

Engineering Design

Computer Engineering as a Discipline

Basic Design Process

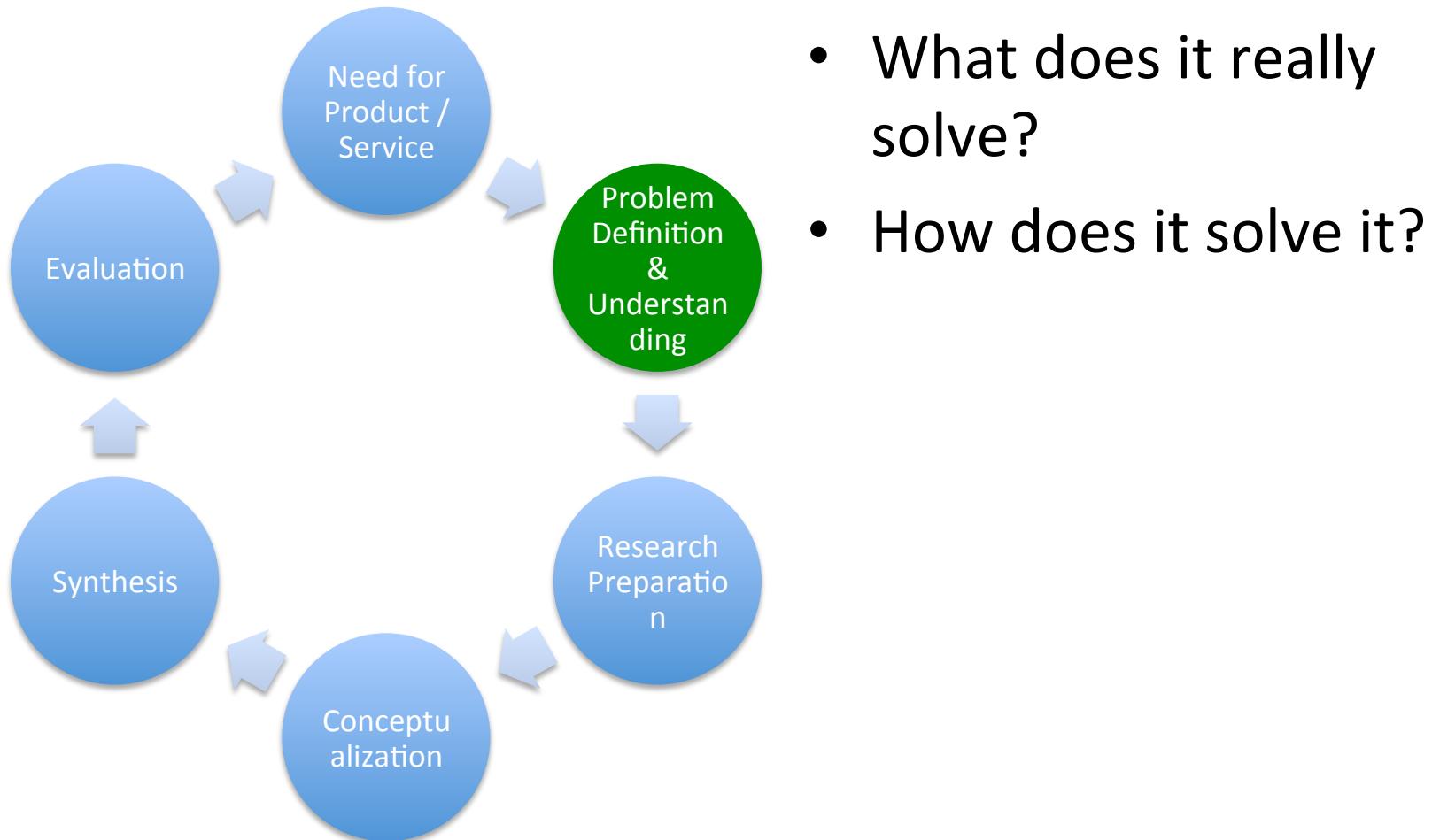


Basic Design Process



- Is there a real need for this?
 - Why?

