

EST 582 Introduction to Systems Concepts

Split form class: Face-to-face and on-line

This is the FTF syllabus

Frey Hall 216 5:30-8:20

Two lectures: 5:30-6, 6-6:30

Discussion 6:30-7:30 Group Work Mon 7:30-8:20

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Systems thinking requires changing perspectives on how to analyze problems and seek solutions. Socio-technological systems are the more complicated kinds of systems that require integrating knowledge of technologies with human elements. We will examine common systems through engineering, political, social, and ethical analyses.

Learning Outcomes

- 1) Gain fluency in systems vocabulary and concepts
- 2) Combine technical and social aspects to explain complicated phenomena
- 3) Demonstrate some mastery of socio-technological systems concepts

Required texts:

The Big Short (2015), directed by Adam McKay. Paramount Pictures. Starring Christian Bale, Steve Carell, Ryan Gosling, Brad Pitt. 130 min. Available on Prime Video (rent \$3.99, buy \$9.99)

CSI (Cambridge Systematics, Inc. with Texas Transport Institute). 2005. The nature of traffic congestion and reliability: causes, how they are measured, and why they matter. Ch. 2. In: *Traffic Congestion and Reliability: Trends and Advanced Strategies for Congestion Mitigation*. Federal Highway Administration, Department of Transportation, Washington, DC. Available at: https://ops.fhwa.dot.gov/congestion_report/chapter2.htm

Meadows, DH. 2008. *Thinking in Systems: A Primer*. D. Wright (Ed.). Chelsea Green Publishing: White River Junction, VT.

Scheffer, M. 2009. *Critical Transitions in Nature and Society*. Princeton University Press: Princeton, NJ.

Sugiyama, Y., M. Fukui, M. Kikuchi, K. Hasebe, A. Nakayama, K. Nishinari, S-I Tadaki, and S. Yukawa. 2008. Traffic jams without bottlenecks – experimental data for the physical mechanism of the formation of a jam. *New Journal of Physics* 10:033001, 7 pp. (posted on BlackBoard)

Thyberg, KL, and **DJ Tonjes**. 2015. A management framework for municipal solid waste systems and its application to food waste prevention. *Systems* 3:133-151. (posted on BlackBoard)

Truxal, JG. 1989. *Feedback-Automation*. New American Library: Stony Brook, NY. (posted on BlackBoard)

Waldrop, MM. 2018. Free agents. *Science* 360:144-147. (posted on BlackBoard)

What's up with that: Building bigger roads actually makes traffic worse. Blog by Adam Mann, Wired.com/Gear, 6/17/14. Wired.com/2014/06/wuvt-traffic-induced-demand/

Grading:

Readings	10%
Group Work Participation	10%
Homework	10%
Midterm	20%
Paper	50%

Readings:

1 page summary of every reading assignment required by Mon class time.

Home Work:

Individual submissions due before following Mon class

Midterm

Take-home. Do not collaborate. Issued Mon week before spring break; due Mon after spring break

Paper

Three choices:

- 1) Fossil fuel electricity
- 2) Shopping through Amazon
- 3) Twitter

Explain the technical framework for these systems using systems vocabulary and technical details. Show how social considerations are essential to explain the benefits and problems associated with these systems, and to create a complete understanding of the system. You are invited to offer means to improve these systems that use concepts explored in the class. (10-20 pp.)

These are not intended to be intense research papers regarding the engineering aspects of the systems; however, provide references for what you explain.

Plagiarism

Plagiarism is presenting someone else's work as your own. It consists of copying, intellectual property theft, and unauthorized collaboration. Do not copy material from the web or other sources for homework, exams, presentations, papers, etc., without properly citing. Do not use someone else's ideas or work without sufficient attribution (be careful and record "who, what, and where" when researching) (find examples from professional research work for referencing and use that) (do not cite generic websites – www.wikipedia.org – as that is a meaningless reference). Do not work with someone else if the work is supposed to be your own.

All plagiarized submissions will be scored as 0. Plagiarism has resulted in failing this class, and even in dismissal from graduate school.

Course Schedule

Date	Topic	Reading discussions	Group Work	Reading Assignment (for next class)	Assignments (for next class)
1/27	Introduction to Systems Feedback	Syllabus	Feedback examples	Truxal pp. 1-38	HW#1
2/3	Complicated-complex systems Modeling	Truxal	Systems analysis: automobile	Meadows pp. 1-72	HW #2
2/10	Systems dynamics modeling 1 & 2	Meadows Part 1	Home heating systems	Meadows pp. 75-141	HW #3
2/17	Socio-technical systems concepts Socio-technical system example	Meadows Part 2	Immigration as a socio-technical system	Meadows pp. 145-185	HW#4
2/24	Systems & Subsystems Resilience	Meadows Part 3	The spring budworm	Sugiyama et al. 2008; CSI, 2005; Mann, 2014	
3/2	LI Suburbanization Traffic patterns	Sugiyama et al.	Propose road system changes to LI	None	HW #5
3/9	Learning Cybernetics & the classroom	Syllabus	Topics for midterm (group review)	Scheffer Ch 1-3, 7	Midterm! Due 5 pm 3/23
3/16	No class -- Spring break				
3/23	Stability & Transitions More Systems Transitions	Scheffer Part 1	Explain Fig 2.9 completely	Waldrop 2018	
3/30	Agent models Simple agent models	Waldrop 2018	The Game of Life	Watch The Big Short	HW#6
4/6	Economic Systems The Great Recession	The Big Short	Join a research group	Scheffer Ch 12-14, 16, 18	
4/13	Plastics Plastics in our World	Scheffer Part 2	Research group meeting #2	None	
4/20	Bureaucracies Public School Systems	SBU as a system	Research group meeting #3	None	HW#7
4/27	Communication Systems Smart phones	HW#8	Research group meeting #4	Thyberg & Tonjes 2018	
5/4	Socio-techno-environmental systems	Thyberg & Tonjes 2015	Supervised work on your own	None	
5/11	No class meeting	Paper due Mon 5/11 @5 pm via BlackBoard			

DISABILITY SUPPORT SERVICES (DSS) STATEMENT

If you have a physical, psychological, medical or learning disability that may impact your course work, please contact Disability Support Services, ECC (Educational Communications Center) Building, Room 128, (631) 632-6748. They will determine with you what accommodations, if any, are necessary and appropriate. All information and documentation is confidential.

Students who require assistance during emergency evacuation are encouraged to discuss their needs with their professors and Disability Support Services. For procedures and information go to the following website: <http://www.stonybrook.edu/ehs/fire/disabilities>

CRITICAL INCIDENT MANAGEMENT:

Stony Brook University expects students to respect the rights, privileges, and property of other people. Faculty are required to report to the Office of Judicial Affairs any disruptive behavior that interrupts their ability to teach, compromises the safety of the learning environment, or inhibits students' ability to learn.

ACADEMIC INTEGRITY

Intellectual honesty is the cornerstone of all academic and scholarly work. Therefore, the University views any form of academic or scholarly dishonesty as a serious matter. Instructors are required to report all allegations of academic or scholarly dishonesty to their Graduate Program Director and the student's home Graduate Program Director if different. Furthermore, Graduate Program Directors must report all incidents in which a student is found guilty to the Graduate School. Additional details on procedures for hearings and other functions at the judiciary processes are available in the Grievances and Appeals section of the Bulletin

(http://sb.cc.stonybrook.edu/gradbulletin/current/regulations/academic_probation/appeals.php)