Systems Thinking for Implementation Research & Practice

VA QUERI Series
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Jennifer Terpstra, MPH
Doctoral Student, UBC

Luci Leykum, MD, MBA, MSc
Investigator, VERDICT

Objectives

1. Explain the need for alternative approaches to implementation
2. Define systems-based approaches
3. Explore potential application of systems thinking for implementation research and practice
4. Discuss alternative approaches for implementation in healthcare systems

Why do we need new approaches to implementation?

Overview of the Problem

- Difficulty translating “best practice” into routine practice
- Inconsistency of intervention effectiveness across time and settings
- Many of our approaches inherently assume linearity and predictability

However…

- Healthcare problems are context specific
- Healthcare settings are rarely linear and predictable systems
- We need a new approach that is consistent with the fundamental nature of the system

A Paradigm Shift

Towards a More Complex Understanding of Causality and Change

Different Types of Science

MODE I

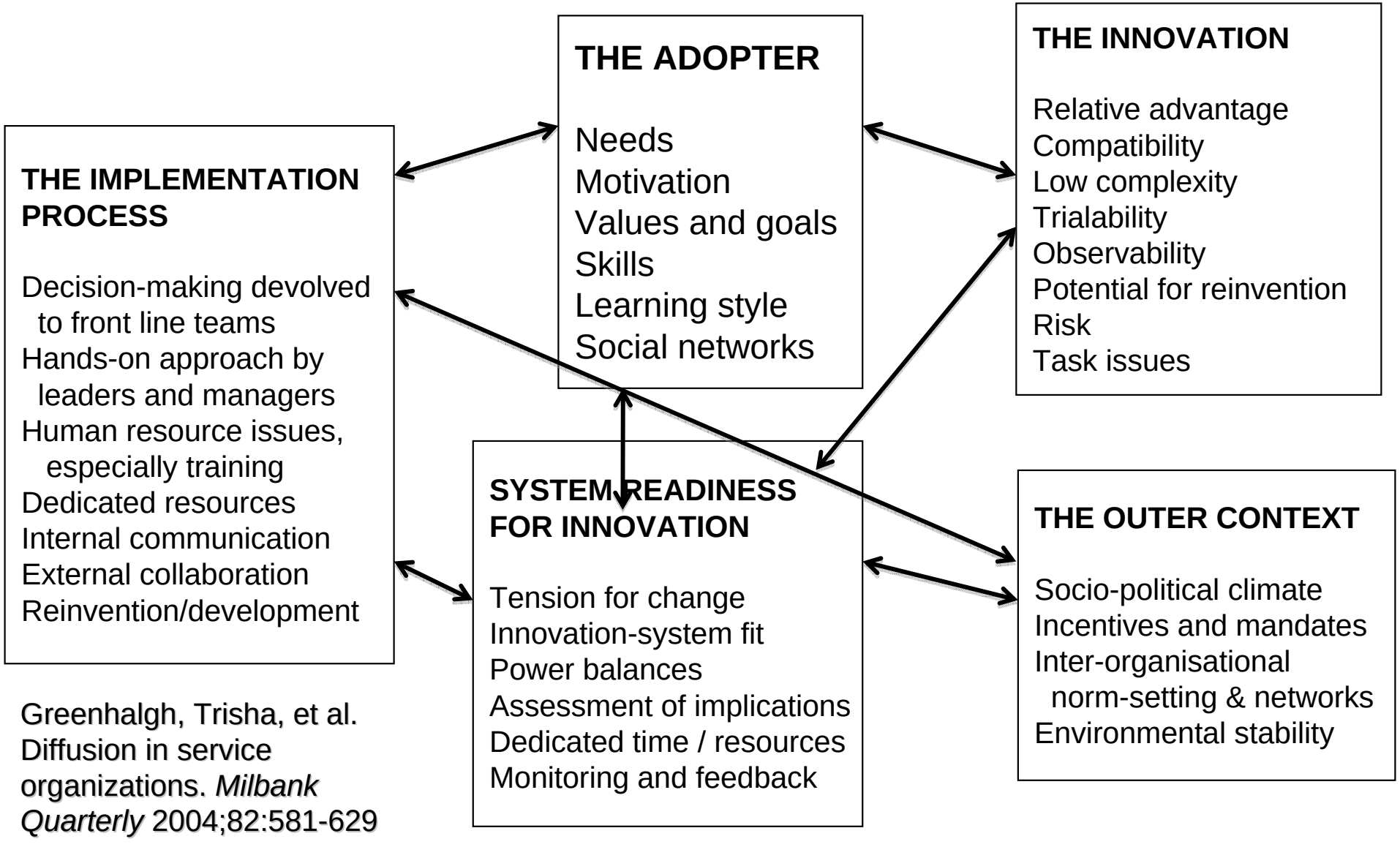
- Focus is knowledge generation
- Basic to applied research
- Scientist as expert
- Researcher driven
- High internal validity

