Engineering Systems
Doctoral Seminar
ESD.83-- Fall 2011

Class 7
Faculty: Chris Magee and Joe Sussman
TA: Rebecca Saari
Guest: Professor Chris Zegras (DUSP & ESD)
Welcome, Overview and Introductions (5 min.)

Dialogue with Professor Zegras (55min)--Redaction provided by David Gerstle

Break (10 minutes)

Discussion of ESD.83 faculty-provided theme-related papers led by Xin Zhang (approximately 40 minutes)

Discussion of *Triumph of the City* by Glaeser, facilitated by Chris Magee (approximately 30 minutes)

Theme and topic integration: Report from the front; Words; Quotes; Teaching and Learning Time-- Cities as complex systems-- (Sussman)

Next Steps -preparation for Class 8 - (5 minutes)

Magee
Discussion of *Triumph of the City*

- Colleague’s *additional insight* to note
- Strengths of book
- Weaknesses
Discussion of *Triumph of the City II*

- Colleague’s additional insights to note
- Strengths of book:
  - geographic, temporal and subject diversity;
  - Concepts (idea density) and nice stories;
  - raising our awareness of importance of human interaction at center of success
- Weaknesses:
  - Economics thinking only; parochial green definition; broad but shallow systems view;
  - Generalization from selected cases;
  - “Honesty” about firmness of conclusions (for example, proximity goodness)
Discussion of *Triumph of the City III*

- Colleague’s additional insights to note
- Strengths of book
- Weaknesses
- Looking forward, what does the thesis of the book suggest for living patterns, etc.?)?
- How does the book connect to the rest of today’s session?
  - Zebras article
  - Innes & Booher (development complexity, CAS)
  - Cascetta (urban transport governance complexity)
Theme and topic integration: Class 7

- Report from the front; ________
- Words
- Quotes
- “Teaching and Learning Time”
- Class 8 Plan (Magee)
Words

- Modularity
- Scalability
Sets of simultaneous equations as a way to “model” or define a system are, if linear, tiresome to solve even in the case of a few variables; if nonlinear, they are unsolvable except in special cases.

- Ludwig von Bertalanffy, *General Systems Theory*
Trust is an important lubricant of a social system. It is extremely efficient; it saves a lot of trouble to have a fair degree of reliance on other peoples’ word. Unfortunately this is not a commodity which can be bought very easily... Trust and loyalty... are not commodities for which trade on an open market is technically possible or even meaningful.

Kenneth Arrow, *The Limit of Organization*
Book I

- Coordination without Hierarchy: Informal Structures in Multiorganizational Systems by Donald Chisholm
Urban Transportation Organizations in the Bay Area

- AC Transit
- Golden Gate
- Muni
- Samtrans
- Santa Clara
- BART

Highly interdependent operationally but organizationally independent-- System of Systems....?
Under conditions of stress, coordination is essential.

“The depth of interdependence ... is never more evident than when through catastrophe or labor-management dispute, one operator is unable to provide its regular service.”

Informal ties become essential....
Networks

- The urban transportation network, or collectively a set of networks
- The formal organizational networks of various players: BART, AC, etc, likely connected only at the CEO level
- The informal organizational networks with lateral connections within and among organizations
- Think about the role of technology here
Other Examples

- Military Organizations
- MIT
Book II

The Metropolitan Problem and American Ideas: Lectures Delivered on the William W. Cook Foundation of the University of Michigan by Luther Halsey Gulick, 1961
Some ideas from the book circa 1961

- “New” problems
- Boundaries
- The principle of “exception”
- The principle of “integration”
Framing questions for ESD.83 I

- What is a complex system?
- What are our ways of thinking about these complex systems?
- What kinds of research questions do we want to ask in the field of Engineering Systems and how do we answer them?
Framing questions for ESD.83 II

What are the historical roots of the field of Engineering Systems and what is their relevance to contemporary engineering systems issues and concepts?

What does “practicing” Engineering Systems mean?
Framing questions for ESD.83 III

- What are the **design** principles of Engineering Systems?
- What does it mean to advance the field of Engineering Systems and how do we accomplish it?
- How do we integrate engineering, management and social science in Engineering Systems?
Learning Objectives

- **Basic Literacy:** Understanding of core concepts and principles - base level of literacy on the various aspects of engineering systems.

- **Interdisciplinary capability:** The capability to reach out to adjacent fields in a respectful and knowledgeable way and the ability to engage with other ES scholars in assessing the importance to ES of new findings in related fields.
Learning Objectives

- **Critical Analysis:** Ability to critically assess research and scholarship aimed at furthering knowledge in engineering systems; development of defensible point of view of important contributing disciplines in Engineering Systems Field

- **Links Across Domains and Methods:** Ability to identify links/connections across different fundamental domains and methods relevant to engineering systems
Learning Objectives

- **Scholarly Skills**
  
  1) The ability to write a professional-level critical book review;
  
  2) A beginning level ability to develop and write a research proposal in the ES field;
  
  3) The ability to present and lecture on critical analysis of material that one is not previously familiar with;
  
  4) Developing wider reading skills and habits
THE END