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# SWE 530:

## Software Design Process

### The Nature of the Design Process

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Adapted from slides of Dr. Albert Ali Salah

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# Overview

- What is design?
  - The role of the design activity
  - Design as a problem-solving process
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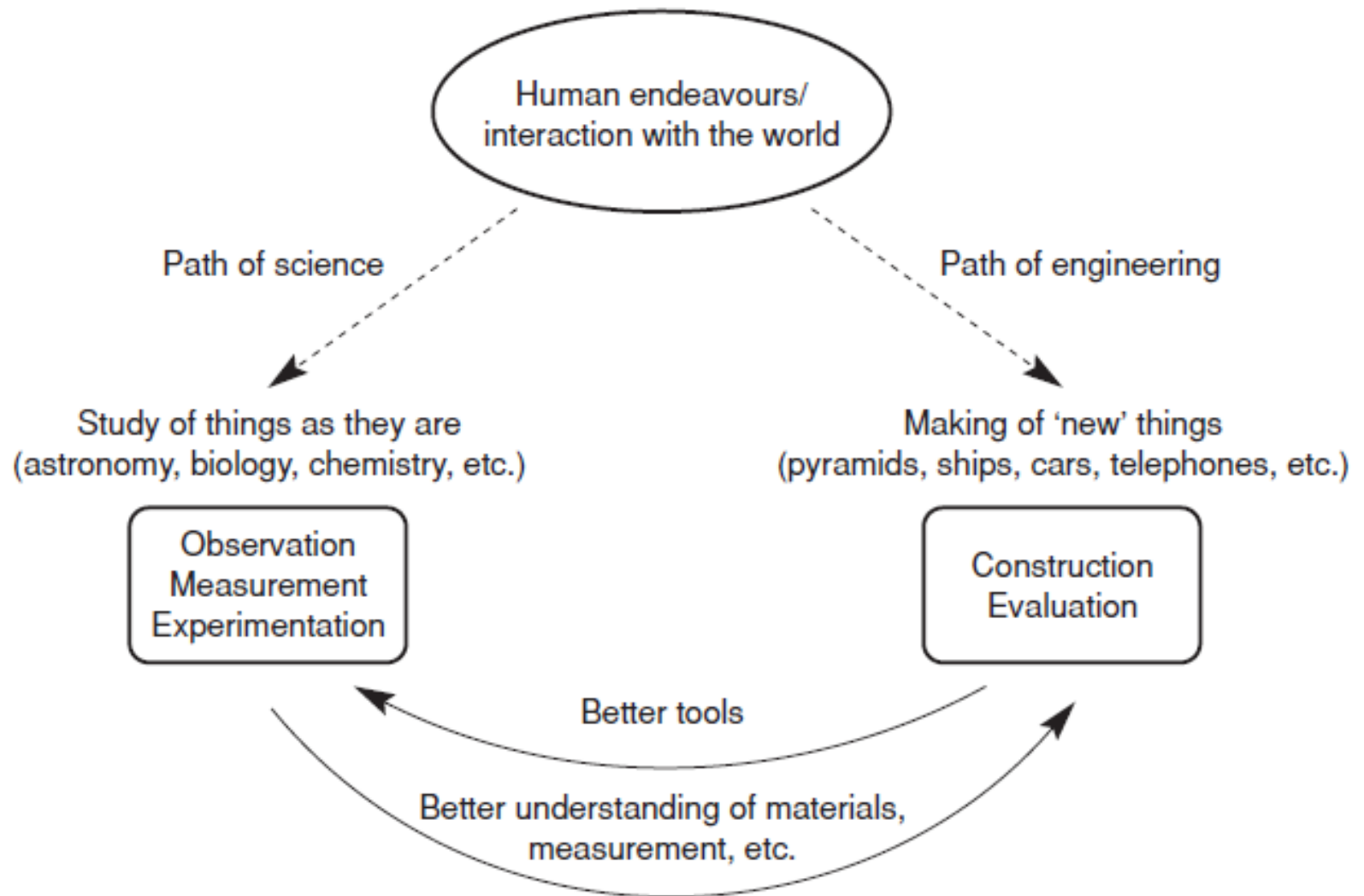
# What is design?