MODE II

- Focus on problem-solving
- Co-creation of knowledge
- Context dependent
- Stakeholder driven
- High external validity

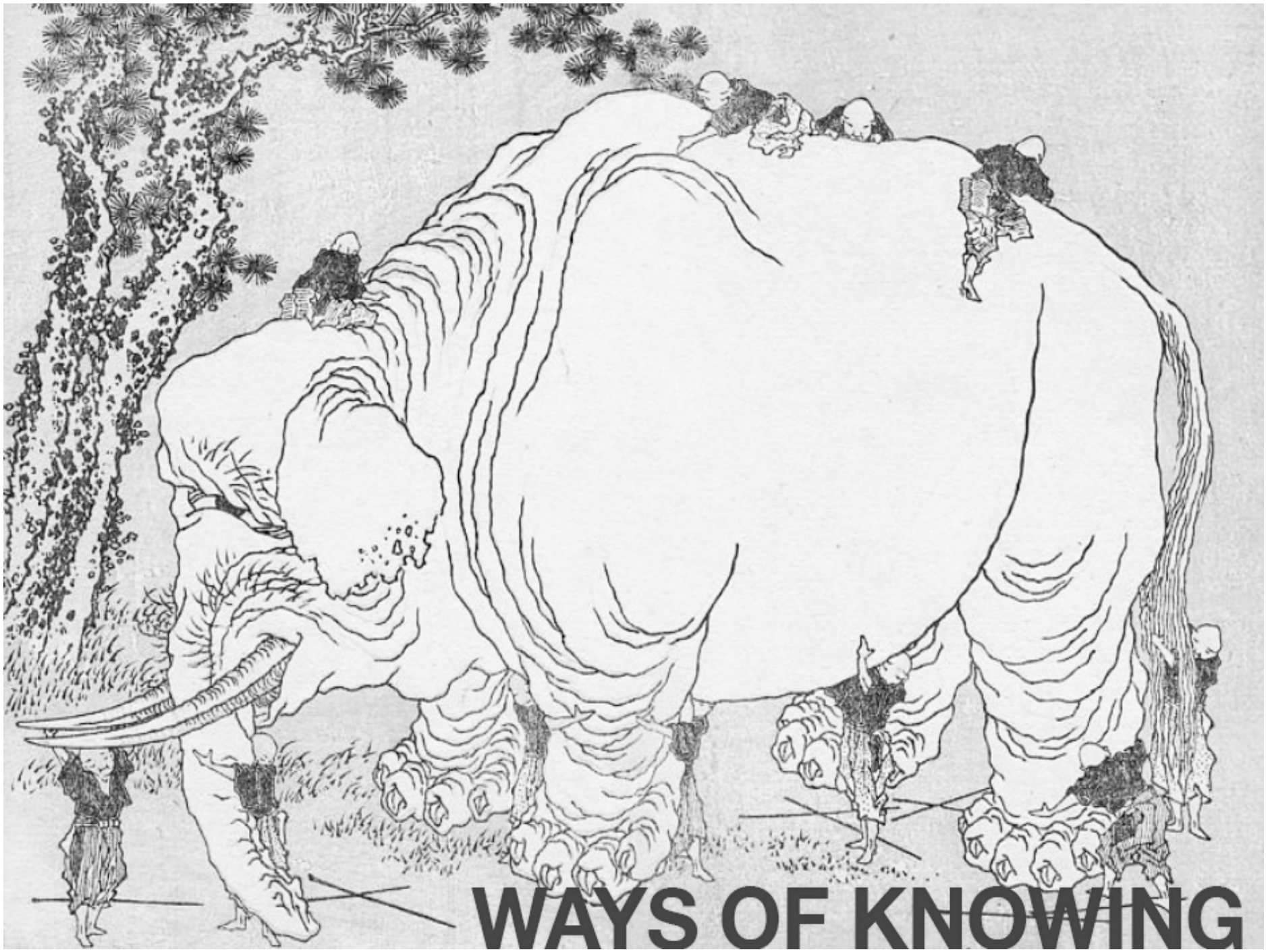
Denis JL et al. In Lemieux-Charles L & Champagne F. *Using Knowledge and Evidence in Health Care*, U of T Press, 2004

A Whole Systems Approach



Greenhalgh, Trisha, et al. Diffusion in service organizations. *Milbank Quarterly* 2004;82:581-629

What are systems-based approaches,
and how do do they add to our understanding of health care systems?


