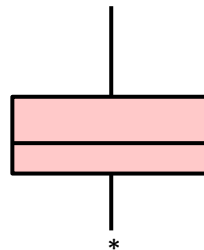
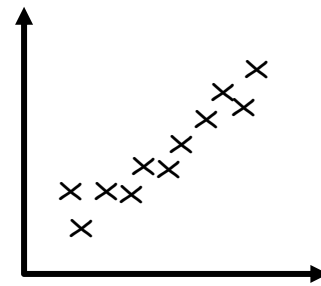
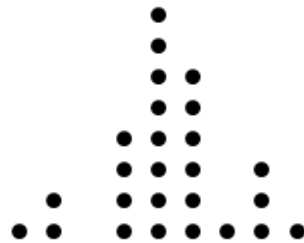
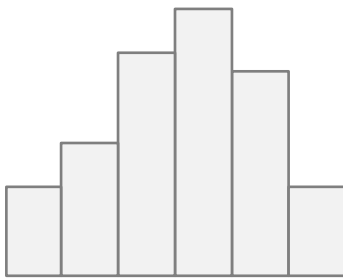


The Continuous Improvement Map



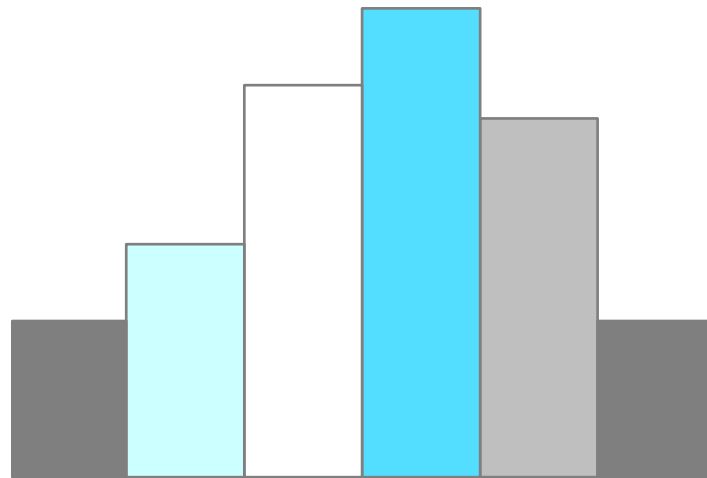
Histogram

One of the best ways to analyze any process is to **plot the data**



Histogram

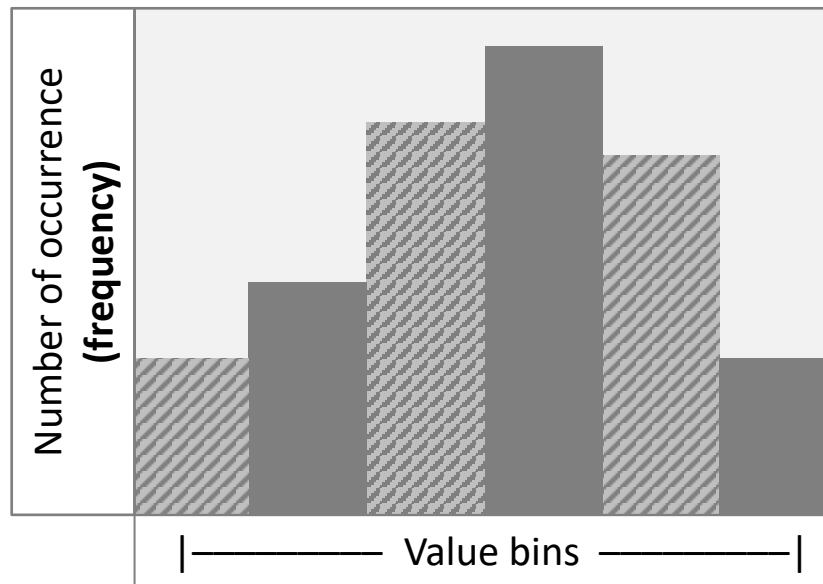
A **histogram** is a graphical way that summarizes the important aspects of the distribution of continuous data



It is a type of **bar chart**

Histogram

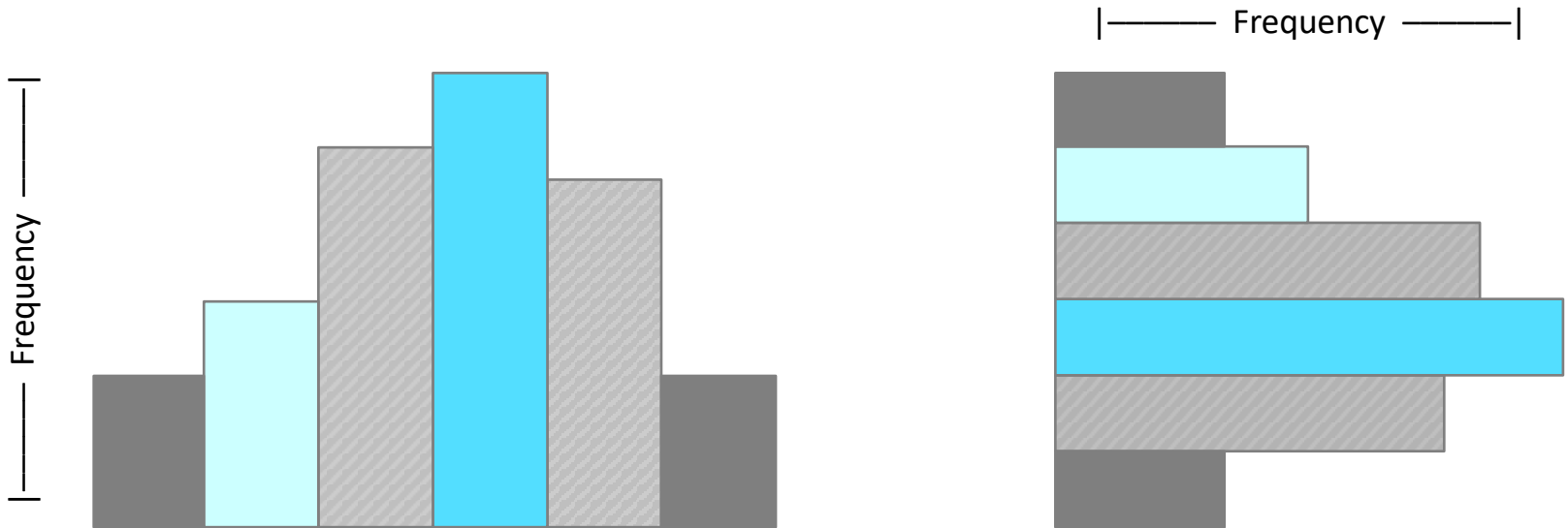
Histograms are sometimes called **Frequency Plots** as they show the frequency of continuous data values on a graph