- Producing tools involves **design**.
- Translating a design into a product involves **communication**.
- Design expertise
  - Ability to **reuse** ideas
  - Includes all-round consideration of aspects (including safety, efficiency, reliability, aesthetics...)
  - Extends to **fabrication** of the product.

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# Activity

- What is the difference between science and engineering?



**Figure 1.1** The complementary nature of scientific and engineering activities.

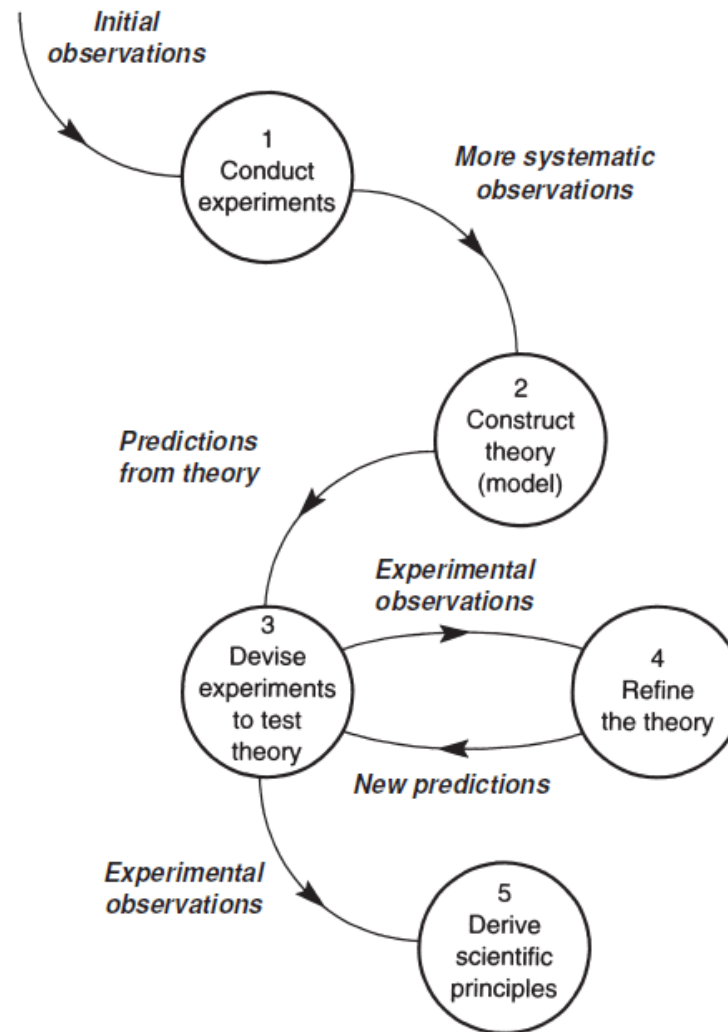


Figure 1.2 The nature of scientific analysis.

# What is design?

- Design is a set of activities that need to be performed by the designer in deriving and specifying **a solution to a problem**
- Design is a set of activities that need to be performed by the designer to **produce a workable solution**
- There is an order or sequence to these actions
- There may be more than one possible solution for a given problem
- The fitness of the solution is measured by the correctness or appropriateness of that solution

# What is design?

- **Black box model:** describes the external functionality and behaviour of a system as a whole, without any reference to HOW this is to be achieved.
- **White box model:** a model in which the workings of the system are described.



