



*EE 15N*  
**The Art and Science of  
Engineering Project Design**

*Professor Andrea Goldsmith*  
*Professor My Le*



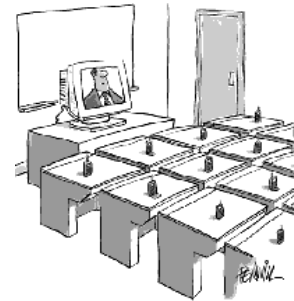
## Outline

- Course Goals
- Student Introductions
- Course Information
- Lectures
- Assignments
- Project
- Introduction to Engineering Design

## Course Goals

- To introduce freshmen to the design process of an engineering project.
- To present the different functions that people play in a project
- For students to consider what role in a project is best suited to their interests and skills.
- To have fun

## Advanced Classroom Design



## Student Introductions

- Introduce yourself
- Say why are you interested in this course
- Share any thoughts on your future career

## Course Information

*(see web or handout for more details)*

- Instructors:
  - Andrea Goldsmith, Packard 371, andrea@ee, Ext: 56932, OHs: M 2:15-3:05pm and by appt.
  - My T. Le, drmytle@yahoo.com, 224 1351, OHs: M 1:30-2:15 and by appt.
- Class Homepage: [www.stanford.edu/class/ee15n](http://www.stanford.edu/class/ee15n)
- Class Mailing List: ee15n-win0708-students (automatic registration)
- Admin: Pat Oshiro, 365 Packard, poshiro@stanford, 3-3164.
- Book: Engineering Design - A Project-Based Introduction by Clive Dym and Patrick Little.
- Grading: Class Participation 20%, Assignments 20%, Project Assignments, Presentation, and Final Report: 60%

## Lectures

- Lecture 1: Introduction to Engineering Design
  - Guest: Gary Banta (Founder/Former CEO of Stretch)
- Lecture 2: The Design Process
  - Guest: Jim Fruchterman (Benetech)
- Lecture 3: Defining an Engineering Problem
  - Guest: Mark Ross (Dell)
- Lecture 4: Functions and Specifications
  - Guest: Michael Farn, Partner, Fenwick and West LLP
- Lecture 5: Generating Design Ideas
  - Guest: Shanda Bahles (El Dorado Ventures)
- Lecture 6: Why Things Fail
  - Guest Panel: K. Meyer (Intuit), E. Schooler (Intel), J. Hei (Orbitbaby)
- Lecture 7: Wrapping Up, Looking Ahead, Long-Term Impact
  - Guest Lecture: Vinu Sundaresan (Speakeasy)

## Tours and Presentations

- Google Tour with dinner: March 6 (tentative)
- Another tour may be scheduled

**Project presentations will be March 19, 12:30-3:30  
(Wednesday of finals week).  
Or we can schedule for the last week of classes.**

## Assignments (pick 2 of 3, 3-5 pages)

- A report on how society shapes technology or vice versa.
  - Examples: stem cell research, cell phones, nuclear power, the Internet, space travel.
- A case study of a complex engineering project
  - Examples: the IPOD/iPhone, Facebook, the space shuttle, MRIs, hybrid cars.
- Describe in more detail an engineering project executed by one of our guest speakers

## Project

- A term project will be used to illustrate the design concepts introduced in the course.
- The project will be designed by a team of approximately four students
  - Must form teams and decide on project by 1/28 (next lecture, 2 weeks from now).
  - 1 paragraph proposal due 1/30 (extra OHs next week; Andrea: 1/23 2:15-3pm, My: 1/22 2-3pm)
  - Projects from last year will be posted on website
- Project requirements include interim documents, a final report, and a final presentation

## Project Ideas

- Cell phone (features/programs/interface)
- Software to share/archive/market and distribute music legally
- A new user interface for cell phones
- An Internet service for a remote village
- An automated house for elderly/disabled
- A green dorm
- Propose your own *Any thoughts?*

## Engineering Design *Some Questions*

- What is engineering design?
- Who participates?
- What processes are needed?
- How is success measured?

## Textbook Definition of Engineering Design

The systematic, intelligent generation and evaluation of specifications for things/devices whose form and function achieve stated objectives while satisfying given constraints

- Design is a systematic process
- There are formal methods for this process
- The form and function of a design are separate yet related
- Design specifications detail how the design should perform, and provide a metric for success

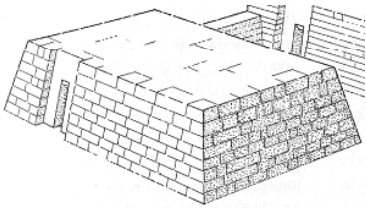
## History of Design

- People have been designing things for a long time
- Examples of great designs from antiquity:
  - Great Pyramids in Egypt
  - Mayan Cities and Temples
  - Great Wall of China
- No records survive from these projects
- Basic design method in the past (and present)

**Trial and Error**

## Design Evolution: Pyramids

*Mastaba*



## Design Evolution: Pyramids

*Step Pyramid*

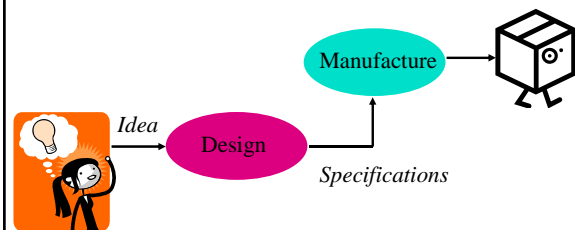


## Design Evolution: Pyramids

*Bent Pyramid*



## From Design To Manufacture



## Failure in Communication

Example: Collapse of a Walkway

Place: Regency Hyatt Hotel, Kansas City

Date: July 17, 1981

Result: 114 deaths  
more than 200 injuries

## New Practices

- Design for Manufacturing
  - Incorporate manufacturing into design specifications
- Concurrent Engineering
  - Designers & manufacturing specialists working together

## Design In A System Context

Design is intended to produce a description of an artifact in terms of its organization and functioning – its interface between inner and outer environment

*Herbert A. Simon*

## Engineering Design Is Difficult

- Design problems are ill-structured
  - Cannot directly apply formulas or algorithms
- Design problems are open-ended
  - Problems usually have several acceptable solutions

## Managing Engineering Design

- Planning
- Organizing
- Leading
- Controlling

*How would you go about managing a complex engineering project?*

## Today's Guest Speaker

Gary Banta  
Founder of Stretch