

# The Design of Buildings

## *A Complex Activity*

- 1** *Many issues* that are *related* to each other.
- 2** *Information volume* tends to *overwhelm* the human designer.
- 3** Constant *information changes* impact issues and relationships.
- 4** Some variables largely *undefined* - decisions must be made with *partial information*.
- 5** *Experience* and *intuition* are necessary design decision-making skills.

# The Design of Buildings

## *Frequent Failures*

- 1** *Errors in judgement* during earliest conceptual design stages.
- 2** *Lack of experience* and knowledge of the human designer.
- 3** Error correction downstream *loses the intent* of the original designer.
- 4** Loss of time due *lack of integration* and *coordination*.
- 5** Poor solutions that are *costly* to implement or subject to *failure during execution*.

# Human Design Process

## *Rationalistic Approach*

**Step 1:**

### Define problem

as a system of identifiable objects that have known characteristics.



**Step 2:**

### Find general rules

that define the relationships among the objects within the context of the solution.



**Step 3:**

### Apply the rules

to the problem situation and draw conclusions that lead to the solution.



**Step 4:**

### Test the solution

against specific acceptance criteria and if unsatisfactory return to any of the previous steps.



# Human Design Process

## *Complex Problem Characteristics*

- Many *Related* Variables
- Some Variables *Undefined*
- *Dynamic* Information Changes
- Solution Objectives *Change*
- *Several* Possible Solutions

