

What is happening?



# Phenomenon

Observable events in  
the real world

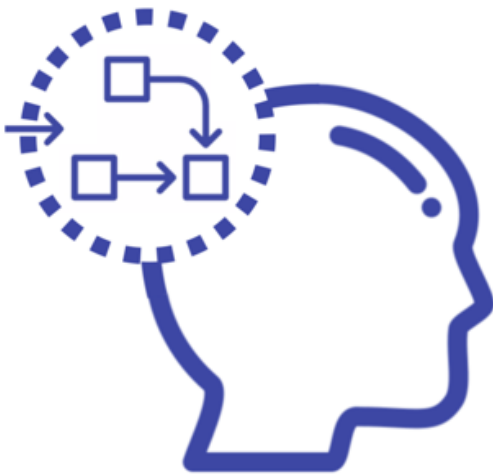
What is the problem?



# Problem

Human needs and wants

What do you wonder?

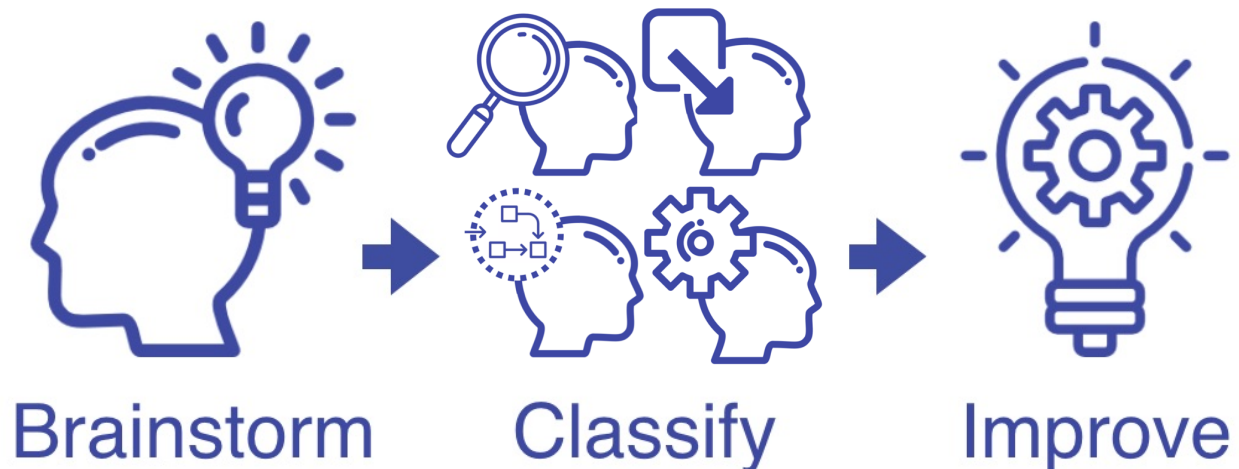


# Asking Questions

What do you wonder?

## Asking Questions

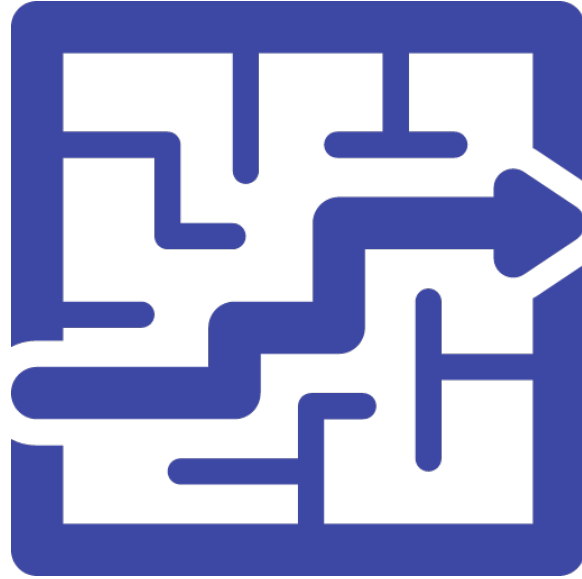
---



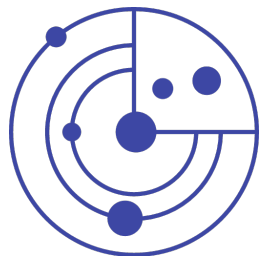
### Good Questions:

- Address the **phenomenon** or **problem**
- Identify the **nature** of the question
  - Observational - What do I notice?
  - Explanatory - How does it work?
  - Systems - What happens in the system?
  - Engineering - What is the problem?
- Can be empirically **tested**

What do you think?



