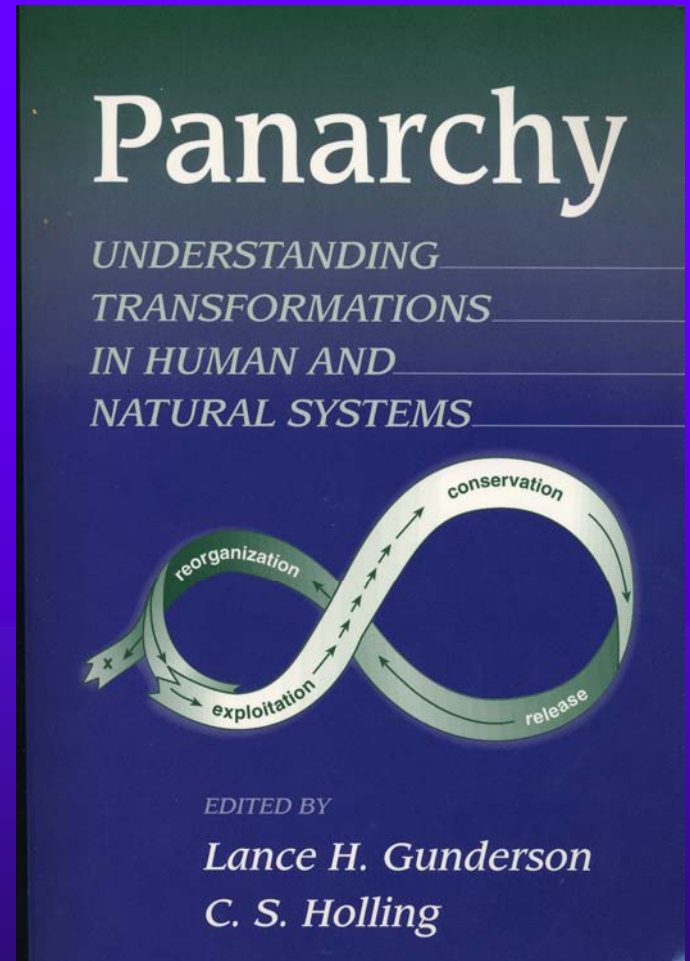
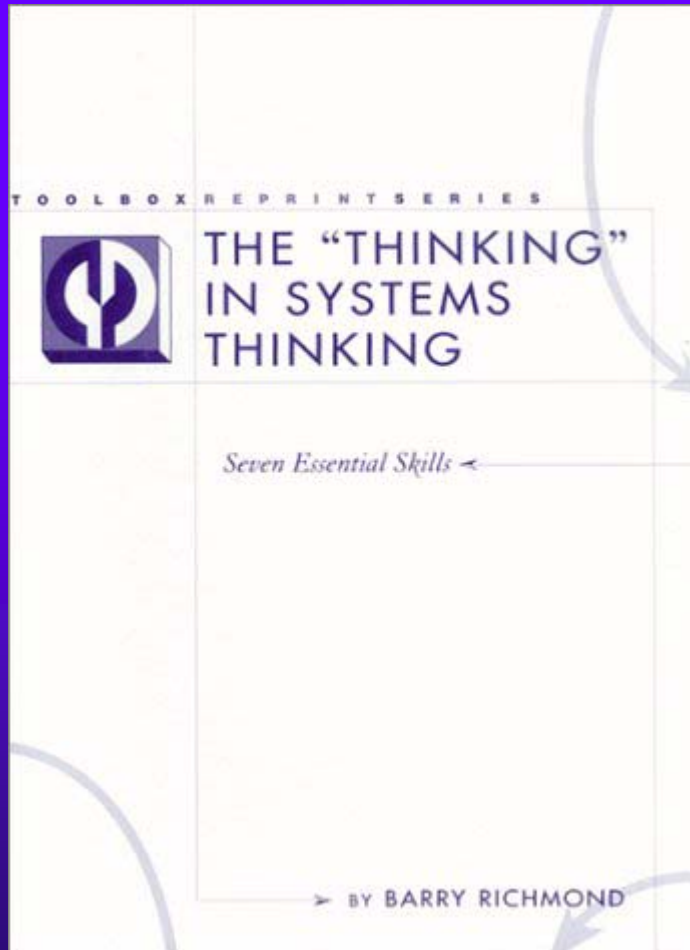