# Nature of Design

## *Principal Components*

### 1. Information



### 2. Representation



### 3. Visualization



## CHARACTERISTICS OF THE DESIGN ACTIVITY

### 4. Communication



### 5. Reasoning

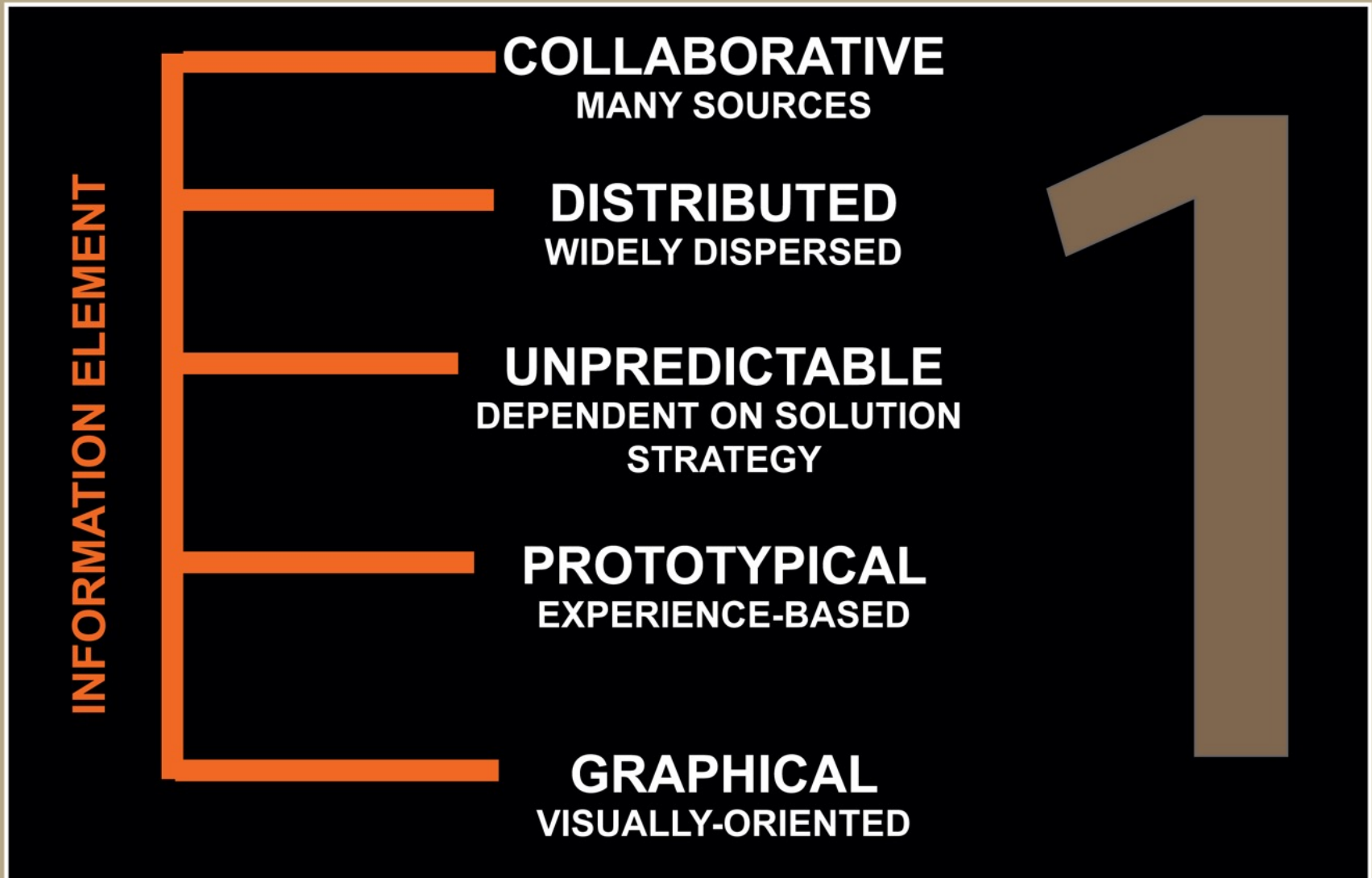


### 6. Intuition



# Design Activity Components

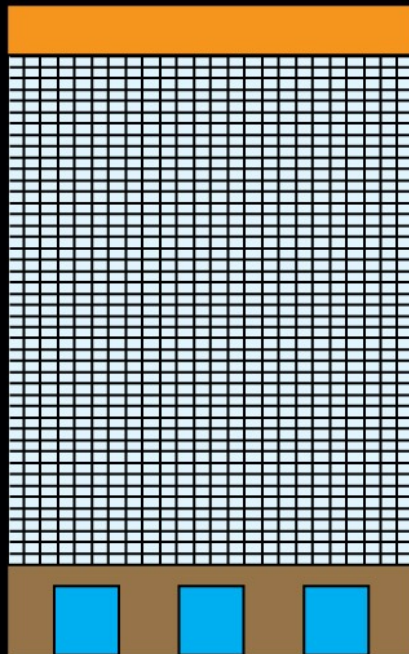
## *Information*



# Prototype Knowledge

## *Vertical Prototypes*

**Vertical Prototype** knowledge bases contain typical information for a complete problem situation or complete artifact such as a building, or aircraft.



**BUILDING TYPE**

**TYPICAL USER NEEDS**

- PROFILES
- FUNCTIONS
- ACTIVITIES

**TYPICAL OWNER NEEDS**

- EXPECTATIONS
- CONSTRAINTS

**TYPICAL DESIGN CRITERIA**

- STRUCTURE
- CONSTRUCTION
- SERVICES

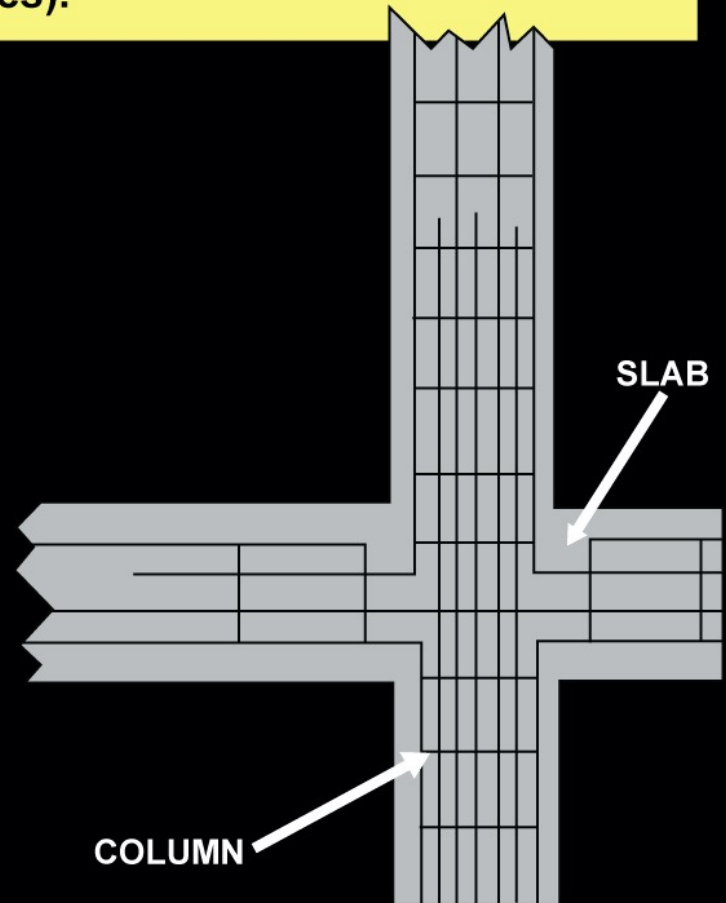
# Prototype Knowledge

## *Horizontal Prototypes*

**Horizontal Prototype** knowledge bases contain typical solutions for sub-problems that may apply to more than one discipline (e.g., equipment repair practices).

### STANDARD PRACTICES

- SUB-PROBLEM SOLUTION
- VALIDATED
- REPLICABLE





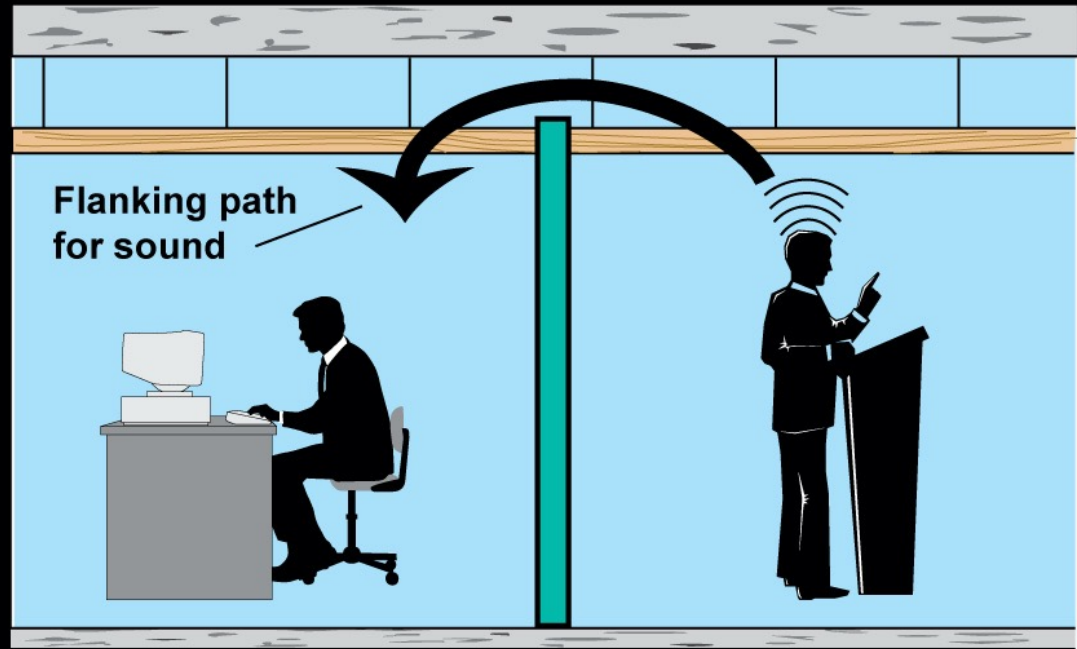
# Prototype Knowledge

## *Domain Prototypes*

**Domain Prototype** knowledge bases contain information and guidelines for developing solutions within contributing narrow domains.

