

# Using a “Ladder of Engagement” as a Template for Guiding Student Activities with Systems Thinking and Dynamic Modeling

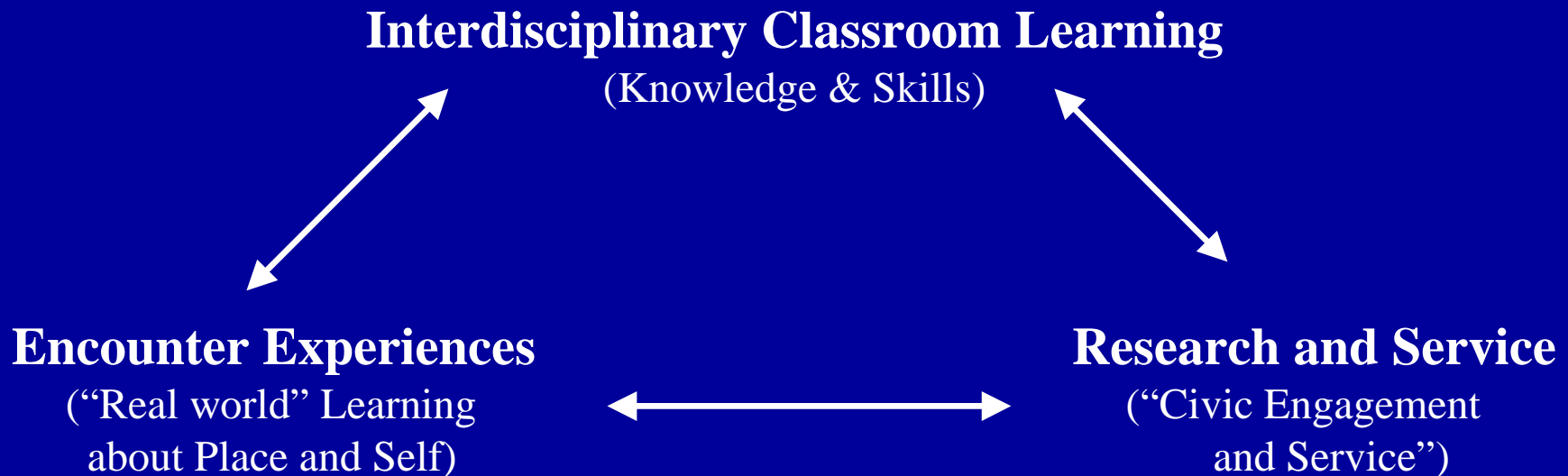
**John F. Heinbokel, P. Jeffrey Potash, &  
Robert A. Skiff, Jr.**

Center for System Dynamics, The Vermont Commons School  
75 Green Mountain Dr., South Burlington, VT 05403

Systems Thinking & Dynamic Modeling  
2 July 2004

# Introduction: To Us at the VT Commons School

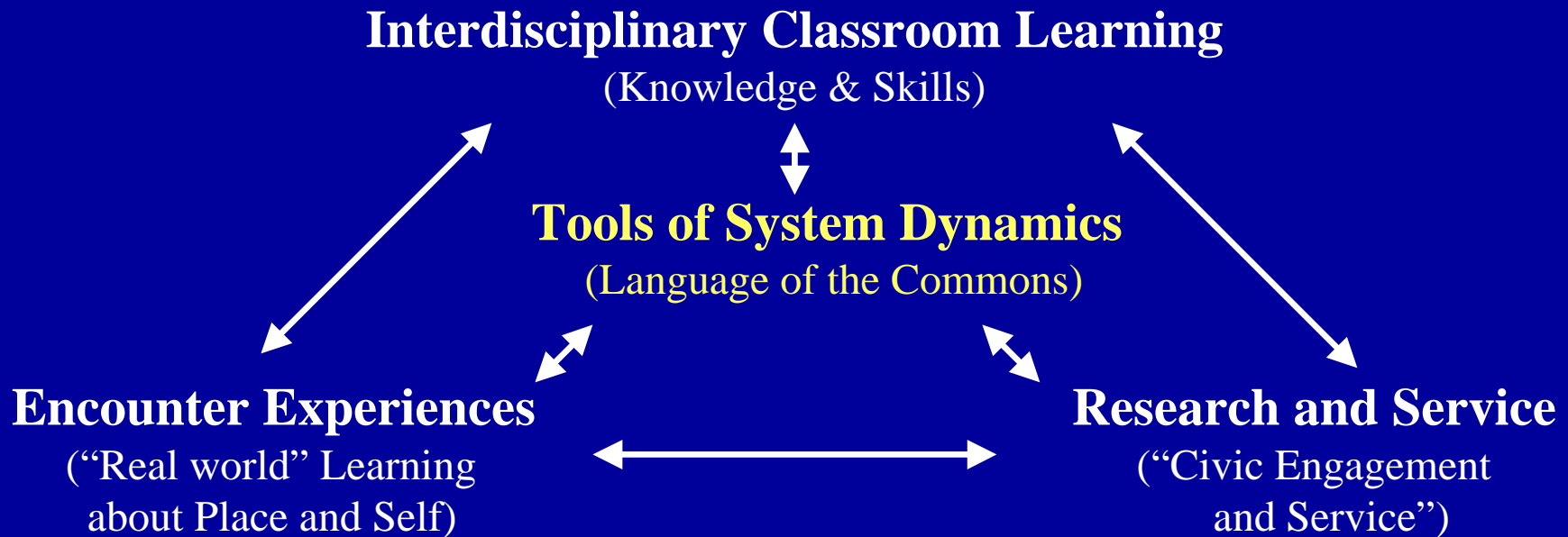
**VCS Mission: Provide a vision of education crossing traditional boundaries & developing ecological citizenship; empowering students with knowledge, character, skill, & moral vision necessary to become responsible, pro-active members of the world community.**



**Vermont Common School: Model for “Systemic” Student Learning**

# Introduction: To Us at the VT Commons School

Fall 2001: Center For System Dynamics at VCS, to develop & apply tools of system dynamics (ST & DM) as “*language of the commons*” to support the systemic education of its students and its community.



**Vermont Common School: Model for “Systemic” Student Learning**

## Introduction: Defining a Purpose and Focus

Richmond (2001, 2002):

**“systems thinking”** + **“systems being”**

Filtering Skills

Expanded Self-boundary

Representing Skills

Empathy

Simulating Skills

Excellent Communication

Respect

= **“systems citizen”**

## Introduction: Defining a Purpose and Focus

### Pulling More Threads Together:

Richmond (2001, 2002): “systems thinking” + “systems being”  
= “systems citizen”

Forrester (1994): “outlook and personality” to confidently  
create a future

Brown (1990’s ?): “the power’s in the feedback and the  
feedbacks are always interdisciplinary”

Some of us mortals (various dates): “learner directed learning,”  
“ask better questions,” “there is a free lunch,”  
etc, etc, etc, etc, .....

**BUT ...**

**How to operationalize Barry (et al)’s vision of systems citizenry?**

# Introduction: Mapping the “Design Space”

## LADDER OF ENGAGEMENT

### INFLUENCE

Can I (or can we) devise a better policy to affect the behavior of the system and communicate effectively to convince others of its power? Do I (we) wish to?

### UNDERSTANDING

Do I (or do we together) understand how systemic structures (e.g. feedbacks and delays) control the way the system behaves?

### KNOWLEDGE

Do I (or do we collectively) know how the System “behaves”?

# Introduction: Mapping the “Design Space”

## LEVELS OF COMPLEXITY

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Simple  
(sentence)

### INFLUENCE

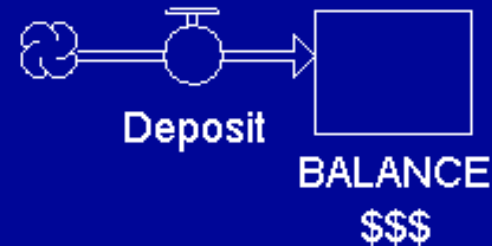
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*“Deposits add to my account balance.”*

# Introduction: Mapping the “Design Space”

## LEVELS OF COMPLEXITY

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(sentence)

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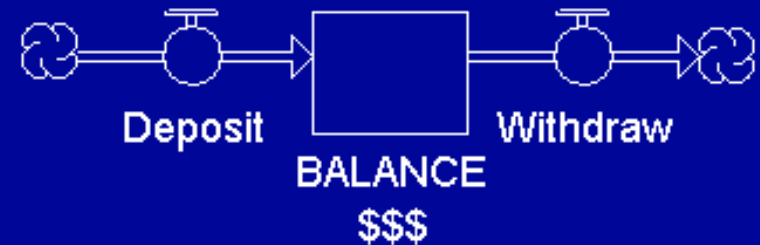
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*“Deposits add to my account, and withdrawals deplete it.”*

# Introduction: Mapping the “Design Space”

## LEVELS OF COMPLEXITY

Simple  
(sentence)

### INFLUENCE

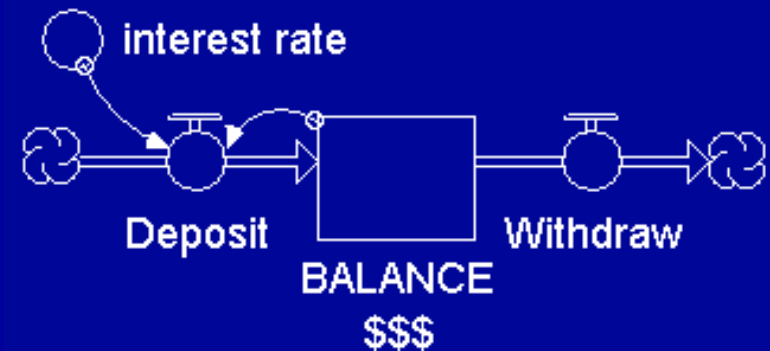
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### UNDERSTANDING

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*“Interest, acting in a compounding fashion, adds to my balance; while withdrawals deplete it.”*

# Introduction: Mapping the “Design Space”

## LEVELS OF COMPLEXITY

Simple  
(sentence)

Intermediate  
(paragraph)