WAYS OF KNOWING

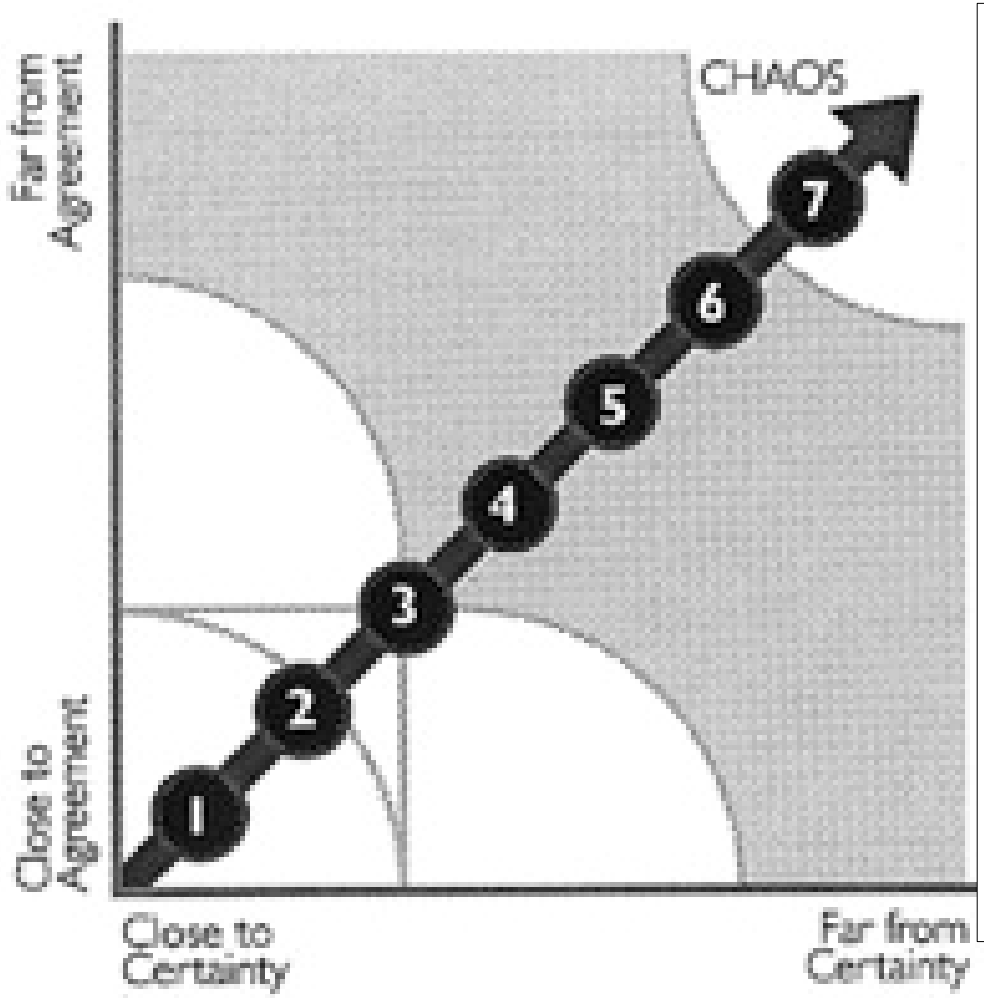
Systems Thinking

- Systems are bounded entities with **interdependent parts**, where the whole is greater than the sum of the parts

- Systems are **nested**

- **Holism** – Understand the whole by looking for **emergent patterns** resulting from **interactions** of different system parts

Stacey Matrix



- Simple systems
- Complicated systems
- Complex systems
- Complex Adaptive Systems
- Chaotic systems

