EMBRACING

CHANGE

# Embracing Change from a Complex Adaptive Systems Perspective

Presented by

Dr. David Gould and Dr. Pete Anthony

Walden University

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- Systems Basics
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- Change
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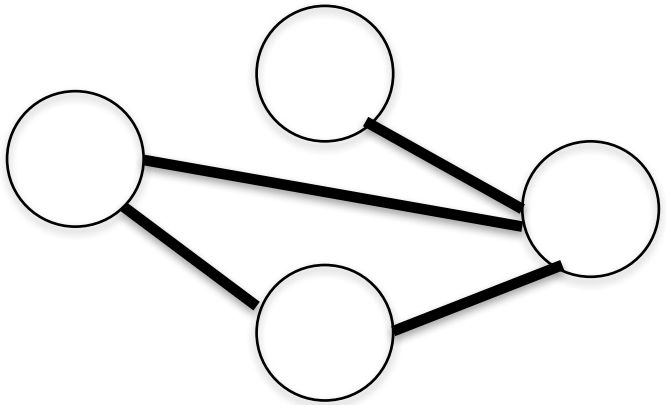
# Systems Basics

# System Basics

- A **network** is a set of agents (nodes) and relationships (links)
- A **system** is a set of one or more networks (structure), which exhibits some function.



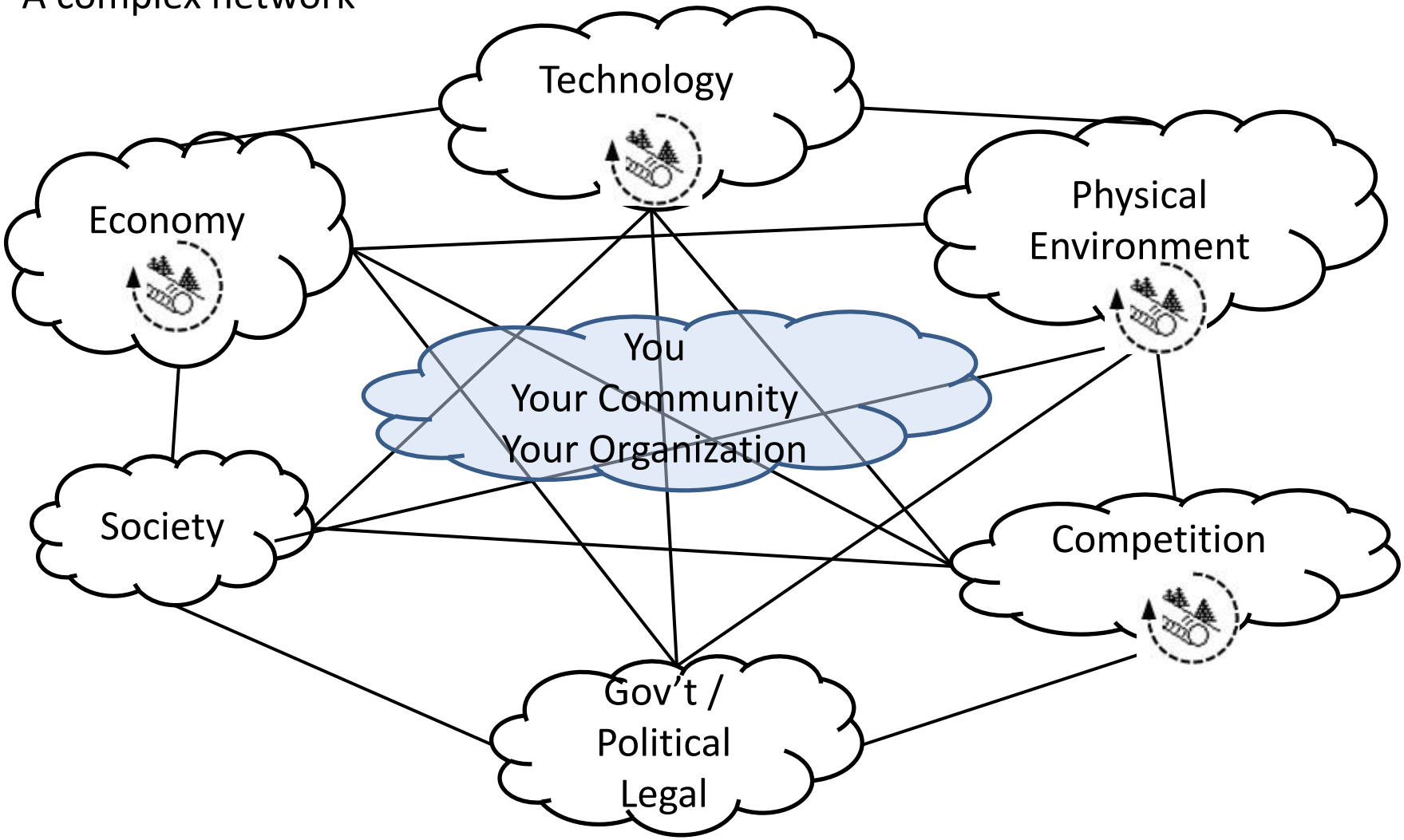
# Complex Systems

A complex system is a group of “agents” existing far from equilibrium, interacting through positive and negative feedbacks, forming interdependent, dynamic, evolutionary networks, that are sensitive dependent, fractionally organized, and exhibit avalanche behavior (abrupt changes) that follow power-law distributions.

