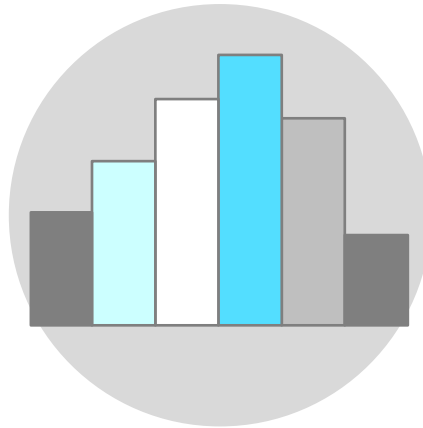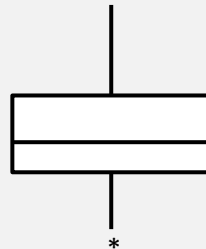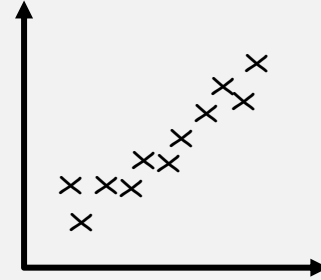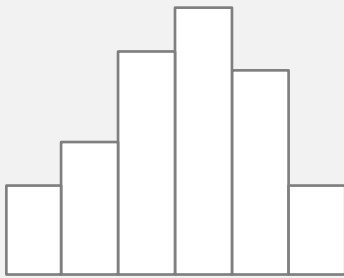# Continuous Improvement Toolkit

HISTOGRAM

HISTOGRAM

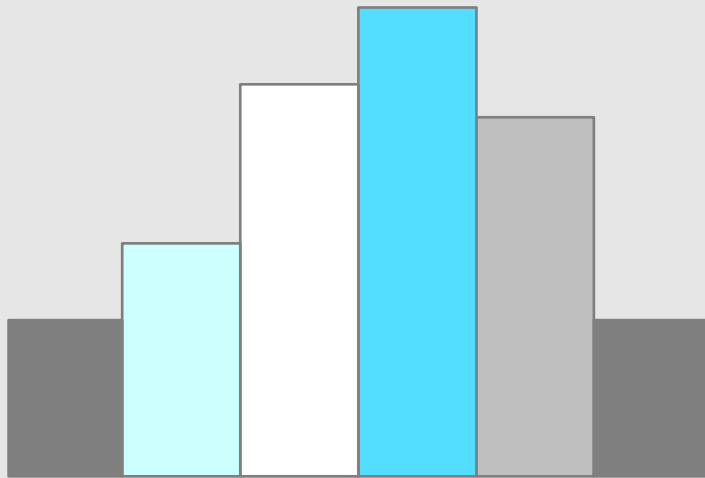One of the best ways to analyze any process is to **plot the data** on a graph or chart.
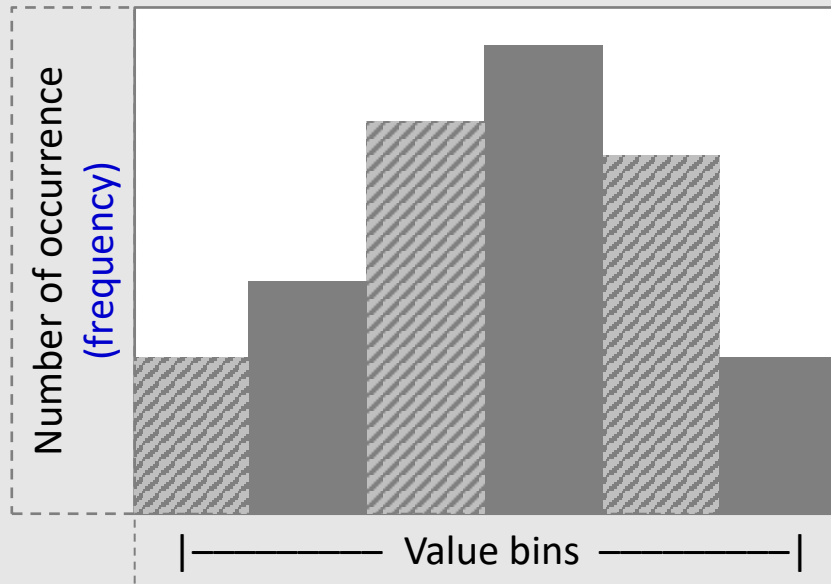
HISTOGRAM