While **Pareto charts** plot the frequency of **count** data

Histogram

Histograms can be drawn either vertically or horizontally

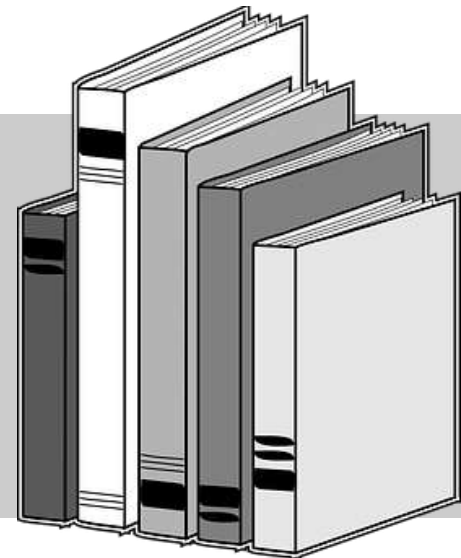


The **height** of the column indicates how often that data value occurred

Histogram

Histograms are widely used in statistics, process improvement, scientific research, economics, and in social and human sciences

Mainly used to **explore** data as well as to **present** the data in an easy and understandable manner.



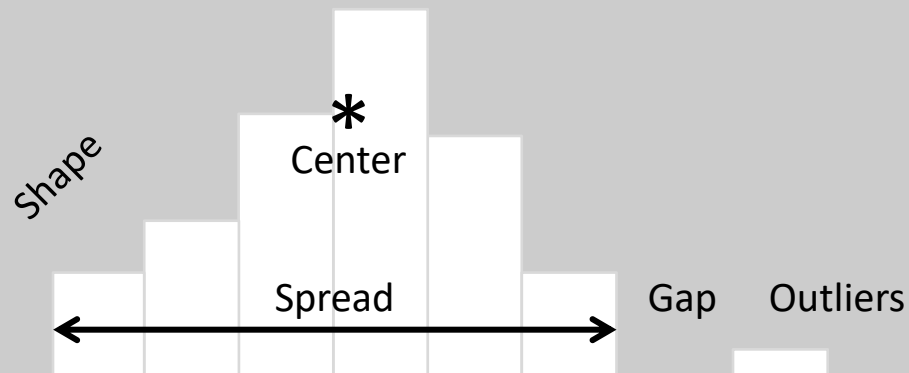
Histogram

It allows to visually and quickly assess . . .

The **shape** of the distribution

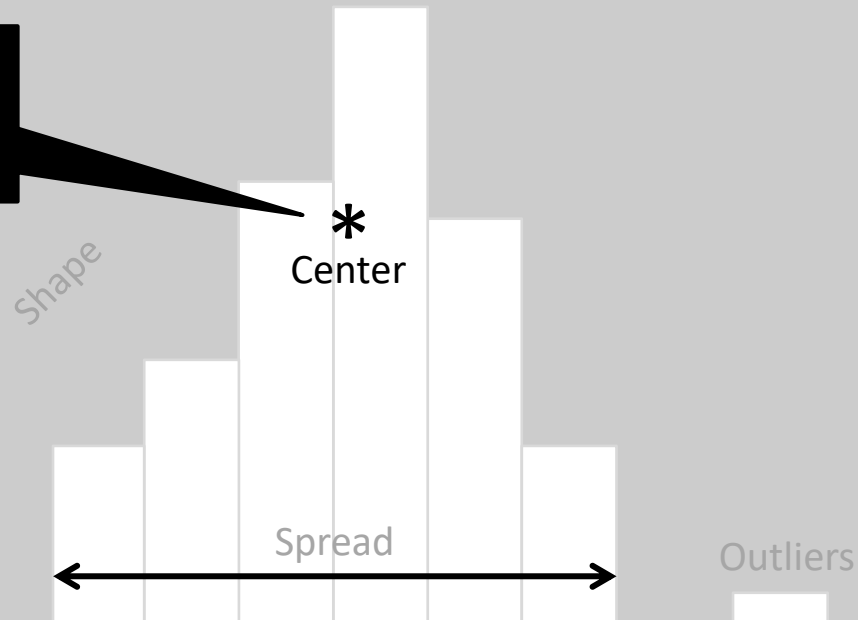
The **central tendency** and the amount of **spread** in the data

