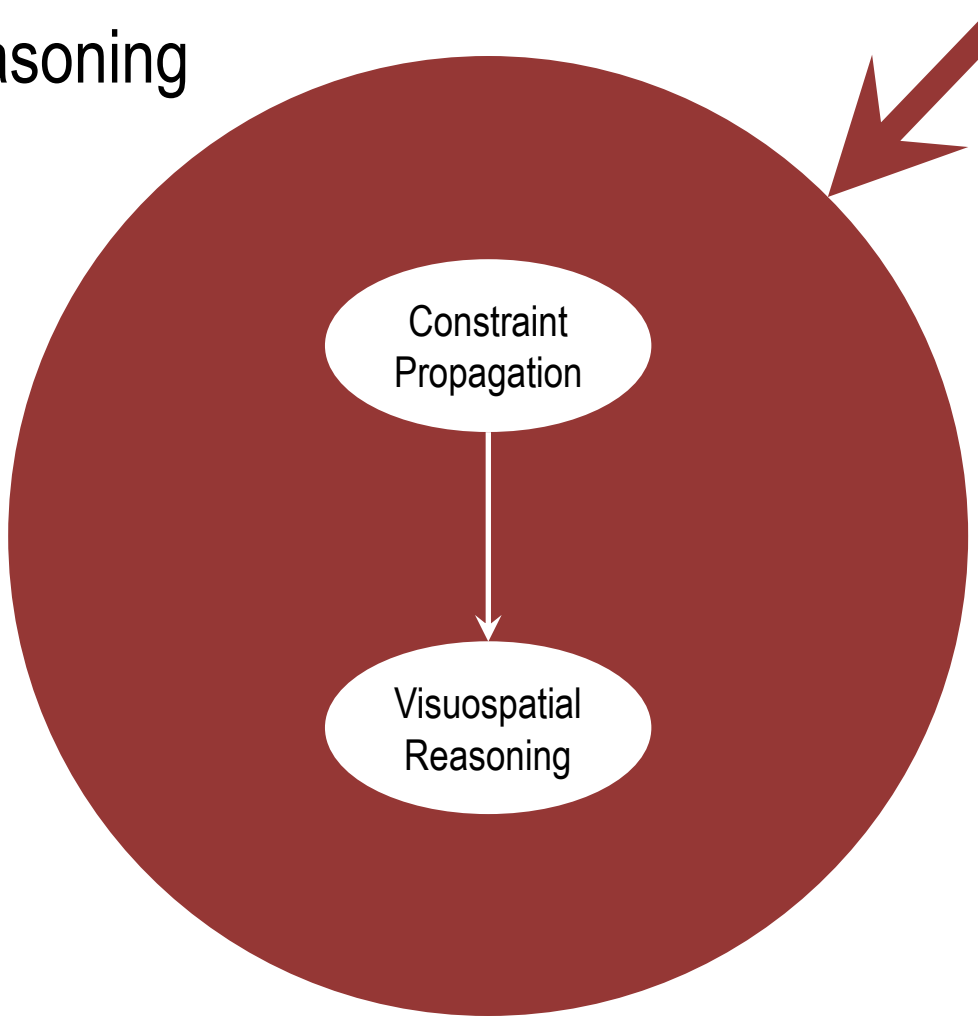
Advanced
Topics

Visuospatial
Reasoning

Visuospatial Reasoning



Visuospatial Knowledge: Knowledge wherein causality is, at most, implicit.

