



Framing and Reframing Design Problems

Week 2: Second Lecture

Designers don't just solve problems – they shape them

Product Design

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BRIGHAM YOUNG UNIVERSITY



**DESIGN
EXPLORATION
RESEARCH
GROUP**

Goal

Be introduced to concepts that make you think deeper
about the process of design

Differentiate between **what the designer does**
and **what happens to the design** when the designer does
what they do

Outline

- **Business**
- **On design process**
- **Sketching**
- **More on design process**
- **Closing**

	Su	M	T	W	Th	F	S	
Week 0								Design Philosophy & Engineering Design Essentials
Week 1								
Week 2					L		●	Complete Opportunity Development -- Initiate
Week 3		■	L	D	L		●	
Week 4		■	L	D	L		●	Complete Opportunity Development – User Insights
Week 5		■	L	D	L		●	
Week 6		■	L	D	L		●	Complete Concept Development
Week 7		■	L	D	L		●	
Week 8		■	L	D	L		●	
Week 9		■	L	D	L		●	Complete Sub-System Engineering
Week 10		■	L	D	L		●	
Week 11		■	L	D	L		●	Complete System Refinement
Week 12		■	L	D	L		●	Complete Product Pitch
Week 13		■	L					
Final Exam				●				Design Portfolio Due as Final Exam

- Decomposition
- Recombination (Table)
- Most Critical Module/Interface
- Geometry-Material-Process Decisions
- Observations (+Thoughtless Acts)
- Nucor’s Circle (Hedgehog Concept)
- 5W Problem Framing Framework
- Double Diamond Process
- Conversation Starters
- Design Thinking Process
- Stages of Development

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How would you know if you did a good job?

What is Framing?

“In *Design Thinking*, design is primarily about reframing problems, not just solving them. It’s learning what the problem really is, and not accepting it without first asking a lot of questions” [5].

“Problem framing is a process of discovery to understand and define a problem” [6]. “It is [a process] of challenging preconceived assumptions and considering different perspectives to a problem [6]”. “The problem is opened up through the analysis of the wider problem arena, and its complexity is increased by potentially involving a greater group of possible stake holders” [7].

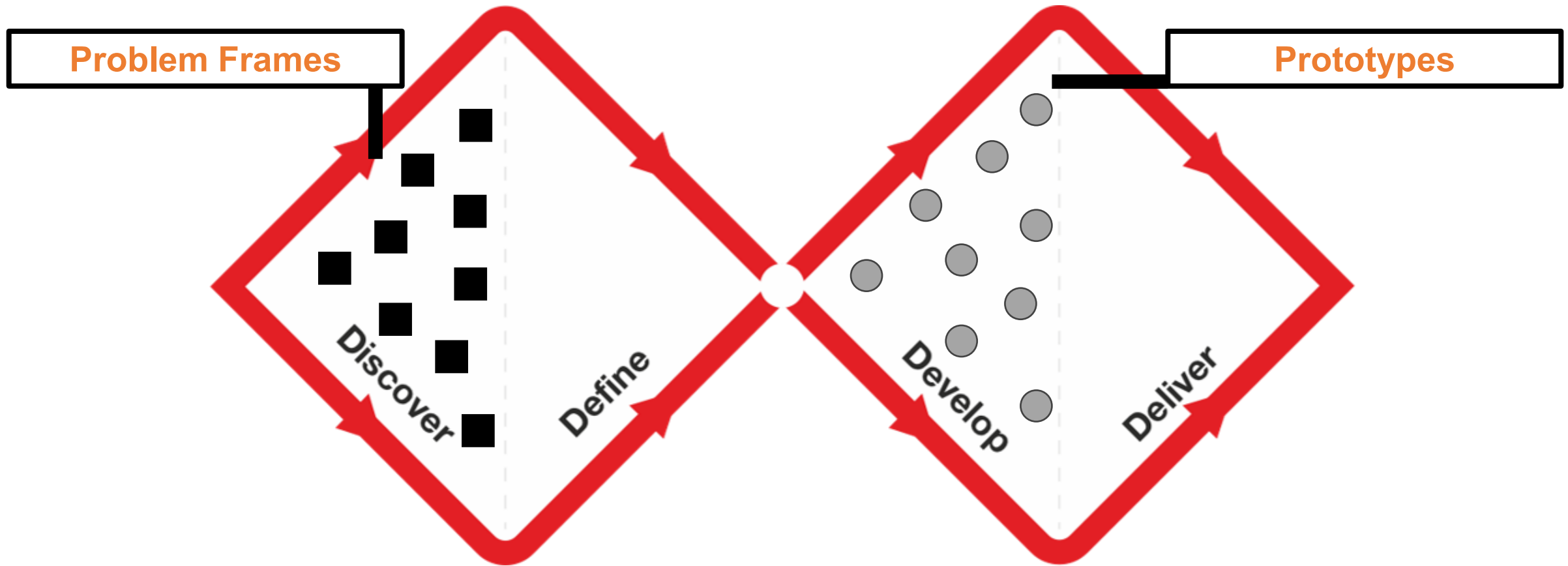
“Problem framing requires intense engagement in sensemaking to develop deep understanding of the problem to be solved” [8]. “Framing requires understanding current mental models and developing alternative ones” [9].

“Most of the great breakthroughs in human history have been a result of people thinking differently about the problems, not the solutions” [11].

“Problem framing is the art of finding a better problem to solve.” [10]

References

5. R Quinlan
6. A. Hermanto
7. K. Dorst
8. S. Beckman
9. P. Senge
10. C. Wooding
11. J Roberts



DISCOVER

The first diamond helps people understand, rather than simply assume, what the problem is. It involves speaking to and spending time with people who are affected by the issues.

DEFINE

The insight gathered from the discovery phase can help you to define the challenge in a different way.

DEVELOP

The second diamond encourages people to give different answers to the clearly defined problem, seeking inspiration from elsewhere and co-designing with a range of different people.

DELIVER

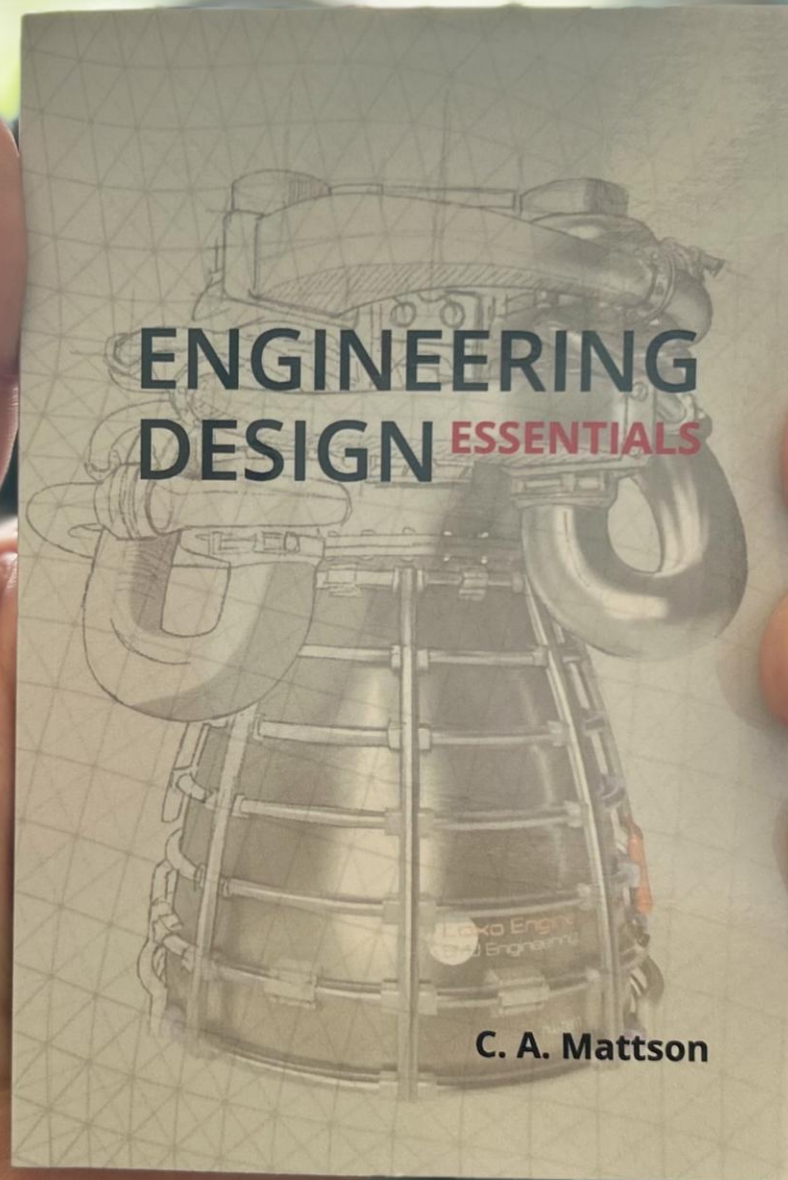
Delivery involves testing out different solutions at small-scale, rejecting those that will not work and improving the ones that will.

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Conversation Starters

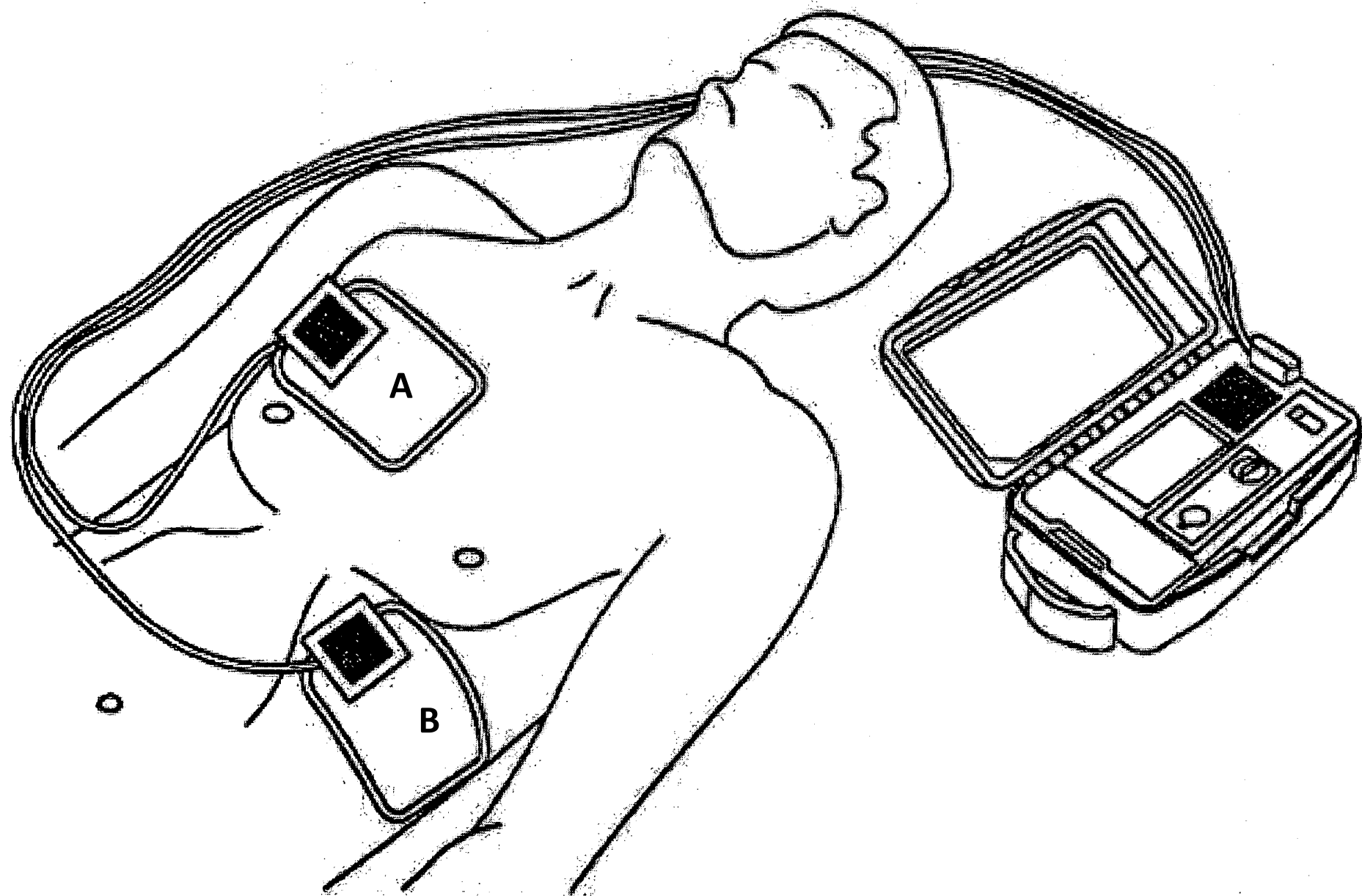
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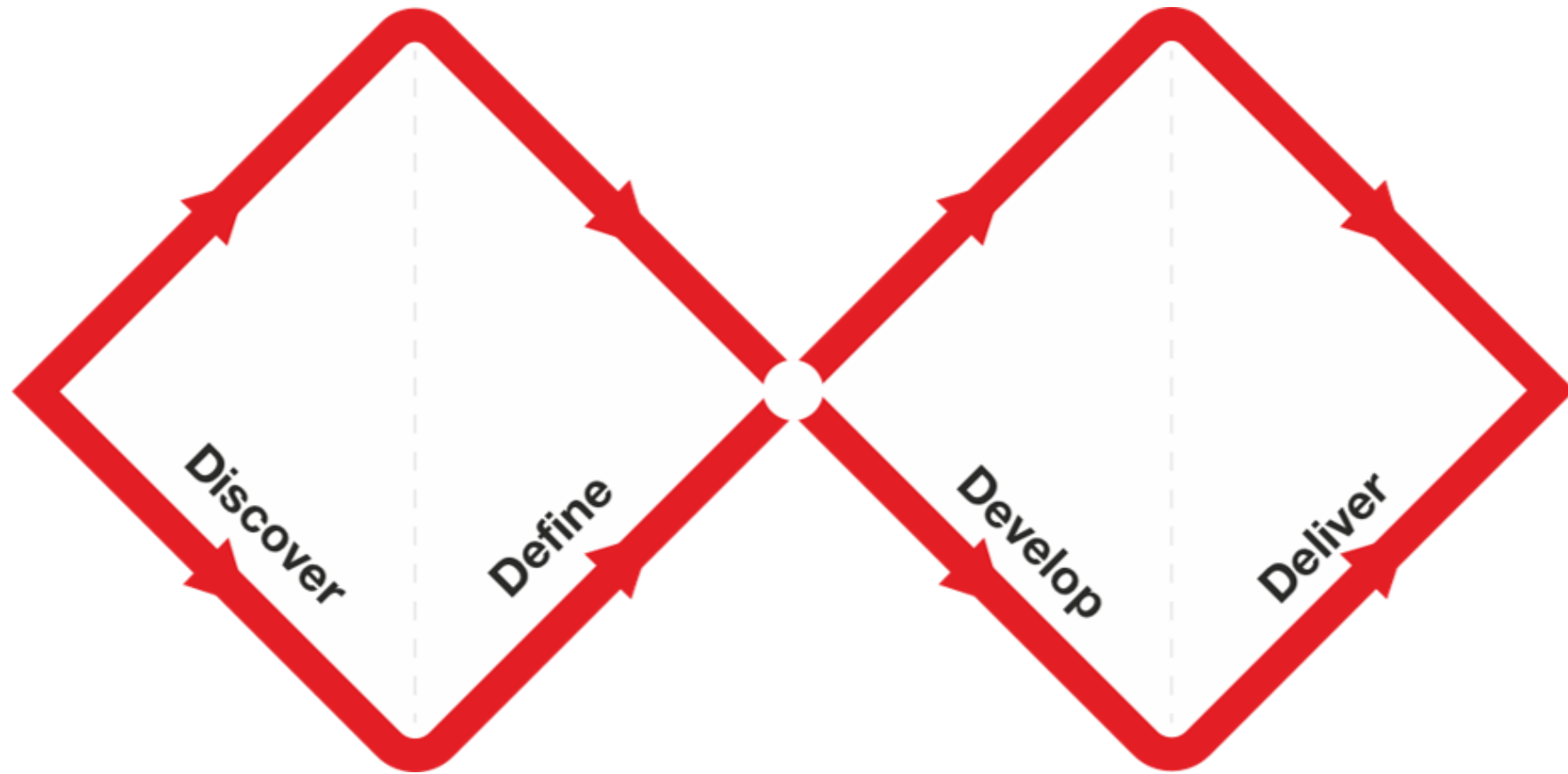


DESIGNETTE

Show and Tell

What is your torque wrench
innovation? What problem does it
solve, and who is the innovation for?

Design Process



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DEFINE

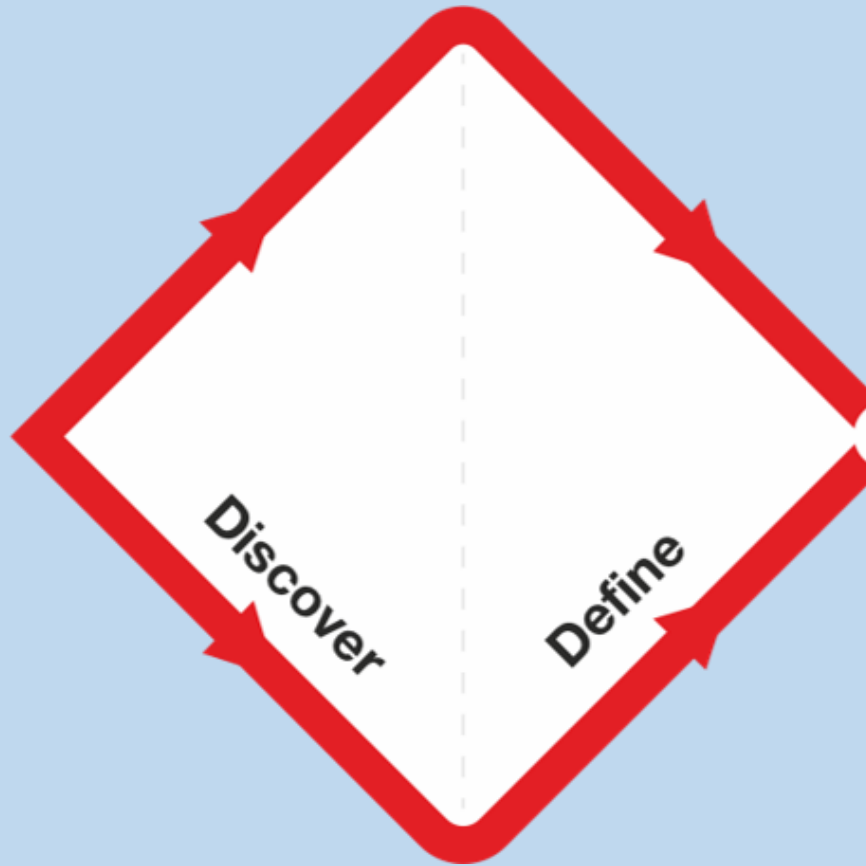
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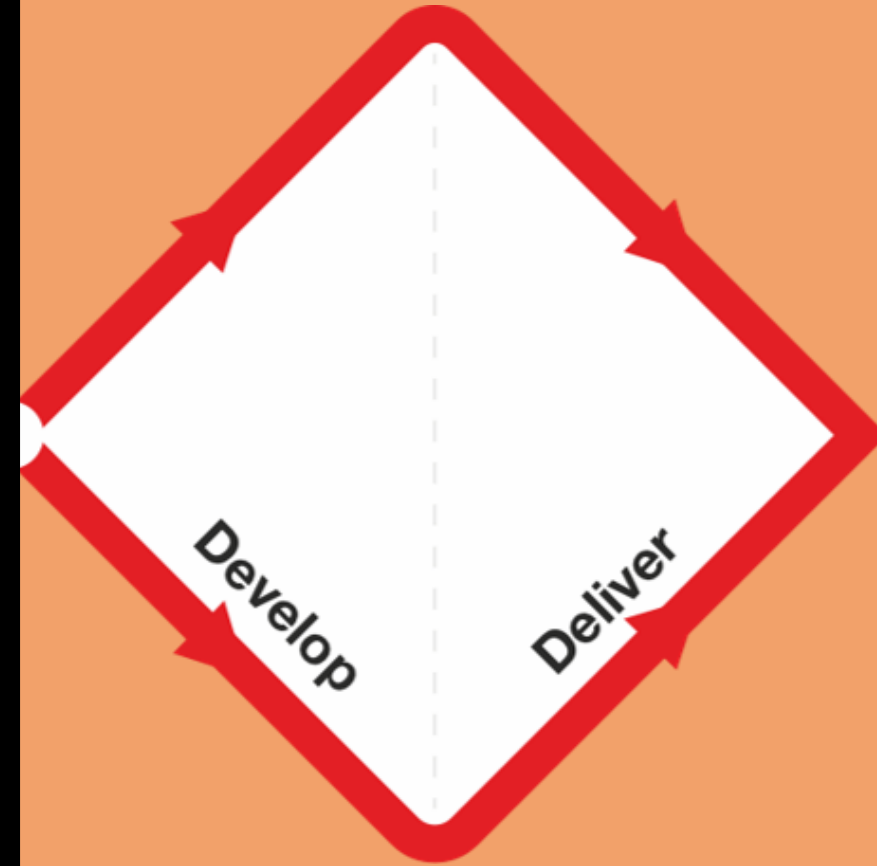


