

# Exploring Complexity

In Science and Technology

Sept. 27, 2010

Jeff Fletcher

## What are Complex Systems?

- Examples
  - [Ants](#)
  - [Brains](#)
  - [Immune System](#)
  - Economies
  - World Wide Web
- What do these examples have in common?
  - Explore with your neighbor
- Large networks of simple interacting elements, which, following simple rules, produce emergent, collective, complex behavior.

## Central question for the sciences of complexity

- How do large networks with
  - simple components
  - limited communication among components
  - no central control
  - simple rules of operation
- give rise to complex (“adaptive”, “living”, “intelligent”) behavior, involving
  - complex pattern dynamics, behavior
  - information processing and computation
  - adaptation via learning or evolutionary processes

## Core disciplines of the science of complexity

- Dynamics
  - The study of continually changing structure and behavior of systems
- Information
  - The study of representation, symbols, and communication
- Computation
  - The study of how systems process information in order to solve problems
- Evolution
  - The study of how systems adapt to their environments

## Goals of the Science of Complexity

- Cross-disciplinary (interdisciplinary, trans-disciplinary) insights into complex systems
- General Theory of complex systems
- To give insight towards better addressing real-world problems involving complex systems

## Next Up

- What is Systems Science?
- Class Details, Syllabus, Intros, Sorting, Pictures
- (Not yet) History of Dynamics
- (More to come) Population growth, Logistic Model, Logistic Map
- (Not yet) NetLogo (Logistic Model, Ants)