

# Lecture 1

## Course Overview

### Engineering Design



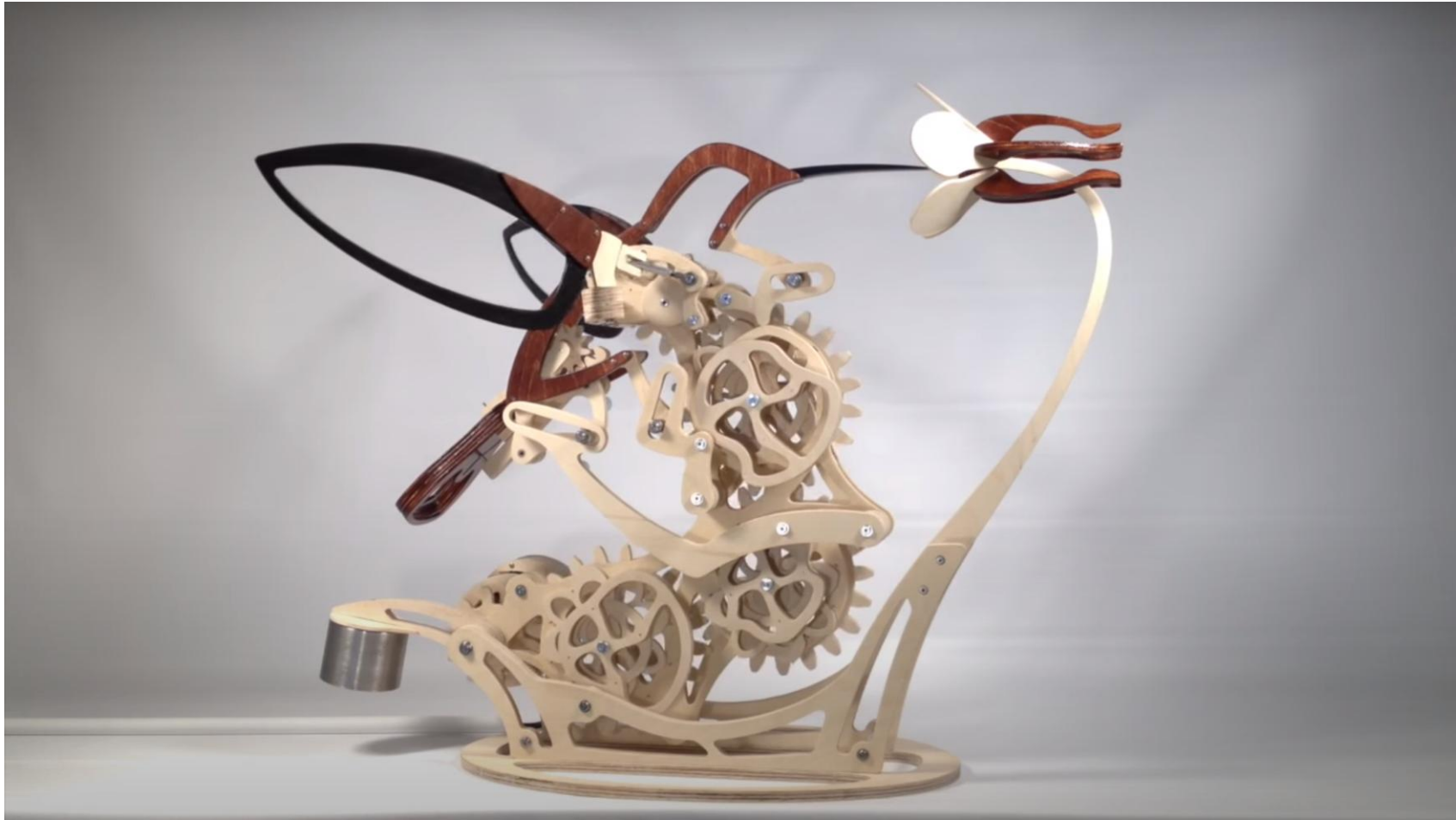
**ME 370 - Mechanical Design 1**

*"Colibri" by Derek Hugger*

[www.youtube.com/watch?v=1scj5sotD-E](http://www.youtube.com/watch?v=1scj5sotD-E)