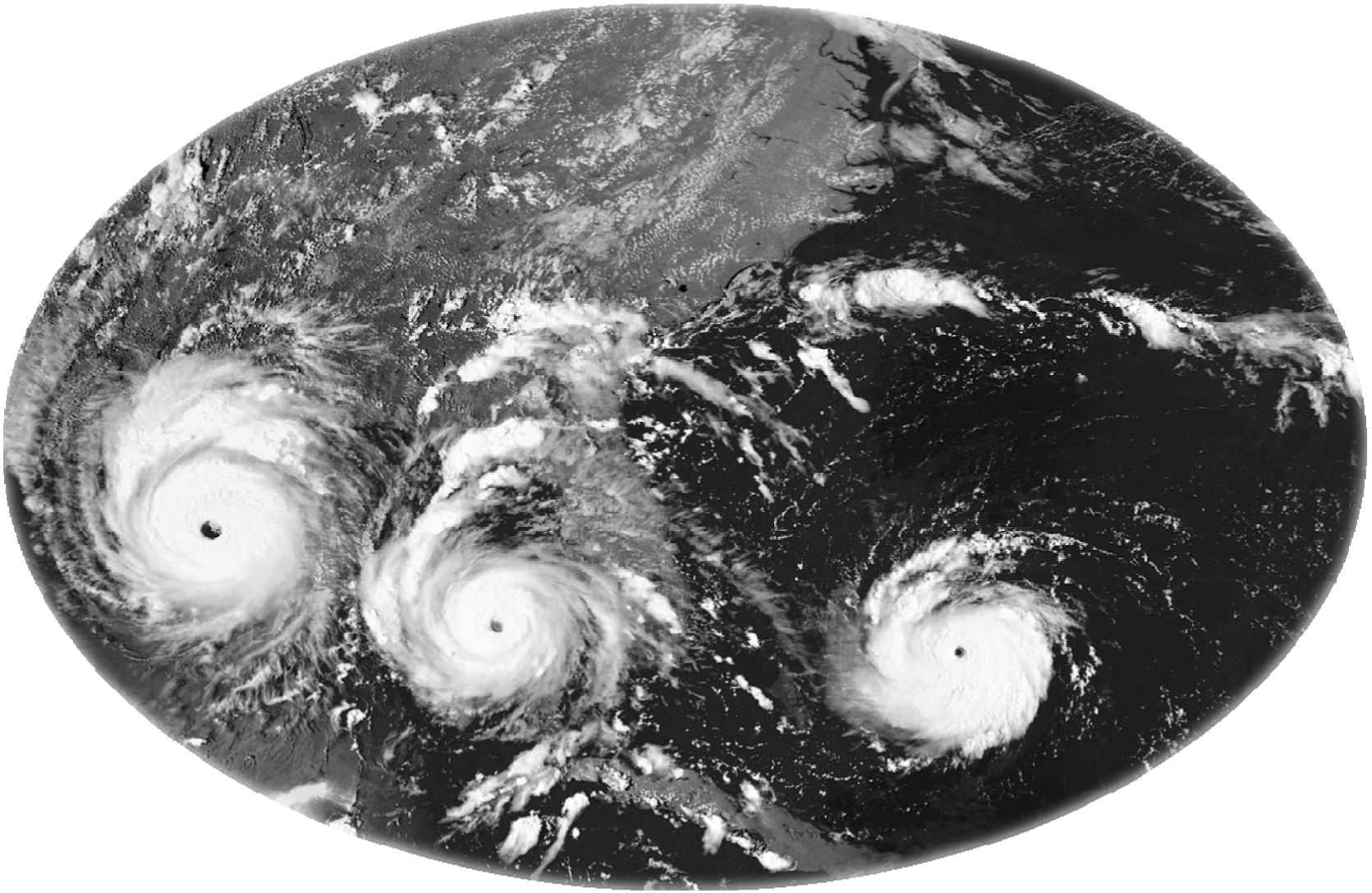
Zimmerman, Lindberg, & Plsek (2001). *Edgware: insights from complexity science for health care leaders*.

Complex Systems

- Characterized by interactions that are:
  - Non linear
  - Not deterministic

- Complex systems approach can be applied to physical, biological, or social systems
- Application to organizations often called “complex adaptive systems”

Analogy of a Complex System



The Characteristics of Complex Systems

Learning

Current approaches:

- People with specific licenses, skills, etc., are interchangeable
- "Pushing" knowledge is an effective strategy

Complex systems perspective:

- Individuals have a fund of organizational knowledge that makes them valuable

Implication:

- Improving individuals' ability to learn may be an effective way of improving a clinical system

Relationships / Interconnections

Current approaches:

- Focus on role definition, individual skill sets
- "everyone does her or his own job"

Complex systems perspective:

- The patterns of relationships are important

Implication:

- Interventions that focus on interconnections may be more effective than those that focus on individuals

