



College of Engineering & Applied Science  
UNIVERSITY OF COLORADO **BOULDER**



# Design Processes + Principles

**Dr. Grace Burleson**  
**Assistant Professor, Mechanical Engineering**

# Today's agenda

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**About me + design  
science research**

**Design process  
principles**

**Discussion**



# Today's agenda

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**About me + design  
science research**

**Design process  
principles**

**Discussion**

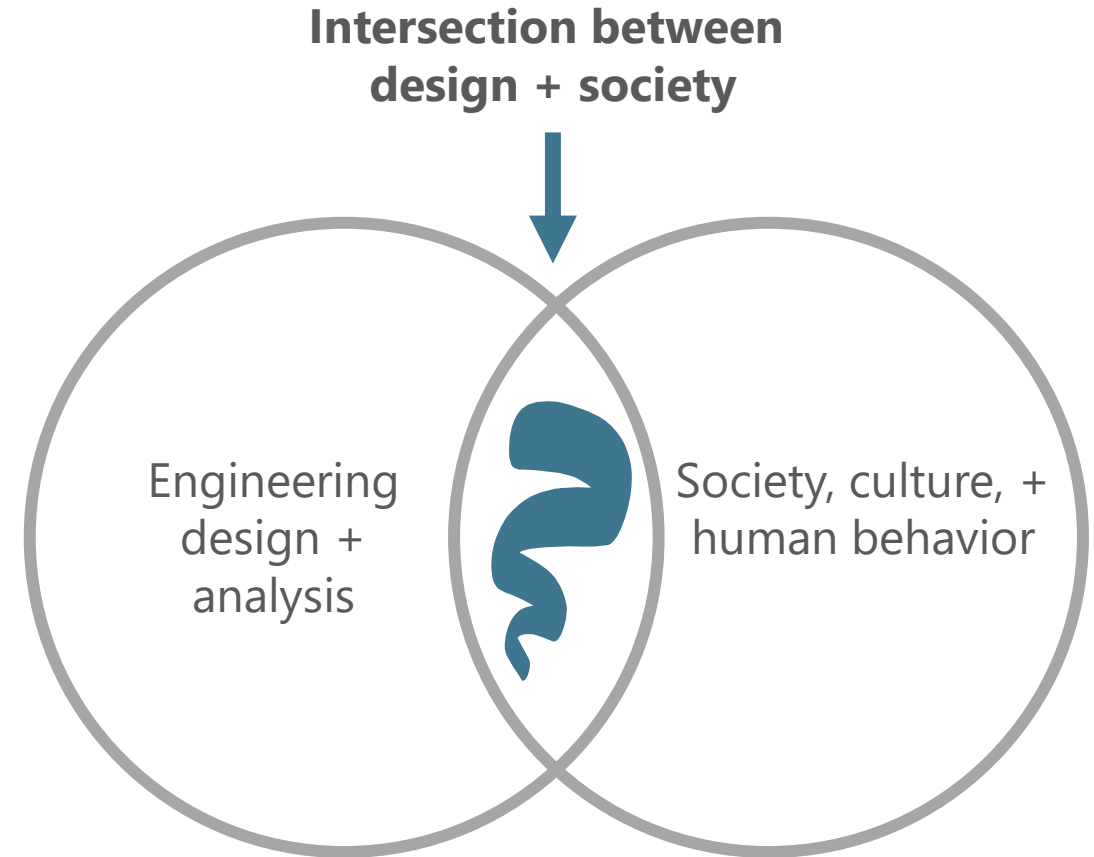


# About me

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## **Grace Burleson, Ph.D.** (she/her)

- Assistant Professor, [Mechanical Engineering](#), University of Colorado Boulder (since 2023)
- NASA Research Assistant (2022)
- ASME Engineering for Change Fellow (2017-2021)
- Ph.D., [Design Science](#), University of Michigan
- M.S., [Mechanical Engineering & Applied Anthropology](#), Oregon State University
- B.S., [Mechanical Engineering](#), Oregon State University





# About me + my research group

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## Burleson Global Design Group

**Research Aim:** To advance design theory and methods to improve the social outcomes of engineered solutions.

**Our approach:** Design science research via human subjects studies (ethnographic and experimental) focused on uncovering the relationships between design processes, artifacts, and outcomes.

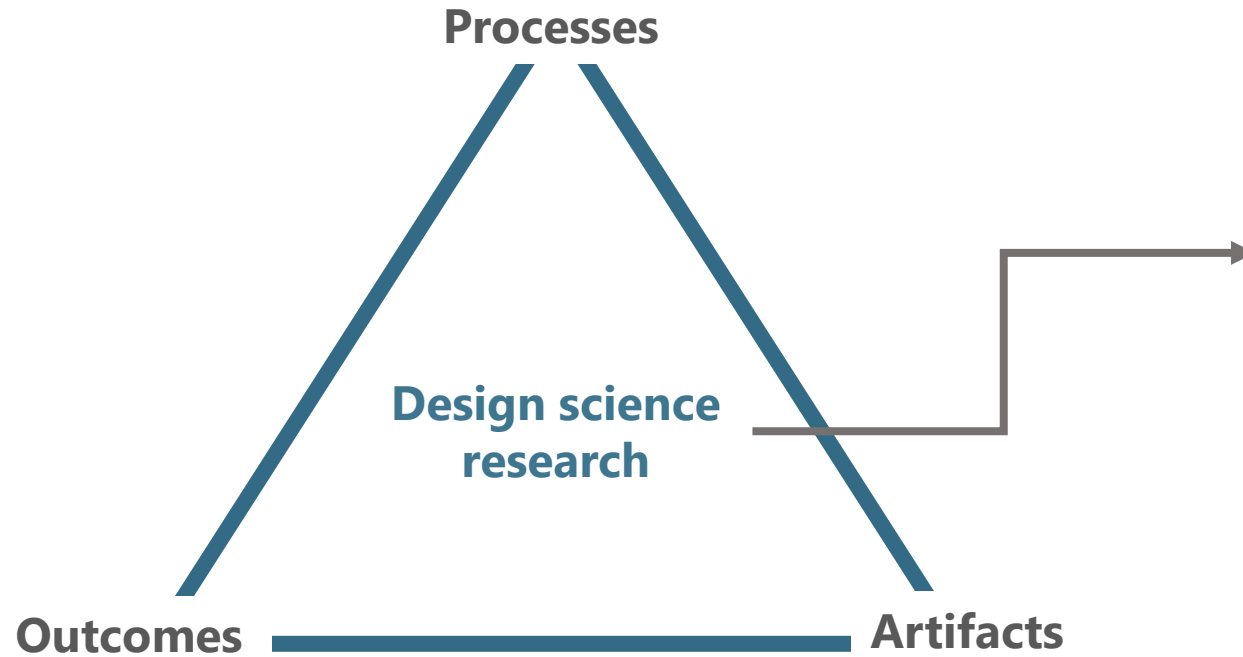


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# What is “Design Science Research”?

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## One definition of Design Science Research:

The scientific study of how artifacts are created and how artifacts are embedded into our societies.