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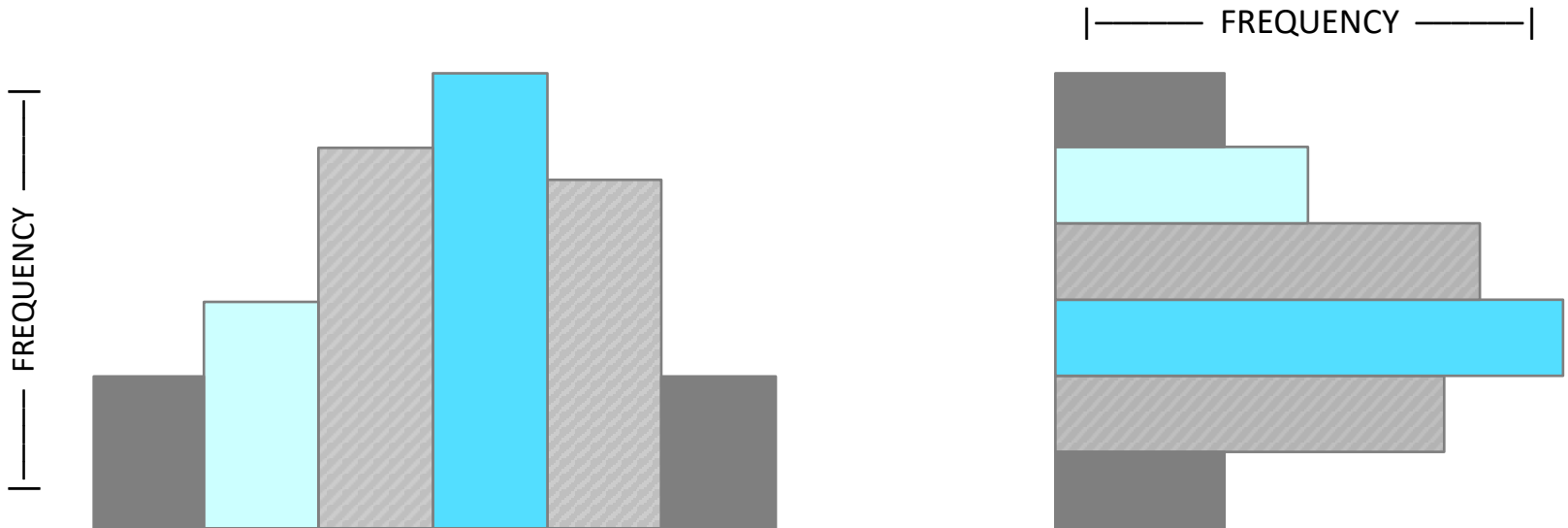
A type of bar chart

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
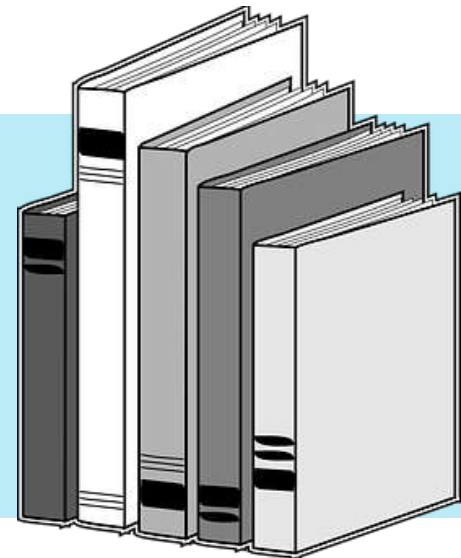
Can be drawn either vertically or horizontally.

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

HISTOGRAM

Histograms are widely used in statistics, scientific research, higher education, process improvement, and in social and human sciences.

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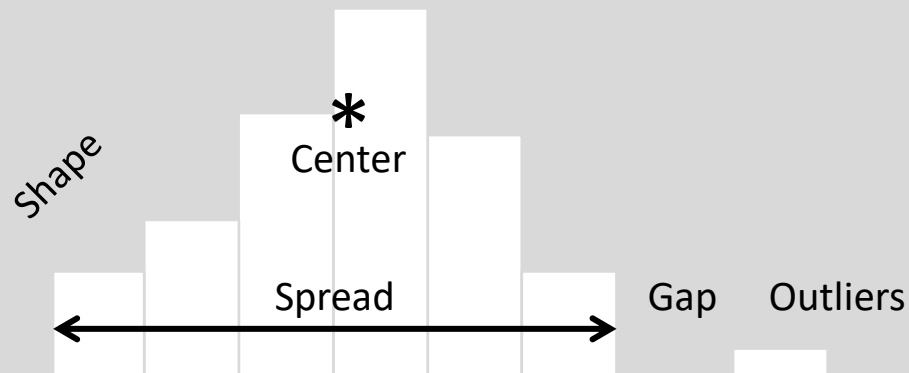
HISTOGRAM

It allows to visually and quickly assess . . .
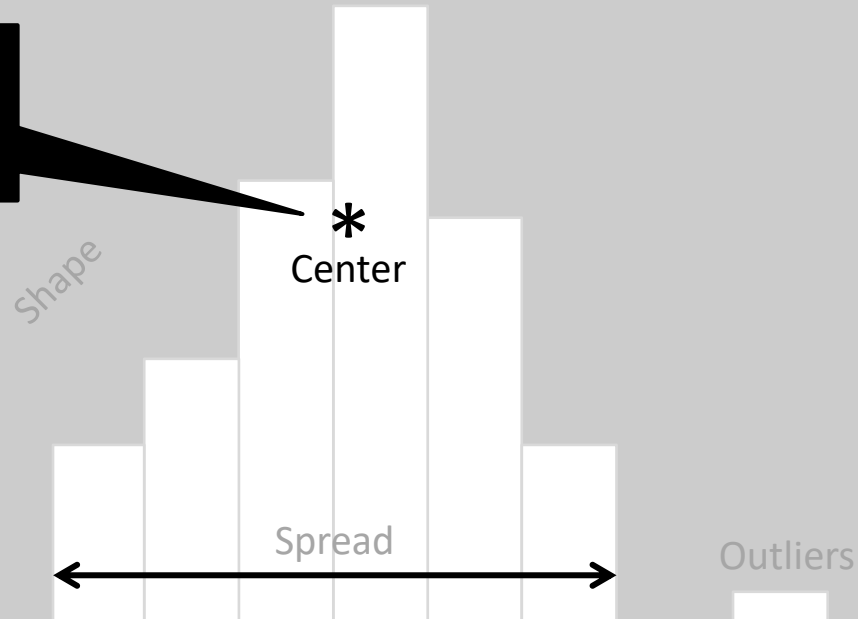
The **shape** of the distribution

