

EGR 107 - Introduction to Engineering Design

Course Coordinator:

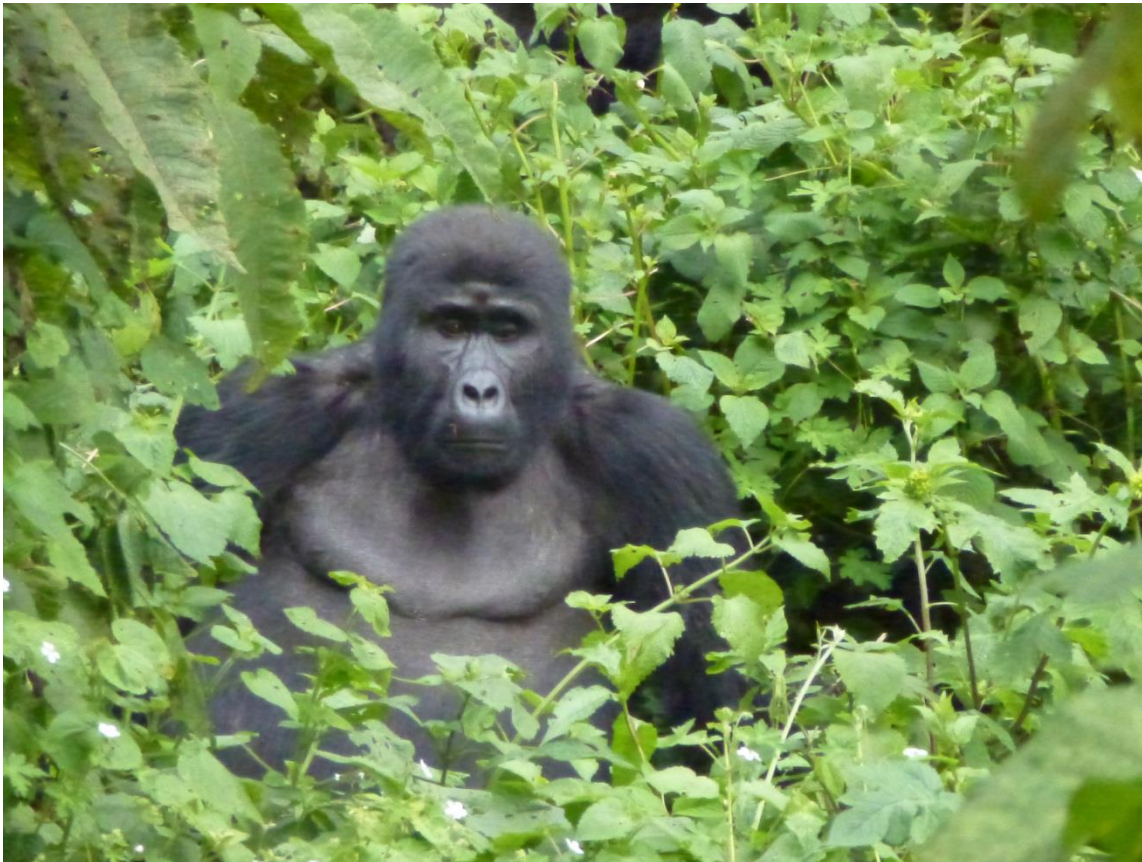
Dr. Laura Lackey

Course Instructors:

Dr. Edward O'Brien

Ms. Melinda Hollingshed

Dr. Michael MacCarthy



Course Materials

- Textbook - None
- Handouts in Lecture and Recitation
- On the web at
[http://faculty.mercer.edu/lackey_I/
EGR107Handouts.htm](http://faculty.mercer.edu/lackey_I/EGR107Handouts.htm)

Administration

- Attendance will be taken in both Lecture and Recitation
- **No** open Laptops during Lecture presentations
- E-mail contact:
 - Mercer e-mail – lackey_l@mercer.edu
 - Please start subject line with EGR 107
- Assignments:
 - Read the Syllabus [you will receive a copy in your recitation section]
 - Course content, structure, requirements, and attendance policies
- Sign-in sheet at end of Lecture by section
 - If you are not on it, print your name and initial by current date

What is Design?

The word “*design*” is often used as a generic term that refers to anything that was made by a conscious human effort.