# Panarchy: A Metaphor for Conveying Systems Concepts and Improving Systems Thinking Skills

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# Richmond's Seven Thinking Skills

- ◆ Dynamic Thinking
- ◆ Systems-as-Cause Thinking
- ◆ Forest Thinking
- ◆ Operational Thinking
- ◆ Closed-Loop Thinking
- ◆ Quantitative Thinking
- ◆ Scientific Thinking



# Dynamic Thinking

- ◆ Alternative to Static Thinking
  - Focus on events over patterns
  - Do not consider that things might get worse before they get better
- ◆ Focus on behavior over time
- ◆ Events result from “the continuous build-up of pressures within a system”



# Systems-as-Cause Thinking

- ◆ Alternative to Systems-as-Effect Thinking
  - View behavior as driven by external forces
  - Predict and prepare mentality
- ◆ Ask the question, “In what ways are we ‘doing it to ourselves?’”
- ◆ Structure system so that unexpected perturbations are manageable



# Forest Thinking

- ◆ Alternative to Tree-by-Tree Thinking
  - Heavy in details
  - Focus on numerical accuracy
- ◆ View from 10,000 meters
- ◆ Enables you to connect different parts of the forest



# Operational Thinking

- ◆ Alternative to Factors thinking
  - “Critical Success Factors”
  - “Key Drivers”
- ◆ How is performance being generated?
- ◆ Concentrating on causality



# Closed-Loop Thinking

- ◆ Alternative to Straight-Line Thinking
  - Causality runs only one way
  - Each factor is independent of other factors
- ◆ Factors affect each other
- ◆ Accounts for feedback within the system



# Quantitative Thinking

- ◆ Alternative to Measurement Thinking
  - Knowledge implies precise measurement
  - Attempt to get beyond uncertainty
- ◆ Applying rough numbers to soft variables (e.g., level of motivation, morale, etc.)
- ◆ Specifying numerical values for graphing relationships



# Scientific Thinking

- ◆ Alternative to Proving-Truth Thinking
  - Focus on proving models true
  - Over-investment in models
- ◆ “Science proceeds by discarding falsehoods, not by proving truth.”
- ◆ Willingness to change models/policies to fit the situation