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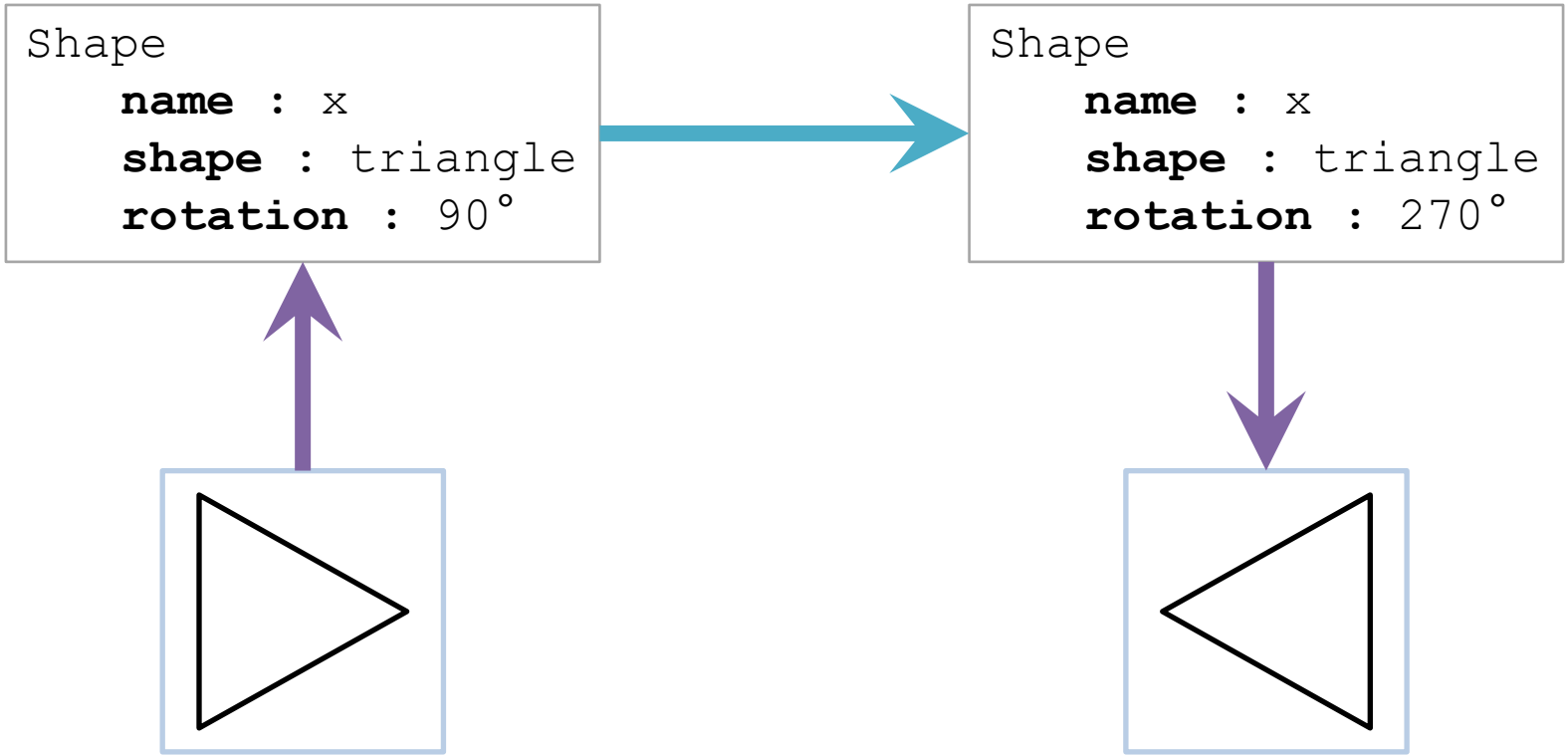
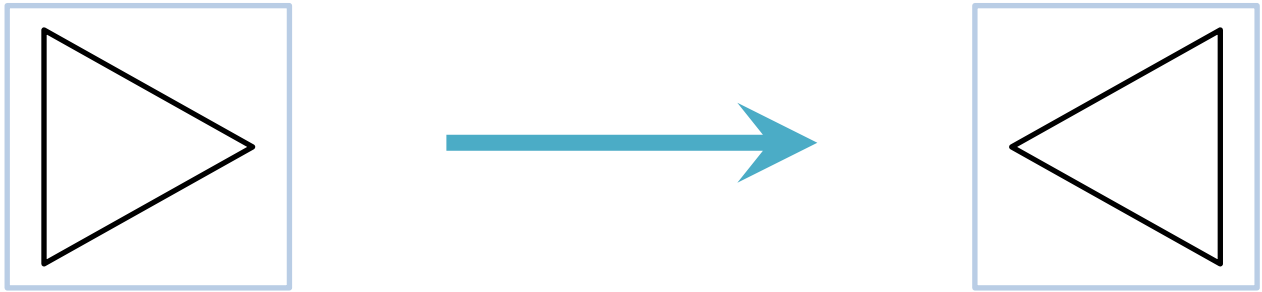