Design is also a process that is used to systematically solve problems.

What is a Design Process?

Engineering Design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

What is Design, really?

Which of the following is design and which is analysis?

A. Given that the customer wishes to fasten together two steel plates, select appropriate sizes for the bolt, nut and washer.

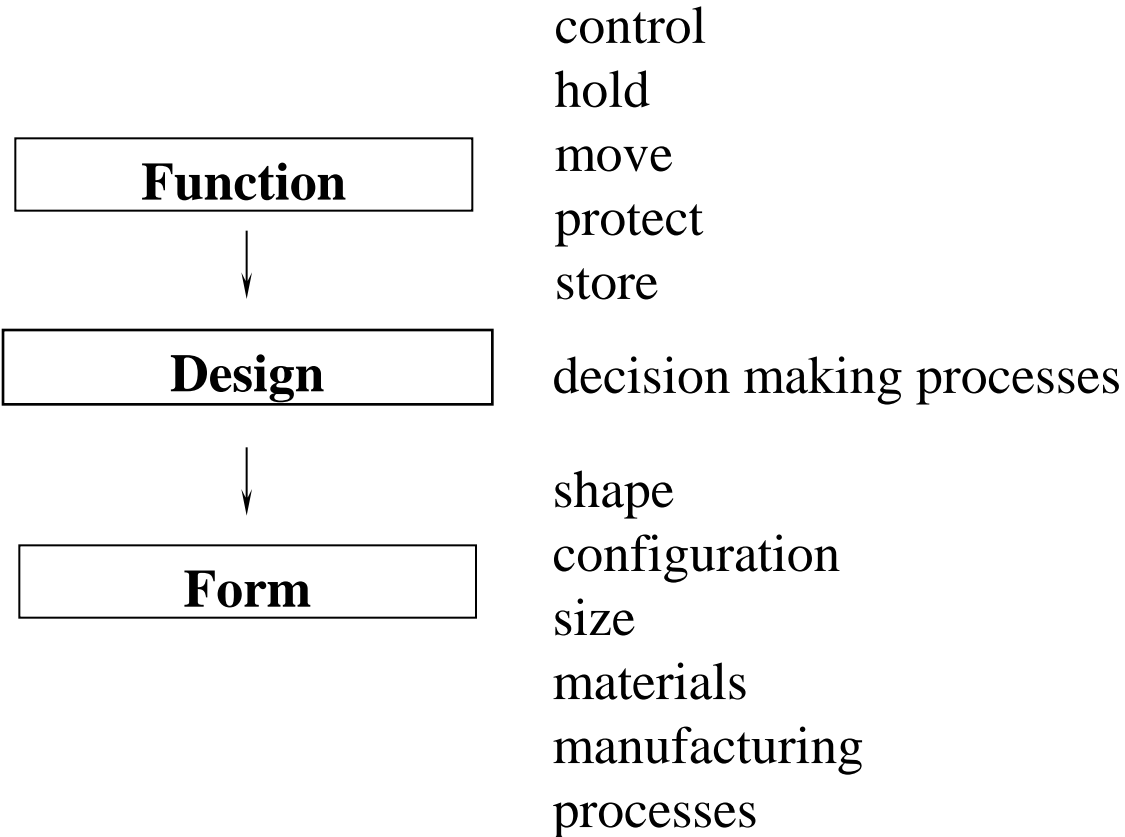
B. Given the cross-section geometry of a new airplane wing we determine the lift it produces by conducting wind tunnel experiments.

Design

Analysis

Form is the solution to a design problem.

