

**ELG3336**

# **Introduction to Engineering Design**

Both the engineer and scientist are thoroughly educated in the mathematical and natural sciences, but the scientist primarily uses this knowledge to acquire new knowledge, whereas the engineer applies this knowledge to design and develop usable devices, structures and processes. In other words:

**The scientist seeks to know, the engineer aims to do.**

*Eddie, Jenison, Mashaw and Northup, Engineering Fundamentals and Problem Solving.*

I hear... I forget  
I see... I remember  
I do... I understand

— *Confucius c. 500 B.C*

# Design Explained

*Design is not just what it looks like and feels like. Design is how it works. Steve Jobs*

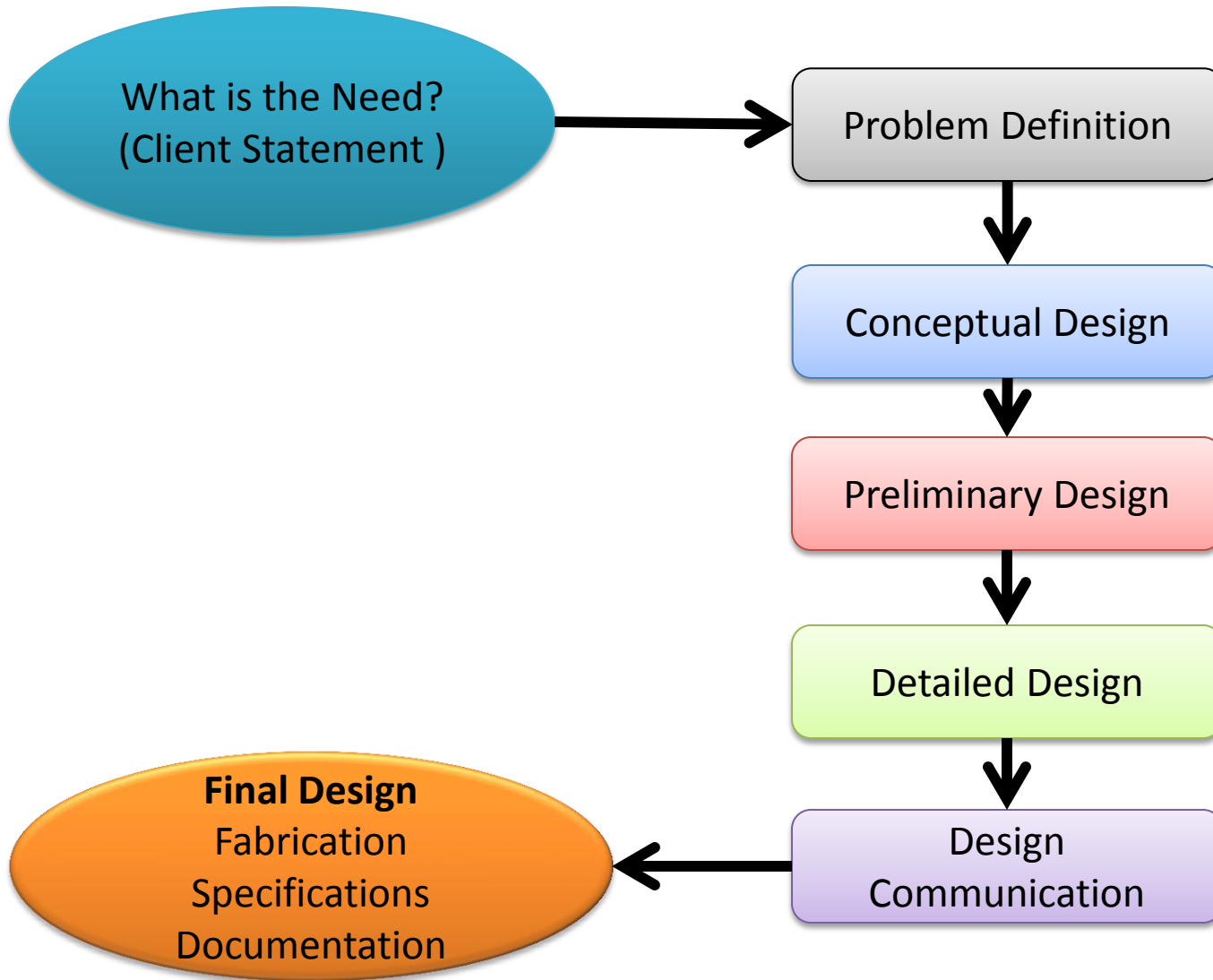
- The word “**design**” takes on a variety of noun and verb meanings.
- In its noun form, dictionaries suggest concepts of sketch, drawing, plan, pattern, intention or purpose, or the art of producing them.
- In its verb form the same dictionaries suggest elements of definition involving representing an artefact, system or society, or the fixing of its look, function or purpose.
- The word “**design**” therefore has meanings ranging from the abstract conception of something to the actual plans and processes required to achieve it.

# Design in Engineering

- Design is the “central creative process” of engineering. It is, in fact, the **“essence of engineering.”**
- The Canadian Academy of Engineering states that, “Engineering is a profession concerned with the creation of new and improved systems, processes, and products to serve human needs. The central focus of engineering is design, an art entailing the exercise of ingenuity, imagination, knowledge, skill, discipline, and judgment based on experience.”

# Types of Design

- **Engineering Design:** Concerned with applying various techniques and scientific principles to the development and analysis of basic functional features of systems, devices, and service.
- **Product Design:** Associated with specifically those items that are ultimately to be sold to consumers. It takes into consideration how the item will perform its intended functionality (engineering design) in an efficient, safe, and reliable manner.
- **Interface Design:** Concerned with translating the functionality conveyed by the product designer and formulate how the user actually uses and experiences to understand that functionality in the product, on a step-by-step basis.
- **Visual Design:** Concerned with the appearance features of an item. It reflects personal expression (artistic), concrete (realism) or abstract.