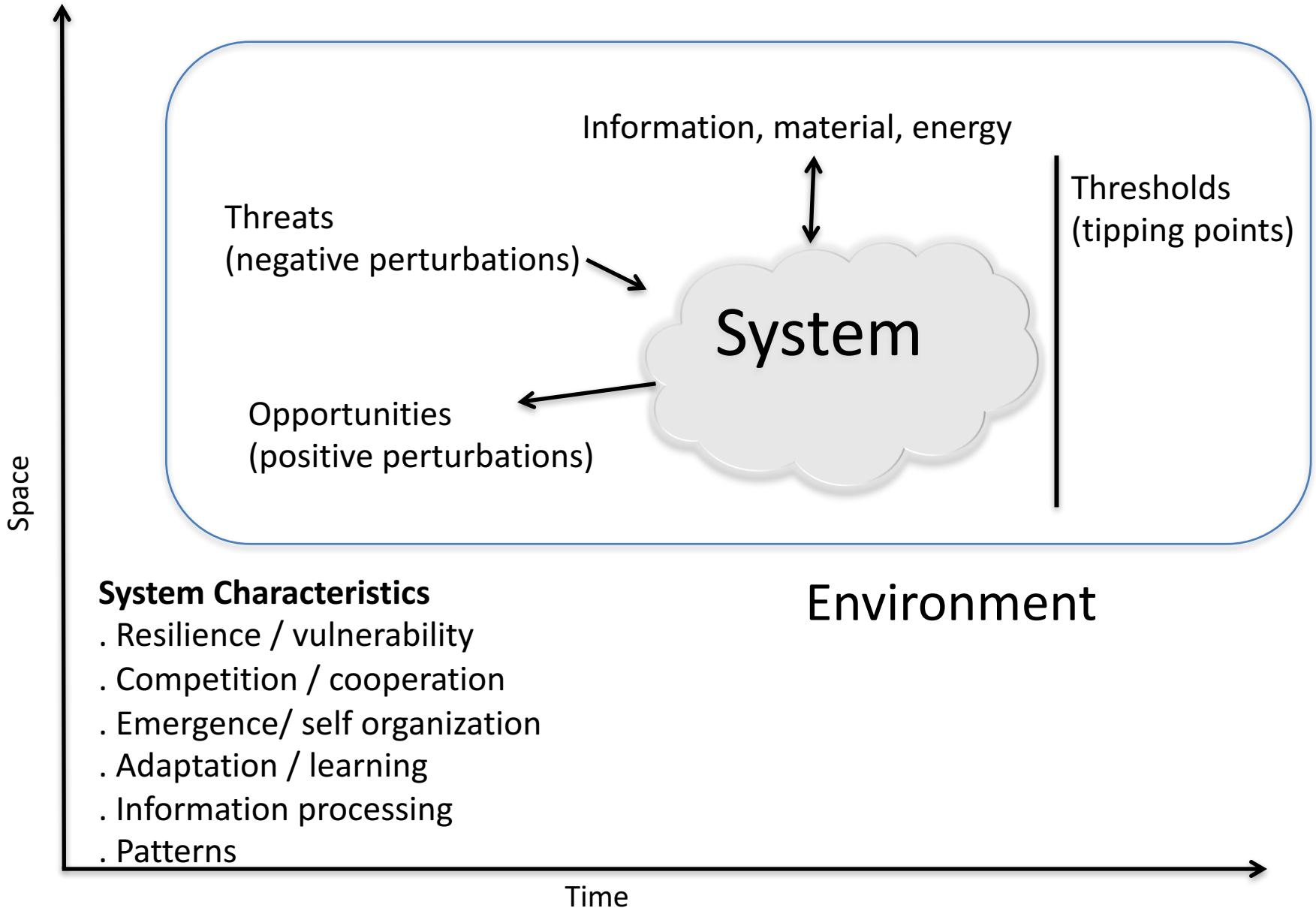
Fichter, L.S., Pyle, E.J., & Whitmeyer, S.J. (2010). Strategies and Rubrics for Teaching Chaos and Complex Systems as Elaborating, Self-Organizing, and Fractionating Evolutionary Systems. *Journal of Geoscience Education*. *58*(2)