# Welcome to ME 370!

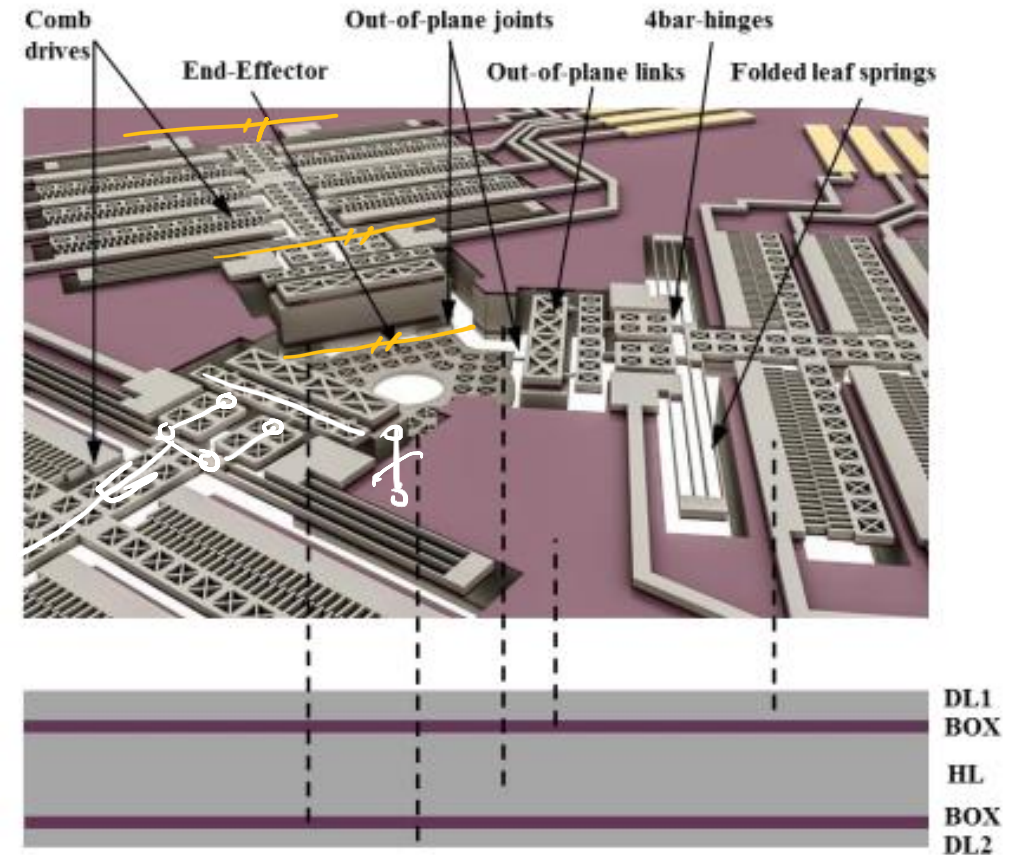
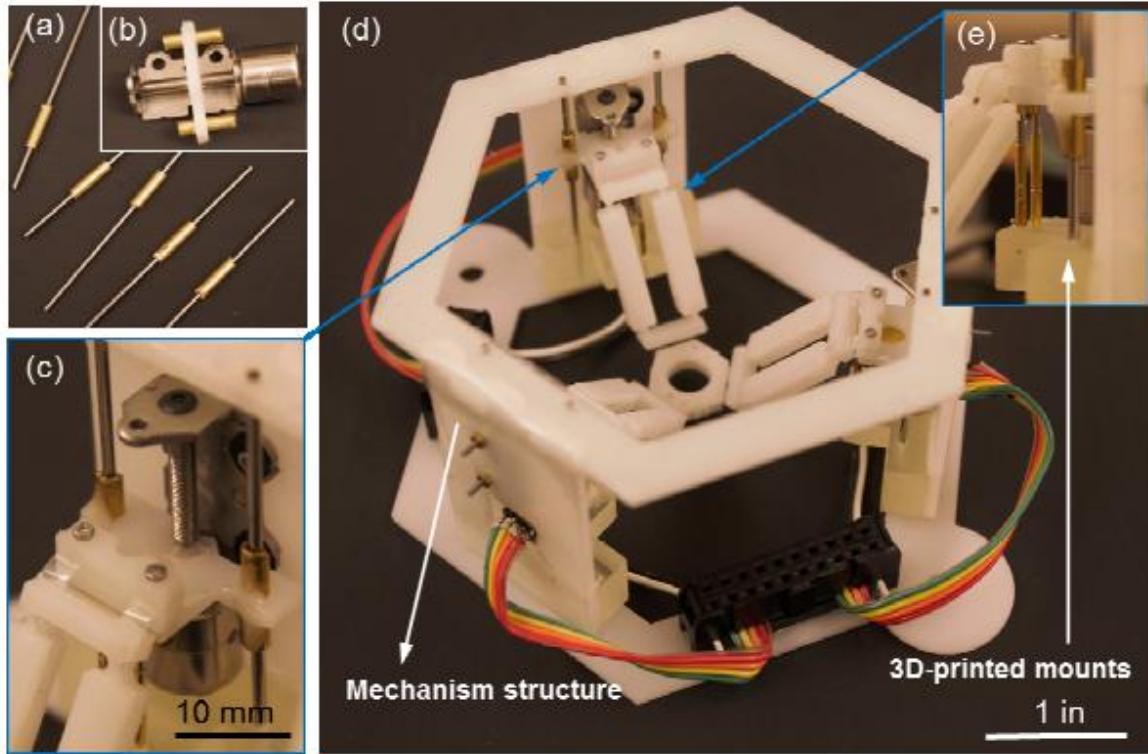
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Colibri: an organic motion sculpture  
By Derek Hugger