# Constructing Explanations



Developing  
and Using  
Models

Mathematics



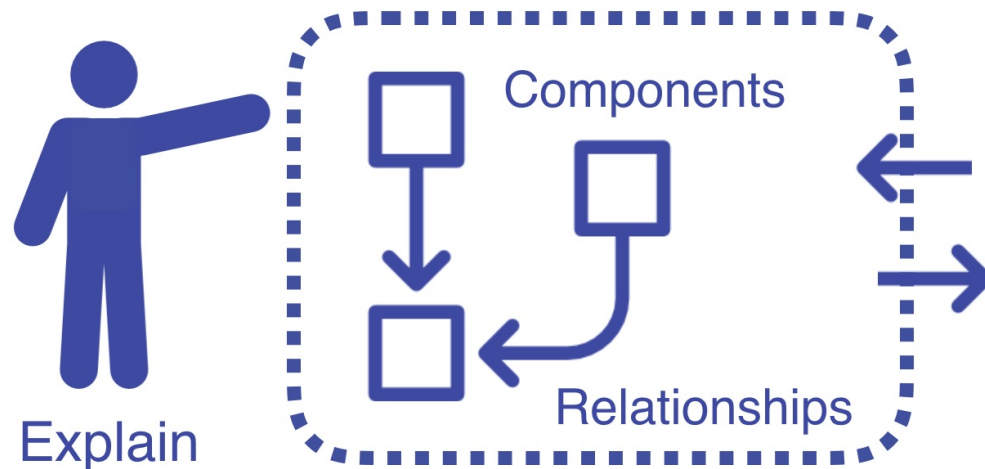
Computational  
Thinking



What do you think?

## Constructing Explanations

---



### Good Explanations:

- Identify a scientific **cause**
- Identify the **components** of the system
- Use connections between the components to **explain**, describe and predict
- Represent the **components** of the system mathematically
- Use **computational thinking**

How do you investigate?



Planning and  
Carrying Out  
Investigations

# How do you investigate?

## Planning and Carrying Out Investigations

---



Plan



Evidence



Design

### Good Investigations:

- Investigate a **phenomenon** or **design**.
- Identify the **evidence** that will be collected
- Have a **plan**
- Collect **evidence**
- Improve** the design of the investigation



How do you know?



# Engaging in Argument from Evidence



Analyzing and  
Interpreting  
Data



Obtaining,  
Evaluating and  
Communicating  
Information

How do you know?

## Engaging in Argument From Evidence

---



Evidence



Reasoning



Claim

Good Arguments:

- Obtain, evaluate** and **organize** the evidence
- Identify **patterns** within and between datasets
- Identify a **claim**
- Link the evidence and claim with a chain of **reasoning**.
- Communicate** information using the appropriate style and format

What do you notice?