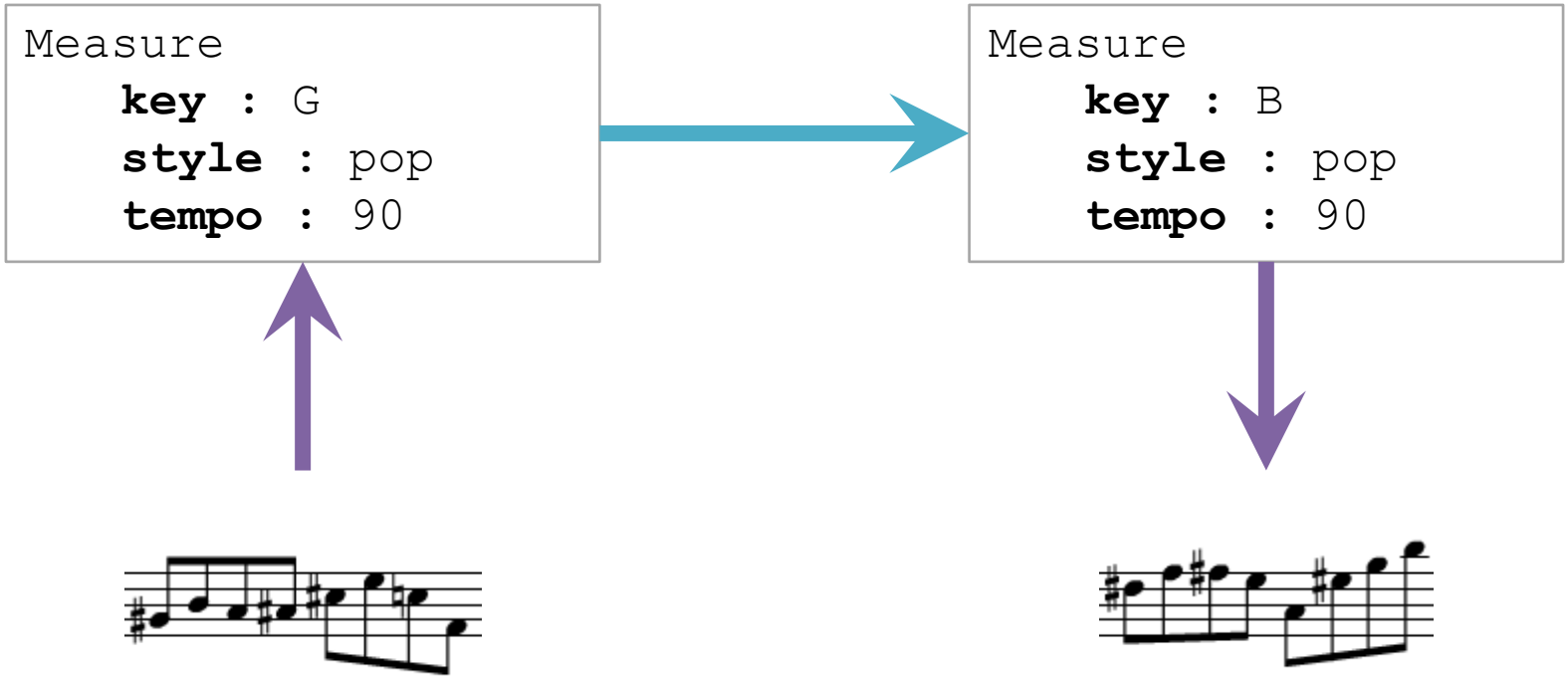
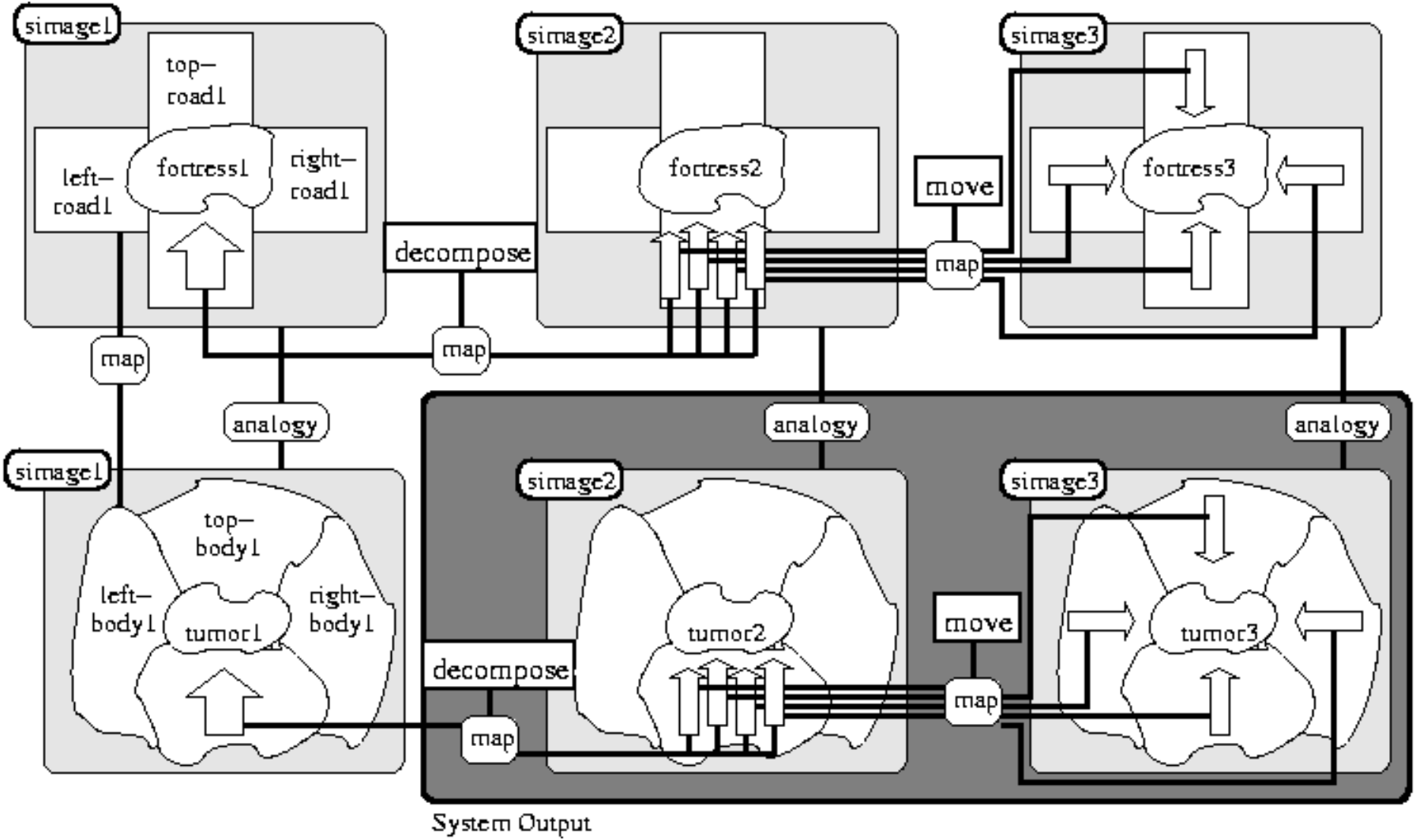
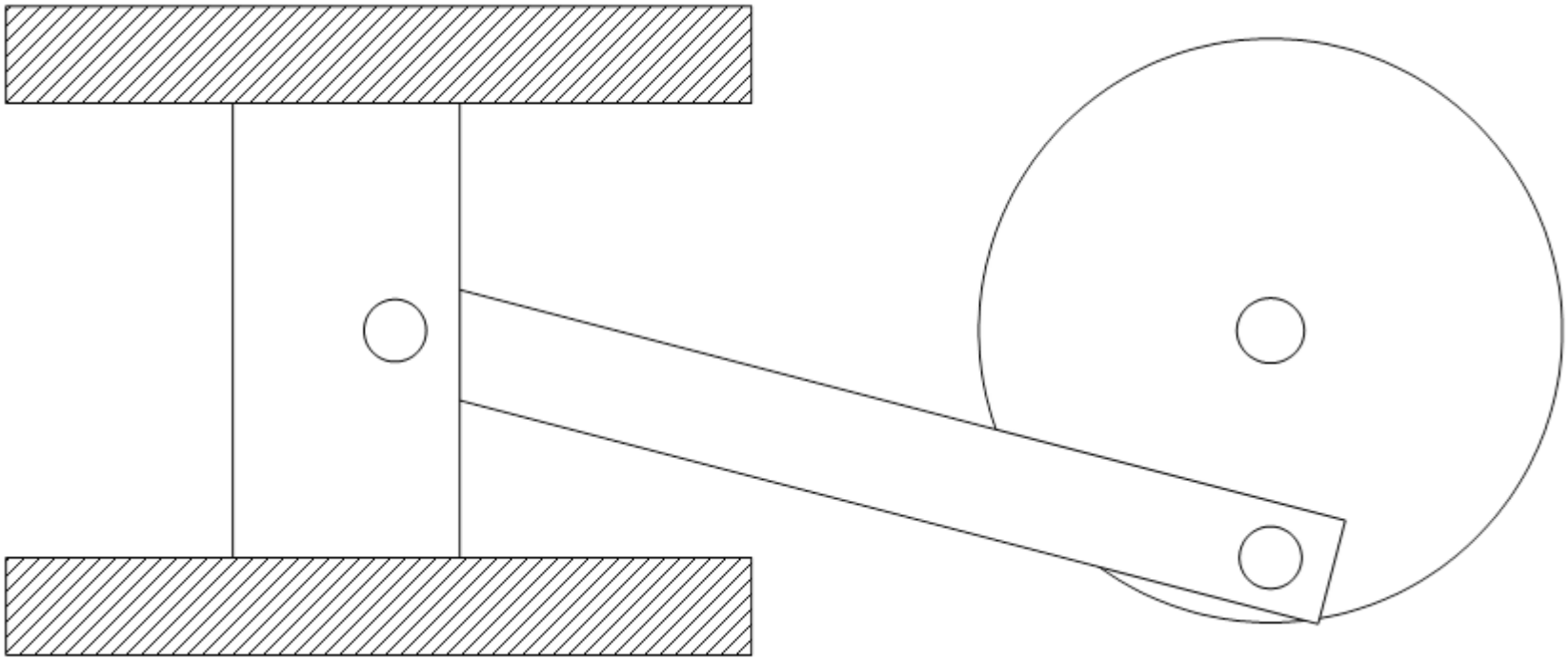