<https://www.youtube.com/watch?v=1scj5sotD-E>

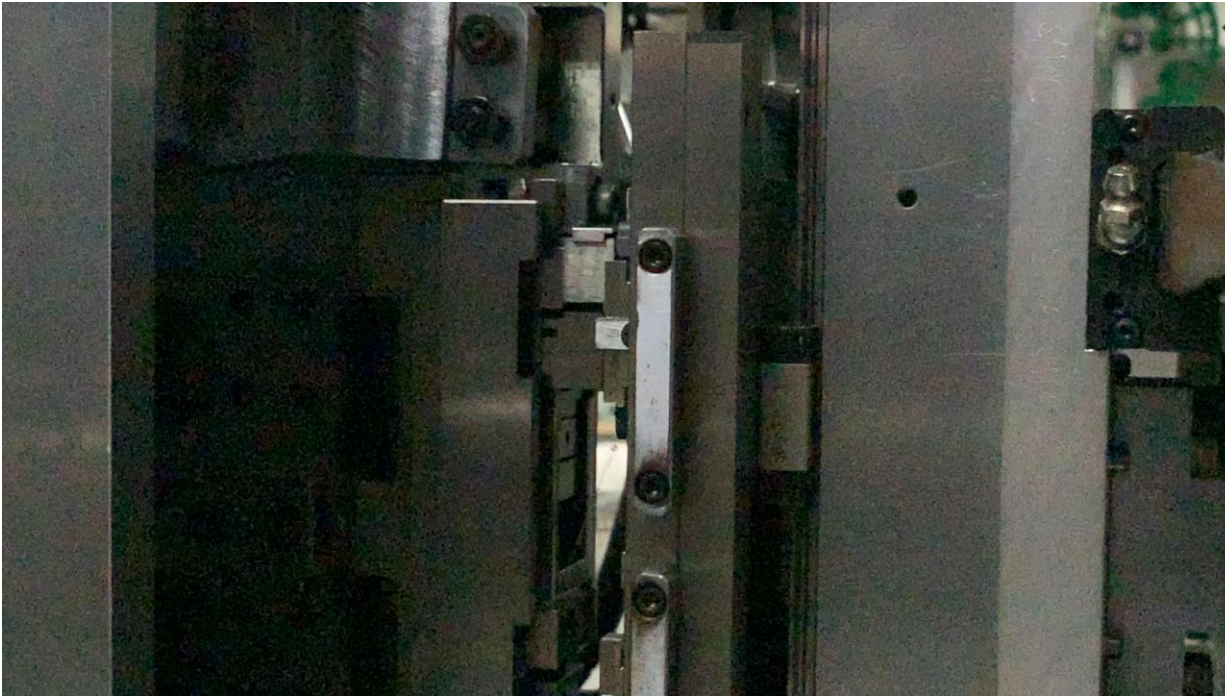
# Dr. Jorge Correa's previous research



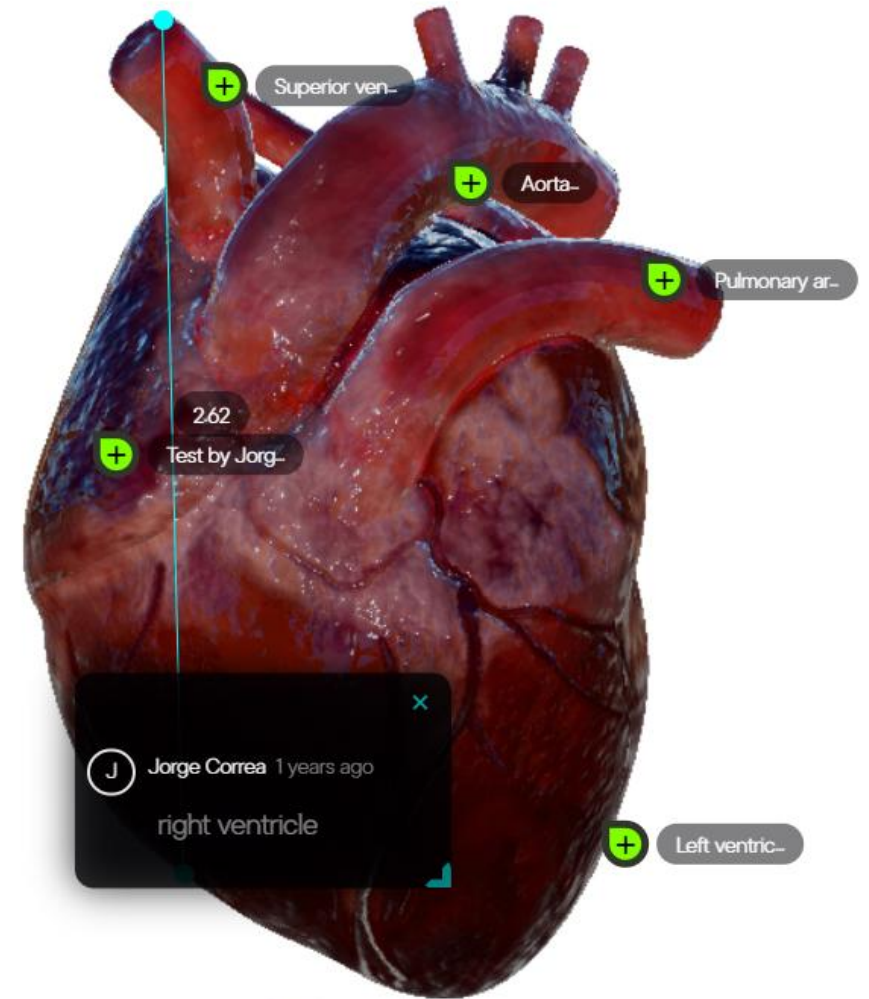
Design and prototyping of positioning robots at the MESO and MICRO scales



# Dr. Jorge Correa's current research



Redesign of cam driven insertion machinery in micro-electronics



3D Web tech.

# Module 1: Engineering Design & Planar Mechanisms

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## Lecture 1 Topics: 8/25/25

Course Overview

Engineering Design and Human-Centered Design (Chap 1)

## Activities & Upcoming Deadlines

### ▪ Week 1:

- **Class participation:** "Getting to Know Your Classmates" in [Discussion board](#), due 8/29 by 11:59pm
- **Lab 1 (Design Considerations lab):** [Review lab manual](#)
- **HW 1:** Planar Mechanisms #1, due 9/2 in [Gradescope](#). All HWs due on Tuesdays by 11:59pm

### ▪ Week 2:

- No class - Monday 9/1
- **Project Teams will be identified and used starting Lab 2**
- **Lab 2 (Design Lab 1):** Review lab manual. Submit Pre-lab assignment to [Gradescope](#)

## Lecture 2: Wednesday 8/27/25

Planar Mechanisms #1 (Chap 2)

# Lecture 1 Topics:

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- Course Overview
- Engineering Design (Chap 1)
  - MechSE Engineering Design Process
- Human-Centered Design
  - Labs 2 and 3

# Course Objectives

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- ME 370 covers three main topics:
  - Kinematics
    - Getting the geometry and motion right
  - Machine dynamics
    - Understanding the forces associated with a rapidly moving mechanism
  - Rotating machinery
    - Understanding balancing, gears, cams

# By the end of the course, you should be able to

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- Recognize and assess the underlying functionality of everyday mechanisms.
- Synthesize and prototype a mechanism to perform a specified task.
- Analyze mechanisms for position, velocity, acceleration, and dynamic forces in 2-D, using both analytical and computational tools.
- Understand issues of dynamic forces, balancing, gears, cams, and motion control.
- Apply knowledge of basic part and assembly design (engineering drawings, fits, tolerance).