### DOMAIN SPECIFIC

- SPECIALIZED
- DISCIPLINE-BASED



# Prototype Knowledge

## *Exemplar Prototypes*

**Exemplar Prototype** knowledge bases describe a specific solution such as an outstanding building or a method (e.g., welding technique) that can be applied across several disciplines.

EXEMPLAR REFERENCE



# Prototype Knowledge

## *Experiential Prototypes*

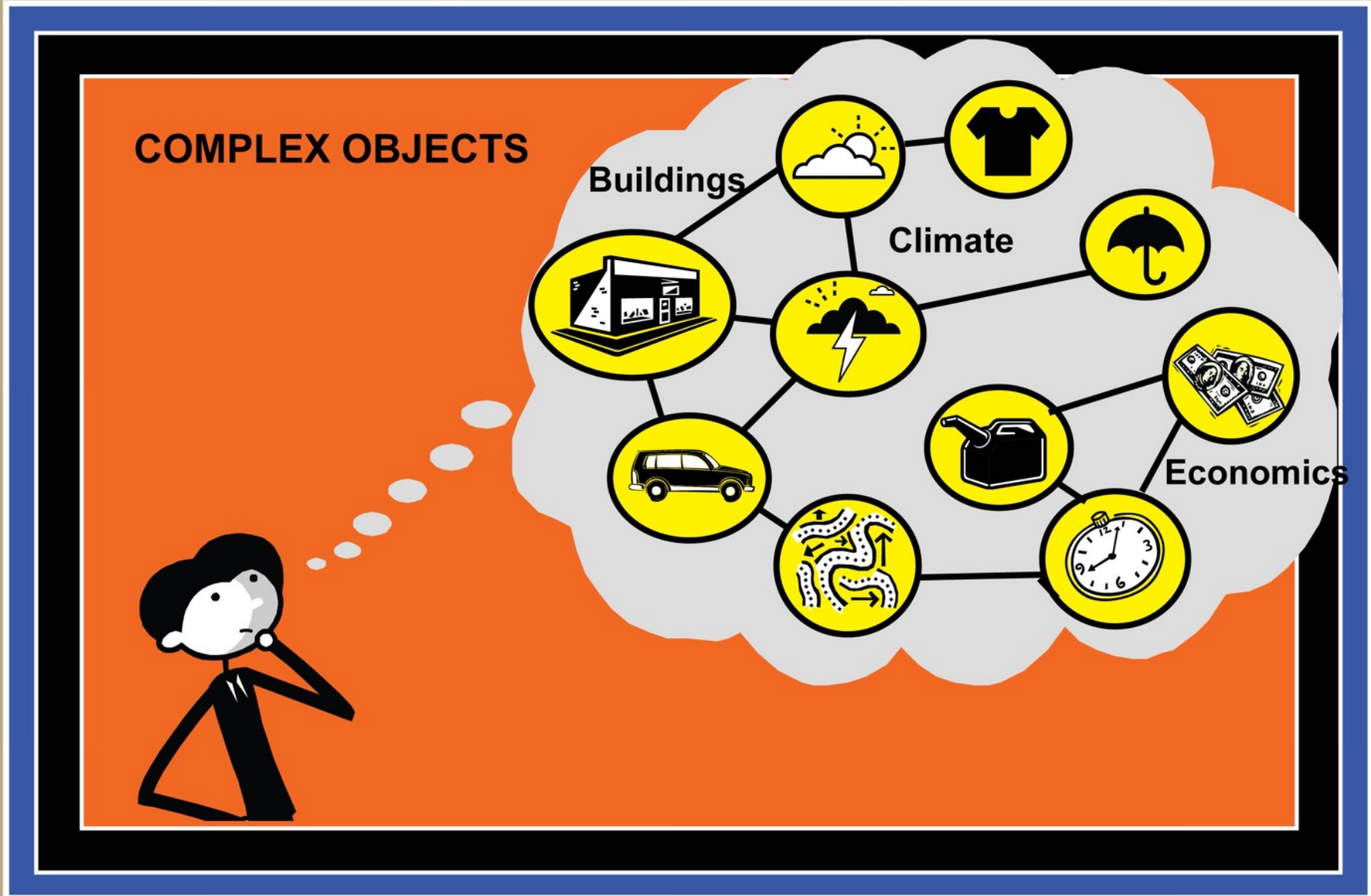
**Experiential Prototype** knowledge bases contain information about actual solutions, or events, or memorable experiences that can be reapplied.