Basic Design Process



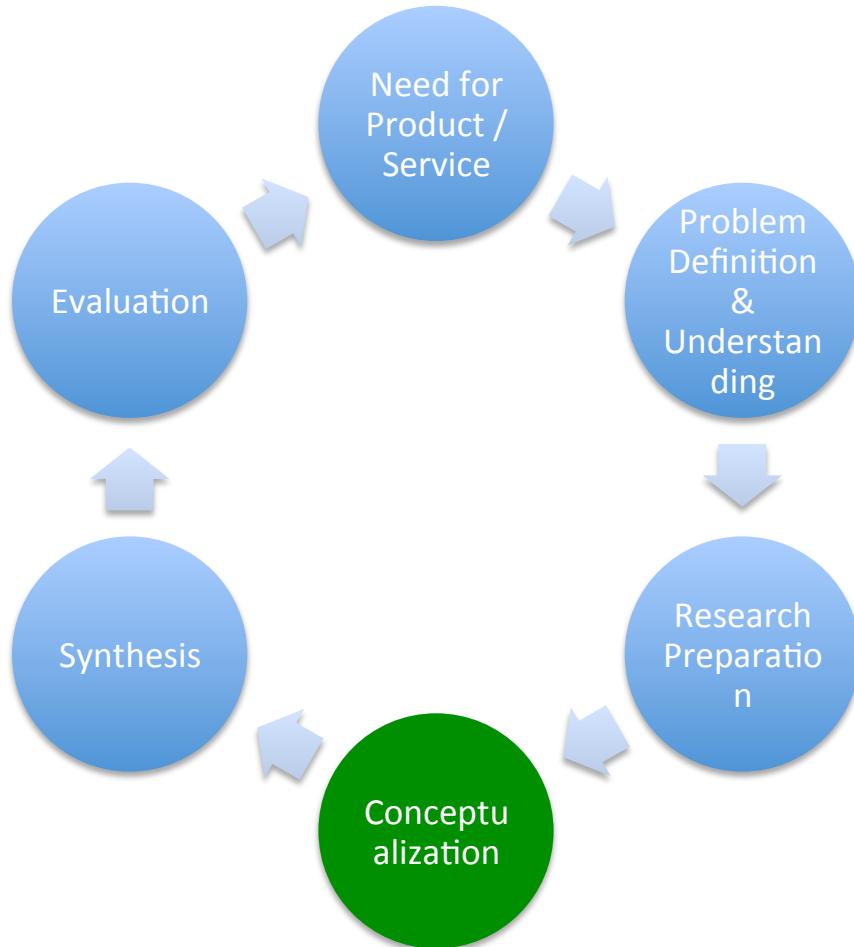
- What does it really solve?
- How does it solve it?

Basic Design Process



- Why do we need to solve it?
- Who benefits from it?

Basic Design Process

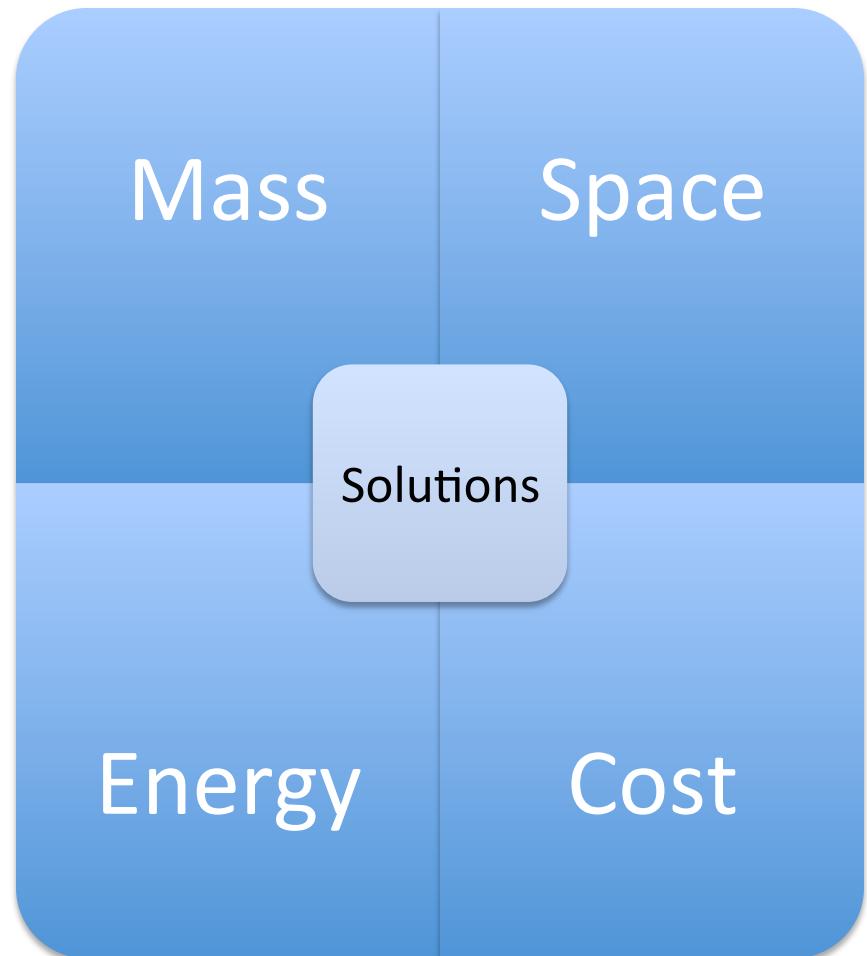


- What solutions can you create to address the problem?
- What do you need to create these solutions?
- How do you merge components to come out the the ideal solution?
- How much will it cost?

Advanced Ideas in Conceptualization

Instructors Recommended Approach

- Teoriya Resheniya Izobretatelskikh Zadatch (TRIZ)
 - The ideal solution is one that:
 - Occupies no Space
 - Has no Mass
 - Consumes no Energy
 - Costs Nothing



Example: Writing data results in micro-gravity environment

NASA USA Solution

- Cost: 1M USD Supposedly
- Technology:
 - Hermetically Sealed and Pressurized Ink Well and ball point tip
- Works in Micro and Zero G Environments
- Mass = 20g

USSR Solution

- Cost: 0.55 Cents
- Technology:
 - Graphite Encased in two laminated wood panels. Needs Sharpening only
- Can work in Micro-Gravity and Zero Gravity Environments and wet environments.
- Mass 20g