In addition, you should learn some general engineering skills such as

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- Synthesize user design requirements
- Create low fidelity prototypes, sketches and execution of ideas
- Giving and receiving feedback
- Effectively work in a team
- Write an effective report and clearly visualize and present data

# Carefully Review

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## Canvas Course Site and Syllabus

You are responsible for knowing all policies in the course syllabus even if not covered during the lecture

**CHECK YOUR EMAIL**  
and Canvas for announcements frequently!!

# Mechanical Design Courses

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- ME 370
  - Pull together knowledge from basic classes: Math, Physics, TAM
  - Provide some tools
    - Develop preliminary machine design
    - Analyze for functionality
    - Focus on 2D planar mechanisms
- ME 371
  - Additional tools
    - Failure prevention
    - Power transmission
- ME 470
  - Apply knowledge to design, develop, analyze, build, and present a project

# What is Engineering Design?

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

1

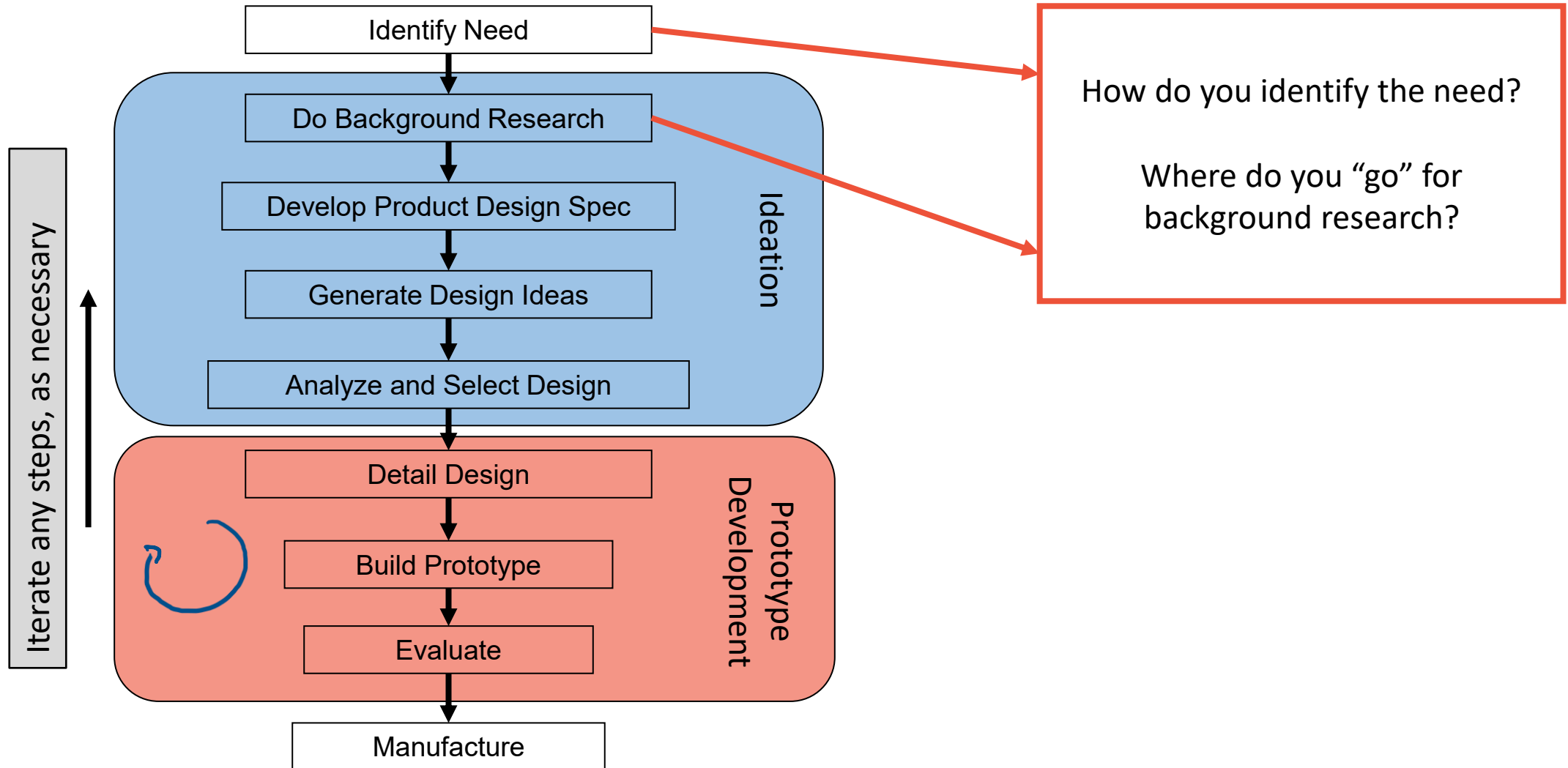
It is a decision-making process (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.

2  
3

*According to ABET definition*

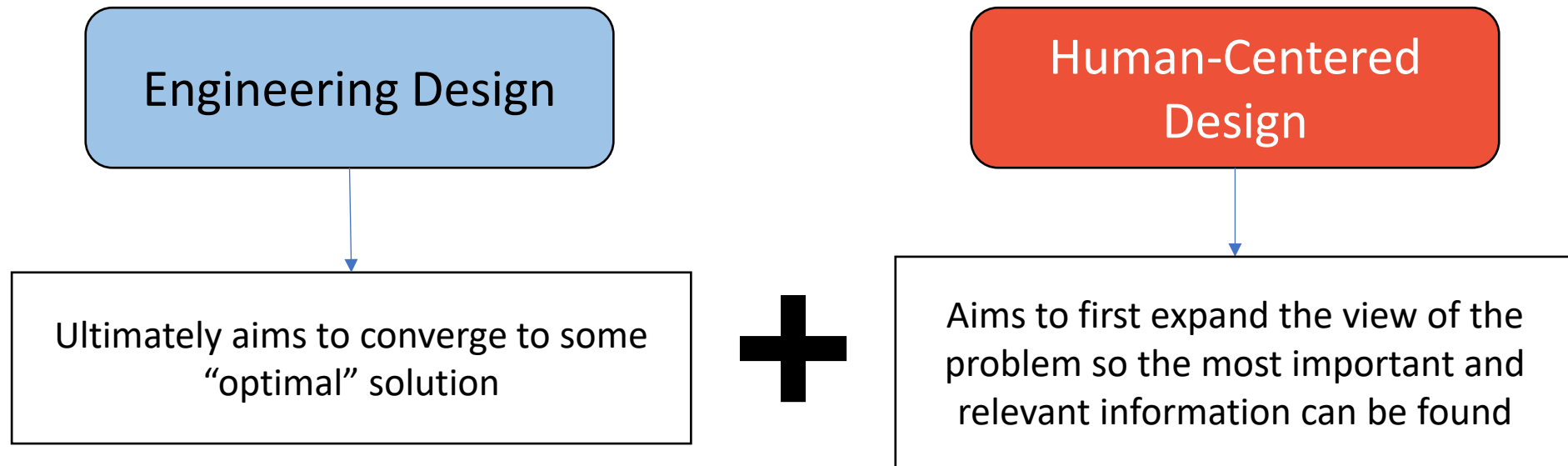


# MechSE Engineering Design Process



# Human-Centered Design

- Human Centered Design (HCD) is a problem-solving approach that identifies the unmet needs of a population in order to collaboratively develop solutions.