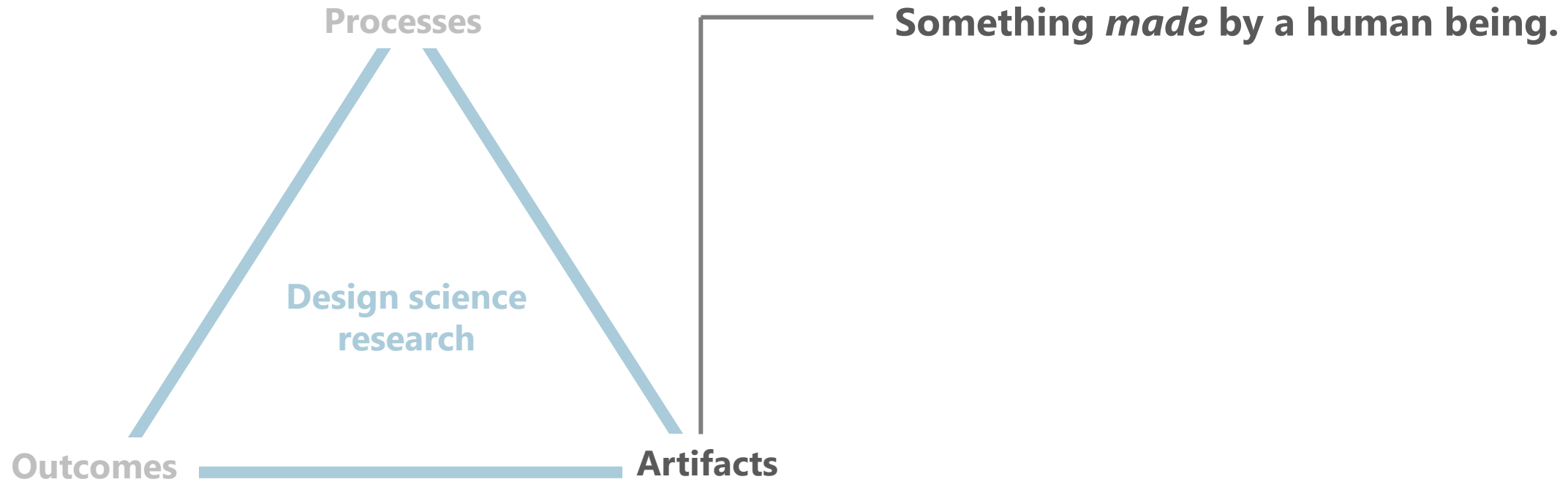
Less focused on *what* is being designed,  
More focused on *how* that artifact is designed.

Design science extends across many contexts, domains, and disciplines!



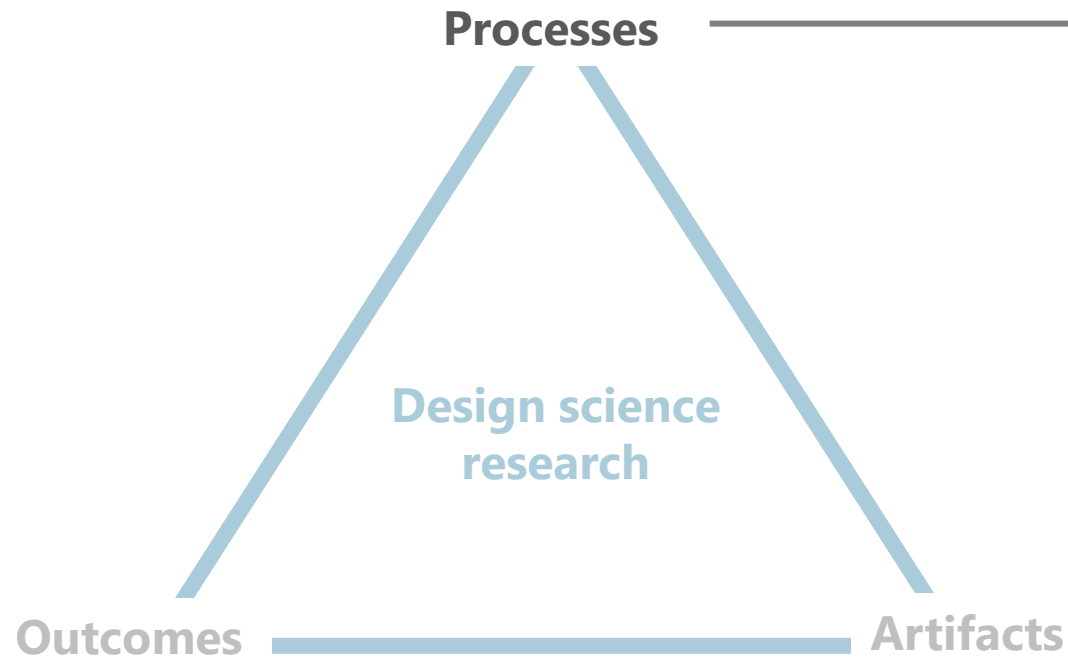
# Design Science Research: Let's break it down

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# Design Science Research: Let's break it down

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**A series of actions or steps taken to design something**

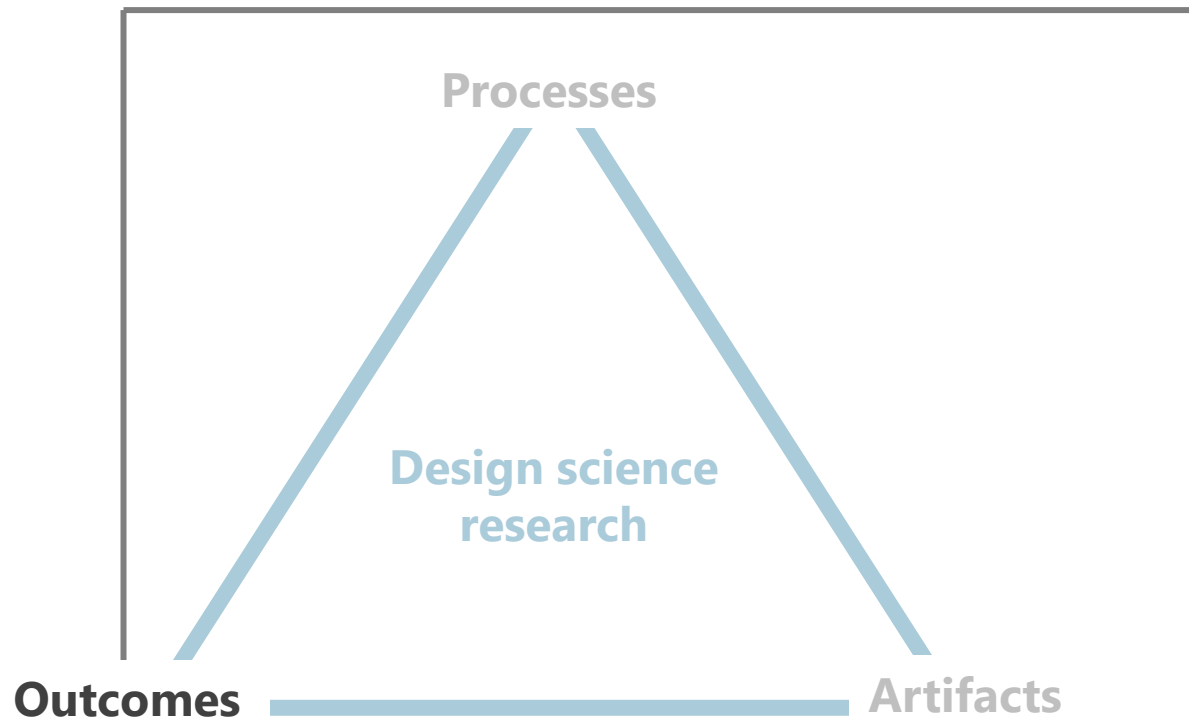
**Conditions surrounding the design process, including team make-up and institutional/organizational characteristics.**