Example: Writing data results in micro-gravity environment

NASA USA Solution



USSR Solution



V. Dupo

Example: Writing data results in micro-gravity environment

**Energy: Melt and Form Metal
Pressurize and Seal Vessel**

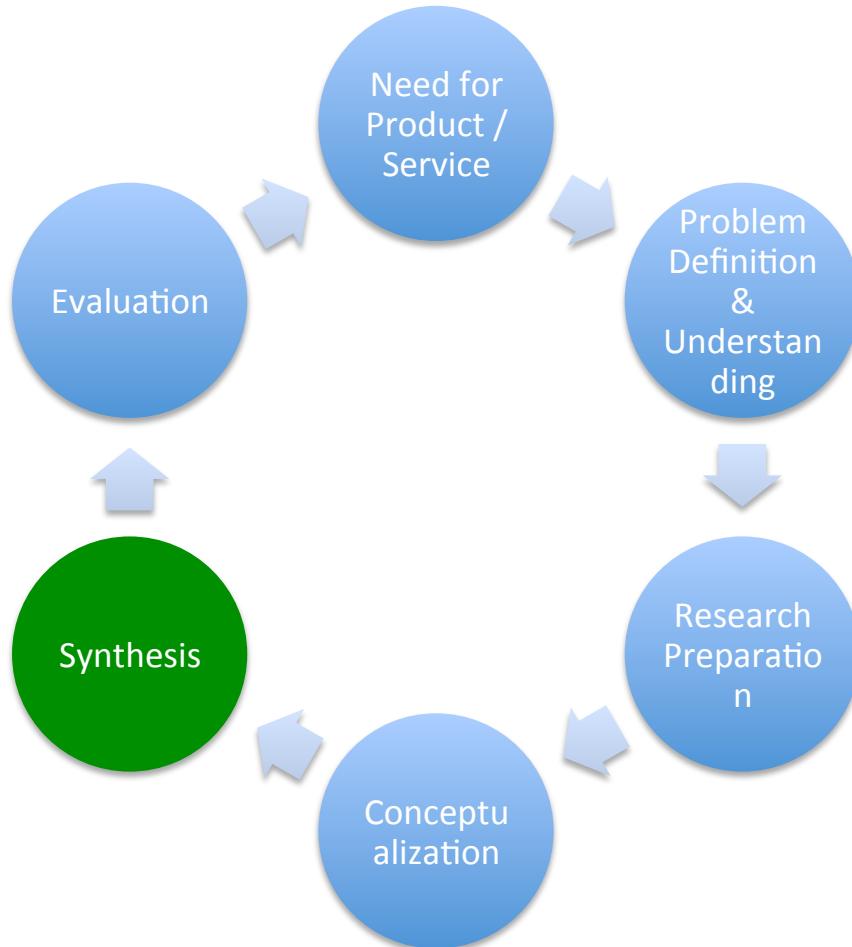


Energy: Make rubber, Metal Forming and Melting, Wood and Graphite Cutting and Lamination



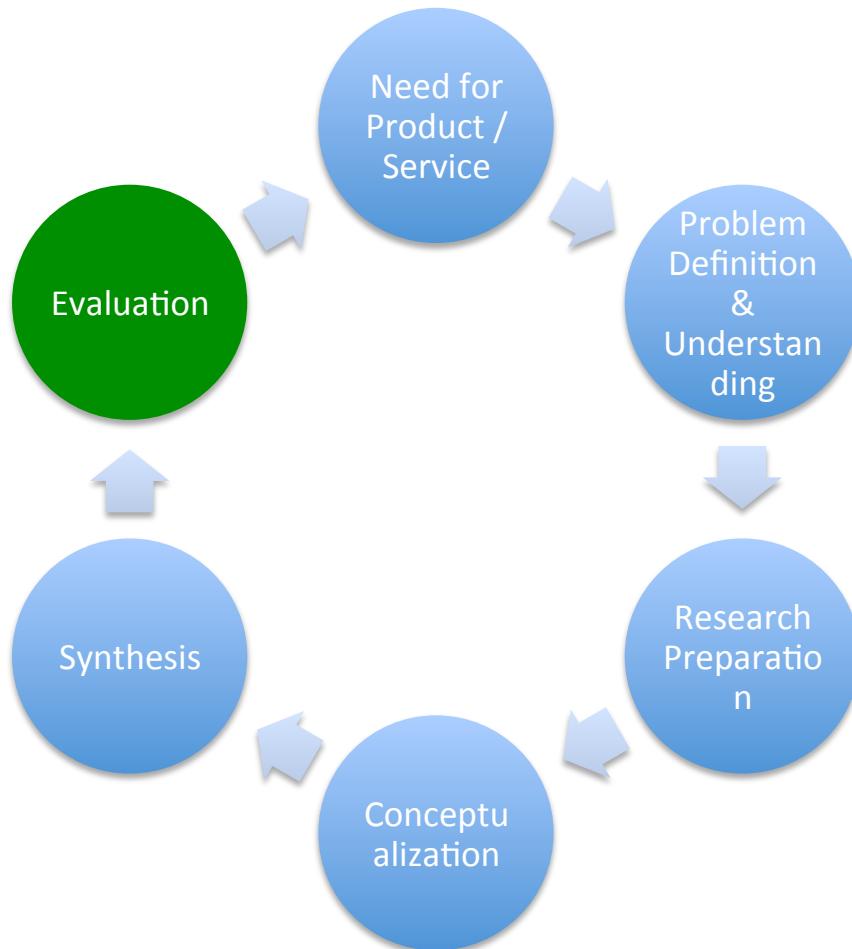
V. Dupo

Basic Design Process



- Figuring out what works as viable solutions to the problem.
- Granted limit in
 - Materials
 - Time
 - Manpower
 - Funding

