FORE6333. Intro to Systems Thinking
University of Houston | Spring 2022 | Dr. Wendy L. Schultz
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Interactive online session on Wednesdays from 17.45 – 19.30 pm CST on Zoom
(recorded) + using a class whiteboard for exercises on Miro
Mini-recordings of lectures on methods and readings will be posted on-line.

ZOOM LINK:
Register in advance for this meeting:
https://us06web.zoom.us/meeting/register/tZwkduyqrTssHtS25cwLyt5OV5dwL9t1fxRG

MIRO BOARD:
https://miro.com/app/board/uXjVOVetxMs=/?invite_link_id=439691889100
password: Systems2022

SYLLABUS

Futures research and foresight are often described as multi-disciplinary, and some
would even say "post-disciplinary." Exploring our possible futures requires
acknowledging change wherever it originates. Exploring our possible futures also
requires identifying potential impacts wherever they fall across all human activity
and throughout the natural world. Good futures work means thinking systemically,
that is, considering how things interconnect, and the flow of information, resources,
and impacts through those interconnections and out across all the systems with
which people interact.

So it should come as no surprise that futures studies and systems science evolved in
the early 20th century as sister disciplines, interlinked by researchers and scholars
who found themselves asking similar questions that required a new way of thinking
and of perceiving and analyzing problems. This course will:

- describe the historical co-evolution of foresight and systems thinking;
- explain the core theories and concepts of systems science and systems
  thinking, including chaos theory and complexity theory, as they relate to
  futures research and foresight;
- teach influence mapping and causal loop diagramming and analysis;
- demonstrate how to use influence maps and systems maps within futures
  research and foresight; and
- link systems thinking concepts and tools to futures research methods and
  practical applications.

Overview of Assignments

1. Participation in class discussions and activities, on Blackboard and during
   Zoom sessions, including 'thinkpieces' [10%]
2. Initial influence map of an issue of your choosing, diagrammed and
   explained [10%];
3. Two examples of reinforcing systems, diagrammed and explained [10%];
4. Two examples of balancing systems, diagrammed and explained [10%]

5. Two examples of complicated systems (systems archetypes), diagrammed and explained [15%];
6. Two examples of complex adaptive systems, described and analysed [10%];
7. Two examples of chaotic system behaviour, described and analysed [10%]; and
8. Embed systems thinking in a futures study of a topic of your choosing (eg, "the future of 'x'") [25%].

Assignments 2-7 are relatively brief, with each example systems map or diagram accompanied by 1-2 pages of description and explanation. The final assignment can be combined with a futures study assignment from one of your other futures grad seminars, or, if you choose a focus topic early, can be assembled by using assignments 2-6 as building blocks, with some additional horizon scanning and impact analysis. More detailed descriptions of the assignments will be available on Blackboard.

Formats for each assignment/class activity: specific, detailed descriptions of the format and content required for each assignment to be handed in will be available when it is assigned.

Grading
Submissions are assessed on a five-point scale using the following criteria:

5 = outstanding submission, shows considerable insight and/or proficiency
4 = good submission, shows more insight and/or proficiency than required
3 = acceptable submission, shows insight and/proficiency required
2 = poor submission, shows less insight/proficiency than required
1 = failed submission, shows no insight/proficiency

Note – a "5" is equivalent to publishable quality. All assignments will receive feedback focussed on improving the work, and any assignment may be edited and resubmitted for a revision of the grade.

Abilities/Outcomes
- Master influence mapping / territory mapping of an issue;
- Master approaches to identifying, classifying, and analyzing different kinds of systems and systems behaviour (simple; complicated; complex; chaotic);
- Master causal loop diagramming of simple and complicated systems;
- Demonstrate an ability to embed systems thinking in futures research and foresight effectively;
- Communicate the above clearly to others via discussion, presentation, and writing.

READINGS

REQUIRED – available as free pdfs on the UH Blackboard course site
Draper L Kauffman, Systems 1 and Systems 2 – available on Blackboard as zip files.

Selected chapters from Peter Senge, *The Fifth Discipline* – available on Blackboard; you may want to buy your own copy, as it is a classic in both management and foresight.