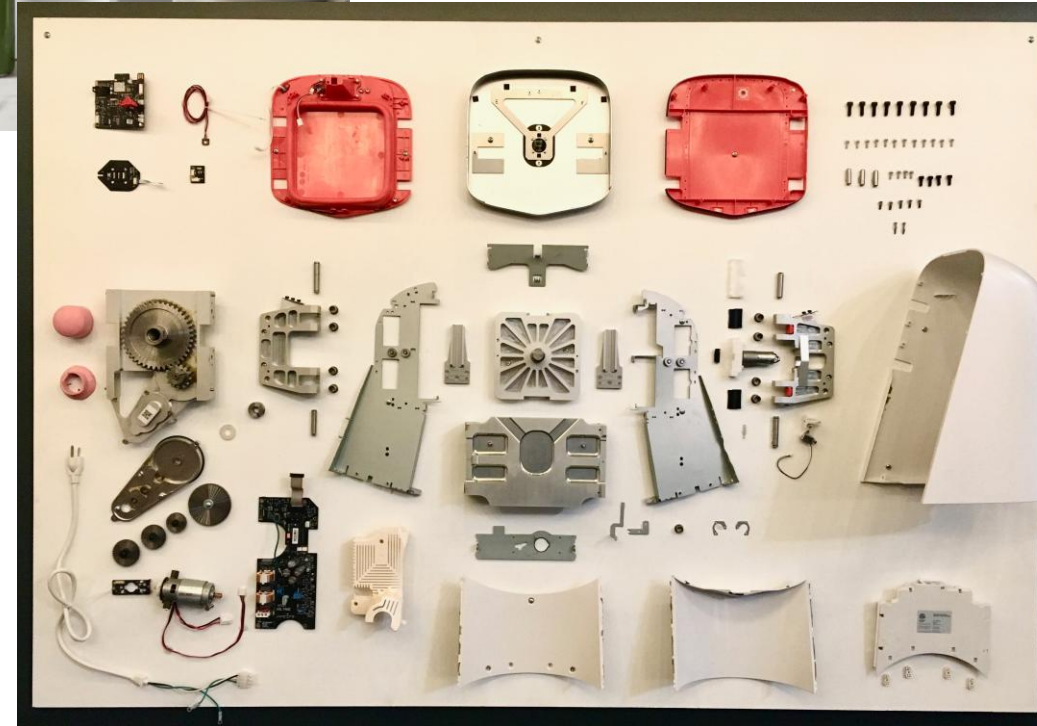
- look for unmet needs
- consider user first
- better engineers.

??

# Juicero – \$400 Wi-Fi connected juice and vegetable press

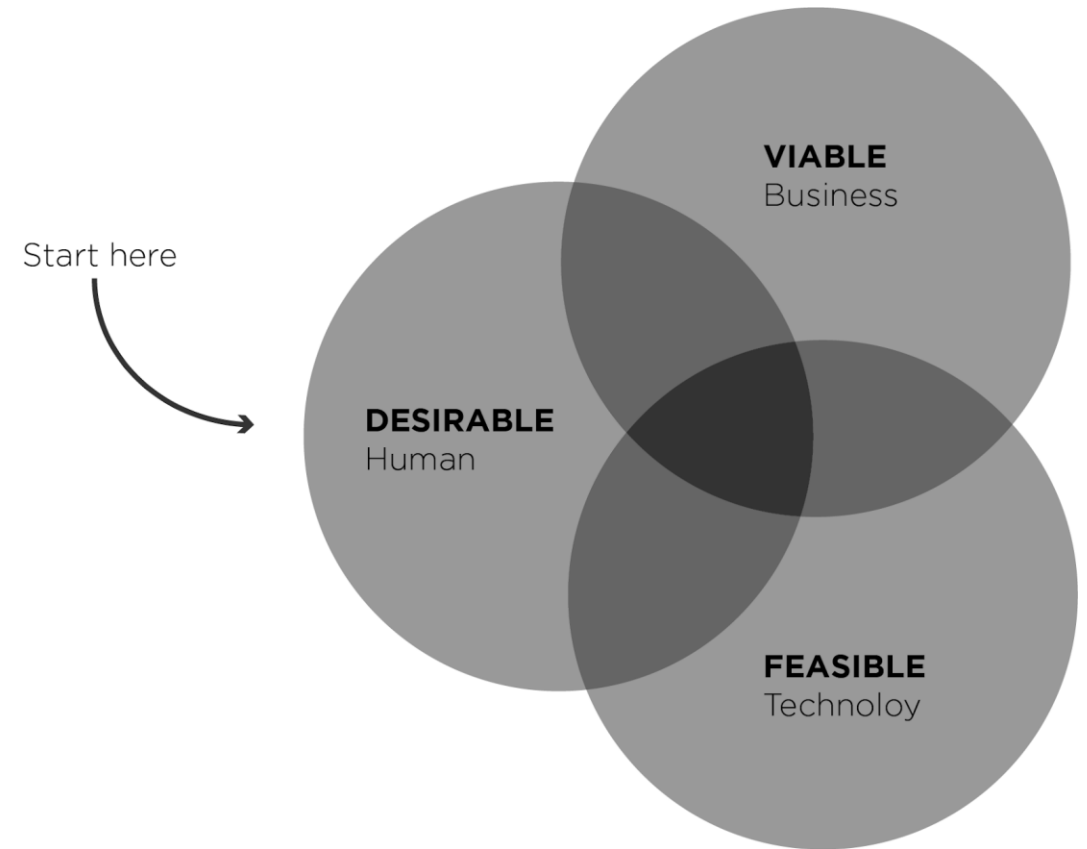


- does user need it?
- Over Engineered
- just as easily squeezed
- lack of design constraints → \$\$



# So What? Or Why HCD?

- A more complete and empathetic understanding of unmet needs.
- Make informed design decisions, especially where objective metrics aren't readily available.
- By designing in response to the needs of a real stakeholder, human centered design leads to solutions which are impactful and innovative.