The presence of **gaps, outliers** or unusual data points



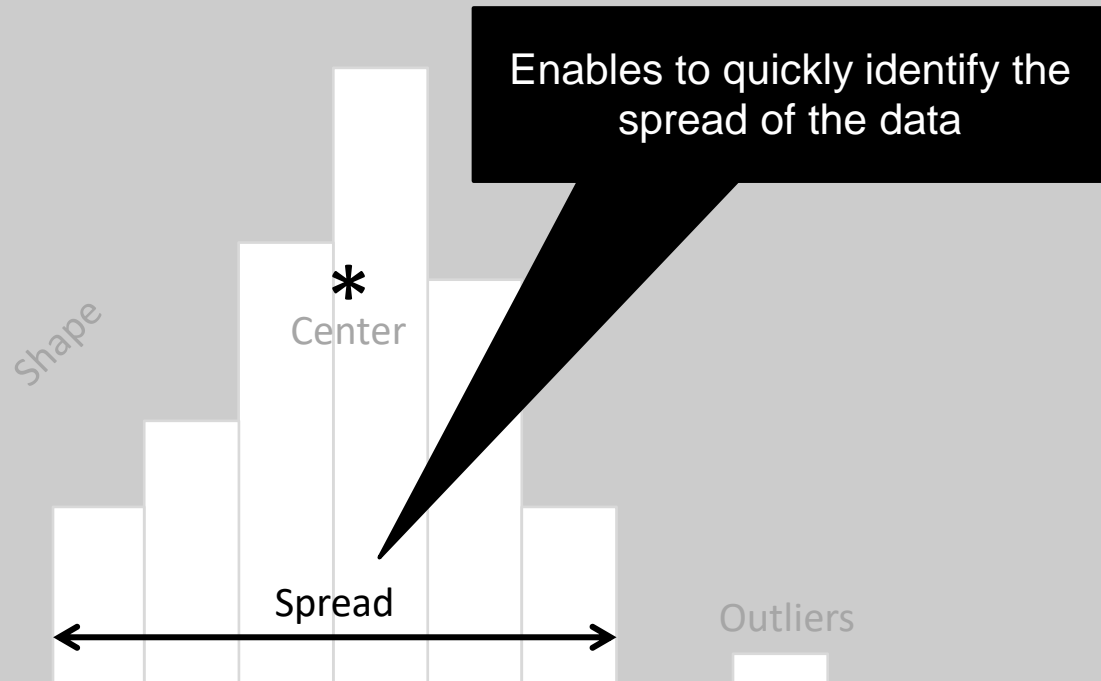
Histogram

Shows where most of the data exists

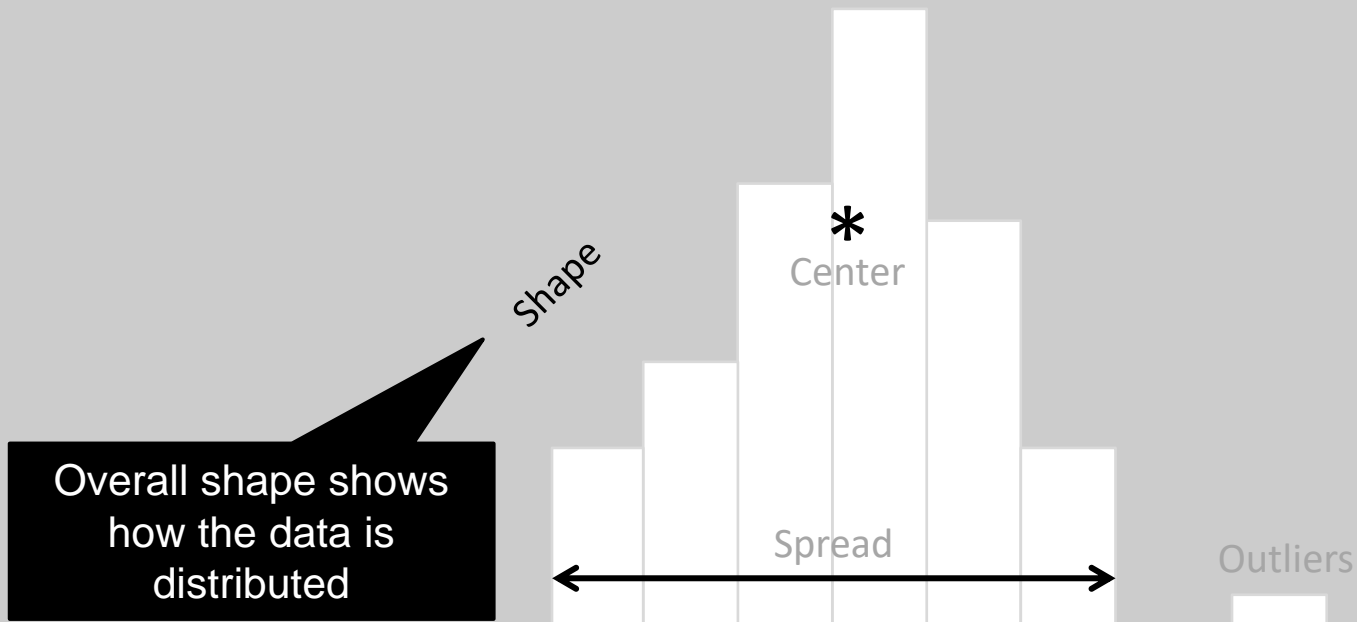


Histogram

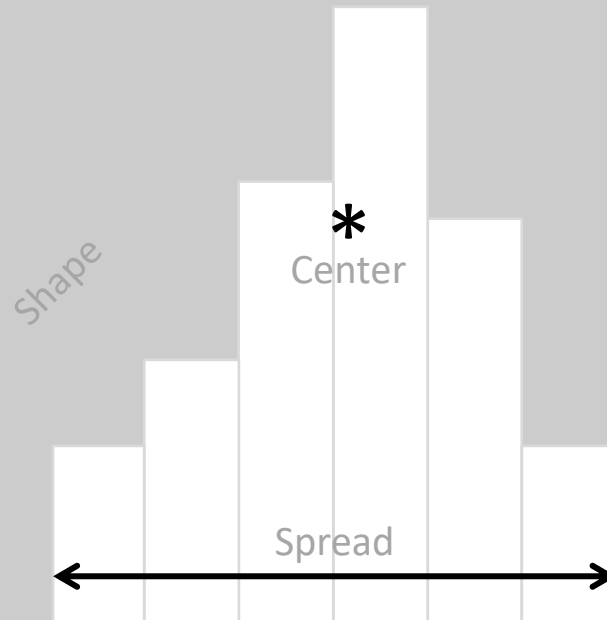
Creates a picture of the **variation** in a process