Co-evolution

Current approaches:

- All clinical settings are the same

Complex system perspective:

- Each system is at a unique point
- Each system co-evolves with its external environment

Implication:

- interventions may not be easily translated

Self-organization

Current approaches:

- Organization can be dictated from outside
- Hierarchical command and control is possible

Complex system implications:

- Organization cannot be imposed from above – individuals must be active participants in change
- Control is distributed amongst system agents

Implications:

- Bottom-up approaches may be more successful

Emergence

Current approach:

- Strategic management based on study of individual parts
- Uncertainly can be reduced to zero through planning and role-definition

Complex systems perspective:

- The whole is greater than the sum of the parts
- Patterns can be seen at the macro level, not the micro level

Emergence

Implications:

- Because uncertainty and surprise are inherent, strategies that improve individuals' ability to "make sense" of what is going on may be more successful
- It may be difficult to interpret the intervention effects

Non-linearity & Time Lag

Current approaches:

- The effects of interventions should be the same over time

Complex system perspective:

- ***Inputs and outputs are not proportional or predictable!***
- Uncertainly and surprise are inherent

Feedback Loops

Current approaches:

- Events unfold in a linear process

Complex system perspective:

- A circular relationship- an influence is both a cause and an effect
  - Reinforcing (positive) loops
  - Self-correcting (negative loops) (eg. Thermostat)

Nonlinearity & Feedback Loops

Implications:

- Identify feedback loops to guide change
- The same action can have different effects over time, depending on the state of the system
- Difficult to predict outcomes and impossible to identify single causative factor

Examples of complex systems approaches in the healthcare literature

Paul Plsek
Crossing the Quality Chasm

- Clinical microsystems are interconnected, self-organizing, naturally adaptive, potentially unpredictable
- BMJ series:
  - Complexity Science: the challenge of complexity in healthcare
    - Plsek & Greenhalgh 2001
  - Complexity Science: complexity, leadership, and management in healthcare organizations
    - Plsek & Wilson 2001

Work in primary care

- Application of CAS to primary care developed by Crabtree, Miller, Nutting, Stange, McDaniel et al
  - "Practice Jazz"

    Miller et al, J Fam Practice 50(10) 2001

  - "Using Complexity theory to build interventions that improve health care delivery in primary care"

    Likater et al JGIM 21 2006

Work in primary care

- Observations on the following key attributes of primary care systems:
  - ***Relationships***
    - Talia et al, Family Practice Management 13(1) 2006; Scott et al, Annals of Fam Med 6(4) 2008
  - ***"Knowledge management"***
    - Orzano et al, Health Care Mgmt Review 33(1) 2008
  - ***Surprise***
    - McDaniel et al, Health Care Mgmt Review 28(3) 2003

NECSI

- Work in healthcare has looked at problems of scale
  - Mismatch between simple, large-scale activities and the complex treatment of individual patients
  - Mismatch between complexity of patient care situations and current reductionist approaches
  - Bar-Yam et al. Am J Public Health 2006
  - Bar-Yam et al. NECSI Technical Report 2004

Multimethod Assessment Process Reflective Adaptive Process

- How to more effectively create change / improve processes in primary care practices?

- 5 principles:
  - Articulate a vision and mission
  - Create time / space for learning and reflection
  - Tension and discomfort is normal and essential
  - Improvement teams must include a variety of participants with different perspectives
  - Supportive leadership must facilitate the process

Stroebel et al, Joint Comm J Qual and Pt Safety 31(8) 2005

Association between CAS and outcomes in chronic disease

- Systematic review of organizational interventions to improve outcomes for patients with type 2 diabetes

- Sets of investigators independently rated:
  - Consistency of intervention with CAS principles
  - Outcome effectiveness

Leykum et al, Implementation Science 2 2007

Association between CAS and outcomes in chronic disease

Total CAS Score	Rating of Intervention Effectiveness			Total No. Studies with each CAS Score
	0	0.5	1	
0	1	0	0	1
1	1	1	0	2
2	1	3	0	4
3	0	7	11	18
4	0	1	6	7
Total No. Studies at each Level of Effectiveness	**3**	**12**	**17**	**32**

Leykum et al, Implementation Science 2 2007

Role of Conversations

- Based on work in 5 studies*
- Reframe change as not a problem of reliable transfer, but of local sensemaking and learning
- Conversation concepts:
  - Collaboration
  - Meaning-making
  - Improvisation
- Use of conversation to promote these activities