# Design Science Research: Let's break it down

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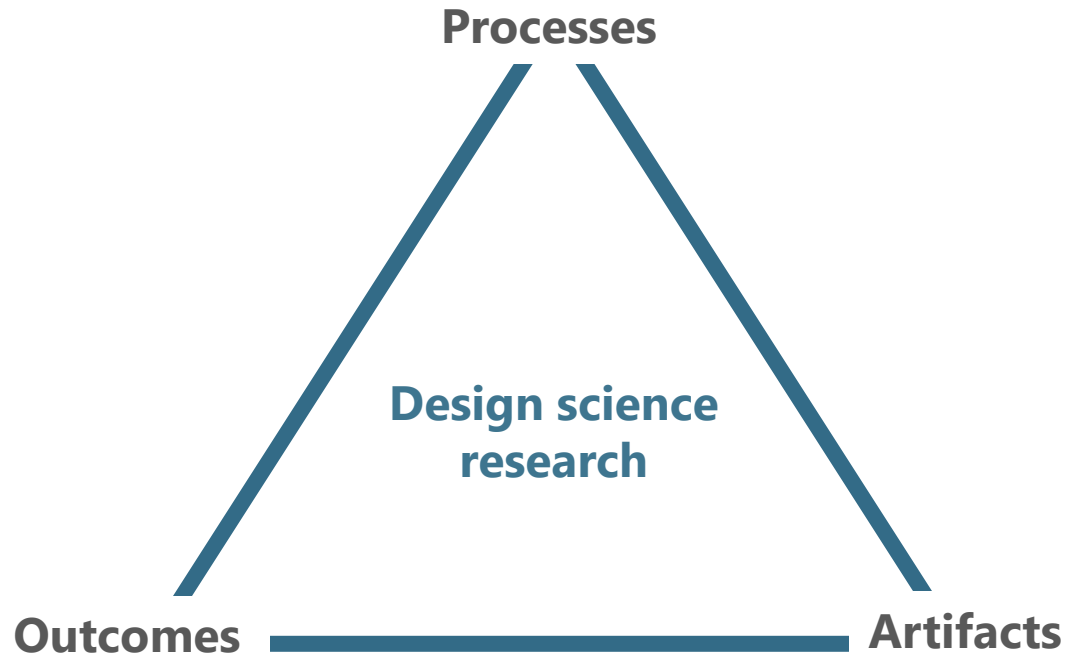
**Broader impacts of the designed artifact, including individual, social, economic, political, environmental, etc.**

**Can be direct or indirect; intentional or unintentional.**



# Let's break it down: Discuss in groups of 2-4

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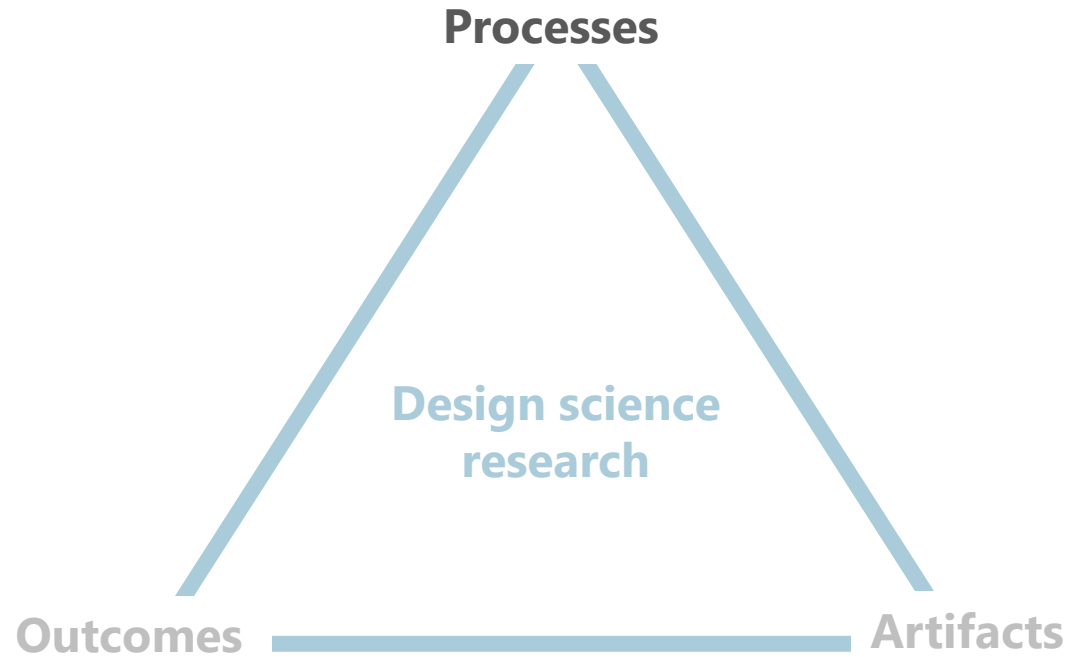
**Reflect on your design experience (could be engineering, art, or anything):**

1. What types of **artifacts** have you created?
2. What **processes** have you followed to create your final designed artifact?
3. What types of **outcomes** came out of your design process and/or due to your final designed artifact?



# Let's focus: Design Processes

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# Today's agenda

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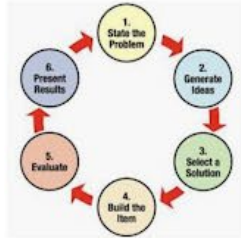
**About me + design  
science research**