LADDER OF ENGAGEMENT

### INFLUENCE

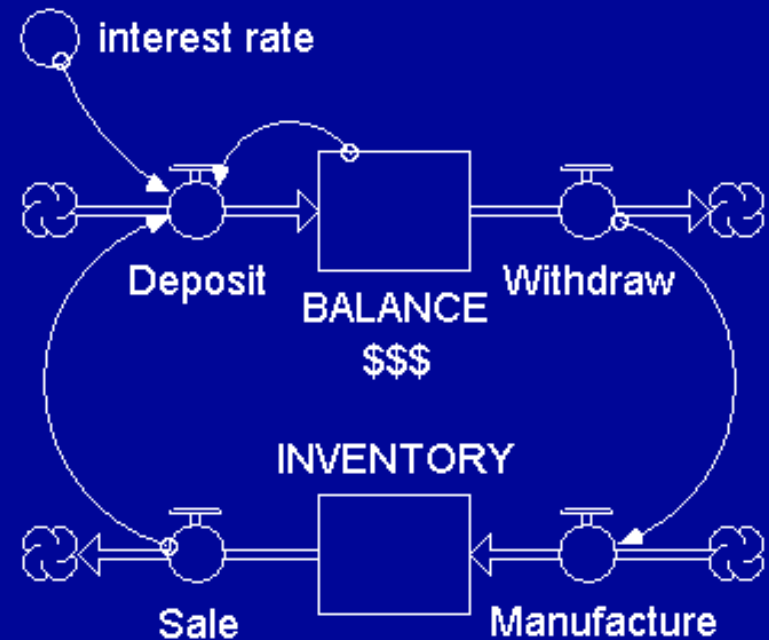
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# Introduction: Mapping the “Design Space”

## LEVELS OF COMPLEXITY

Simple (sentence)	Intermediate (paragraph)	Complex (story → 3-sector richness)
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### INFLUENCE

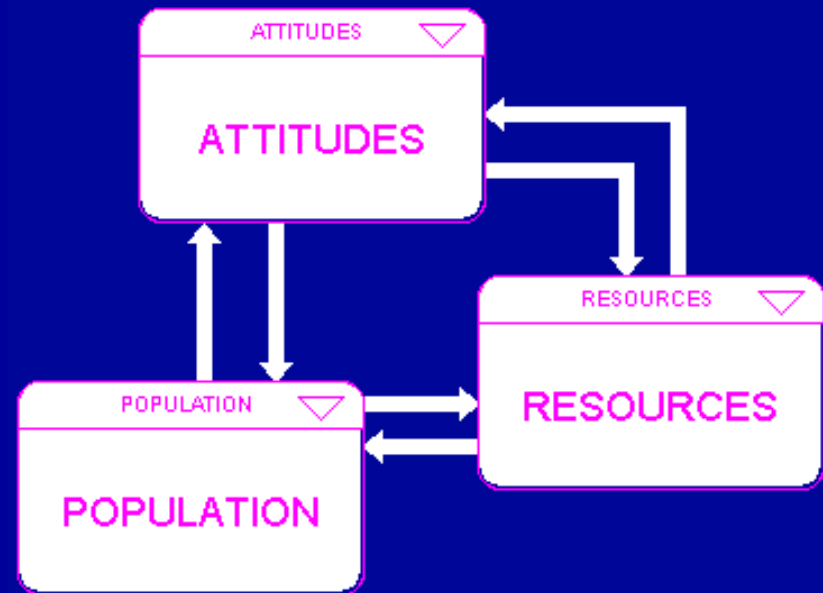
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LADDER OF ENGAGEMENT

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## LEVELS OF COMPLEXITY

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LADDER OF ENGAGEMENT

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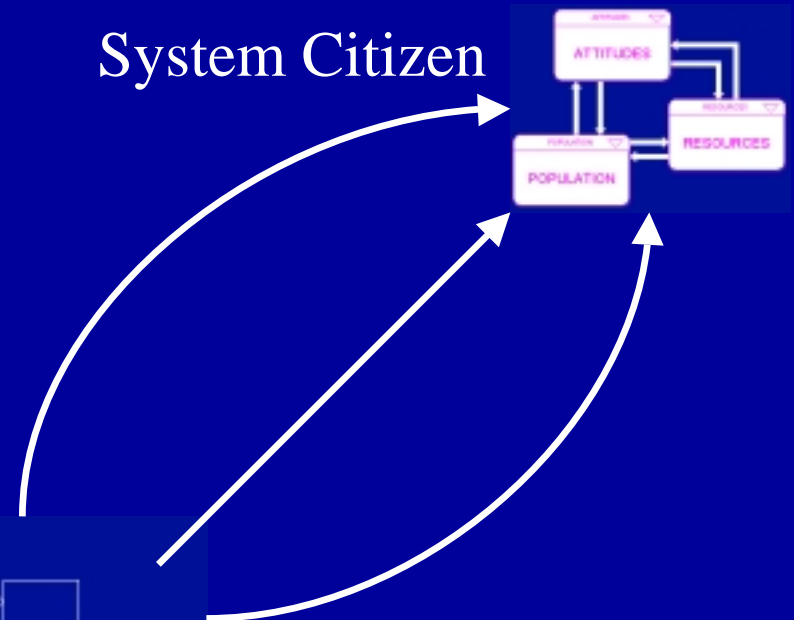
### KNOWLEDGE

Do I (or do we collectively) know how the System “behaves”?

System Citizen



Rookie



## Introduction:

### LEVELS OF COMPLEXITY

Simple  
(sentence)

Intermediate  
(paragraph)

Complex  
(story →  
3-sector richness)

LADDER OF ENGAGEMENT

#### INFLUENCE

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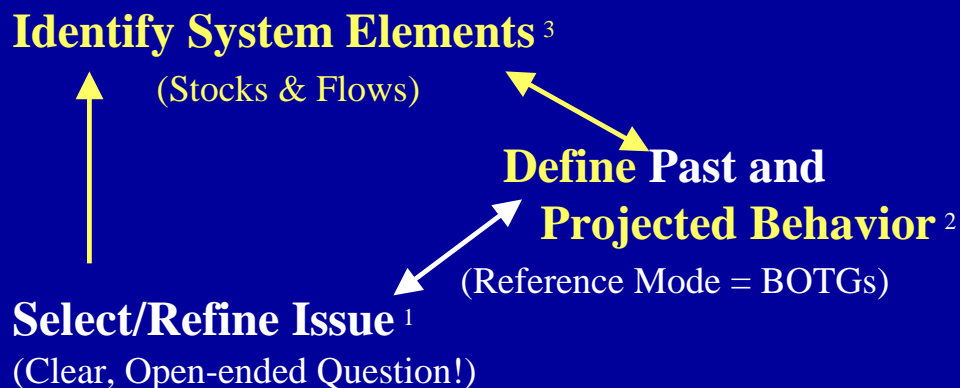
#### KNOWLEDGE

Do I (or do we collectively) know how the System “behaves”?

### Preview the Punchlines:

1. Iterative – Many Times!
2. Partial – OK!
3. Learning Curve –  
Self-Reinforcing!
4. Many Pathways!  
(Basically UP & RIGHT)
5. Focus on BETTER ?’s!

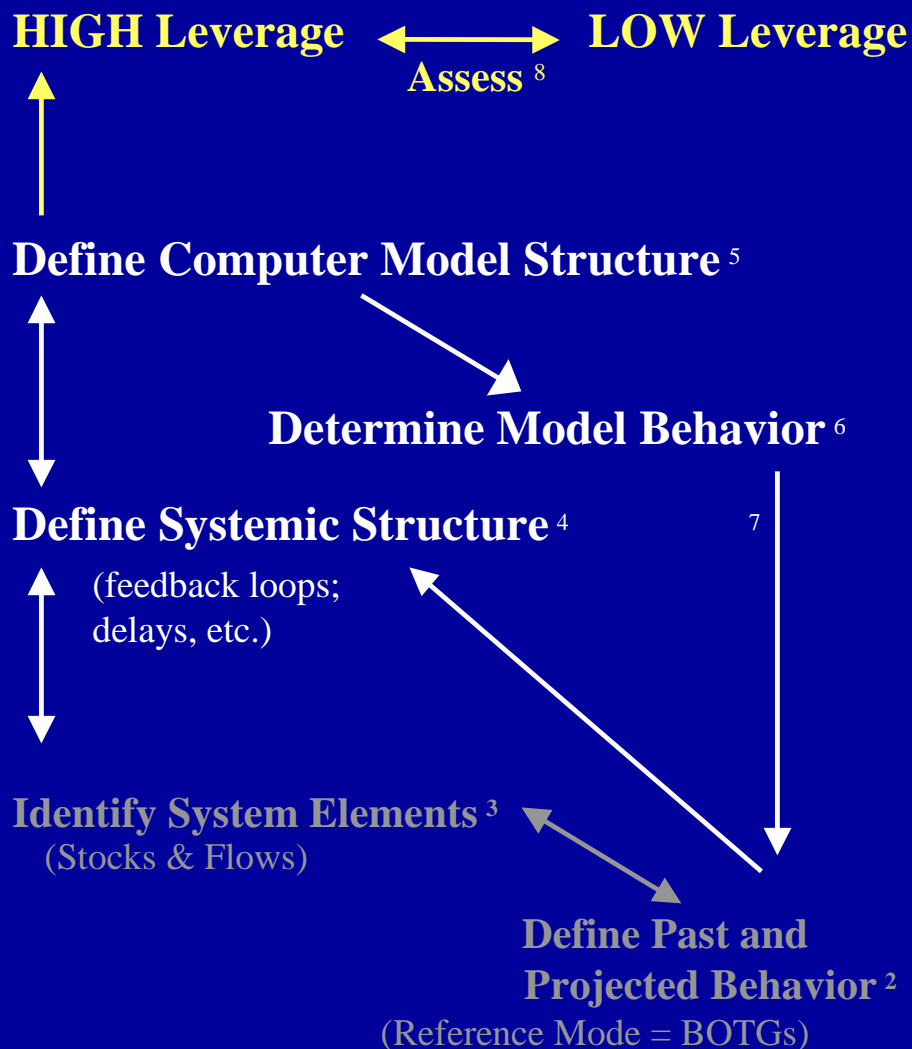
## Ladder of Engagement



## KNOWLEDGE

- What is the system of interest & what is its “problem” that concerns us?
- How has the system “behaved” in the past?
- What stocks and associated flows are likely to be important? (Revisit “Past Behavior”?)
- How do we project those elements will behave in the future?