How are Function and Form related



Form Ever Follows Function

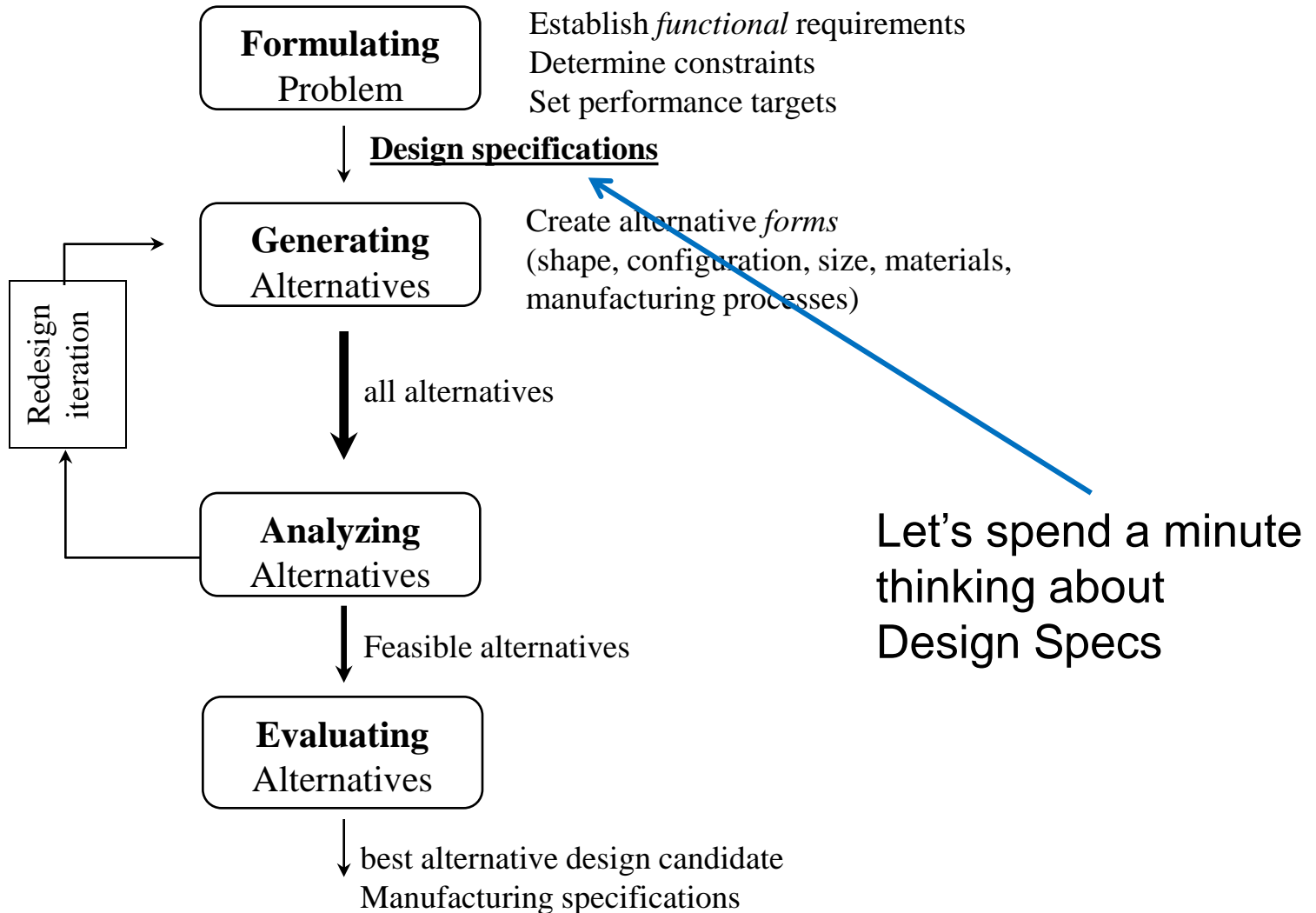
Luis Sullivan

Design – definition

Set of *decision making processes and activities* to determine the *form* of an object, given the customer's desired *function*.