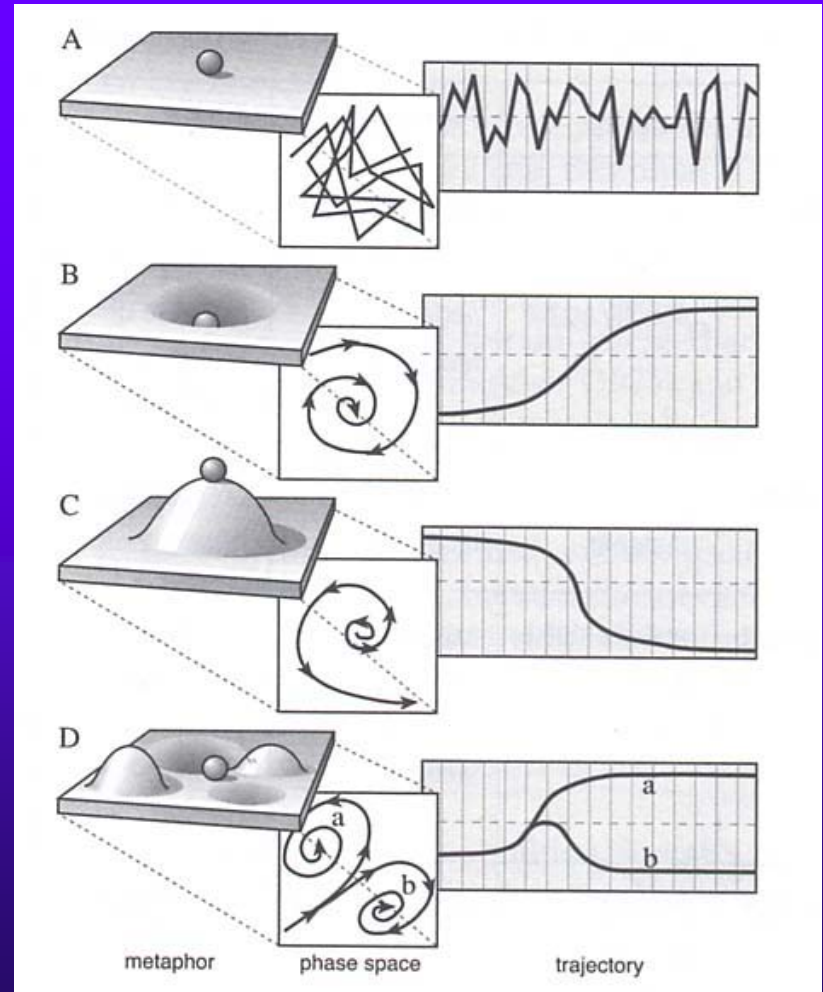


# Panarchy

- ◆ Field of Natural Resource Management: Successes that lead to failure
- ◆ Panarchy is suggested as a metaphor for understanding system dynamics.
- ◆ Caricatures of Nature
  - Inherently stable—moving naturally toward a balanced equilibrium
  - Inherently unstable—slipping inevitably toward total disorder (entropy)
- ◆ Pan (Image of unpredictable change) + Hierarchy

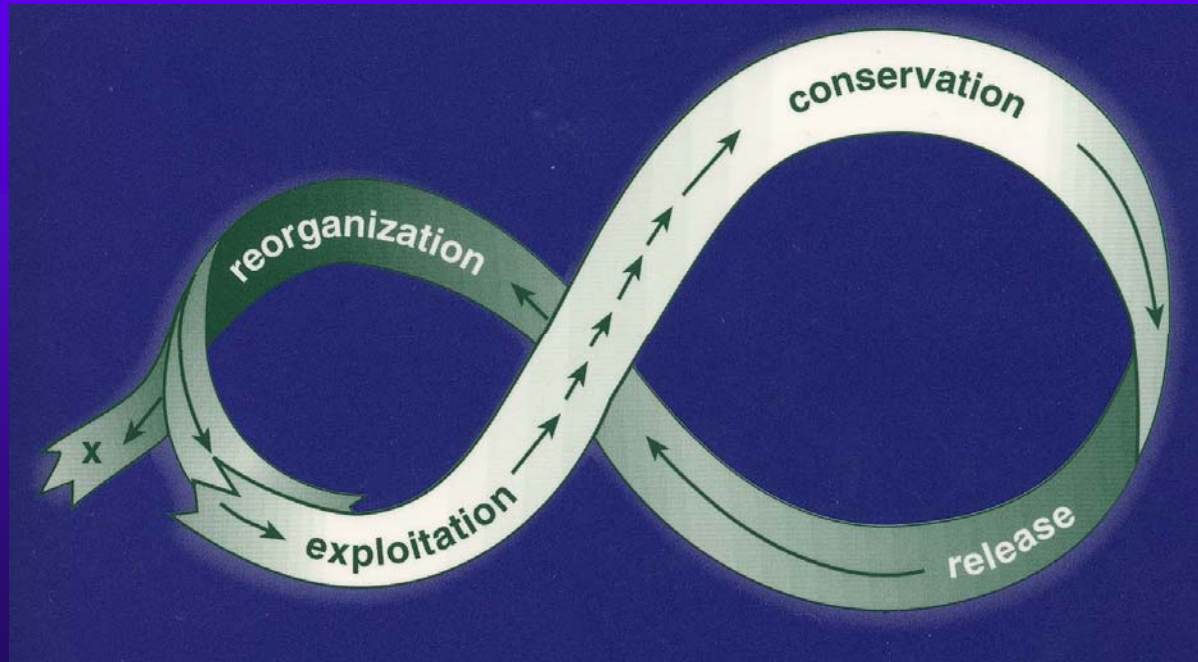
# Caricatures of Nature: A Closer Look

- ◆ Nature Flat
- ◆ Nature Balanced
- ◆ Nature Anarchic
- ◆ Nature Resilient
- ◆ Nature Evolving