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

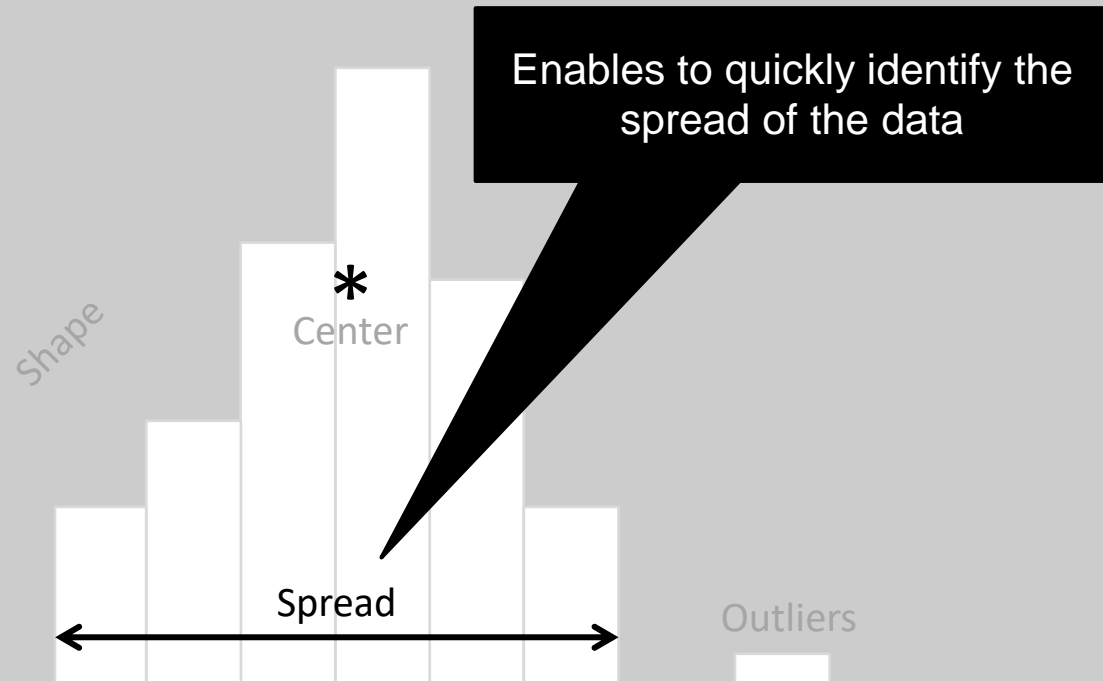The presence of **gaps**, **outliers** or unusual data points

