
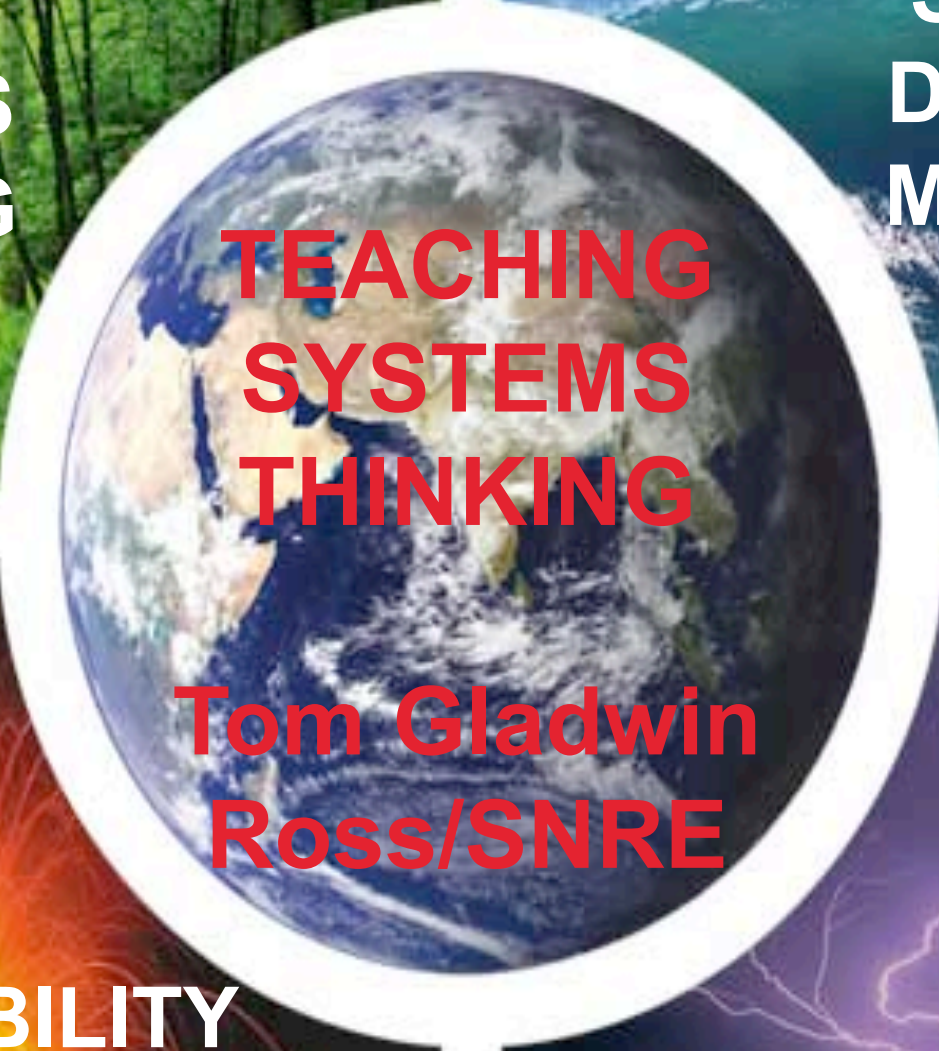


A photograph of a lush green forest with tall trees and a grassy clearing.

**GLOBAL
SYSTEMS
THINKING**

A photograph of large, white-capped ocean waves crashing under a blue sky.

**SYSTEMS
DYNAMICS
MODELING**

A circular inset image showing a view of the Earth from space, with continents and clouds visible.

**TEACHING
SYSTEMS
THINKING**

**Tom Gladwin
Ross/SNRE**

A photograph of a volcanic eruption with bright orange and yellow lava fountains.

SUSTAINABILITY

A photograph of a dark, stormy sky with bright white lightning bolts.

**GLOBAL
CHANGE**



**YOU DON'T SEE THE WORLD
THE WAY IT IS...**

**YOU SEE THE WORLD THE
WAY YOU THINK.**

BIOLOGICAL MIND

- ONE CAUSE –ONE EFFECT
- RELATIONSHIPS ARE LINEAR
- EXPERIENCE BEFORE ACTING
- MAINTAIN THE STATUS QUO
- DISCOUNT THE FUTURE

HISTORICAL MIND

- HUMANS SEPARATE FROM NATURE
- CONQUER AND MASTER NATURE
- PARTS OVER WHOLES
- SELFISHNESS IS RATIONAL
- SEPARATE VALUES FROM FACTS

CONTEMPORARY MIND

- GROWTH IS GOOD/POSSIBLE
- TECHNOLOGY SOLVES PROBLEMS
- CONSUMPTION = HAPPINESS
- CAPITALISM MAXIMIZES WELFARE
- GLOBALIZATION GOOD FOR ALL

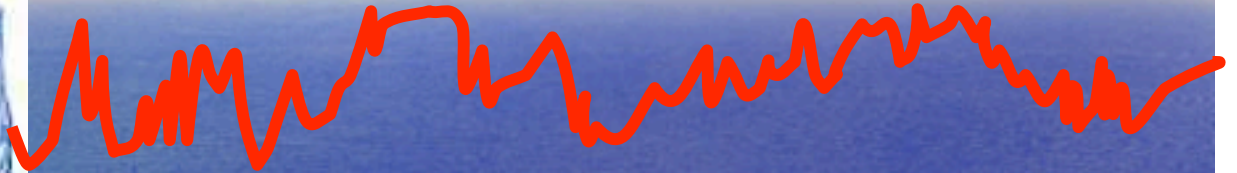
PSYCHODYNAMIC MIND

- REPRESS/DENY PAINFUL IDEAS
- IGNORE LARGE UNCERTAINTIES
- FUTURE IS CONTROLLABLE
- OTHERS ARE TO BLAME
- WE KNOW WHAT WE ARE DOING

Gladwin, et .al., "Why is the Northern Elite Mind Biased Against Community, the Environment, and a Sustainable Future?" (1997).