Assorted readings from free back issues of *Systems Thinker,* available on Blackboard; also at (https://thesystemsthinker.com/) - eg, Russell Ackoff, "Transforming the Systems Movement;" and Daniel Kim, "Introduction to Systems Thinking."

Selected chapters from Peter Checkland, *Systems Thinking, Systems Practice* – available on Blackboard; you may want to buy your own copy.

Snowden and Boone's *Harvard Business Review* article on system types and decision-making, available on Blackboard; the online blogpost mentioning it is available here: https://hbr.org/2007/11/a-leaders-framework-for-decision-making.

Donella Meadows' essay "Leverage Points: Places to Intervene in a System", available on Blackboard.

And other assorted articles, all provided on Blackboard as pdfs.

ALL THE READINGS ABOVE ARE AVAILABLE ON BLACKBOARD TO DOWNLOAD.

Abrams and Sardar, *Introducing Chaos: A Graphic Guide*, **please purchase** – it is available as a Kindle ebook for $4.54.

RECOMMENDED – available from Amazon.com as paperbacks or Kindle ebooks
James Gleick, *Chaos: Making a New Science*

Donella Meadows, *Thinking in Systems: A Primer*

Anderson and Johnson, *Systems Thinking Basics* [out of print; copies still available]

SYSTEMS MAPPING RESOURCES
Kumu – free online systems mapping software, here: https://kumu.io
Loopy - free online systems software - more primitive than Kumu, here: https://ncase.me/loopy
You can also use **Prezi**, here: https://prezi.com
Or use some free space on the class Miro board and map using post-its and arrow connectors.
Or just use Powerpoint. Or draw them on paper, take a snapshot, and upload it.

COURSE SCHEDULE

MODULE 1 | 19 JANUARY – live session
Topic – INTRODUCTIONS – Intro to each other and to the course: getting to know each other; what is the course structure; what are the course resources; and why is systems thinking relevant to futures studies?

Readings for next week:
- Russell Ackoff, "Transforming the Systems Movement,"
- Russell Ackoff, "From Mechanistic to Social Systemic Thinking"
- Peter Bishop, "Teaching Systems Thinking"
- Draper L. Kauffman, Foreword and Chapter 1 from *Systems 1*
- Daniel Kim, "Introduction to Systems Thinking,"

Thinkpiece: What's the most complicated critical issue challenging our futures?

MODULE 2 | 26 JANUARY – recorded lecture; live discussion session
Topic – SYSTEMS SCIENCE – HISTORY AND BASIC CONCEPTS: when did systems science emerge as a scientific discipline, and why? What are its connections to the emerging field of futures studies? What are the key paradigms, concepts, and terms?

Readings for next week:
- Peter Checkland, "Systems Thinking and Soft Systems Methodology"
- Reisman and Oral, "Soft Systems Methodology: A Context within a 50-Year Retrospective of OR/MS"
- Maqsood, Finegan, and Walker, "Five Case Studies Applying Soft Systems Methodology to Knowledge Management"
- Williams, "Soft Systems Methodology"
- Gasson, "The Use of Soft Systems Methodology (SSM) As A Tool For Investigation"

Thinkpiece: What single long-range problem most concerns you?

MODULE 3 | 2 FEBRUARY – recorded lecture; live session mapping practice
Topic – INFLUENCE MAPS: How do we begin to map variables and their interconnections? How do we best express key variables, and include stakeholders or actors? Using Kumu to map systems.

Readings for next week:
- Draper L. Kauffman, Chapter 4 from *Systems 1*
- Colleen P. Lannon, "Causal Loop Construction: The Basics"
- Systems Thinker, "Guidelines for Drawing Causal Loop Diagrams"
- Kellie T. Wardman, "Selecting Variable Names for Causal Loop Diagrams"
- Kellie T. Wardman, "Anatomy of a Reinforcing Loop"
- Sally Goerner, "The Science of Glow Says Extreme Inequality Causes Economic Collapse"

Thinkpiece: find a clear, concrete example of runaway growth or decline.

Assignment: initial influence map of an issue of your choosing, diagrammed and explained [10%].

MODULE 4 | 9 FEBRUARY – recorded lecture; live session reinforcing loop practice
Topic – SIMPLE SYSTEMS - REINFORCING: what is a reinforcing system? How do we express and diagram reinforcing relationships? What are the most common observable reinforcing systems?