Jordan et al. Implementation Science 4 2009

* DOPC, P&CD, STEP-UP, IMPACT, ULTRA

Working in complex systems

Practice Facilitation

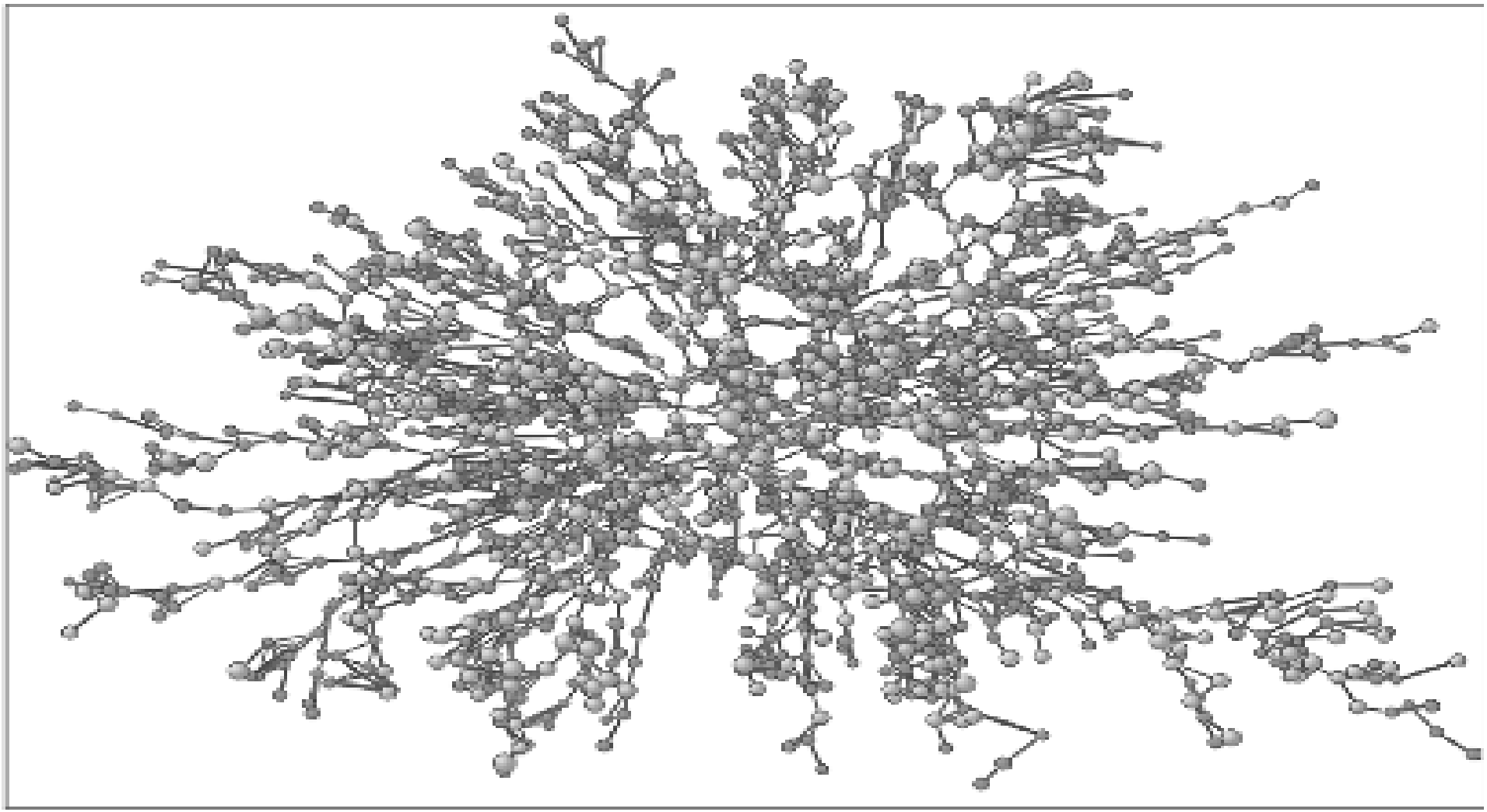
- Individuals who assist change efforts
- Goal is to help practice to achieve system-level changes
- ***Relevance to Systems theory*:**
  - Help promote relationships
  - Explicitly create time for reflection & conversation
  - Work within local context
  - Allows solutions to emerge