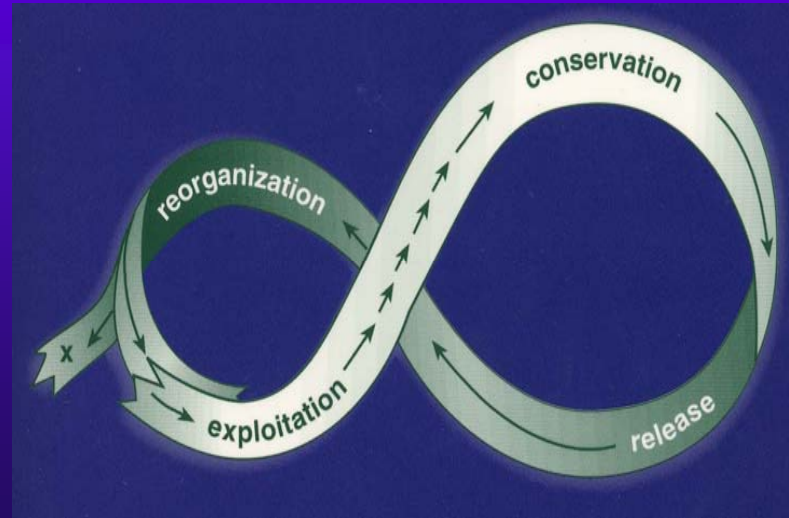
# Key Concepts

- ◆ Change follows a general pattern
- ◆ Nonlinear behavior are the result of interactions between large- and small-scale processes



# Example: Spruce-Fir Forests

- ◆ Release—Forest fire or pest outbreak
- ◆ Reorganization—soil processes make nutrients available for exploitation
- ◆ Growth and Exploitation—early stages of ecological succession
- ◆ Conservation—“climax” community