**EXPERIENTIAL  
ARCHETYPE**



# The Importance of Context

## *Symbolic Reasoning*



# Design Activity Components

## *Representation*

REPRESENTATION ELEMENT

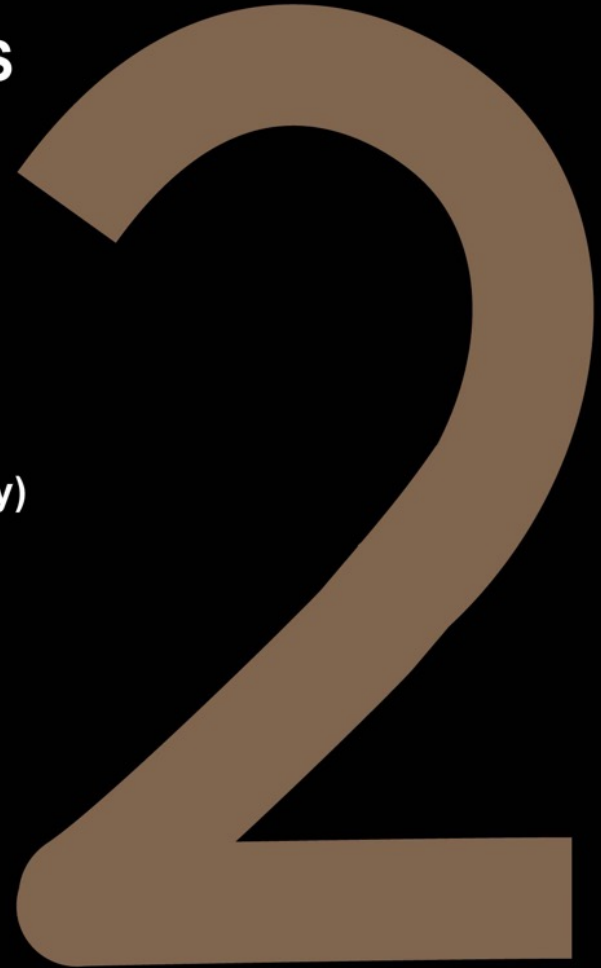


### HIGH LEVEL OBJECTS

- **Physical**  
(e.g. Car, Fuel, Road)
- **Conceptual**  
(e.g. Efficiency, Safety, Comfort)
- **Metaphorical**  
(e.g. Image, Power, Loyalty)