# The Environment (for Social Systems)

A complex network



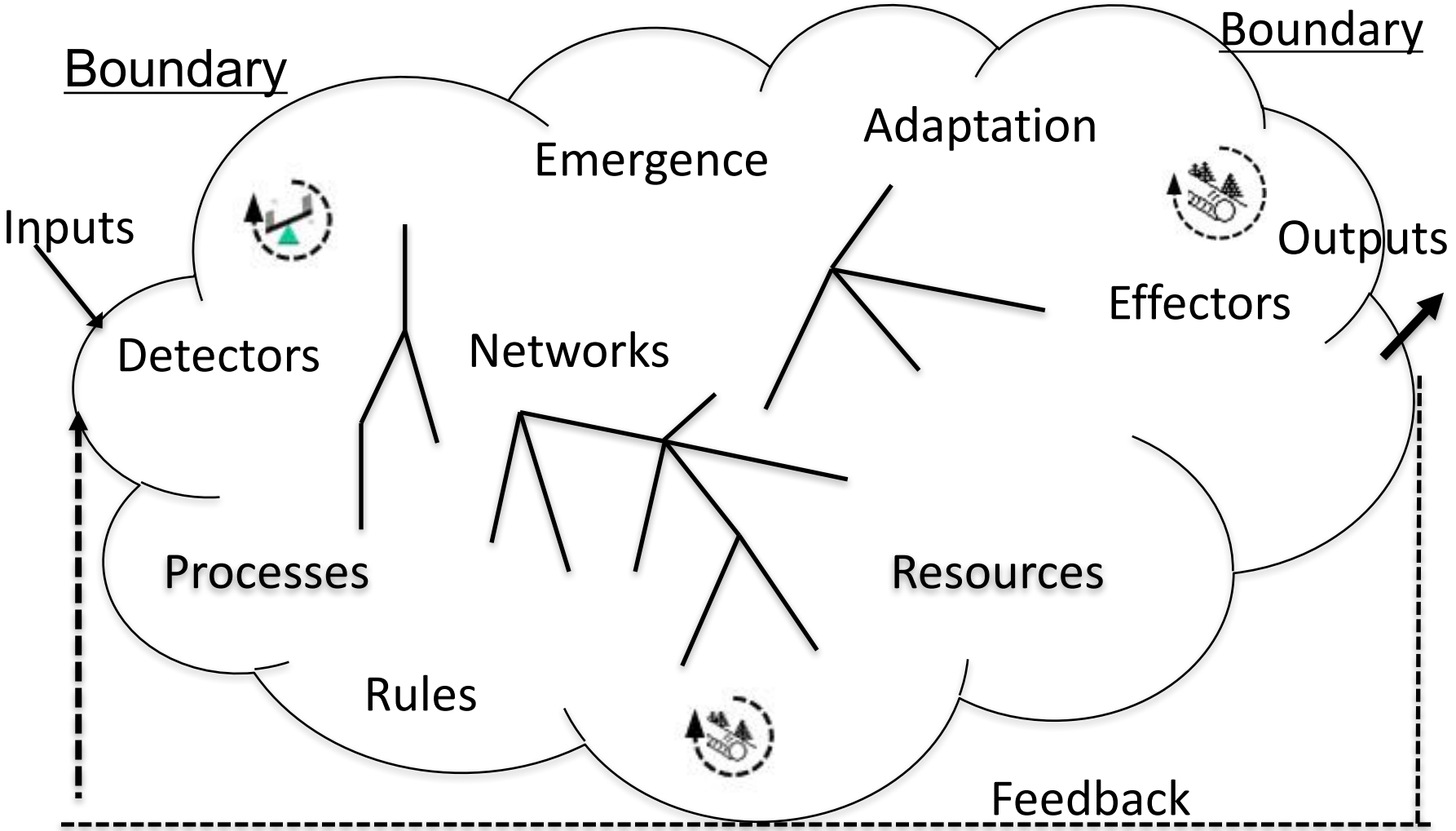
# A Complex Systems Model



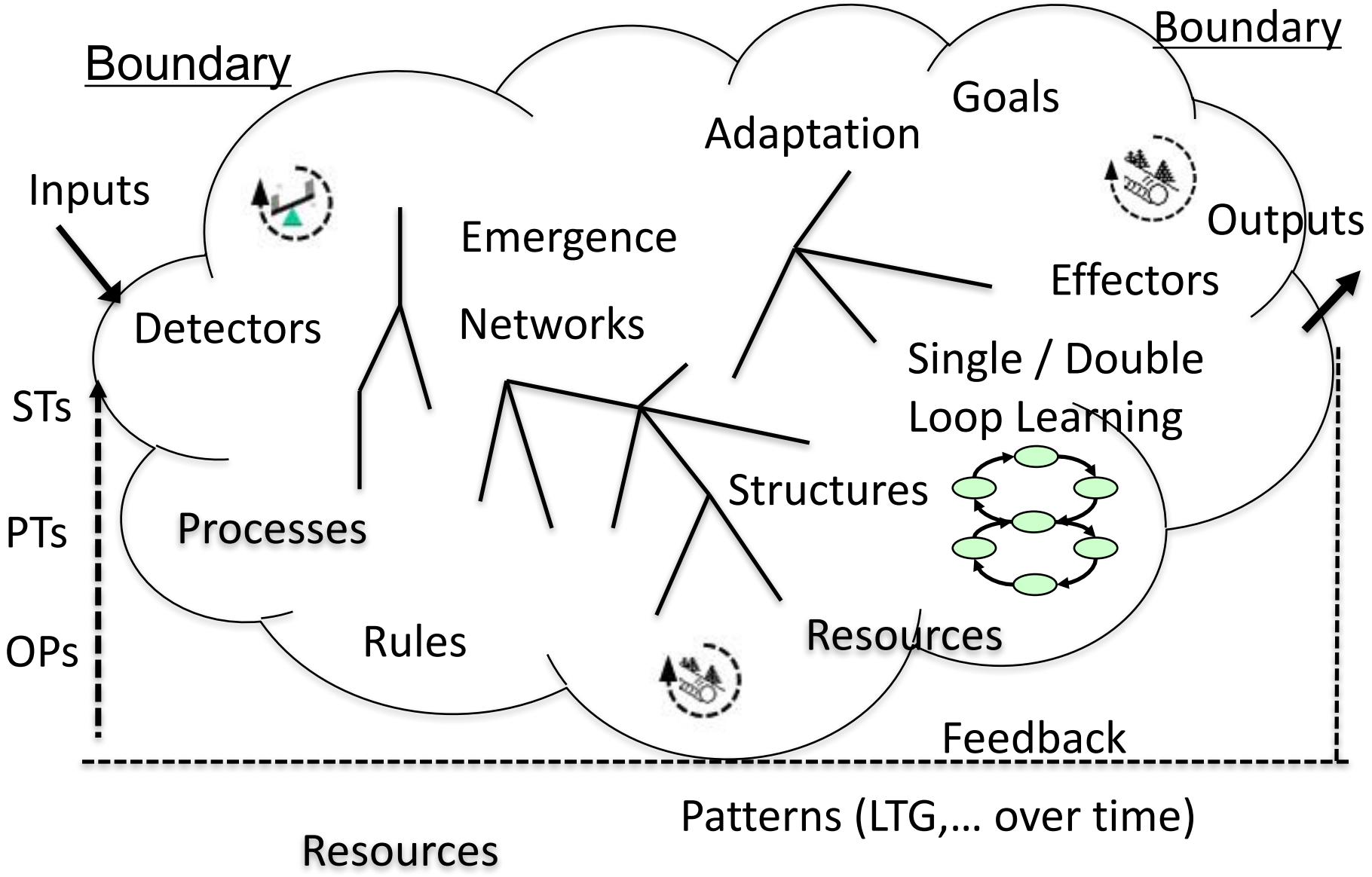

**System Characteristics**

. Resilience / vulnerability
. Competition / cooperation
. Emergence/ self organization
. Adaptation / learning
. Information processing
. Patterns

# Complex Systems Model



# Complex Social Systems Model



# Complex Adaptive Systems

Examples

- Central Nervous System
- Cities
- Economy
- Ecosystems
- Immune System
- **Organizations**
- Technology

# Types of Systems

- Systems may be natural, social, or artificial
- Examples:
  - The universe, solar systems, planets, atmosphere, hydrosphere, lithosphere, ecosystems, floral, fauna, …
  - Society, organizations, communities, families, …
  - Artificial life, …

# Notes

Open systems, including *complex adaptive systems*, are open to the environment and exchange information, energy, or material to survive

A threshold is a breakpoint between two regimes of a system.

Source: Walker and Meyers

Opportunities are favorable changes in the environment

Threats are unfavorable changes in the environment

# Notes

An environment for a social system includes the economy, technology, society, the physical environment, government / legal / military, and competition

These six elements comprise the framework used by many strategic planners and futurists.

While a framework perspective is appropriate; it is more complete to note that each of these elements is not just an environment but a complex adaptive system as well

# Notes

The boundary of a system delineates it from its environment

Detectors sense environmental stimuli

Processes transform inputs to outputs

Effectors express outputs to the environment

# Notes

Physical Technologies or PTs are methods and designs for transforming matter, energy, and information from one state to another

Social Technologies or STs are methods and designs for organizing people

Organization Plans or OPs are schema that code for the design of an organization

Beinhocker, E. D. (2010). *Evolution as computation: Implications for economic theory and ontology*. Retrieved from http://www.santafe.edu

# Properties of Social Systems

- Roles and responsibilities
- Performance (system and agent)
- Structure
- Emergence

# Properties of Systems

- Type (social, natural, or artificial)
- Size
- Hierarchy (number of subsystems)
- Diversity
- Nonlinearity
- Flows

# Notes

Complex systems contain structures and algorithms and exhibit patterns or behaviors

Performance is an accomplishment of an activity as assessed against established criteria such as time, cost, and scope.