**Design process  
principles**

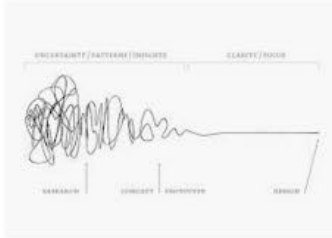
**Discussion**



# Let's focus: Design Processes



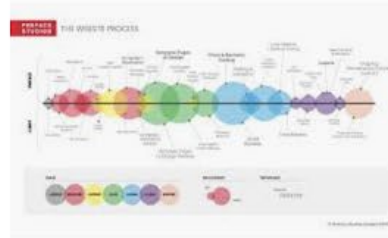
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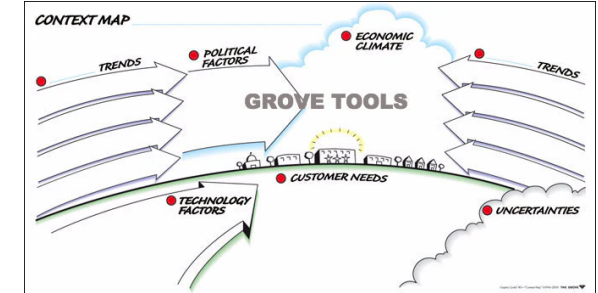
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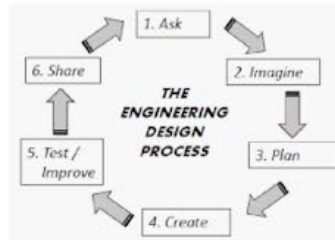
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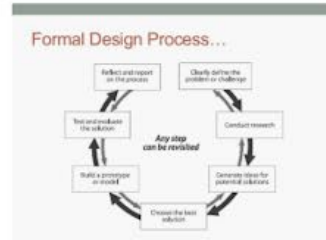
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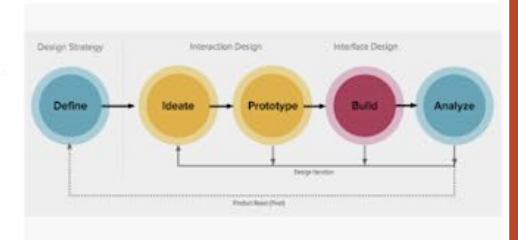
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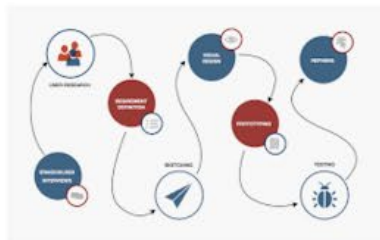
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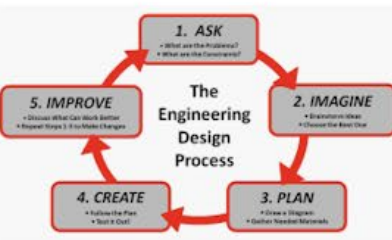
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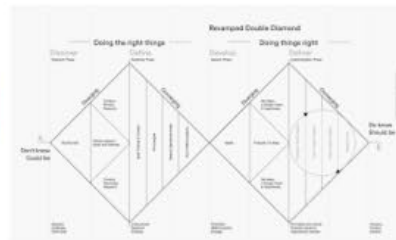
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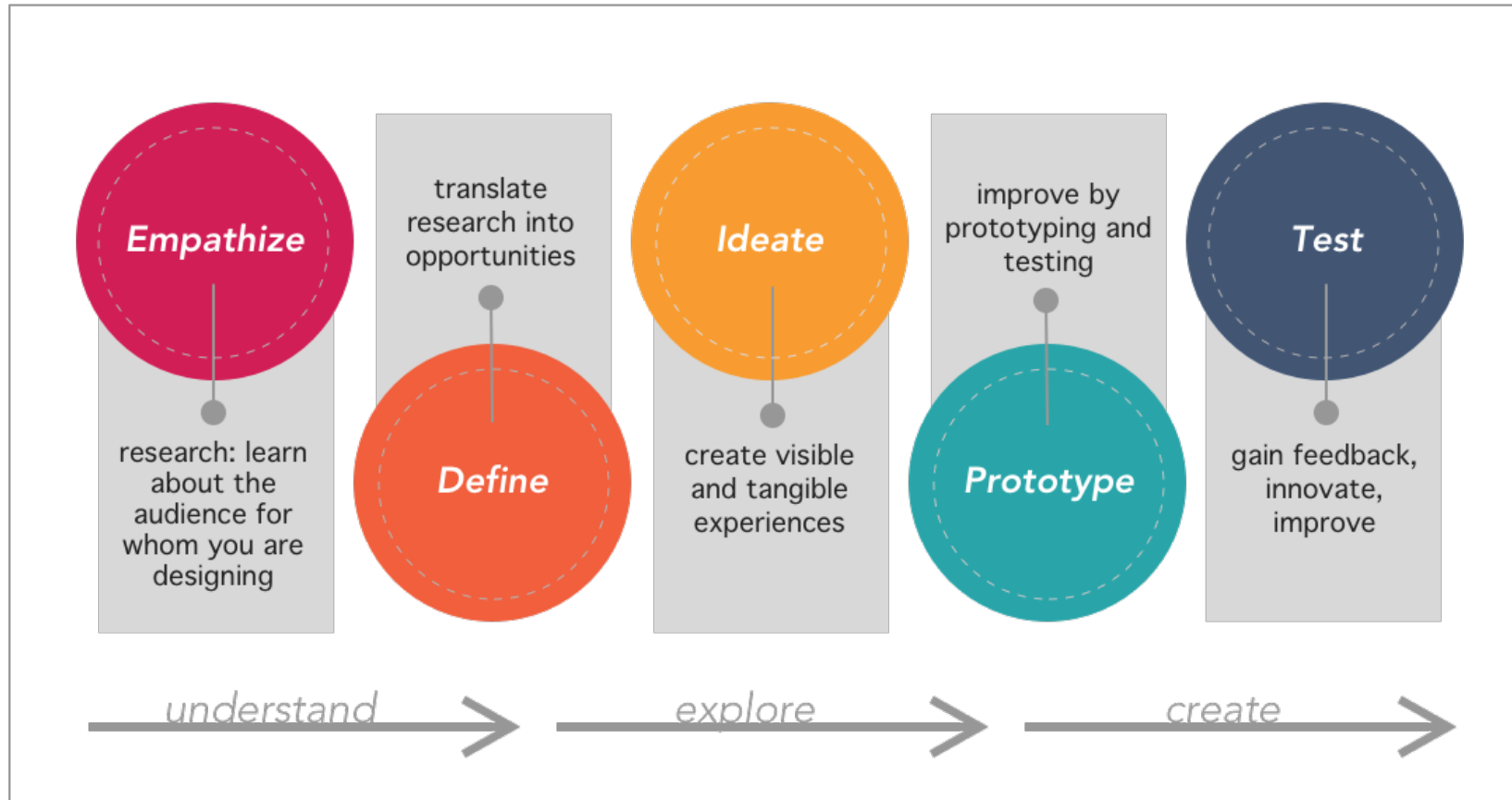
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# Design Processes Principle 1: **Temporal**



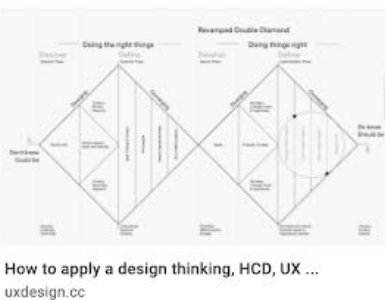
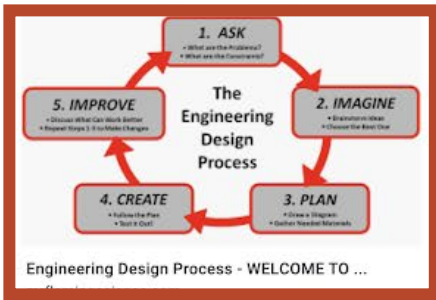
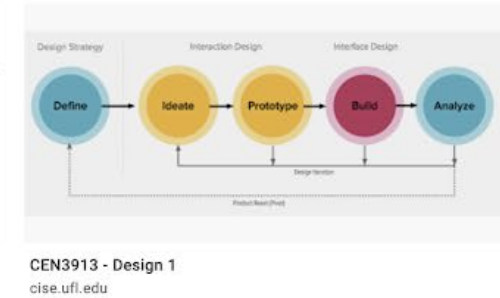
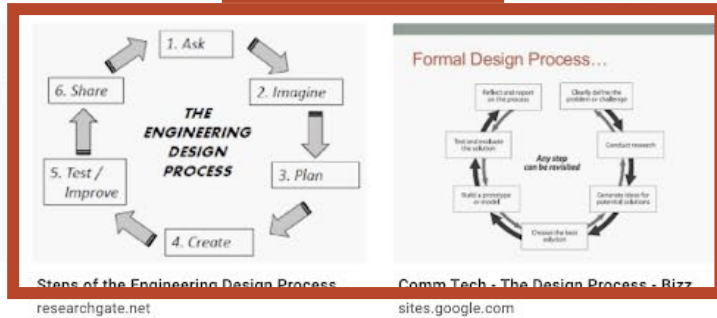
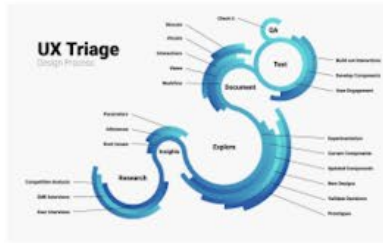
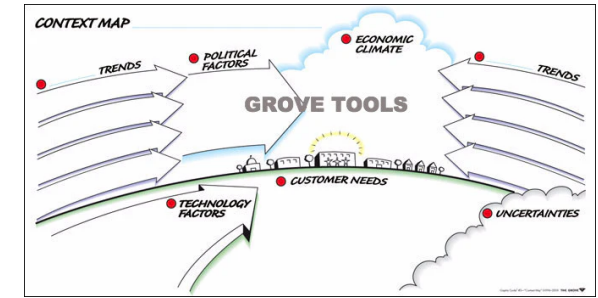
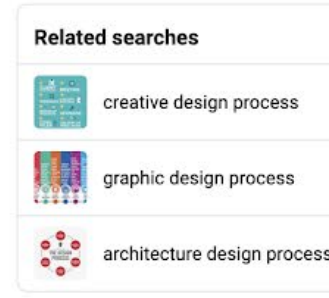
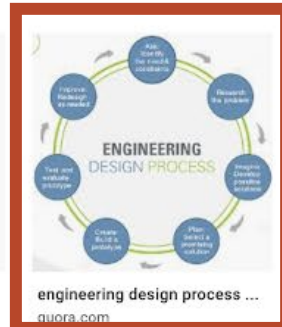
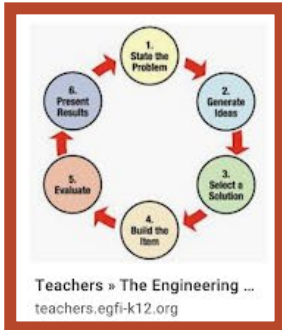
Anne's design process