THE ICEBERG OF REALITY

EVENTS.....REACTIVE



PATTERNS.....ADAPTIVE

SYSTEMIC
STRUCTURES.....CREATIVE

MENTAL MODELS.....
REFLECTIVE

WORLDVIEWS.....GENERATIVE

**LEARNING &
LEVERAGE**



Reciprocal Effects

Feedback Loops

Synergisms

Cascading Effects

Nonlinearity

Critical Thresholds

Tipping Points

Surprises

Abrupt Changes

Irreversible Effects

Emergence



The diagram shows a central globe with various layers and processes labeled. The layers include the **ATMOSPHERE** (with sub-labels: stratosphere, protective natural ozone layer, troposphere), **HYDROSPHERE**, **BIOSPHERE**, and **GEOSPHERE**. Processes shown include *atmospheric circulation*, *ocean circulation*, *precipitation*, *transpiration*, *photosynthesis*, *respiration*, *decomposition*, *erosion*, *sedimentation*, *volcanism*, *plate tectonics*, *climate change*, *human activities*, and *ecosystem services*. A red arrow points from the **HYDROSPHERE** towards the center. The central text is **COMPLEXITY OF COUPLED HUMAN-ENVIRONMENT SYSTEM** in large yellow letters.

COMPLEXITY OF COUPLED HUMAN- ENVIRONMENT SYSTEM

**(Liu, Science,
9/14/07)**

Path Dependence

Large Time Lags

Chaotic Behavior

Varied Resilience

Interacting Stresses

Heterogeneity

Variability/Change

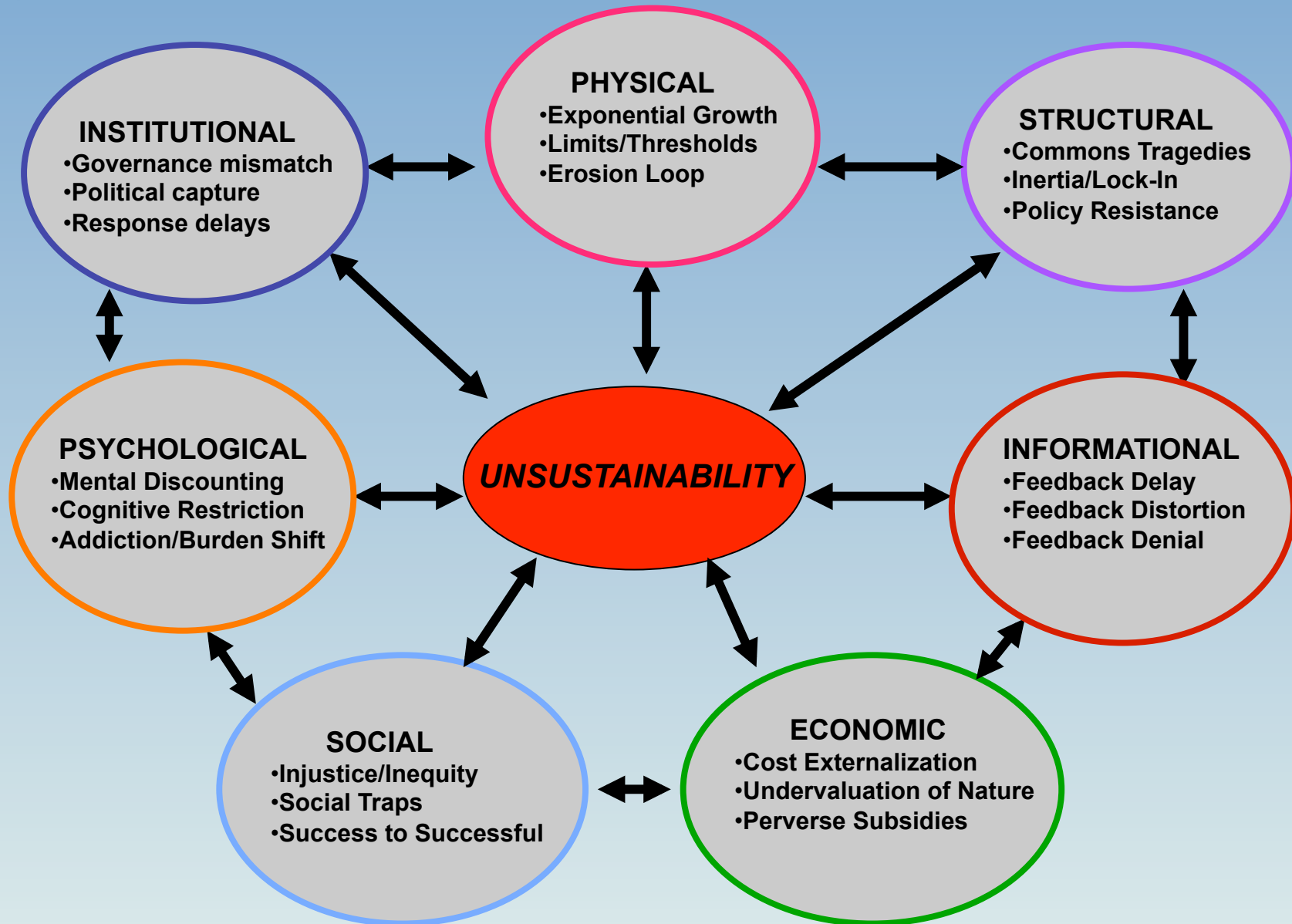
**Irreducible
Uncertainties**

Acceleration

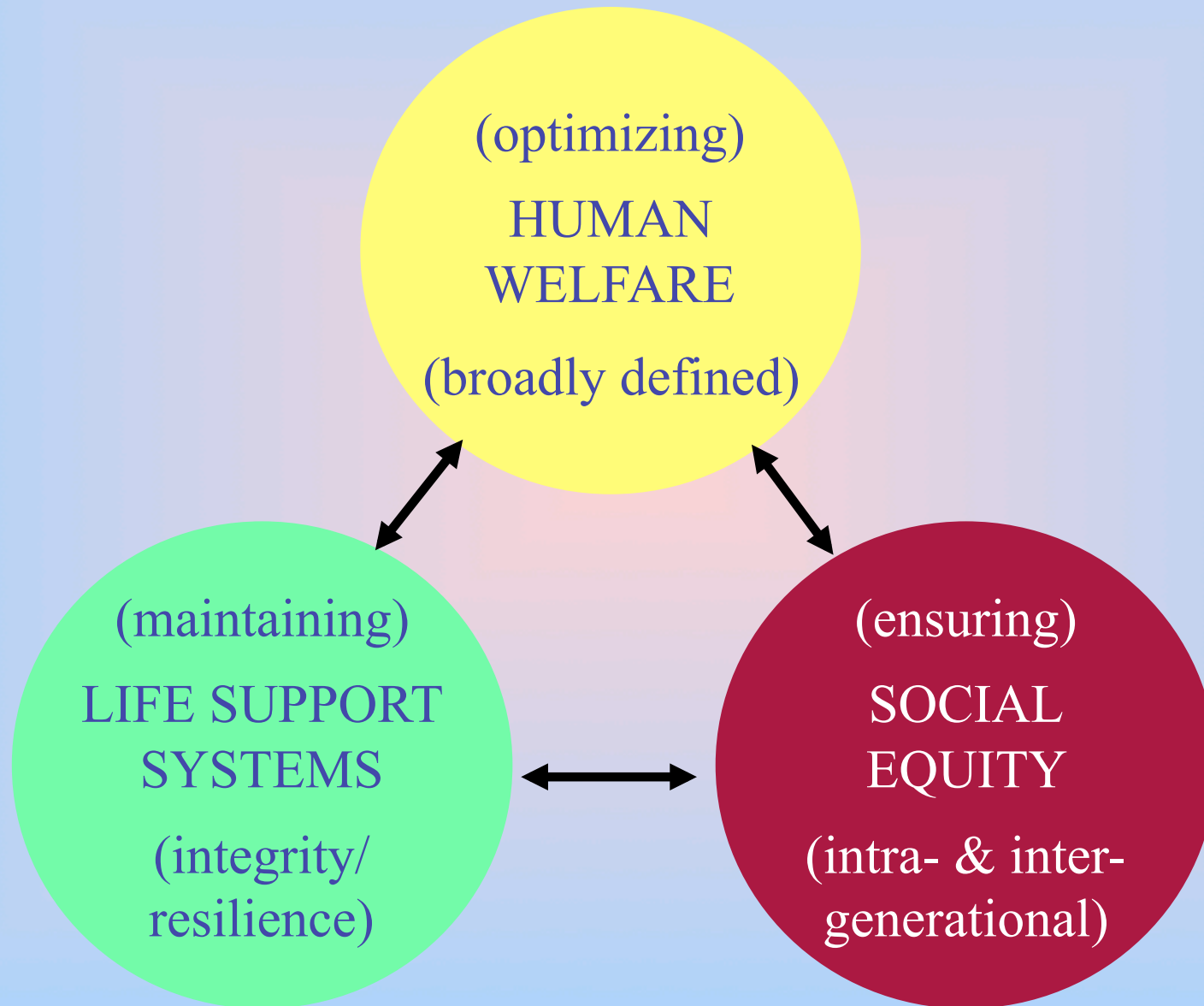
**Cross-Scale
Interactions**



Systemic Failure



THE SYSTEMIC BIG IDEA



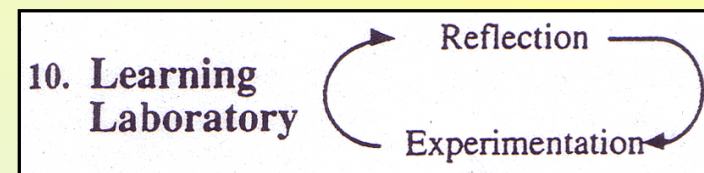
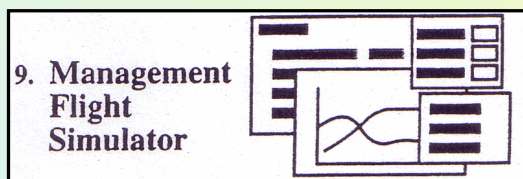
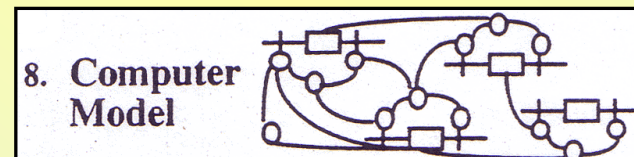
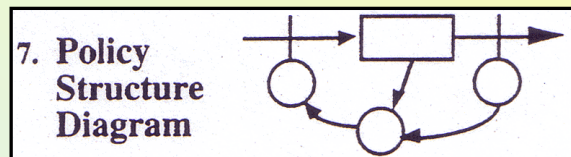
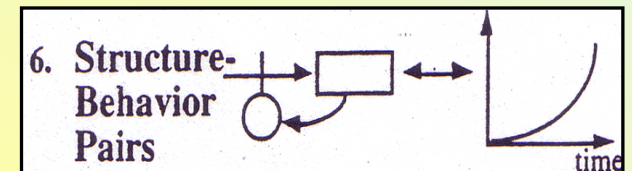
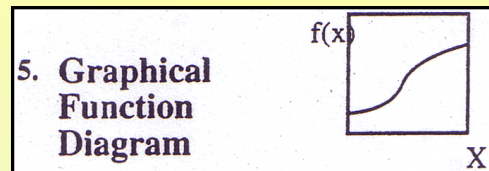
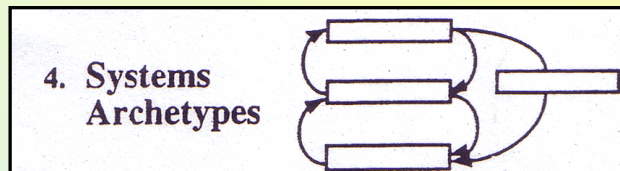
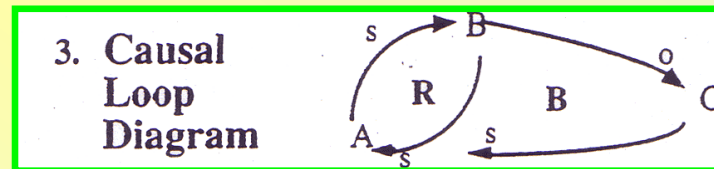
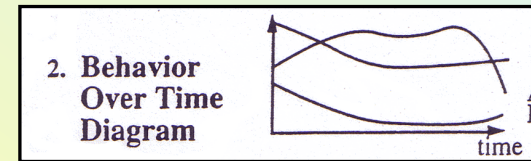
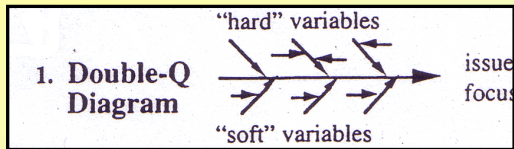
MECHANISTIC THINKING

Parts
Objects
Events
Isolation
Specificity
Linearity
Statics
Simplicity
Proximity
Continuity
Determinism