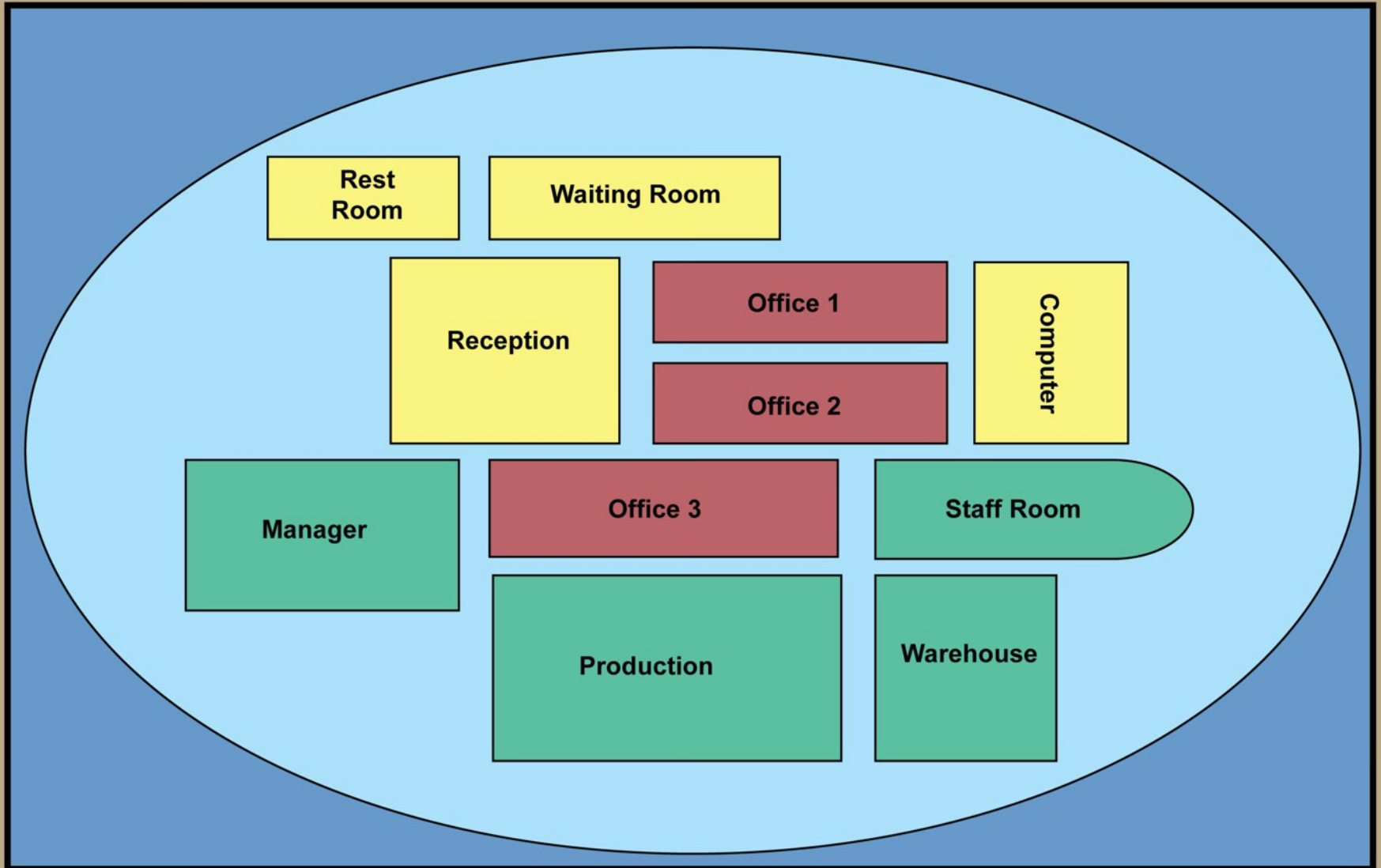
### COMPREHENSIVE DESCRIPTION

- **Geometry**
- **Location**
- **Characteristics**
- **Relationships**



# Spatial Representation

## *The Floor Plan Problem*



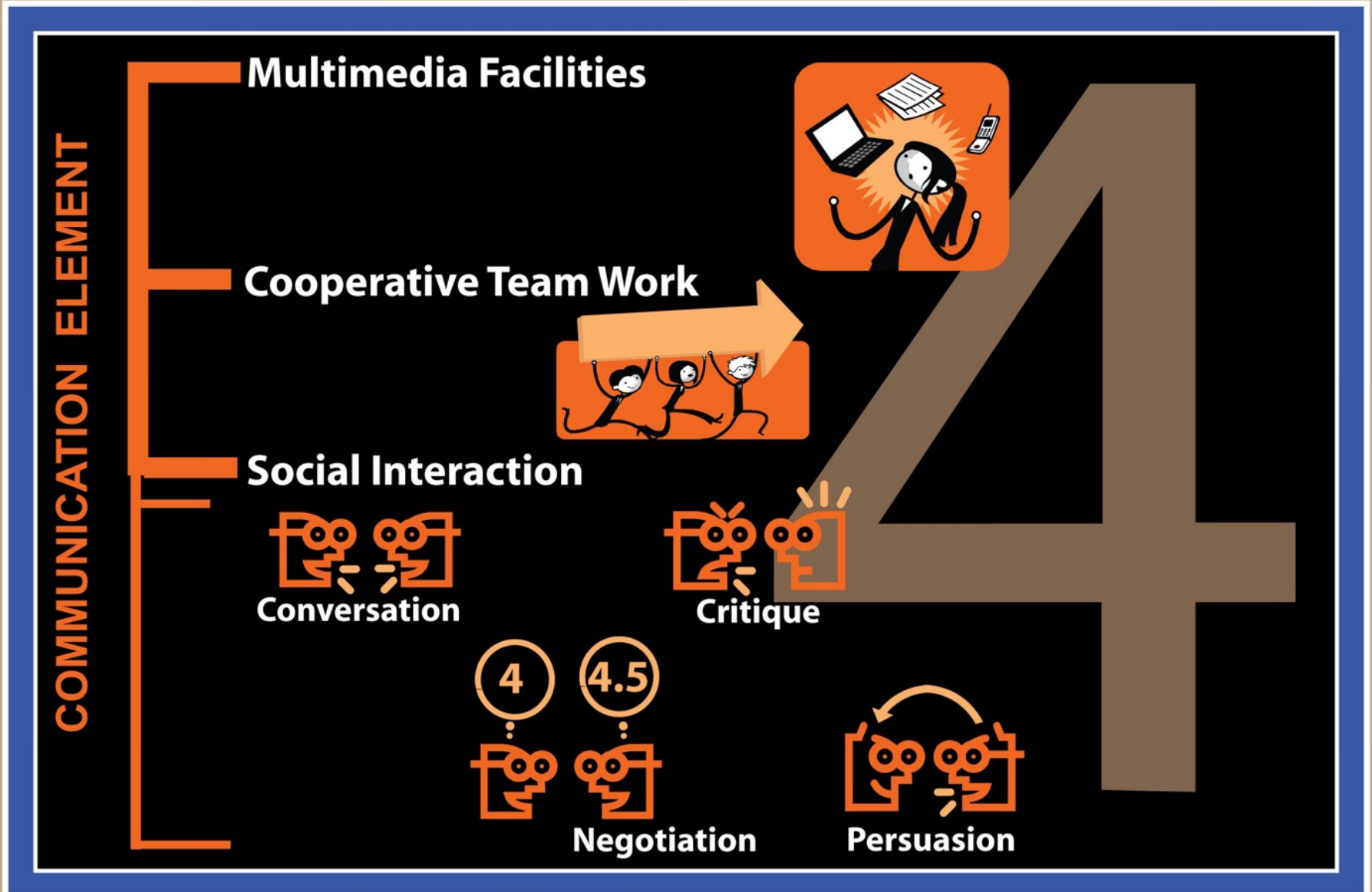