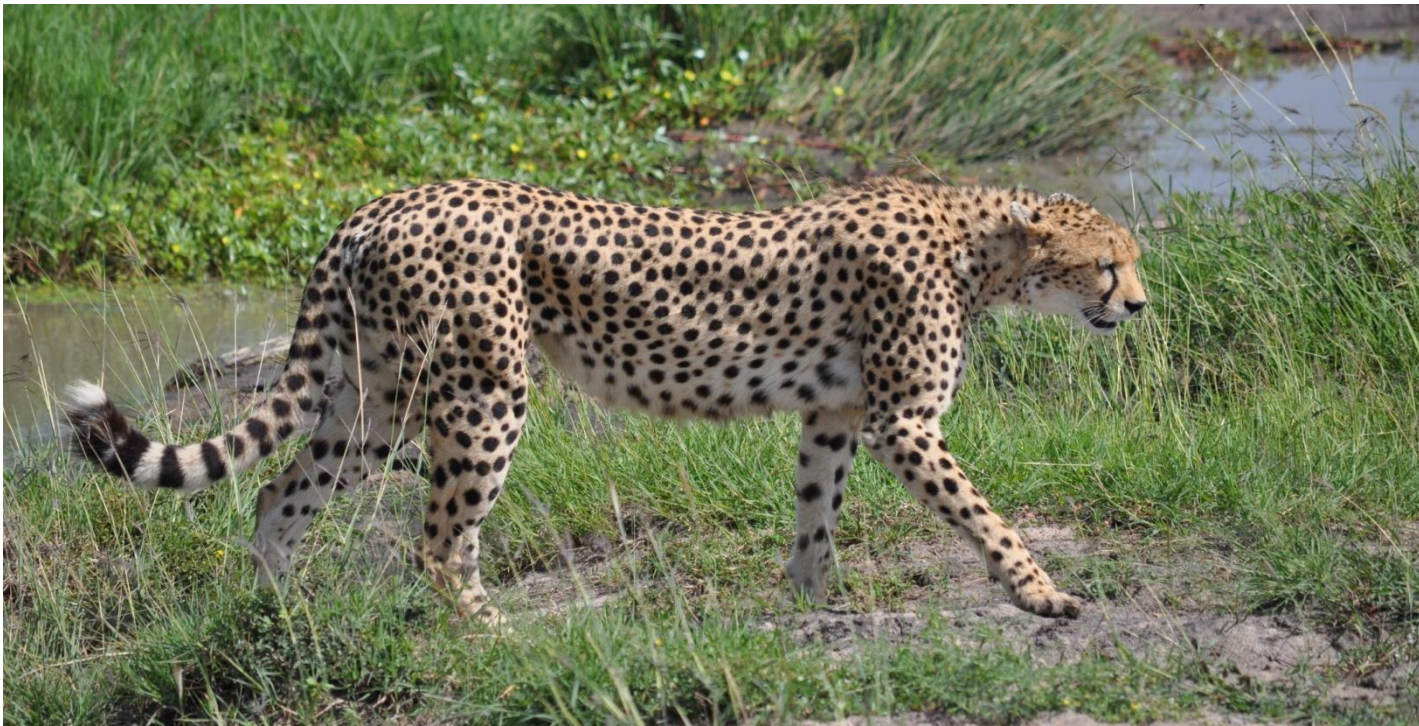


Making Decisions? Use the *design process*



Project Specification

- Developed from project description and requirements
- Define project goals
- Listen to your client



Design Criteria include both Feasibility and Merit

- Developed from specifications to
 - Ensure compliance with client's requirements
 - Discriminate between designs
 - Identify a 'best' design
- Two Types
 - Feasibility Criteria
 - Eliminate infeasible designs
 - Merit Criteria
 - Identify characteristics of 'best' designs

Feasibility Criteria provide design constraints

- Factors that limit the scope of a project
- Normally expressed as constraints
 - Unit must weigh less than 100 lbs.
 - Unit must accelerate to a velocity of 60 mph in less than 10 seconds.
- Go/No-Go Criteria
 - Feasible/Not-Feasible
- Project Specification are a primary source

Merit Criteria used for discriminating between design ideas

- Factors that promote discrimination
between FEASIBLE design alternatives
- Provide a logical method for selecting the
“best” design
- Should be presented in a form that will
facilitate the decision making process

Merit Criteria are...

- Specific while still providing a basis for choosing between alternatives
- Examples include:
 - low unit production cost, low shipping cost, low storage cost, etc.
 - high acceleration, high velocity, high efficiency, etc.
- Project Specification are a good starting point
- Ask: What is the overall project goal?

