
Human Centered Design and Engineering

Fall 2019

ME 170

**Siebel
Center
for
Design**

Open Fall 2020!



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Learning Objectives

At the end of this lecture you should be able to...

1. Define human centered design
 2. Summarize why engineers should practice human centered design
 3. Explain how human centered design fits into this course and beyond
-

Wait isn't this a CAD class?

Yeah, don't worry. You will be learning how to use CAD software to represent and develop your designs.

Wait isn't this a CAD class?

Yeah, don't worry. You will be learning how to use CAD software to represent and develop your **designs**.

But what is the design?

What is (Engineering) Design?

Engineering Design

is...	is not...
1. Relevant and purposeful	1. Quick and easy (straightforward)
2. Process starting from concept	2. unrealistic
3. Progressive and innovative	3. finished
4. Goal oriented	

→ **ABET Definition**

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.

→ ABET Definition

Engineering design is the process of devising a system, component, or process to **meet desired needs**.

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•**Engineering Design** – Engineering design is the process of devising a system, component, or process to meet desired needs and specifications within constraints.

- is iterative/creative decision-making *process*

- in which the basic sciences, mathematics, and engineering sciences are applied to convert resources into solutions.

•Engineering design involves (_____) for the purpose of obtaining a high-quality solution under the given circumstances:

- identifying opportunities

- developing requirements

- performing analysis and synthesis

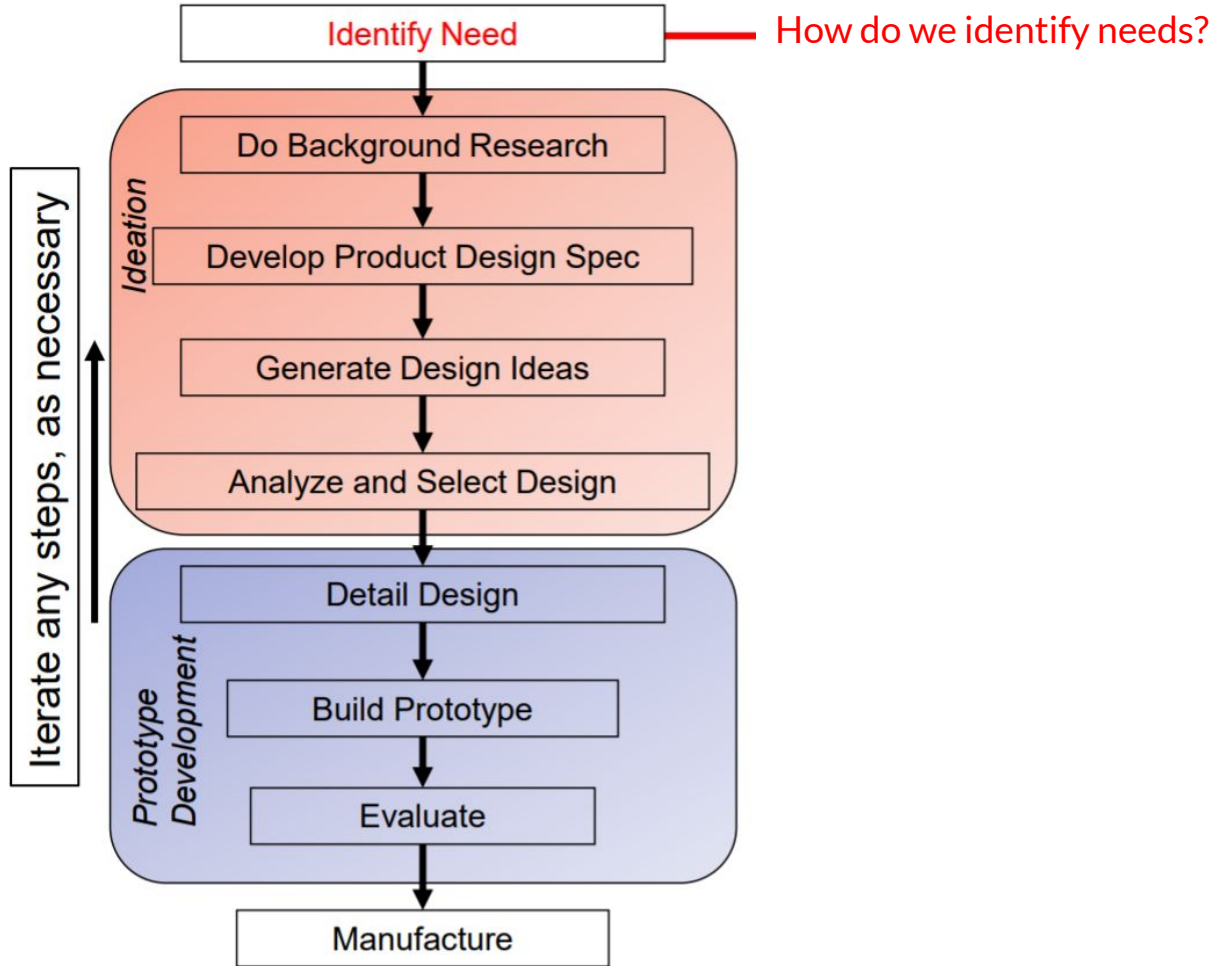
- generating multiple solutions

- evaluating solutions against requirements

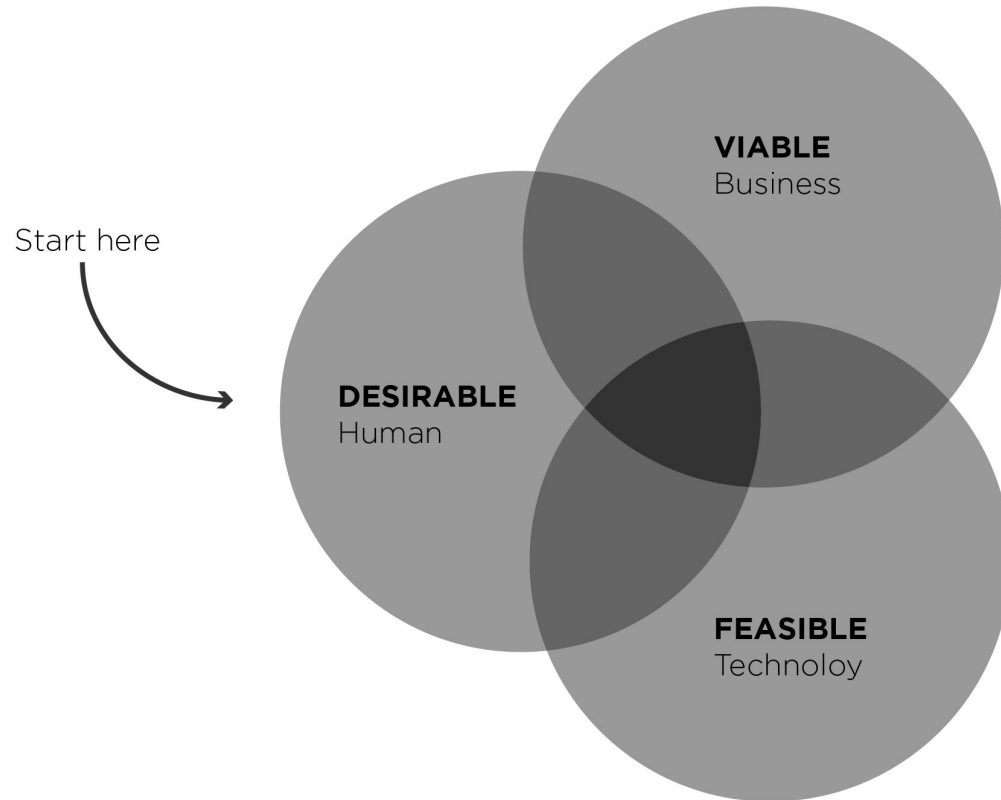