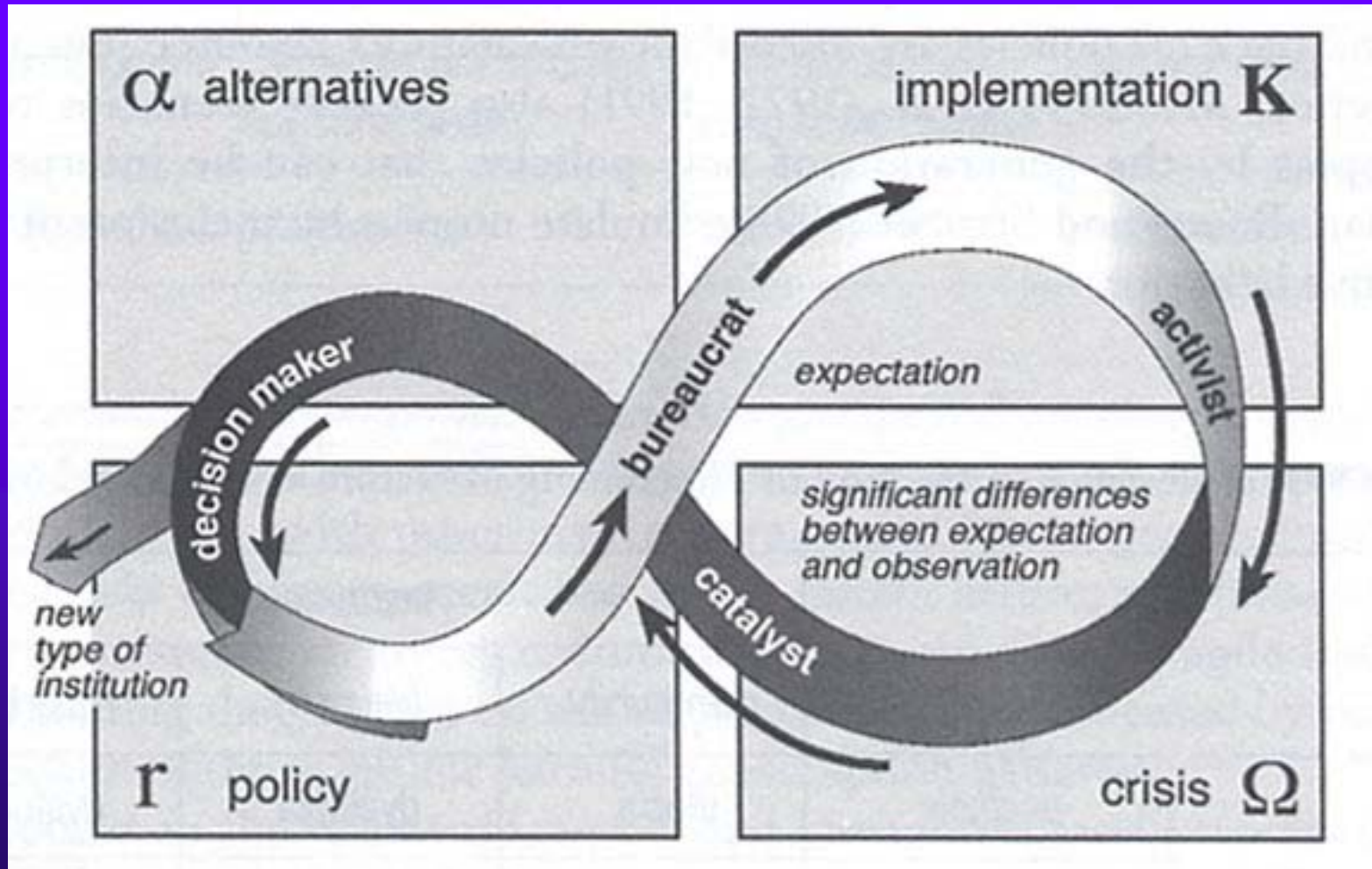




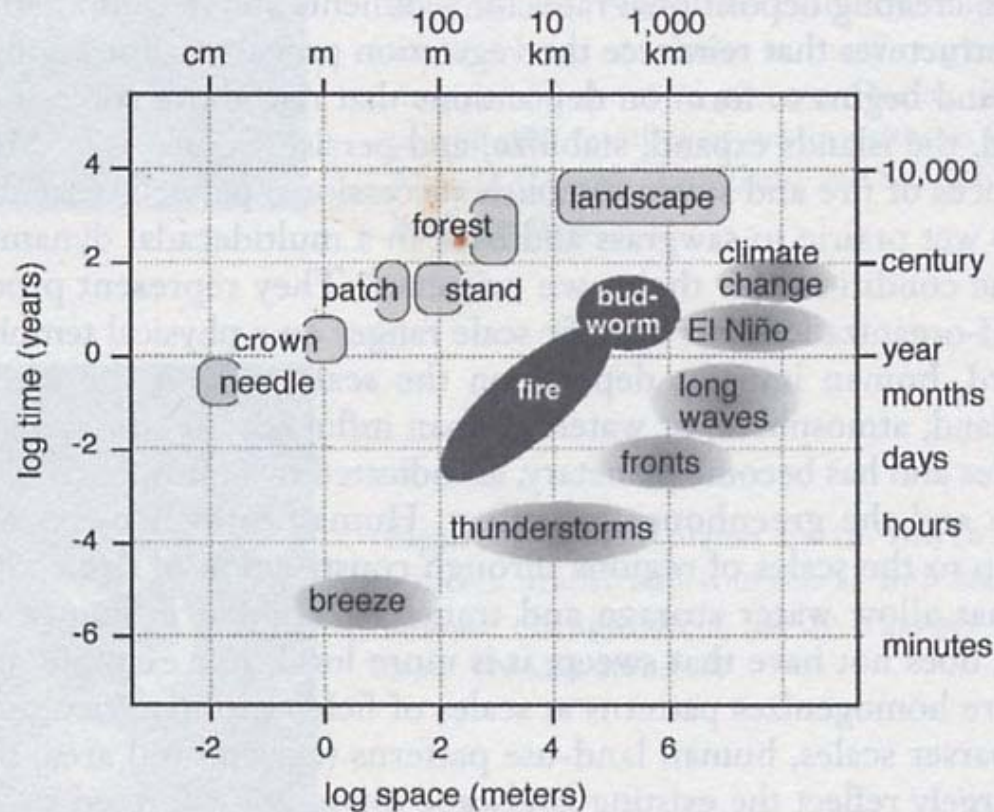
# Other Examples

- ◆ Physical—pile of sand
- ◆ Historical—rise and fall of governments and/or civilizations
- ◆ Literary—progression of characters
- ◆ Political—elections as a way to manage release peacefully

# Adaptive Cycle—Social Context



# Scale—Natural Context



**Figure 3-8.** Time and space scales of the boreal forest (Holling 1986), of the atmosphere (Clark 1985), and of their relationship to some of the processes that structure the forest. Contagious meso-scale processes such as insect outbreaks and fire mediate the interaction between faster atmospheric processes and slower vegetation processes.