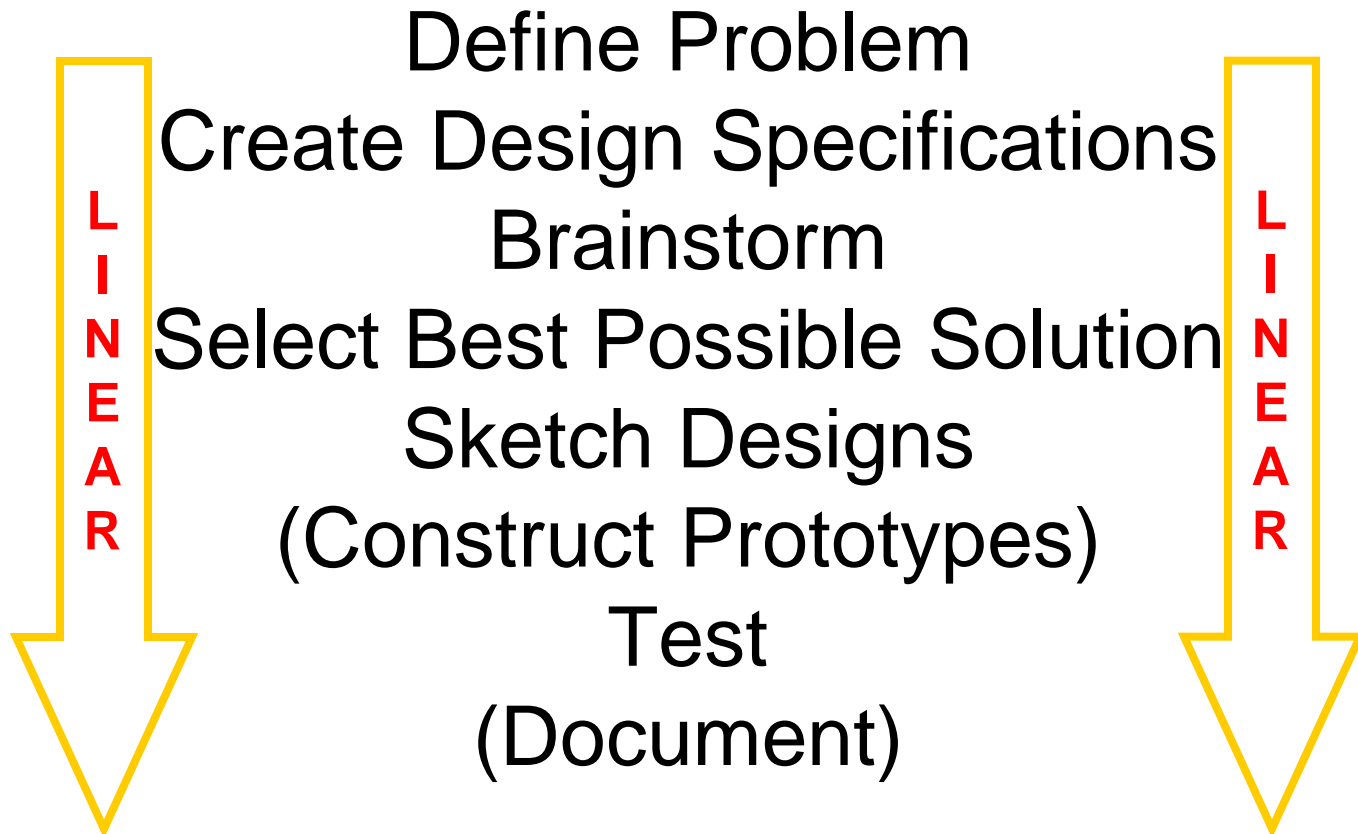
Design Processes

- Overview video
 - “Designing with Project Teams”
 - Dr. Michael Marcus
 - Pennsylvania State University – York Campus



Marcus Video

Overview of Marcus Design Process



Marcus Video - Critique

- No distinction between feasibility and merit criteria
- All of the criteria have the same importance.
- No analytical basis for identifying the best design.
 - Mathematical modeling and engineering analysis are not incorporated in the design process
- The role of management and clients is not discussed.
- Project management and progress reports are not discussed.
- The link between test results, verification of the design criteria, design performance, and iteration/evolution of the design was not developed.

Design Reviews – importance of communication

Preliminary Design Review [PDR]

- Define problem
- Develop specifications and criteria
- Develop **multiple** designs or solutions
- Document selection of the 'best' design(s) or solution(s)

Critical Design Review [CDR]

- Document construction and changes to selected design
- Verify that design meets specifications and criteria
- Provide recommendations

Questions (initial by your name)