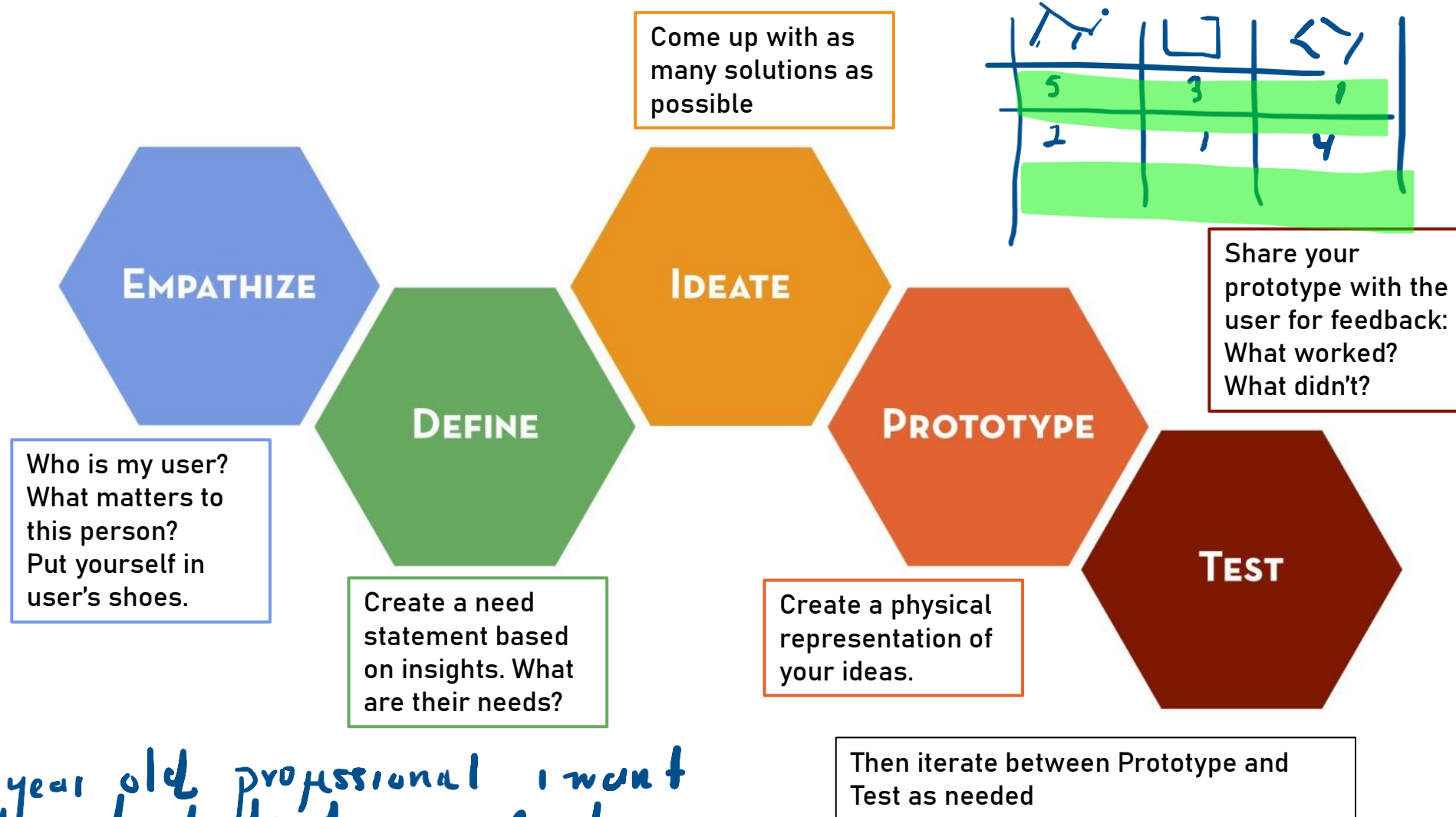
# Which “Advertisement” experience would you prefer?

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- The new Ibuprofen safety cap prevents accidental opening of the medicine, and its large size and rubber grips makes it easy to grip and open.
- In the U.S., over 1000\* kids die every year by ingesting medicine intended for adults. The new ibuprofen safety cap can save your kid's life.

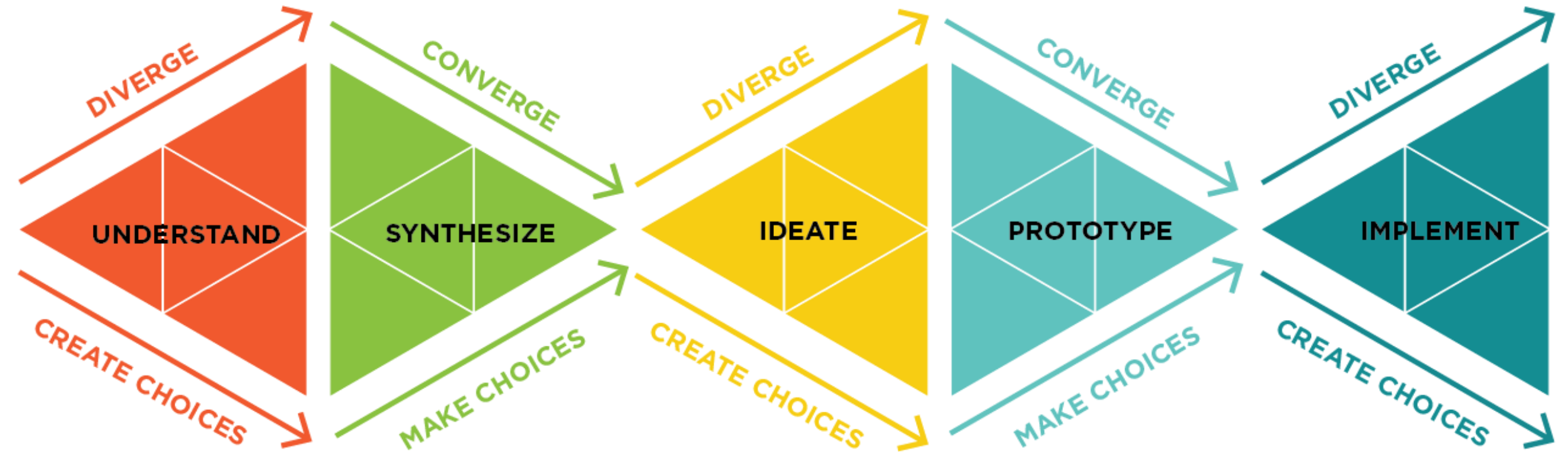
\* This number is for educational purpose and not based on data

# Examples of HCD: IDEO Design Thinking Process



as a 35 year old professional i want  
a kitchen tool that ... faster ...

