FORE6333 Intro to Systems Thinking

University of Houston | Spring 2025 | Denise Worrell
dwworrell@uh.edu or denise@worrellcreative.com

Interactive online session on **Wednesdays from 5:45pm to 8:30pm CST on Zoom** (recorded) + using a class whiteboard for exercises on Miro

All lecture recordings and live class recordings will be transcribed using Otter.ai.

ZOOM LINK:
https://thinklangrand.zoom.us/j/88063129144?pwd=8CmnE6CbjaEVzLOUeIMIPC2XFlpQn5
Meeting ID: 880 6312 9144
Passcode: 425522

One tap mobile
+13462487799,,88063129144#,,,,*425522# US (Houston)
+14086380968,,88063129144#,,,,*425522# US (San Jose)
Find your local number: https://thinklangrand.zoom.us/u/khz4Mro6K

MIRO BOARD:
https://miro.com/app/board/uXjVLzUi7nM=/?share_link_id=232735843628
Password: AllSystemsGo!

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.

COURSE GOALS

- Understand systems thinking as an underlying foundation of foresight
- Diagram a system to analyze and understand the dynamics of an issue

- Identify, classify, and evaluate various types of systems and their behaviors to identify systemic patterns and relationships (simple, complicated, complex, chaotic)
- Demonstrate an ability to embed systems thinking into futures research and foresight
- Articulate and defend systems thinking insights clearly in discussions and writing

OVERVIEW OF ASSIGNMENTS

Module	Assignment	% of grade	Date assigned	Date due
All	Participating in class discussions and activities + completing Thinkpieces	10%	1/15/25	ongoing
3	**Influence map** of an issue of your choosing, diagrammed and explained	10%	1/29/25	2/5/25
4	Two examples of **reinforcing systems**, diagrammed and explained	10%	2/5/25	2/12/25
5	Two examples of **balancing systems**, diagrammed and explained	10%	2/12/25	2/19/25
7	Two examples of **complicated systems** (systems archetypes), diagrammed and explained	15%	2/19/25	3/19/25
9	Two examples of **complex adaptive systems**, described and analyzed	10%	3/19/25	3/26/25
10	Two examples of **chaotic system** behavior, described and analyzed	10%	3/26/25	4/2/25
13	Embed systems thinking in a futures study of a topic of your choosing (e.g., "the future of 'x'")	25%	4/9/25	4/30/25

All but the final assignment 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 are available on the Canvas course site.

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.

Put the assignment title, your name, email, and the date at the top of each assignment.
The assignment filename should be YourLastName_AssignmentName.docx

***Thinkpiece tips*:**

+ Focus on quality over quantity, making each point meaningful
  - Recommend 100 words to 250 words (one to two paragraphs)
+ Use a conversational yet professional tone to invite dialogue
+ Break up text into shorter paragraphs for easier online reading
+ Incorporate personal experiences or observations when relevant
+ Respond thoughtfully to classmates, building on their ideas

GRADING

Submissions are assessed on a five-point scale using the criteria below.

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 focused on improving the work, and any assignment may be edited and resubmitted for a revision of the grade.

READINGS

REQUIRED – all required readings are available on Canvas as free pdfs (no books to buy for this class)

- Draper L Kauffman, Systems 1 and Systems 2
- Selected chapters from Peter Senge, The Fifth Discipline – available on here on Canvas; 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 here on Canvas; 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 here on Canvas; you may want to buy your own copy.
- Snowden and Boone's Harvard Business Review article on system types and decision-making, available on here on Canvas; 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*
- And other assorted articles, all provided on here on Canvas as pdfs.

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

There is no one tool you have to use for assignments in this class. You can use one of the ones below, hand draw your maps and upload a picture, use Miro or PowerPoint. You do you!

- Kumu – free online systems mapping software, here: https://kumu.io
- Loopy - free online systems software - more primitive than Kumu, here: https://ncase.me/loopy

COURSE SCHEDULE

Module 1	January 15, 2025	Intros, course overview, initial questions
Module 2	January 22, 2025	Systems science: basic concepts + history
Module 3	January 29, 2025	Influence maps, variables, connections
Module 4	February 5, 2025	Simple systems: reinforcing behavior
Module 5	February 12, 2025	Simple systems: balancing behavior
Module 6	February 19, 2025	Complicated systems - archetypes 1
Module 7	February 26, 2025	Complicated systems - archetypes 2
Module 8	March 5, 2025	One-on-one review sessions – ***no live class***