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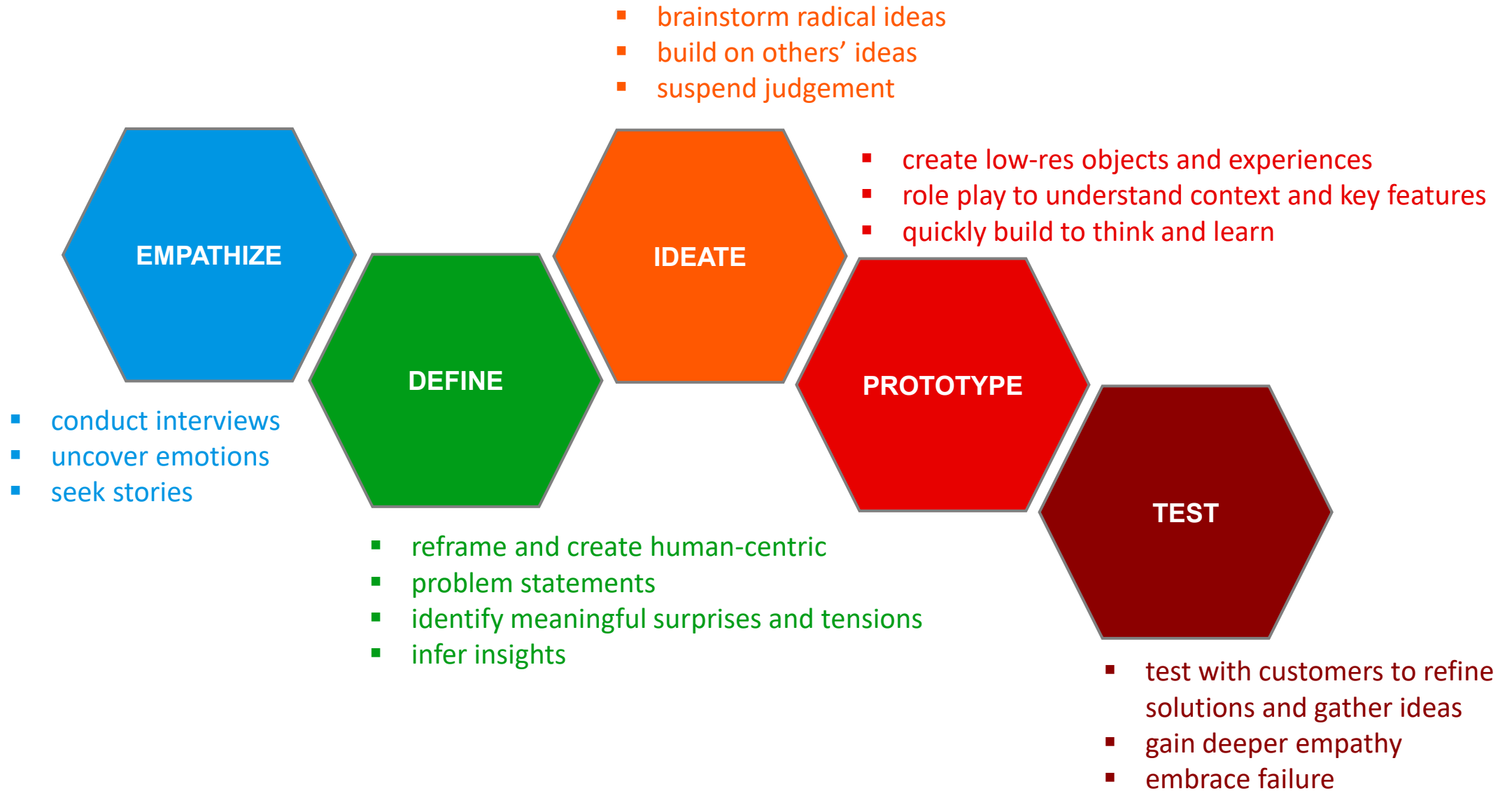


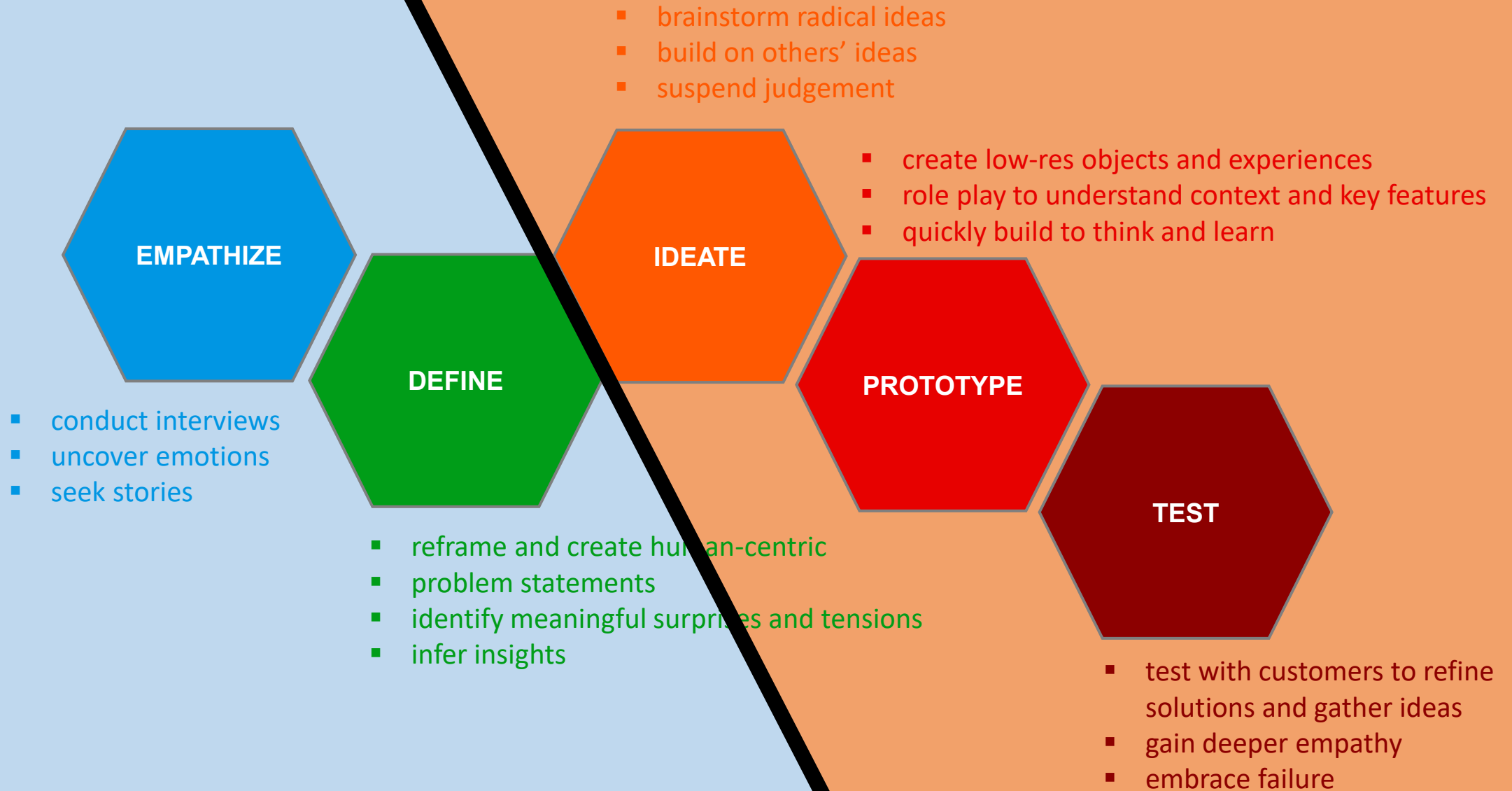
DEVELOP

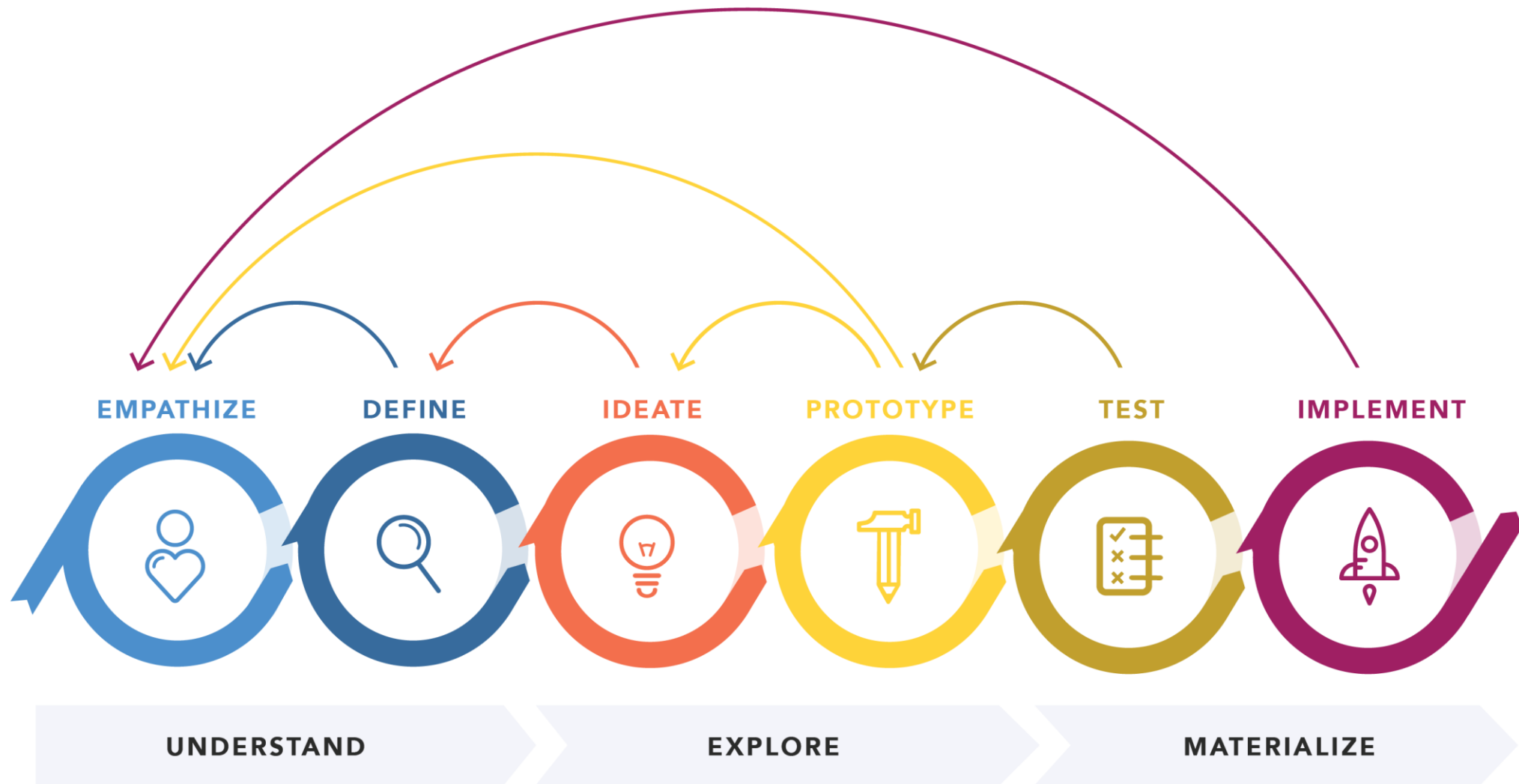
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Human-Centered Design

Human-Centered Design

EMPATHIZE

- conduct interviews
- uncover emotions
- seek stories

DEFINE

- reframe and create human-centric problem statements
- identify meaningful surprises and tensions
- infer insights

IDEATE

- brainstorm radical ideas
- build on others' ideas
- suspend judgement

PROTOTYPE

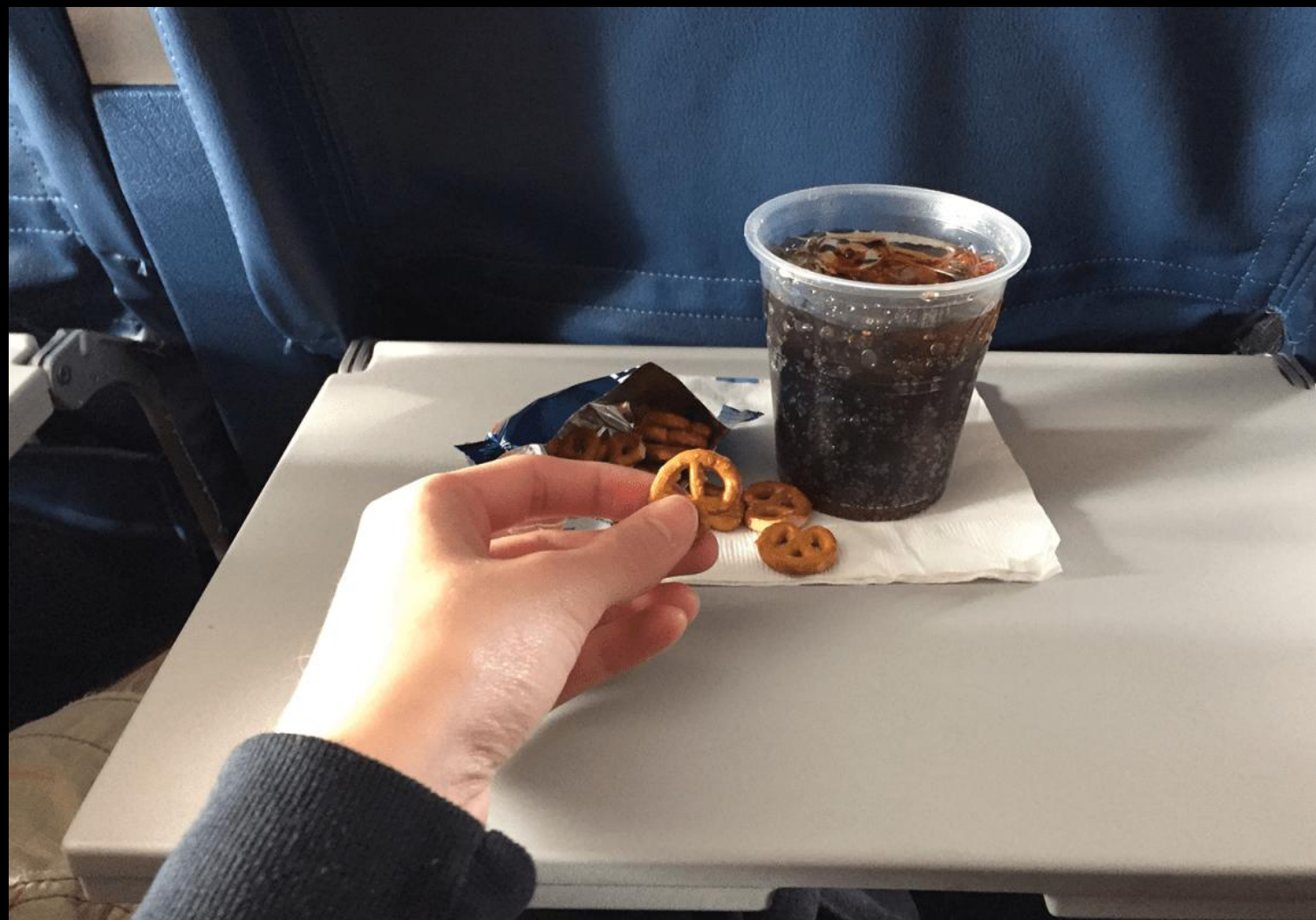
- create low-res objects and experiences
- role-play to understand context and key features
- quickly build to think and learn

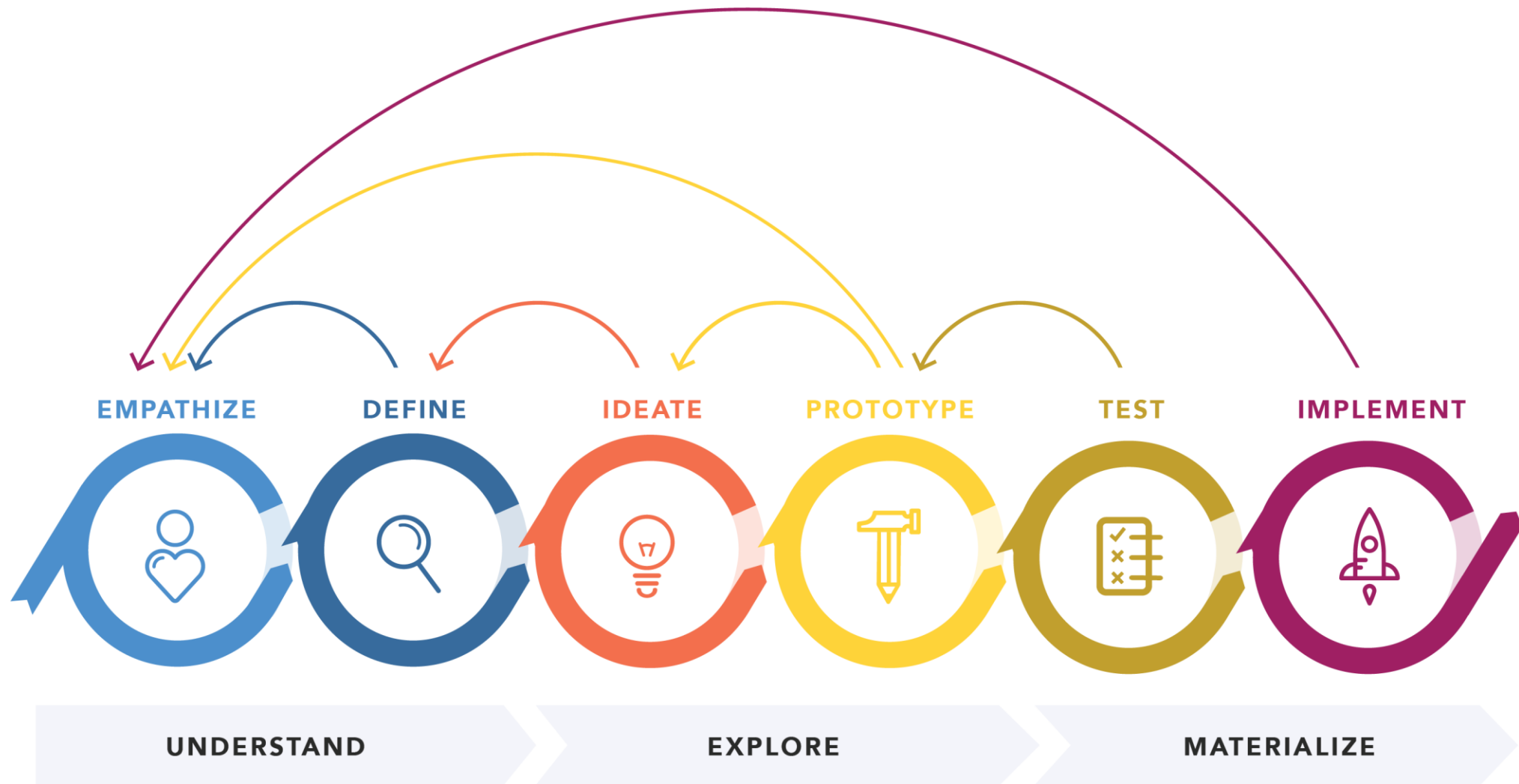
TEST

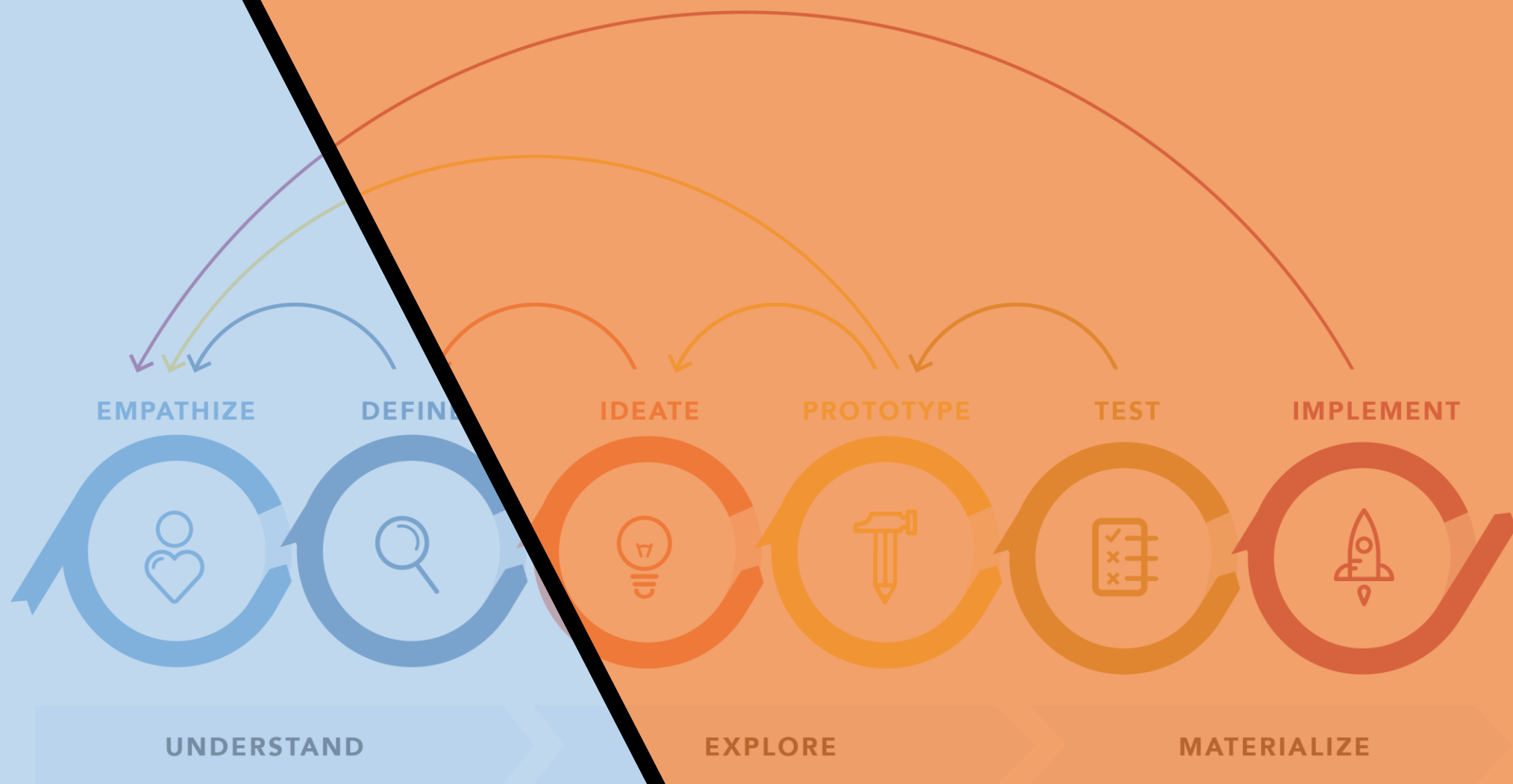
- test with customers to refine solutions and gather ideas
- gain deeper empathy
- embrace failure