Shape
name : x
shape : triangle
rotation : 90°
Shape
name : x
shape : triangle
rotation : 270°

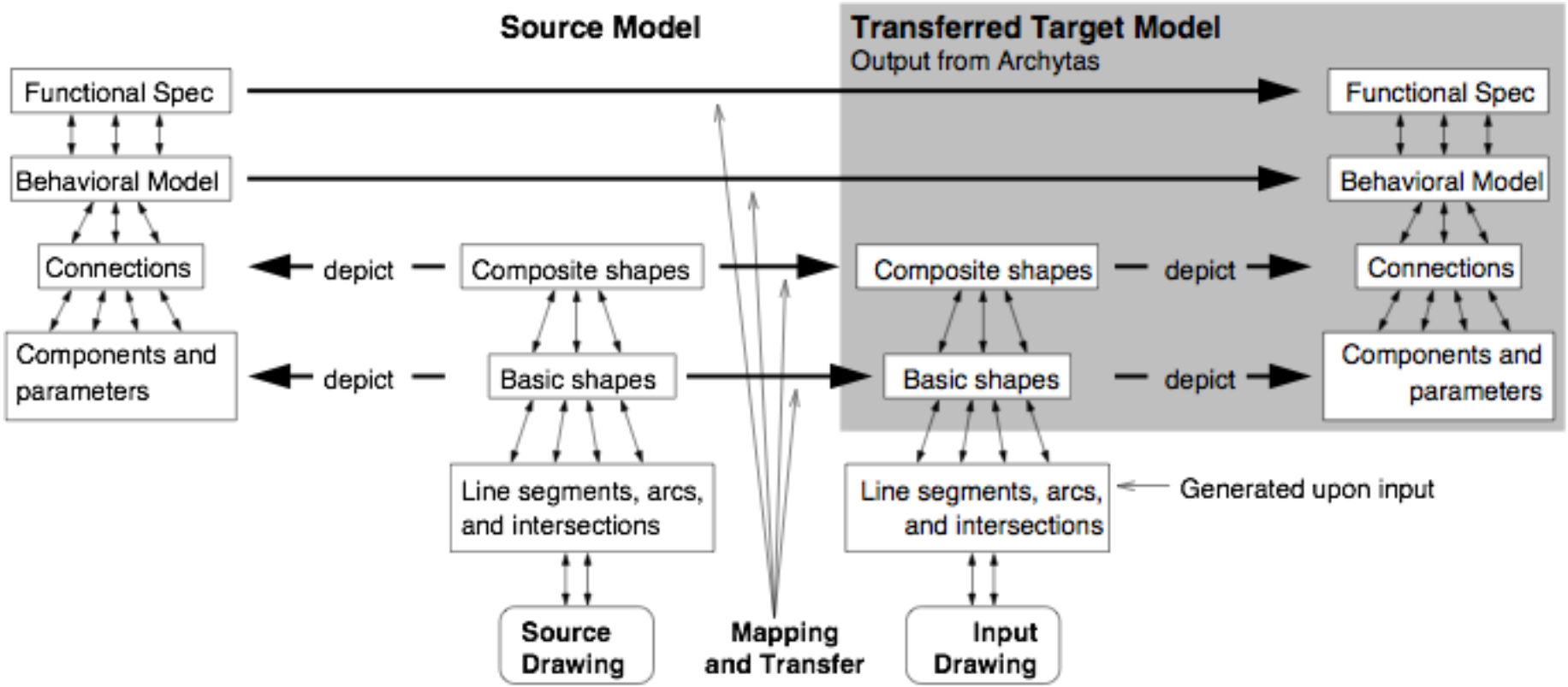


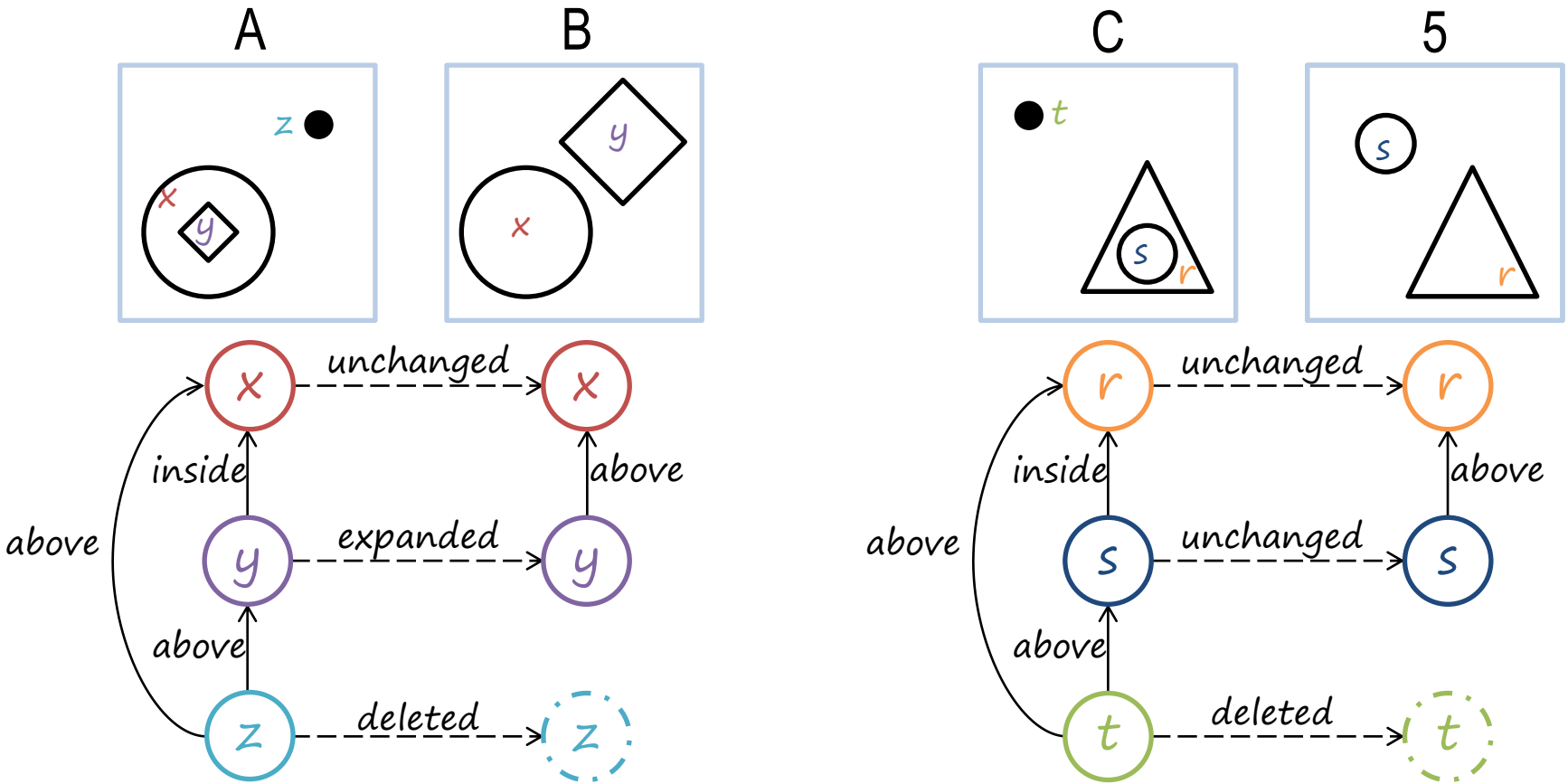

Measure
key : G
style : pop
tempo : 90
Measure
key : B
style : pop
tempo : 90

	Visuospatial	Verbal
Content	**Appearance:** What and Where	**Arbitrary:** Driven by Inferential Needs
Encoding	**Analogical:** Structural Correspondence	**Propositional:** No Correspondence

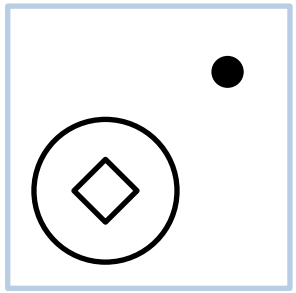

simage1
top–road1
left–road1
fortress1
right–road1
simage2
fortress2
simage3
fortress3
move
map
decompose
map
map
analogy
analogy
analogy
simage1
top–body1
left–body1
tumor1
right–body1
simage2
tumor2
simage3
tumor3
move
decompose
map
map
System Output



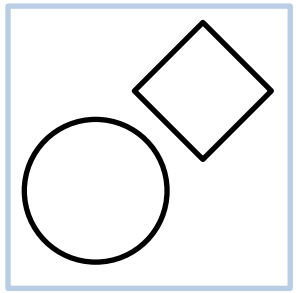

Source Model
Transferred Target Model
Output from Archytas
Functional Spec
Behavioral Model
Connections
Components and parameters
depict
depict
Composite shapes
Basic shapes
Line segments, arcs, and intersections
Source Drawing
Mapping and Transfer
Composite shapes
Basic shapes
Line segments, arcs, and intersections
Input Drawing
depict
depict
Generated upon input
Functional Spec
Behavioral Model
Connections
Components and parameters


A
B
C
5
z
x
y
x
y
t
s
r
s
r
x
unchanged
x
inside
above
above
y
expanded
y
above
z
deleted
z
r
unchanged
r
inside
above
above
s
unchanged
s
above
t
deleted
t

