UNI360Y; 2001-02
Social Adaptation to Complex Change:
The Cases of Climate Change, Infectious Disease, and Light Weapons
University College, Room 163, Wednesdays, 6 to 8 p.m.

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Overview

Our technological, social, political, and economic systems are becoming more complex, and they are operating at a faster pace. Our burden on Earth's environment is also rising quickly. The problems our societies must address - from pandemics of TB and AIDS, to international financial instability and climate change - are generally becoming harder to solve. What factors affect our ability to adapt to such complex change? Can humanity effectively address the challenges it is creating for itself? What are the consequences of these for peace and war?

In this course, students will simulate a complex adaptive system (a CAS) to address the contemporary problems of global climate change, emergent and re-emergent infectious diseases (ERIDs) in the developing world, and the diffusion of light weapons in the developing world. CAS theory suggests that the most adaptive systems are those that reside on the cusp between order and chaos. The units within a CAS alternately compete and cooperate to solve common problems through decentralized, parallel strategies, and by sharing information through weak networks of communication. The overall system's tendency towards chaos encourages more thorough exploration of the system's fitness landscape; while its tendency towards order promotes learning over time.

We will ask whether such CAS strategies are adequate for the challenges humankind now faces. Is humankind exceeding its "complexity horizon"? That is, are the systems around us becoming so complex and nonlinear that they are beginning to exceed our fundamental cognitive and management capacities?

If they are, we can expect that human societies will experience major systems failures - economic, technological, political, and ecological - in coming decades, failures that may lead to significant violence within and among societies.

Course Format and Requirements

This course will be divided into five segments: a three-week introduction to theories of complexity and complex adaptive systems; three "case-study" segments dealing with specific sources of complex stress in the developing world (six weeks on climate change, four weeks on infectious disease, and four weeks on the diffusion of light weapons); and a CAS simulation.

At the beginning of each of the three case-study segments, students will be assigned to a group. Each group will be assigned a topic relevant to the case study, and each will prepare and present a written and oral report to class. Copies of the written report, with a complete list of references, should be distributed to each member of the class at the beginning of the presentation. When preparing their reports, groups will decide within themselves how tasks will be allocated. However, the topic at hand should be divided into three or four sub-topics and each sub-topic should be assigned to one student (within another student assigned as a research assistant). That student will be responsible for writing a section of the overall report on the given sub-topic and presenting it to class. Each student's presentation should last no more than 15 minutes, which will leave ample time for discussion.

The first case-study segment will focus on climate change. The topics for the six weeks will be: 1. Contemporary climate-change theory and methodology; 2. Evidence on climate trends to the present, and projections of future climate change; 3. The basics of the Kyoto Protocol and subsequent adjustments; 4. Emissions trading, joint initiatives, and other market-based strategies; 5. The perspective of the South; and., 6. Geoengineering.

The second case-study segment will focus on emergent and re-emergent infectious diseases (ERIDs) in developing countries. The topics for the four weeks will be: 1. Basic epidemiological theory; 2. Recent infectious disease trends in developing countries; 3. Economic, social, and political consequences; and, 4. Domestic and international efforts at control.

The third case-study segment will focus on the diffusion of light weaponry in developing countries, and on the general trend for violence capabilities to diffuse away from the state to smaller and smaller groups. The topics for the four weeks will be: 1. Trends in light-weapon lethality and in the diffusion of light weapons in the developing world; 2. Economic, social, and political consequences; 3. Domestic and international efforts at control; and, 4. Terrorism.

Over the course of these three case studies, each student should make at least one presentation to the class and should assist, at least once, a classmate as a research assistant.

The fifth segment of the course will involve a four-week simulation of a CAS-approach to addressing the combined effect on the developing world of the above three problems. In the first week, students will be given a description of the world in 2010, as it relates to climate change, disease, and weapons and to the political and economic issues surrounding these problems. The students will again be divided into groups, and each group will develop a strategy to meet the challenges identified in the 2010 description. The groups must not communicate with each other during the subsequent week. In the next class, each group will present its strategy and argue for the relative advantages of its approach.

In the third week of this segment, the instructor will announce which of the four approaches has "won" that round of the competition and will present the justification for that judgement to the class. He will also present a new description of the world - this one for 2015. Based on the "learning" that has taken place in the first round of the competition, and the information in the 2015 description, students (who will remain in the same four groups) will develop a further strategy for meeting the challenges of 2015. The final week of the segment will again involve presentations of strategies by each group.

The simulation will therefore proceed in the following sequence: strategy development, competition, evaluation, learning, strategy development, competition, and evaluation.

Grades Breakdown

Given this course format, each student will present at least one written report (of no more than 1000 words, plus references) on a designated sub-topic to the class. The report and presentation will be evaluated as follows: 50 percent on the written report itself; 30 percent on the oral presentation; and 20 percent on the overall quality of the group's written and oral performance. There will also be two in-class tests and one take-home exam.

Written and oral presentation	20%
Two in-class tests (October 31 and February 13)	40%
Take-home exam (assigned March 20, due April 10)	30%
Other class participation	10%

NOTE: Marks will be deducted from all assignments received late. The penalty is four percent per day, weekends included. I will grant extensions without penalty only in truly exceptional circumstances, and I require documentary evidence of illness or any other emergency.

Required Readings

1. Thomas Homer-Dixon. *The Ingenuity Gap*. Knopf, 2000.

2. Stuart Kaufmann, *At Home in the Universe: The Search for the Laws of Self-Organization and Complexity*. Oxford, 1995.

3. The Worldwatch Institute, *Vital Signs*. Norton, 2001