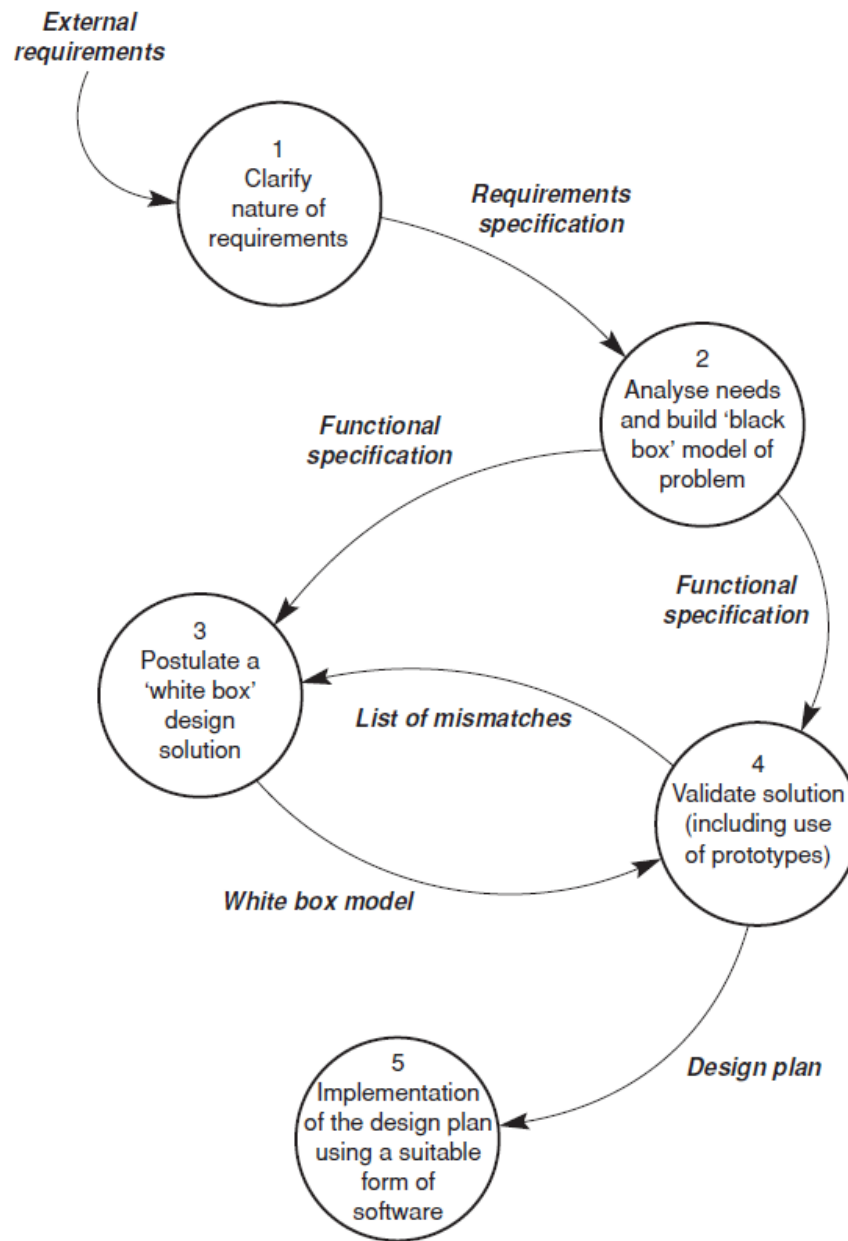


Figure 1.3 A model of the design process.

# What is design?

- The design process consists mainly 4 activities
  - 1) Postulate a solution
  - 2) Build a model of the solution
  - 3) Evaluate the model against original requirements
  - 4) Elaborate the model to produce a detailed specification of the solution

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# What is design?

- The nature of the design process
    - The design process will not be implemented in a single precise sequence
    - The design process is **iterative** in nature
    - The design process contains the extensive backtracking
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# Case Study: Moving House

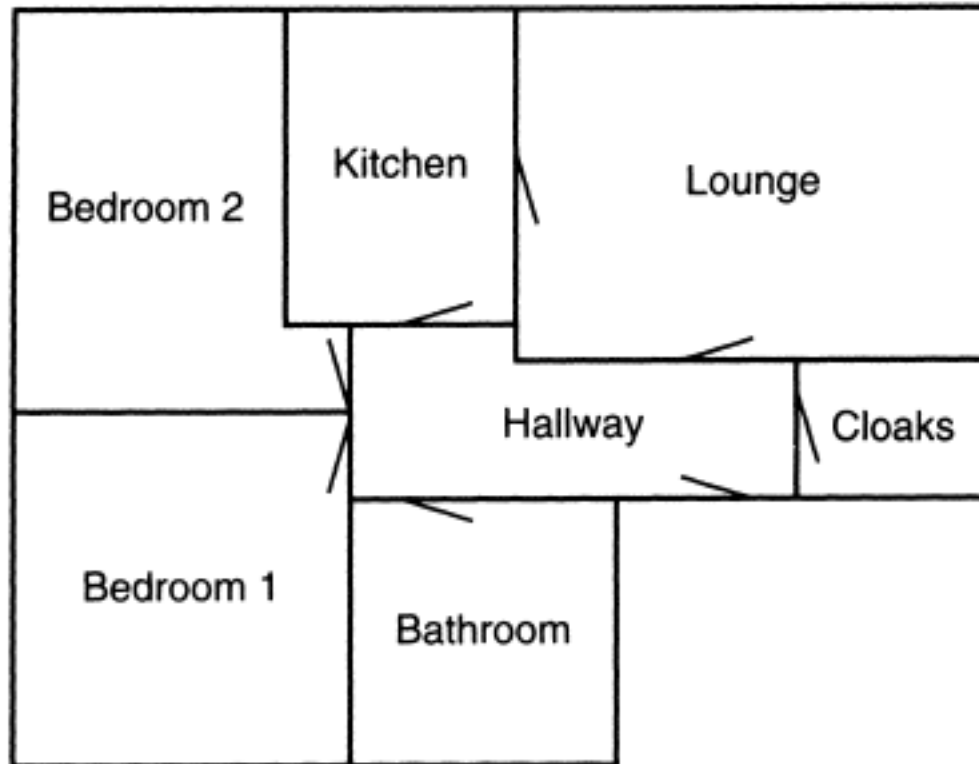
- How do you plan when moving to a different house?