A symptom is a manifestation of a performance element or change in an element

# Agent

- System elements are referred to by different names such as component, element, entity, object, part, unit, or agent.
- Agents process material, information, or energy
- An agent's behavior is determined by a set of rules
- Agents may be aggregated into meta-agents

# Relationships

- Agents are connected to other agents via one or more links or relationships.
- Relationships may be
  - Strong / weak
  - Attract / repel
  - Competitive / cooperative
  - Necessary
  - Synergistic
  - Redundant

# Relationships (Examples)

- Is the parent of
- Is the child of
- Is the sibling of
- Is a
- Is part of
- Is contained in
- Is consumed by
- Is transformed by

# Relationships
## Classification in Social Relations

- Interactions
  - Helped
  - Hindered
  - Consulted with
  - Talked to
  - Had sex with
- Flows
  - Information
  - Beliefs
  - Resources

Caldarelli, G., & Catanzaro, M. (2012). *Networks*. Oxford, UK: Oxford University Press.

# Relationships
## Classification in Social Relations

- Similarities
  - Location (same spatial or temporal space)
  - Membership (same clubs, events, activities …)
  - Attributes (same gender, attitude, …)
- Social Relations
  - Kinship  (mother of, father of, sibling of, ….)
  - Other role (friend of, student of, professor of, …)
  - Affective (likes, dislikes, neutral, …)
  - Cognitive (knows, knows about, …)

Caldarelli, G., & Catanzaro, M. (2012). *Networks*. Oxford, UK: Oxford University Press.

# Interdependencies

- Agents are interdependent with other agents …
- Examples
  - Agents may trade with other agents
  - Agents may cooperate with other agents to achieve something
  - Agents may consult with other agents
  - Agents may provide inputs to other agents

# Rules

- A formal means of defining agents
- Stimulus response or if then else rules
  - Basic format: If Then Else
  - Example:
    - If (income > 40%) then (distribute bonuses + merit) else (distribute merit only)
    - If (customer walks in the door) then (greet) else (continue working on current projects)
    - If (our products lose money) then (….)
    - BOIDS / Schools

Holland, J. H. (1995). *Hidden Order*

# Processes

- The set of steps by which inputs are transformed into outputs
- Examples
  - Consulting
  - Decision making
  - Manufacturing
  - Recruiting
  - Selling

# Feedback

- Complex systems exhibit positive and negative feedback loops
- Positive feedback is an amplifying feedback
- Negative feedback is balancing or goal seeking feedback
- Positive feedback example: customers recommending other customers

# Resilience

- The capacity of a system to absorb disturbance and re-organize so as to retain essentially the same function, structure, and feedbacks—to have the same identity.
  - Source: David Salt
- The opposite of resiliency is vulnerability
  - Brian Walker
- Resilience is the capacity of a system to continually change and adapt yet remain within critical thresholds
  - Stockholm Resilience Centre
- Components
  - Robustness, redundancy, resourcefulness, response, recovery

# Resilience Examples

- An ecosystem is resilient to change if it can withstand storms, fire, or other perturbations
- A society is resilient if it can manage political instability, natural disasters, population growth, economic disasters, or other perturbations.
- A company is resilient if it can manage financial swings, increasing / decreasing numbers of customers, increasing competition, lawsuits, ….

# Adaptation

Adaptation is successful change to either external forces or internal capabilities

What happens to organizations, communities, or families that cannot adapt?

# Mitigation

The effort to reduce the effects of a problem or situation

# CAS Properties

Tags

Internal Models

Nonlinearity

Flows

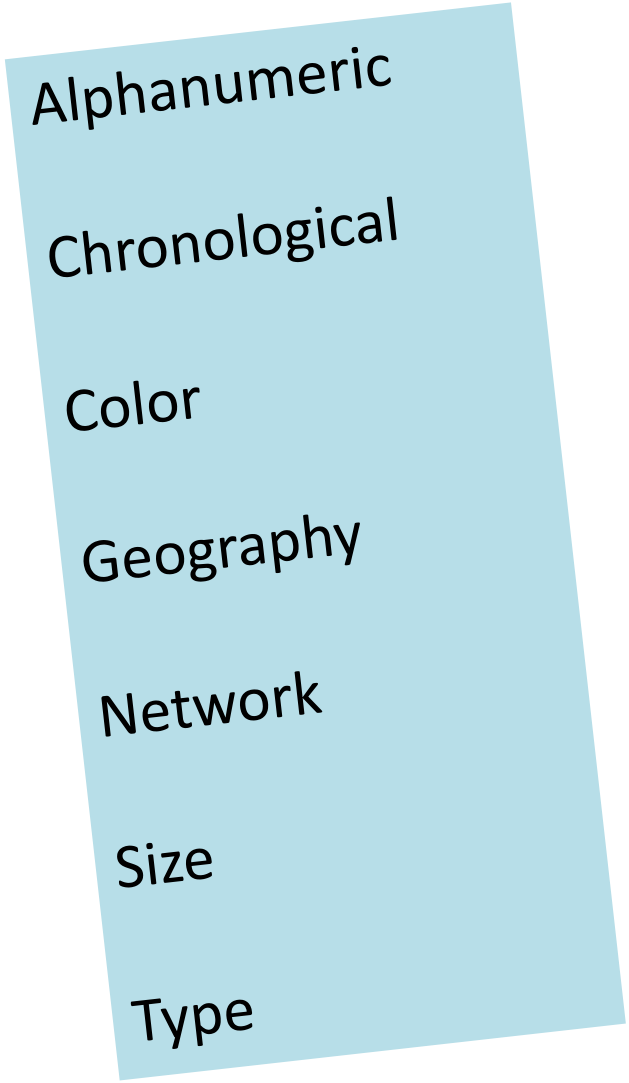
Diversity

Building Blocks

Aggregation

Source: John Holland*, Hidden Order*

# Information Organization Patterns
# Aggregation Possibilities




Agents can be aggregated in a few possibilities.

Examples of types: clusters of managers, technical staff, …

Organization charts are organized by hierarchy

May organize by the size of cities, countries, ..