- considering risks

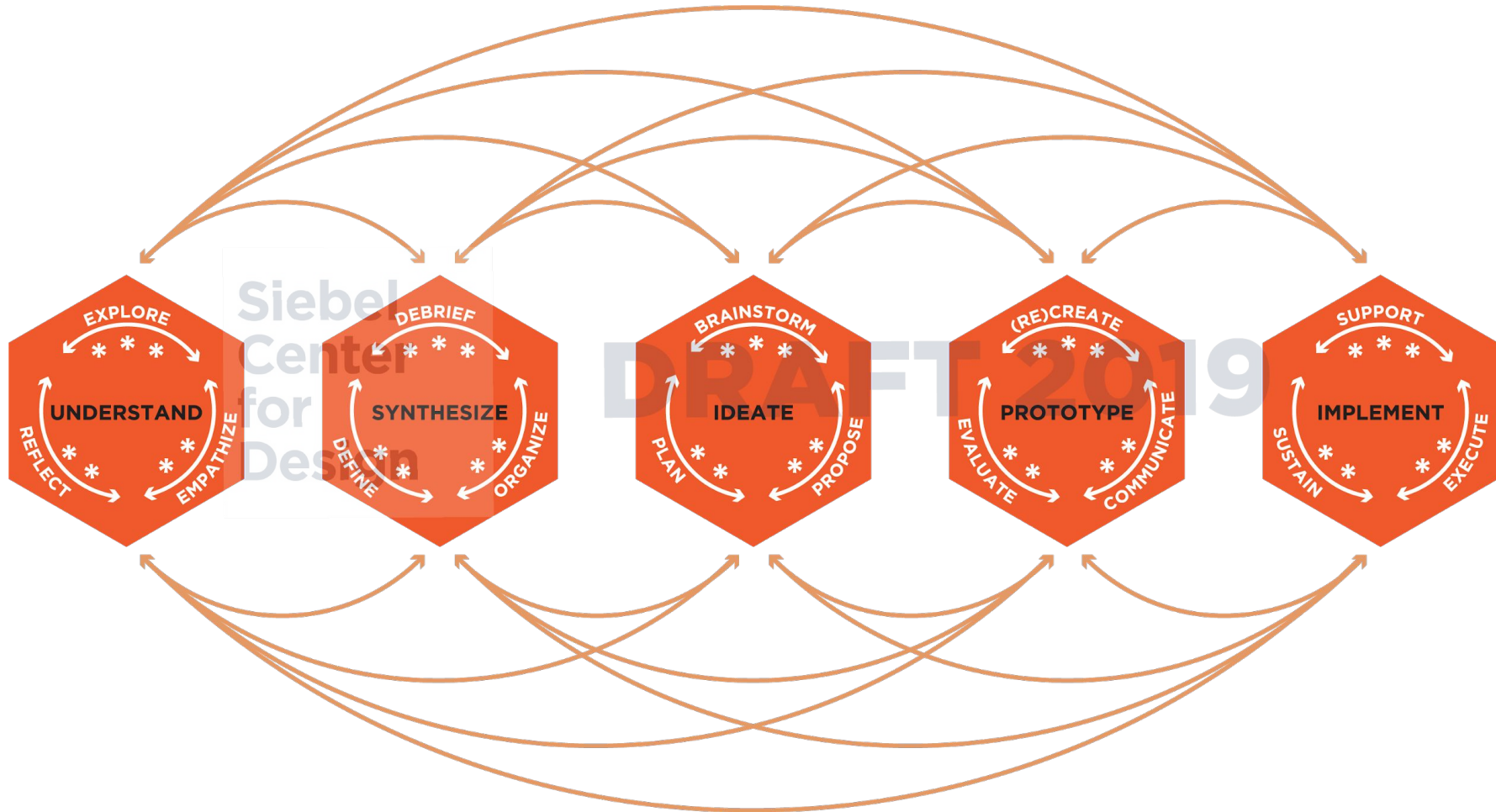
- making trade- offs

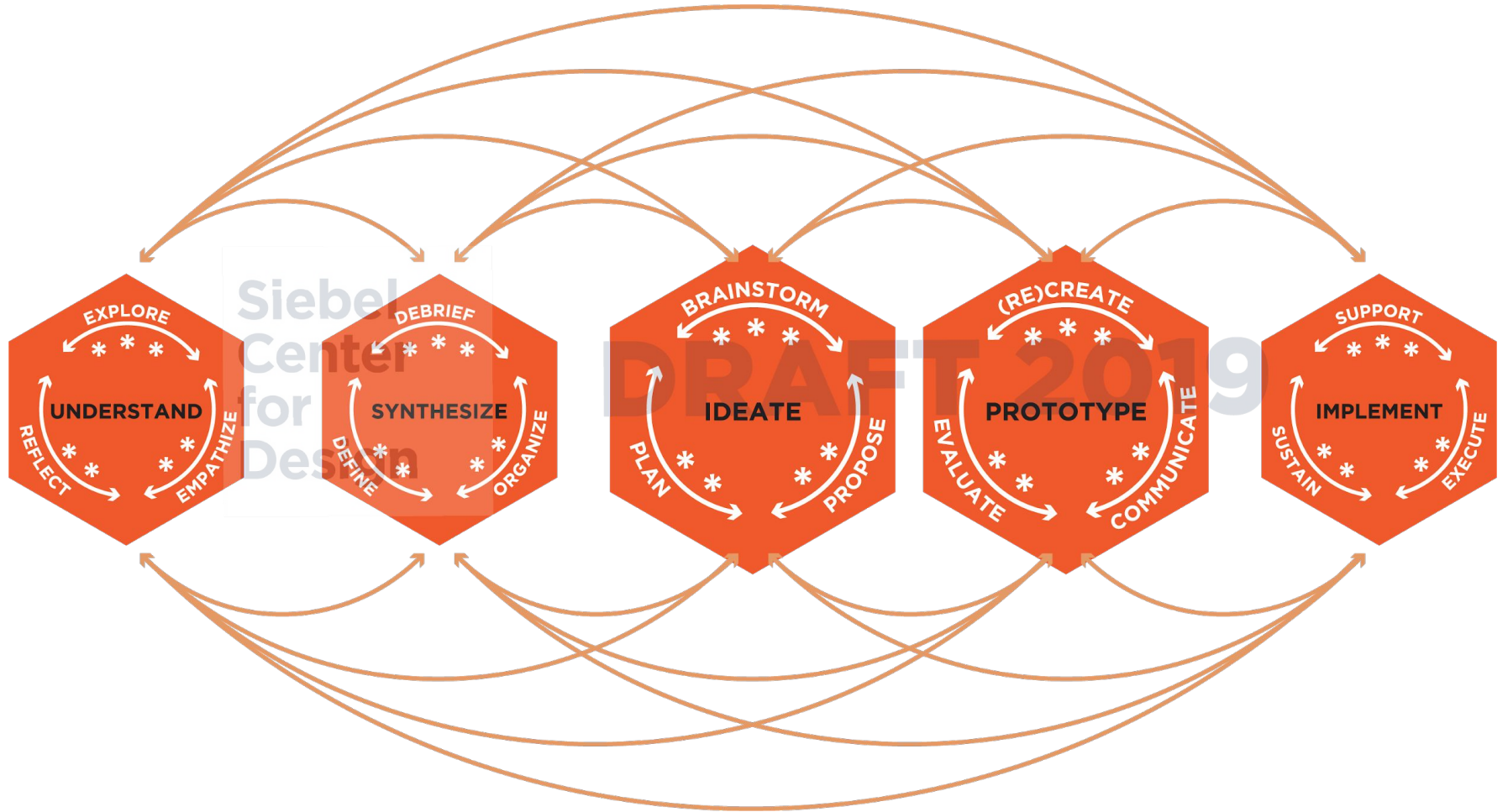
•For illustrative purposes only, examples of possible constraints include accessibility, aesthetics, codes, constructability, cost, ergonomics, extensibility, functionality, interoperability, legal considerations, maintainability, manufacturability, marketability, policy, regulations, schedule, standards, sustainability, or usability.