# Examples of HCD: Siebel Center of Design at UIUC



Lawrence, L., Shehab, S., Tissenbaum, M., \*Rui, Y., & \*Hixon, T. (2021). "The Development and Implementation of a Taxonomy for Teaching and Learning Human-Centered Design."

# Take-away (Benefit of a Divergent/Convergent Process)

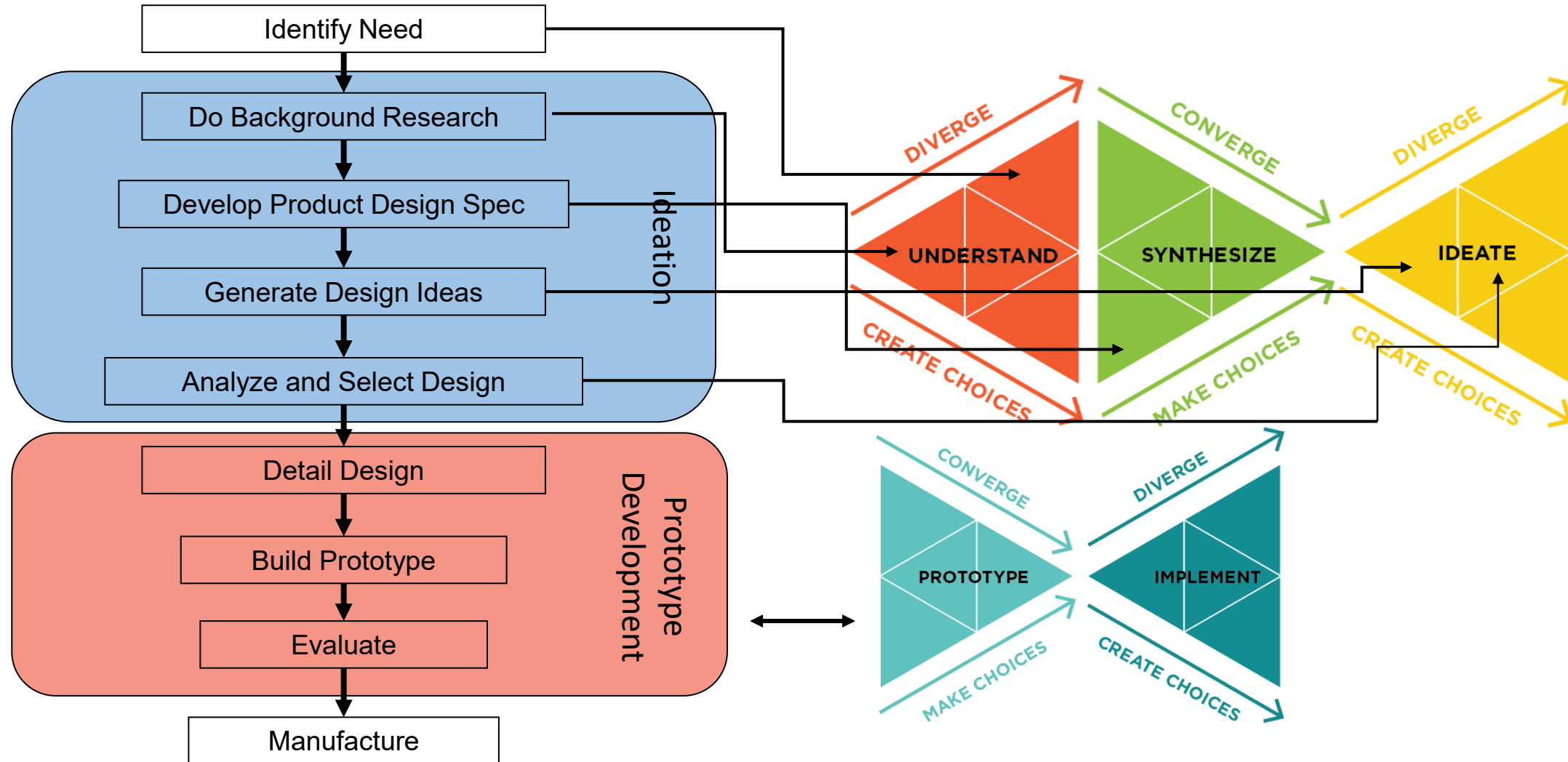
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- By focusing on the user/stake-holder and by allowing yourself to diverge and converge rather than just worrying about reaching an optimal solution “quickly” will help you:
  - Fully understand the problem before committing to a solution
  - Develop strategies to effectively communicate with stakeholders
  - Document the design process to enable reflection and collaboration
  - Support design decisions by tracing to unmet needs
  - Make informed judgments in the face of ambiguity

\*(Crismond & Adams, 2012; Goldman et al., 2012; Razzouk & Shute, 2012)