# Patterns in Systems

Systems Archetypes

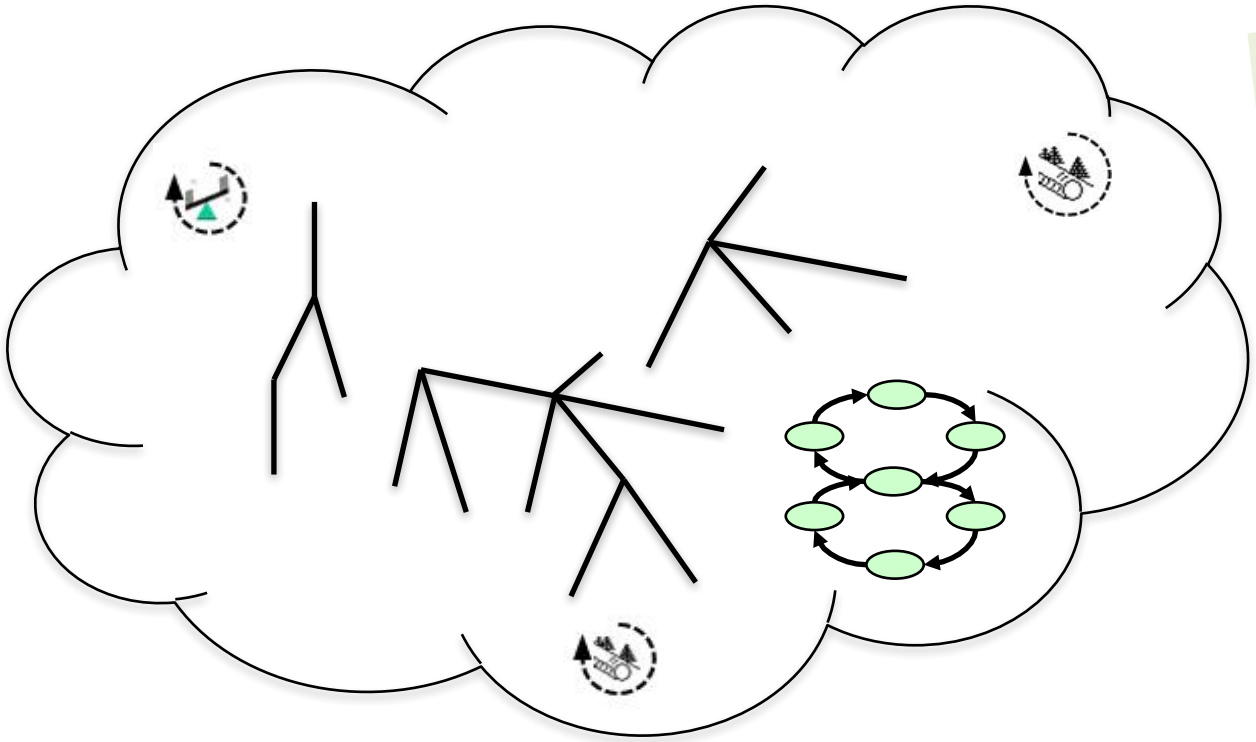
- Limits to Success
- Shifting the Burden
- Tragedy of the Commons
- Growth and Underinvestment
- Attractiveness
- Escalation
- Positive Feedback
- Negative Feedback
- Birth / Death
- Success to the Successful

# Some Trends / Forecasts

- U.S. Top 1%
  - 25 years ago, 12% of income, 33% of wealth; today 25% of income and 40% of wealth.
- The processing speed of a laptop will exceed the processing speed of the human brain by 2020
- U.S. population projected to increase from 308 million to 440 million by 2050, and 1 billion by 2100.
- Political gridlock (divergent world views or philosophical civil war?)
- Human consumption is now 23% larger than nature's capacity to regenerate or to absorb our "ecological footprint."

# Complex Social Systems

## Behavior Patterns Over Time



Equilibrium

Periodic

Random / Chaotic

Complex

Understanding complex adaptive and evolutionary systems provides insights into change that affect ourselves, our families, communities, and organizations

Complex systems are composed of structures and algorithms or processes.

We understand some structures such as boundaries and networks, while quantitative algorithmic understanding is very limited


But, are things as rosy
as we might think?

Change

# Pace of Change

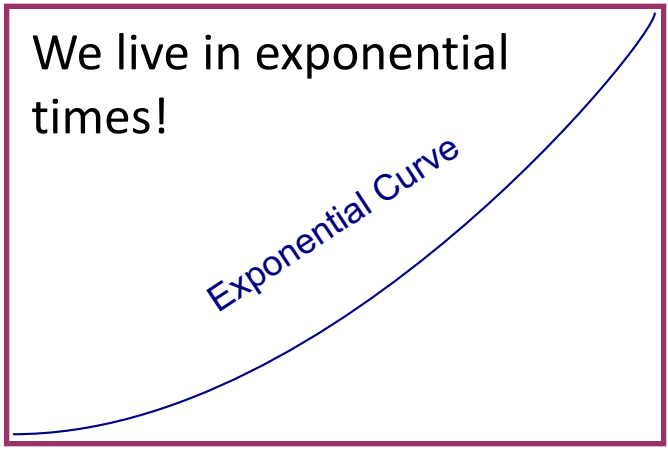
Some Characteristics of the Future

*Speed* – *the rate of change will accelerate*
*Complexity* – *continuously increasing*
*Risk* – *new and higher risks*
*Change* – *radical changes will force faster adaptation*
*Surprise* – *will become a daily feature of life*