Histogram

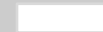


Histogram

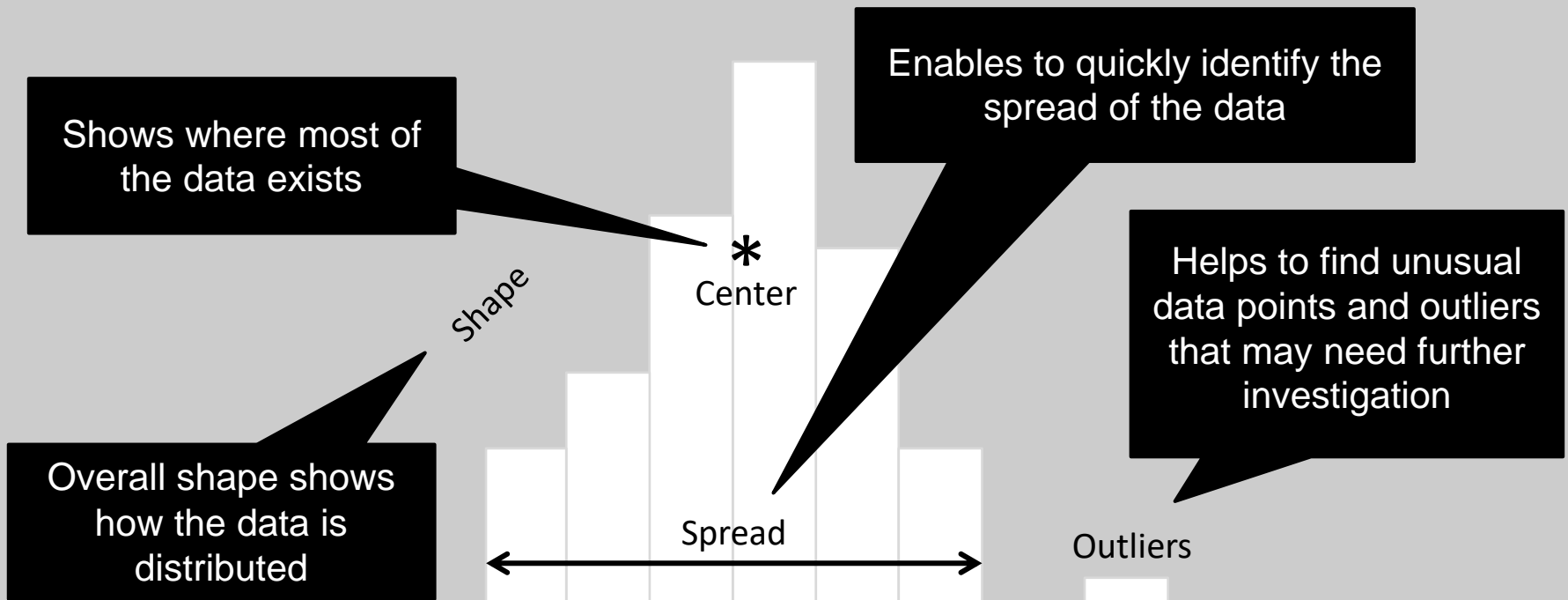


Helps to find unusual data points and outliers that may need further investigation

Outliers



Histogram



Histogram

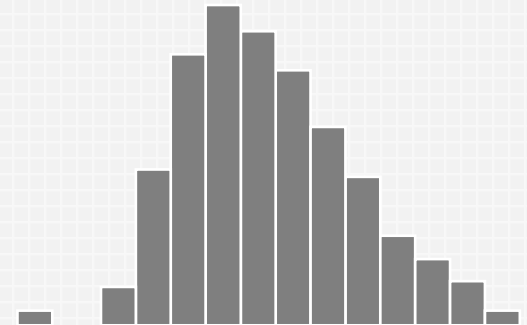
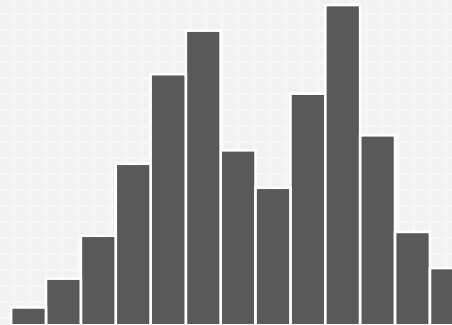
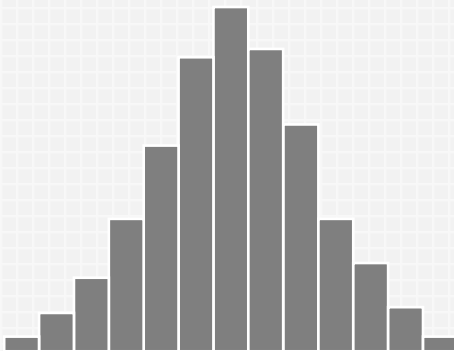
Plotting data in a histogram allows to know . . .