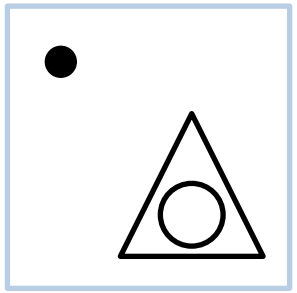
A



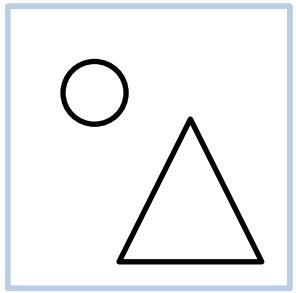
B



C



5



Systems
Thinking

Systems Thinking:

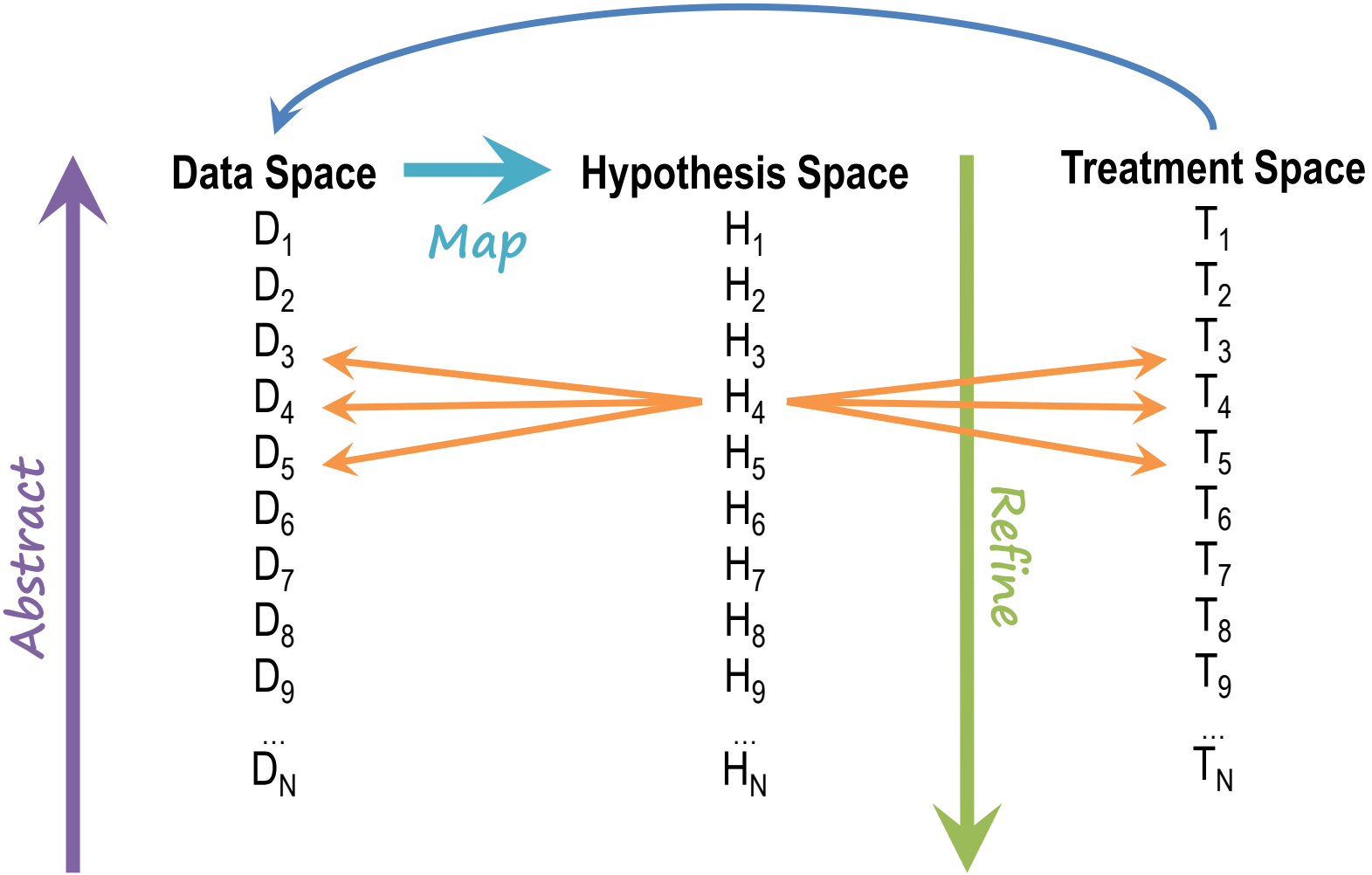
Reasoning about systems with numerous components and processes at multiple, potentially invisible, levels of abstraction.

Today, an extremely serious earthquake of magnitude 8.5 hit Lower Slabovia, killing 25 people and causing $500 million in damage. The President of Lower Slabovia said that the hard-hit area near the Sadie Hawkins fault has been a danger zone for years.

Today, the **President of Lower Slabovia killed 25** proposals totaling **$500 million** for research in **earthquake** prediction. Our Lower Slabovian correspondent calculates that **8.5** research proposals are rejected for every one approved. There are rumors that the President's science advisor, **Sadie Hawkins**, is at **fault**.

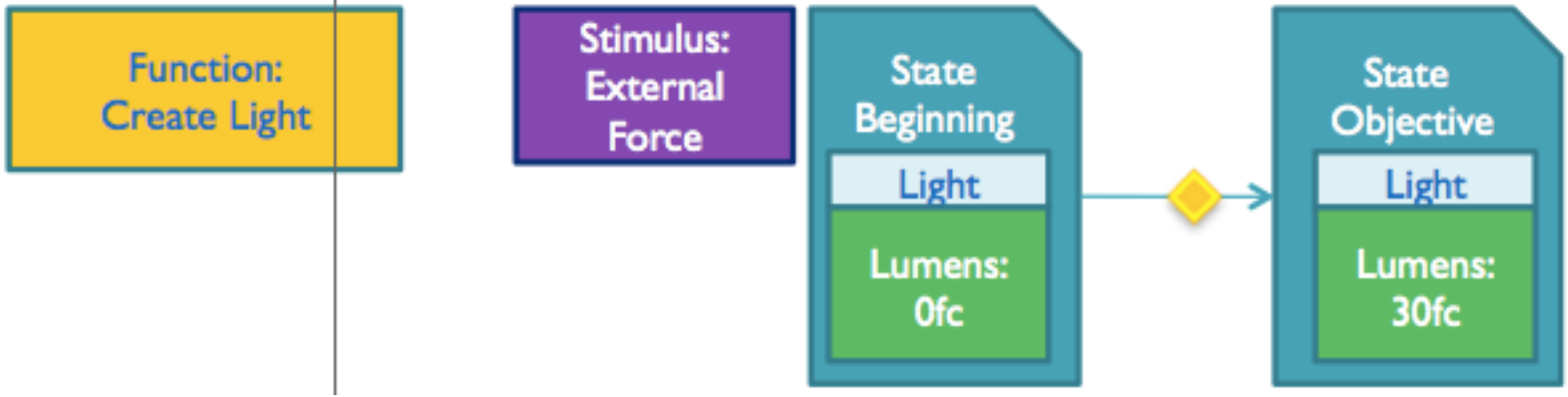
Restaurant Script

Script
script : restaurant
track : formal dining
props : tables, menu, check, money, F = food, P = place
roles : S = customer, W = waiter, C = cook, M = cashier, O = owner
entry : S is hungry, S has money
result : S has less money, O has more money, S is not hungry, S is pleased
scenes :