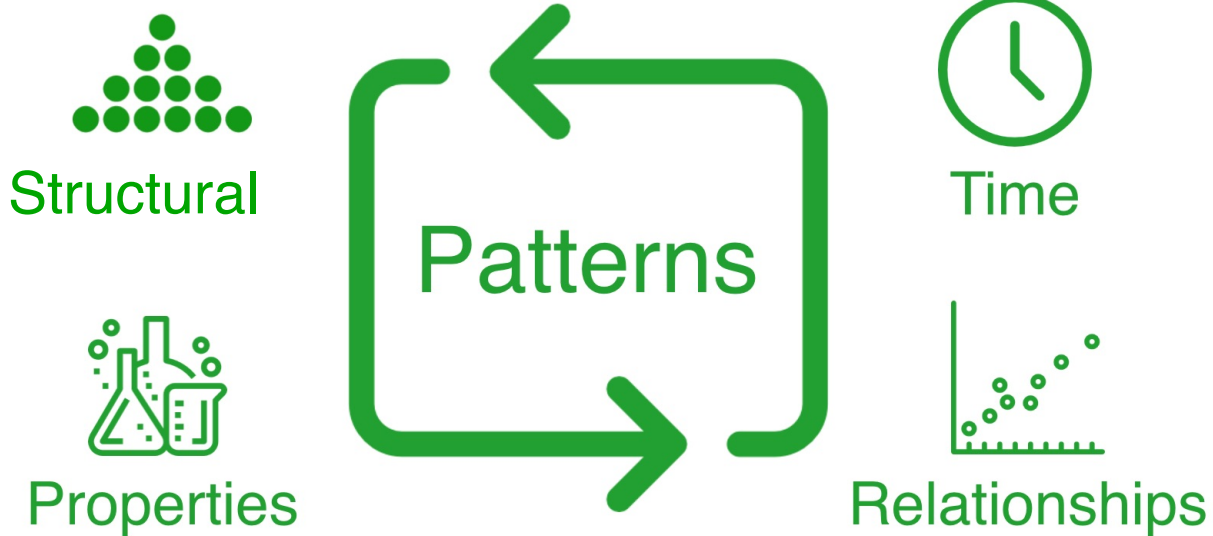


# Patterns

What do you notice?

## Patterns

See - Hear - Touch - Smell - Taste



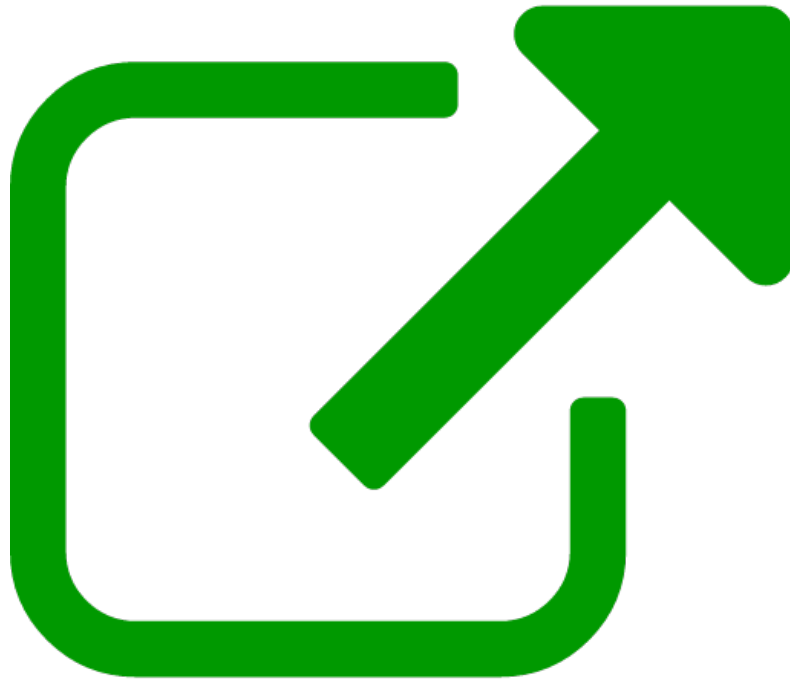
What are the parts?

How does it change?

What stays the same?

What is related?

How does it work?



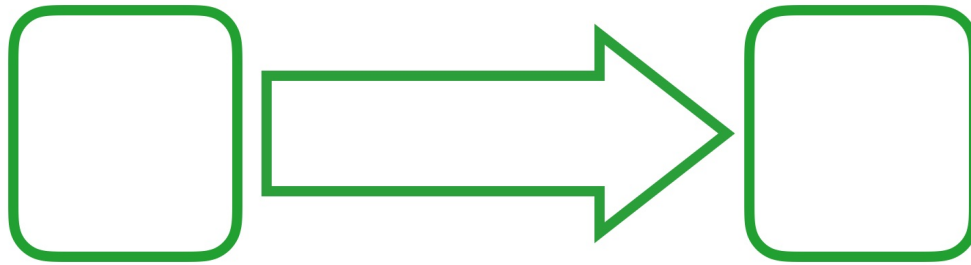
# Cause & Effect



Structure  
Function

How does it work?