Shape

*

Center

Spread

Gap   Outliers

HISTOGRAM

Shows where most of the data exists

Shape

*
Center

Spread

Outliers

HISTOGRAM

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

HISTOGRAM

Overall shape shows how the data is distributed

Shape

* Center

Spread

Outliers

HISTOGRAM

Shape

Center

*

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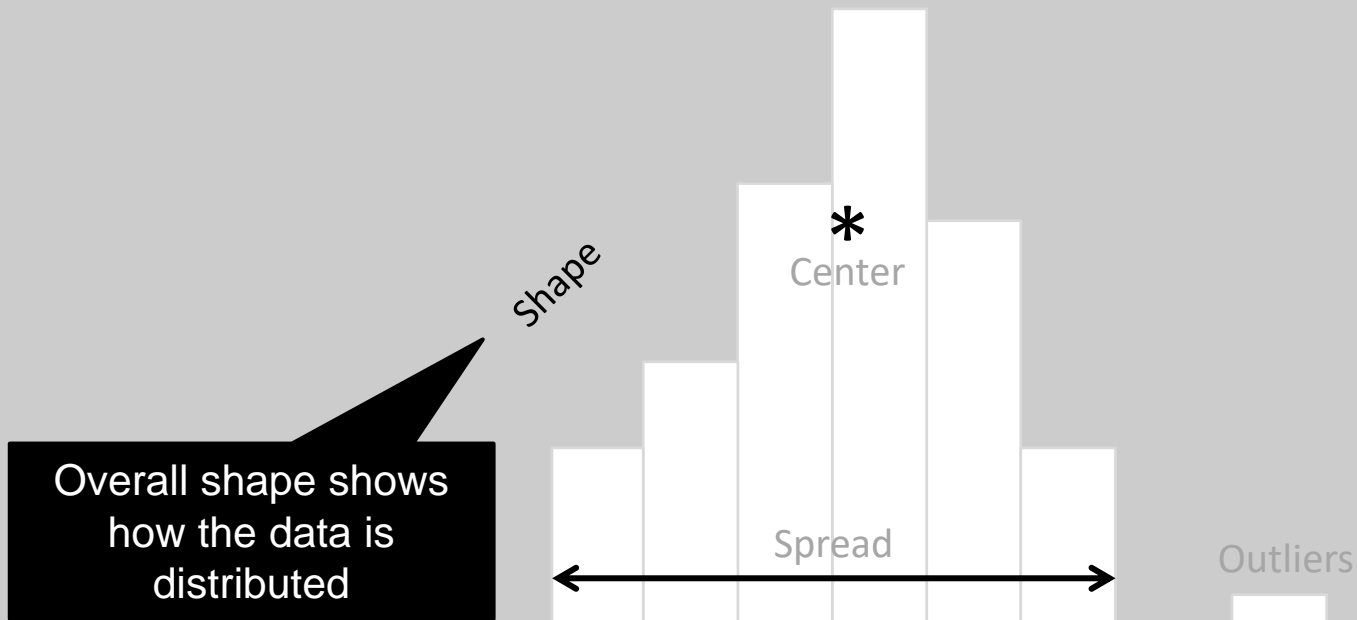
Outliers
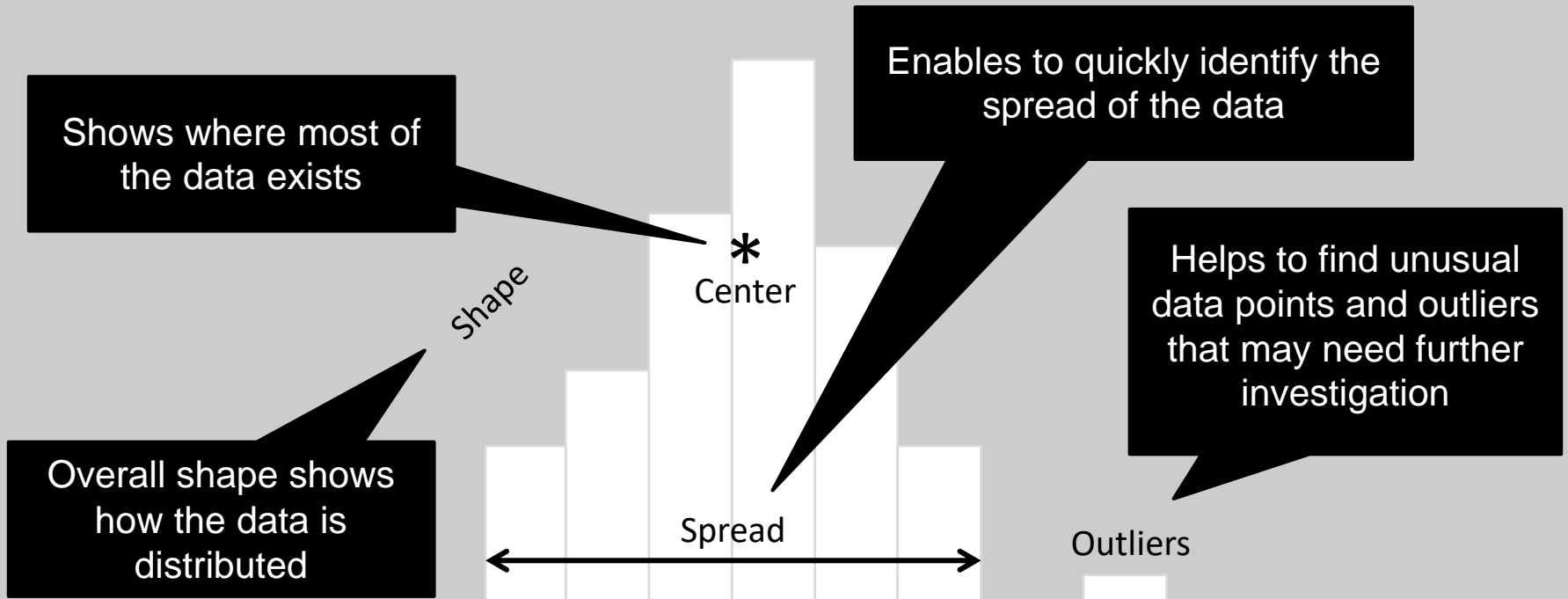
Helps to find unusual data points and outliers that may need further investigation
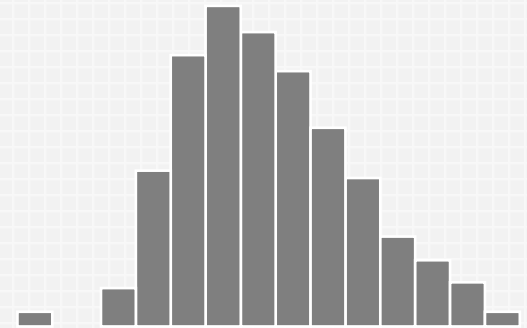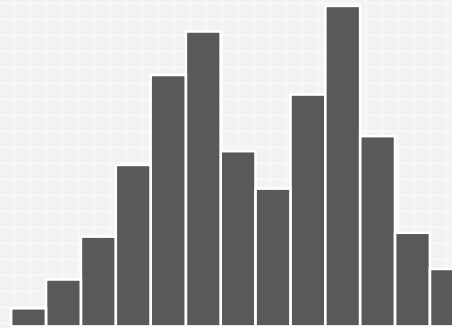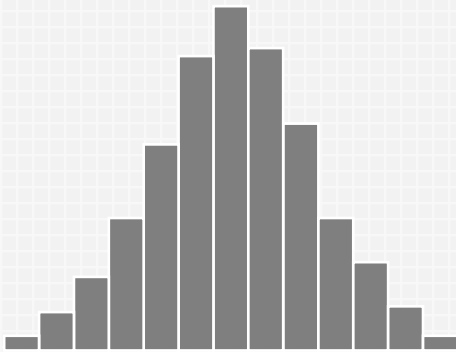
HISTOGRAM

HISTOGRAM

Plotting the data using a histogram allows to explore many characteristics of the data . . .