# Ladder of Engagement



## UNDERSTANDING

- What reinforcing and stabilizing feedback loops control the flows?
- Are there delays in material or information flow that are important?
- Do these structures generate the historical behaviors?
- Can we identify places (leverage) in the structure where the behavior can be readily affected?

## KNOWLEDGE

# Ladder of Engagement



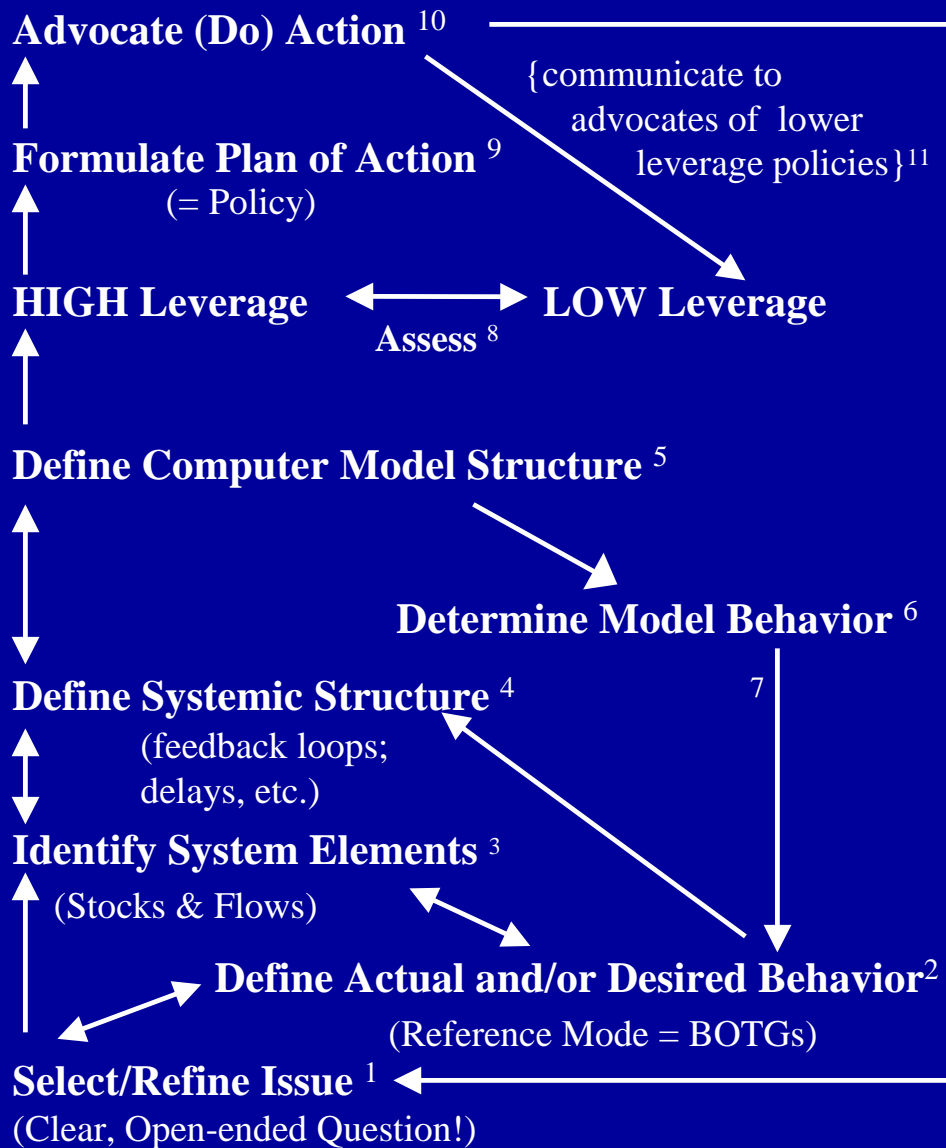
## INFLUENCE

- Can we understand leverage points to identify effective policies?
- Can we demonstrate that other policies represent low leverage?
- How do we best use these systemic insights to communicate with others to advocate those effective policies?
- **As we affect the system, do we revisit the original issue definition?**



## UNDERSTANDING

## KNOWLEDGE



## Ladder of Engagement

**INFLUENCE**

**UNDERSTANDING**

**KNOWLEDGE**

# Illustrating the “Ladder of Engagement” Easter Island

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**Story of Easter Island:**

**What do we know?**

**Why do we care?**

**What’s the ‘problem’ to be ‘solved’?**

# Illustrating the “Ladder of Engagement” Easter Island

**What “feel” like the important elements?**

**people; food (sweet potatoes, chickens, dolphins, palms, sea birds, etc); statues; competition; trees; war/cannibalism; divine favor**

**Story of Easter Island:**

**What do we know?**

**Why do we care?**

**What’s the ‘problem’ to be ‘solved’?**

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# Illustrating the “Ladder of Engagement” Easter Island

I |  
U |  
**Can we pick one specially important element and agree on  
*what* happened? At least to start with ...?**

**Doesn't the human  
population make  
sense?**

**K** What “feel” like the important elements?

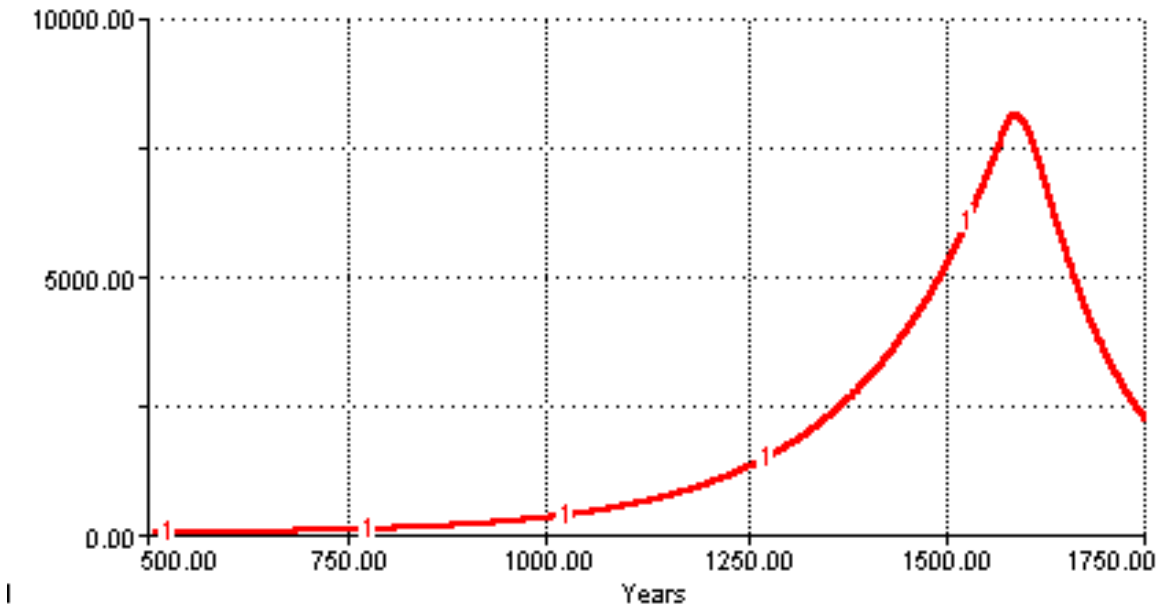
Story of Easter Island:

# Illustrating the “Ladder of Engagement” Easter Island

Can we pick one specially important element and agree on *what* happened? At least to start with ...?

Doesn't the human population make sense?

EASTER ISLAND POPULATION:



What “feel” like the important elements?

Story of Easter Island:

I

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# Illustrating the “Ladder of Engagement” Easter Island

Can we depict that dynamic with a Stock & Flow structure?

Can we pick one specially important element and agree on *what* happened?

What “feel” like the important elements?

Story of Easter Island:

I

U

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# Illustrating the “Ladder of Engagement” Easter Island

**Can we depict that dynamic with a Stock & Flow structure?**

**What would be the “stock”?**

**POPULATION** is what  
accumulates!

**NOW, what causes population  
to grow or shrink?**

Can we pick one specially important element and agree on *what* happened?

What “feel” like the important elements?

Story of Easter Island:

EASTER ISLAND  
POPULATION



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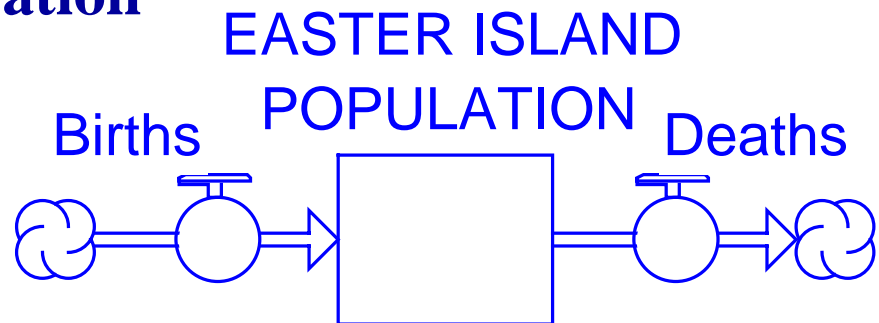
# Illustrating the “Ladder of Engagement” Easter Island

Can we depict that dynamic with a Stock & Flow structure?

What causes population to grow or shrink?

“Births” & “Deaths”

(story suggests that migration  
is pretty trivial!)