Image credit: Anne C Everett

<https://medium.com/@anneceverett/my-design-process-99eba2f0c098>



# Let's focus: Design Processes



# Design Processes Principle 2: **Iterative**

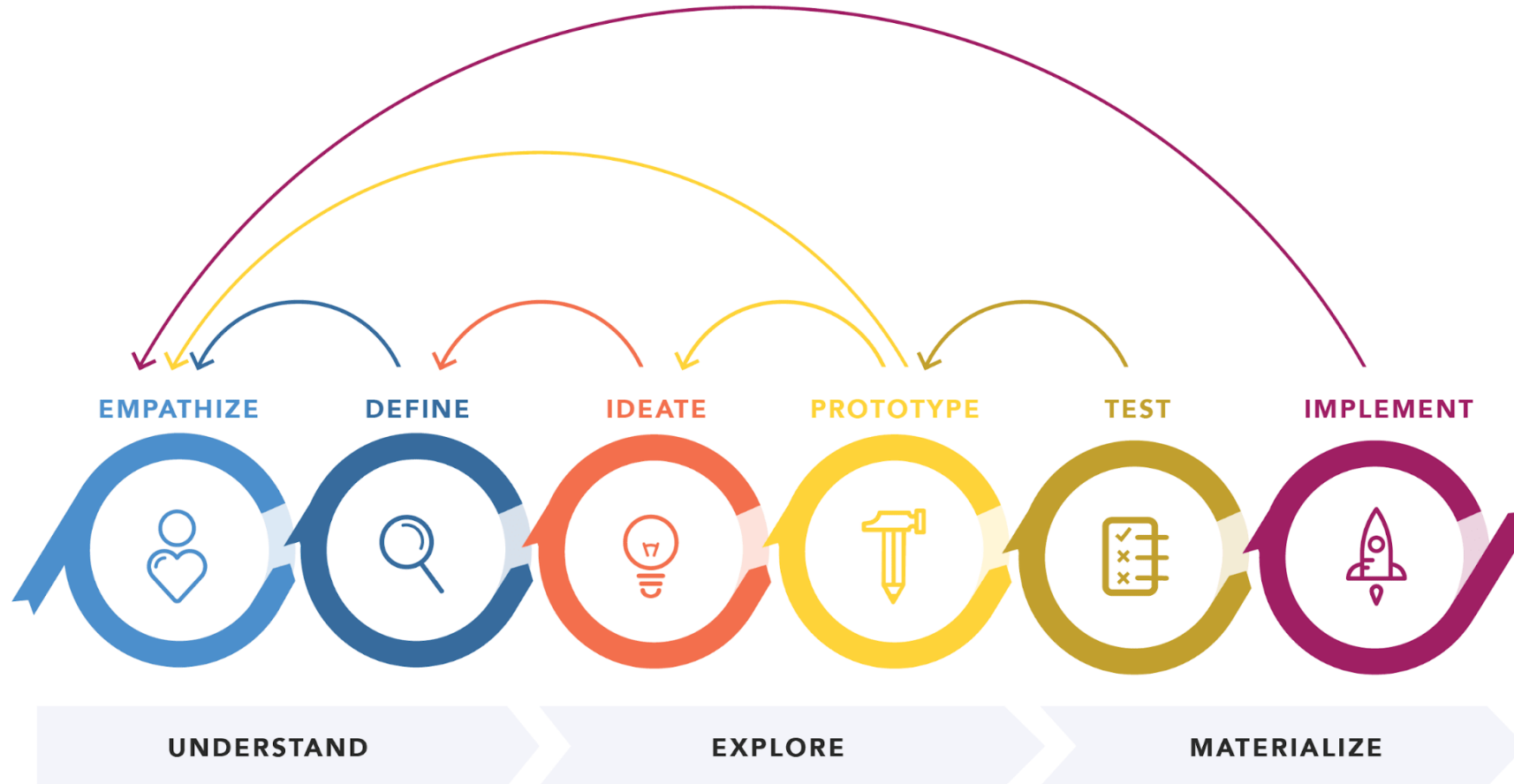
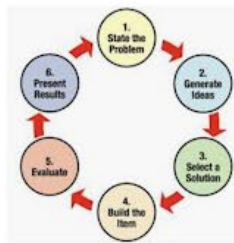


Image credit: Sarah Gibbons  
<https://www.nngroup.com/articles/design-thinking/>



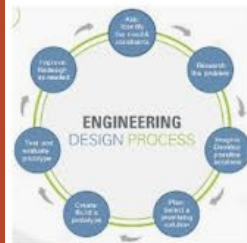
# Let's focus: Design Processes



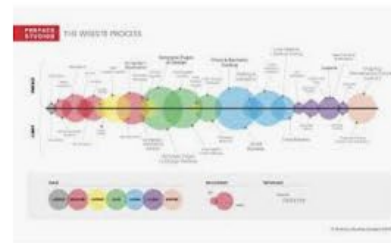
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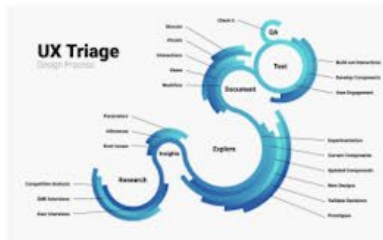
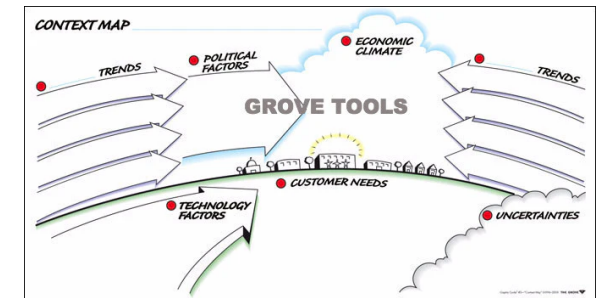
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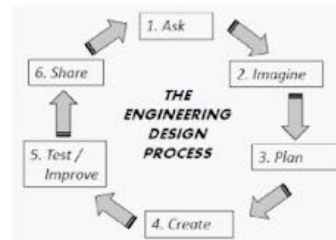
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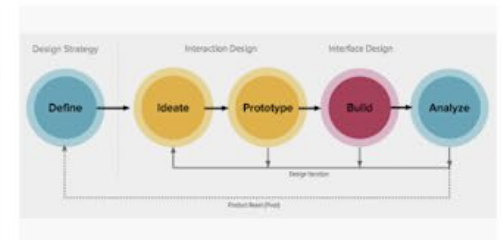
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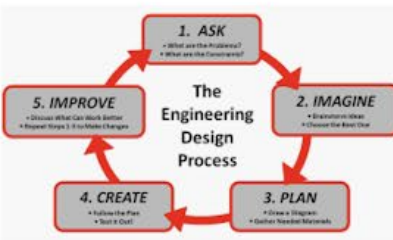
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# Design Processes Principle 3: **Fuzzy Front End**