Source: Dr. James Canton

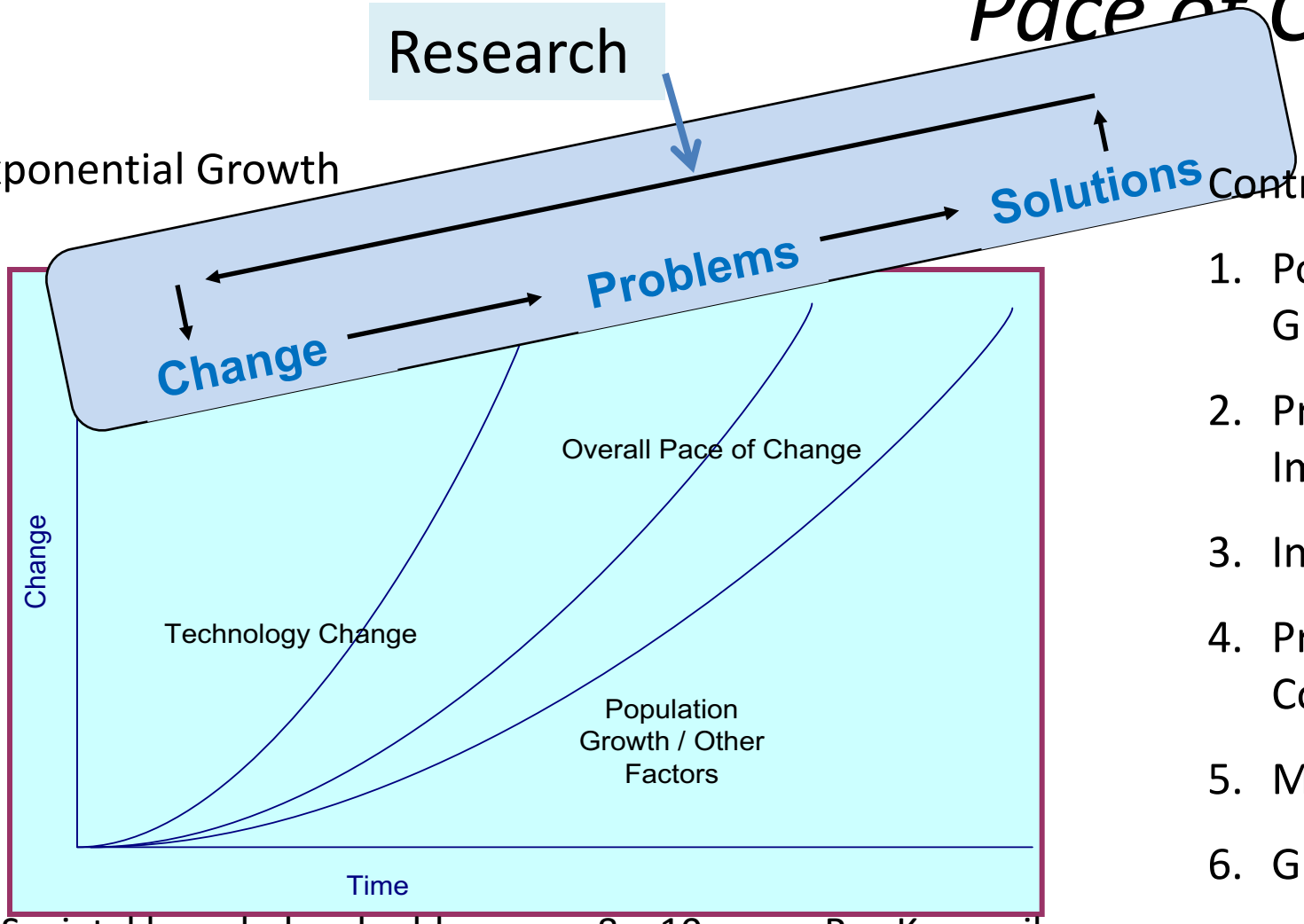
Plus,
*increasing* interdependency
and interaction

We live in exponential times!



# *Pace of Change*

Exponential Growth




Societal knowledge doubles every 8 – 10 years: Ray Kurzweil

Processing speed doubles every 12 – 18 months: Moore's Law

Contributing Factors

1. Population Growth
2. Process Improvement
3. Innovation
4. Product Combinatorics
5. Market Demand
6. Globalization
7. Cost Reductions

# Change

- The **Why** of change
  - Forces and sources of change
- The **What** of change
  - First and second order change, scale, timing
- The **How** of change
  - Adaptive / generative, proactive / reactive, planned / unplanned
- The **Target** of change
  - Outcomes

Source: Adrianna Kezar, "Understanding and Facilitating Organizational Change in the 21st Century"

# Change

As your organization begins a change process, management needs to understand **why** they are changing, **what** they are changing (degree of change), the approach (**how**) to adopt, and what the **outcome** will be.

Source: Adrianna Kezar, "Understanding and Facilitating Organizational Change in the 21st Century"