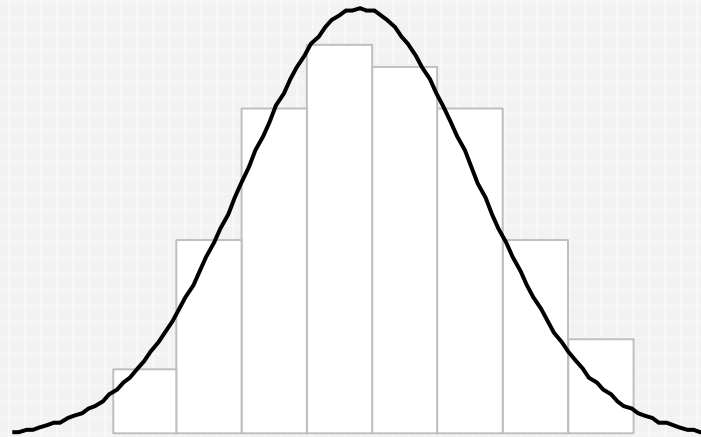| Central tendency and the amount of spread	Minimum and maximum values
The shape of data (symmetric or skewed)	Whether it's unimodal, bimodal or multimodal

HISTOGRAM

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

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

HISTOGRAM

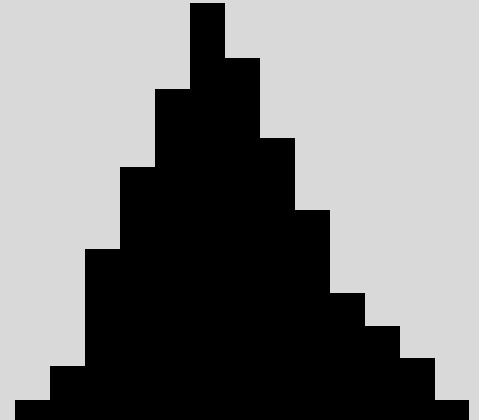Histograms are used to identify . . .

Patterns that provide clues to certain types of problems

Whether you can apply certain **statistical tests**

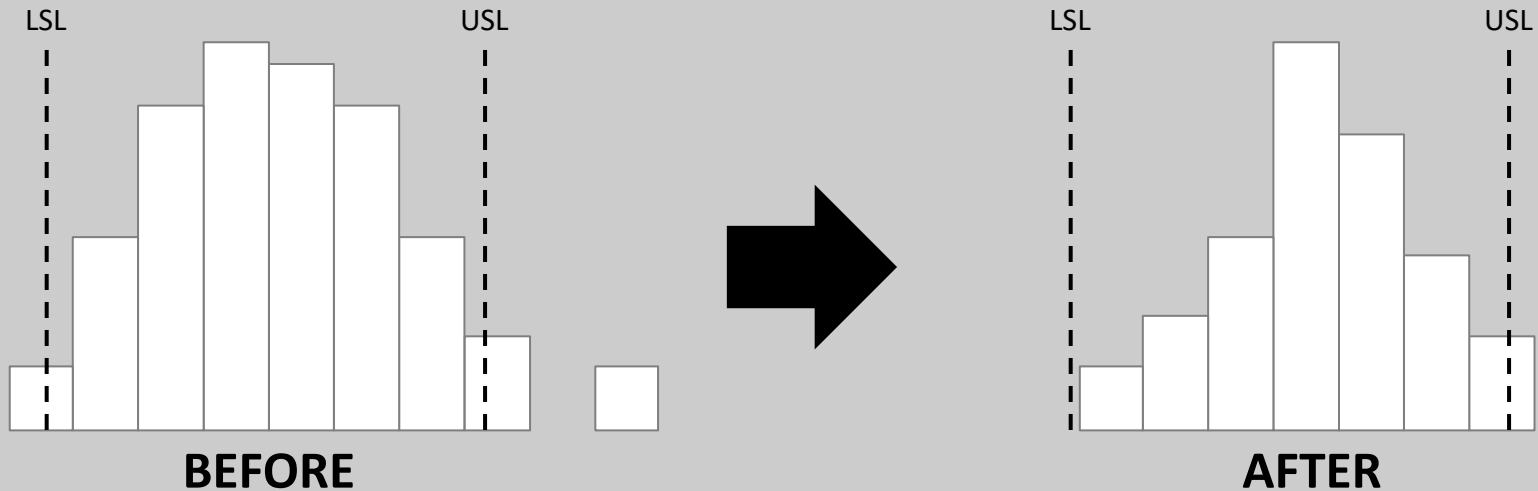Whether variability is within **specification limits**

Whether the process is **capable** or not

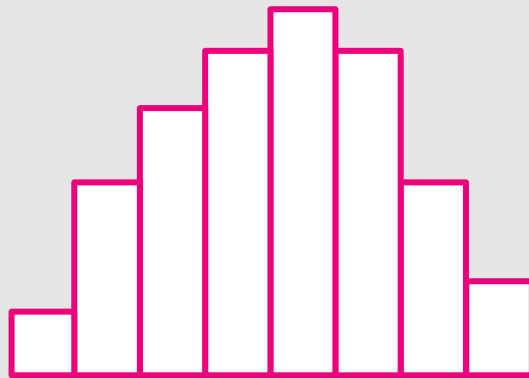Whether there is a **shift** in the process

HISTOGRAM

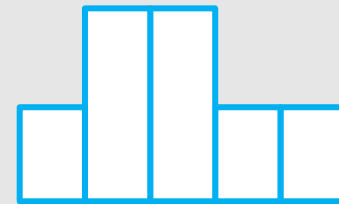Used to verify that the changes made were a real **improvement**.

HISTOGRAM

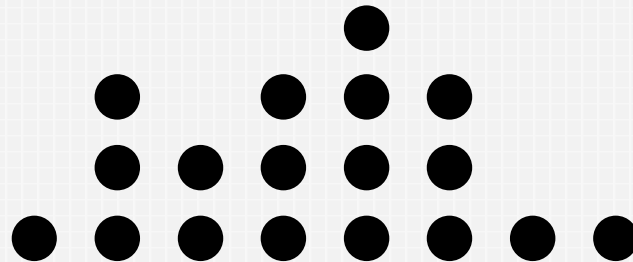Ideal to represent moderate to large amount of data.