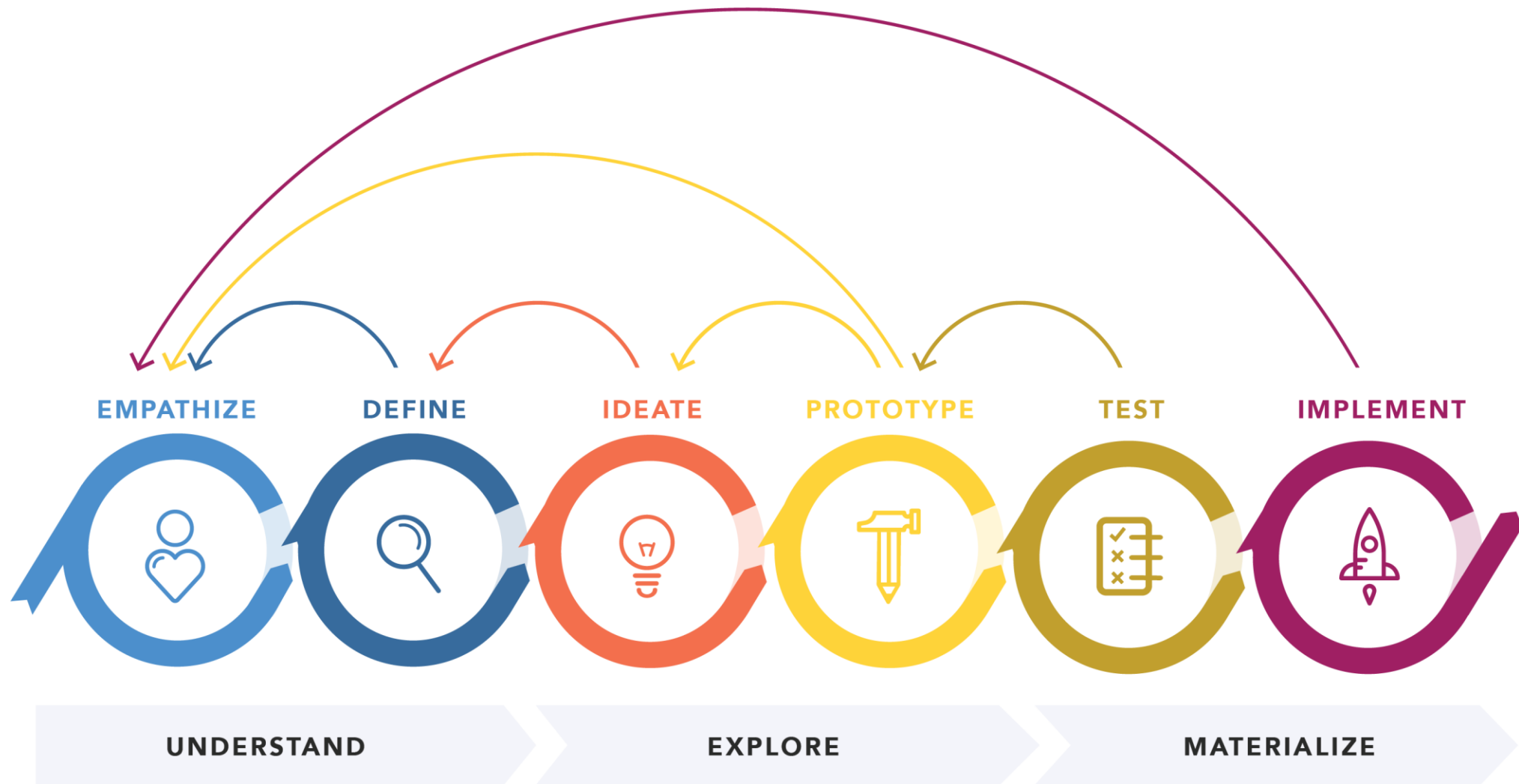
Human-Centered Design

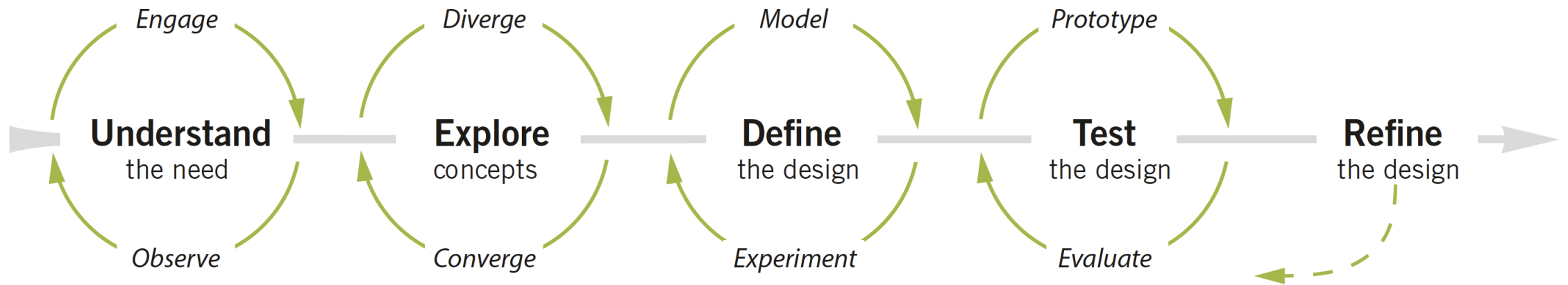
“Design Thinking is not a good strategy for all problems. For example, there are a large number of engineering problems that can be adequately solved using only engineering knowledge -- knowledge about humans is not needed. ” BDR Design Thinking Part 1











DESIGN THINKING



Empathize
Understanding
people



Ideate
Generating
your ideas



Define
Figuring out
the problem

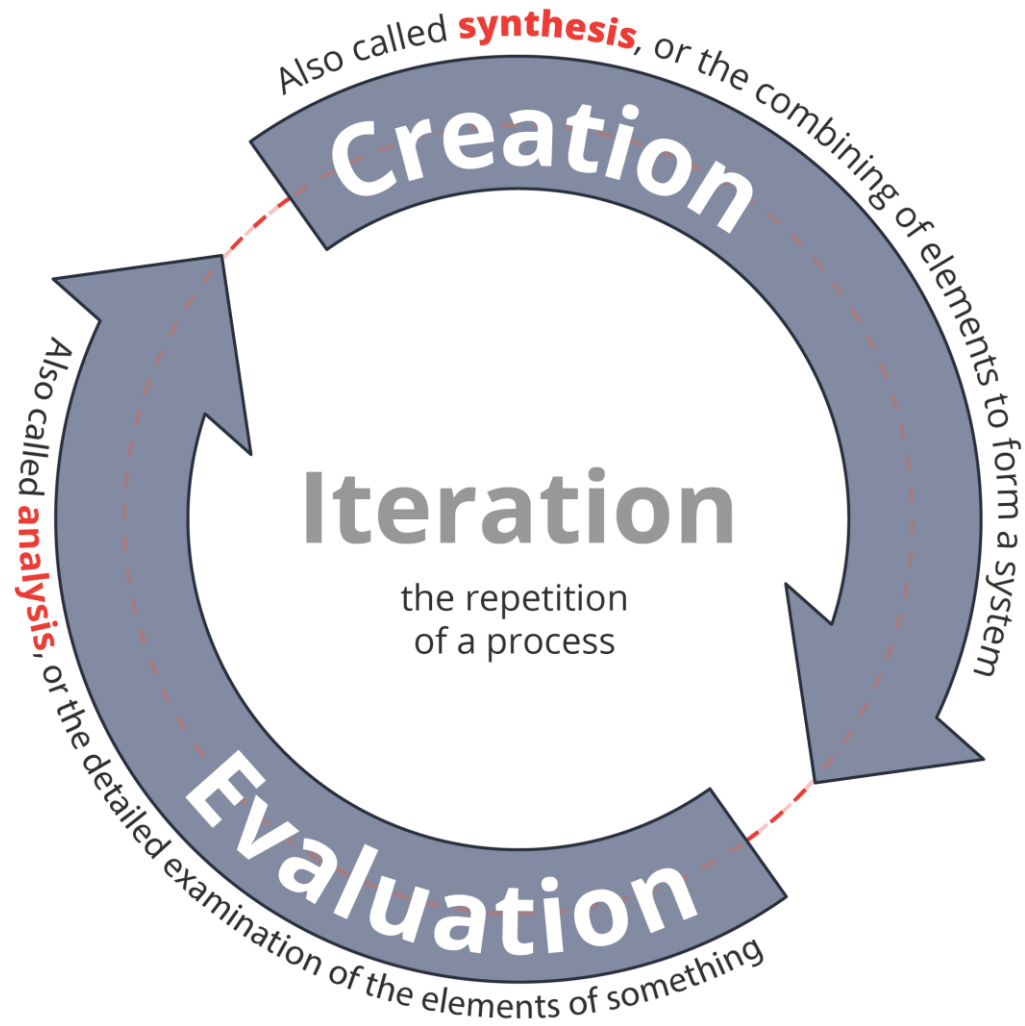


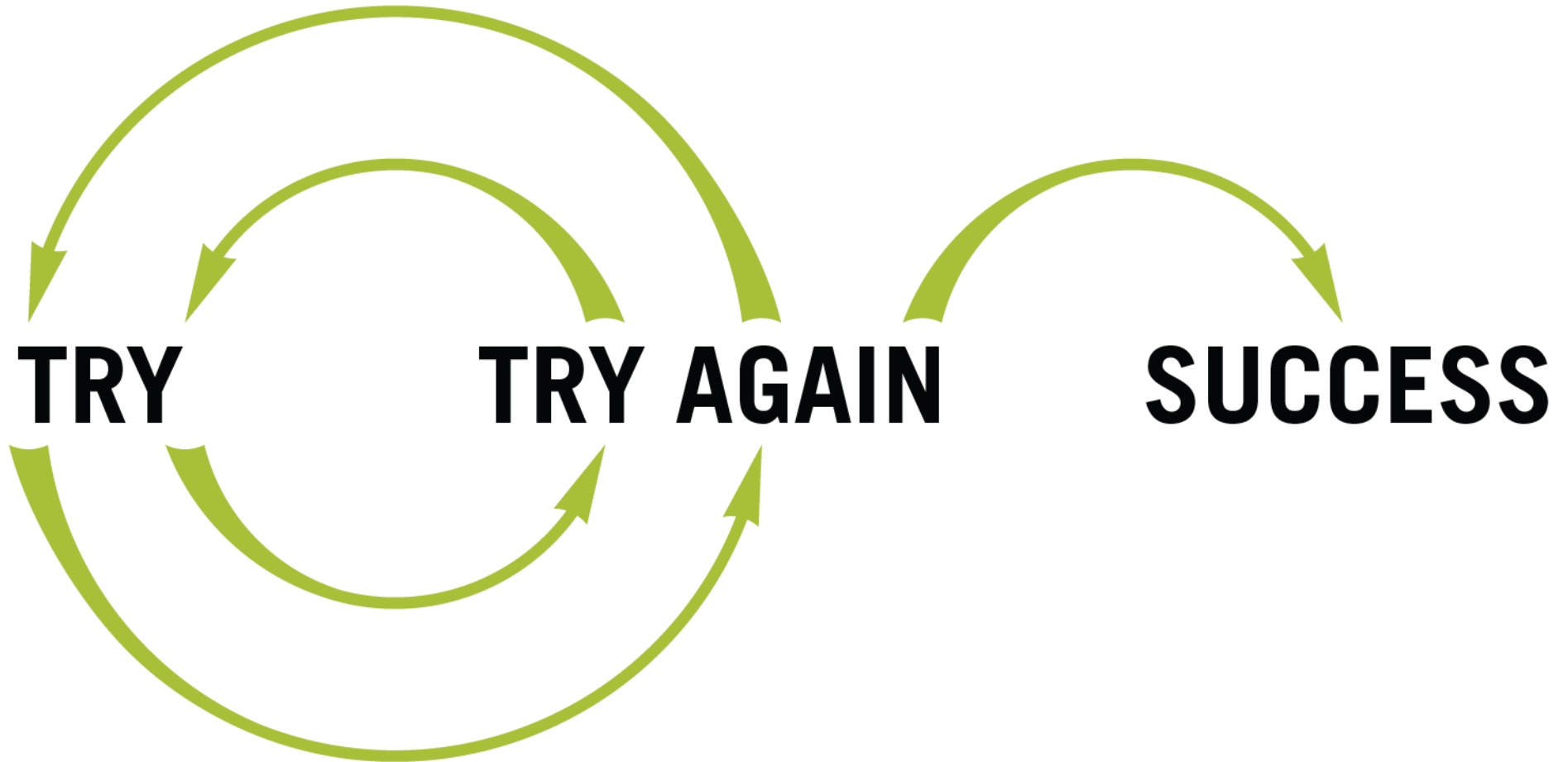
Test
Refining
the product



Prototype
Creation and
experimentation

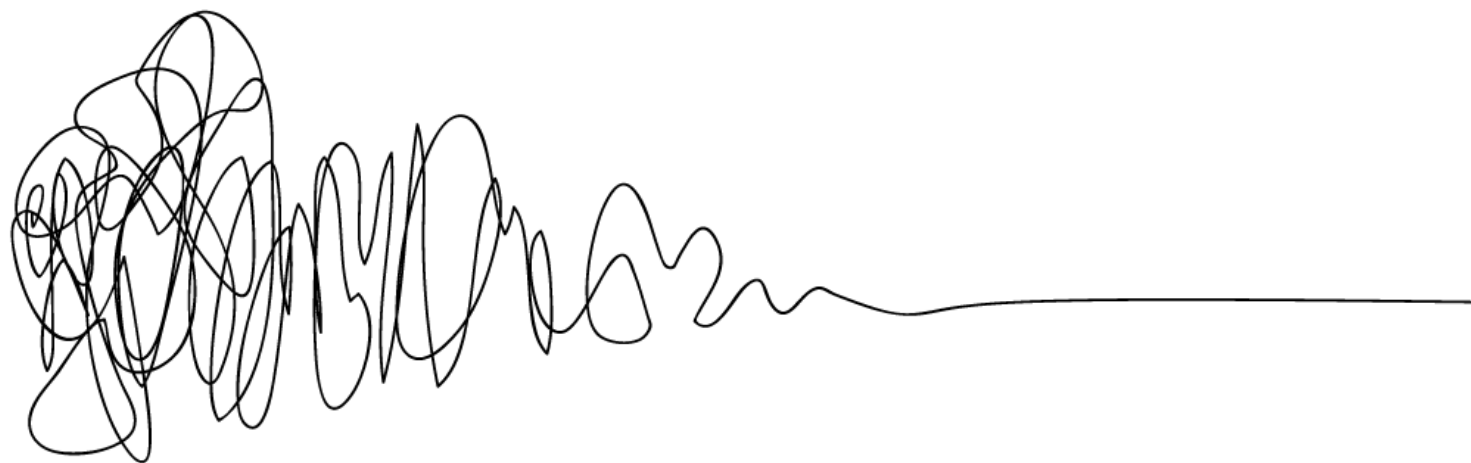






Noise / Uncertainty / Patterns / Insights

Clarity / Focus

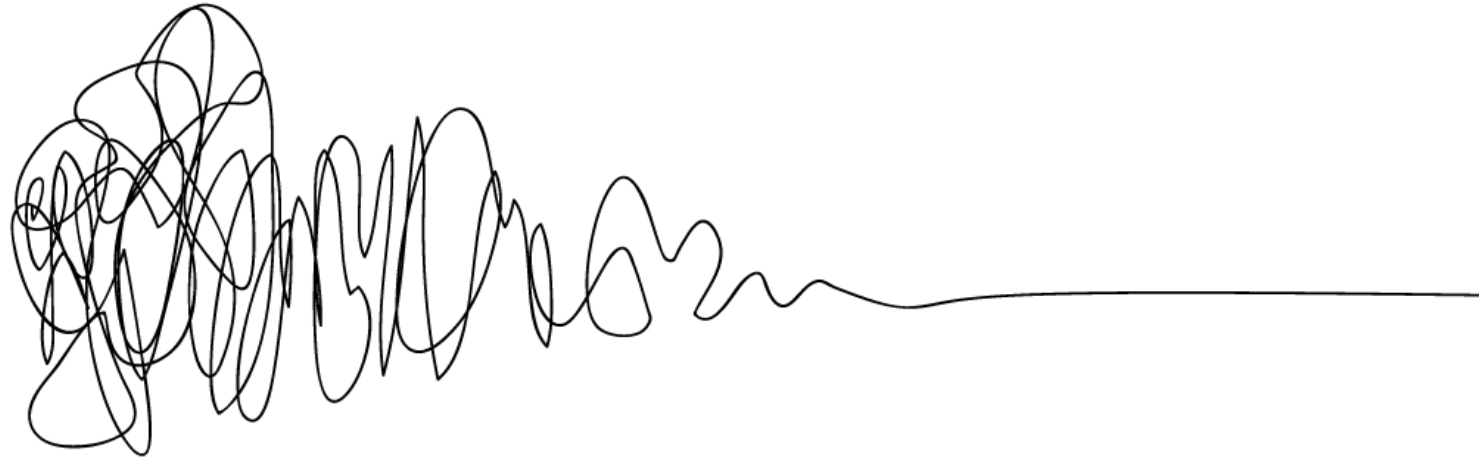


Research & Synthesis

Concept / Prototype

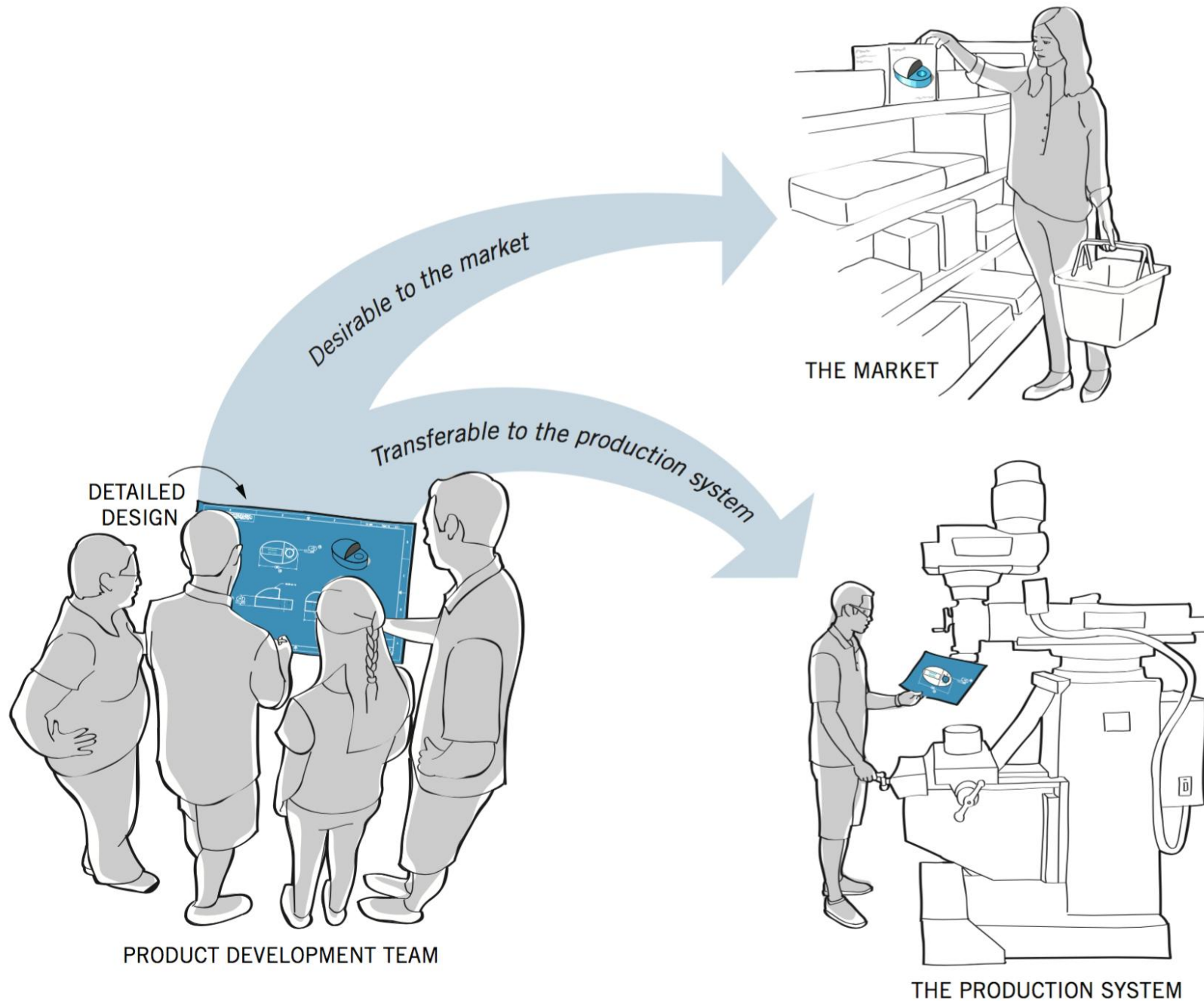
Design

What are we really doing?