Minimum and maximum values

Gaps and outliers

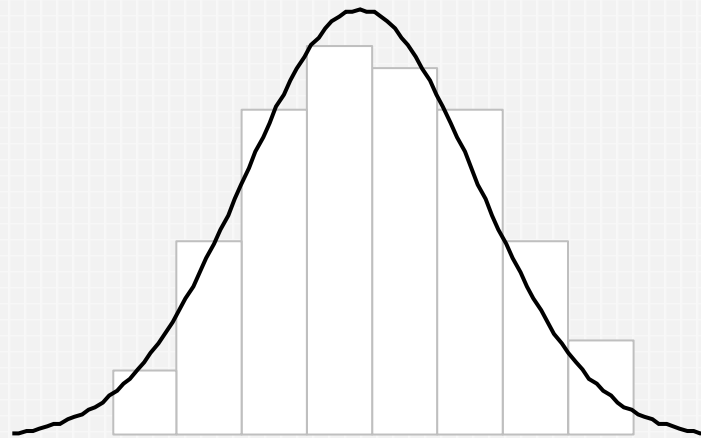
The shape of data (symmetric or skewed)

Whether it's unimodal, bimodal or multimodal



Histogram

Used as the first step to determine the underlying **probability distribution** of a data set



A way to shape the sample data to make **predictions** and draw conclusions about an entire population

Histogram

Histograms are used to identify . . .

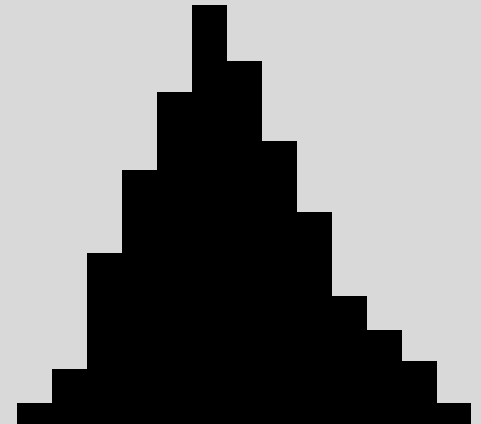
Patterns that provide clues to certain types of problems

Whether you can apply certain **statistical tests**

Whether variability is within **specification limits**

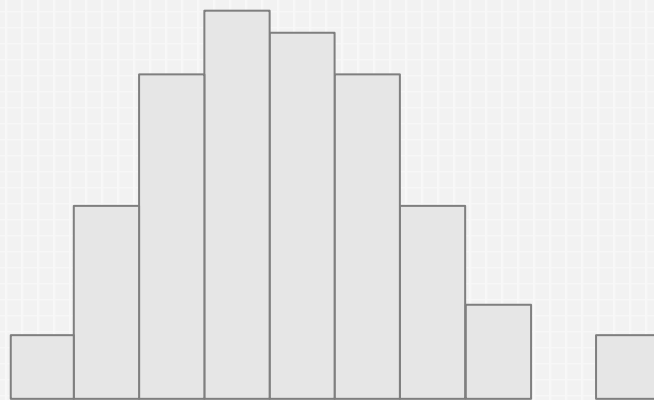
Whether the process is **capable** or not

Whether there is a **shift** in the process

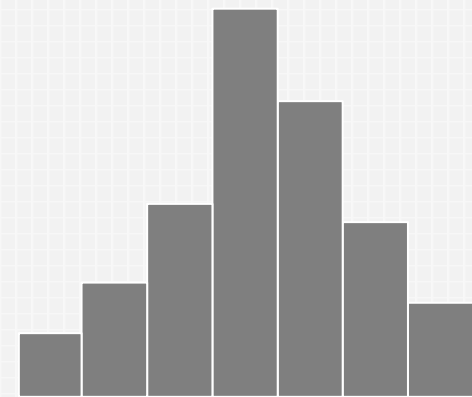
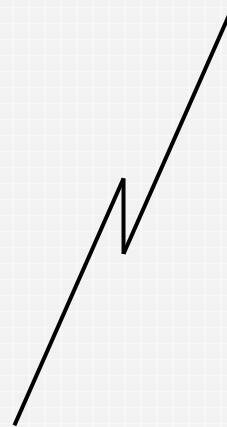


Histogram

Used to verify that the changes made were a real **improvement**



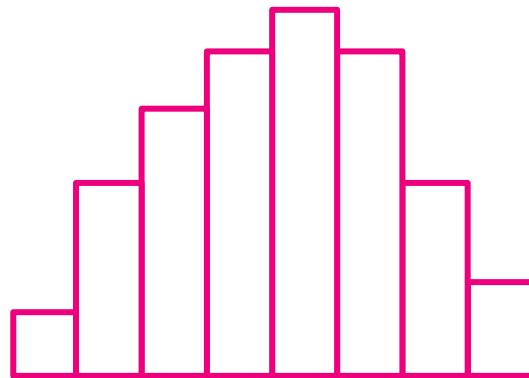
Before



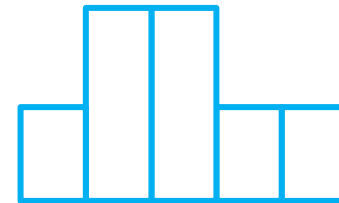
After

Histogram

Ideal to represent moderate to large amount of data



N = 40

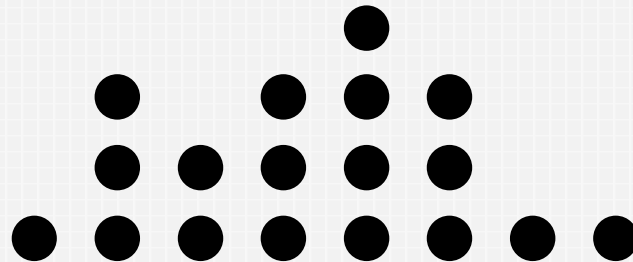


N = 14

In practice, a sample size of at least 30 data values would be sufficient

Histogram

It may not accurately display the distribution shape if the data size is **too small**