SYSTEMIC THINKING

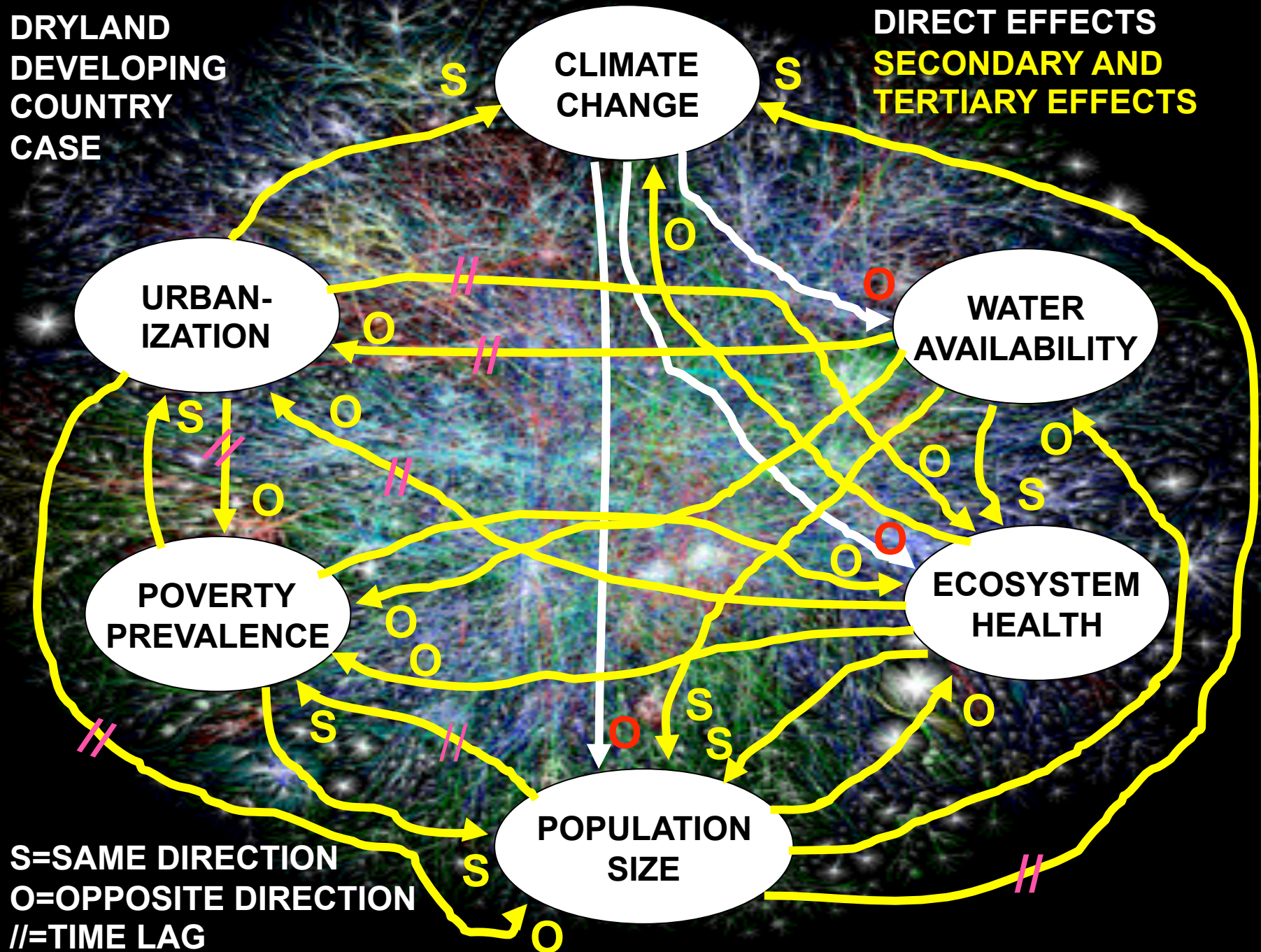
Wholes
Relationships
Structures
Interdependence
Generality