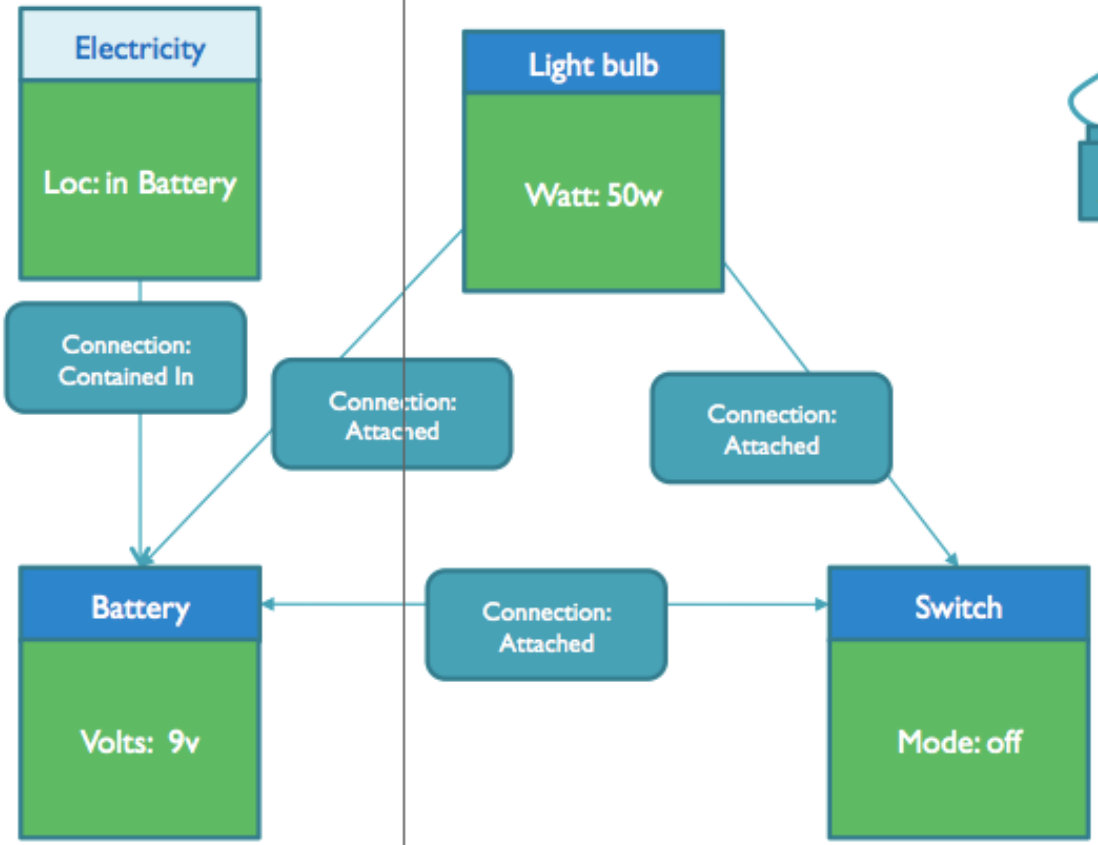

Data Space
Map
Hypothesis Space
Treatment Space
Abstract
Refine
D1
D2
D3
D4
D5
D6
D7
D8
D9
...
DN
H1
H2
H3
H4
H5
H6
H7
H8
H9
...
HN
T1
T2
T3
T4
T5
T6
T7
T8
T9
...
TN

