Types of Data and Measurement Scales

Data Science for Quality Management: Module 1 - Data and Measurement

with **Wendy Martin**

Learning objective:
Discern between qualitative and quantitative data, continuous and discrete data

Compare / contrast measurement and underlying characteristics

Using Data

“When you can measure what you are speaking about, and express it in numbers, you know something about it…

Using Data

…but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind.”

Lord Kelvin (1883)

Why Do We Need Data?

In business, we have questions that need to be answered.

- We must ask ourselves, “What do I really want to know?” and
- “Do my data help answer these questions?”

Data Costs Money

We must make data both

- Efficient and
- Effective

Measurement and Data

How do we study, record and communicate an event? We assign numbers.

- **Measurement** is the *process*
- **Data** is the *output*

Two Basic Types of Data

Quantitative data are data measured along a numerical scale.

- Often referred to as **continuous**.

Two Basic Types of Data

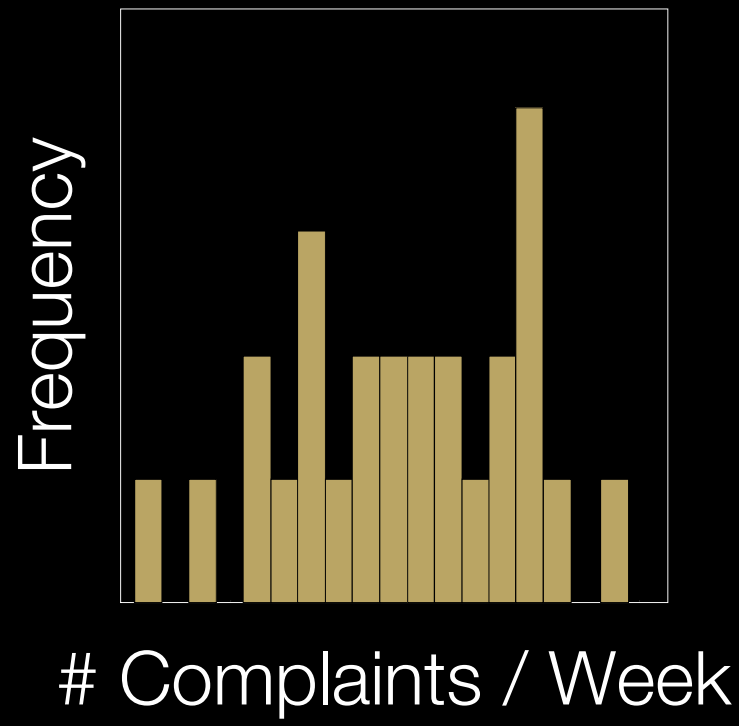
Qualitative data are descriptions that fall into categories.

- Often referred to as **discrete**.
- Frequencies, proportions, or rates.

Discrete vs. Continuous Data

Discrete Data:

- Items/Units we count



Discrete Data Examples

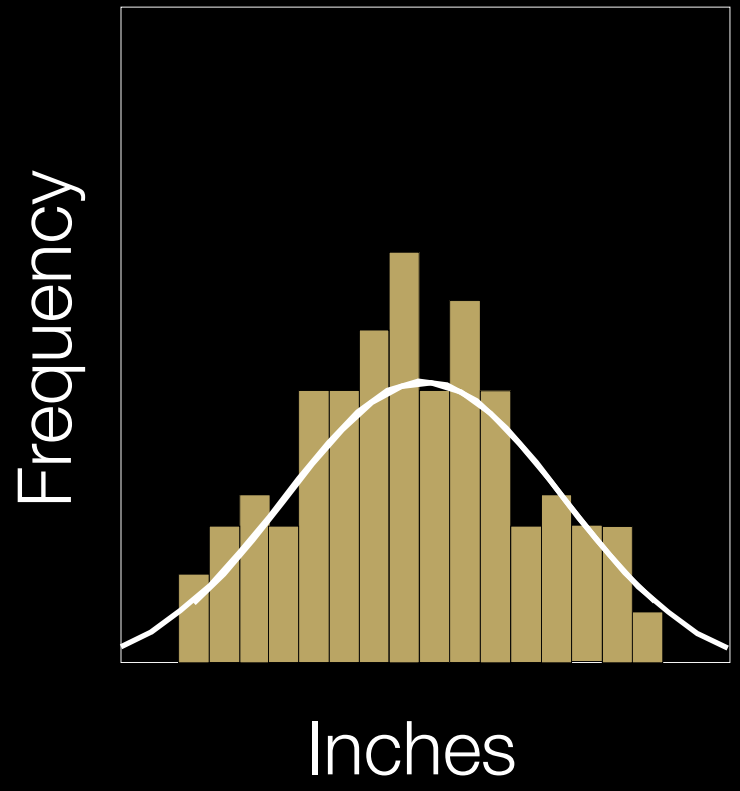
Examples of discrete data in business:

- Complaints per sales period
- Number of defects per unit
- Percent defective units
- Number of orders shipped on time

Discrete vs. Continuous Data

Continuous Data:

- Items/Units we measure



Continuous Data Examples

Examples of continuous data in business:

- Dimensions (height, length, width)
- Temperature
- Speed
- Volume of sales

Measurement & Measurement Scales

Measurement is the assignment of numbers or other symbols to an underlying attribute, characteristic or property.