# Design Activity Components

## *Visualization*



# Design Activity Components

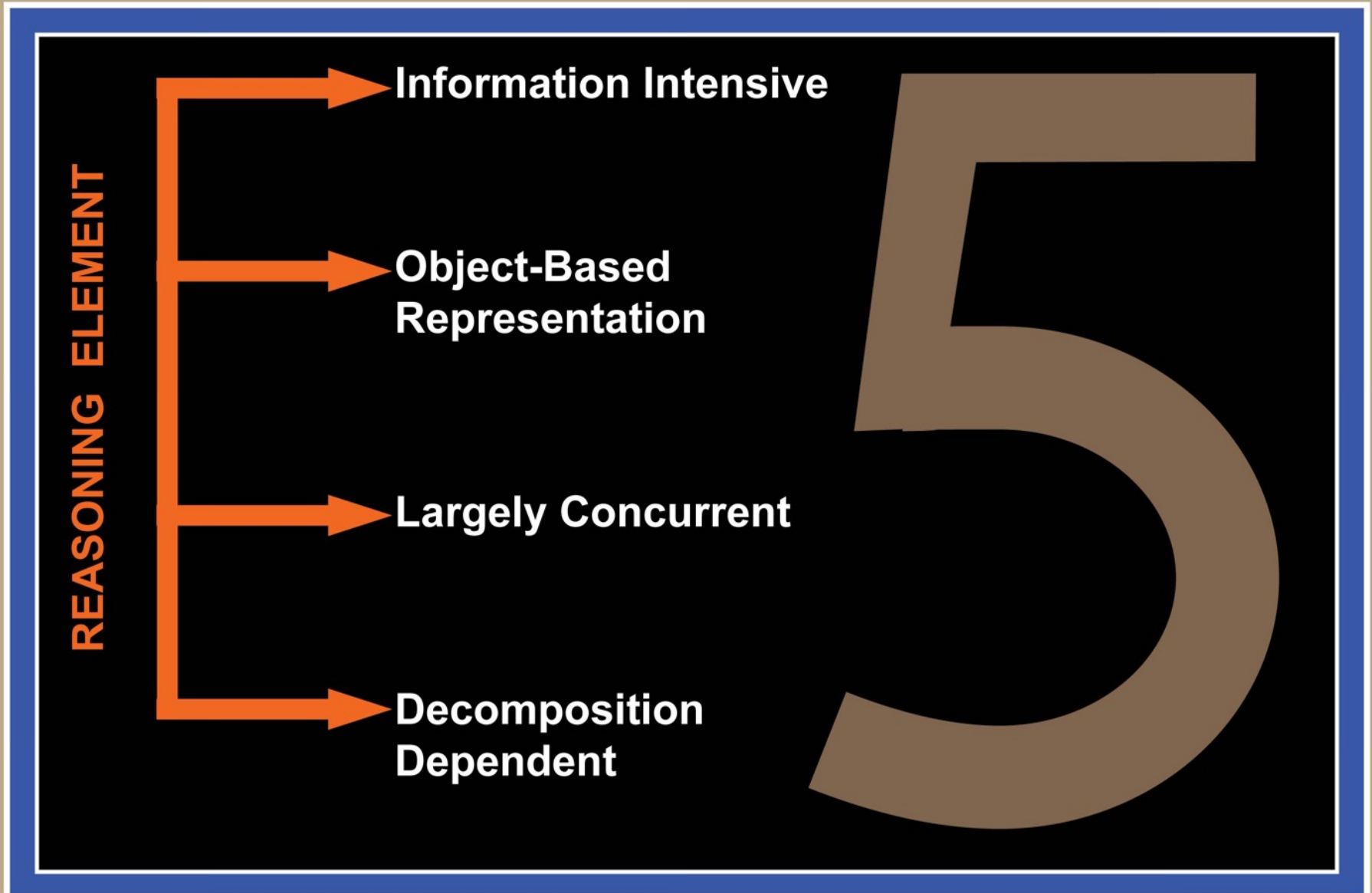
## *Communication*





# Design Activity Components

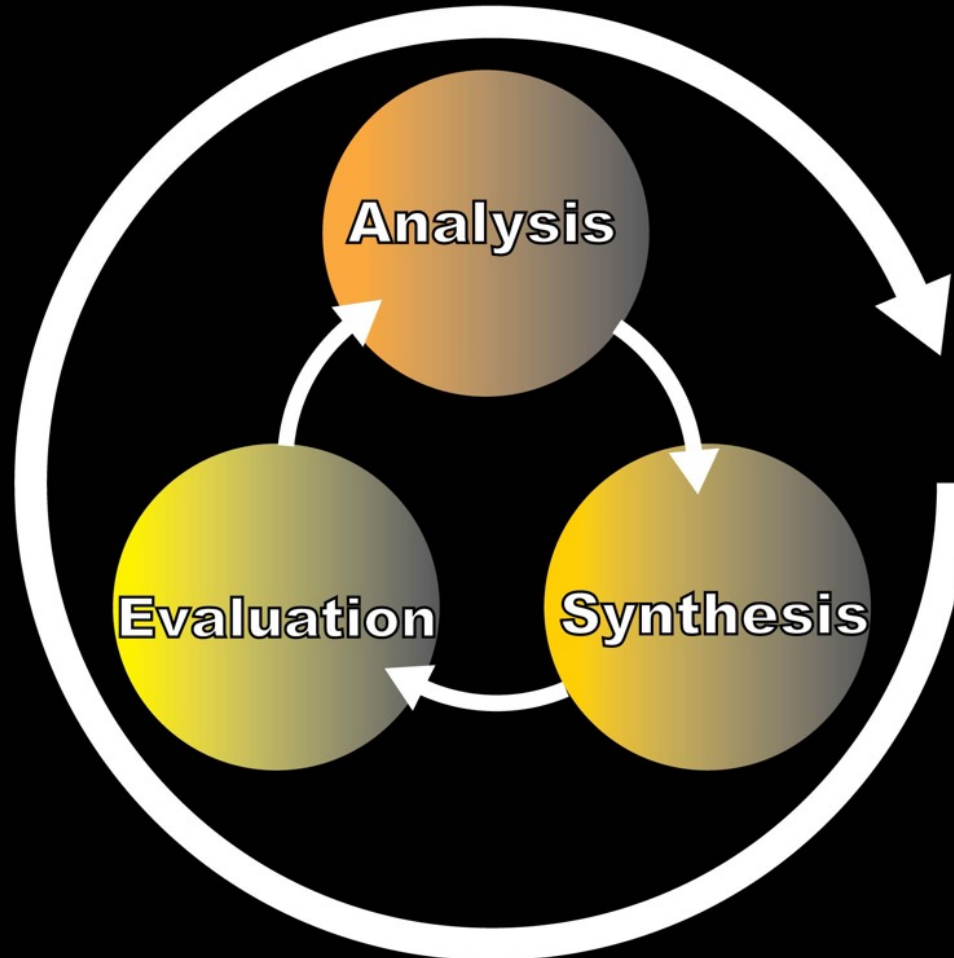