Cyclicity
Dynamics
Complexity
Distance
Discontinuity
Evolution

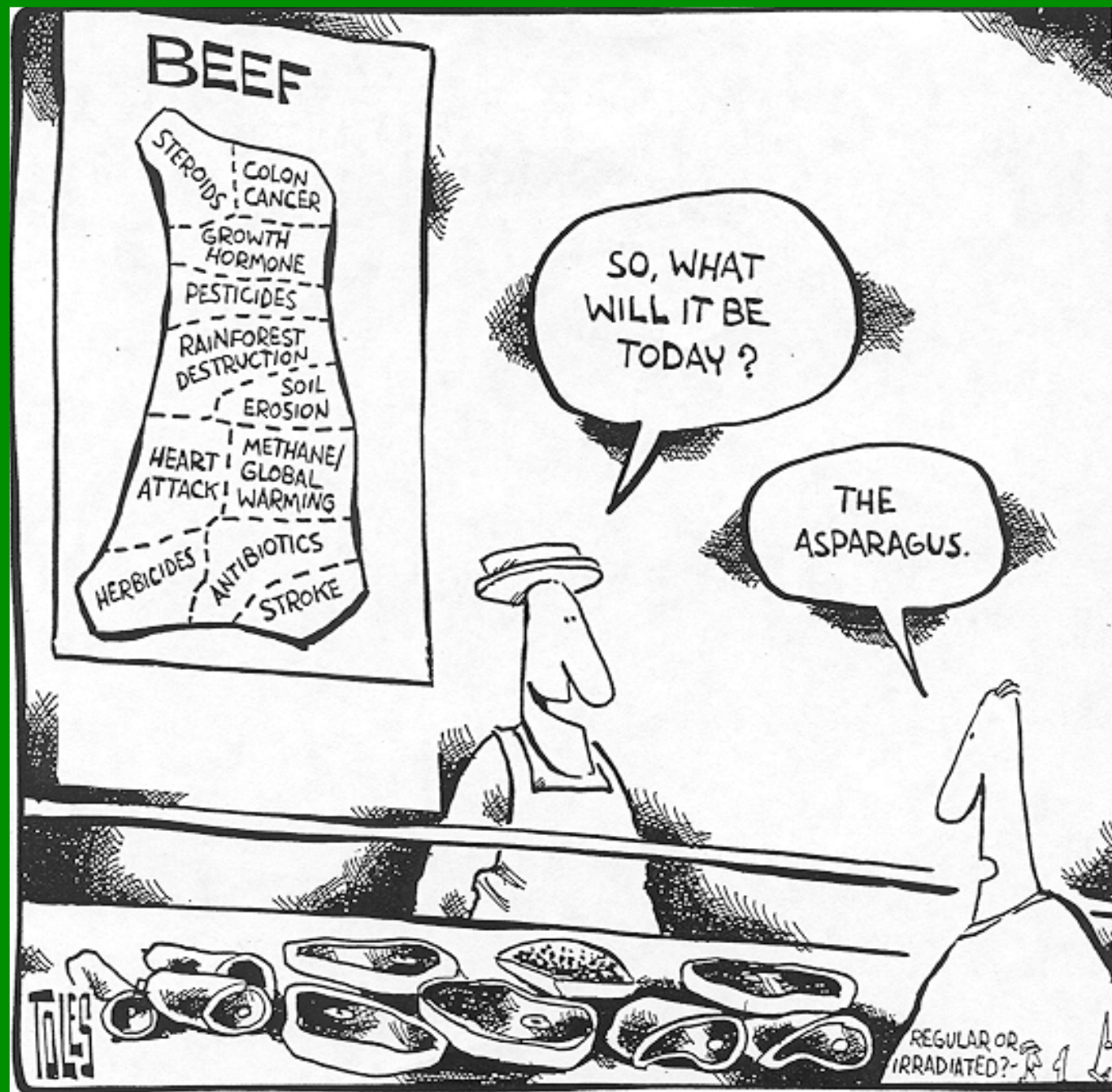
A set of tools...