Phases of the Engineering Design Process

# Problem Definition

Identify the Problem

## Information

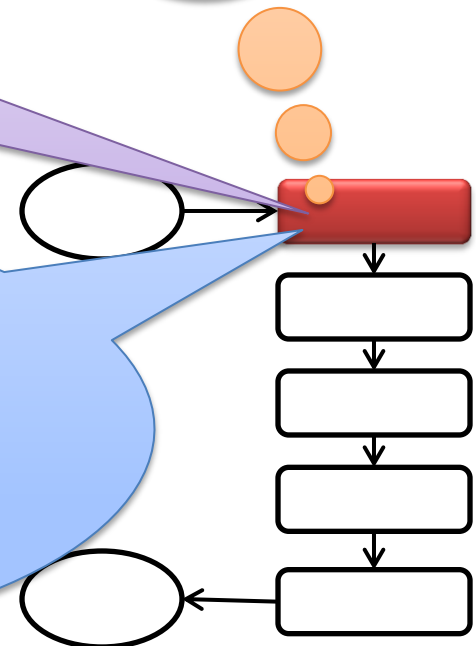
Literature on the state-of-the art!  
Experts!  
Standards!  
Regulations!

## Techniques

Objectives tree!  
Function-means tree!  
Requirements matrix!

## Means

Literature review!  
Brainstorming!  
User surveys and questionnaires!  
Interviews!



# Conceptual Design

Select the Best Design Parameters

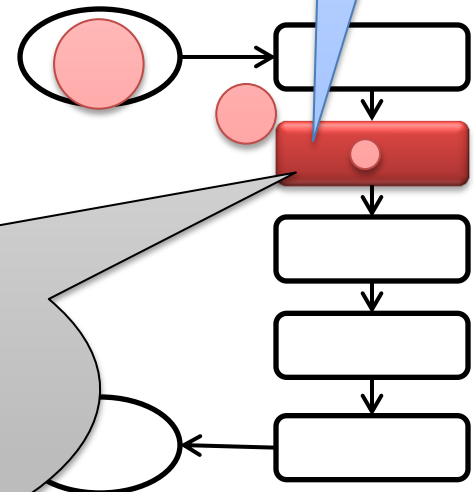
Sources of Information  
Competitive products!

## Techniques

Quality function deployment!  
Morphological chart!

## Means

Brainstorming!  
Benchmarking!  
Reverse engineering!





# Preliminary Design

## Information

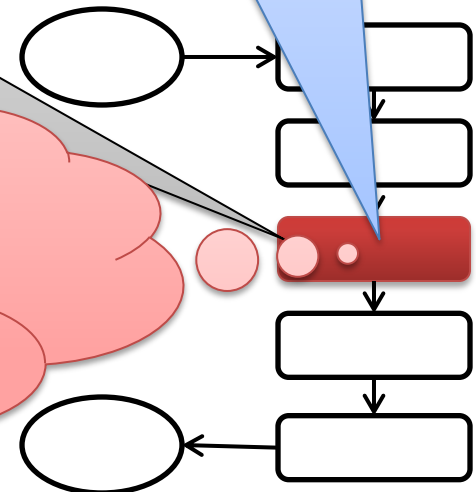
Rules of thumb!  
Simple models!  
Known physical relationships!

## Means

Laboratory experiments!  
Prototype development!  
Simulation!

## Techniques

Refined objectives tree!  
Comparison charts!



# Detailed Design

## Means

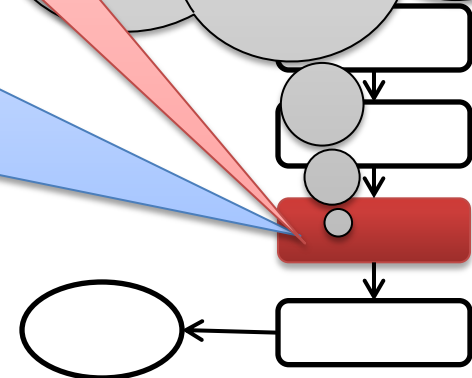
Formal review!  
Public hearing!

## Information

Design codes!  
Handbooks!  
Local laws and regulations!  
Suppliers specifications!

## Techniques

Computer Aided  
Design and Drafting

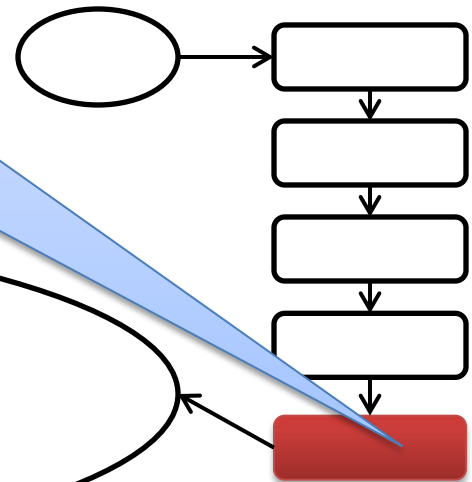


# Design Communication

## Information

Feedback from clients!

*Design is really an act of communication, which means having a deep understanding of the person with whom the designer is communicating. Donald A. Norman*



# ELG3336 Course Project

- Project presentations will be carried out during the third and fourth week of November, 2017 as shown in the course Webpage.
- Presentations will be conducted based on each TA teams.
- It is recommended to start preparing a video (text and animation) for the presentations (2-3 minutes).
- Presentations may include the following:
  - Project Title
  - Team Members
  - The Project Idea
  - The Project Design
  - The Development Timeline and Prototype in Progress