Nagykaldi et al, JABFM 19:506-10 2006

Participatory Action Research

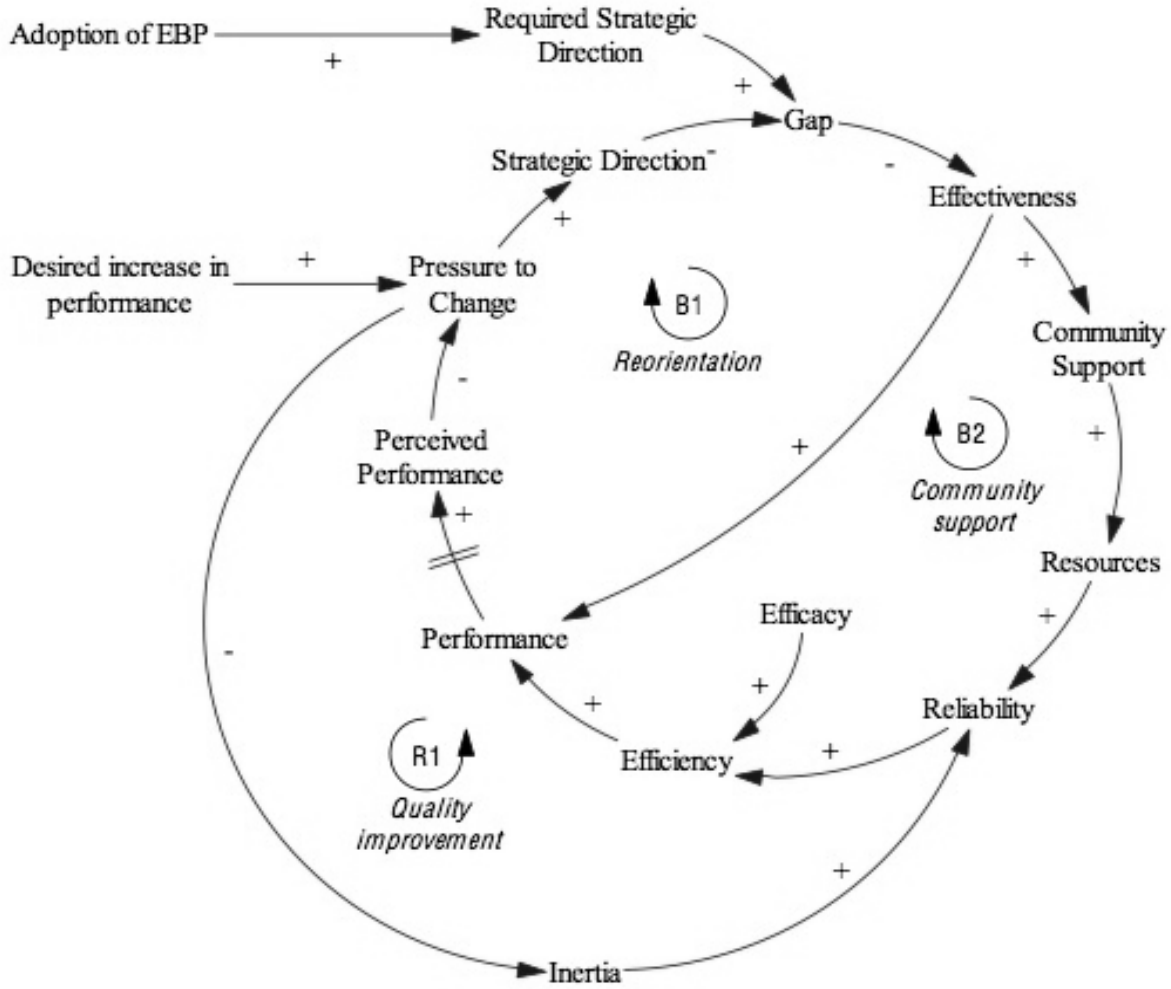
- Design in which researchers and participants are partners in implementing change
- Cyclical, iterative process that focuses on understanding impact of change
- ***Relevance to Systems theory:***
  - Context specific
  - Builds relationships
  - Reflection part of the process
  - Self organization promoted, solutions emerge

Social Network Analysis



Christakis & Fowler (2007) N Engl J Med 357:4,370.