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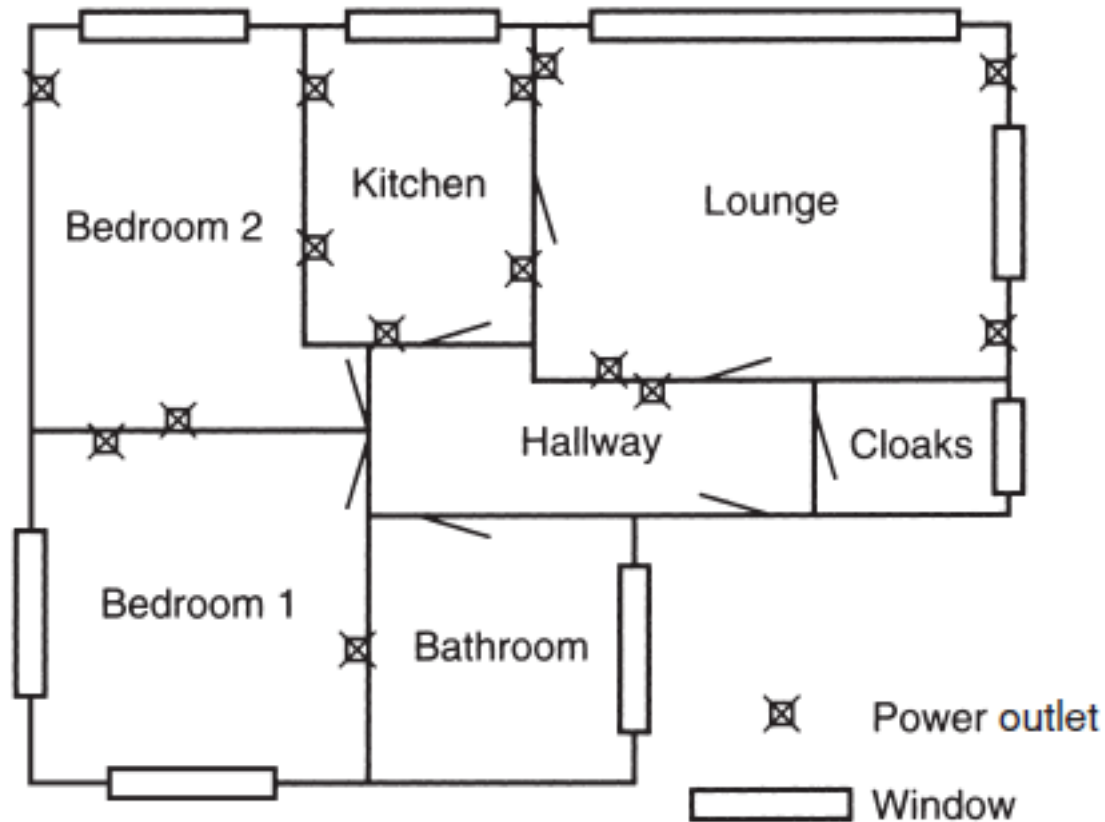
# Case Study: Moving House