SPRING BREAK: March 10-14, 2025

Module 9	March 19, 2025	Complex adaptive systems
Module 10	March 26, 2025	Chaotic systems
Module 11	April 2, 2025	From complexity to chaos and back
Module 12	April 9, 2025	Creating change in systems
Module 13	April 16, 2025	Melding systems thinking with foresight
Module 14	April 23, 2025	One-on-one review sessions – ***no live class***
Module 15	April 30, 2025	Final discussion; wrap-up

MODULE 1 | January 15, 2025 – 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, January 22, 2025:
+ Ackoff, *From Mechanistic to Systemic Thinking*
+ Ackoff, *Transforming the Systems Movement*
+ Kauffman, *Forward and Chapter One*
+ Kim, *Introduction to Systems Thinking*

Recommended Watch: *The Biggest Little Farm*
- Prime Video
- YouTube

Thinkpiece – post before class on 1/22/25
Spotting wicked problems: What's the most complicated critical issue challenging our futures?

MODULE 2 | January 22, 2025 – live 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, January 29,2025:
- From the folks at Systems Innovation, 1 System Mapping Overview and 2 Mapping
- Checkland, *Systems Thinking and Soft Systems Methodology*
- Williams, *Soft Systems Methodology*

Optional readings
- Reisman and Oral: *Soft Systems Methodology: A Context*
- Maqsood, Finegan, Walker: *Five Case Studies Applying SSM*
- Gasson, *Uses of Soft Systems Methodology*

Thinkpiece – post before class on 1/29/25
Your long-range worries*:* What single long-range problem most concerns you?

MODULE 3 | January 29, 2025 – live session
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, February 5, 2025:
- Kauffman, *Chapter 4 from Systems 1*
- Lannon, *Causal Loop Construction: The Basics*
- Systems Thinker, *Guidelines for Drawing Causal Loop Diagrams*
- Wardman, *Anatomy of a Reinforcing Loop*
- Wardman, *Selecting Variable Names for Causal Loop Diagrams*

Optional reading
- Goerner, *The Science of Glow Says Extreme Inequality Causes Economic Collapse*

Thinkpiece – post before class on 2/5/25
The more, the more. The less, the less: Find a clear, concrete example of runaway growth or decline.

Assignment – Due 2/5/25: initial influence map of an issue of your choosing, diagrammed and explained [10%].

MODULE 4 | February 5, 2025 – live session
Topic – MAPPING BASICS + REINFORCING BEHAVIOR: what are the basic elements of a systems maps? 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, February 12, 2025:

- Kauffman, Chapters 2 and 3 from Systems 1
- Wardman, *Balancing Loop Basics*
- Wardman, *Balancing Loops with Delays*
- Sterman, *Fine-tuning Your Causal Loop Diagrams – Part I*
- Sterman, *Fine-tuning Your Causal Loop Diagrams – Part II*

Thinkpiece – post before class on 2/12/25:
The more the less. The less the more: Find a clear, concrete example of a system that tries to maintain equilibrium and stability.

Assignment – Due 2/12/25: Two examples of reinforcing systems, diagrammed and explained [10%]

MODULE 5 | February 12, 2025 – live session
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, February 19, 2025:

- Kauffman, Chapter 5 from Systems 1
- Senge, *A Shift of Mind* from The Fifth Discipline
- Kim, *Systems Archetypes I*
- Kim, *Systems Archetypes II*

Thinkpiece – post before class on 2/19/25:
Archetypes ! – common stories that repeat: Find a real-life example that fits one of these archetypes: Shifting the Burden, Drifting Goals, Escalation, or Fixes that Fail

Assignment – Due 2/19/25: Two examples of balancing systems, diagrammed and explained [10%]

MODULE 6 | February 19, 2025 – live session
Topic – COMPLICATED SYSTEMS – ARCHETYPES 1: Think about something that goes wrong, over and over again, at work or in some other organization of which you are a member. Who are the key actors? What are the critical variables?

Readings for next week, February 26, 2025:

- Kim, *Systems Archetypes III*
- Kim and Lannon, *A Pocket Guide to Using the Archetypes*
- Kim and Lannon, *Applying Systems Archetypes*

Thinkpiece – post before class on 2/26/25*:*
Archetypes II – common stories that repeat: Find a real-life example that fits one of these archetypes: Growth and Underinvestment, Limits to Success, Success to the Successful, Tragedy of the Commons

Assignment – none

MODULE 7 | February 26, 2025 – live session
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, March 5, 2025*:* none

Thinkpiece – post before class on 3/5/25
Half-way debrief: What are your key take-aways from the first half of the course?

Assignment – Due 3/19/25*:* Two examples of complicated systems (systems archetypes), diagrammed and explained [15%]

MODULE 8 | March 5, 2025 – no live session; one-on-one review meetings.
Share draft archetype assignment for feedback and have questions answered.