DRYLAND
DEVELOPING
COUNTRY
CASE

DIRECT EFFECTS
SECONDARY AND
TERTIARY EFFECTS





What is System Dynamics?

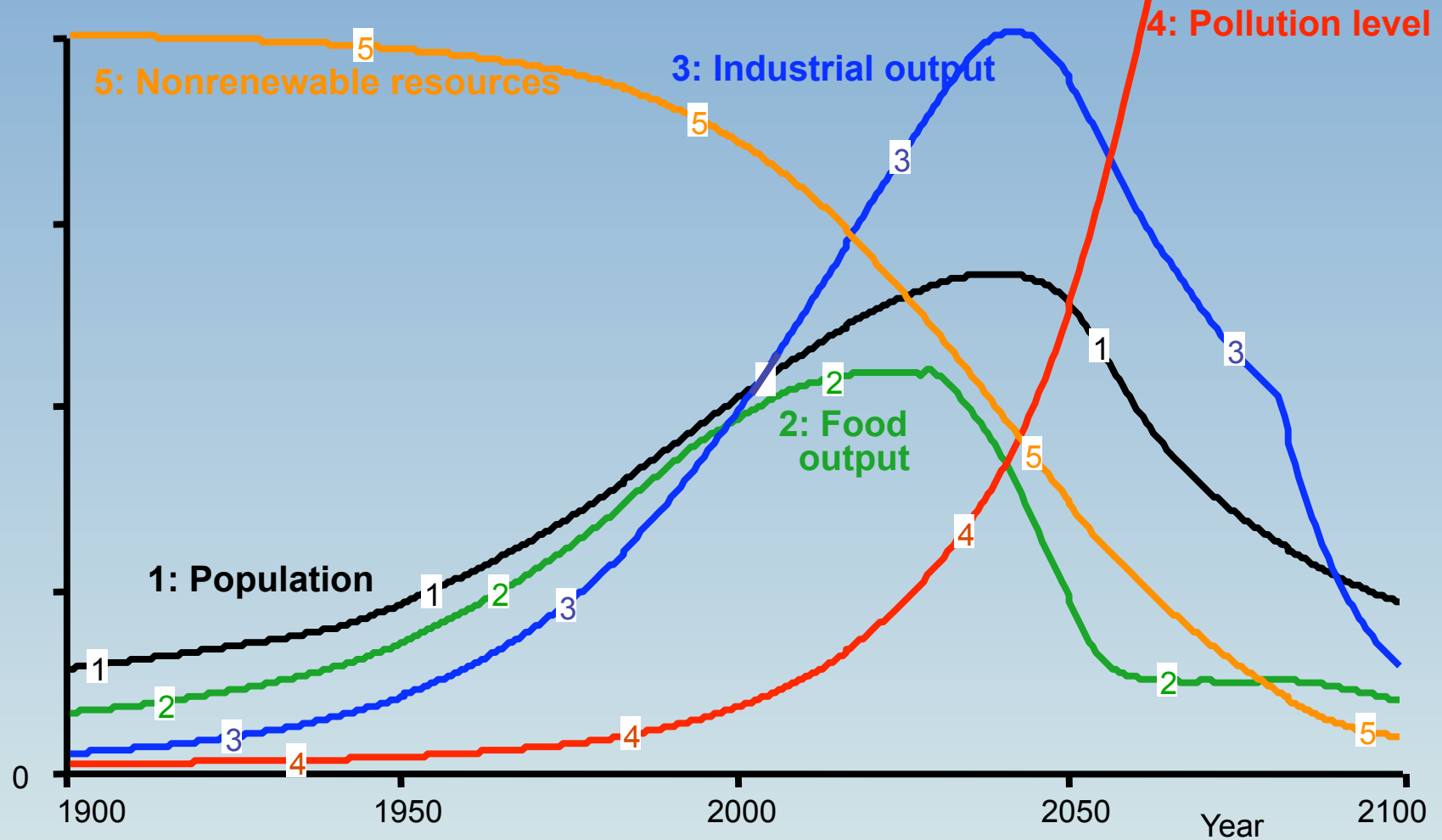
“System Dynamics is a methodology for studying and managing complex feedback systems...The methodology:

- 1. Identifies the problem**
- 2. Develops a dynamic hypothesis explaining the cause of the problem**
- 3. Builds a computer simulation model of the system at the root of the problem**
- 4. Tests the model to be certain that it reproduces the behavior seen or projected in the real world**
- 5. Devises and tests in the model alternative policies that alleviate the problem, and**
- 6. Implements this solution**