Principle 1

The job of the product development team is to create a design that is desirable and transferable



design:

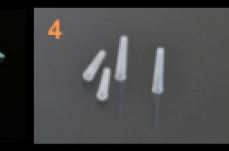
a clear and complete
definition of the product

Electrical & Mechanical Assemblies

Product: Cricut Paper Cutter
Client: Provo Craft, 2005
Role: Director of Engineering
Stage: System Integration, Producibility Refinement
Tasks: Decomposition, system definition, sub-system refinement, production ramp-up, QC plan
Impact: Cricut is still on the Amazon "Top 100 in Arts, Crafts, and Sewing" best sellers list

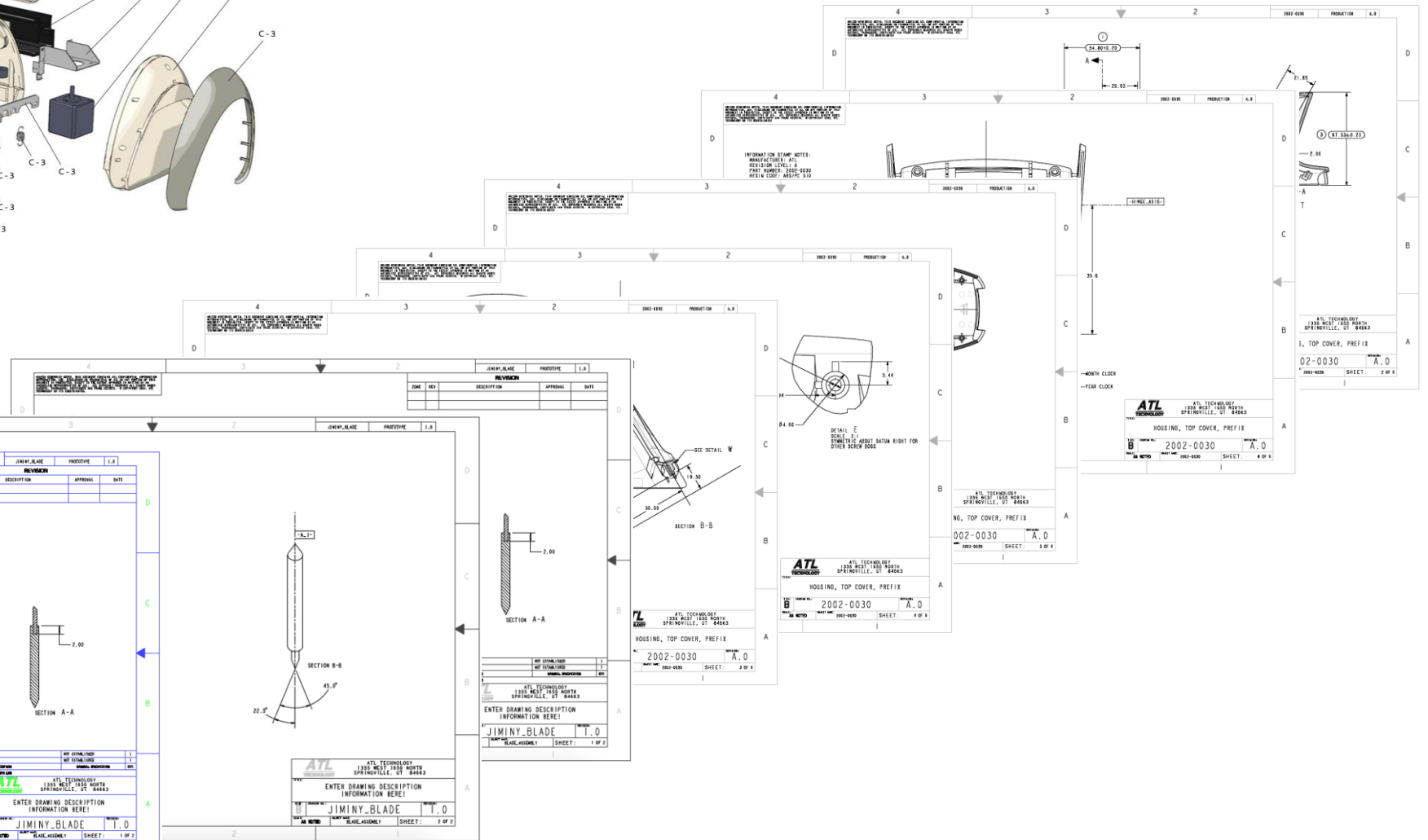
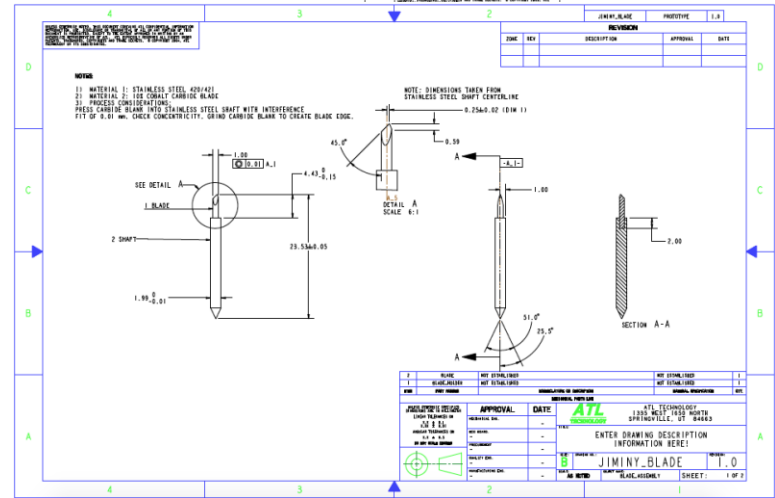


Additional Products in Portfolio



- 1. Amazon Kindle book light
- 2. Various circuit assemblies
- 3. Various styli for PDAs
- 4. Pipette protein filter

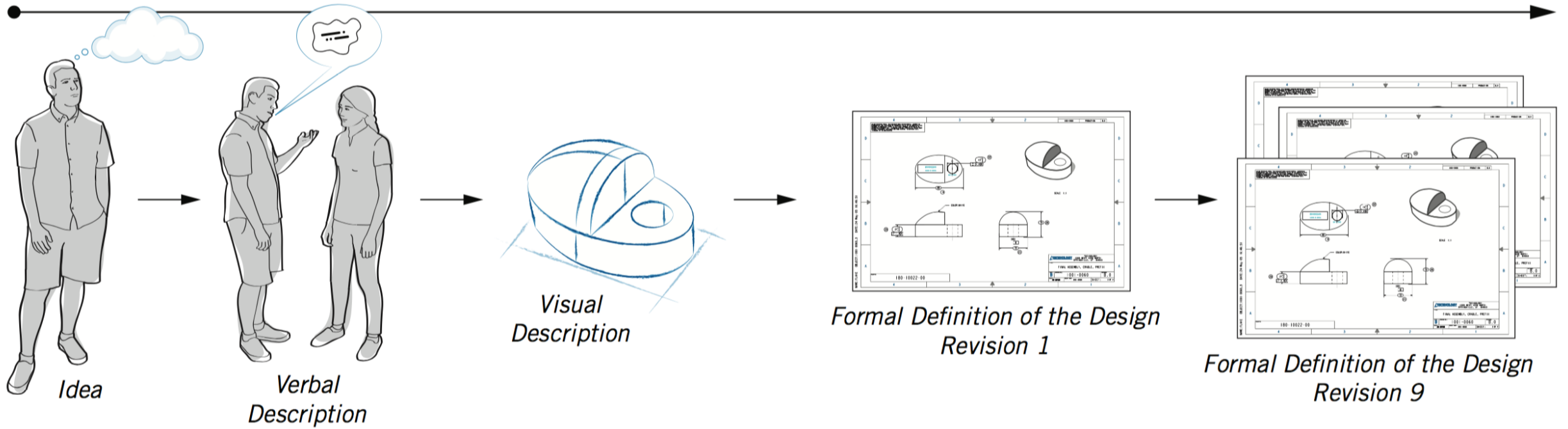


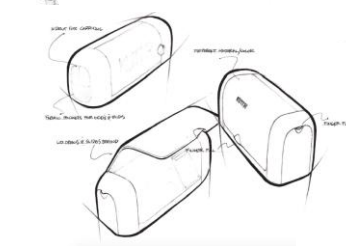
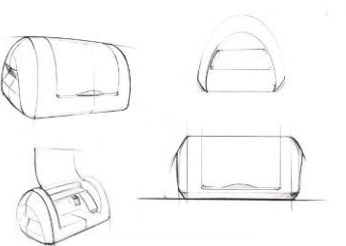
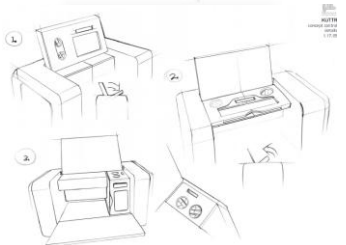
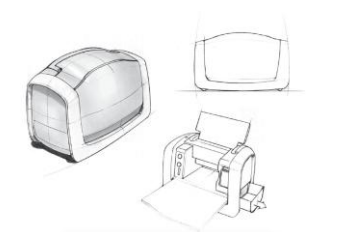


Principle 2

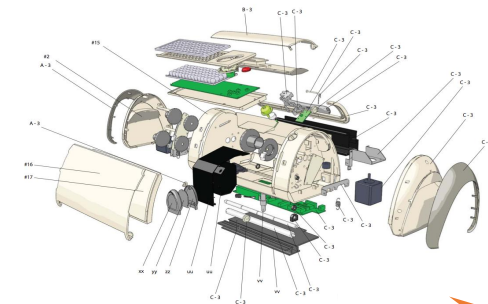
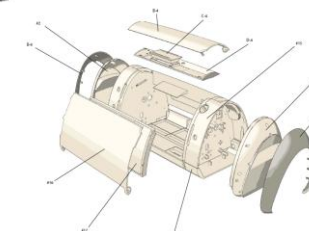
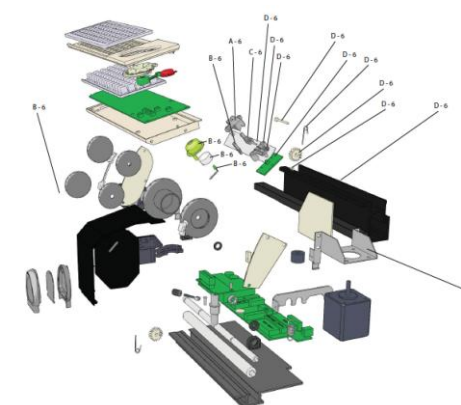
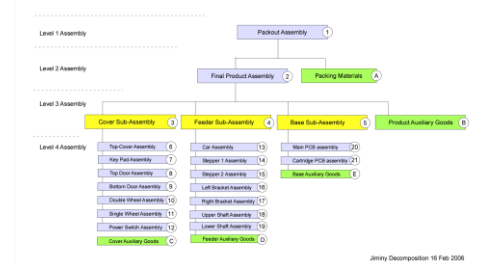
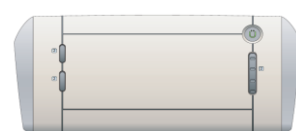
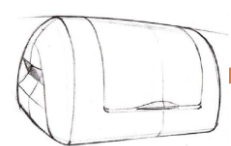
The design must evolve, gradually becoming better, more mature, and until it contains all the necessary information for the production system to manufacture the product and test its quality

Increasing Level of Detail / Production Readiness



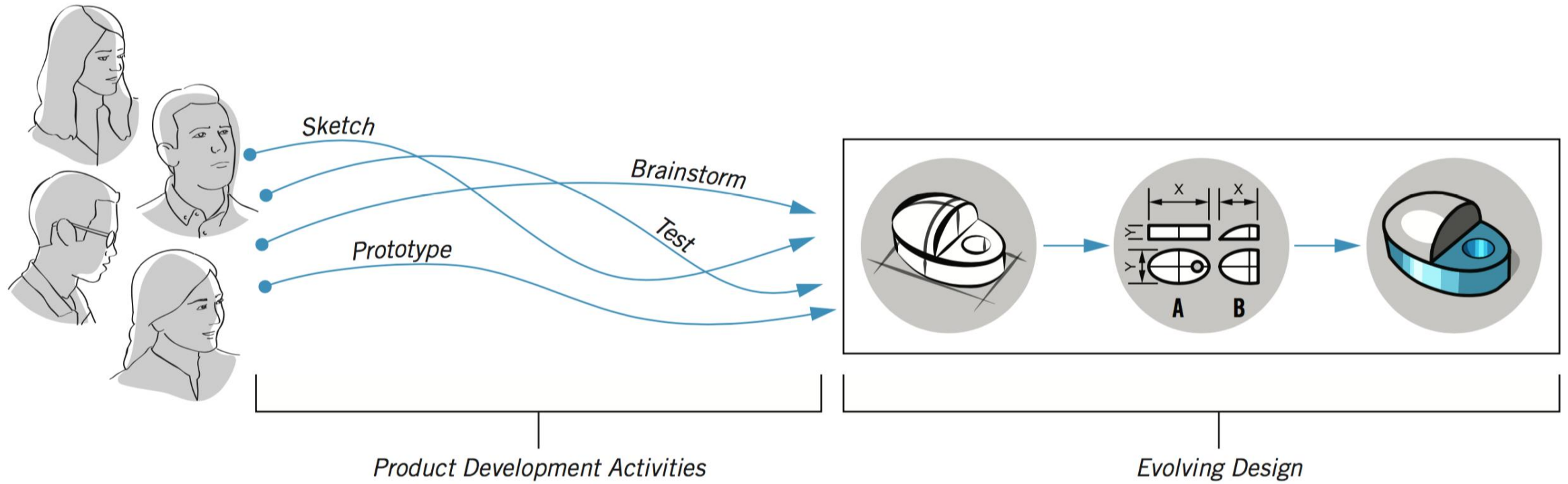


NOTES
1. 100%
2. 100%
3. 100%



Principle 3

The product development team causes design evolution through design activities





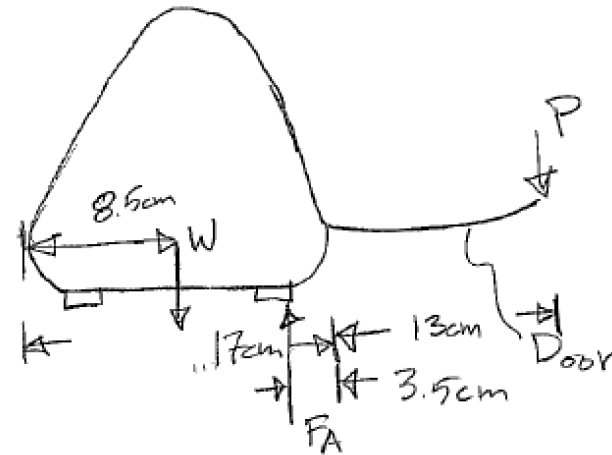
Market Requirement: The door should not break easily, but it should break before the machine would otherwise be thrown on to the floor.

Performance Requirement: The door should not break off when a force between 0 and 4.5 lbs is applied to the top edge of the open door, and there is no support under the door. The door should break off between 4.5 lbs and 5.5 lbs (note machine will fall off the table when approximately 6.3 lbs of force is applied.)

Find the force at the edge of the door required to tip cricut.

O. Carlson
ATL
4-7-06.

Side view



P = Force Required to tip cricut

F_A = Pivot point

W = Weight = 43.14N (9.7lb)

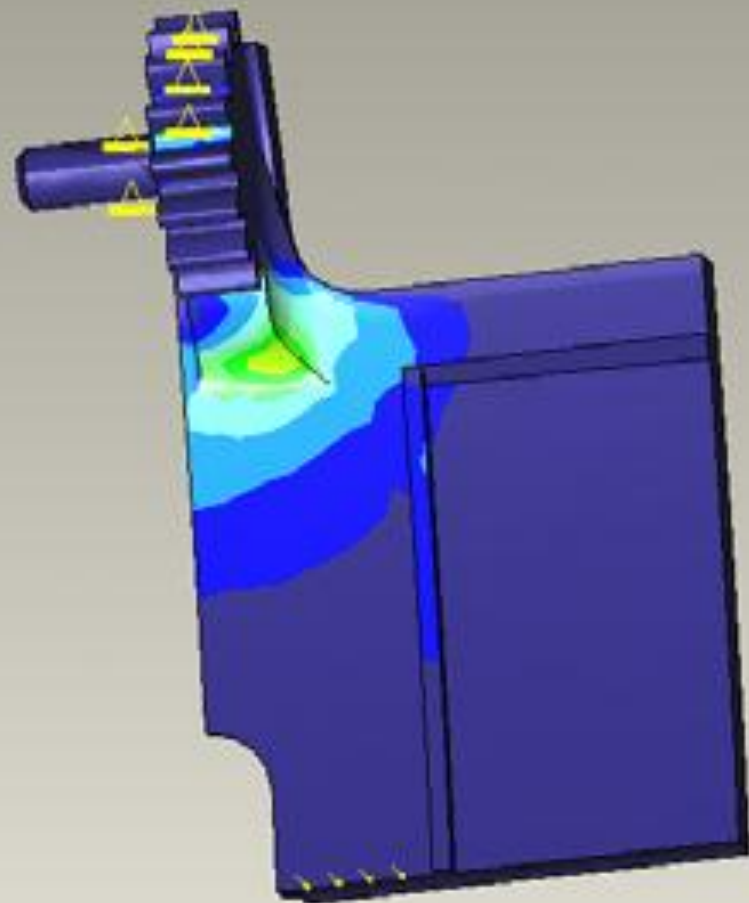
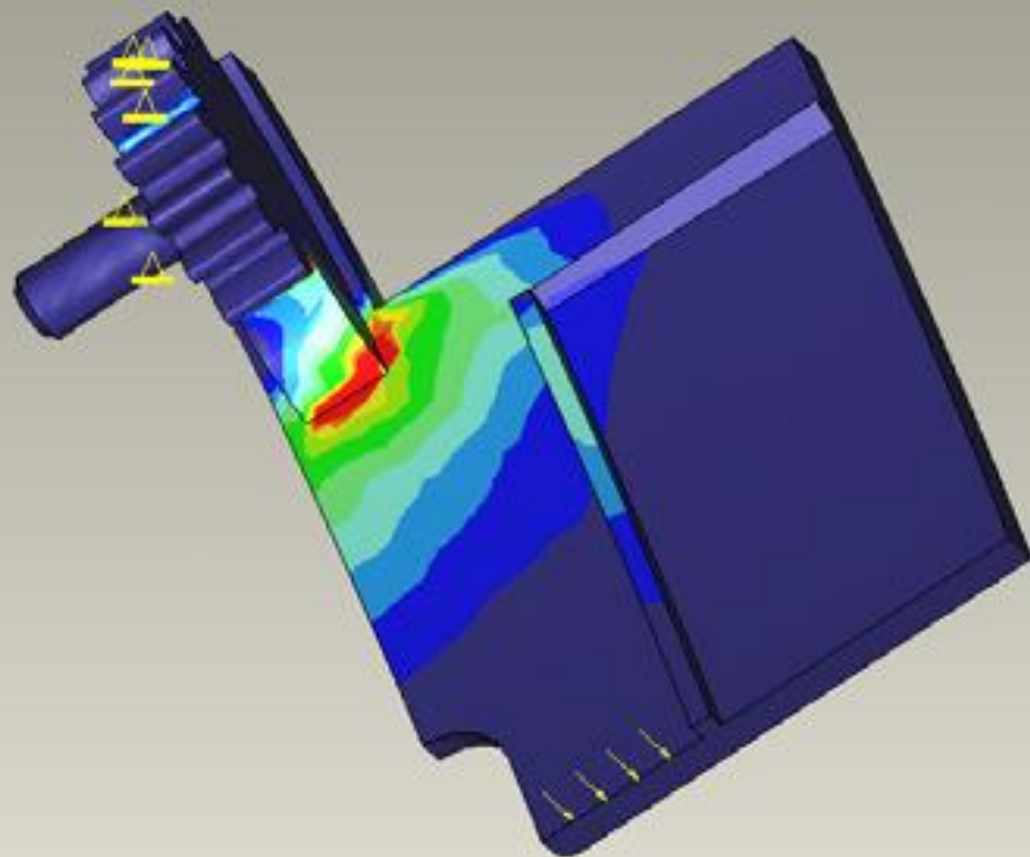
$$\sum M_A = 0$$

$$43.14\text{N}(8.5\text{cm}) - P(13\text{cm}) = 0$$

$$P = \frac{43.14\text{N}(8.5\text{cm})}{13\text{cm}} = 28\text{N} \quad (6.3\text{lb})$$

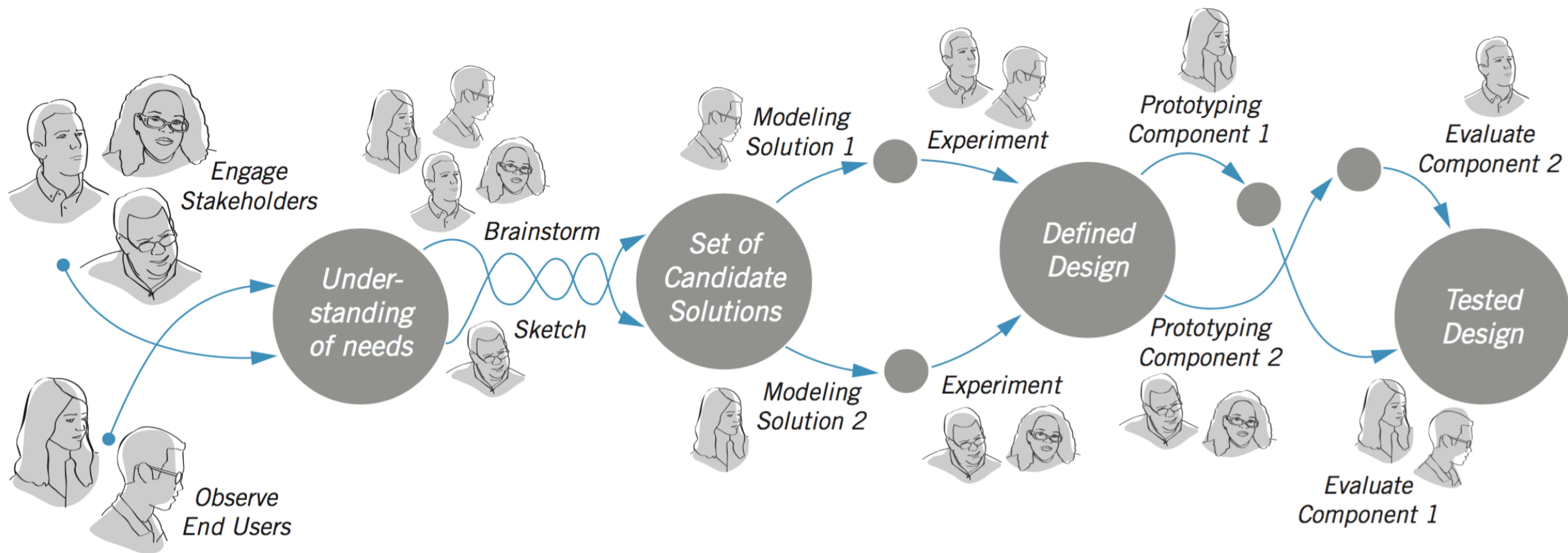
28N or 6.3lb is the force required to tip cricut.