Basic Design Process

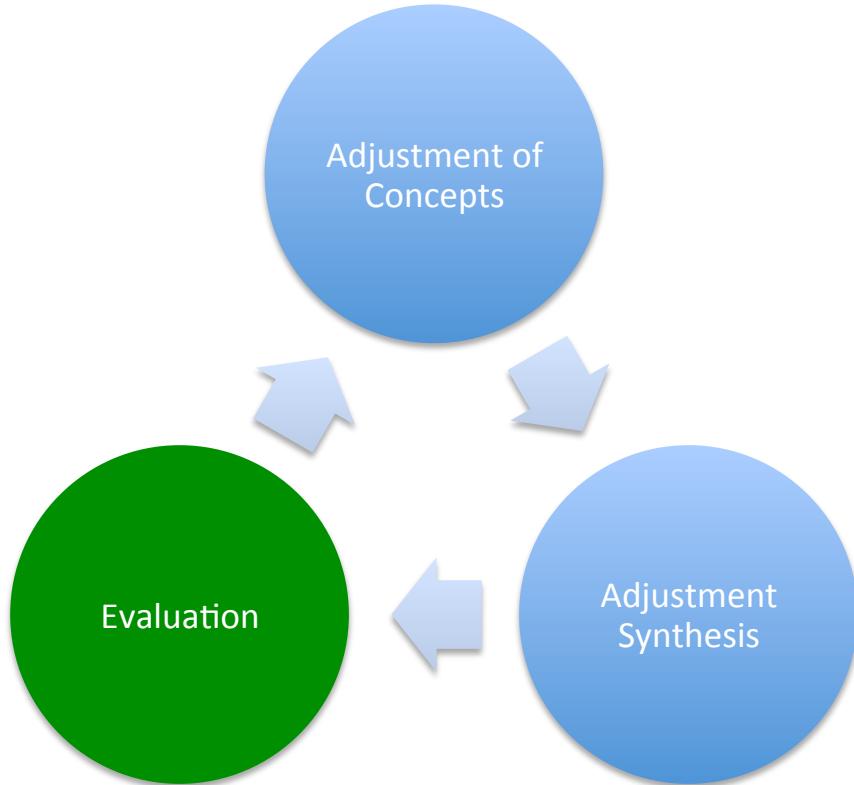


- Does it really do the task set?
- How do you go about testing it?
 - How easy is it use use / operate? (Usability)
 - How effective is the solution? (Efficacy)

Evaluation

- Human Testing / Animal Testing
 - Protocol / Rules on how its done
 - Objectives
 - Removal of Bias
 - Data Handling and Interpretation
 - Informed Consent (Human Testing Only)
 - Liability and Risk Reduction (Human and Animal Testing)

Basic Design Process: Optimization



- How can its performance be improved?

Design Process Final Step

- Presentation
 - Problem
 - Solution
 - Capacity of Solution
 - Cost
 - Effectively of a solution
- Examples
 - Product Pitch
 - Conference Presentation
 - Journal Publication
- Other Examples
 - Demonstration of Product

Summary of Engineering Thinking Design Process

Stage	Area	Subjects
Needs Establishment	Specific to Requirement	Social Sciences, Current Affairs
Problem Definition and Understanding		English / Filipino Interview Process or Reading of Related Literature
Preparation Research	General Body of Knowledge	Reading areas related to the problem as past solutions or current ones
Conceptualization	Specific to Area of Expertise	Professional Subjects
Synthesis		
Evaluation	Testing Process	Statistical Design of Experiments
Optimization	Specific to Area of Expertise	Professional Subjects
Presentation	Venue to Present V. Dupo	English Communication Skills