Readings for next week:
- Draper L. Kauffman, Chapters 2 and 3 from *Systems 1*
- Kellie T. Wardman, "Balancing Loop Basics"
- Kellie T. Wardman, "Balancing Loops with Delays"
- John D. Sterman, "Fine-tuning Your Causal Loop Diagrams – Part I"
- John D. Sterman, "Fine-tuning Your Causal Loop Diagrams – Part II"

Thinkpiece: find a clear, concrete example of a system that tries to maintain equilibrium and stability.

Assignment: Two examples of reinforcing systems, diagrammed and explained [10%]

MODULE 5 | 16 FEBRUARY - recorded lecture; live session balancing loop practice
Topic – SIMPLE SYSTEMS - BALANCING: what are balancing systems? How do we express and diagram balancing relationships? What are the most common observable balancing systems? How do delays affect system dynamics?

Readings for next week:
- Draper L. Kauffman, Chapter 5 from *Systems 1*
- Peter Senge, "A Shift of Mind" from *The Fifth Discipline*
- Daniel H. Kim, "Systems Archetypes I"
- Daniel H. Kim, "Systems Archetypes II"

Thinkpiece: think about something that goes wrong, over and over again, at work or in some other organization of which you are a member. Be prepared to offer the simplest possible description of that problem, for use as an example.

Assignment: Two examples of balancing systems, diagrammed and explained [10%]

MODULE 6 | 23 FEBRUARY - recorded lecture; live session archetypes practice
Topic – COMPLICATED SYSTEMS – ARCHETYPES 1: what are systems archetypes? How do we recognize them as systems behaviours in the world around us? What are the most common 'systems stories'?

Readings for next week:
- Daniel H. Kim, "Systems Archetypes III"
- Daniel H. Kim and Colleen P. Lannon, "A Pocket Guide to Using the Archetypes"
- Daniel H. Kim and Colleen P. Lannong, "Applying Systems Archetypes"

Thinkpiece: what issues critical to the future did these archetypes bring to mind? Find one example and be prepared to share it – in brief!

MODULE 7 | 2 MARCH - recorded lecture; live session archetypes practice
Topic – COMPLICATED SYSTEMS – ARCHETYPES 2: Additional exploration of common systems stories and the archetypes used to express them. How can we use archetypes to understand organizational dynamics, and apply them to address or correct maladaptive dynamics?

Readings for next week: NO READINGS; sharing archetypes assignments.

Thinkpiece: no thinkpiece: sharing archetypes assignments.

Assignment: Two examples of complicated systems (systems archetypes), diagrammed and explained [15%]

MODULE 8 | 9 MARCH – no live session; one-on-one review meetings.
Topic – FROM SIMPLE to COMPLICATED SYSTEMS – REVIEW: sharing draft archetype analyses.

SCHEDULE A MEETING WITH ME HERE:
https://calendly.com/wendyinfutures/intro-to-systems-thinking-one-on-one-sessions

Readings for the week after Spring Break:
- Draper L. Kauffman, Chapter 6 from *Systems 1*
- Serena Chan, "Complex Adaptive Systems"
- Murray Gell-Man, "Complex Adaptive Systems"
- Fred Spier, "Complexity in Big History Cliodynamics"
- Judith E. Innes and David E. Booher, "Consensus Building and Complex Adaptive Systems"
- J. Stephen Lansing, "Complex Adaptive Systems"
- John Holland, "Complex Adaptive Systems"
- START READING James Gleick's *Chaos*.

Thinkpiece for Spring Break: what are our key take-aways from the first half of the course?

Assignment: none.

16 MARCH: SPRING BREAK (15 - 20 MARCH)

MODULE 9 | 23 MARCH - recorded lecture; live session complex system practice
Topic – COMPLEX SYSTEMS: what defines a complex adaptive system? How can we identify one? What behaviours does it display?

Viewing for next week – CRITICAL!

- "The Strange New Science of Chaos," Nova
https://www.youtube.com/watch?v=eJAs9Qr359o

Readings for next week:
- James Gleick, *Chaos: Making a New Science*
- James P. Crutchfield et al., "Chaos"
- Geoff Boeing, "Visual Analysis of Nonlinear Dynamical Systems: Chaos, Fractals, Self-Similarity and the Limits of Prediction"

Thinkpiece: identify a complex system in the throes of adapting.