N = 40

N = 14

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

HISTOGRAM

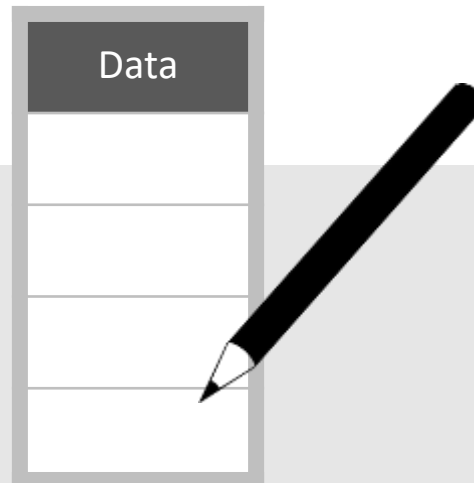It may not accurately display the distribution shape if the data size is too small.

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
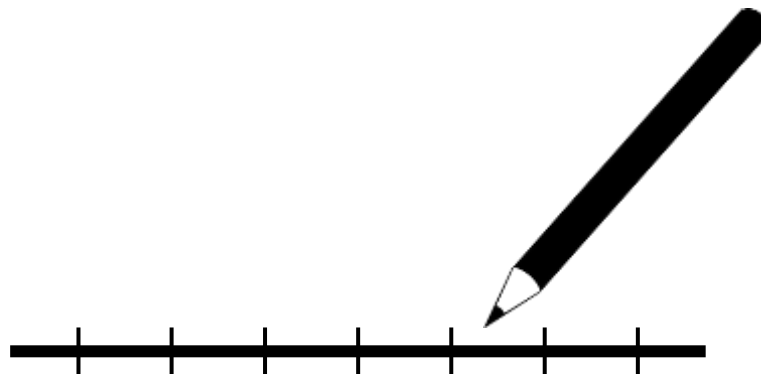
Create a summary table of the data

HISTOGRAM

Draw a horizontal line and divide it into equal **intervals** or bins (12 intervals for example)

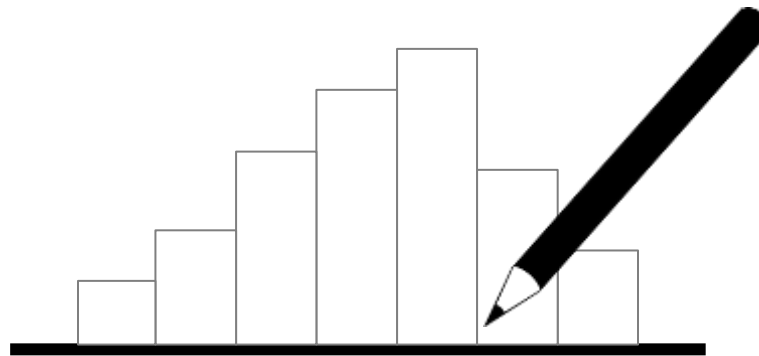The total width should be equal to the range of the data

HISTOGRAM

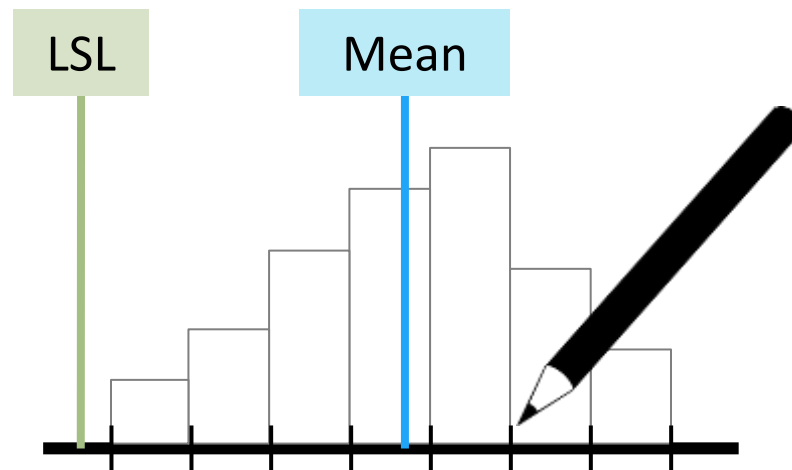Draw bars above each bin to represent the **frequency of the data values** within each interval

