Lecture 6: Models

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Goals for this Lecture

- Discuss Models
  - to wrap up our discussion on descriptions

Models: What are they?

- Examples
  - model airplane
  - new car models
  - economic models
  - mathematical models
- What generic characteristics do these examples possess?

Focus: Mathematical Models

- Mathematicians and Logicians speak of the real world as a model of their theories
  - Theory is fundamental and the world is secondary
    - So, frustrated airline customers waiting to check in are merely a model of a queue
    - A pile of plates is a model of a stack
- Is this view useful to software engineers?

Software Engineering Models

- Ed Yourdon in *Modern Structured Analysis*
  - The systems analysis models …are for the most part, paper models of the system-to-be, that is, abstract representations of what will eventually become a combination of computer hardware and computer software
- Marca and McGowan in *SADT*
  - An SADT system description is called a "model"…An SADT model is a complete, concise, and consistent description of a system which is developed for a particular reason
- Are these definitions useful?
  - These models sound like descriptions…

Models are more than Descriptions

- From Ackoff's *Scientific Method*
  - He distinguishes three kinds of models
    - iconic
      - Model airplanes are icons of real airplanes
    - analogic
      - an electric network modeling liquid flow via pipes
        - » wires are analogous to pipes, current = flow, etc.
    - analytic
      - a set of differential equations claiming to describe how prices change; represent economist's analysis

In SE, Models are Analogic

- Analogic models are interesting because they are analogues of the things they model
  - They share properties and structure
    - For instance, a good model airplane is not only an "icon", it can also fly!
  - Analogic models thus simulate (to some degree) the things they model
- Object-Orientation is predicated on this notion
  - If I want to model an elevator system, I will create objects in my descriptions that model real world elements, such as elevators, doors, buttons, etc.
  - I use these objects to create requirements, to design a software system, and finally to implement it

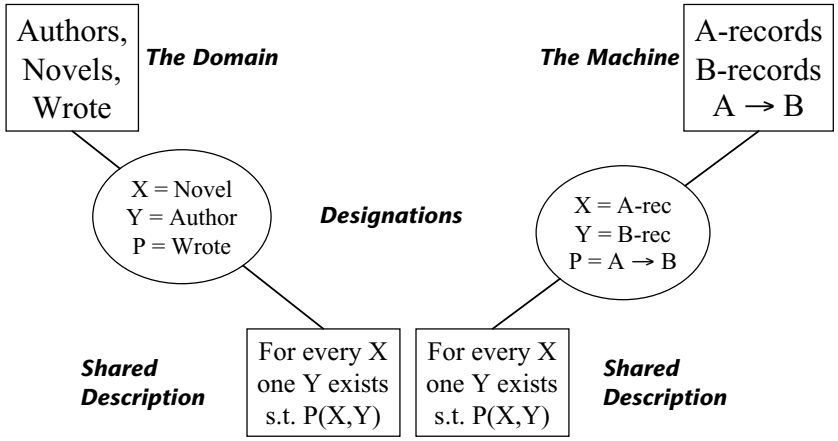
More on Analogic Models

- Analogic models have two distinct characteristics
  - First, there is some description that applies both to the machine and to the world it models, and captures what they have in common
    - what we have been calling "the shared phenomena"
  - Second, there is a correspondence between individuals in the machine and individuals in the world

An Example

- Assume you are building a database of nineteenth-century English novelists
  - You are building a database model inside the computer of the real world of the novelists
    - Some of the real-world relationships among authors, books, fictional characters will also hold among the novelist records, book records, and character records in the database
  - The machine, thus, becomes a model of reality; Information about this particular reality becomes accessible to the machine and its users

Correspondence between Reality and the Machine



Another Way to Think About It

We can use this one model and switch mentally between the domain and the machine; however beware, this risks causing confusion between

- ¥ the description that is true of the domain and the machine
- ¥the description that is just true of the domain
- ¥the description that is just true of the machine

M is for Modeling