Assignment: Two examples of complex adaptive systems, described and analysed [10%]

MODULE 10 | 30 MARCH - recorded lecture; live session chaotic system practice
Topic – CHAOTIC SYSTEMS: what is chaos? How does it differ from pure disorder? How can we identify a system in chaos? What behaviours does it display?

Readings for next week:
- Paul Raeburn, "Chaos and the Catch of the Day"
- Florence Williams, "Why Fractals Are So Soothing"

Thinkpiece: Identify a system displaying chaotic behavior.

Assignment: Two examples of chaotic system behaviour, described and analysed [10%]

MODULE 11 | 6 APRIL - recorded lecture; live session dynamic analysis practice
Topic – FROM COMPLEXITY TO CHAOS AND BACK: what's the dynamic between complex adaptive behavior, and chaotic behavior? What examples can we find in the world of complex systems descending into chaos – and adapting to new levels of complexity?

Readings for next week:
- David J. Snowden and Mary E. Boone, "A Leader's Framework for Decision Making"
- Dave Snowden, "The Origins of Cynefin"
- Helen Hasan and Alanah Kazlauskas, "Making Sense of IS with the Cynefin Framework"

Thinkpiece: Offer an example of a system adapting / re-organizing its way out of chaos.

MODULE 12 | 13 APRIL - recorded lecture; live session Cynefin mapping practice
Topic – WORKING ACROSS ALL SYSTEMS TYPES: How does it help analysis, foresight, decision-making, and action to be able to distinguish among these four types of systems and system behaviours? Introduction to Snowdon's *Cynefin* model.

Readings for next week:
- Draper L. Kauffman, *Systems 2 (entire document; it's brief)*
- Tony Hodgson and Bill Sharpe, "Deepening Futures with System Structure"
- Thomas Chermack, "The Role of System Theory in Scenario Planning"
- UK Foresight Programme, Office of Science and Technology, "Intelligent Infrastructure Futures Scenarios Toward 2055 – Perspective and Process"
- UK Foresight Programme, Office of Science and Technology, Land Use Futures conceptual diagrams, assorted.

Thinkpiece: what is your focus issue for a futures study? How can the *Cynefin* framework help you to understand it?

Assignment: Two examples of chaotic system behaviour, described and analysed [10%]

MODULE 13 | 20 APRIL – recorded lecture; live discussion session
Topic – MELDING SYSTEMS THINKING WITH FUTURES RESEARCH: How does systems thinking support futures studies and foresight? Where can we explicitly use systems thinking to add rigor to our analysis and our imaginative exploration of futures?

Thinkpiece: how do you think systems thinking can best contribute to futures research and foresight?

MODULE 14 | 27 APRIL – no live session; one-on-one review meetings.
Topic – REPORTING ON INDIVIDUAL PROJECTS: students share their evolving work on the final assignment to use systems thinking in a framework foresight study; purpose to collect feedback and revise their work prior to submission.

Readings for next week: none.

Thinkpiece: none.

MODULE 15 | 4 MAY – live session
Topic – FINAL DISCUSSION: what have we learned? Wrap-up.

9-13 MAY – EXAM WEEK – finalize all your assignments and submit.

YOU MUST SUBMIT ALL ASSIGNMENTS BY 14 MAY; grades posted on 16 MAY.

UNIVERSITY POLICIES

Academic honesty policy All UH students are responsible for knowing the standards of academic honesty. Please refer to the UH catalog. Plagiarism, using research without citations or using a created production (such as other people's words) without quotations or citations, will result in a grade penalty or failure of the course.

Internet sources must be credited according to the sites recommended citation guideline if available. If no citation guideline is provided by the web source, then the date, URL site owner, and author must be included with the web material used.

Disabilities: If you have a disability and need a special accommodation consult first with the Coordinator of Health Disabilities Services.

Incompletes: A grade of "I" is given only in cases of documented emergency or special circumstances late in the semester, provided that the student has been making satisfactory progress. An Incomplete Grade Contract must be completed.

Withdrawals: For Spring 2022, the last day to drop a course without receiving a grade is February 2nd; the last day to drop a course or withdraw with a 'W' is April 5th.