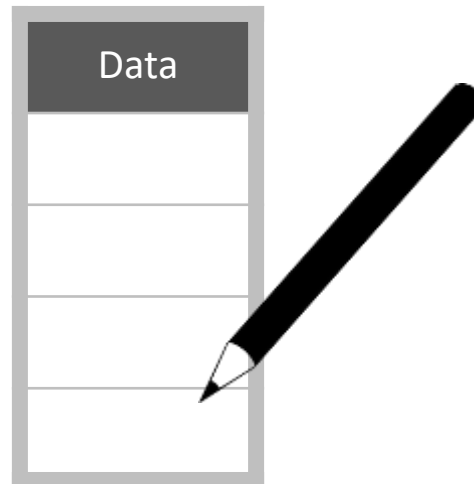
Dot plots are preferred over histograms when representing small amount of data

Histogram

How to Construct a Histogram

Collect the data set and prepare it for the analysis

Create a summary table of the data

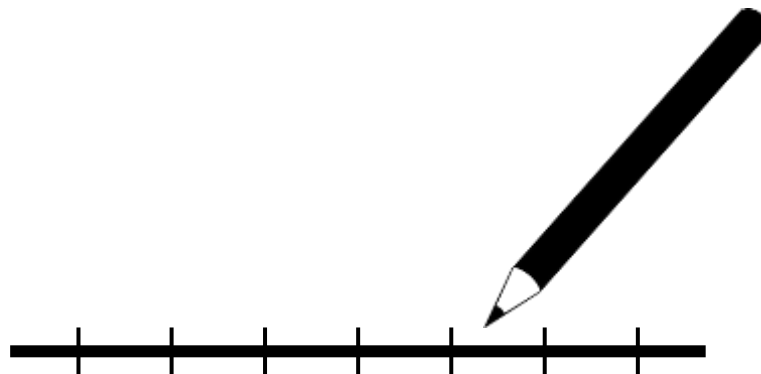


Histogram

How to Construct a Histogram

Draw a horizontal line and divide it into equal **intervals** or bins (between 7 to 10 intervals)

The total width should be equal to the range of the data

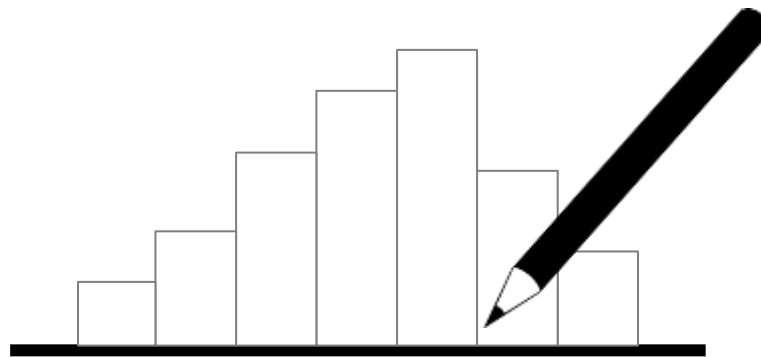


Histogram

How to Construct a Histogram

Draw bars above each bin to represent the **frequency of the data values** within each interval

The bars should be adjacent with no gaps between them (to indicate the continuity of the data)