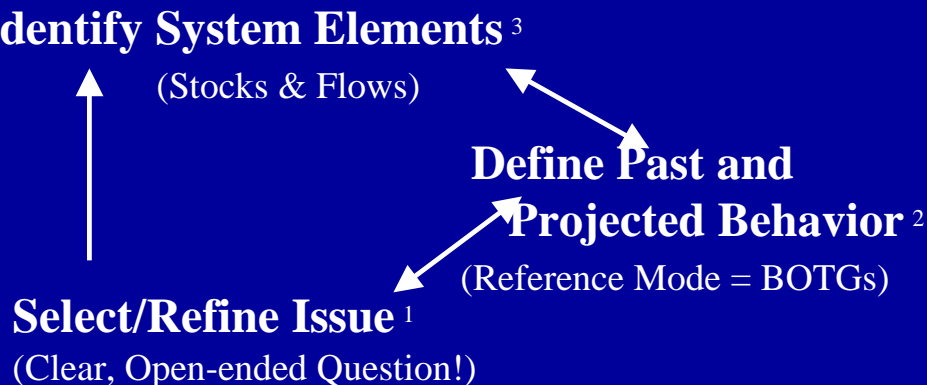


Can we pick one specially important element and agree on *what* happened?

What “feel” like the important elements?

Story of Easter Island:

# Ladder of Engagement from an Easter Island Perspective



## KNOWLEDGE

- What is the system of interest & what is its “problem” that concerns us?
- How has the system “behaved” in the past?
- What stocks and associated flows are likely to be important? (Revisit “Past Behavior”?)
- How do we project those elements will behave in the future?

# Illustrating the “Ladder of Engagement” Easter Island

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That pretty well wraps up the pass through the  
“KNOWLEDGE” portion of the exercise –

at least the **FIRST** pass through.

K

Can we depict that dynamic with a Stock & Flow structure?

Can we pick one specially important element and agree on *what* happened?

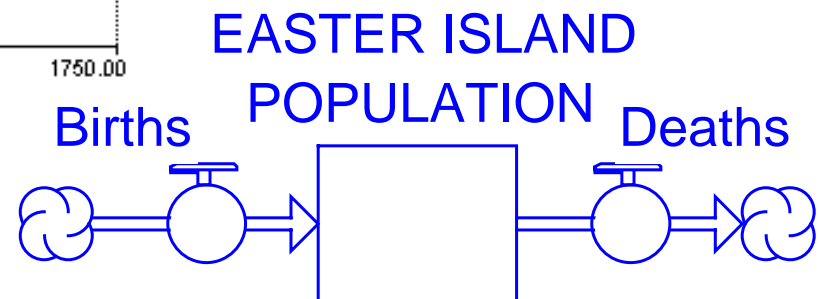
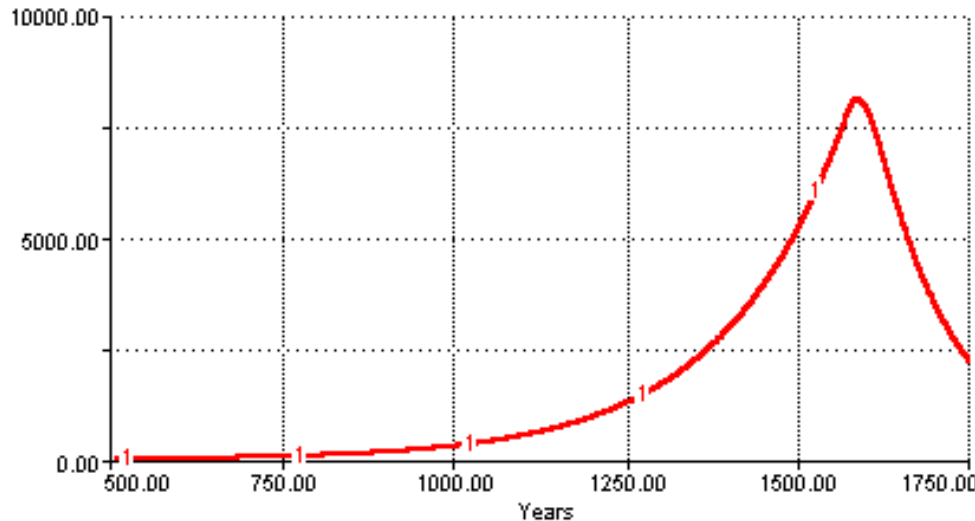
What “feel” like the important elements?

Story of Easter Island:

# Illustrating the “Ladder of Engagement” Easter Island

What controls the births and deaths that drive the population “behavior” that we anticipate?

EASTER ISLAND POPULATION:



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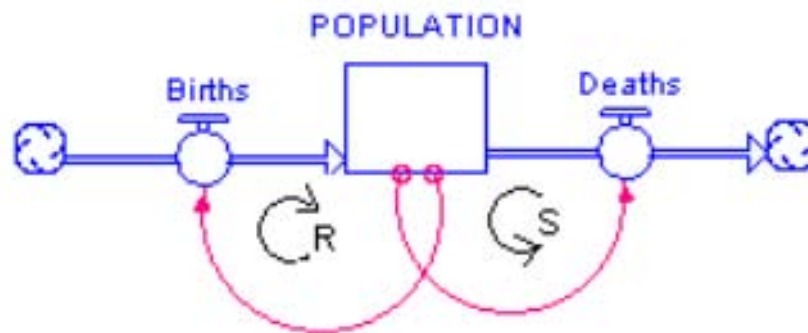
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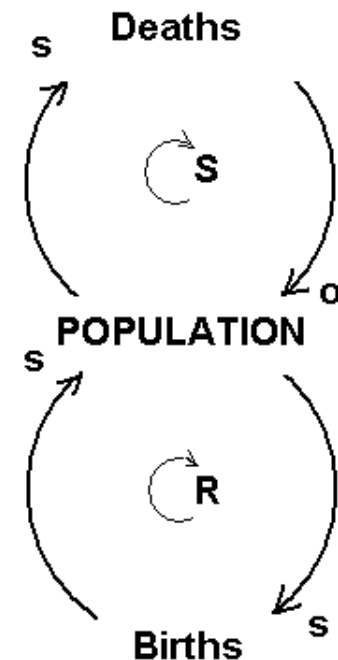
# Illustrating the “Ladder of Engagement” Easter Island

What controls the births and deaths that drive the population “behavior” that we anticipate?

Perhaps simplest, wouldn't we expect births & deaths to be compounding functions of the population itself?



Does that structure produce the behavior we are seeking?



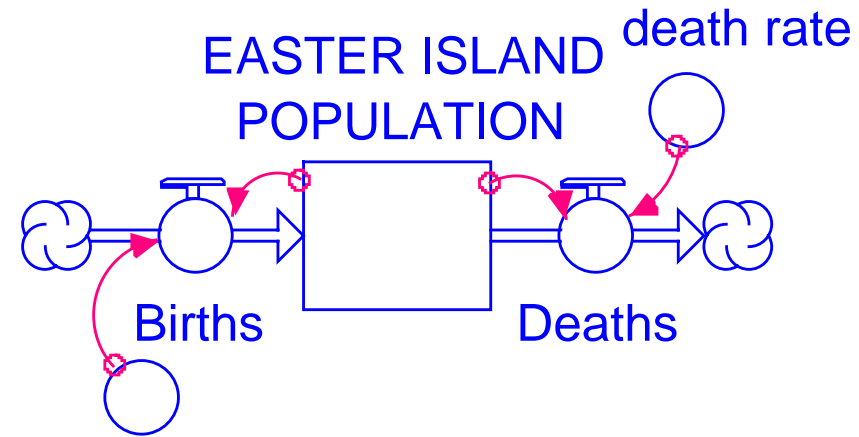
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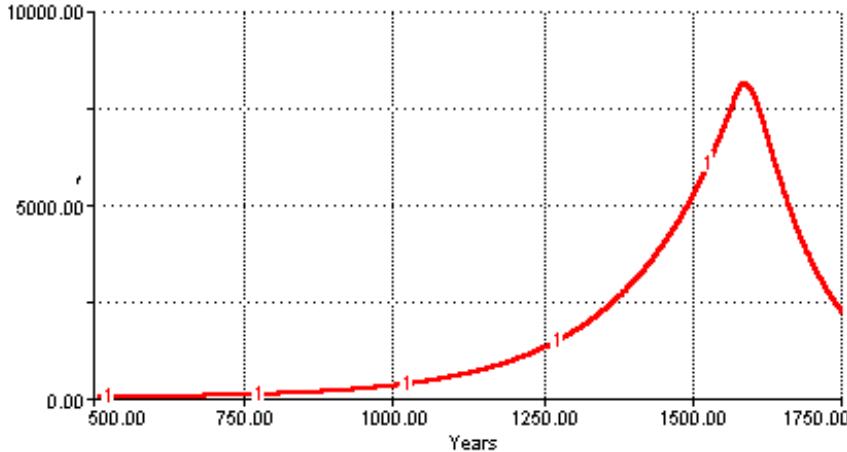
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# Illustrating the “Ladder of Engagement” Easter Island

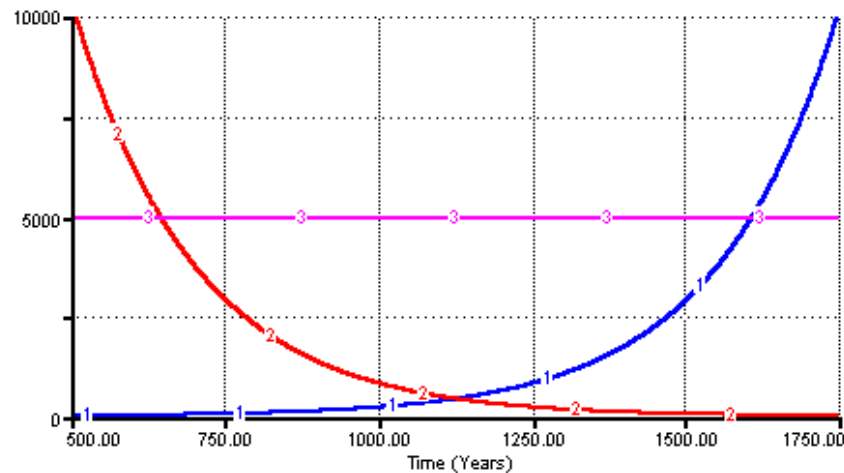
Does this simple structure produce the behavior we are seeking?