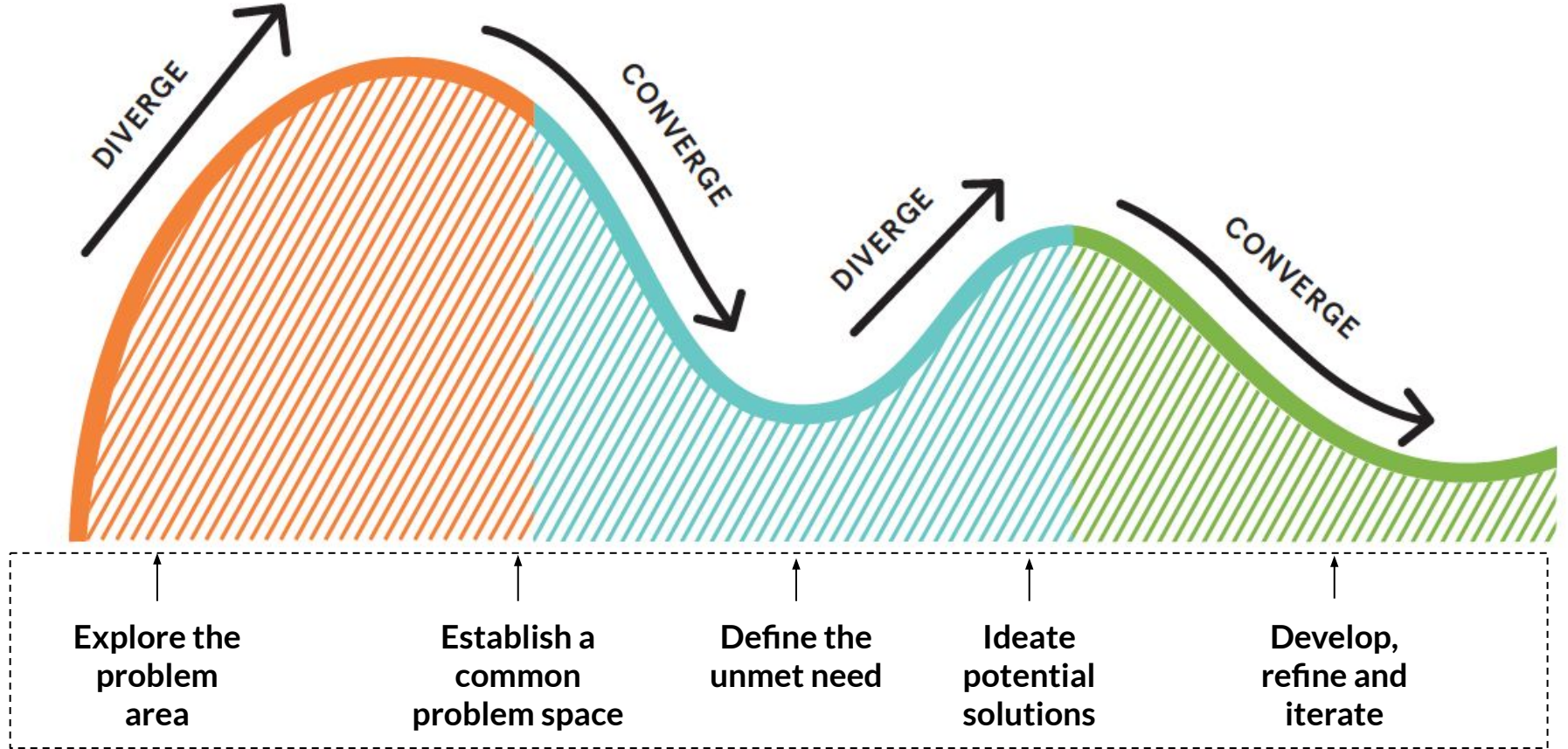


Why Human Centered Design?