# Scale—Social Context

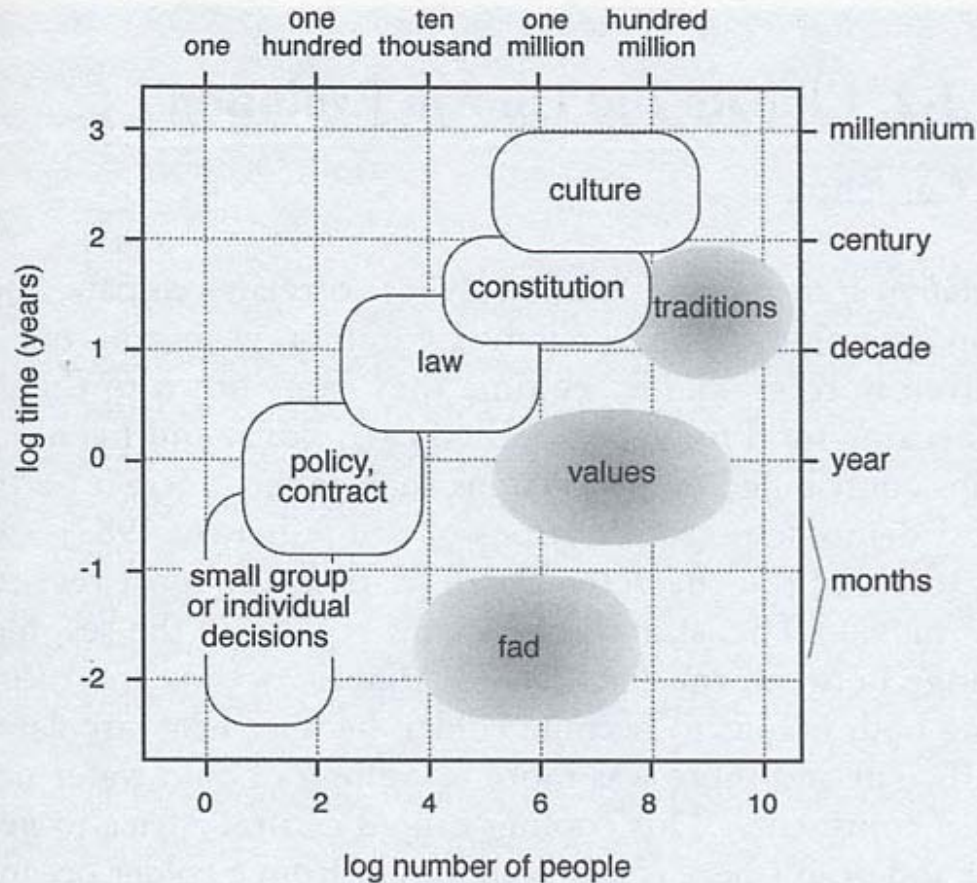
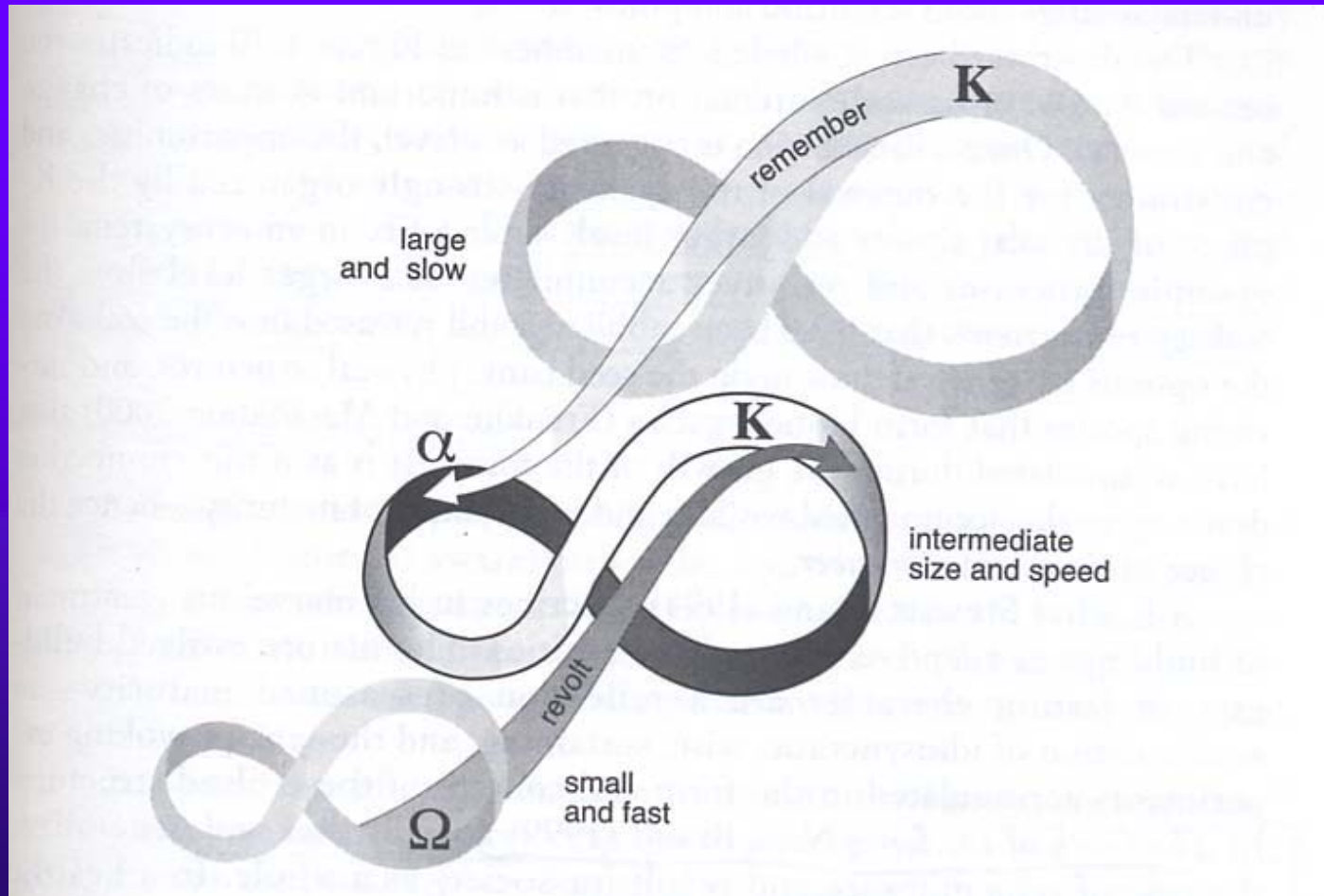