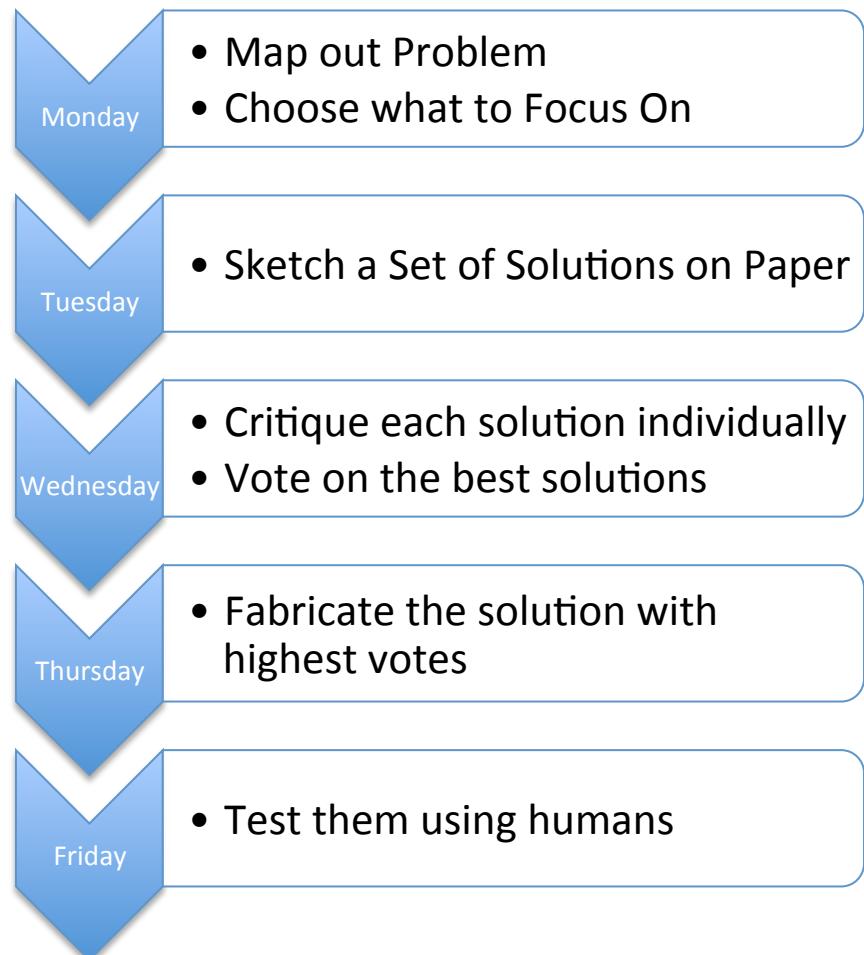
Other Elements in Design Process

- Standards Enforcement (Engineering Management)
- Planning and Budgeting (Basic Accounting)
- Staffing (General Engineering)
- Audit Process for Administrative Area (Accounting and Engineering Management)

Advanced Ideas for the Design Process

Instructors Recommendation not Part of Syllabus

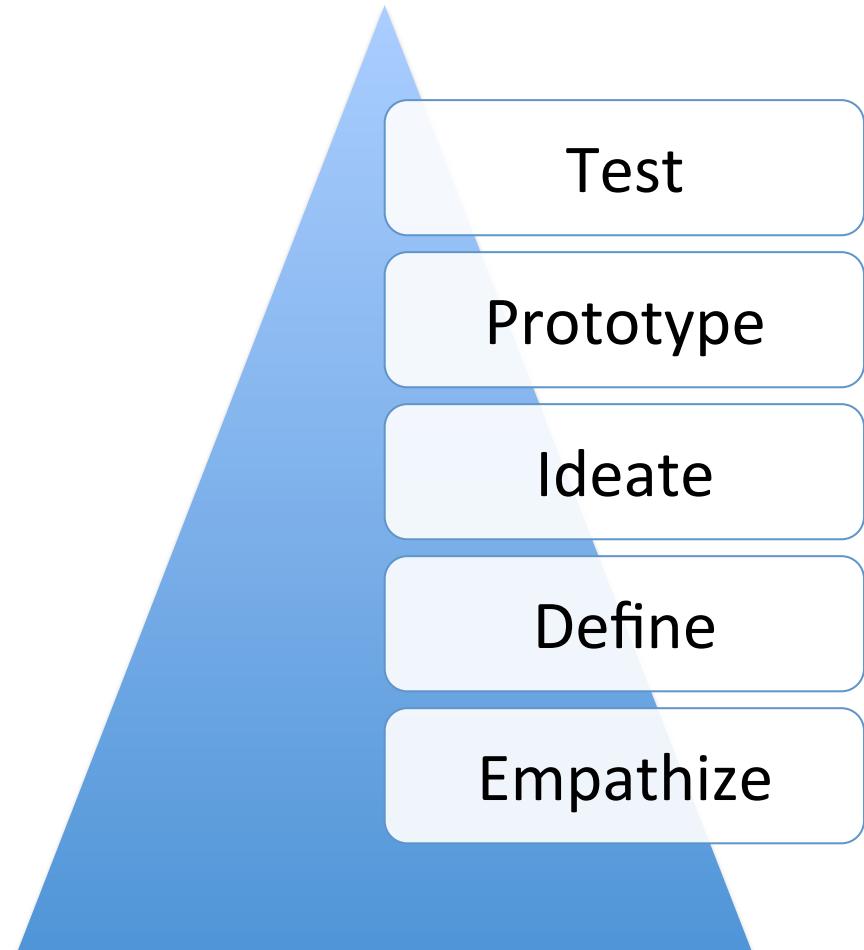
- Design Sprint
 - Five Day Inventive Process to address issues using the least amount of time needed.