- How do you plan when moving to a different house?
  - Possible parameters:
    - House plan
    - Initial model: a coarse representation
    - Strategies: good ideas that can be reused, like priority
    - Constraints: e.g. Do not obstruct power outlets
    - Modularity
    - Quality
    - Reuse
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# Outline plan



# Extended plan



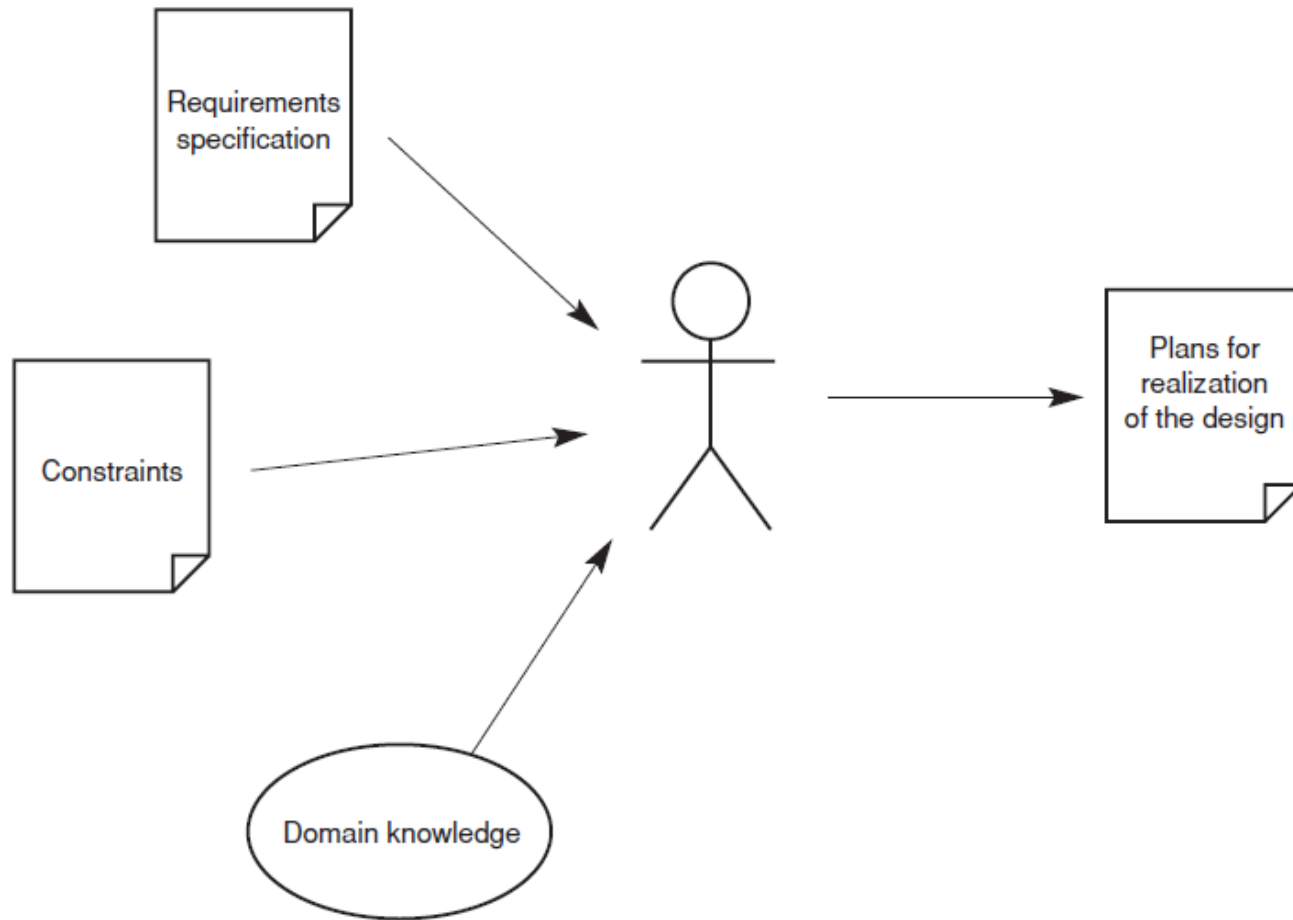
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# The Role of Design Activity