# Change Management

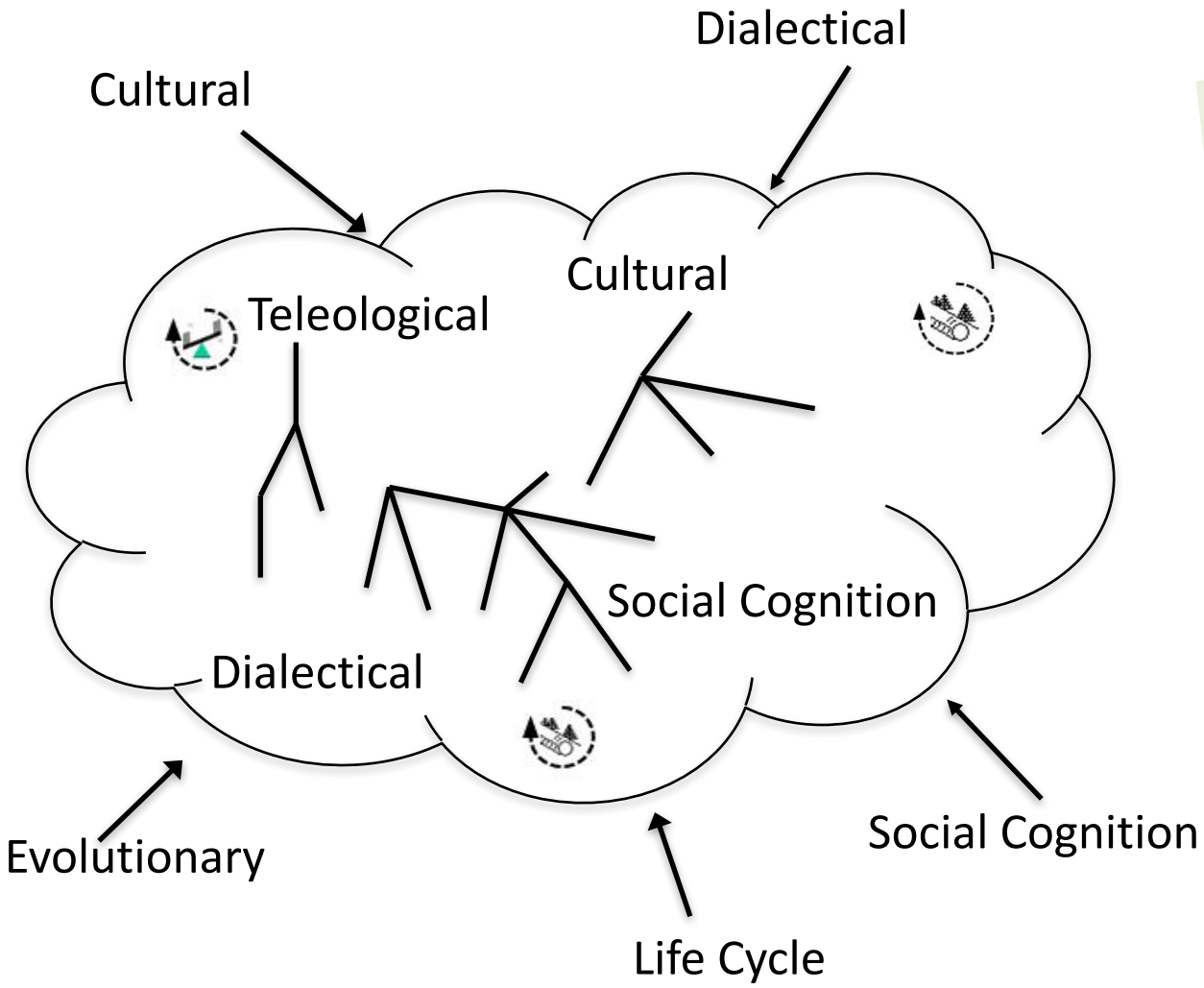
## Key Theories of Change – A Taxonomy

1. Evolutionary
2. Teleological
3. Life Cycle
4. Dialectical
5. Social Cognition
6. Cultural

Source: Adrianna Kezar, "Understanding and Facilitating Organizational Change in the 21st Century"

# Complex Adaptive (Social) Systems

## Behavior Patterns Over Time and Change Factors




Equilibrium

Periodic

Random / Chaotic

Complex

# Evolutionary Change

- Change is a response to external circumstances, situational variables, and the environment
  - Social evolutional models
  - Biological models
- Change is mostly unplanned – instead, it is an adaptive or selection-based process
- Examples
  - Strategic-choice
  - Population-ecology
  - Abiotic evolution

Sources: Adrianna Kezar, "Understanding and Facilitating Organizational Change in the 21st Century"

Eric Beinhocker, "The Origin of Wealth"

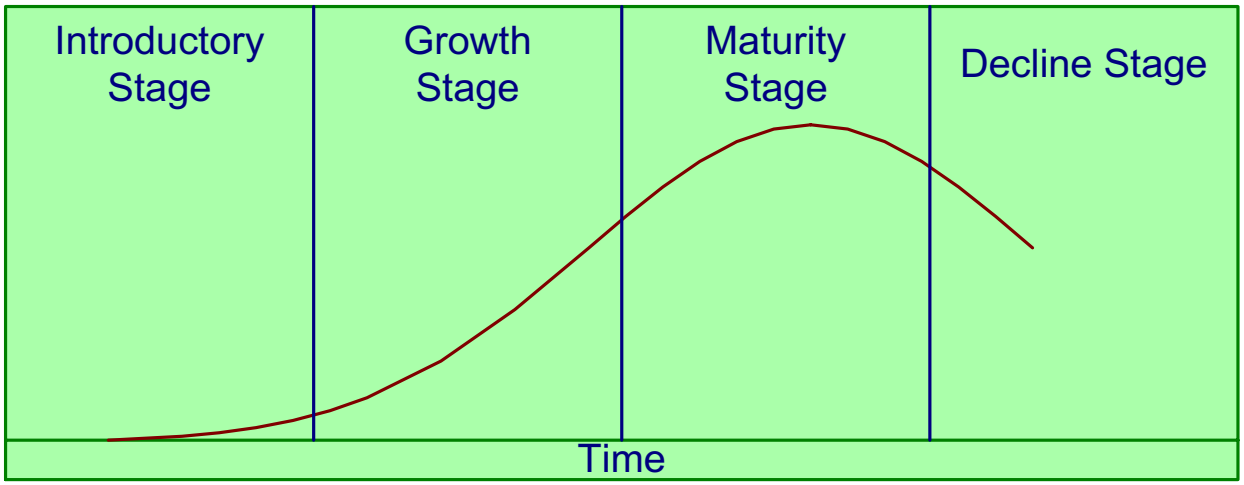
# Teleological Change

- Teleological or planned change occurs because organizations are assumed to be purposeful and adaptive
- The process is rational with managers instrumental in the process
- Models
  - Strategic planning
  - Organizational Development
  - Adaptive learning
  - Total Quality Management
  - Business Process Reengineering
  - Problem Solving
  - Kotter's 8 Step Process
  - Action Research
  - SEI CMM (Capability Maturity Model)
  - SEI PCMM (People Capability Maturity Model)

Source: Adrianna Kezar, "Understanding and Facilitating Organizational Change in the 21st Century"

# Life Cycle Change

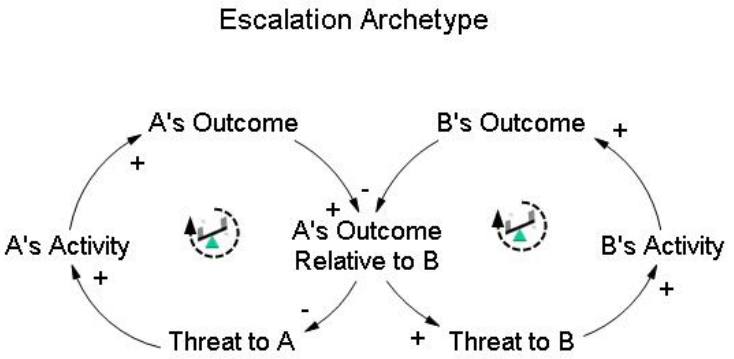
- Life cycle change is focused on stages of growth, organizational maturity, and organizational decline.