Advanced Ideas in Design Process

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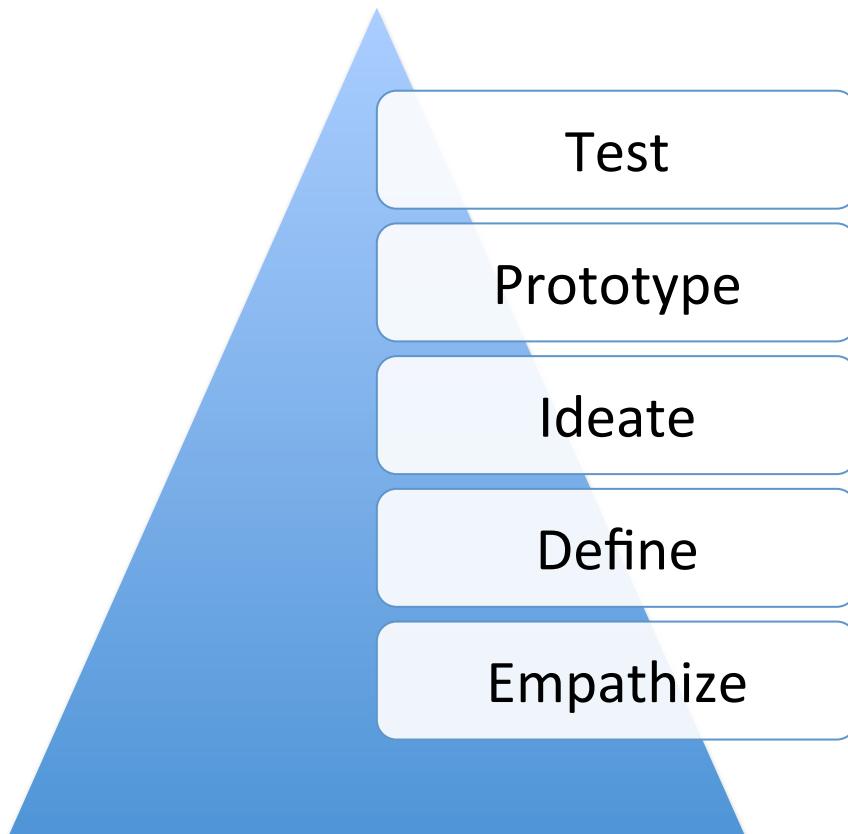
- Design Thinking
 - The inability of a design to consider human nature and human behavior the product ability to access the market or to be considered by the market as usable.