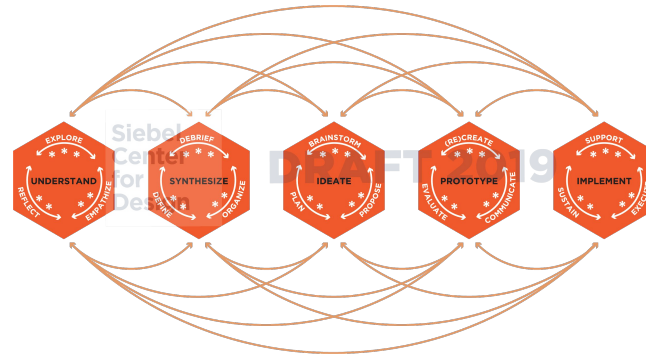




*Example does not represent all cases

Class Project

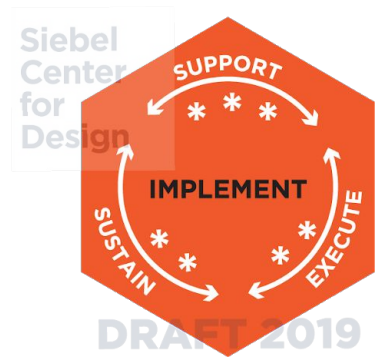
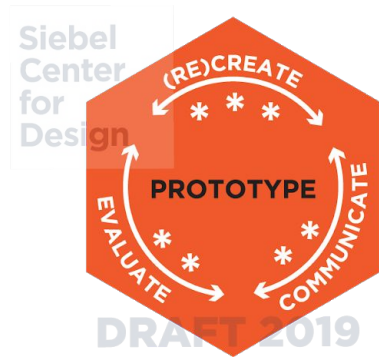
Design a mechanical or electro-mechanical product to address unmet needs related to food on campus



HCD Lab	Design Space	Project milestone
Lab 1	Understand	Initial Interview Plan
Lab 2	Synthesize	Identify Needs
Lab 3	Ideate	Early Concept

Project Deliverables:

- 1) Project Description
 - 2) Concept Sketches - initial and final
 - 3) Concept Selection process
 - 4) Product Design Specification
 - 5) CAD Models
 - 6) Assembly Drawings
 - 7) Exploded Assembly Drawing and BOM
 - 8) Dimensioned Engineering Drawings
 - 9) Tolerance Analysis
 - 10) Materials and Manufacturing Estimates
-



Design Challenge

I have an electric kettle that I use to heat water to make coffee in the morning, but it gets too hot.



Design Challenge

I have an electric kettle that I use to heat water to make coffee in the morning, but it gets too hot. Can you help me?

Write down your thoughts.

What's the goal?

How do you define success?



Design Challenge

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What's the goal?

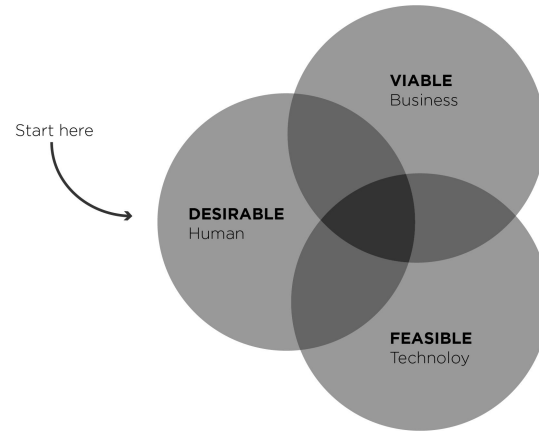
(I want better coffee, more consistently)

How do you define success?

(You address my needs and I adopt your design)

How can we achieve success?

If success is defined by the adoption of the new design, it must be desirable, viable and feasible.





Let's frame this design challenge using a "Point of view" statement.

This is a handy tool which can define the scope of the project and inspire action.

“ User needs unmet need because
 surprising insight ”



Problem Statement/Scope

The electric kettle needs to heat the water less.

vs.

Alex needs a way to make better coffee more consistently because his electric kettle overheats the water.



LAB 1

What else do you need to know?

Alex needs a way to make *better coffee* more consistently because his electric kettle overheats the water.



What else do you need to know?

What kettle do you use? → What system is in place currently?

How do you use it? → What's the experience like?

How do you like your coffee? → What's the target?