- The main task of design activity is to produce the plans necessary for (s/w) production to proceed
  - The form and extent of the plans will be determined by the design practices, means of implementation and size of the system being developed
  - Objectives may be different:
    - a plan that informs the removal men where each major item of furniture is to be positioned;
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# Software design

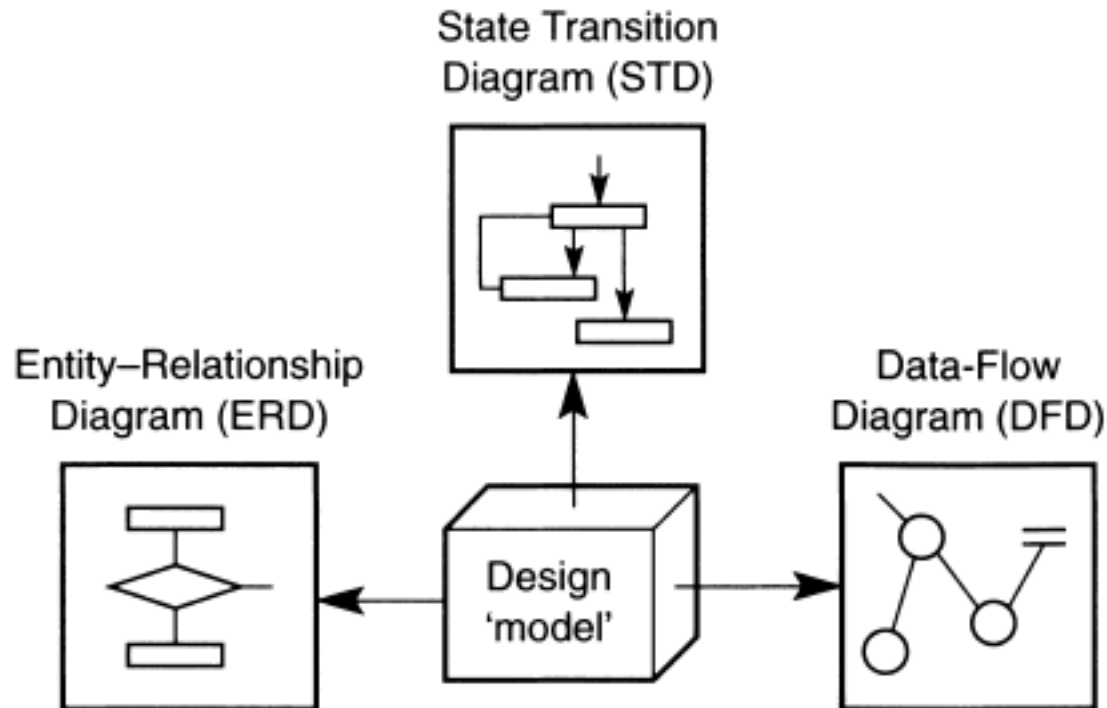


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# Software design

- The plans will be concerned with describing
    - Structure of the system including sub programs
    - Data objects to be used in the system
    - The algorithms to be used
    - Packaging of the system
    - Interactions between the components
    - Designing process
    - Viewpoints (E-R,DFD,STD)
  - The plan should even specify how the final product is to be assembled by making use of components
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# Software design: Viewpoints



# Design as a problem solving process

- Design is NOT an analytical process:
  - The process of design involves the designer in evaluating different options, and in making choices using decision criteria that may be complex and may involve trade-offs between factors such as size, speed and ease of adaptation, as well as other problem-specific factors.
- **Abstraction** enables the designer to concentrate effort on building a logical model of a system, which is translated into a physical model at a relatively late stage in the design process

# Summary

- the design process is concerned with describing ***how*** a requirement is to be met by the design product;
- design ***representation*** forms provide means of modelling ideas about a design, and also of presenting the design plans to the programmer;
- ***abstraction*** is used in problem-solving, and is used to help separate the *logical* and *physical* aspects of the design process;

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# Activity

- Sketch out a design for a wooden storage rack for DVDs
    - Then think about how you reached your design, and what changes you made to it as your thinking developed.
  - Designing software is made more complex because we are designing for a sequence of actions. **Sketch out a design for a set of instructions** for making tea with a teapot and teabags. Try to consider the major problems that might arise. How would you organize the instructions for these exceptional situations so that they do not obscure the original design?
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