EASTER ISLAND POPULATION:



EASTER ISLAND POPULATION: 1 - 2 - 3 -

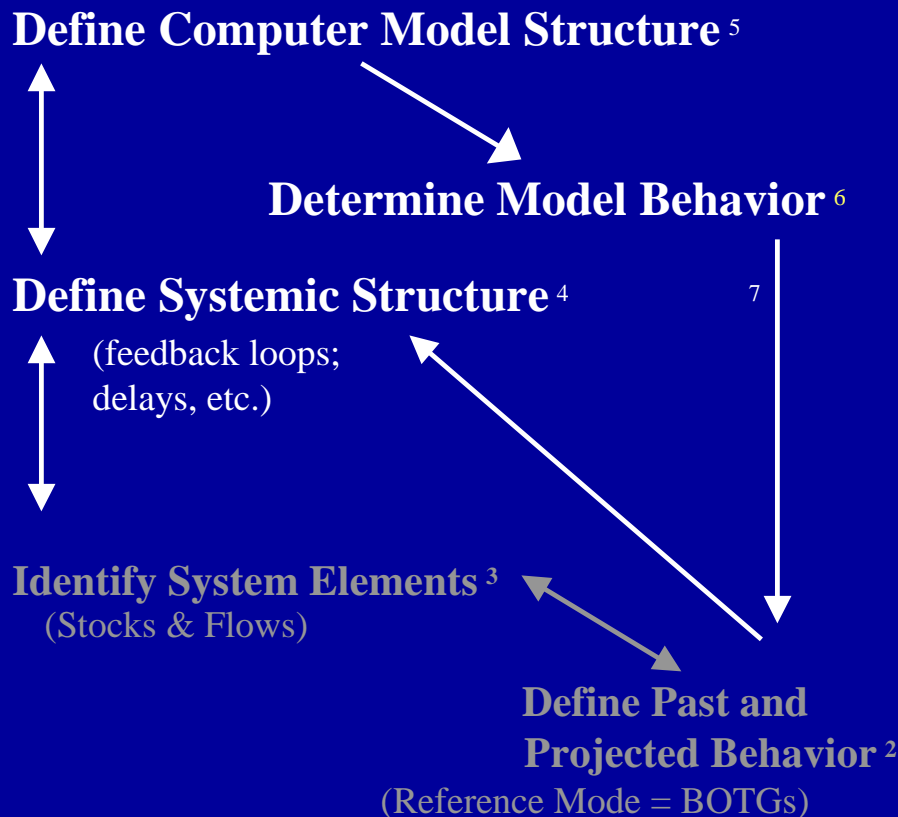


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# Ladder of Engagement from an Easter Island Perspective



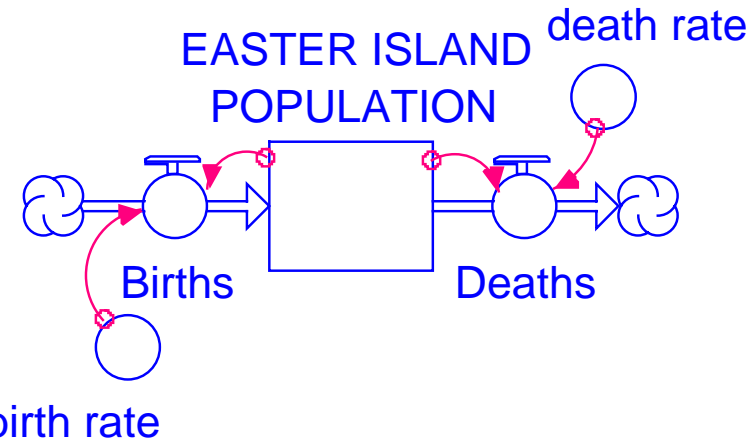
## UNDERSTANDING

- What reinforcing and stabilizing feedback loops control the flows?
- Are there delays in material or information flow that are important?
- Do/can these structures generate the historical behaviors?

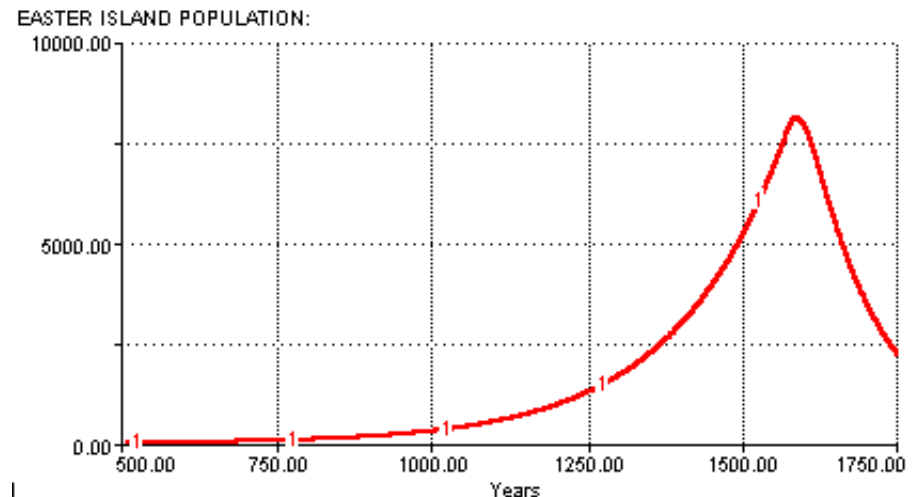
## KNOWLEDGE

# Illustrating the “Ladder of Engagement” Easter Island

**I** | If simple compounding doesn't  
do the trick, what else might  
we need to consider?

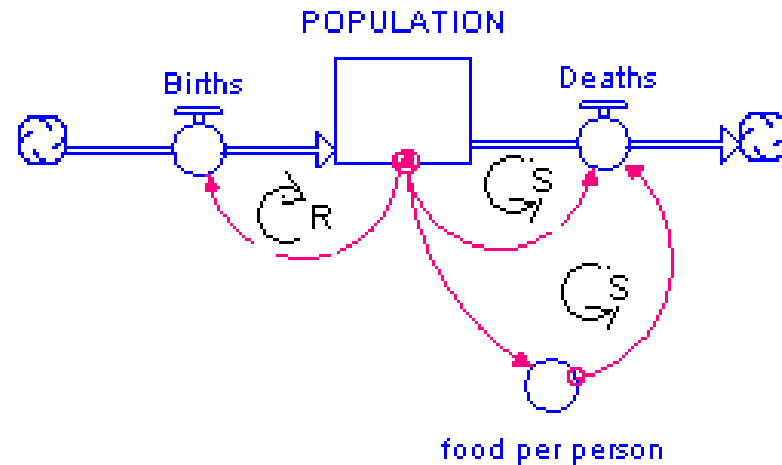
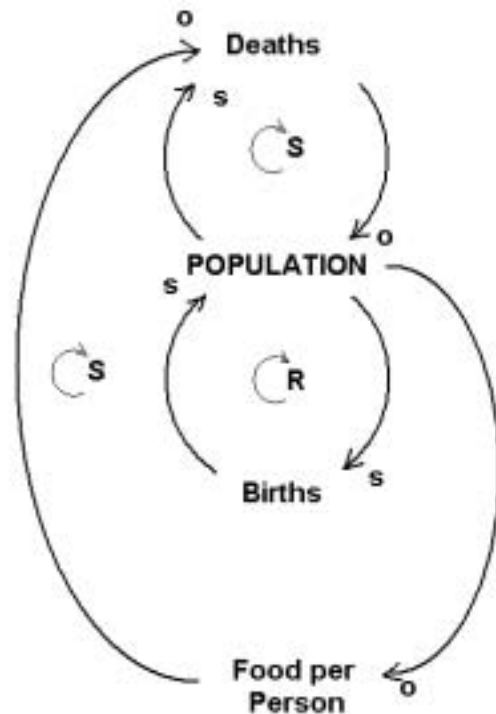


**U** | Why would births and  
deaths switch dominance?  
What would control that  
switch?



# Illustrating the “Ladder of Engagement” Easter Island

What controls the births and deaths that drive the population “behavior” that we anticipate?  
What about food limitation?



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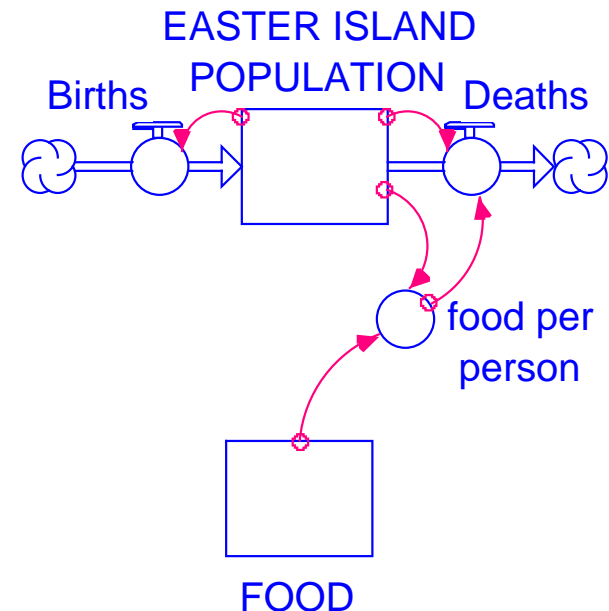
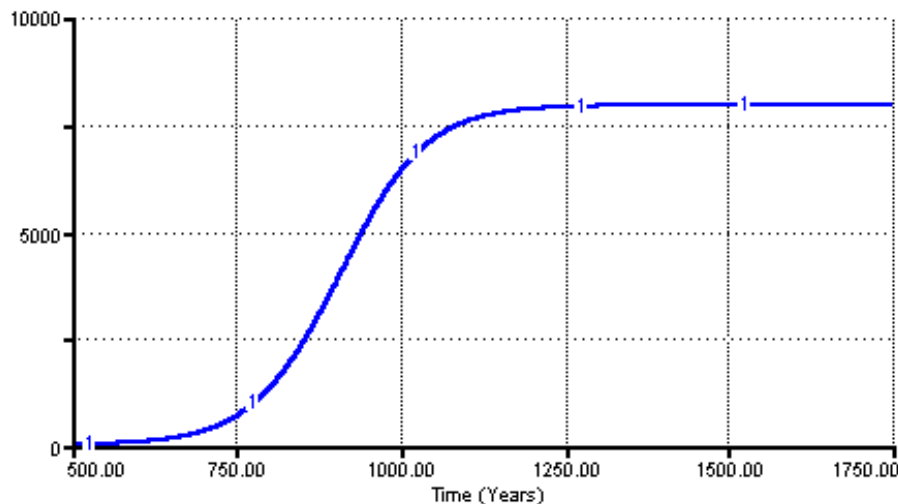
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# Illustrating the “Ladder of Engagement” Easter Island

How do we incorporate “food limitation”?