## *Reasoning*



# Reasoning Methodology

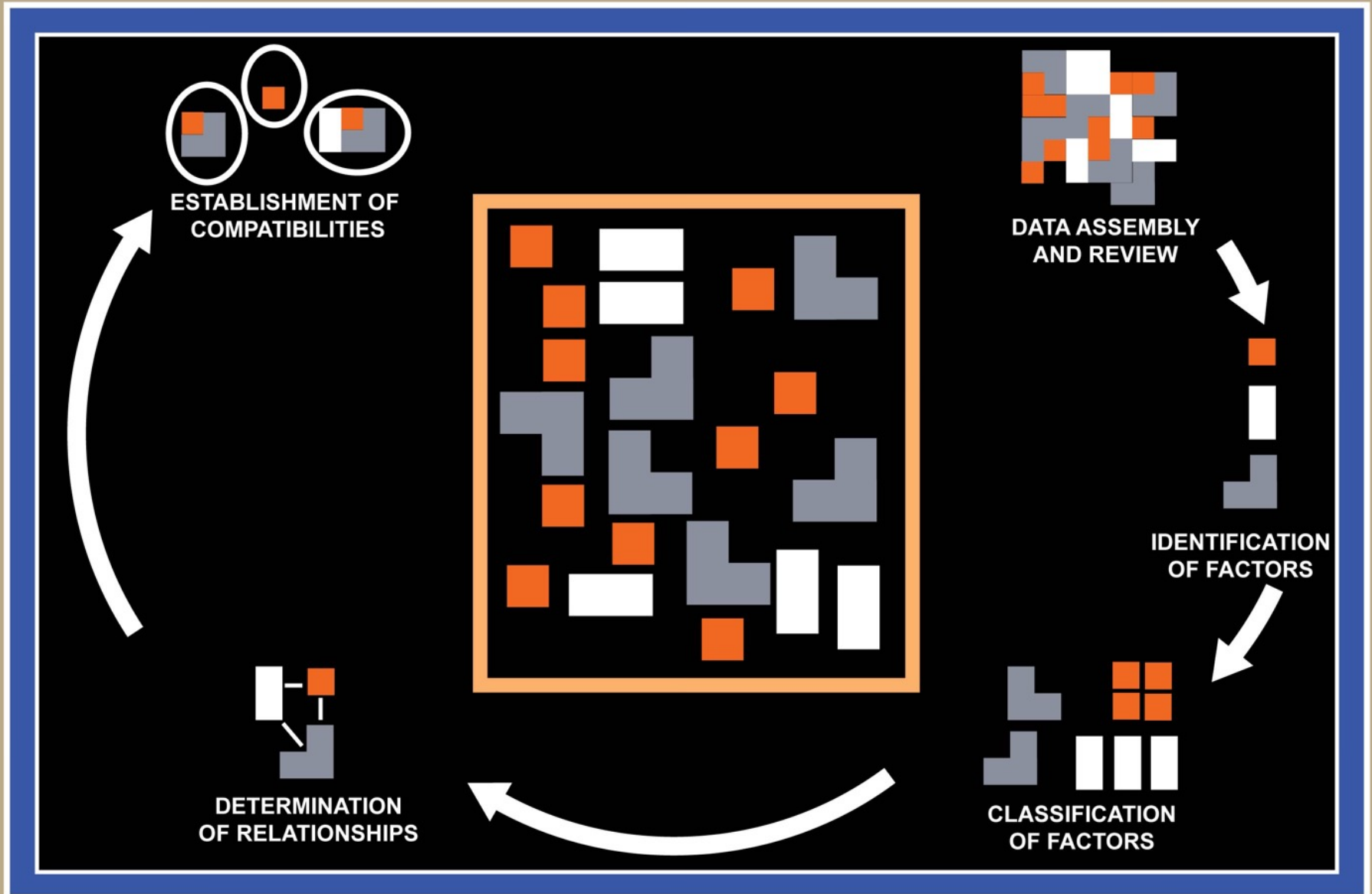
## *An Iterative Cycle*

### DESIGN PROCESS



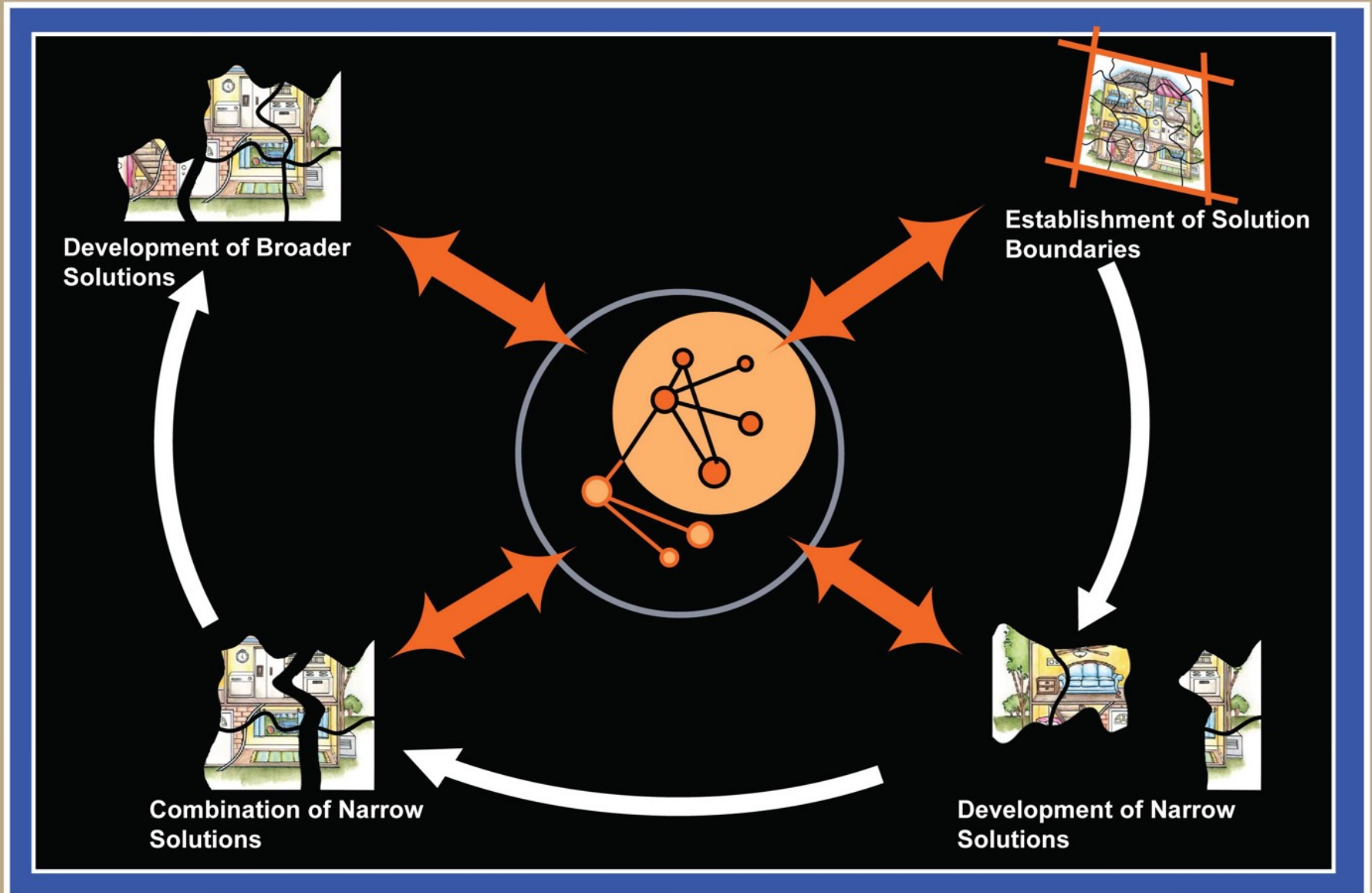
# Reasoning Methodology

## *Analysis Phase of