System Dynamics Society Website

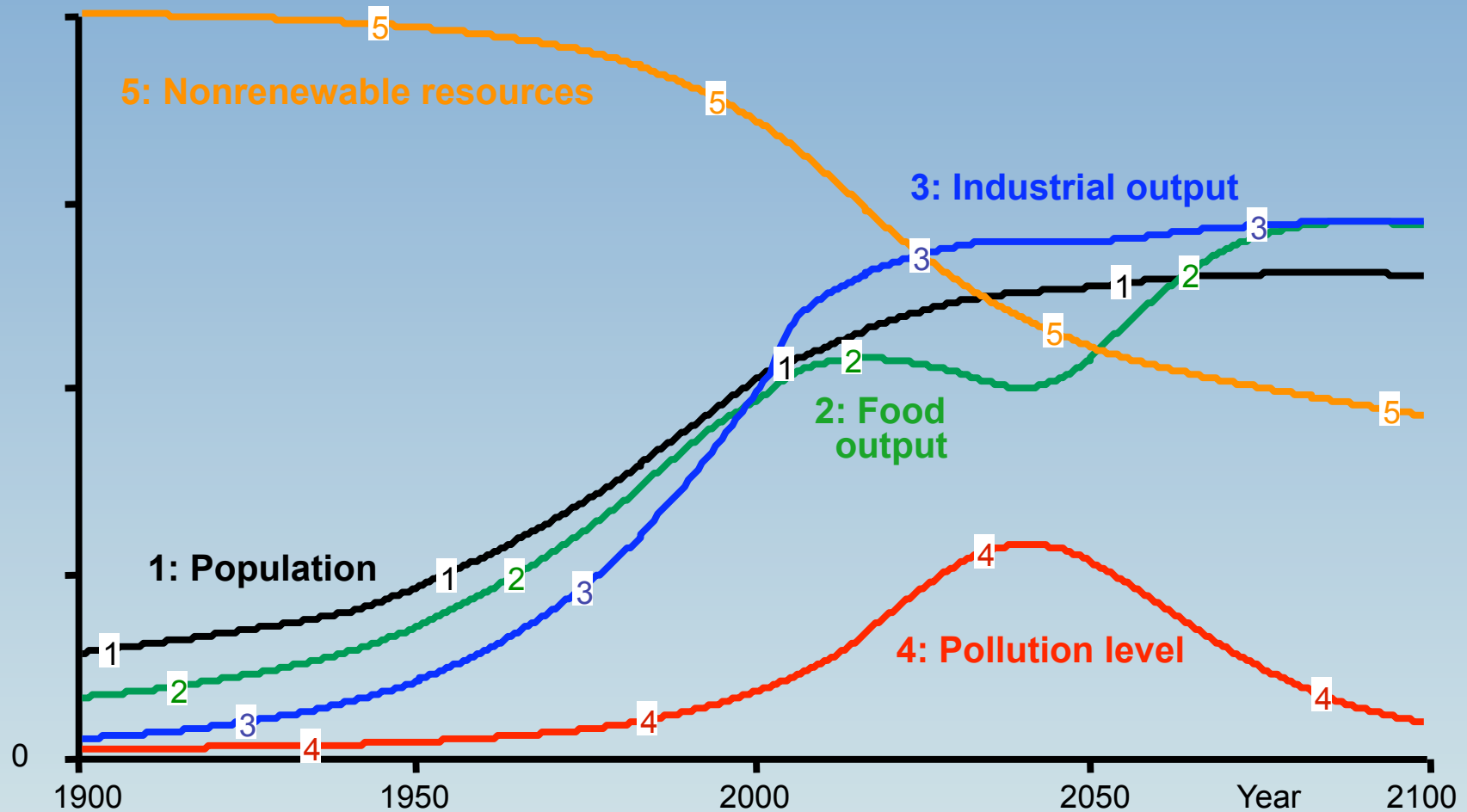


Overshoot & Collapse?