Measurement & Measurement Scales

The numbers, or symbols, are assigned such that the relationships amongst the numbers or symbols reflect relationships in the attribute studied.

Measurement & Measurement Scale Example

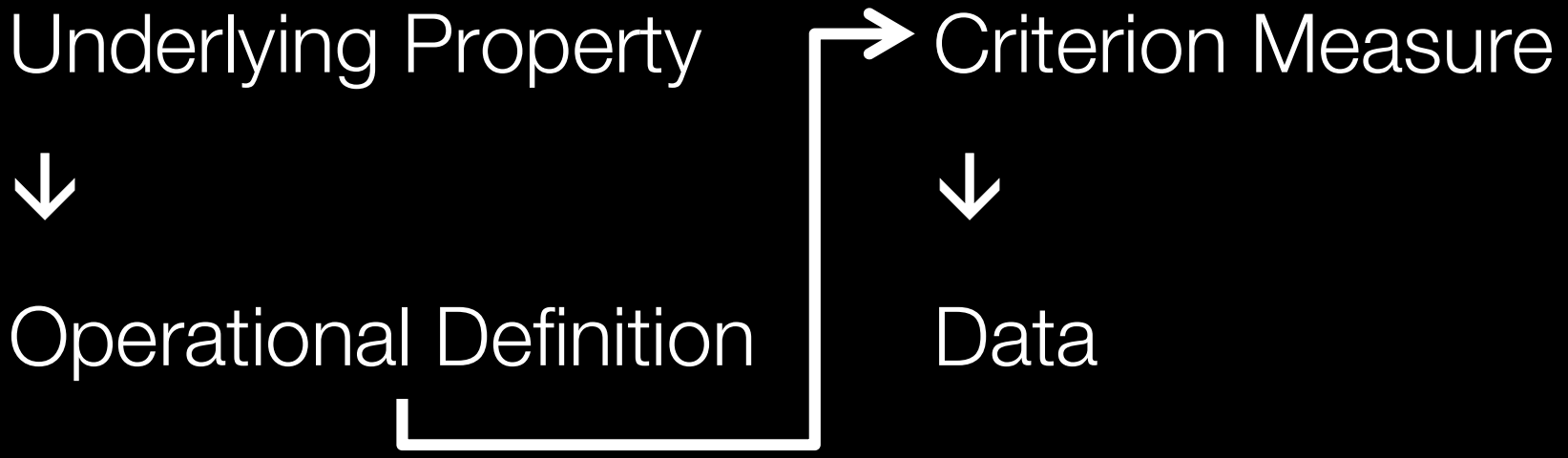
Measurement & Measurement Scale Example

Measurement & Measurement Scales

Measurements are not the same as the attribute studied

To draw conclusions, we must consider how the measurement maps to the attribute

Data


Underlying Property
Criterion Measure
Operational Definition
Data

Sources

The material used in the PowerPoint presentations associated with this course was drawn from a number of sources. Specifically, much of the content included was adopted or adapted from the following previously-published material:

- Luftig, J. An Introduction to Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1982
- Luftig, J. Advanced Statistical Process Control & Capability. Luftig & Associates, Inc. Farmington Hills, MI, 1984.
- Luftig, J. A Quality Improvement Strategy for Critical Product and Process Characteristics. Luftig & Associates, Inc. Farmington Hills, MI, 1991
- Luftig, J. Guidelines for Reporting the Capability of Critical Product Characteristics. Anheuser-Busch Companies, St. Louis, MO. 1994
- Spooner-Jordan, V. Understanding Variation. Luftig & Warren International, Southfield, MI 1996
- Luftig, J. and Petrovich, M. Quality with Confidence in Manufacturing. SPSS, Inc. Chicago, IL 1997
- Littlejohn, R., Ouellette, S., & Petrovich, M. Black Belt Business Improvement Specialist Training, Luftig & Warren International, 2000
- Ouellette, S. Six Sigma Champion Training, ROI Alliance, LLC & Luftig & Warren, International, Southfield, MI 2005