Figure 4-1. Institutional hierarchy of rule sets. In contrast to ecological hierarchies, this one is structured along dimensions of the number of people involved in rule set and approximate turnover times (Gunderson et al. 1995b).

# Adaptive Cycle across Scale



Gunderson and Holling 2002



# Benefits of Using the Panarchy Metaphor for Mental Models

## ◆ Dynamic Thinking:

- events are viewed as part of an ongoing cycle of growth and change
- continuous build-up and release of pressure within a system

## ◆ Systems-as-Cause Thinking:

- system behavior caused by interactions between fast and slow variables
- system creates conditions for its own release period

## ◆ Forest Thinking:

- temporal scales extended to view entire cycles
- look at more than one variable and more than one scale



# Benefits of Using the Panarchy Metaphor for Mental Models

- ◆ Closed-Loop Thinking:
  - feedbacks become critical to understanding system behavior
  - Small-scale processes feedback and dominate during back-loop periods of release.
- ◆ Scientific Thinking:
  - models and policies must change to fit the situation
  - Constantly reassess to see where the model/policy does not fit the system



# Sample Assignments

- ◆ Learning Panarchy
  - Evolution of a musical artist/group
- ◆ Using Panarchy
  - Evolution of a political movement (Civil Rights, Women's Rights, Environmental)
- ◆ Key Tasks and Questions
  - Identify and describe the stages of at least two adaptive cycles for your system.
  - Identify slow processes vs. fast processes and describe key interactions
  - What have occurred from one cycle to the next?
  - What has remained constant from cycle to cycle?



# Closing Comments

- ◆ “As you gain ability and confidence [with systems thinking skills], you’ll find that you’ll begin to see the world in new, more dynamic and holistic ways—which is really the most powerful advantage that systems thinking offers” (Richmond 2000).
- ◆ “The challenge...is to conserve the ability to adapt to change, to be able to respond in a flexible way to uncertainty and surprises. And even to create the kind of surprises that open opportunity” (Gunderson and Holling 2002).



# The End

## Acknowledgements

- ◆ Creative Learning Exchange
- ◆ University of Florida Student Government