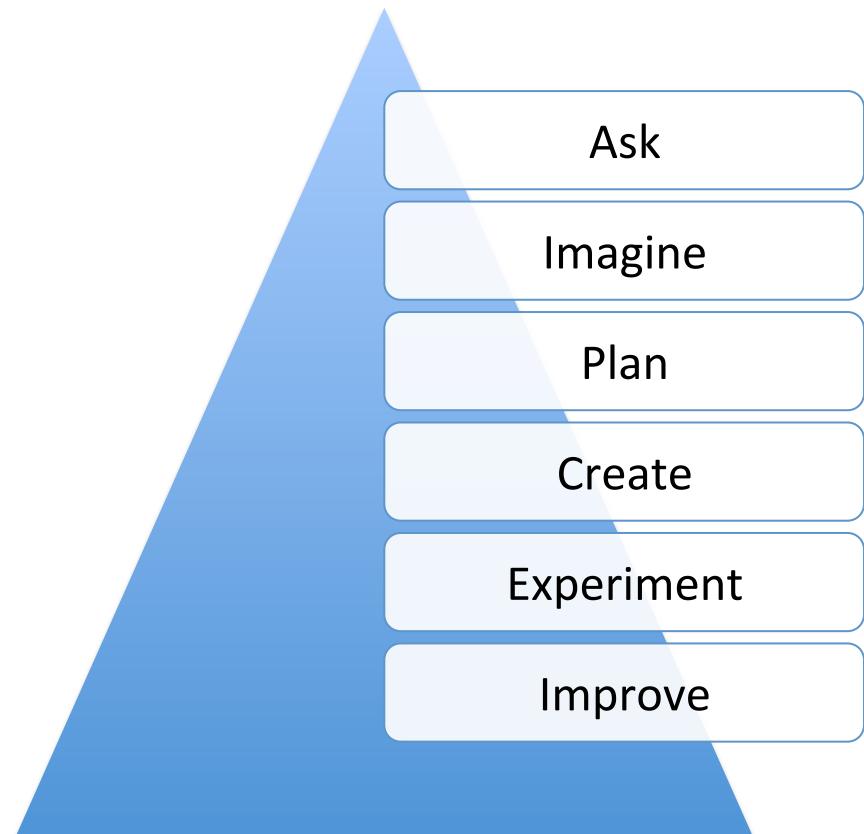
Advanced Ideas in Design Process

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Design Thinking



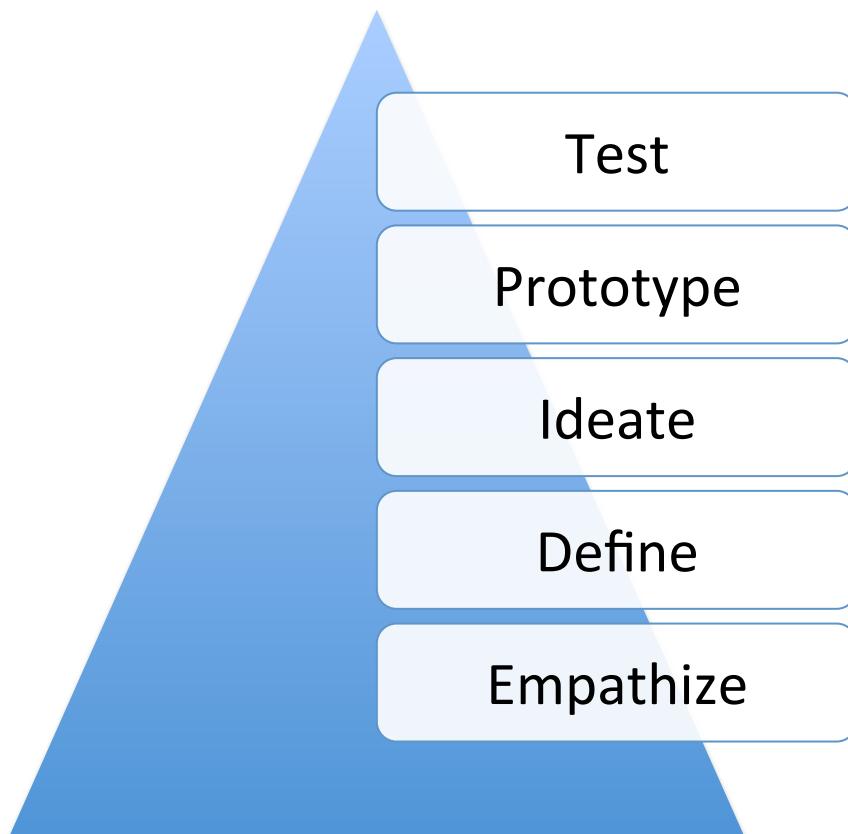
Engineering Thinking



Advanced Ideas in Design Process

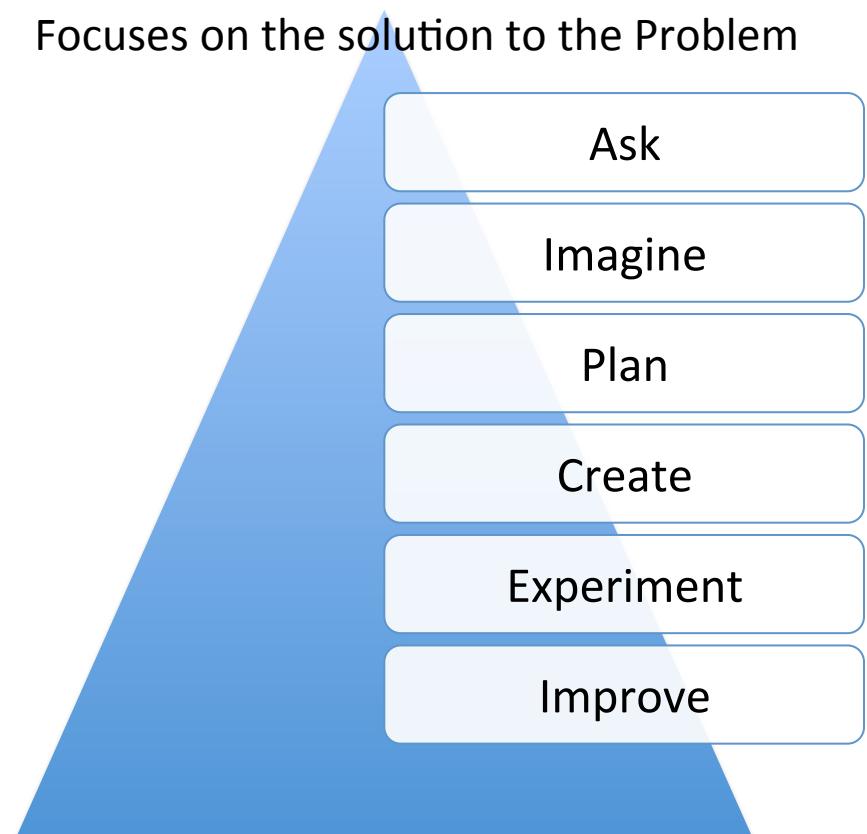
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Design Thinking