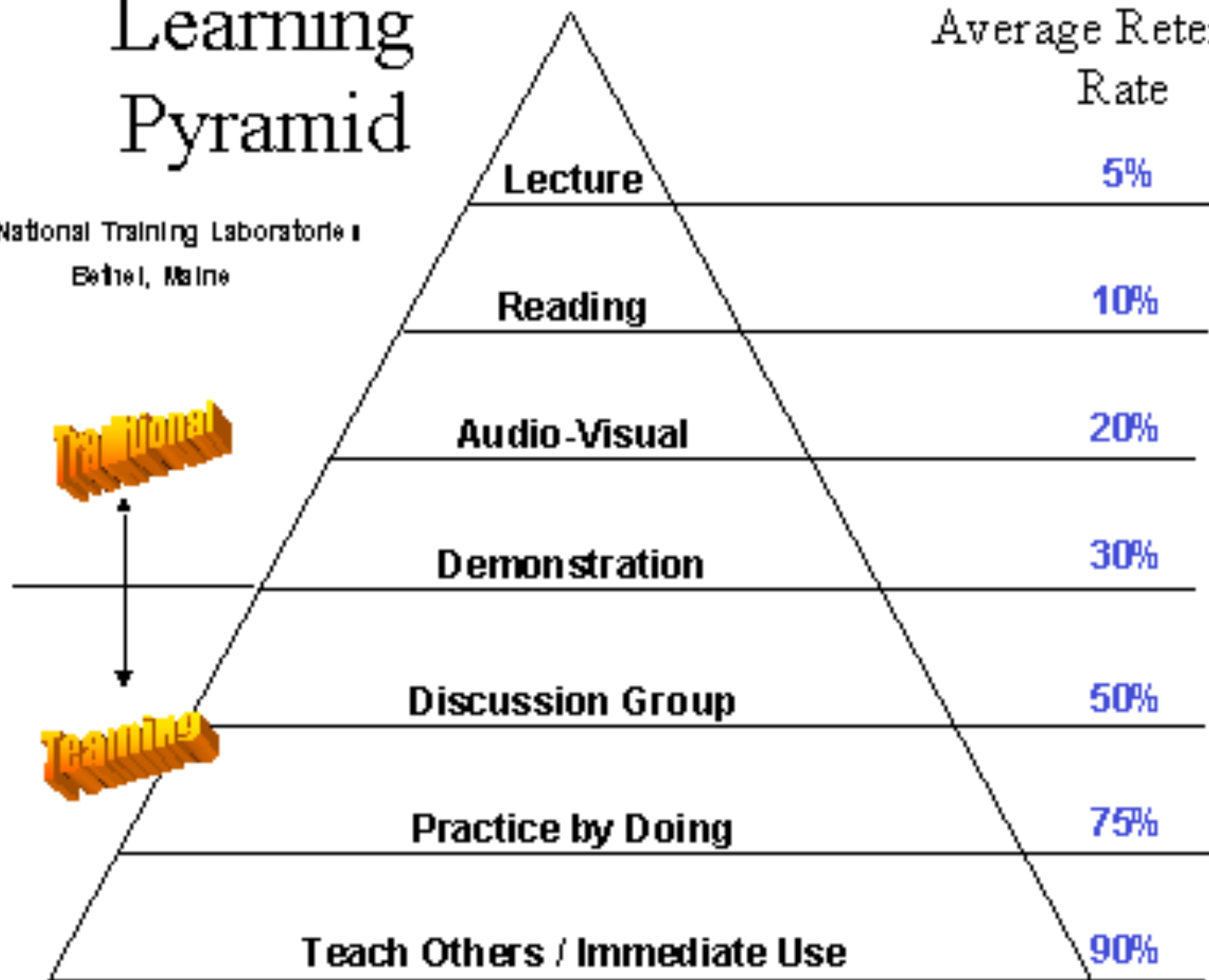
Sustainability

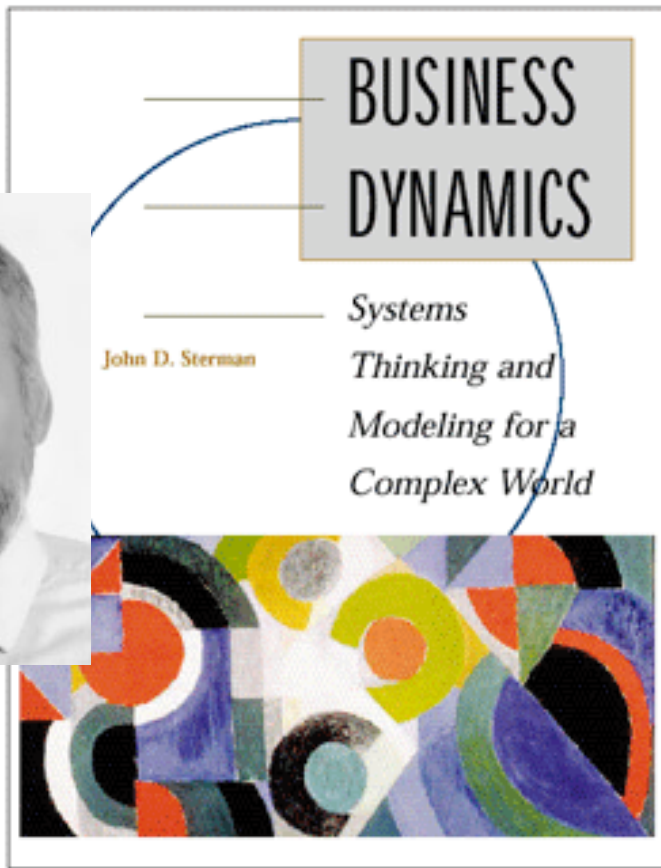


Learning Pyramid

National Training Laboratories
Bethel, Maine

Average Retention
Rate





ctools.umich.edu
Strategy 566/NRE 550

**TOPIC
ASSIGNMENTS
Winter 2010**

CONSUMPTION
Rachana, Nick,
Kim

FRESHWATER
Serkan, Eli,
Paul

URBANIZATION
Bharath, Joel,
Jae-Hyun

**RENEWABLE
ENERGY**
Todd, Theo,
Hanns

MOBILITY
Leonore, Sarah,
Luis

**ADAPTIVE
CAPACITY**
Sarah, Maria,
Dave

FOOD SUPPLY
Kexin, Hee Beom,
Yuka

**GREEN
CONSTRUCTION**
Melissa, Jim,
Jonathan

**ECONOMIC
GLOBALIZATION**
Tim, Takenori,
Young Jin

**MICRO-CREDIT
& ENTERPRISE**
Bruna, Jazmine,
Alanna

**ENERGY
EFFICIENCY**
Joshua,
Jason

PANDEMICS
Justin, Nathan,
Matt

“We can’t solve problems
by using the same kind of
thinking we used when we
created them.”

Albert Einstein