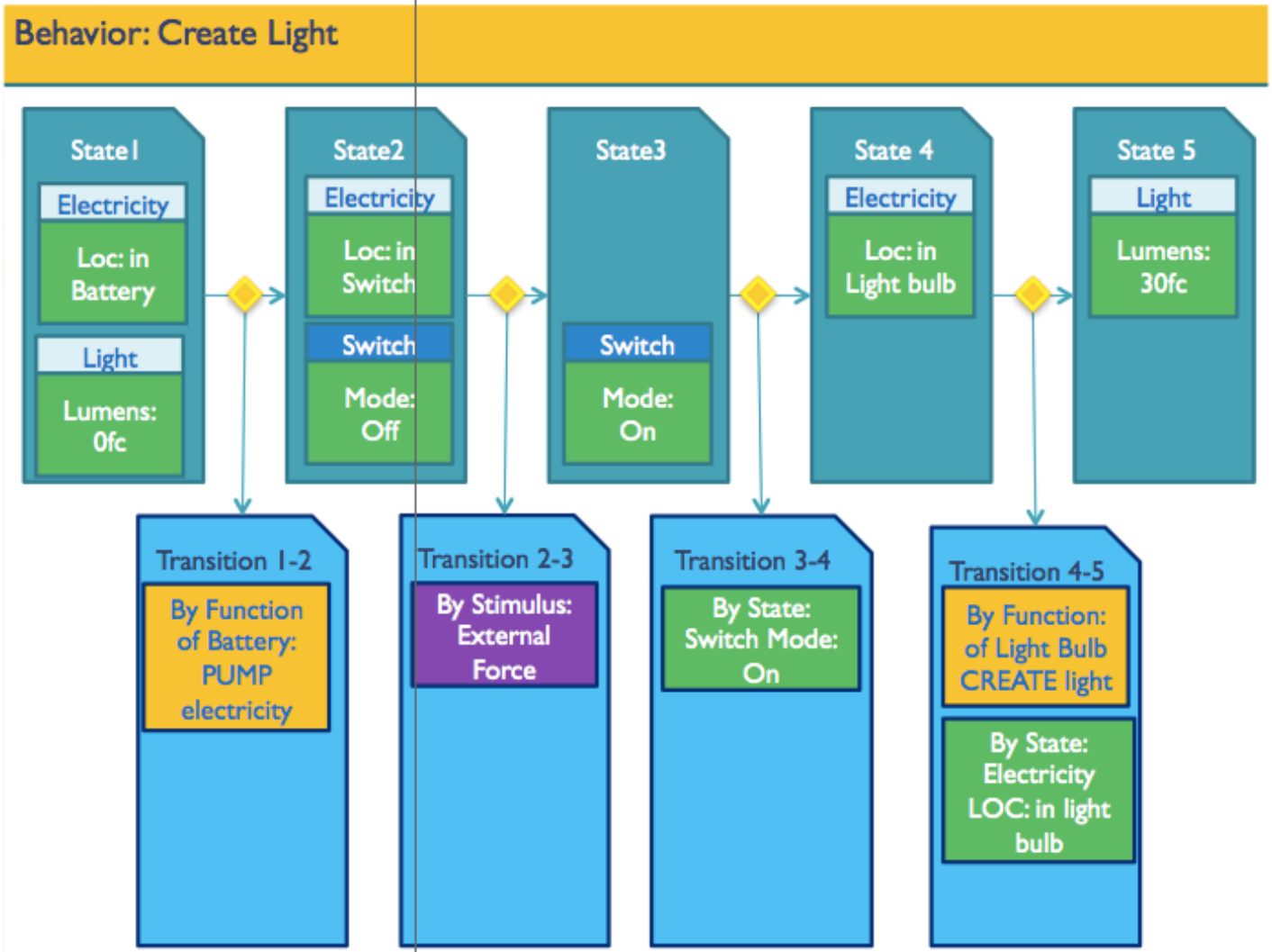
Function Models: Three Types

Light bulb circuit



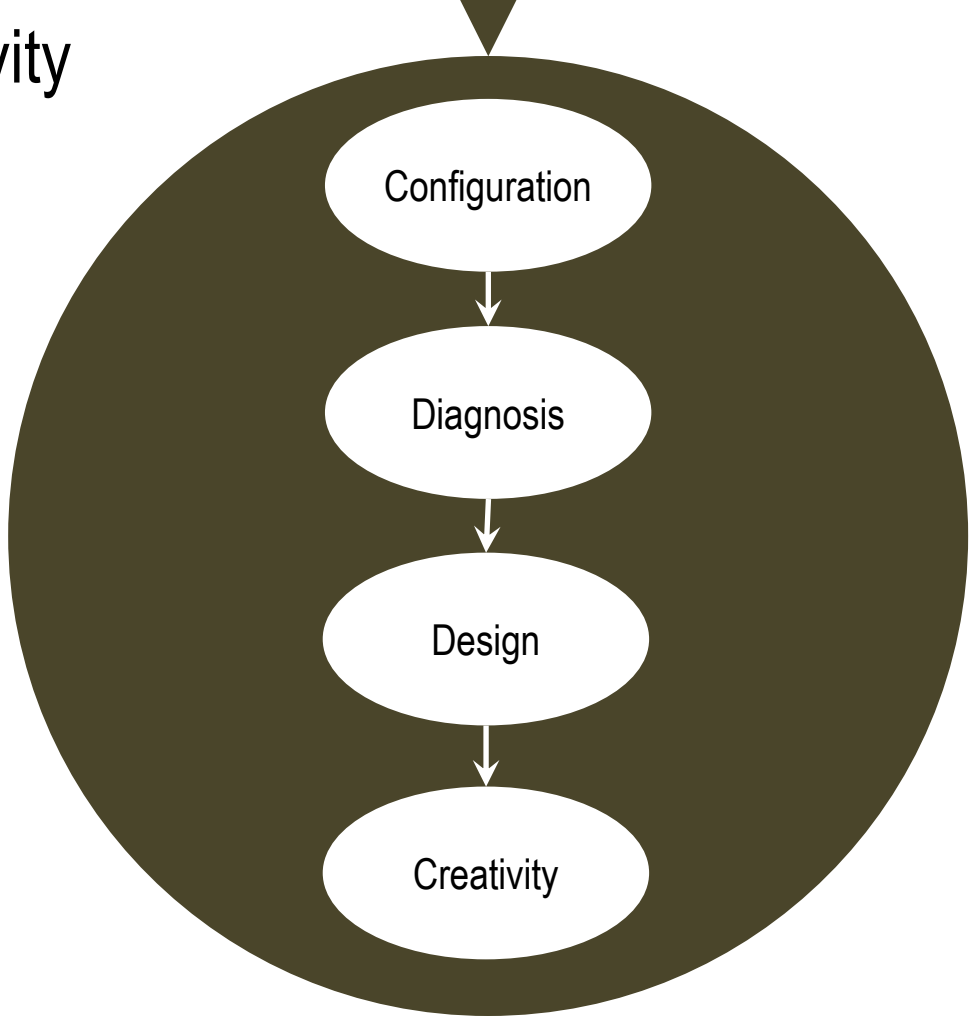
Structure Model: Light Circuit




Behavior: Create Light
State1
Electricity
Loc: in Battery
Light
Lumens: 0fc
State2
Electricity
Loc: in Switch
Switch
Mode: Off
State3
Switch
Mode: On
State 4
Electricity
Loc: in Light bulb
State 5
Light
Lumens: 30fc
Transition 1-2
By Function of Battery: PUMP electricity
Transition 2-3
By Stimulus: External Force
Transition 3-4
By State: Switch Mode: On
Transition 4-5
By Function: of Light Bulb CREATE light
By State: Electricity LOC: in light bulb

Design

Design & Creativity



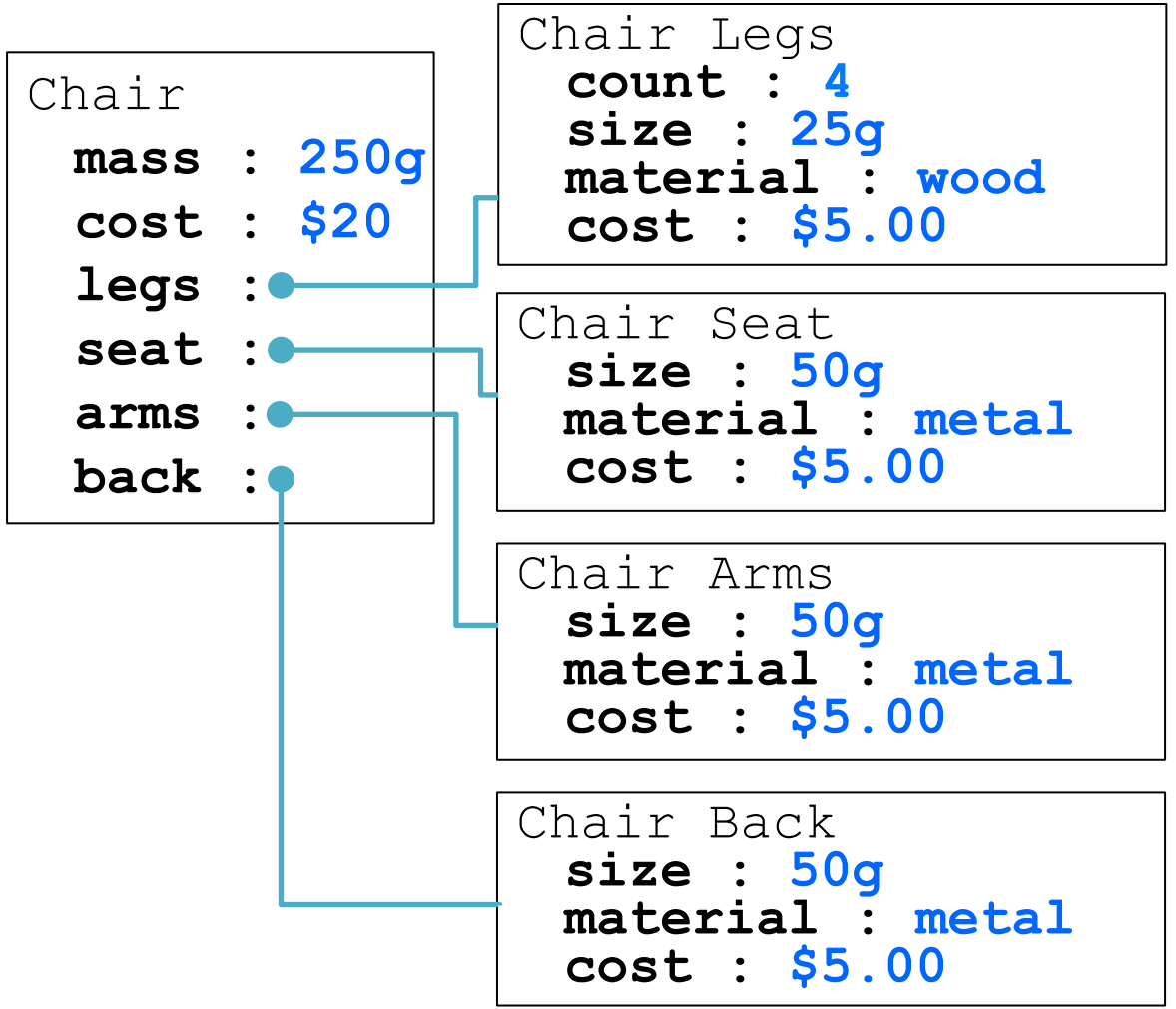
Design Thinking:

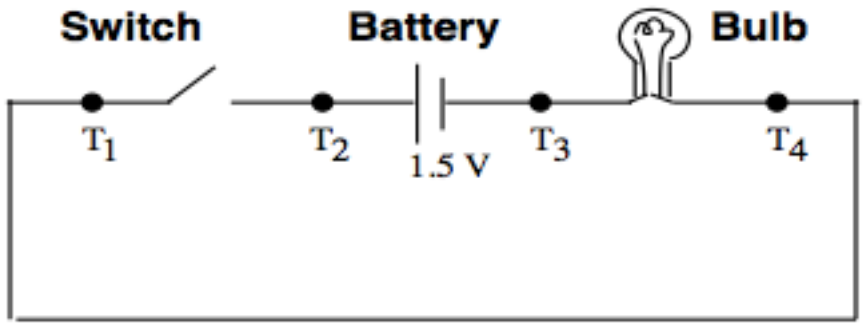
Reasoning about ill-defined, unconstrained, open problems that are situated in the world.

Order:
A chair that weighs over 200g, costs at most $20 to make, and has 4 legs.

Materials Table

Material	Cost per gram
Plastic	$0.01
Wood	$0.05
Metal	$0.10




Switch
Battery
Bulb
T1
T2
1.5 V
T3
T4

DESIRED DESIGN:

GIVEN:

?SUB
?prop1: ?val12

MAKES:

?SUB
?prop1: ?val22

BY-BEHAVIOR: Behavior B2

CANDIDATE DESIGN:

GIVEN:

?SUB
?prop1: ?val11

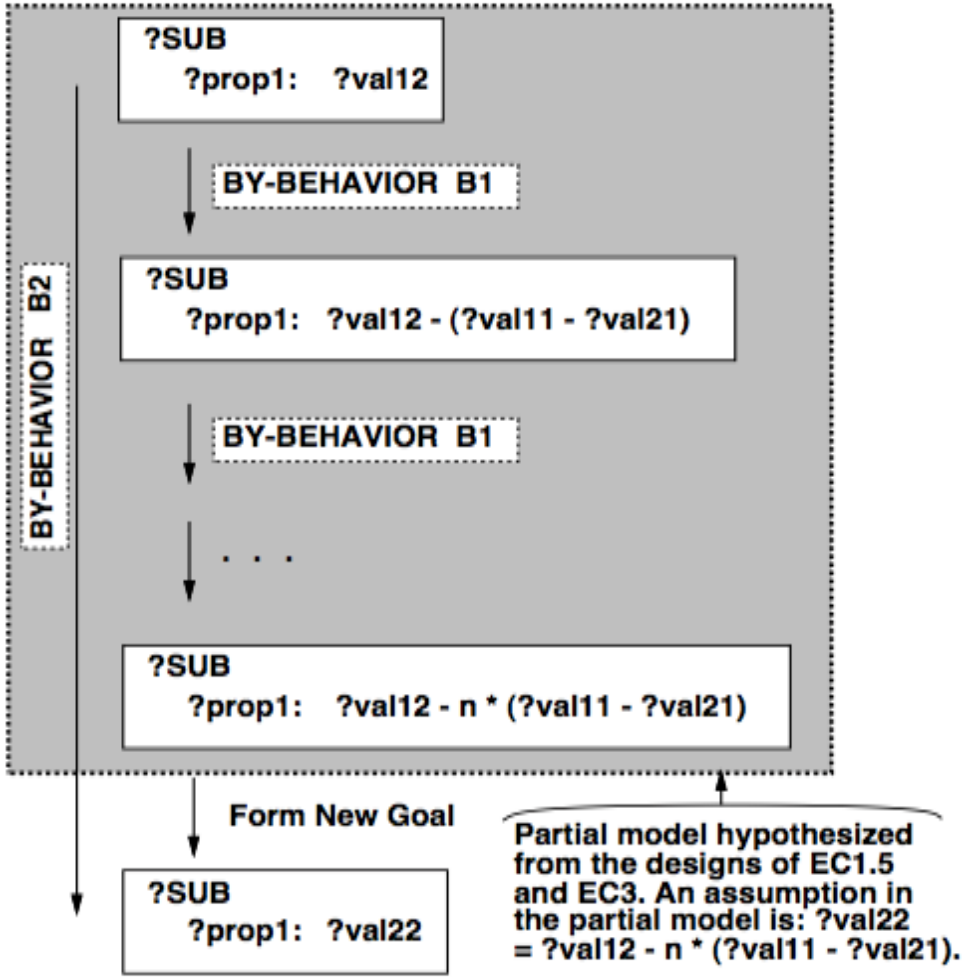
MAKES:

?SUB
?prop1: ?val21

BY-BEHAVIOR: Behavior B1

CONDITION:

?val22 ~ ?val12 >> ?val21 ~ ?val11



Creativity

What is creativity?

A non-obvious, desirable product.

Please also post your answer on the class forum.

Something is creative if it is...

- Novel
- Valuable
- Unexpected

Some other processes of creativity:

- Emergence
- Re-representation
- Serendipity

For each of the following tasks, mark the box if successful completion of a task would mean that the agent is creative.

- Performing well on Raven's Progressive Matrices
- Solving the stacked blocks problem
- Configuring a chair based on input parameters
- Diagnosing an illness in a patient
- Designing a route to a new destination
- Correctly classifying new types of animals
- Using a chair to prop open a door
- Deciding between multiple strategies for a problem
- Designing a new car based on a new fuel source

Do you agree with David's assessment that none of these results are creative because we can trace through the underlying process that led to them?

- Yes, because in order for a result to be creative, it must be novel, and output of an algorithm cannot be novel.
- Yes, because given a set of input, the output will always be the same; therefore, the product can never be unexpected.
- No, because it defines creativity in terms of the output rather than the process.
- No, because under this definition, humans are only considered creative because we don't know how the brain works yet.

AI Ethics

Visuospatial Reasoning:
Reasoning wherein causality is, at most, implicit.