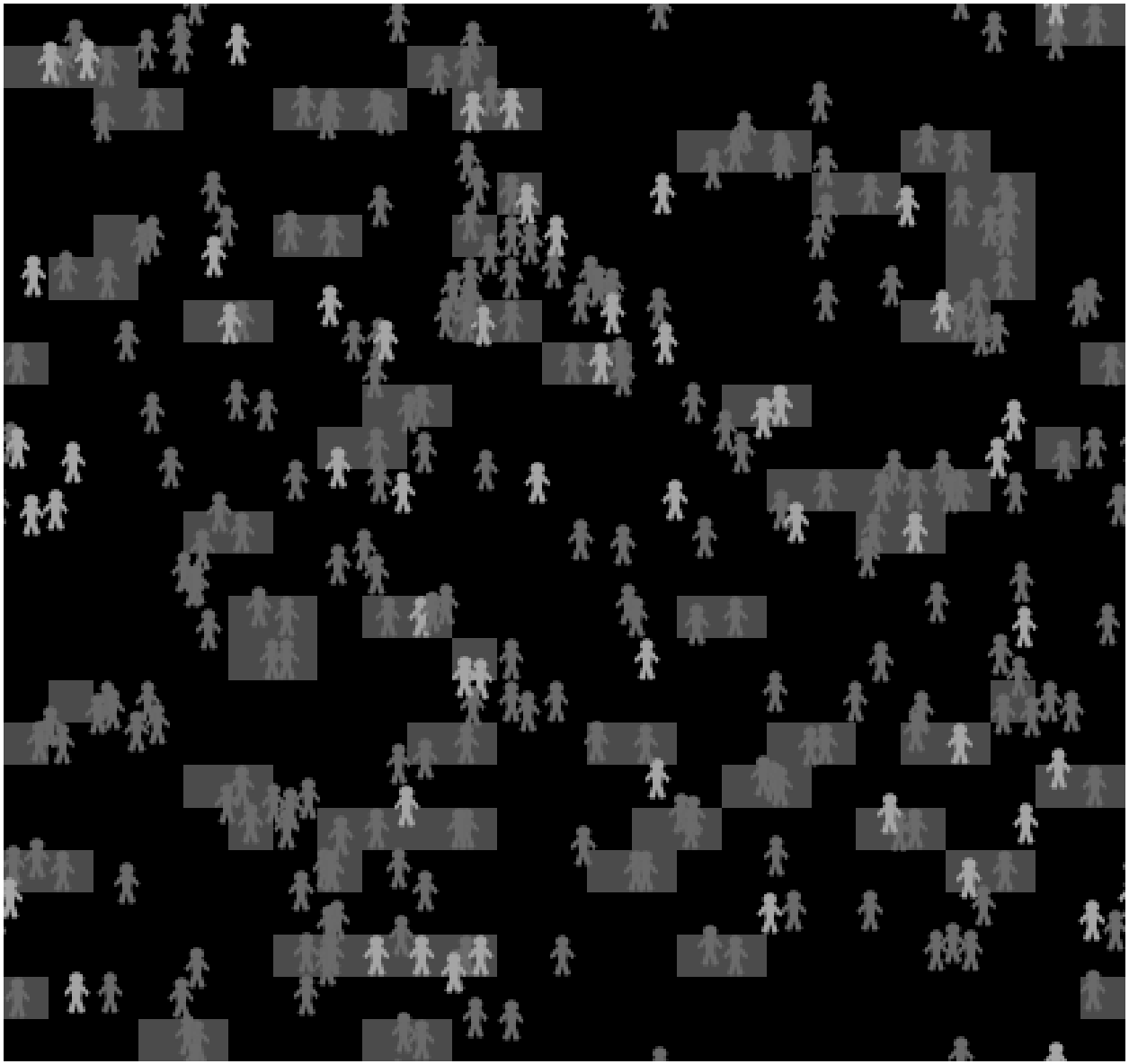
System Dynamics Modeling



Overview of main feedback mechanisms in a model of the implementation and organizational performance

Hovmand, P et al. (2008). Science meets policy practice.

Agent-Based Model of HIV Spread



In summary - A Paradigm Shift

	Reductionist Lens	Complexity Science Lens
Metaphor is a…	Machine	Brain (ie. living system)
Change by …	Plan & control	Change by learning & adaptation
Identify…	Cause & effect relationships	Patterns
Study approach	Reduce to parts and study independently	Identify interactions & feedback loops
Look at the…	Micro level, Study single component	Macro (whole systems) level, monitor patterns
Validity emphasis	Internal validity- control context	External validity Context is a integral
Intervention goals	Standardization of parts	Adaptation to local context
Researcher role	External & objective	Shared development & collaboration

Thank you!

"Order...ladies and gentlemen, please...
...order...order..."