SCHEDULE A MEETING WITH ME HERE:
https://calendly.com/denise-thinklangrand/fore6333-one-on-one?month=2025-03&date=2025-03-05

Readings & videos for the week after Spring Break, March 19, 2025:
- Kauffman, Chapter 6 from *Systems 1*
- Holland, *Complex Adaptive Systems*
- Chan, *Complex Adaptive Systems*
- Video: Introduction to Complex Adaptive Systems
- Video: Complex Adaptive Systems Overview
- Video: Complex Adaptive Systems

OPTIONAL READINGS
- Gell-Man, *Complex Adaptive Systems*
- Spier, *Complexity in Big History Cliodynamics*
- Innes and Booher, *Consensus Building and Complex Adaptive Systems*
- Lansing, *Complex Adaptive Systems*
- Video: An Introduction to Conway's The Game of Life

Thinkpiece: none

Assignment: none

March 12, 2025: SPRING BREAK (March 10-14, 2025)

MODULE 9 | March 19, 2025 – live session
Topic – COMPLEX SYSTEMS: what defines a complex adaptive system? How can we identify one? What behaviors does it display?

- ***Read and watch for next week, March 26, 2025:***
  - CRITICAL Video: *The Strange New Science of Chaos*
  - Video: Chaos Theory and The Butterfly Effect - Predicting The Unpredictable
  - Video: *Chaos: the science of the butterfly effect*
  - Video: Chaos Theory: the language of (in)stability
  - Crutchfield et al., *Chaos*
  - Raeburn, *Chaos and the Catch of the Day*

  OPTIONAL READING
  - Gleick, *Chaos: Making a New Science*
  - Boeing, *Visual Analysis of Nonlinear Dynamical Systems: Chaos, Fractals, Self-Similarity and the Limits of Prediction*
  - Williams: *Why Fractals are so Soothing*

  Thinkpiece – post before class on 3/26/25
  identify a complex system in the throes of adapting.

  Assignment – Due 3/26/25: Two examples of complex adaptive systems, described and analyzed [10%]

MODULE 10 | March 26, 2025 – live session
Topic – CHAOTIC SYSTEMS: what is chaos? How does it differ from pure disorder? How can we identify a system in chaos? What behaviors does it display?

Readings for next week, April 2, 2025:
- Snowden and 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 – post before class on 4/2/25
Find a real-life example of a system displaying chaotic behavior.

Assignment – Due 4/2/25*:* Two examples of chaotic system behavior, described and analyzed [10%]

MODULE 11 | April 2, 2025 – live session
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 behaviors? Introduction to Snowdon's Cynefin model.

Readings for next week, April 9, 2025:
- Meadows, Places to Intervene in a System

Thinkpiece – post before class on 4/9/25: What is your focus issue for a futures study? How can the Cynefin framework help you to understand it?

***Assignment*:** none

MODULE 12 | April 9, 2025 – live session
Topic – CREATING CHANGE IN SYSTEMS: How do you create change in a system? How can we innovation and organize to shape systems?

Readings for next week, April 16, 2025:

- Kauffman, *Systems 2*
- Hodgson and Sharpe, *Deepening Futures with System Structure*
- 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*

Thinkpiece – post before class on 4/16/25: Think about a complex system you interact with personally or professionally. Identify a leverage point you believe has been overlooked or underutilized. How would you use this leverage point to create meaningful change?

Assignment – Due by 4/30/25: Final paper - embed systems thinking in a futures study of a topic of your choosing (eg, "the future of 'x'") [25%]

MODULE 13 | April 16, 2025 – live 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?

Readings for next week, April 23, 2025*:* none.

Thinkpiece – post before class on 4/23/25: How do you think systems thinking can best contribute to futures research and foresight?

MODULE 14 | April 23, 2025 – no live session; one-on-one review meetings.
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.

SCHEDULE A MEETING WITH ME HERE:
https://calendly.com/denise-thinklangrand/fore6333-final-projects-one-on-one-check-in

Readings for next week, April 30*:* none.

Thinkpiece: none.

MODULE 15 | April 30, 2025 – live session
Topic – FINAL DISCUSSION: what have we learned? Wrap-up.

April 30, 2025 to May 6, 2025– EXAM WEEK – Finalize all your assignments and submit.

YOU MUST SUBMIT ALL ASSIGNMENT REVISIONS BY MAY 11; grades submitted on 15 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 2024, the last day to drop a course without receiving a grade is January 29, 2025; the last day to drop a course or withdraw with a 'W' is April 16, 2025.