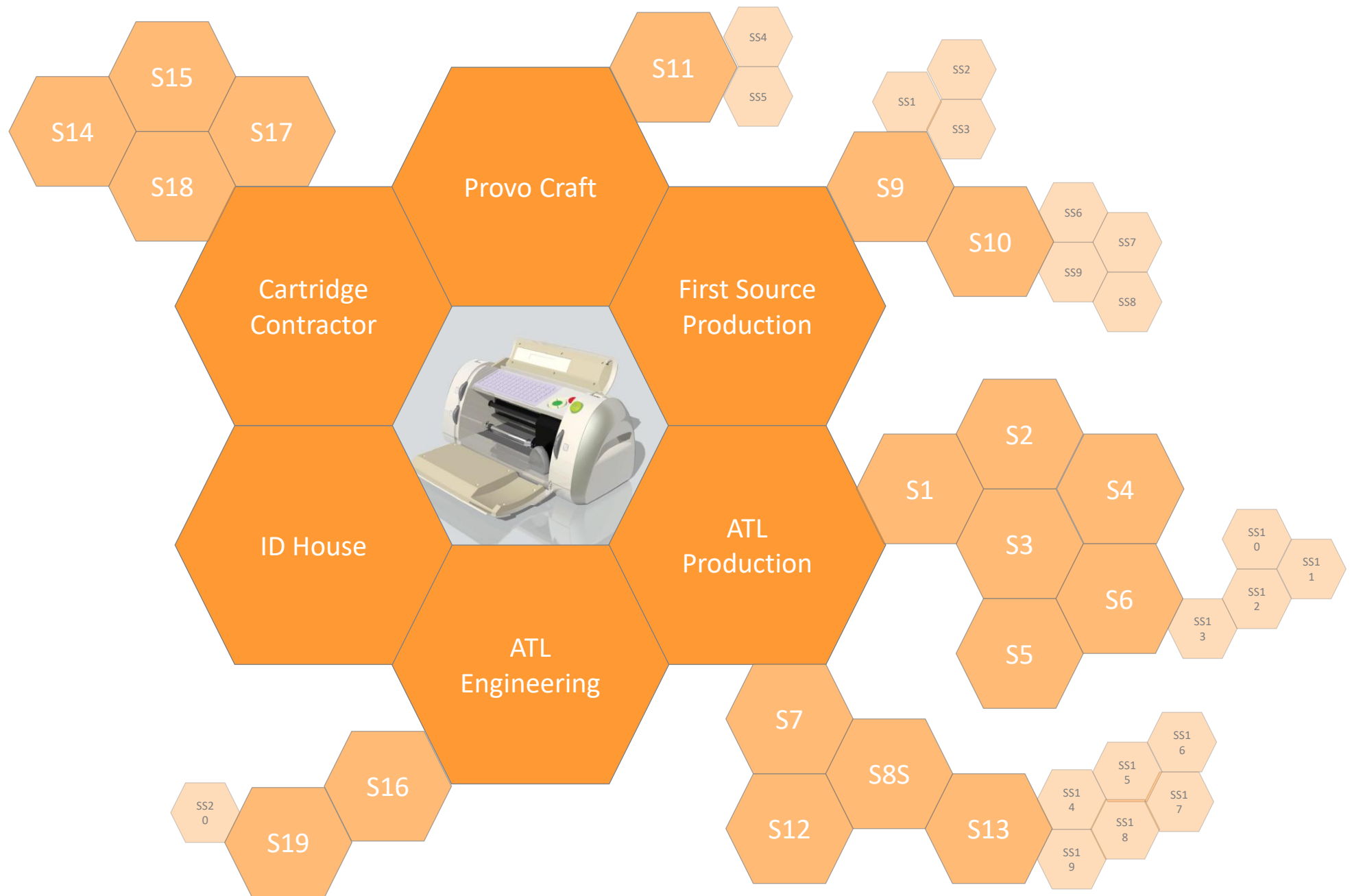
Stress von Mises (WCS)
(N / mm²)
Loadset: LoadSet1



Principle 4

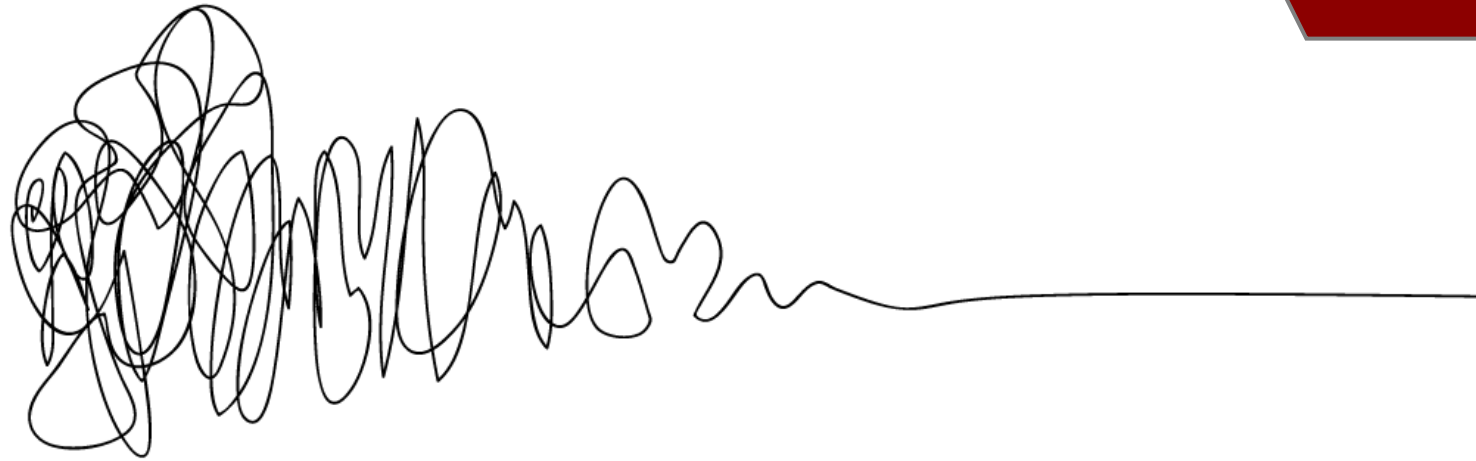
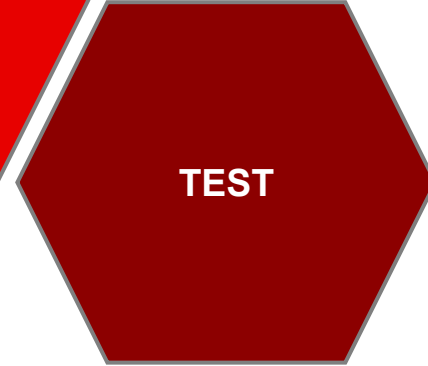
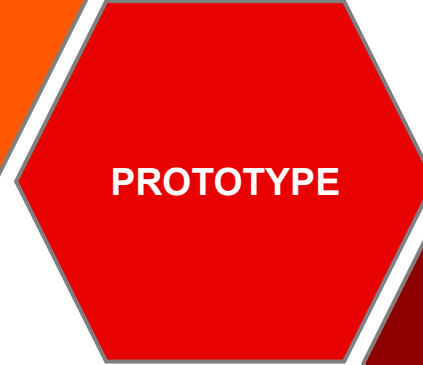
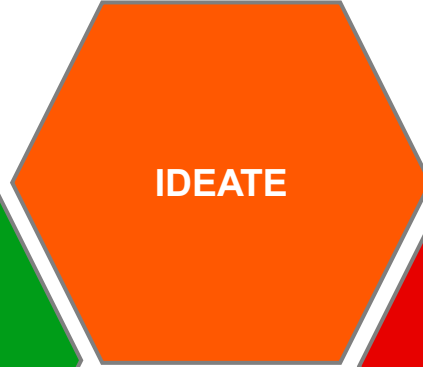
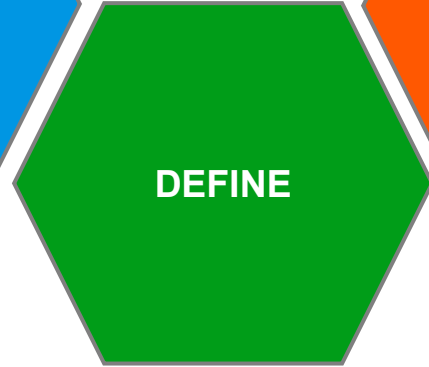
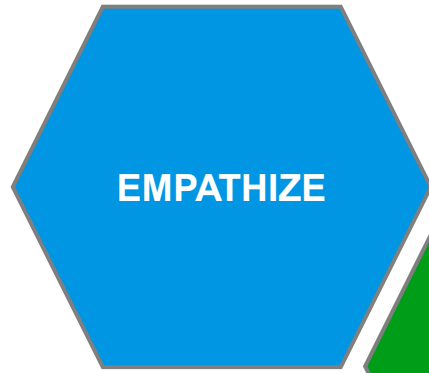
Optimal evolution requires customization
and coordination of activities





Foundational Principles

1. Job is to create a design...
2. Design must evolve
3. Actions cause evolution
4. Customized and coordinated



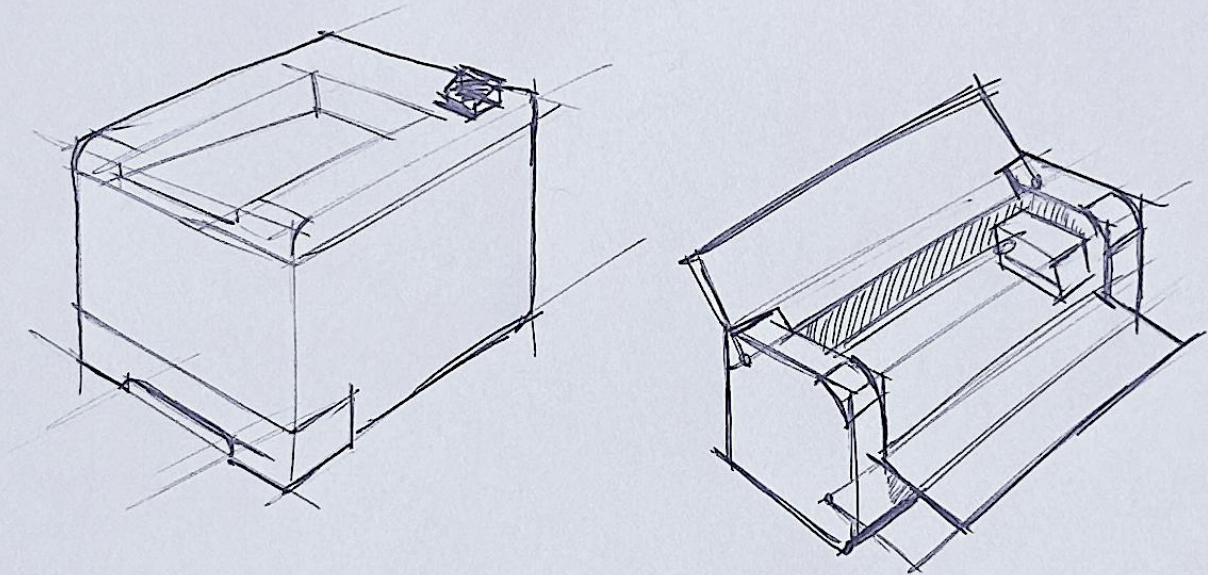
Sketching

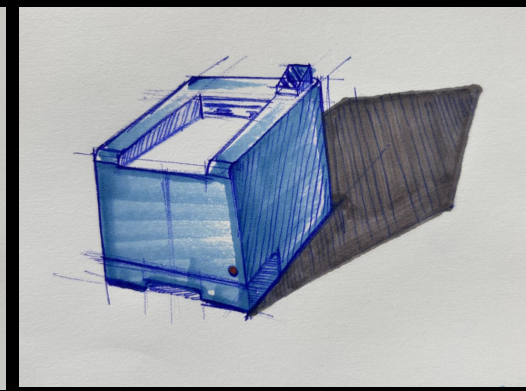
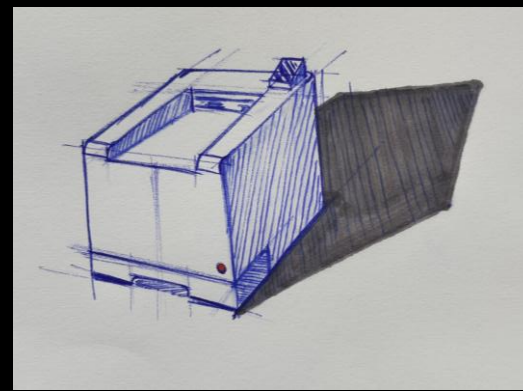
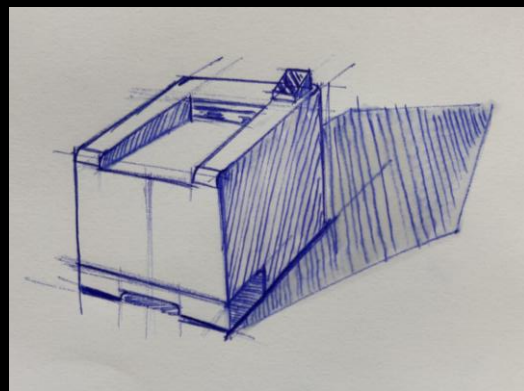
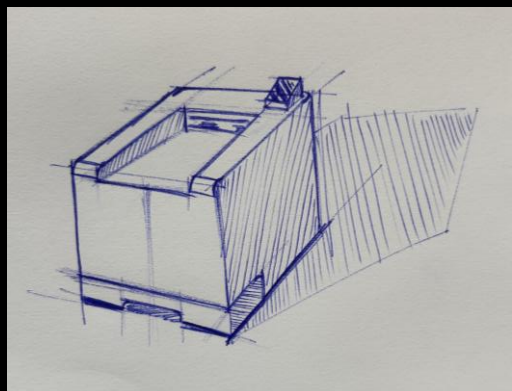
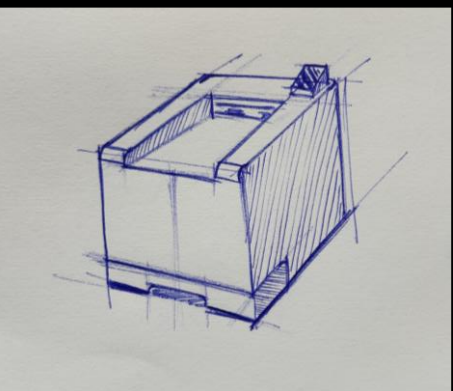
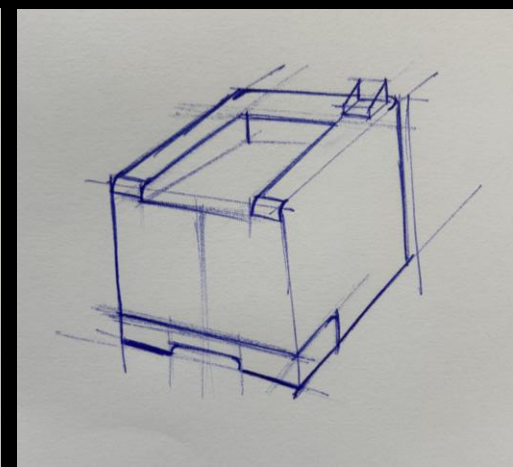
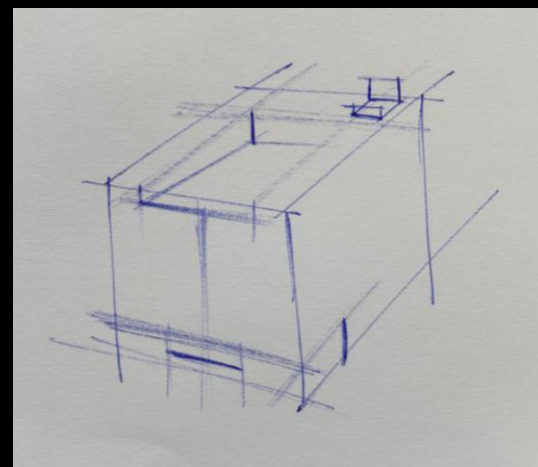
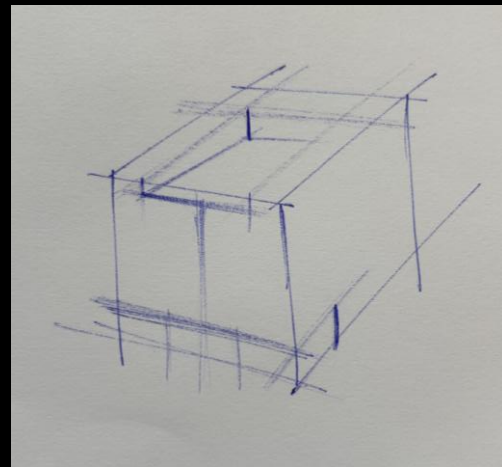
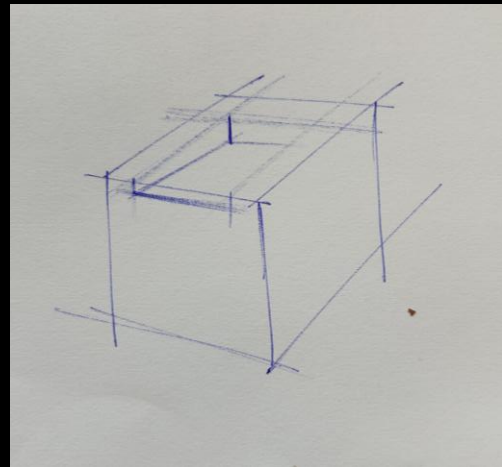
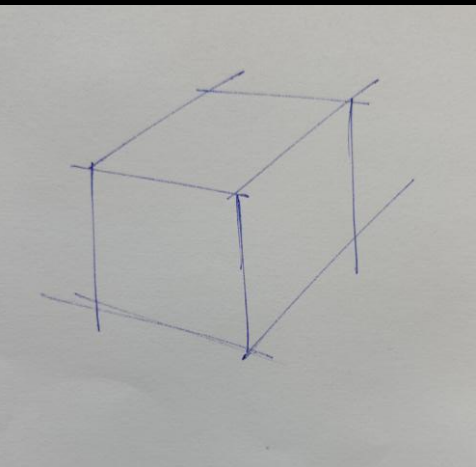
SKETCH Printers (8 minutes)