If the food produced is constant, the behavior we get is:

EASTER ISLAND POPULATION: 1 -



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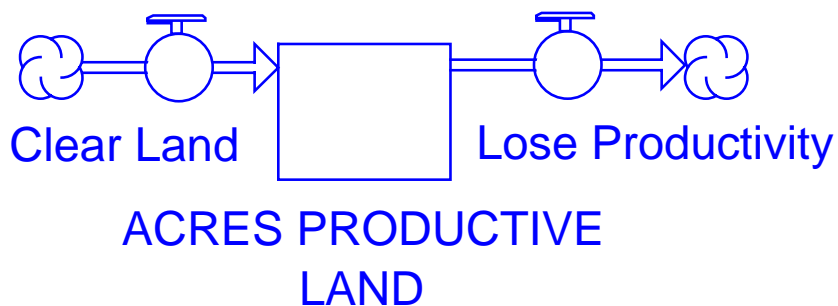
K

# Illustrating the “Ladder of Engagement” Easter Island

That suggests that food production is not constant.

How could/should we think about food production?

We cycled back to “KNOWLEDGE” to identify “Acres Productive Land” as a key factor in the story, controlling food supply.



How does this strand connect to the population structure?

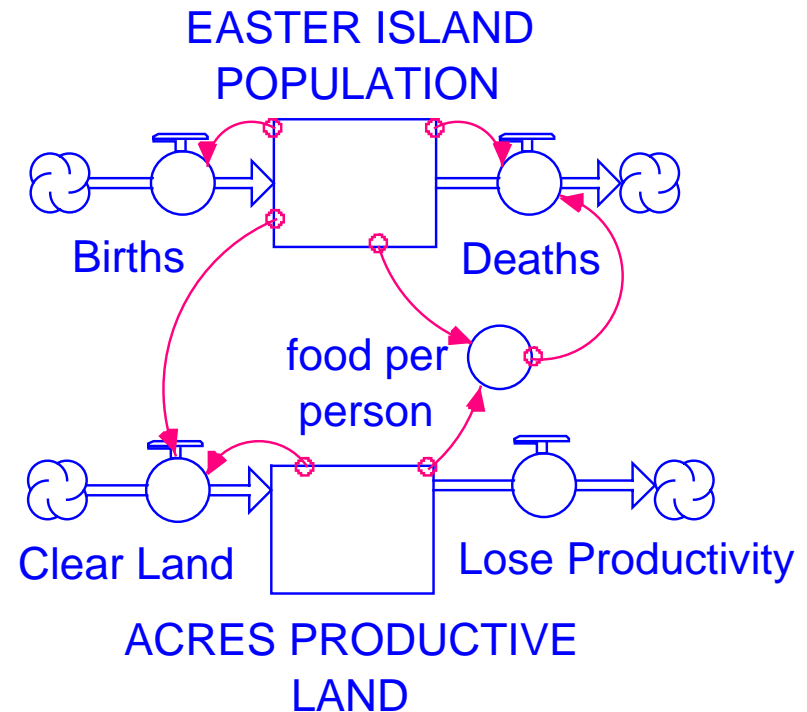
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# Illustrating the “Ladder of Engagement” Easter Island

How does this strand connect to the population structure?



I

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# Mapping the “Design Space” from an Easter Island Perspective

## LEVELS OF COMPLEXITY

Simple (sentence)	Intermediate (paragraph)	Complex (story → 3-sector richness)
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System Citizen

### INFLUENCE

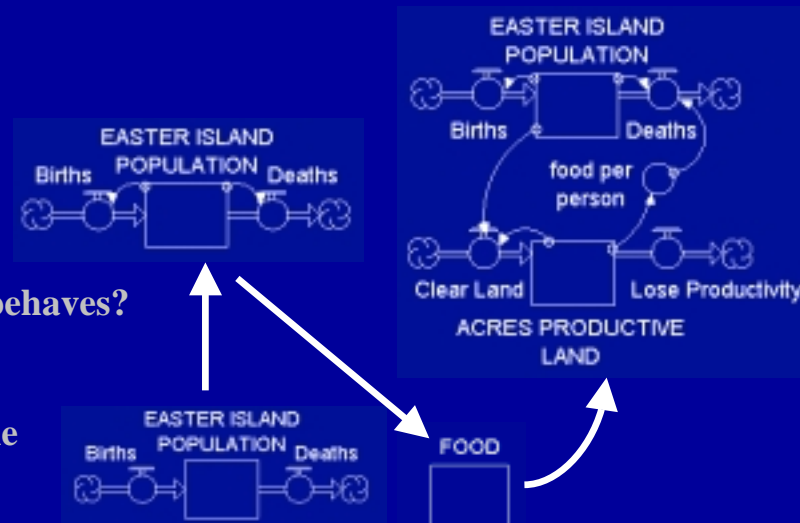
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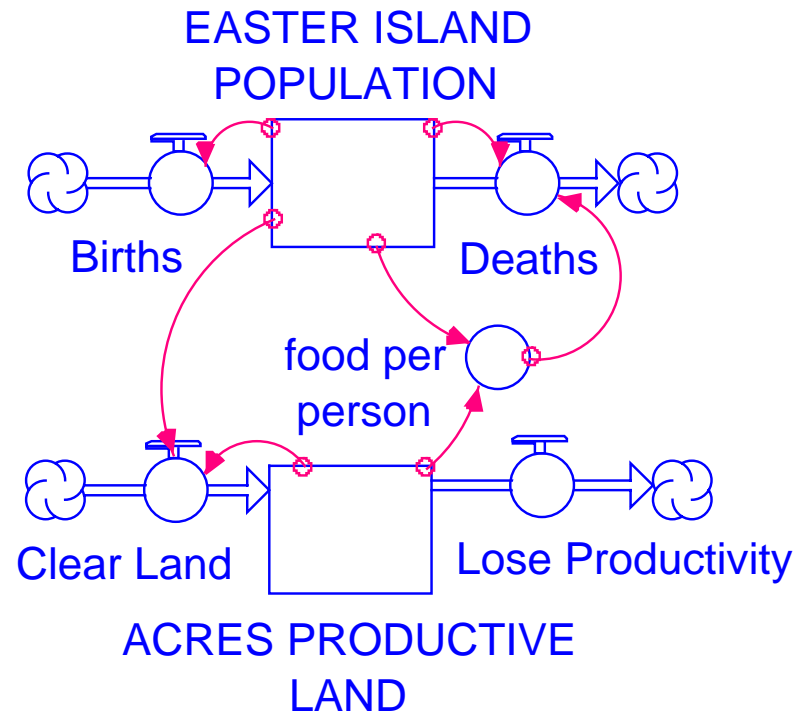


Rookie

LADDER OF ENGAGEMENT

# Illustrating the “Ladder of Engagement” Easter Island

**How does this strand connect to the population structure?**



**But does that just demand an answer to the question: “what causes land to lose productivity?”**

I

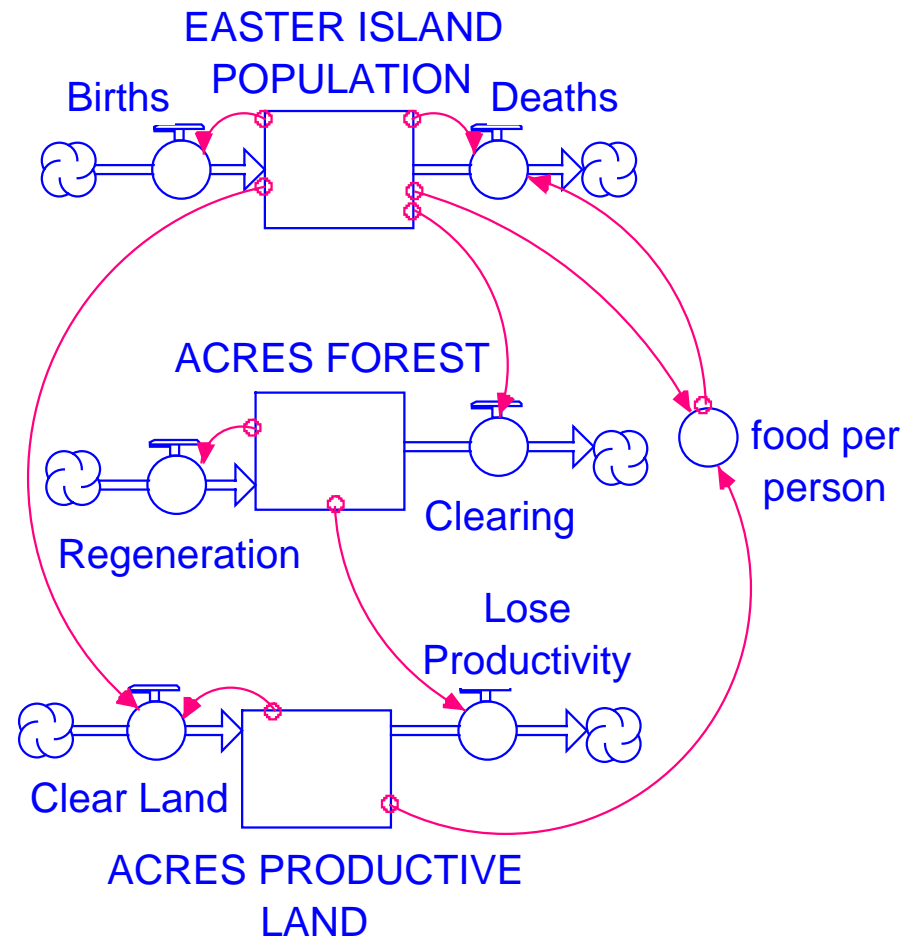
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# Illustrating the “Ladder of Engagement” Easter Island

That, in turn, leads us to **TREES** (the clearing of which leads to erosion), which lead us to statues and statue-rolling competition, and thence to war.