...?



What else do you need to know?

What kettle do you use? → What system is in place currently?

AmazonBasics [\(link\)](#)

How do you use it? → What's the experience like?

I use a non-contact thermometer and turn it off by hand

How do you like your coffee? → What's the target?

*Cream no sugar, thanks. Aeropress, 2 scoops fresh grounds,
water heated <180 F*



LAB 2

Revised POV

Alex needs an effortless and consistent way to make high quality coffee because stopping his electric kettle by hand demands too much attention.



LAB 3

How might we...

How might we create better coffee?

How might we make coffee making a more consistent experience?

How might we control the temperature of the water?

How might we minimize effort?



DRAFT 2019

Ideation

Come up with a bunch of ideas that might work to address the HMW questions.





How might we create *better* coffee?

- Cold brew
 - Optimize variables
 - Grind
 - Temp
 - Ratio
 - Time
 - Pressure
 - Flavor augmentation
-



How might we control the temperature of the water

- Measure temp and control heating (turn off heater)
 - Measure temp and control heat flux (remove from heat)
 - Measure temp and control mixing (add cold water)
 - Measure volume and control heat flux (compute temp)
-



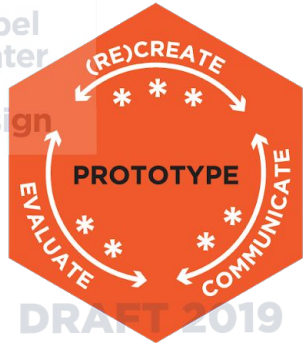
How might we make coffee making a more consistent experience?

- Closed system
- Automated
- Control algorithms
- Post-processing



How might we minimize effort?

- Automated system
 - Timed
 - Routine activated?
- Load once, brew many?
- Minimal maintenance
 - Cleaning
 - Repair



Develop suitable concepts

And review with users to assess your initial understanding of the problem and to inform design decisions.

Want more SCD?



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Farm Hack

AT **Sustainable STUDENT FARM**

Sat., Sept. 21
10am-7pm

I ILLINOIS

This event is brought to you by ACES, Innovation LLC, Siebel Center for Design, Sustainability LLC, Sustainable Student Farm, & Technology Entrepreneur Center.