## Cause & Effect



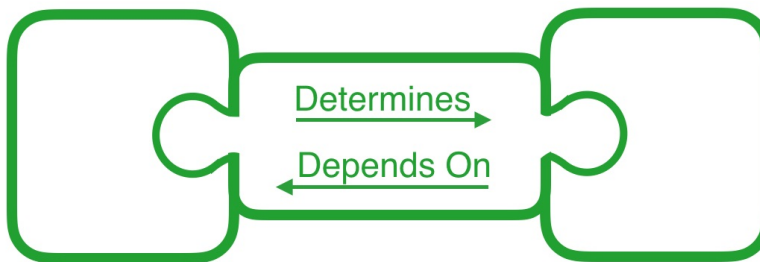
Cause

Mechanism

Effect

What's the structure?

What's the function?



Structure

Function



Structures

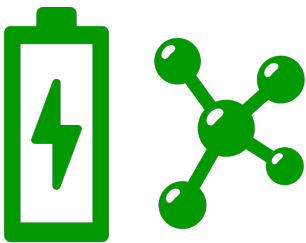
Environment

What happens in the system?



# Systems

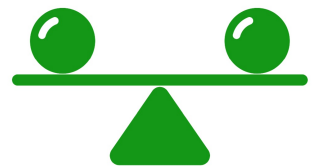
## System Models



Energy  
Matter



Scale  
Proportion  
Quantity

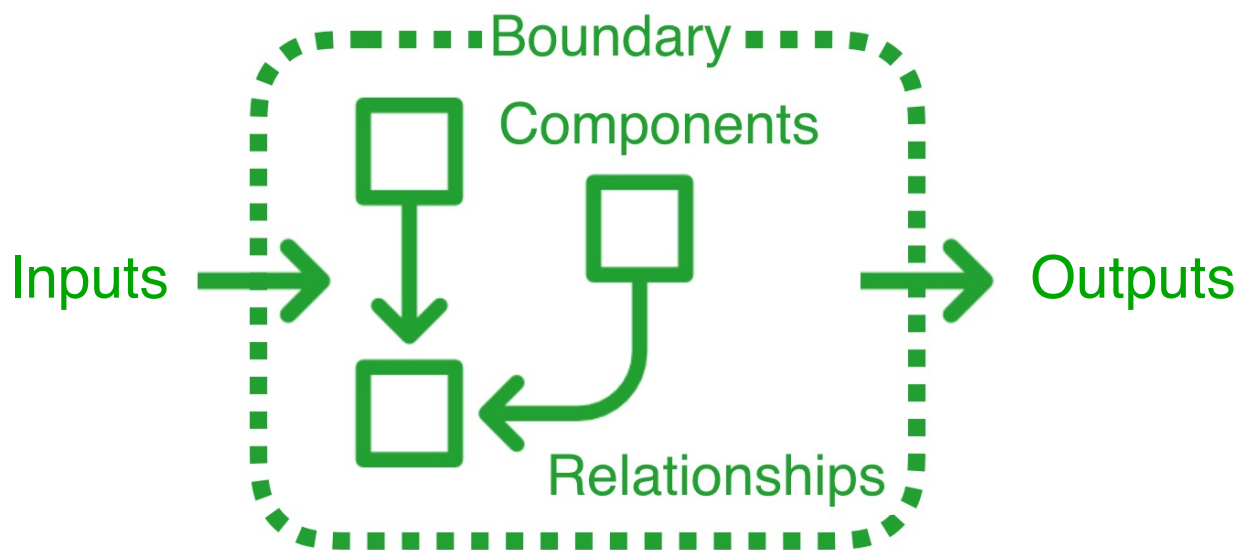


Stability  
Change

What happens in the system?

## Systems and System Models

---



What is the boundary?

What flows? What cycles?

What makes it change?

What keeps it stable?

What is important?