Does this depict the history of Easter Island?



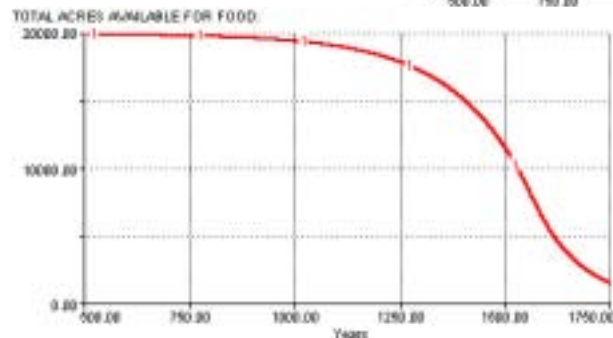
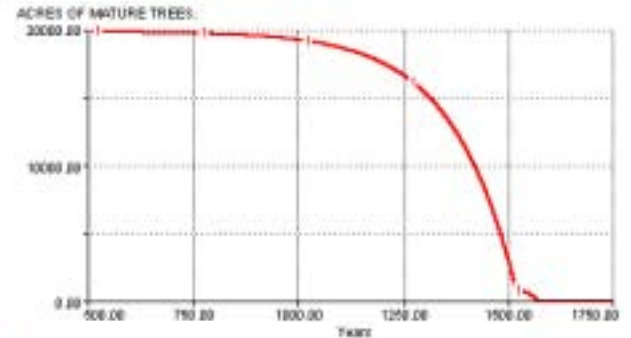
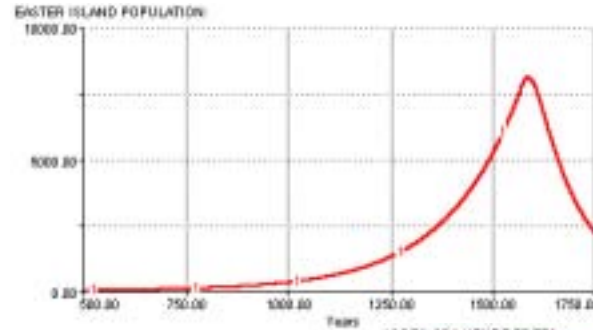
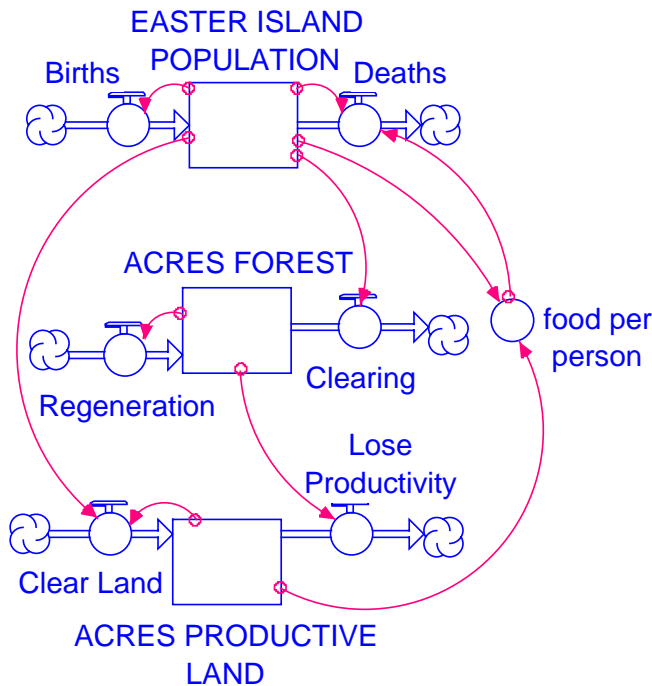
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# Illustrating the “Ladder of Engagement” Easter Island

Does this depict the history of Easter Island?



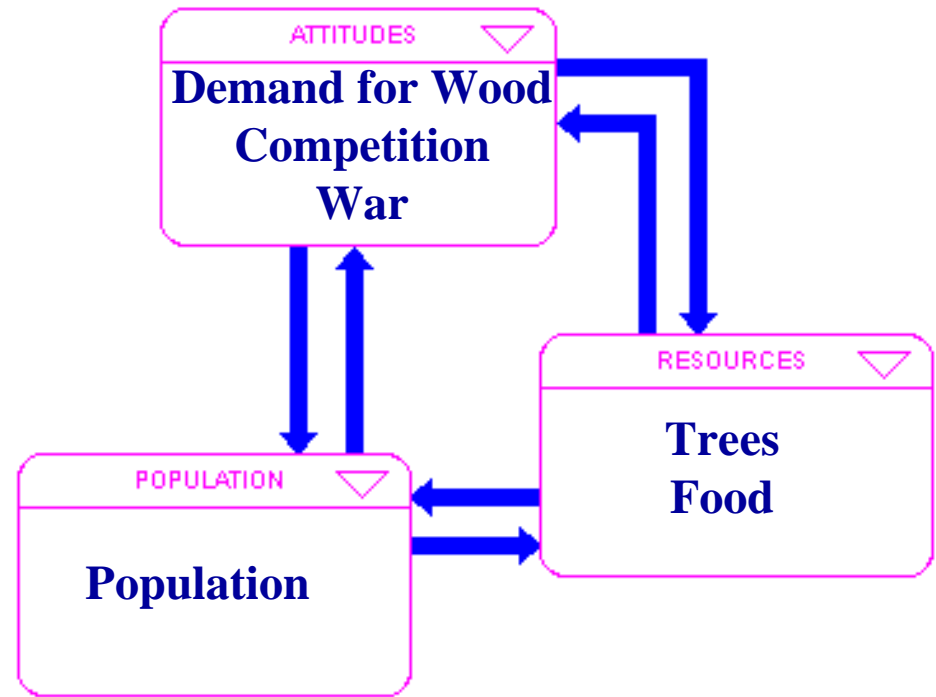
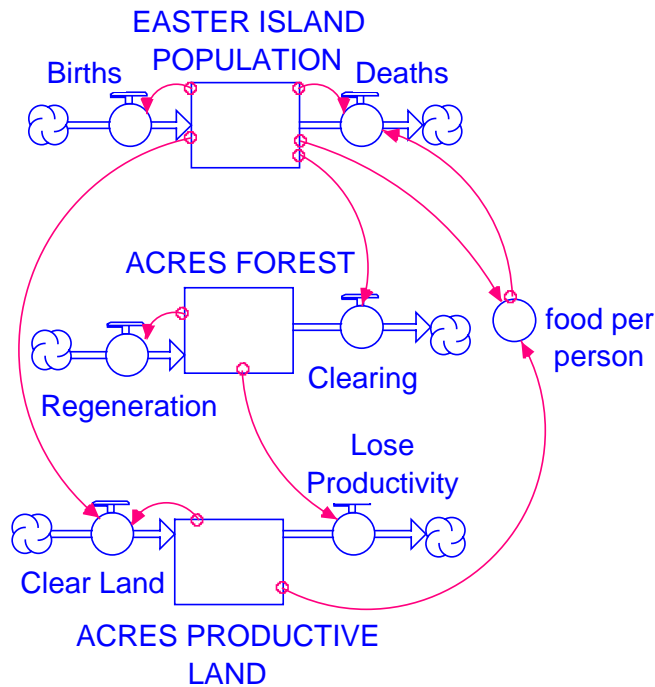
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# Illustrating the “Ladder of Engagement” Easter Island

Does this depict the history of Easter Island?



I

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# Mapping the “Design Space” from an Easter Island Perspective

## LEVELS OF COMPLEXITY

Simple  
(sentence)

Intermediate  
(paragraph)

Complex  
(story →  
3-sector richness)

### INFLUENCE

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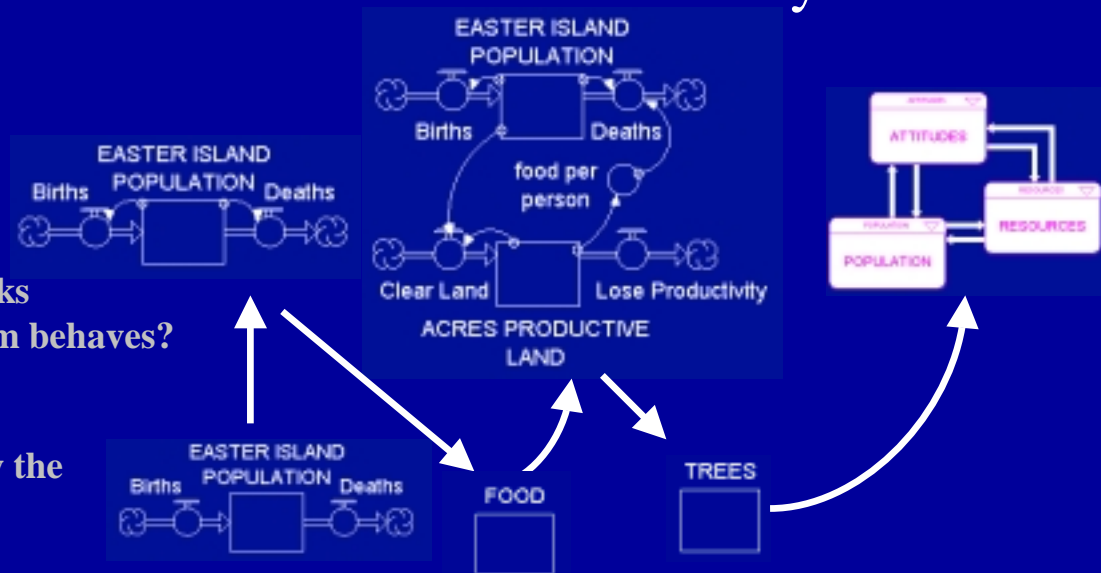
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Do I (or do we together) understand how systemic structures (e.g. feedbacks and delays) control the way the system behaves?