Engineering Thinking

Focuses on the solution to the Problem

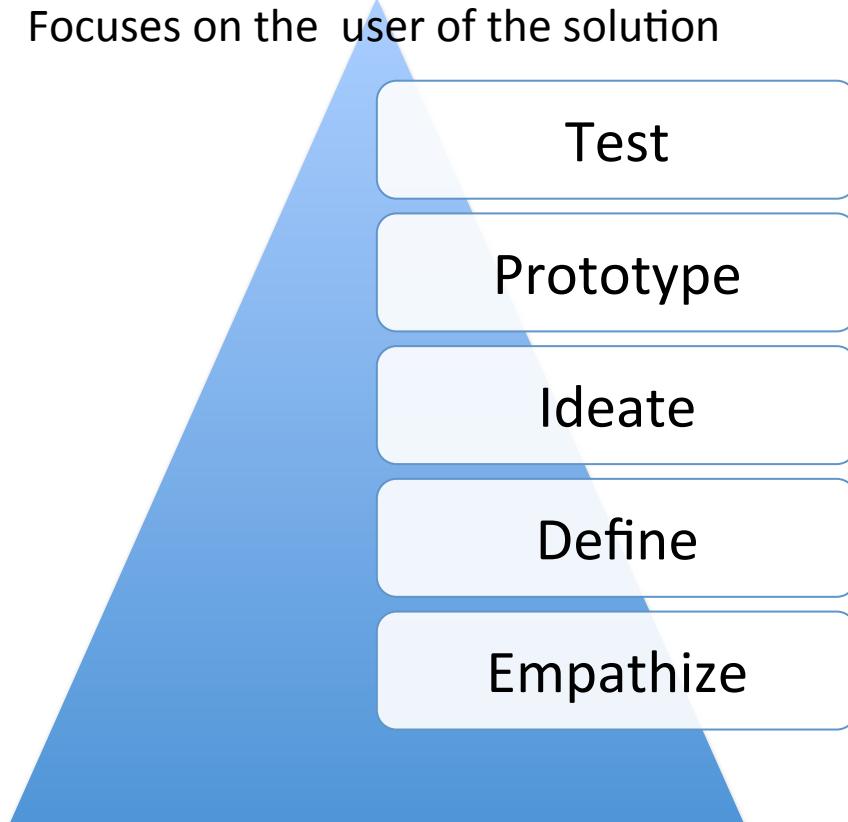


Advanced Ideas in Design Process

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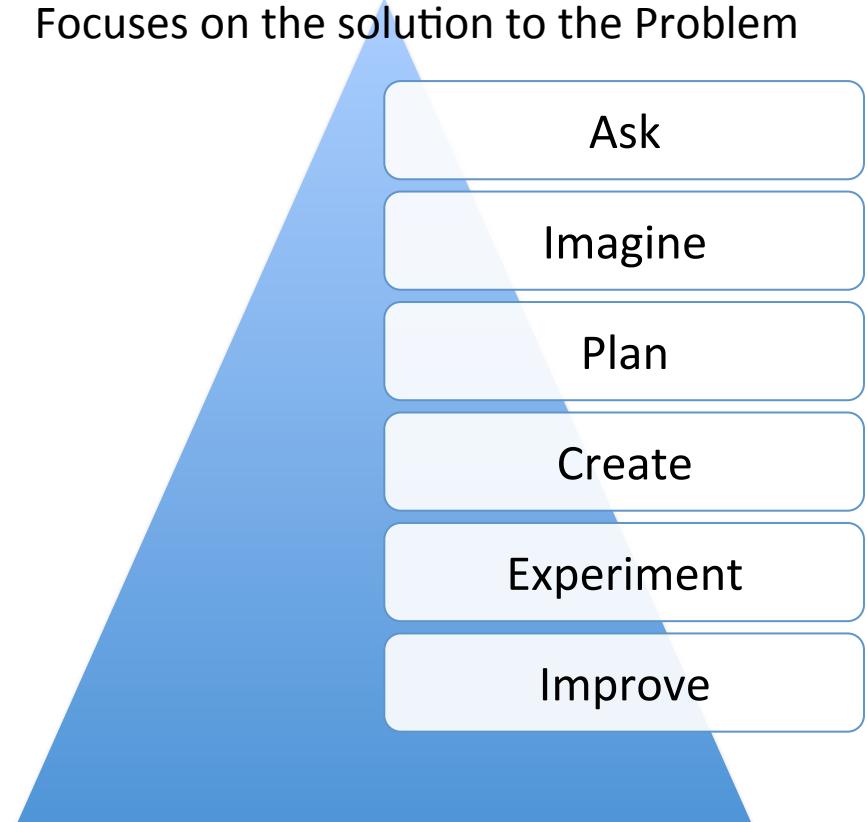
Design Thinking

Focuses on the user of the solution



Engineering Thinking

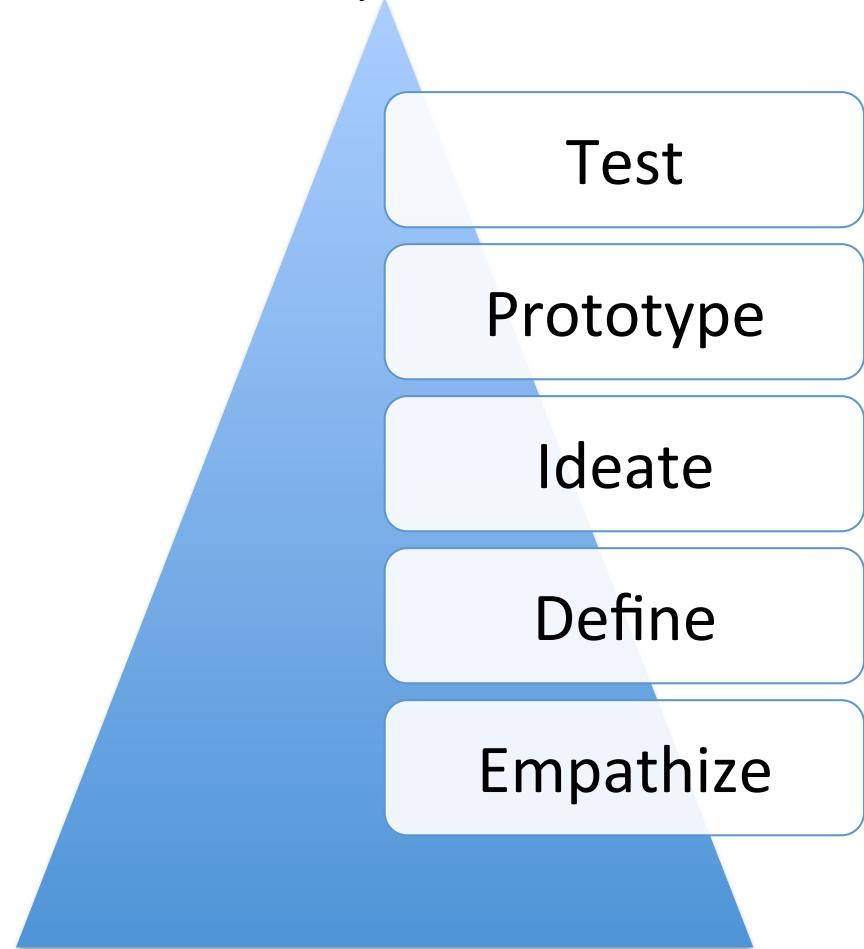
Focuses on the solution to the Problem



Why Design Thinking rather than Engineering Thinking

Instructors Recommendation not Part of Syllabus

- Flexibility of use
- Deals with the issue of product commercialization first rather than later.



Examples