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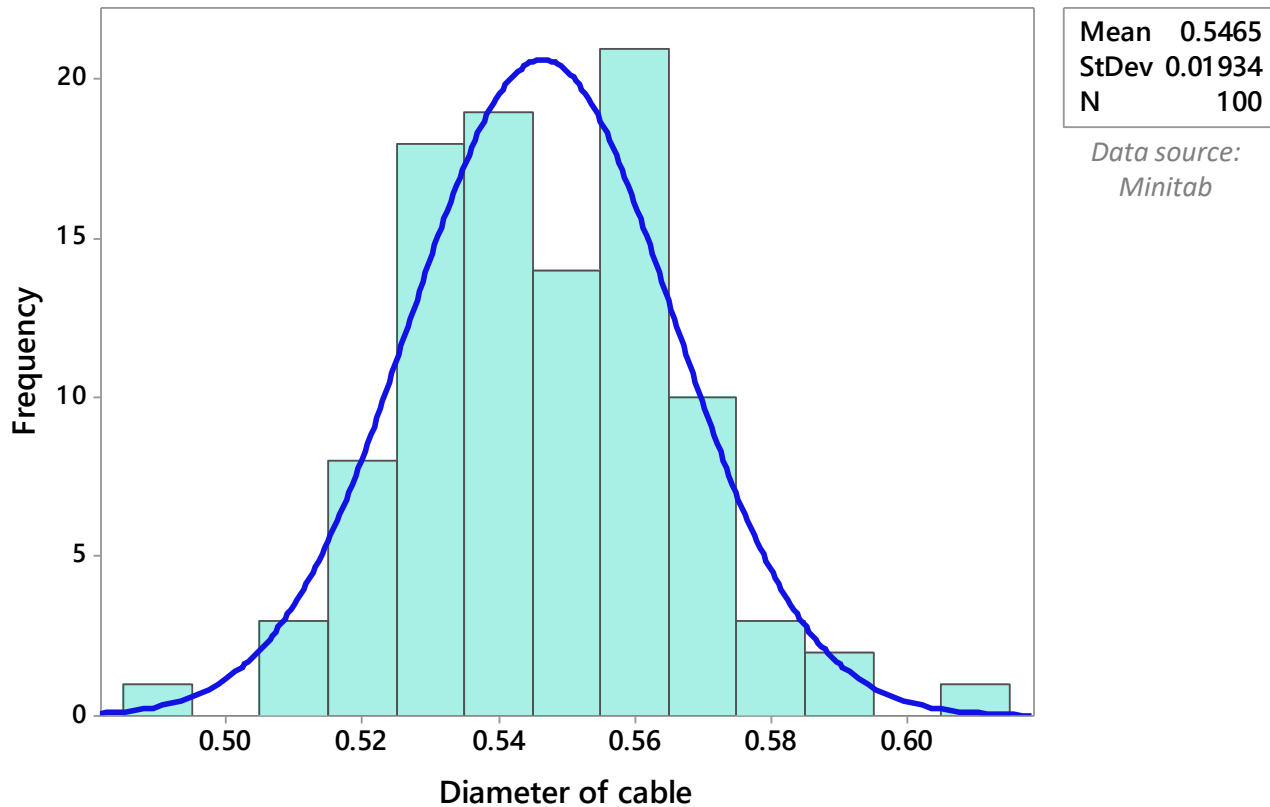(to indicate the continuity of the data)

HISTOGRAM

Indicate the **mean** of the data and other important information such as the **standard deviation** and the **specification limits**

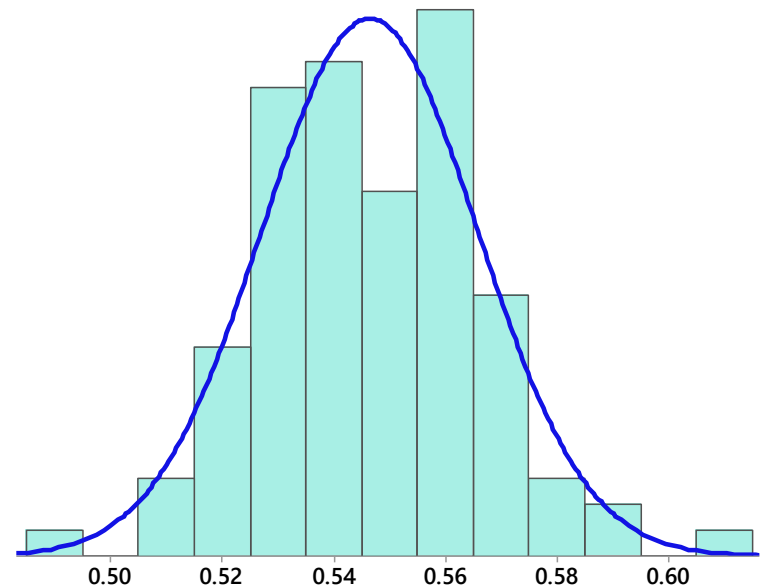# HISTOGRAM

Example – Cable Diameters

HISTOGRAM

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
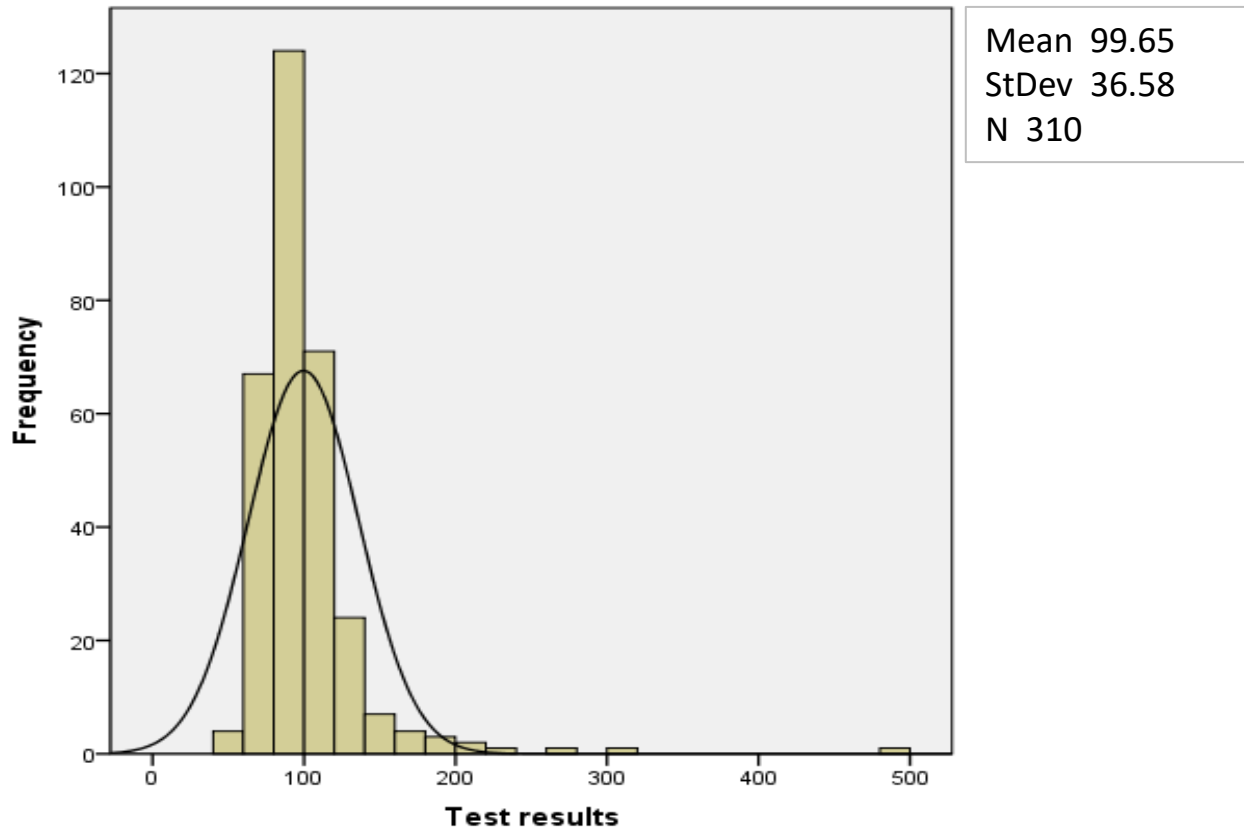Normal Distribution".*