Sketch more than
one printer type

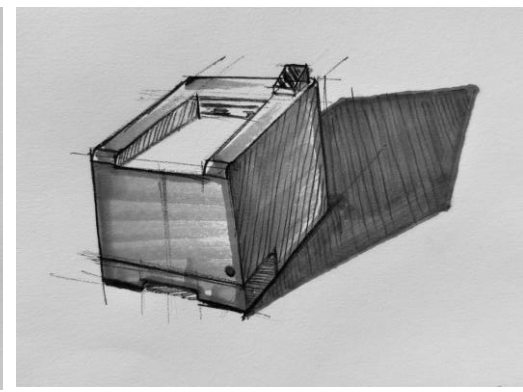
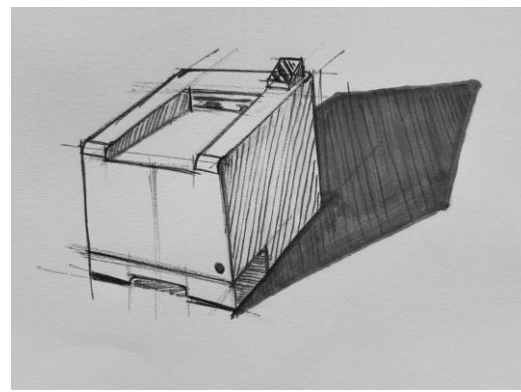
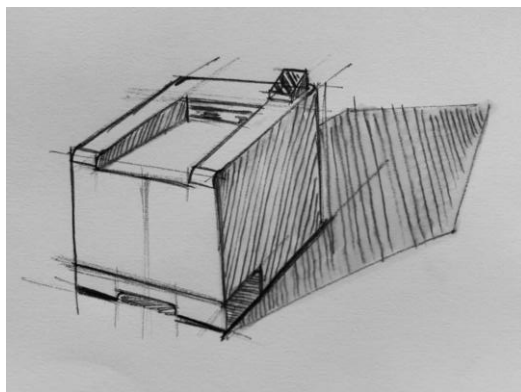
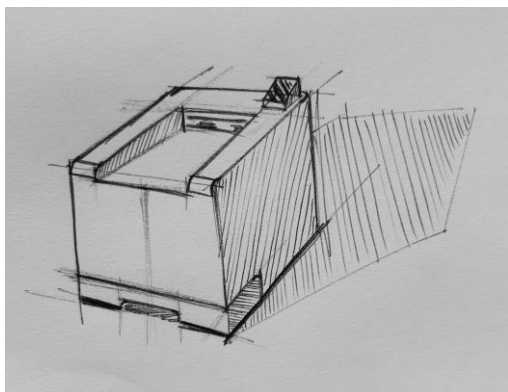
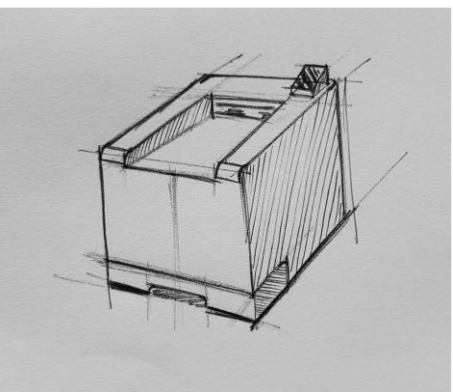
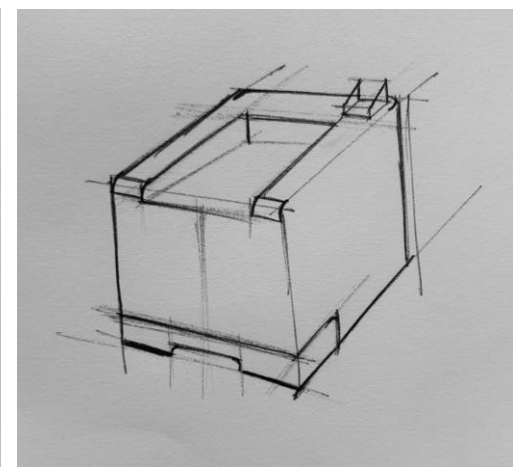
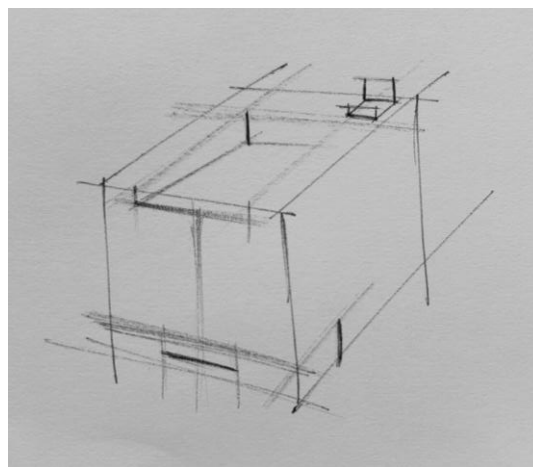
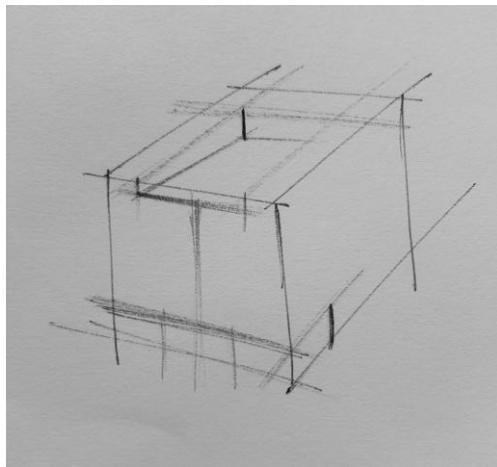
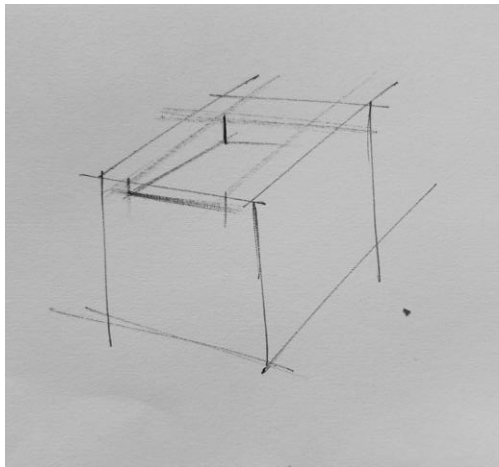
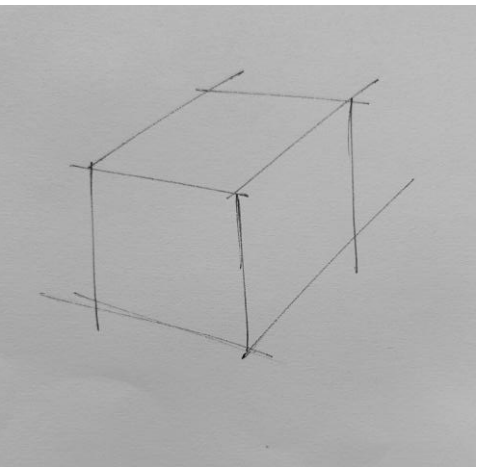
Start with a
cuboid, then split
is up

Draw a dark line
around the
outline

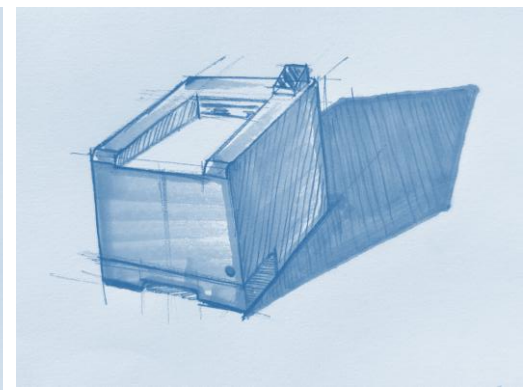
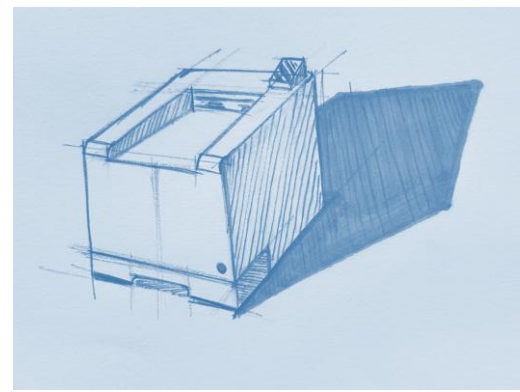
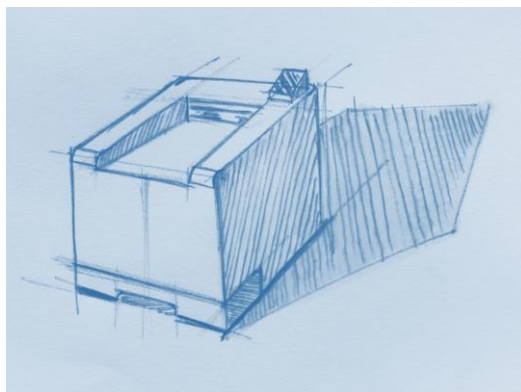
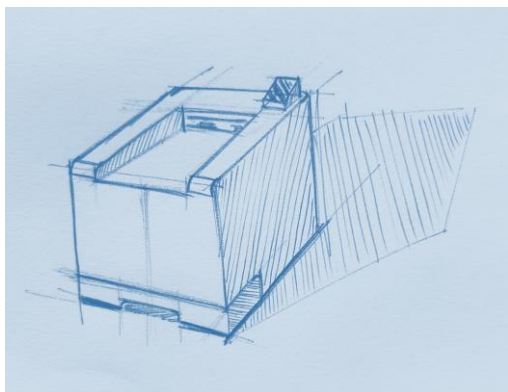
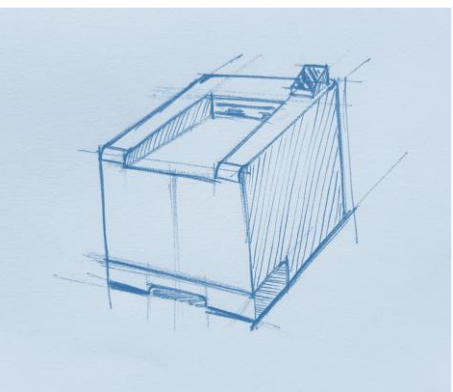
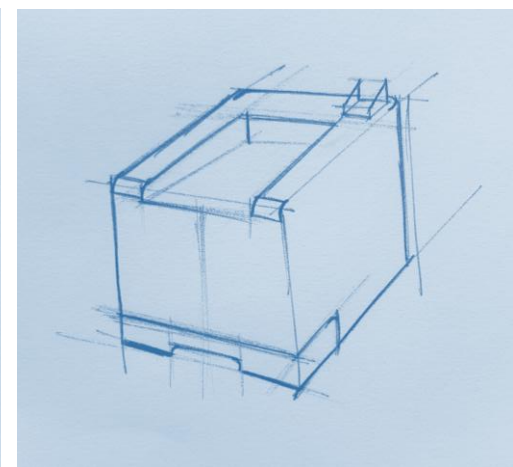
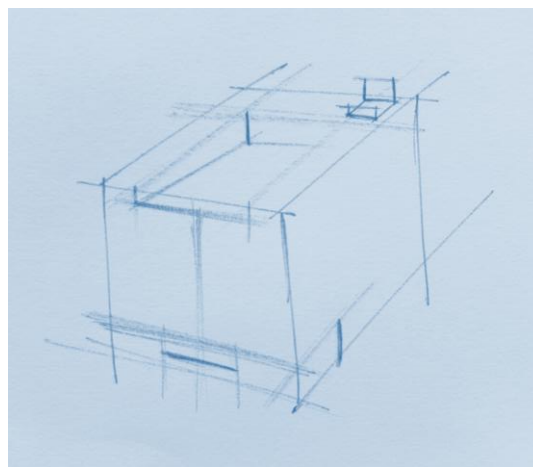
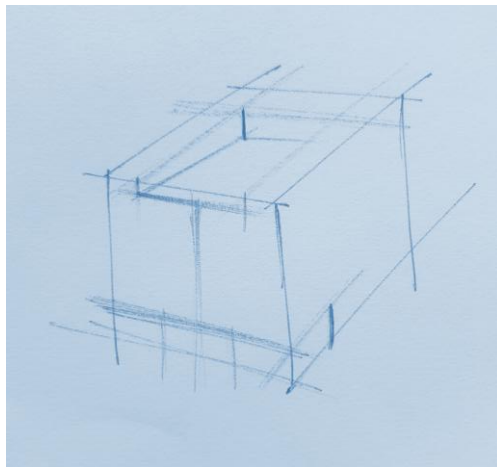
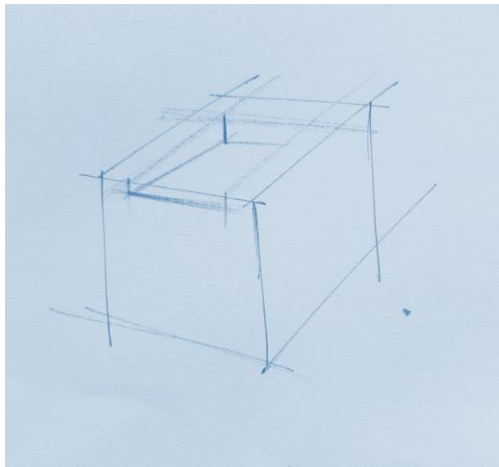
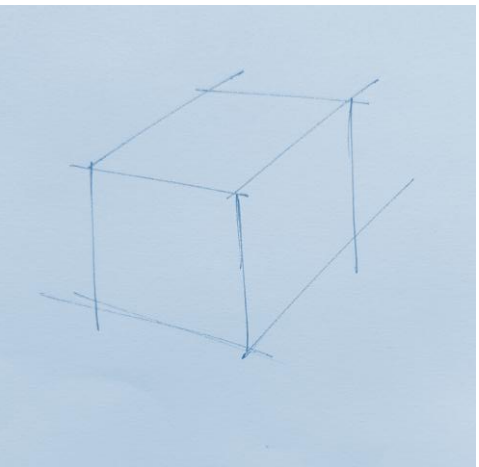




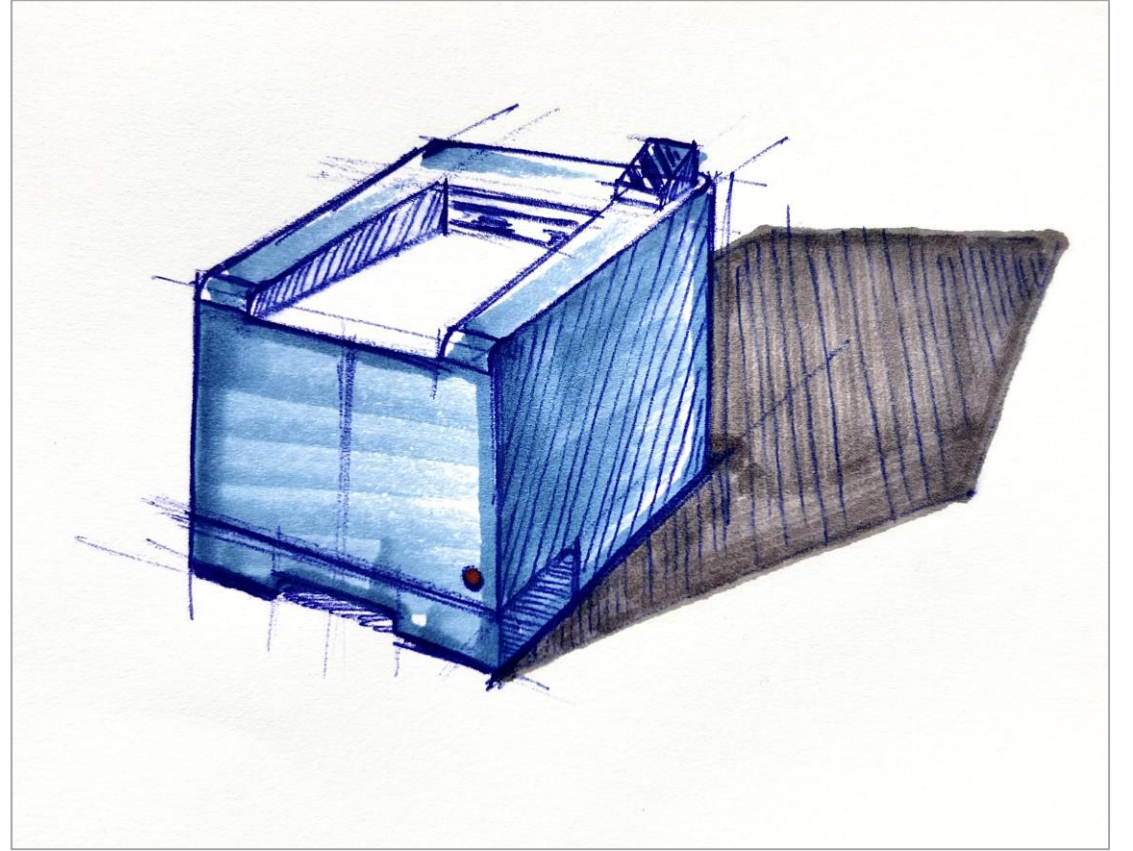
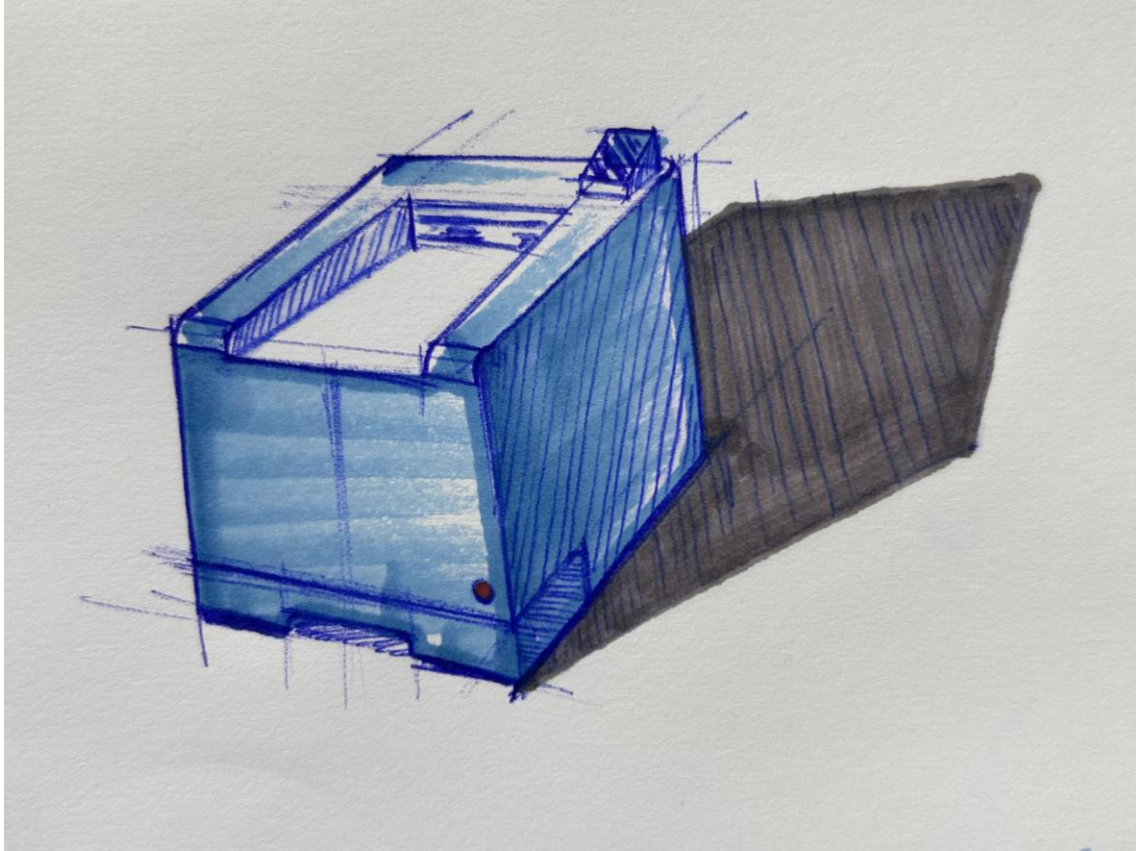
Used Marker



