Classification of Measures

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Classification of Measures

- Point of view
  - Objective
  - Subjective
- Collection type
  - Direct
  - Indirect

Objective Measure

- There is no judgement in the measurement value
- It depends only on the measured object
- It can be measured by different people and the same value is obtained
  - Within the measurement error
- Example of objective measure
  - Number of Files (in a system)

Subjective Measure

- The person measuring makes some judgement
- The measure depends on both the object and the viewpoint
  - Its value can vary if the object is measured by different people
- Example of subjective measure
  - Programming skill of a developer

Direct and Indirect Measures

- Direct Measure
  - It does not involve measurements of other attributes
  - Example: Defects found in tests
- Indirect Measure
  - It is derived from other measures
  - Example: Defect Density (defects divided by lines of code)

Measurement in Software Engineering

Object of Measurement

- In SE, the object can be divided into process, product, and resources
  - **Process**: describes which activities are needed to produce software
  - **Product**: the artefacts, deliverables or documents that result from an activity
  - **Resources**: personnel, hardware or software needed for a process activity

Internal and External Attributes

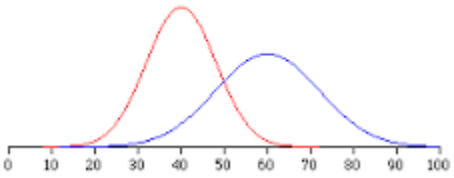
- Internal attributes can be measured purely in terms of the object
- External attributes can only be measured with respect to how objects relates to other objects
  - External attributes are mostly indirect measures derived from internal attributes

Examples of Measures

Class	Object	Attribute	Measure
Process	Testing	Internal	Effort
		External	Cost
Product	Code	Internal	Size
		External	Reliability
Resource	Personnel	Internal	Age
		External	Productivity

Challenges in SE

- It is often hard to define an attribute in a measurable way
- Validation of indirect metrics is difficult
  - We have to validate the underlying model and the direct metrics
- It is difficult to prove that the measures are in a ratio scale (most powerful one)
  - Statistical analysis depends on the scale type



Metric Collection

- How to collect metrics?
  - **Manual**: e.g., subjects fill out forms
  - **Automatic**: e.g., development environment is instrumented

- Metrics should not require too much effort to be collected
- The quality of the collected metrics is the basis for further analysis

Analysis of Metrics

- It is important to understand what kind of metrics were collected
- Example of issues
  - *Scale type*: the most powerful statistical analyses require the ratio scale
  - *Distribution*: it is important to verify if measures are normally distributed
- Ratio of two metrics (A/B) should be used carefully

Bibliography

- C. Wohlin et al. **Experimentation in Software Engineering**, Springer. 2012.
  - Chapter 3 – Measurement (Section 3.1 and 3.2)