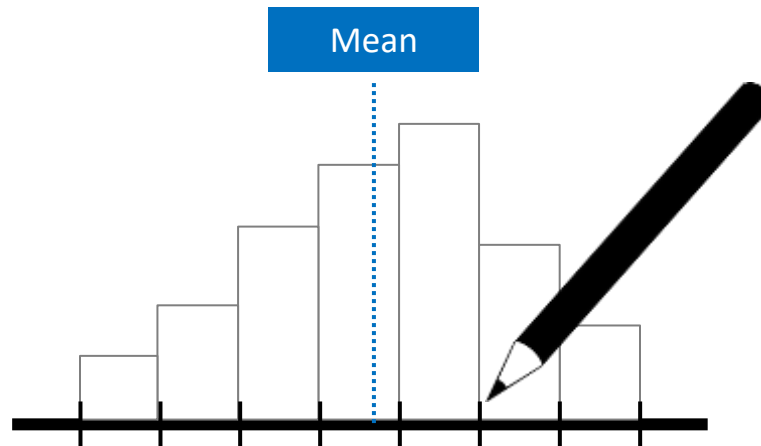


Histogram

How to Construct a Histogram

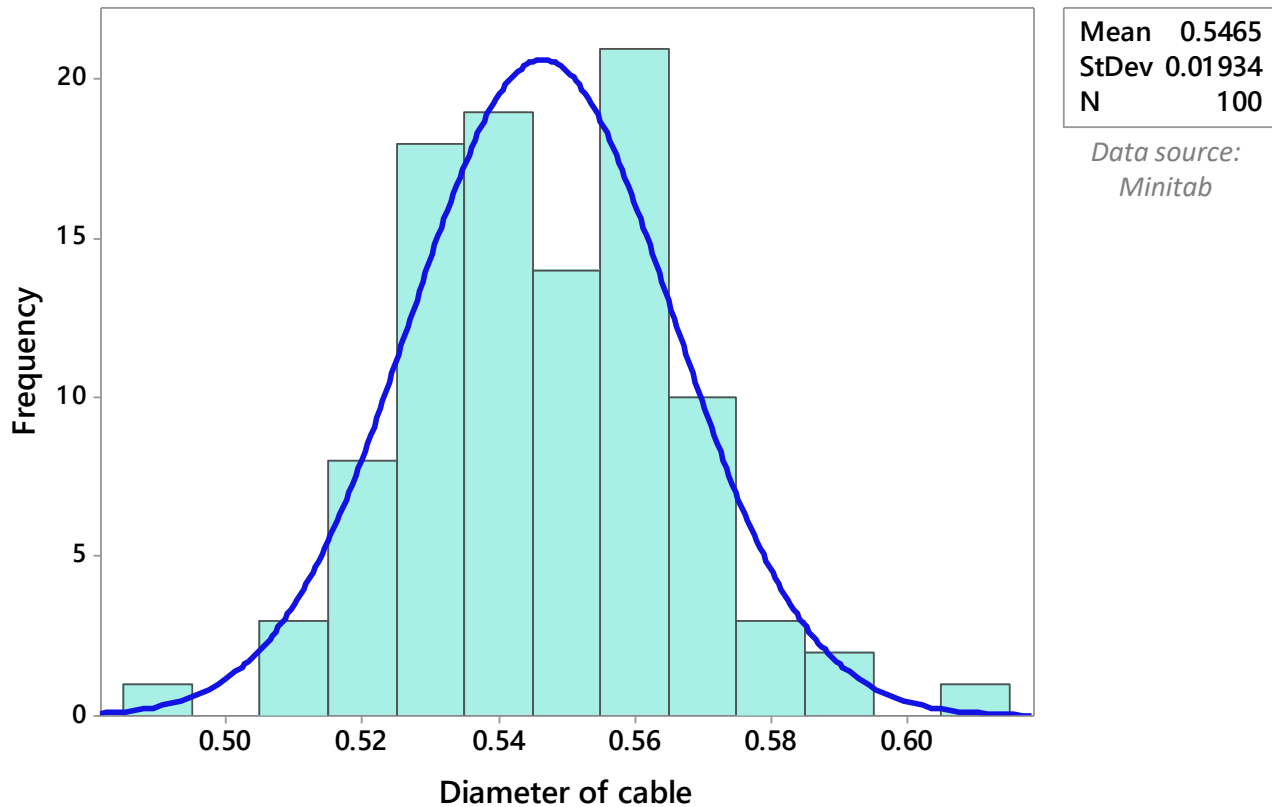
Indicate the **mean** of the data and other important information

Such as the standard deviation and the specification limits



Histogram

Example – Cable Diameters

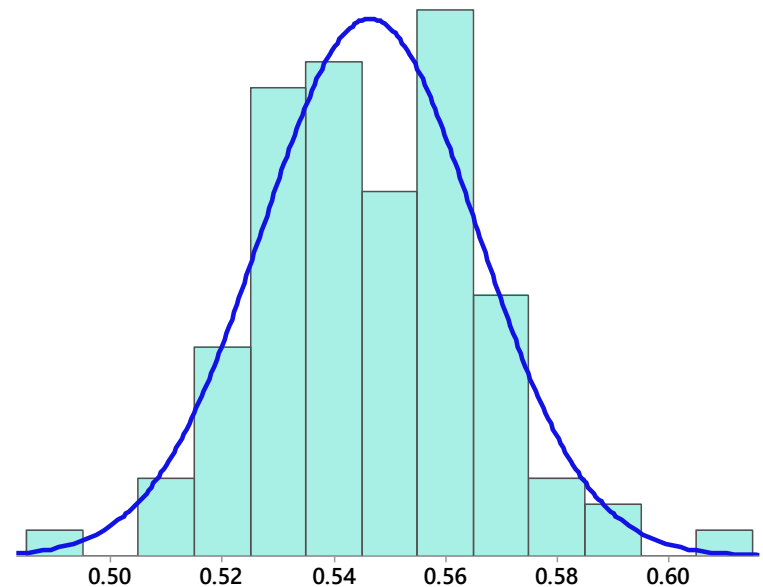


Histogram

Example – Cable Diameters

The result can be **summarized** using day to day language such as:

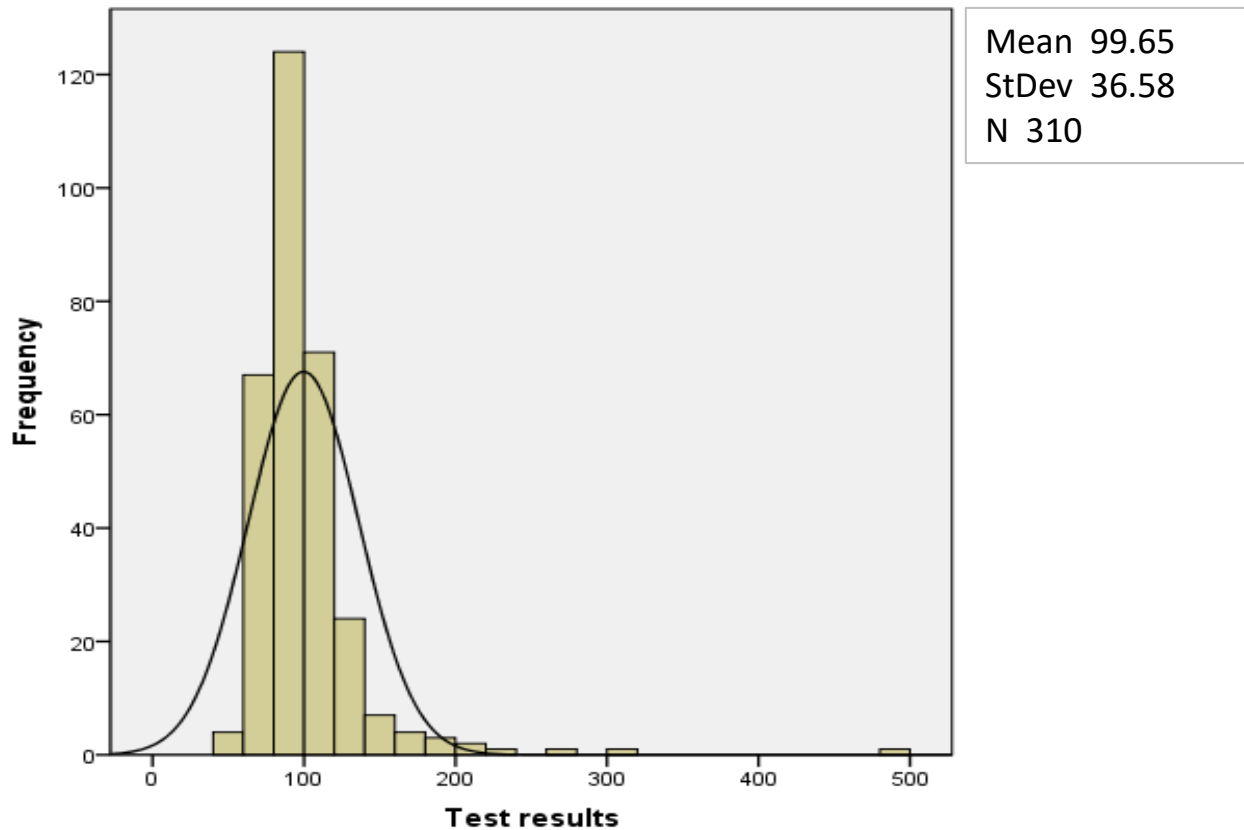
“The distribution looks symmetric around the cable diameter mean (0.546 cm) and appears to fit the Normal Distribution”.