### KNOWLEDGE

Do I (or do we collectively) know how the System “behaves”?

System Citizen



Rookie

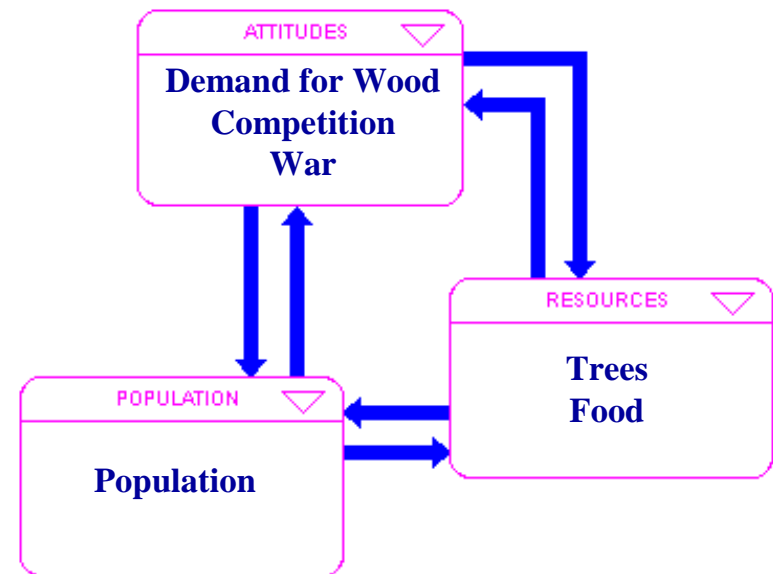
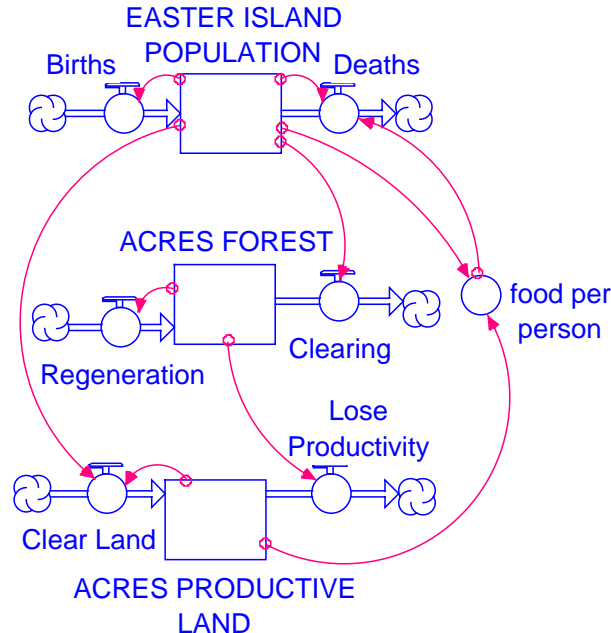
LADDER OF ENGAGEMENT

# Illustrating the “Ladder of Engagement” Easter Island

**NOW: Does our understanding empower us to INFLUENCE this system?**

**What different (better) result would we seek?**

**What leverage would we apply to achieve that result?**



I

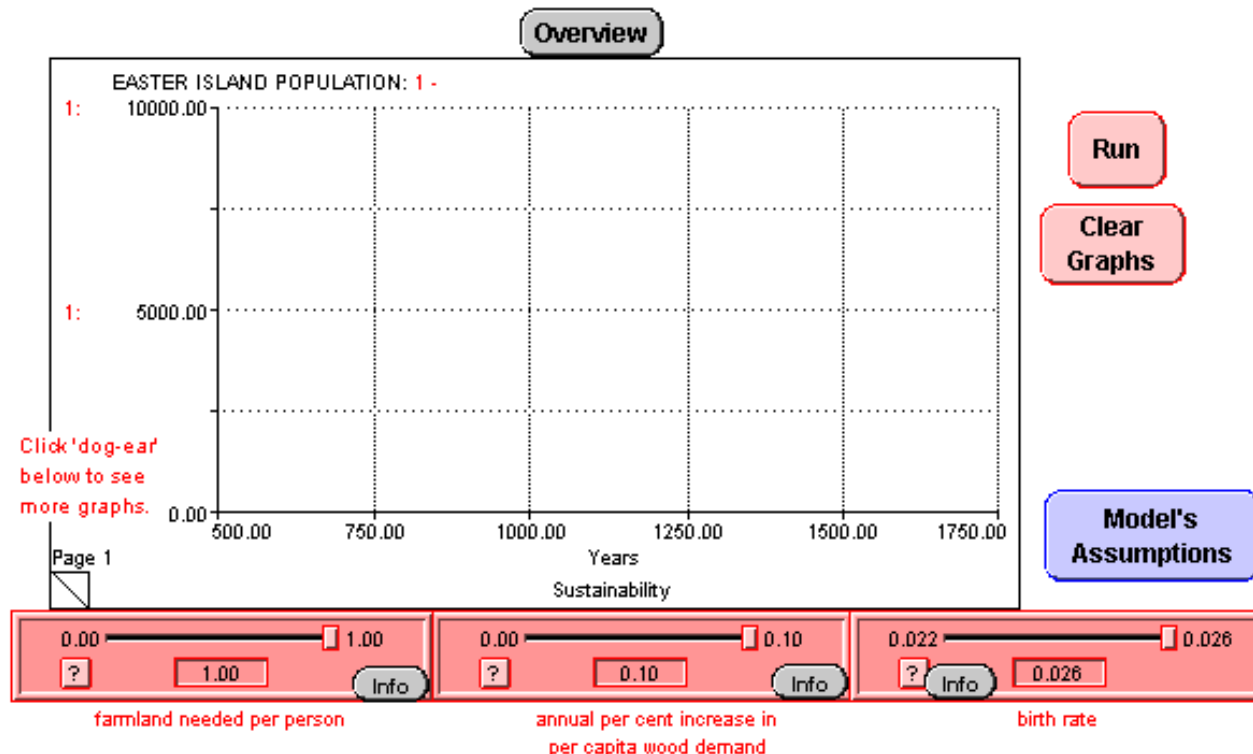
U

K

# Illustrating the “Ladder of Engagement” Easter Island

What different (better) result would we seek?  
What leverage would we apply to achieve that result?

**COULD EASTER ISLAND HAVE BEEN "SUSTAINABLE?"**



I

U

K

# Illustrating the “Ladder of Engagement” Easter Island

Are there take-home lessons from Easter Island that can be applied to other systems?

Interactions of humans, natural resources, and the attitudes that develop around those interactions, are a rich source of modern social issues for exploration! e.g.

Global petroleum dynamics

Vermont moose and pressure for hunting

Middle East water supplies

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## Concluding: The Vision

Richmond (2001, 2002):

**“systems thinking”** + **“systems being”**

Filtering Skills

Expanded Self-boundary

Representing Skills

Empathy

Simulating Skills

Excellent Communication

Respect

= **“systems citizen”**

# Concluding: The Strategy

## LEVELS OF COMPLEXITY

Simple (sentence)	Intermediate (paragraph)	Complex (story → 3-sector richness)
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LADDER OF ENGAGEMENT

### INFLUENCE

Can I (or can we) devise a better policy to affect the behavior of the system and communicate effectively to convince others of its power? Do I (we) wish to?

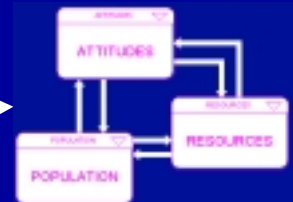
### UNDERSTANDING

Do I (or do we together) understand how systemic structures (e.g. feedbacks and delays) control the way the system behaves?

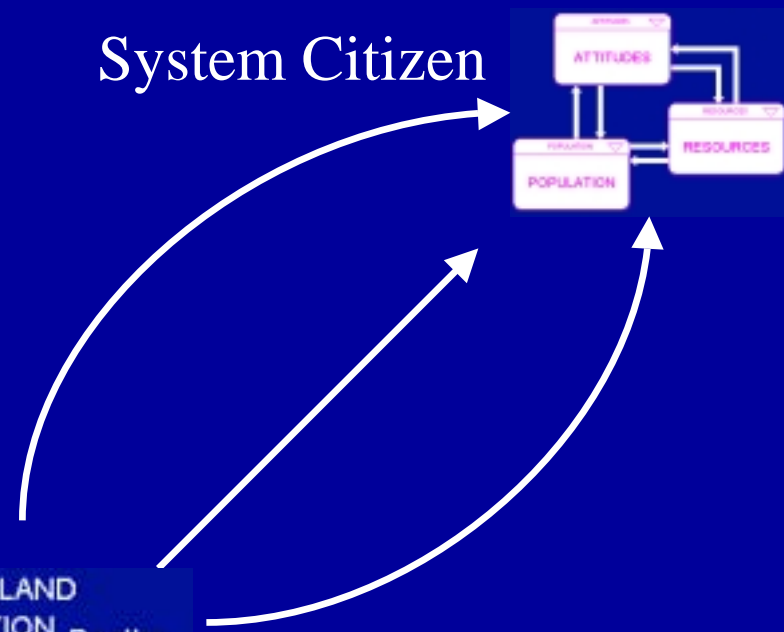
### KNOWLEDGE

Do I (or do we collectively) know how the System “behaves”?

System Citizen



Rookie



# Concluding: The Tactics

## LEVELS OF COMPLEXITY

Simple  
(sentence)

Intermediate  
(paragraph)

Complex  
(story →  
3-sector richness)

LADDER OF ENGAGEMENT

### INFLUENCE

Can I (or can we) devise a better policy to affect the behavior of the system and communicate effectively to convince others of its power? Do I (we) wish to?

1. Iterative – Many Times!

2. Partial – OK!

### UNDERSTANDING

Do I (or do we together) understand how systemic structures (e.g. feedbacks and delays) control the way the system behaves?

3. Learning Curve –  
Self-Reinforcing!

### KNOWLEDGE

Do I (or do we collectively) know how the System “behaves”?

4. Many Pathways!  
(Basically UP & RIGHT)

5. Focus on BETTER ?’s!