Data source: Minitab

HISTOGRAM
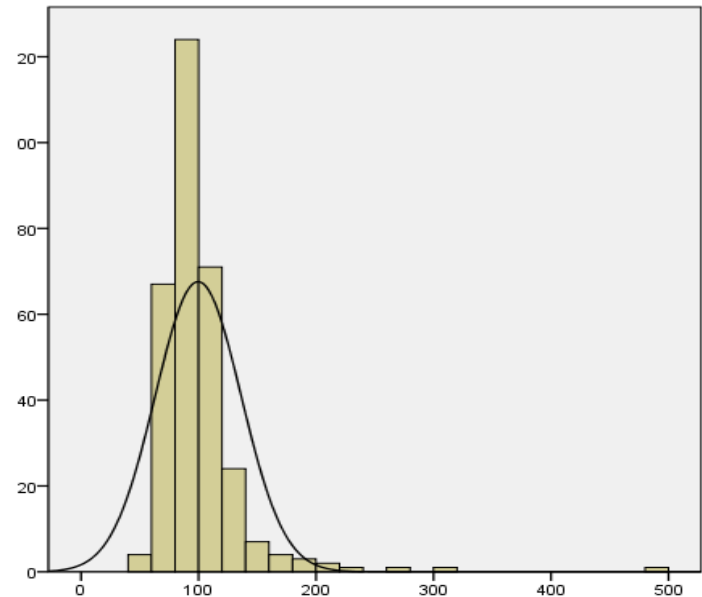
Example – Presence of Diabetes

Mean 99.65
StDev 36.58
N 310

Example – Presence of Diabetes

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

It looks more like an **exponential distribution** which is normal for this type of data.
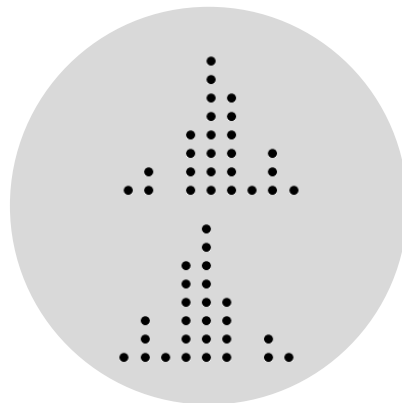
HISTOGRAM

Further Information

Histograms like control charts can be used to **assess improvement** overtime
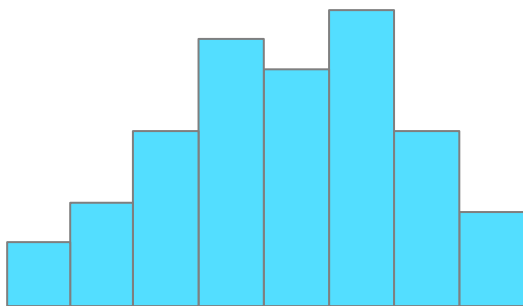
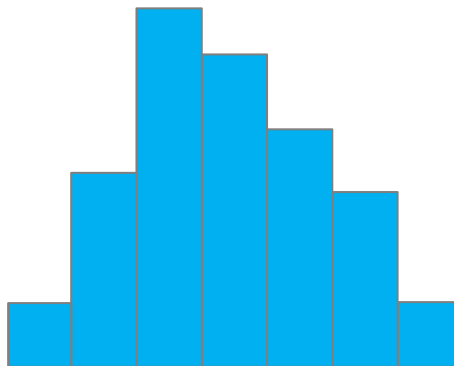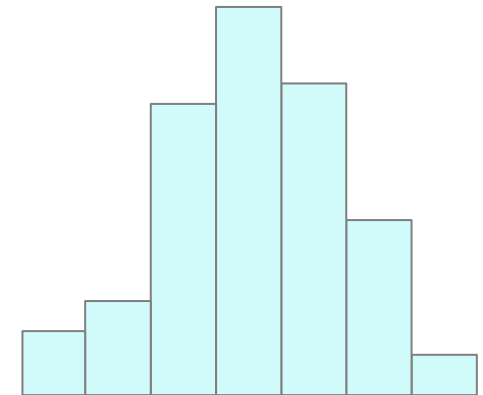Histograms, however, can't see changes and trends over time

HISTOGRAM

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

One of the 7 Basic Tools of Quality

HISTOGRAM

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