Used Marker



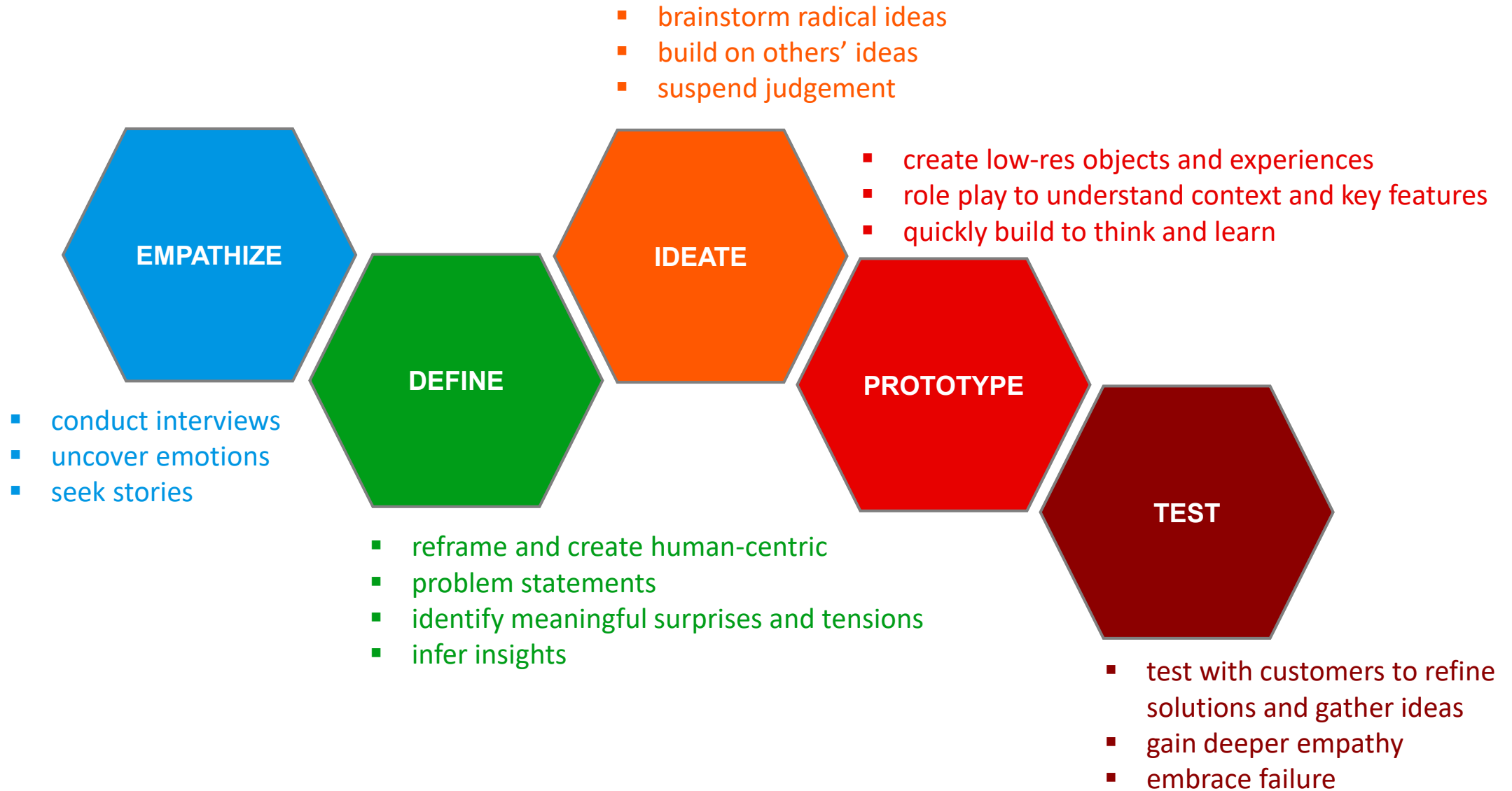
Used Marker



Stages of Development

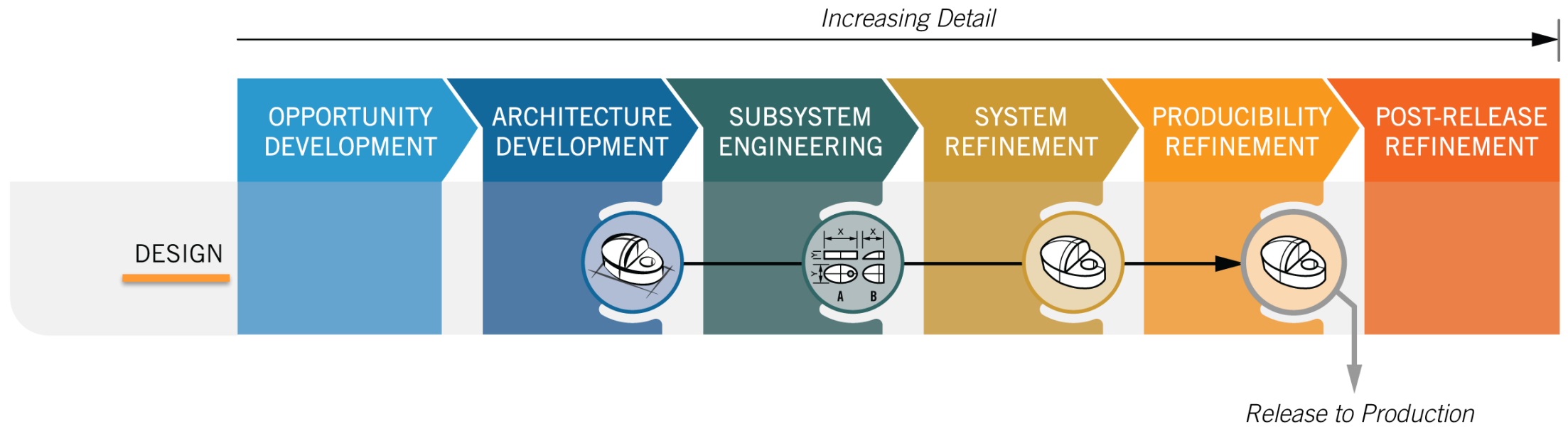
Foundational Principles

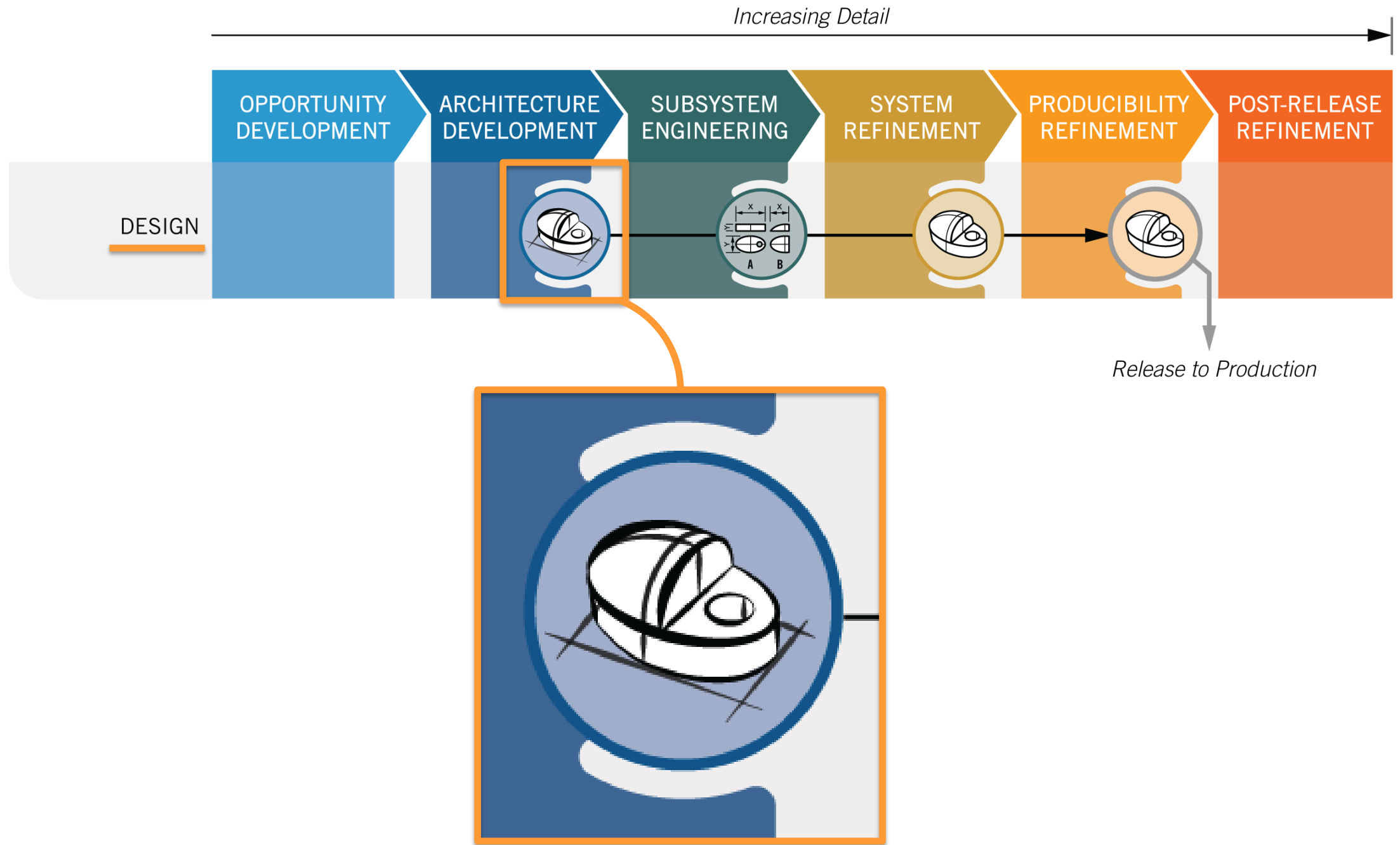
1. Job is to create a design...
2. Design must evolve
3. Actions cause evolution
4. Customized and coordinated