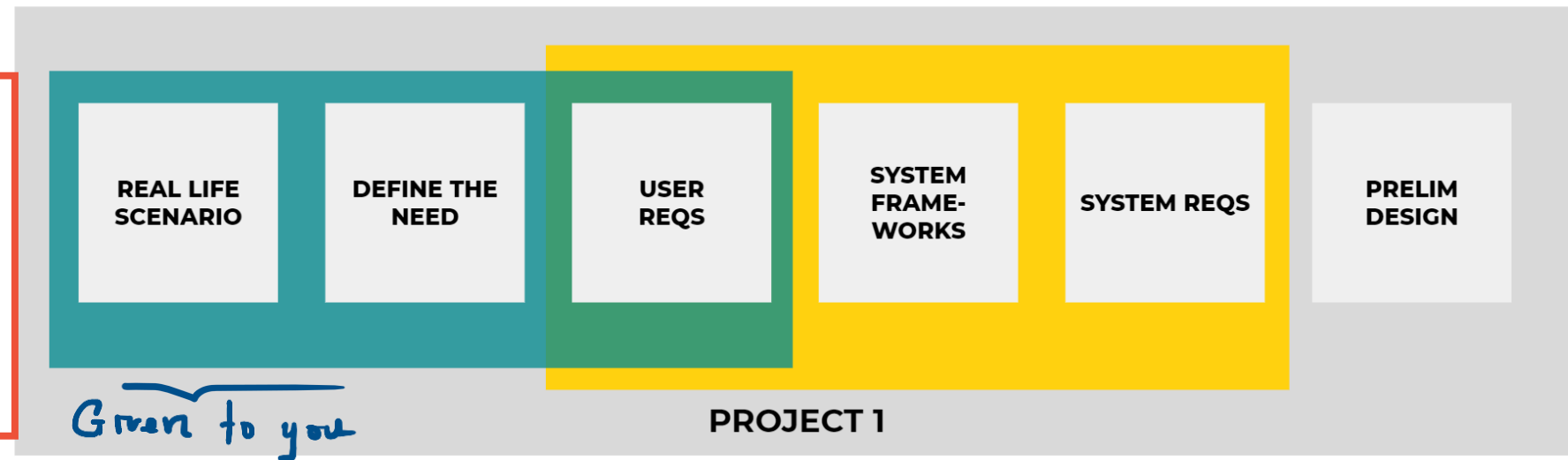
# ED can be reframed into HCD



# In ME 370: HCD & Project 1

- You will practice HCD process → Design Labs 1 & 2 (Weeks 2-3); Project 1

Project 1 Goal: Design and Synthesize defined mechanism



- Focus on the user experience, low-fidelity prototyping, and single mechanism synthesis

# In ME 370: Design for performance & Project 2

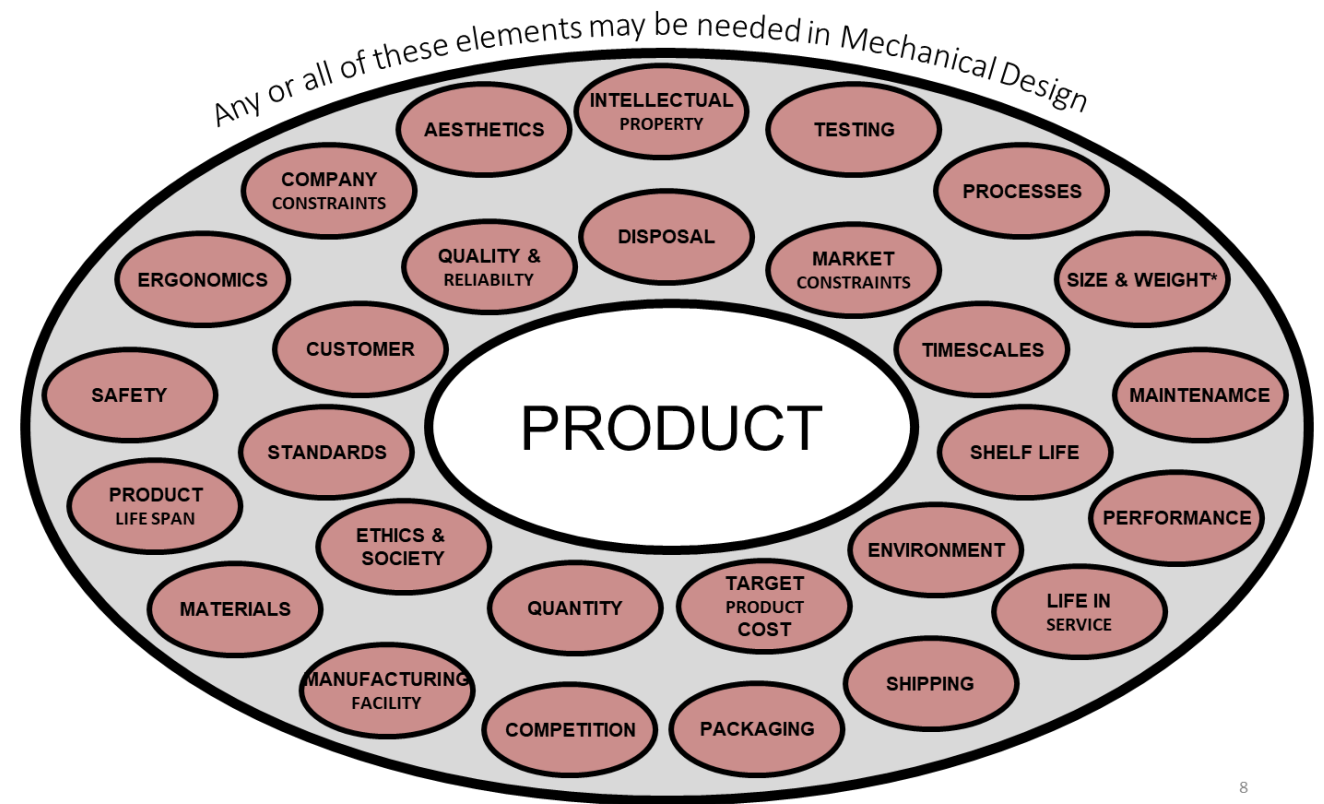
- You will practice designing for “desired/optimal performance” given a set of project design specification → Project 2

## Product Design Specification (PDS)

- Identify product/design requirements
- Review all **29** Primary Elements from performance through cost, to disposal/recycling requirements
- Objective/measurable - with units (metrics)

## For example:

- Able to support 500 N of vertical force
- Produce flow rate of 200 gal/min
- Maintain operating temperature of 32°



# We will focus on performance relevant PDS