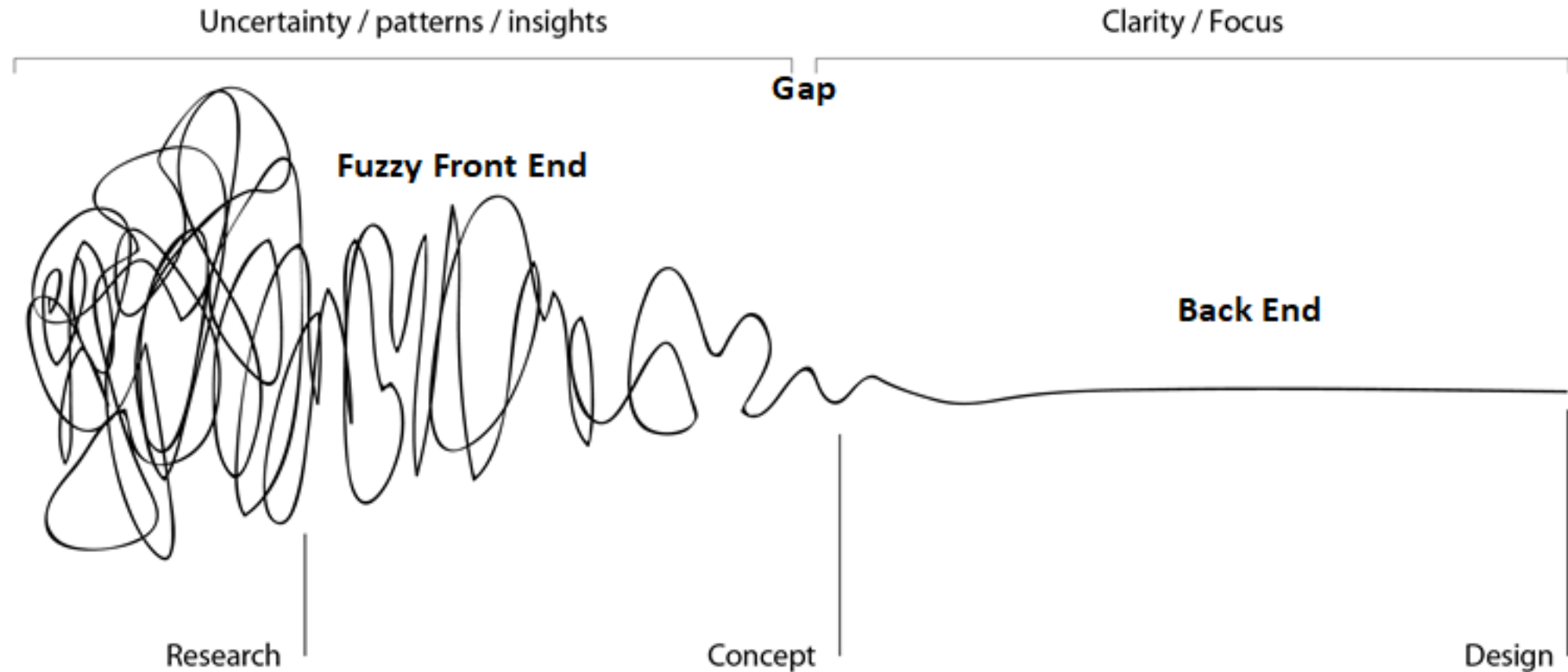


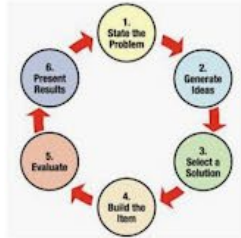
Image credit: Srishti Singhal

<https://medium.com/nyc-design/the-changing-design-process-f8d44abb1420>

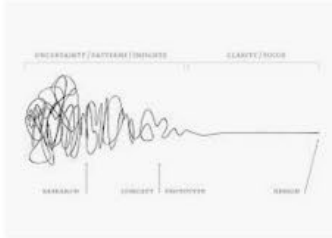




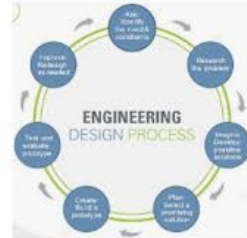
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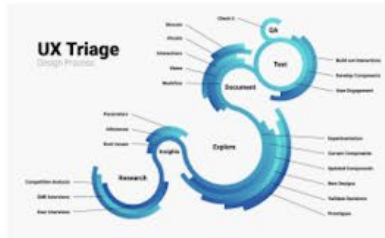
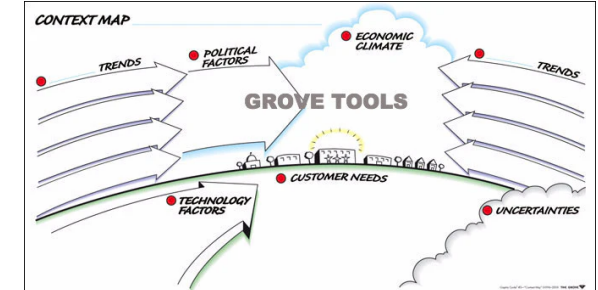
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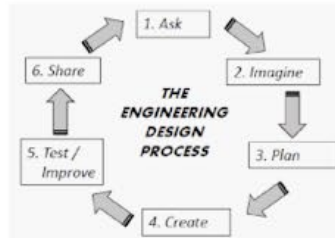
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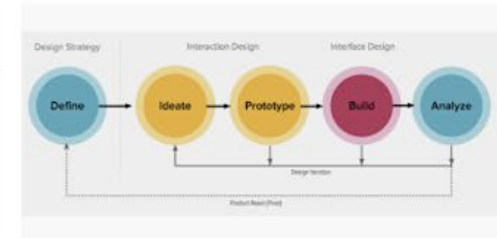
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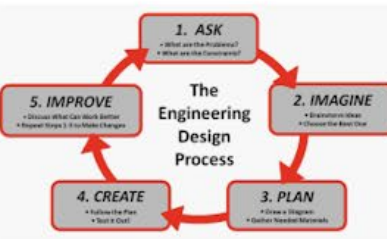
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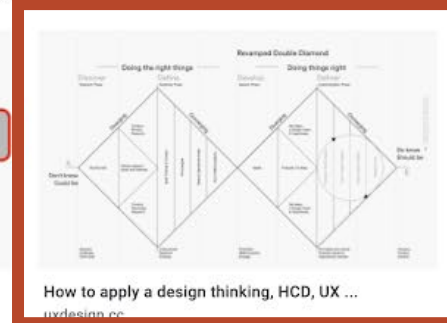
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# Design Processes Principle 4: **Divergence + Convergence**