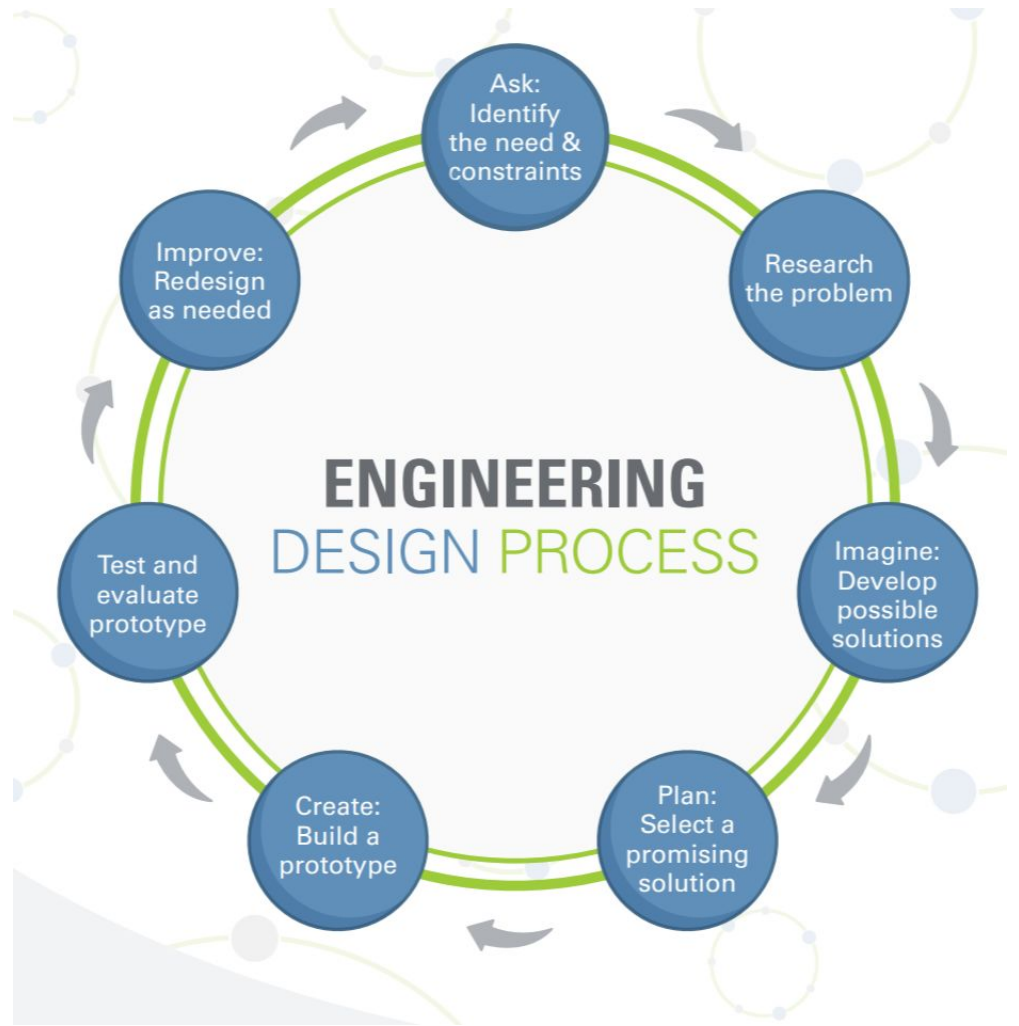
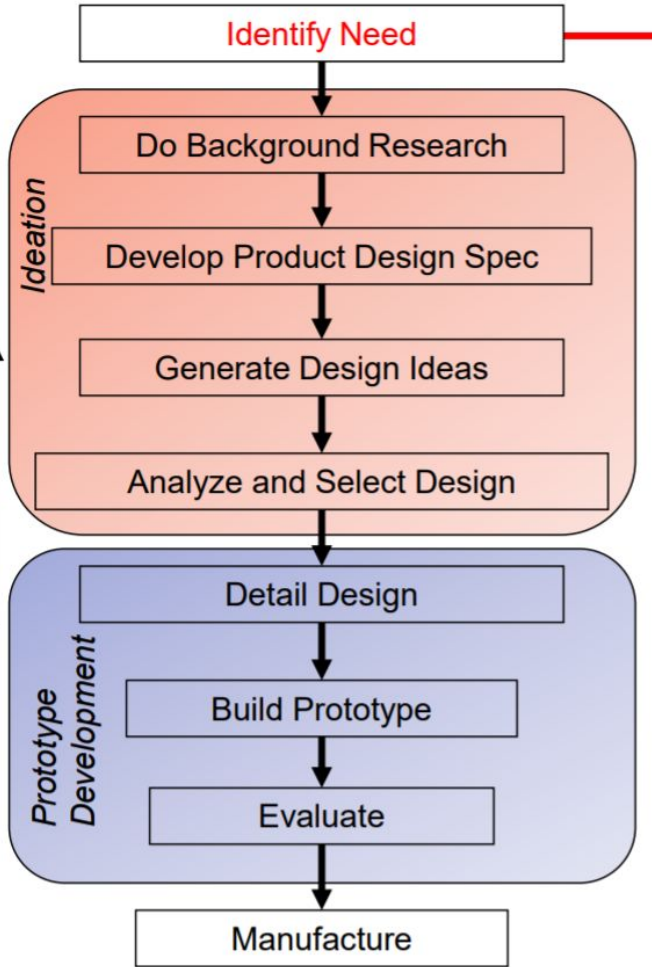


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Iterate any steps, as necessary



Why Engineers need HCD

Engineers are problem-solvers working to address human needs by:

These skills are taught in
Engineering courses

- Increasing efficiency
- Increasing productivity
- Decreasing costs
- Creating new opportunities through innovation

Human Centered
Design!

But how do we know what problems are worth solving?