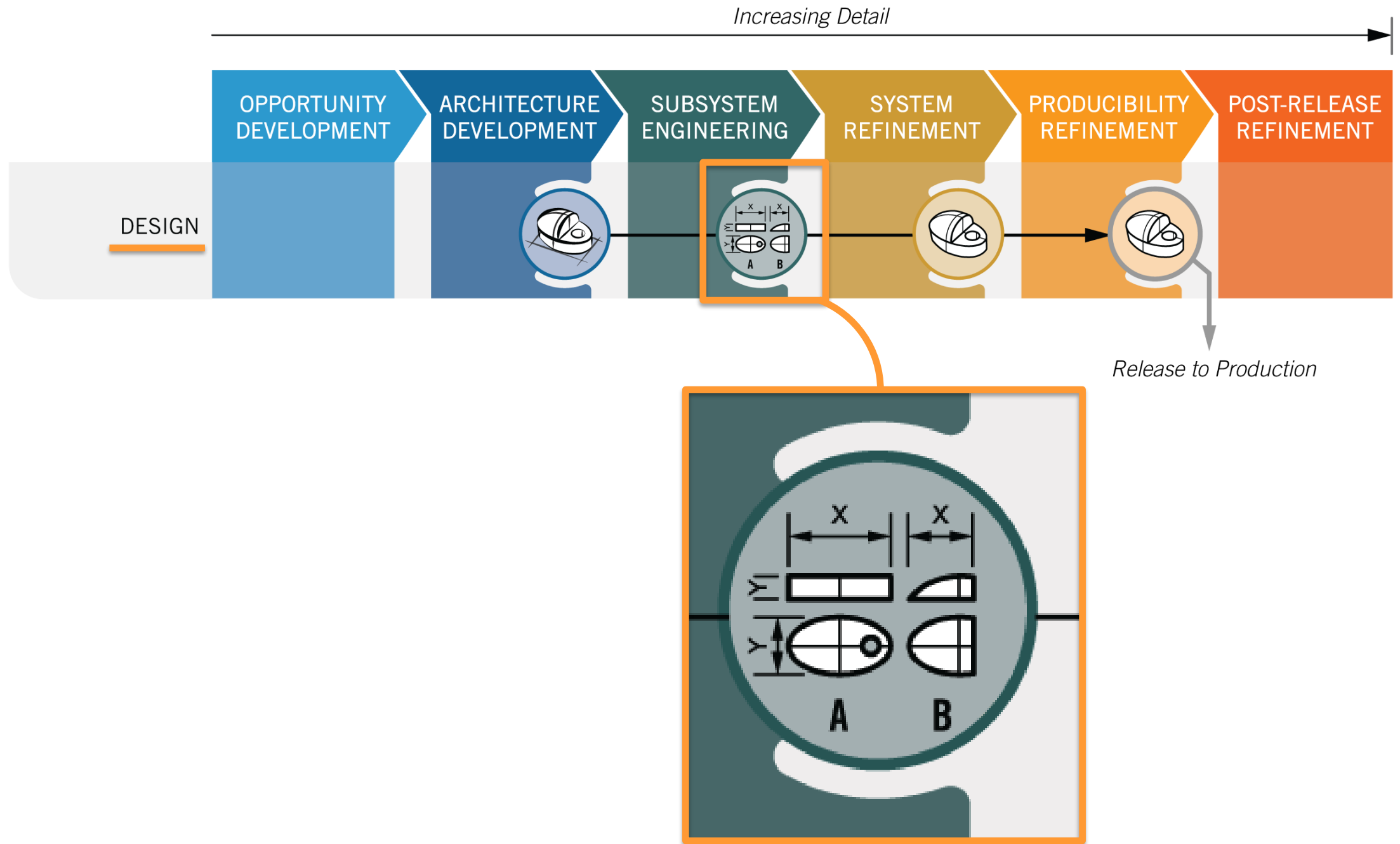


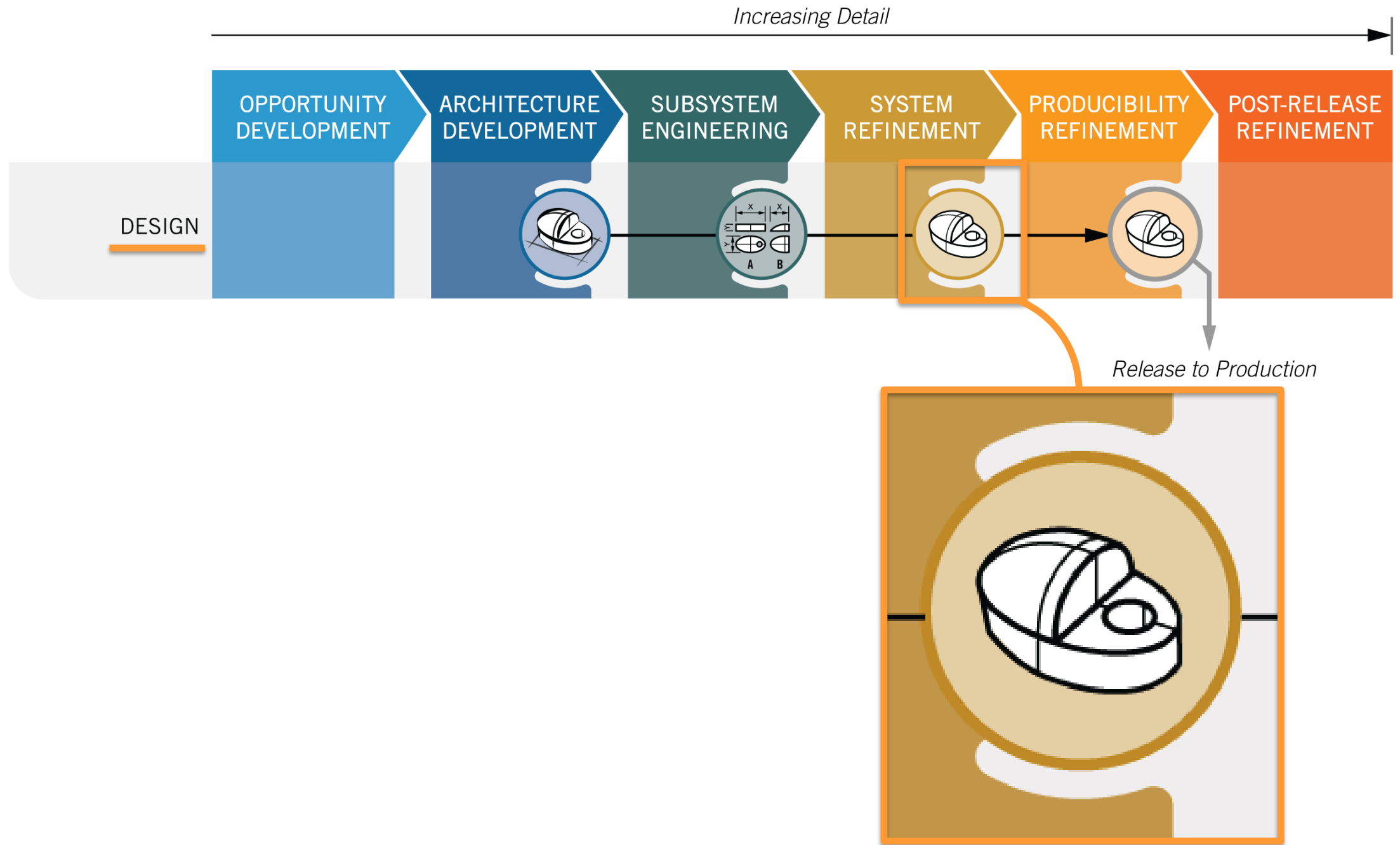
Increasing Detail

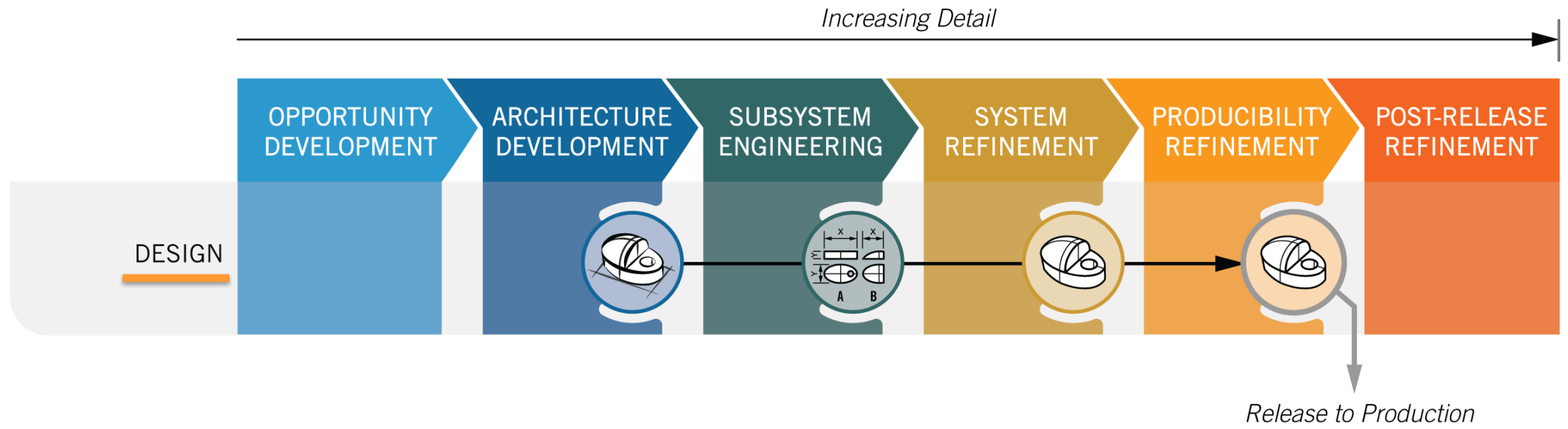




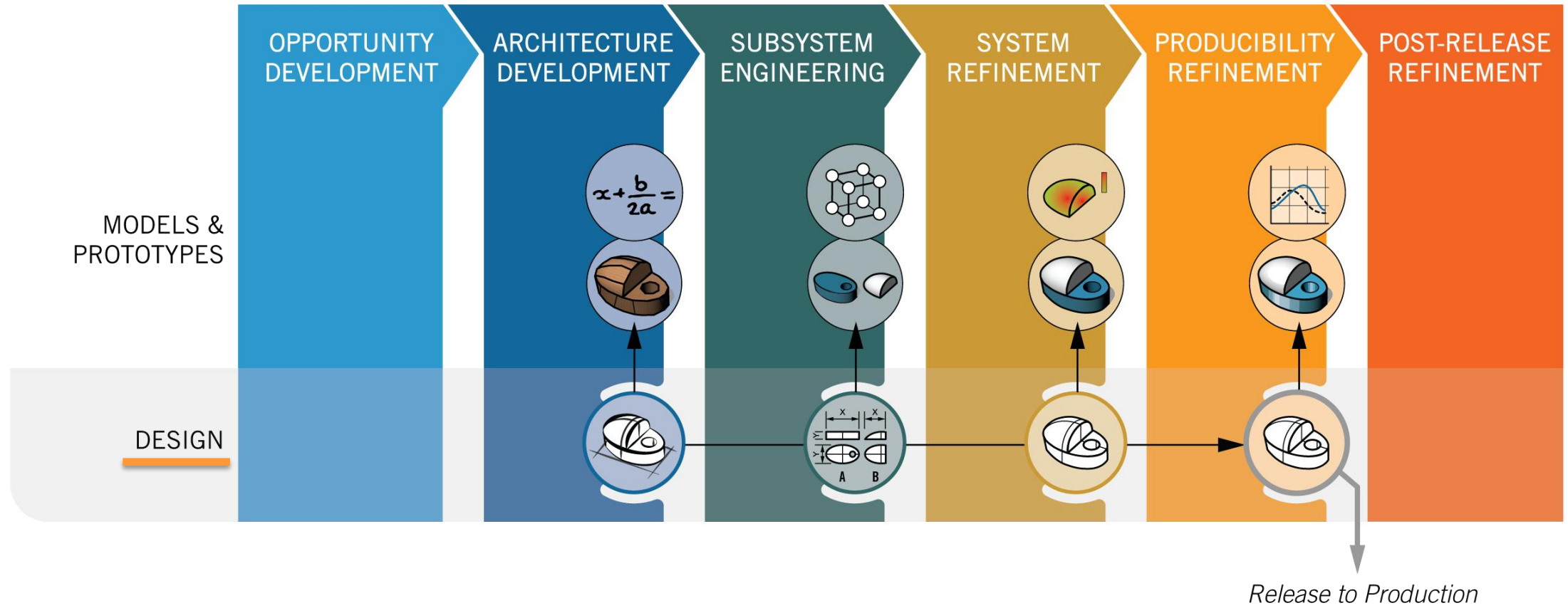




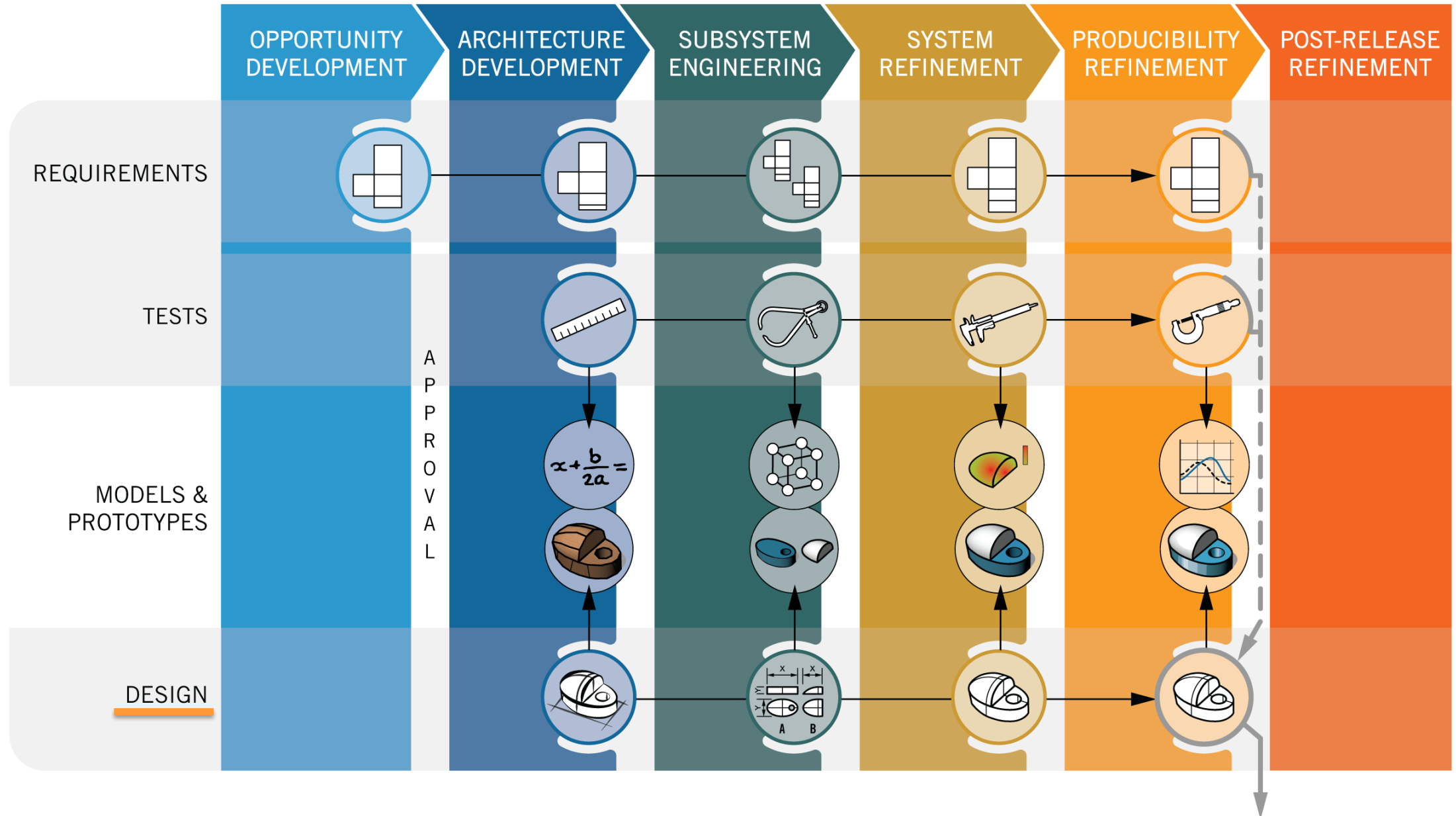




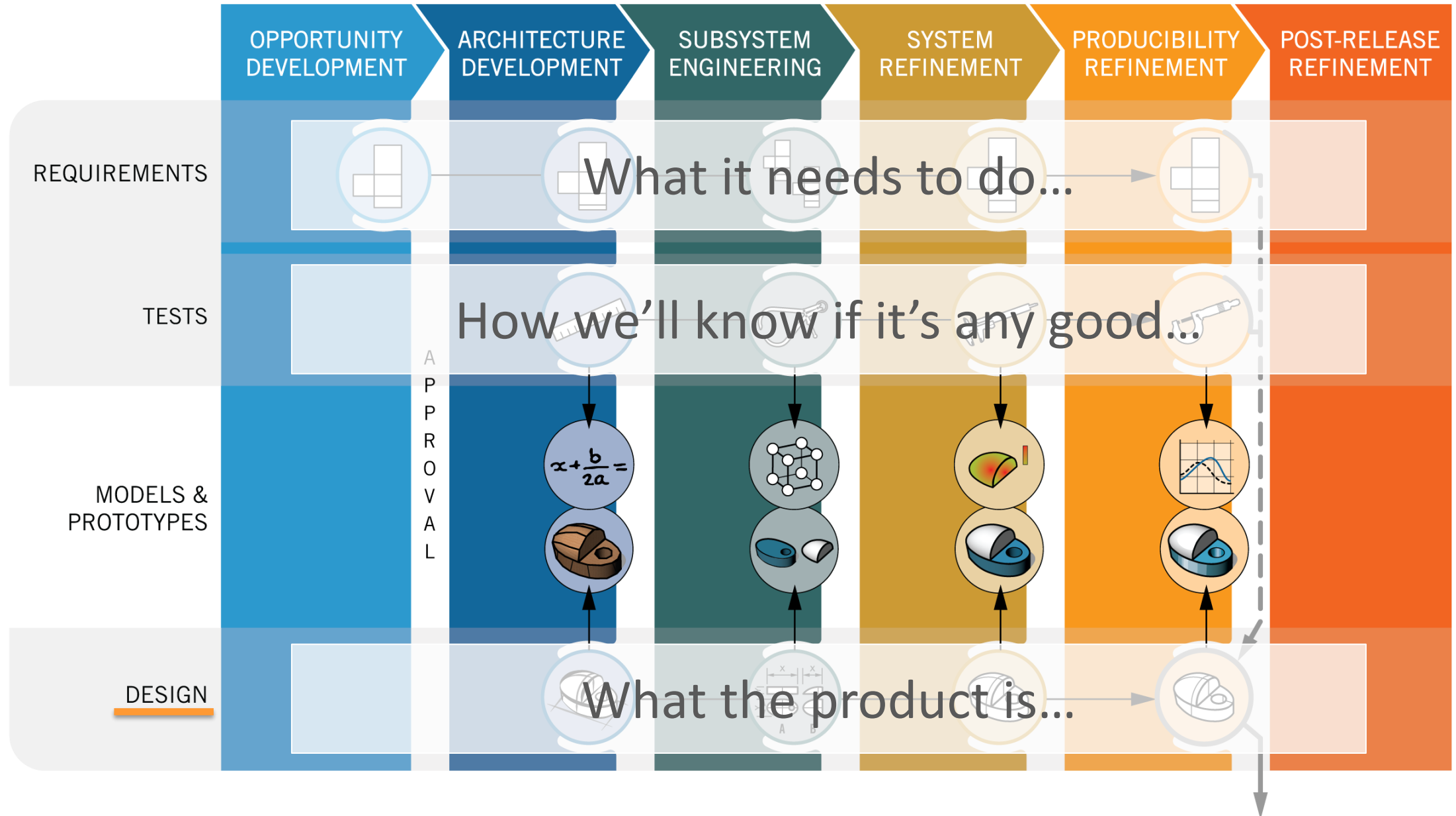
Increasing Detail



Increasing Detail



Increasing Detail



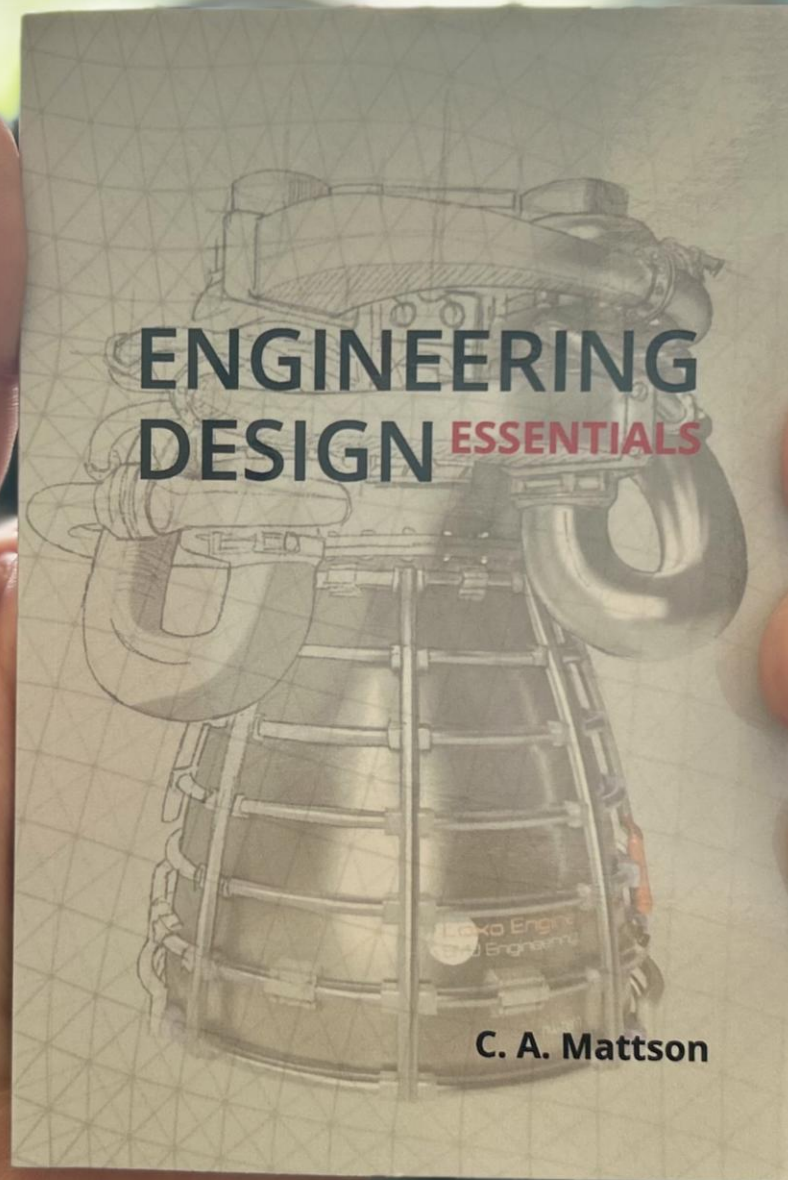
What it needs to do...

How we'll know if it's any good...

What the product is...

Release to Production

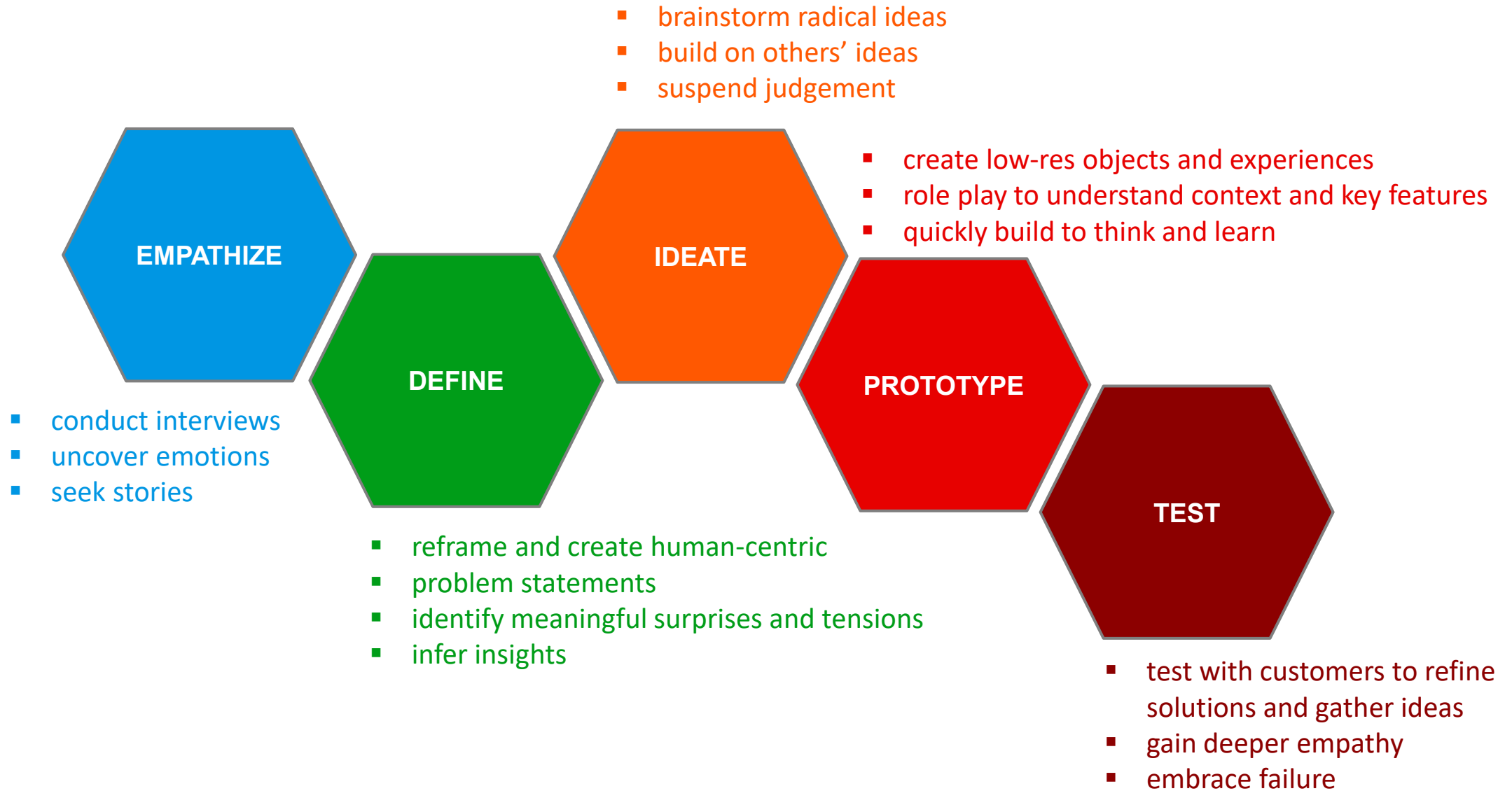
● Go to Page 36



Goal

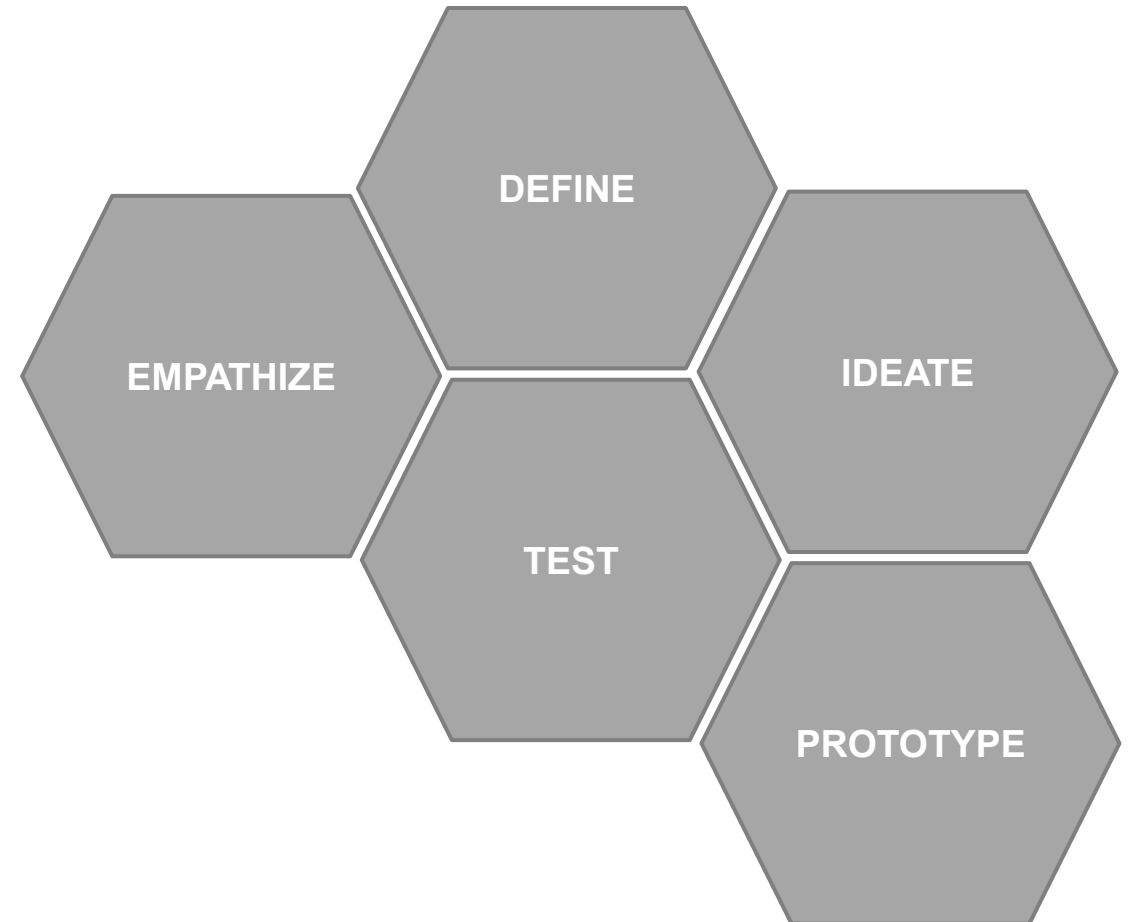
Be introduced to concepts that make you think deeper
about the process of design

Differentiate between **what the designer does**
and **what happens to the design** when the designer does
what they do

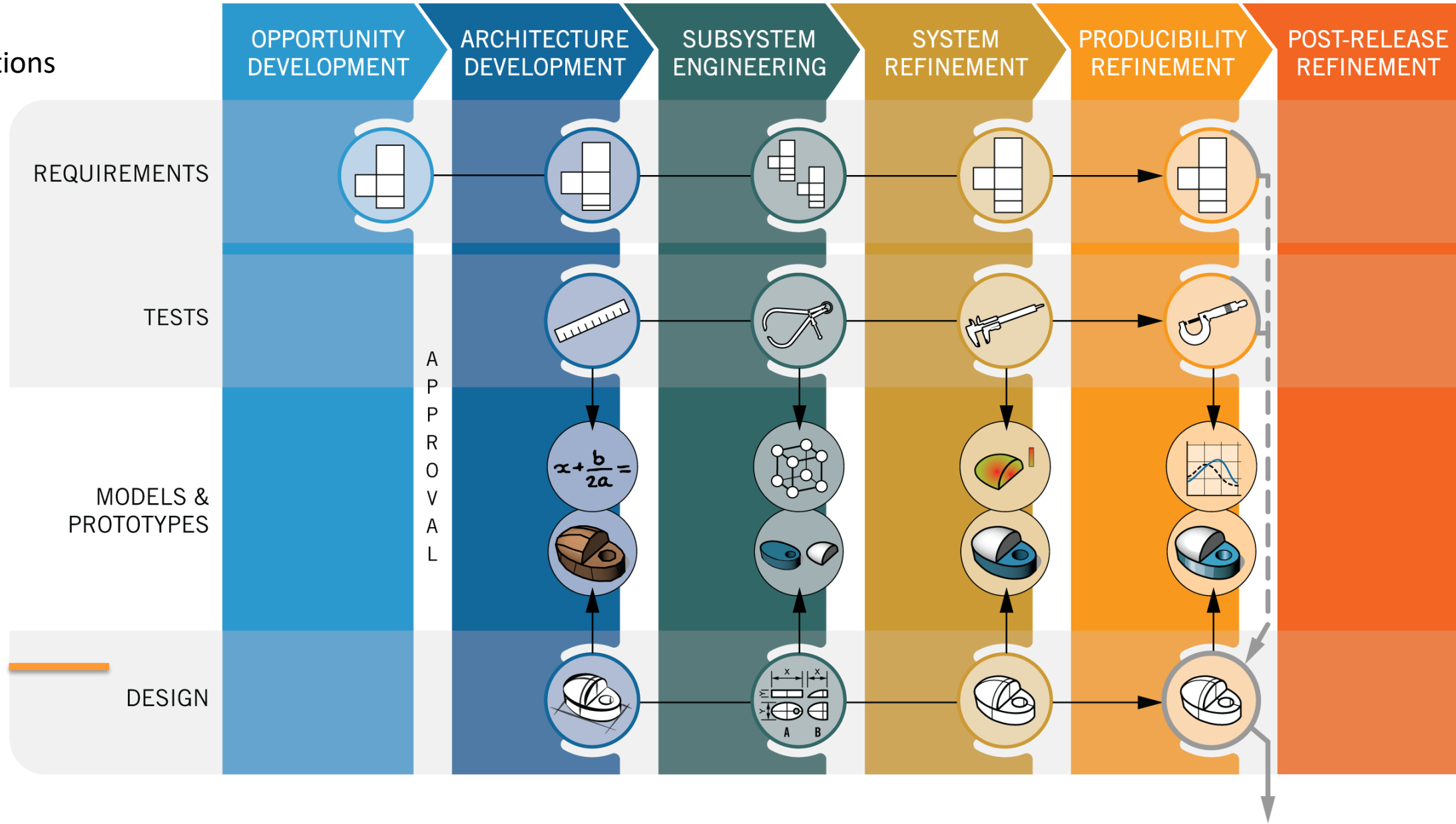


DEFINE
IDEATE
EMPATHIZE
PROTOTYPE
TEST

- brainstorm radical ideas
- build on others' ideas
- suspend judgement
- create low-res objects and experiences
- role play to understand context and key features
- quickly build to think and learn
- conduct interviews
- uncover emotions
- seek stories
- reframe and create human-centric
- problem statements
- identify meaningful surprises and tensions
- infer insights
- test with customers to refine solutions and gather ideas
- gain deeper empathy
- embrace failure



- Conduct interviews
- Ideate
- Infer insights
- Prototype
- Refine solutions
- Empathize
- Role play
- Test
- ...



**Designers don't just
solve problems – they
shape them**

What to do now

- Use the Study Guide
- Work on the Project
- Complete the report for Saturday