

Experiment Terminology

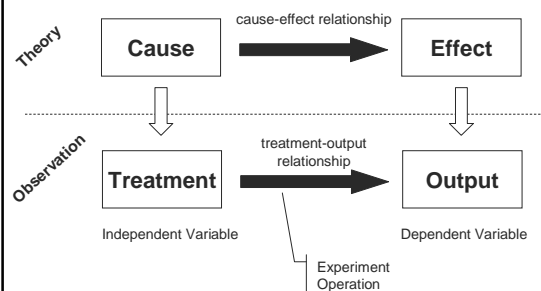
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Cause-Effect Relationship

- Experiment is based on the idea of a cause and effect relationship
 - We then formulate a hypothesis about this relationship
- The experiment tests the relationship between a treatment and the outcome
 - That is, it tests the hypothesis
- The goal is draw conclusions about the relationship between cause and effect

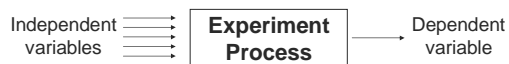
Experiment Principles



Experiment Variables

- There are two main kinds of variables in a experiment
 - Dependent variables
 - Independent variables
- The experiment studies the effect of changing one or more independent variables on the dependent variables

Illustration of Variables



Dependent Variable

- It represents the output or effect
- Often, there is only one dependent variable
- We want to study how it is affected by changes in the independent variables

[Independent Variables]

- They represent the inputs or causes
- Independent variables are all variables manipulated and controlled in an experiment
- Characteristics of objects and subjects can be independent variables
 - Subject: age, background, etc.
 - Object: number of metrics, tool used, etc.

[Example of Variables (book)]

- We want to study the effect of a new development method on productivity
- Dependent variable
 - Productivity
- Independent variables
 - Development method (main one)
 - Experience of developers
 - Tool support
 - Environment

[Our Example]

- We want to study the accuracy of metrics to detect bad smells
- Dependent variable
 - Bad smell detection
- Independent variables
 - Sets of metrics (main one)
 - Experience of developers
 - Time for detection
 - Analysis in pairs

[Factors and Treatments]

- Independent variables are also called factors
- A treatment is one particular value of a factor
- Example
 - Factor: Set of Metrics
 - Two treatment: Use of Traditional Metrics
Use of Concern Metrics

[Objects and Subjects]

- Treatments are applied to objects and subjects
- In human-based experiments, subjects are usually people
 - They are also called participants
 - Example: developers who analyzed the measurements
- Example of objects are the used measurements and documents

[Experimental Tests]

- Tests (or trials) are a combination of treatment, subject, and object
- The number of tests provides an estimation of the mean effect of factor
- Example of test
 - Person S1 uses concern metrics for detecting God Class in Health Watcher

[Human-based Experiments]

- Humans as subjects implies several limitations to the experiment control
 - They have different skills and backgrounds
 - They learn over time (the order of application may matter)
 - They may guess what the experimenter expects
- Technology-based experiments are easier to control since technology can be deterministic

[Bibliography]

- C. Wohlin et al. **Experimentation in Software Engineering**, Springer. 2012.
 - Chapter 6 – Experiment Process (Section 6.1)