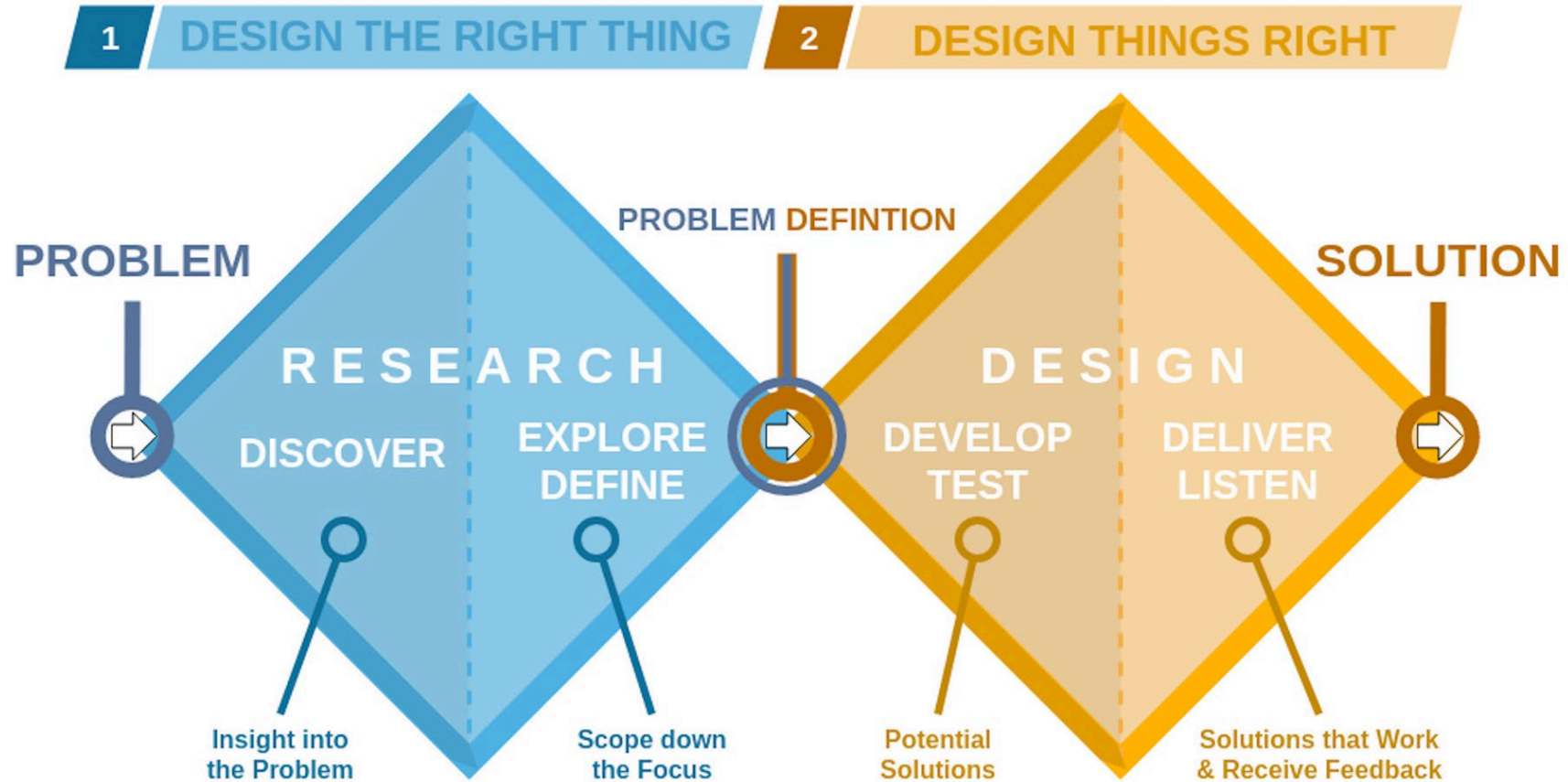
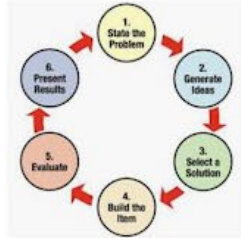


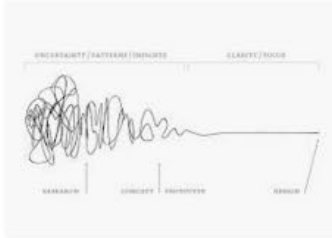
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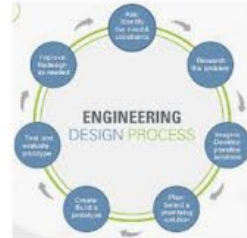
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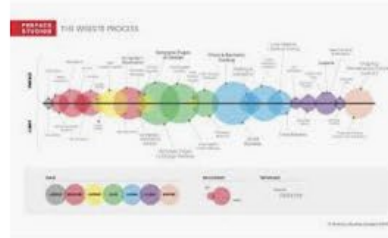
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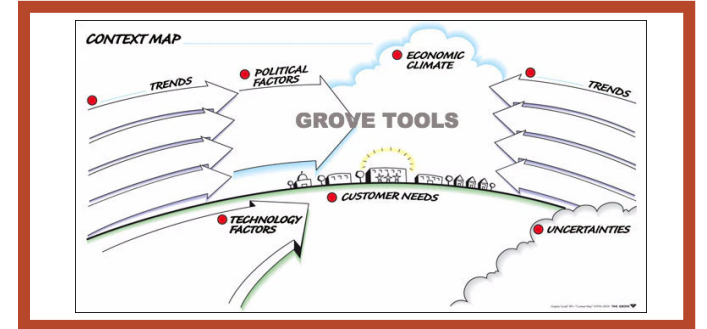
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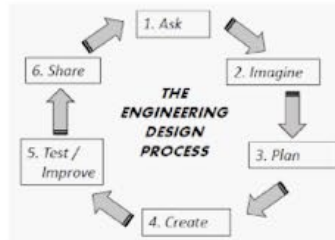
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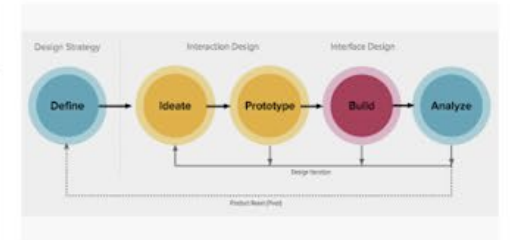
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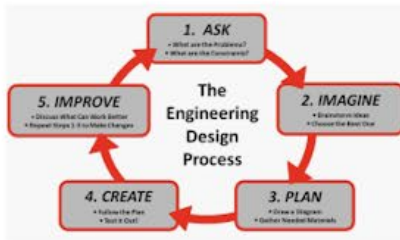
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# Design Processes Principle 5: **Context + Systems Dependent**