Data source: Minitab

Histogram

Example – Presence of Diabetes

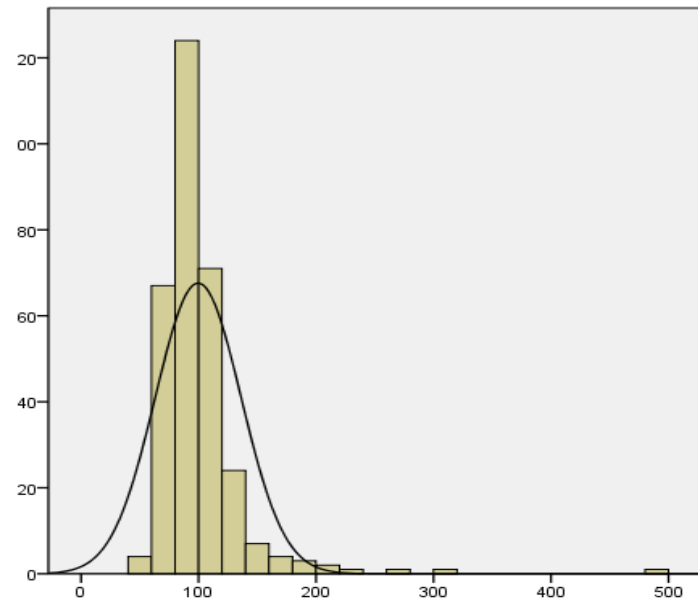


Histogram

Example – Presence of Diabetes

The distribution of the data is **skewed to the right**.

The distribution is more like an **exponential distribution** which is normal for this type of data.

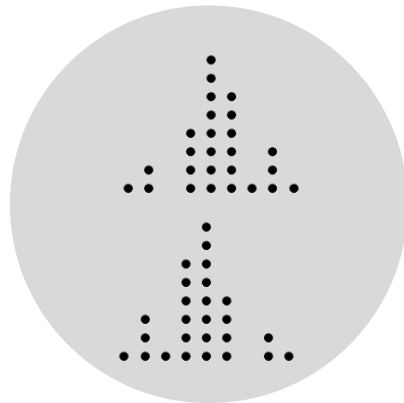


Histogram

Further Information

Histograms like control charts can be used to **assess improvement** overtime

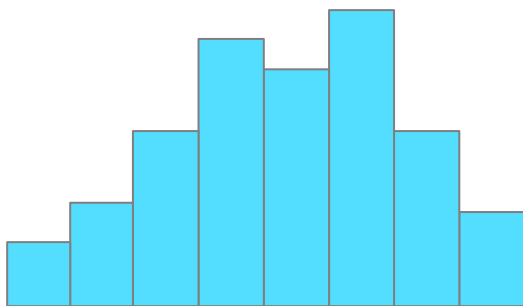
Histograms, however, can't see changes and trends over time



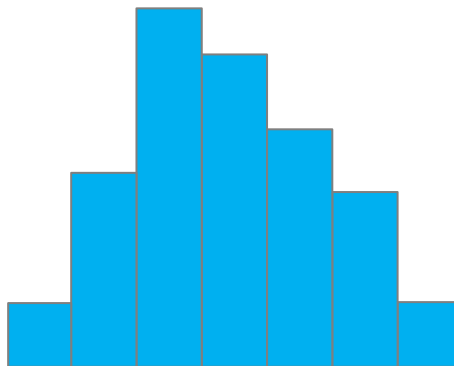
Histogram

Further Information

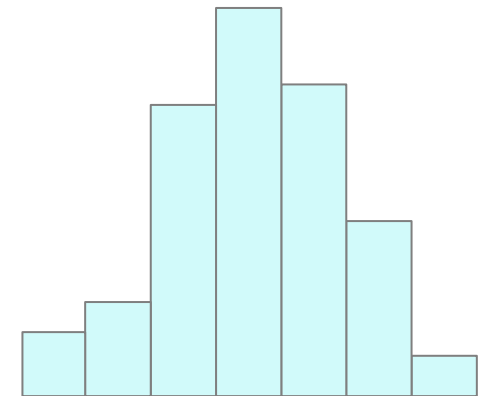
You can illustrate a **stratification factor** in histograms



Morning shift



Evening shift



Night shift

Histogram

Further Information

There are many applications and online services that allow the creation of histograms quickly and **automatically** (such as Minitab, JMP, and SPSS)



Histogram

Further Information – One of the 7 Basic Tools of Quality