Source: Adrianna Kezar, "Understanding and Facilitating Organizational Change in the 21st Century"

# Dialectical Change

- Dialectical change or political change is change that is the result of clashing ideologies or belief systems
- Conflict is seen as an inherent attribute of human interaction
- Change processes are considered to be predominately bargaining, consciousness-raising, persuasion, influence, and power




Source: Adrianna Kezar, "Understanding and Facilitating Organizational Change in the 21st Century"

# Social Cognition Change

- This is change tied to learning and mental processes such as sense making and mental models
- Change occurs because individuals see a need to grow, learn, and change their behavior

Source: Adrianna Kezar, "Understanding and Facilitating Organizational Change in the 21st Century"

# Cultural Change

- Change occurs naturally as a response to alternations in the human environment; cultures are always changing
- The change process tends to be long-term and slow

Source: Adrianna Kezar, "Understanding and Facilitating Organizational Change in the 21st Century"

# The Why of change

# Forces and Sources of Change

- External environment
  - Remote environment
  - Competitive environment
- Internal environment
  - Culture
  - Resources
  - Leader and employee behaviors / objectives
  - Organizational learning / adaptation

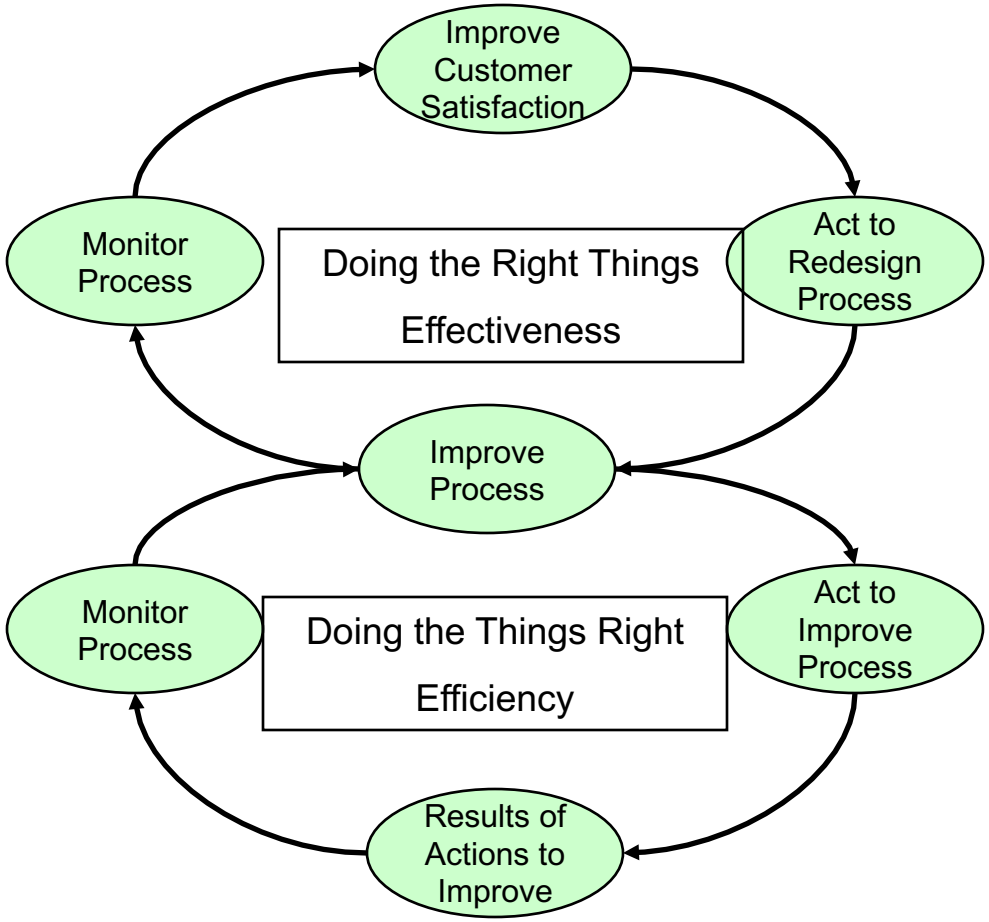
# The What of change

# Degree of Change

- First Order Change
  - Involve minor adjustments / improvements, but does not change the organization's core
  - Characterized by evolutionary change, a linear process, developmental efforts, single loop learning
  - Organization development (OD)
- Second Order Change
  - Transformational change, core change, underlying values, mission , culture, structure
  - Irreversible change
  - Associated with a crisis
  - Double loop learning

Kezar, *Understanding and Facilitating Organizational Change in the 21st Century*

# Single / Double Loop Learning




Double Loop Learning - Information about process effectiveness in serving customers

Single Loop Learning -- Information about process improvement and efficiency in serving customer

# Types of Change

- Developmental change
- Transitional change
  - (unfreeze, change, freeze)
- Transformational change
  - (near death experience)

Some theorists refer to developmental and transitional change (listed here) as first order change and transformational change as second order change. See Kezar

Source: Anderson and Anderson, "Beyond Change Management"

# Timing of Change

- Revolutionary change
  - Departs significantly from the existing organization
  - Occurs suddenly, with drastic changes within the mission, culture, and structure
  - Associated with second order change
- Evolutionary change
  - Less likely to be adopted as it may be seen as very long-term

Kezar, *Understanding and Facilitating Organizational Change in the 21st Century*

# The How of Change

# Planned / Unplanned

- Planned change
  - Changes deliberately made or shaped by the organizational members
- Unplanned change
  - Evolutionary and accidental change are not considered to be planned change

Kezar, *Understanding and Facilitating Organizational Change in the 21st Century*

# Half Full or Half Empty?

# Activities

# Strategic Planning made Simple

1. Where are you?
2. Where do you want to go?
3. How are you going to get there?
4. Who is going to do what and when?

# Activity 1

- Using the system environment framework (economy, technology, government, society, competition and the physical environment), list some:
  - Key events
  - Trends
  - Forecasts

# Activity 2

- What are examples in your organization of:
  - Suppliers / Inputs / Detectors
  - Effectors / Outputs / Customers
  - Resources / PTs / STs / OPs
  - Agents / Meta-agents (roles)
    - Leadership
    - Staff
    - Change agents / Gatekeepers
  - Rules
  - Relationships
  - Interdependencies
  - Processes
  - Resilience
  - Thresholds
  - Feedback loops

# Activity 3: Resilience

- Let's explore resilience in more detail—on a 1 – 5 scale with 1 being high and 5 being low:
  - How **Robust** is your organization?
  - Do **Redundancies** exist in critical functions, programs, …?
  - How **Resourceful** is your organization?
  - How capable is your organization to **Respond** to threats? To opportunities?
  - How capable is your organization to **Recover** from disasters?

# Activity 4

- Summarize where you are
- Summarize where you want to go

# Activity 5

- Given the outcome of activities 1, 2, 3, and 4 what change models might your organization embrace over the next 3-5 years?

# Activity 6

How might your organization be quantified?

***Thank You***

***for***

***Embracing Change!!***

**EMBRACING**

**CHANGE**

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