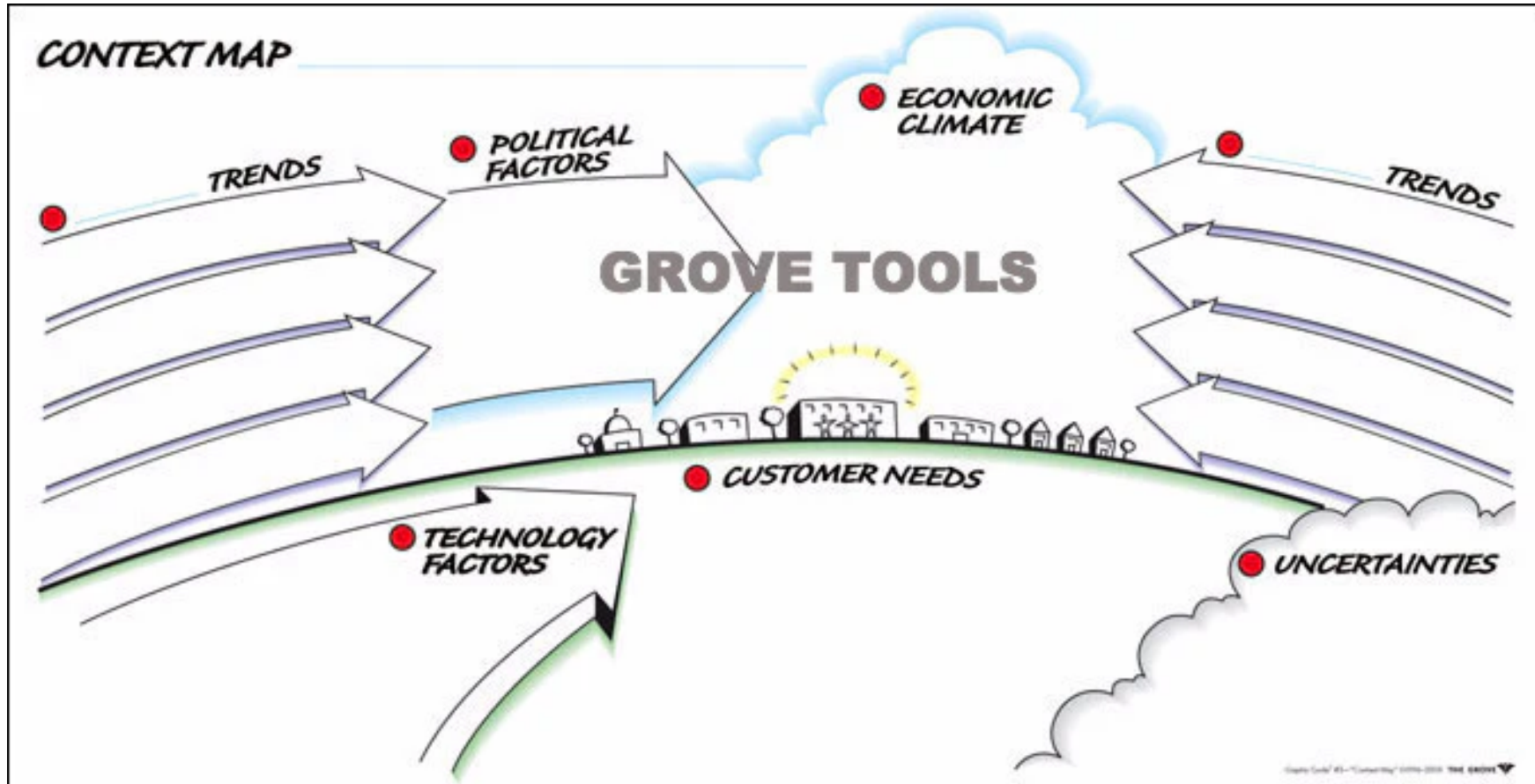


Image credit: Grove Tools

<https://grovetools-inc.com/collections/context-map?srltid=AfmBOorrLydGHkmpd4dXtgQ3NG7yJ1oen5QOARCzJuDCxQ8y1JGvYdHV>



# Today's agenda

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**About me + design  
science research**

**Design process  
principles**

**Discussion**



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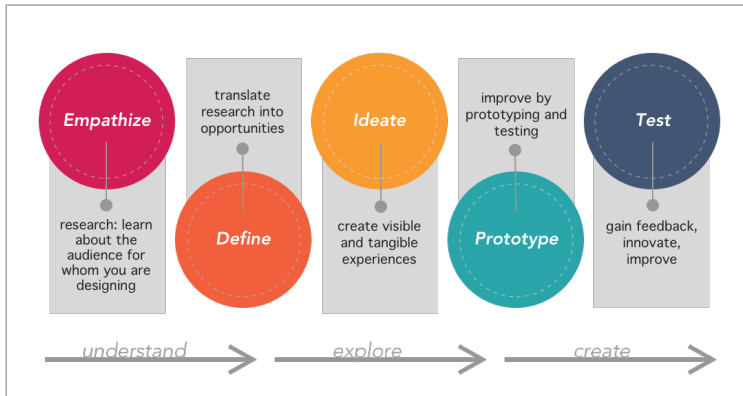




Discussion groups of 2-4:

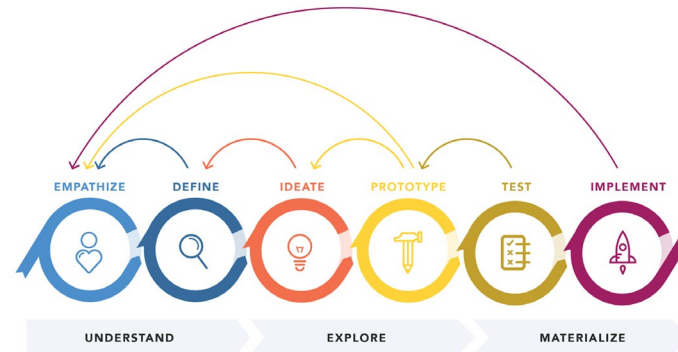
# In what ways have these principles influenced your design work?

## (1) Temporal

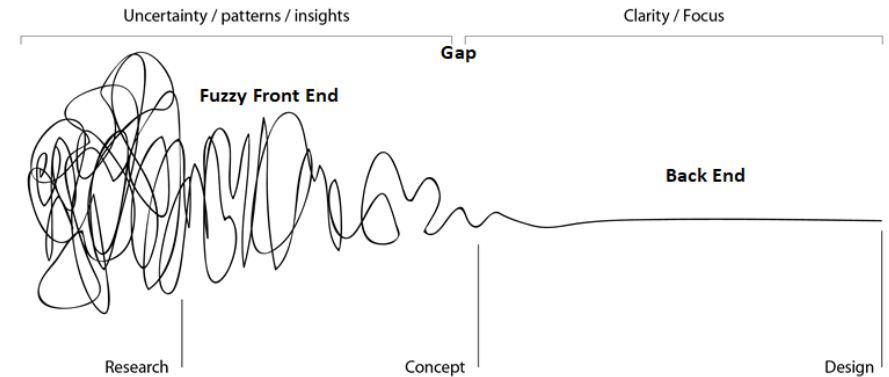


Anne's design process

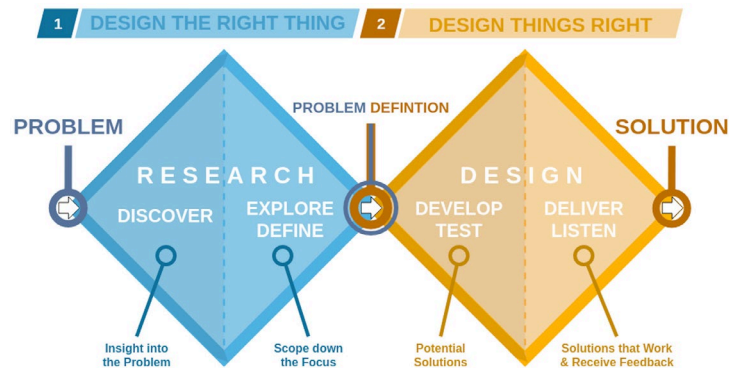
## (2) Iterative



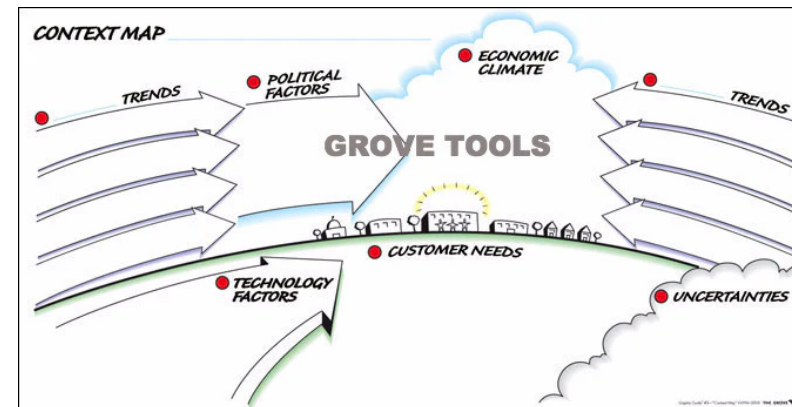
## (3) Fuzzy front end



## (4) Divergence + Convergence



## (5) Context + Systems Dependent





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# Design Processes + Principles

**Dr. Grace Burleson**  
**Assistant Professor, Mechanical Engineering**