Reasoning*



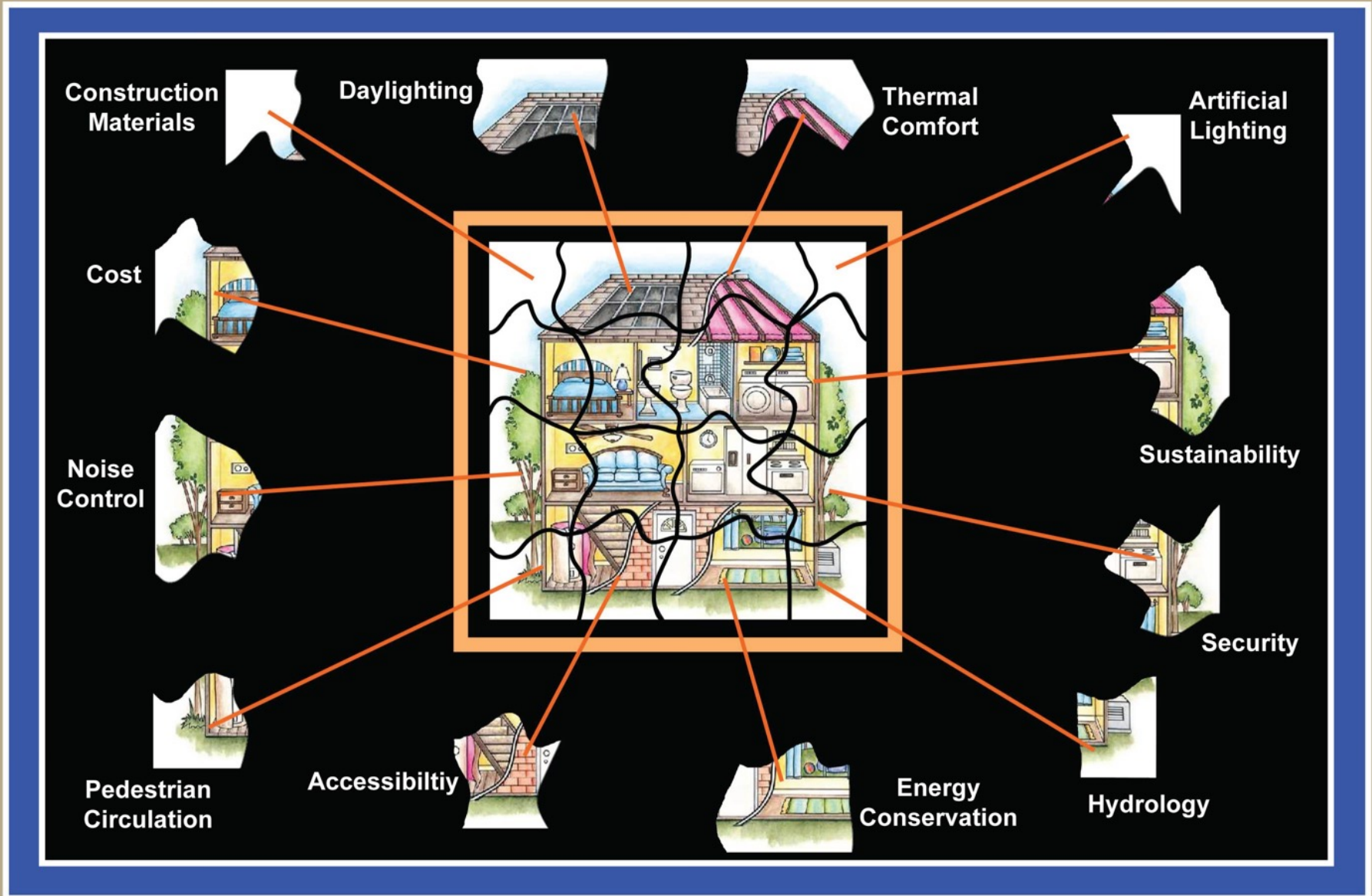
# Reasoning Methodology

## *Synthesis Phase of Reasoning*



# Reasoning Methodology

## *Evaluation Phase of Reasoning*



# Design Activity Components

## *Intuition*

