How systems thinking can provide valuable insight into those important situations in business (or your career in business) where the usual methods don’t seem to work.

Learning Objectives:
- Develop a practical ‘systems thinking’ skill set by:
  - Mastering a set of systems tools including: system archetypes; leverage points; game theory; ecosystems; systems simulation; networks and more
  - Understanding and building a method to use these tools including: role of forecasting and causality; comprehending the agents in complex systems – human judgment and bias; Proper usage of models.

<table>
<thead>
<tr>
<th>Week</th>
<th>Topics</th>
<th>Cases¹</th>
<th>Readings²</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Motivations and Introduction to Systems Science part 1</td>
<td></td>
<td></td>
<td>Please view class introduction on YouTube</td>
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<td>2.</td>
<td>Introduction to Systems Science part 2</td>
<td></td>
<td>CAGT – Ch1 TFD – Ch 1,2 TOOW – Ch1-3</td>
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<td>3.</td>
<td>Dynamics - Qualitative</td>
<td>Beer Game/People Express</td>
<td>TFD – Ch4-8 &amp; App. 2</td>
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<td>4.</td>
<td>Dynamics - Quantitative</td>
<td>US AC</td>
<td>TOOW – Ch5 Sterman1</td>
<td>Optional: Vensim Simulation</td>
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<td>5.</td>
<td>Aggregation</td>
<td>Prediction Markets at Google</td>
<td>TOOW – Ch4</td>
<td>Midterm – Complete before week 6 class</td>
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<td>6.</td>
<td>Aggregation - Simulation</td>
<td></td>
<td></td>
<td>Netlogo simulation</td>
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<td>7.</td>
<td>Strategic Behavior</td>
<td>Hilton-ITT</td>
<td>TOOW-Ch10</td>
<td></td>
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<tr>
<td>8.</td>
<td>Ecosystems and evolution</td>
<td>SAP AG</td>
<td>TOOW-Ch9</td>
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<td>9.</td>
<td>Networks</td>
<td>LinkedIn</td>
<td>TOOW-Ch7 CAGT-CH15,16</td>
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<tr>
<td>10.</td>
<td>Final topics</td>
<td>Lockheed Tri-Star</td>
<td>TOOW-Ch6 Linstone</td>
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<tr>
<td>Finals</td>
<td>Projects</td>
<td></td>
<td></td>
<td>Final Exam</td>
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</tbody>
</table>
1. Cases shown will be discussed in class on week shown and should have been read and prepared in advance of the class session
2. Readings shown need to be completed prior to class.

How this hybrid class will work:
Each week we will have some reading, screencast lectures, cases, discussions etc. I expect the flow to go like this:

1. Last class ends
2. Prior to next class you should:
   a. Watch screencast lectures
   b. Do supporting readings; watch supporting videos
   c. Take on-line review quiz (borderline trivial if you have done a & b)
   d. Read case
   e. Participate in online discussions
3. Class time
   a. Quick summary of concepts (mini-lecture)
   b. Class discussion of concepts
   c. Case analysis
   d. Prep for next week (micro-lecture)

Project: Explore system effects in a real business situation. This can be from your own work experiences or you can base your analysis on public information. Note that if from your experiences the information must be sharable with all (e.g. non proprietary). You can take one of two perspectives (or both):
   - pre-event – detail the situation and what information the decision maker’s had (remember Taleb’s Narrative Fallacy)
   - post-event – forensic examination of the situation. Outline the system effect.
Discuss what ideas from the class are relevant. Building some type of system simulation model (e.g. dynamic simulation with Vensim, agent based simulation with Netlogo, etc.) is optional (but worth nice bonus points). Make a recommendation with pre-event info. Make an analysis with post-event info. The objective is to get past the natural causal storyline and see system-ness of the situation (e.g. how Neo sees the Matrix).

Simulations:
You will be downloading and using two simulation packages: Vensim; and, Netlogo. As Douglas Adams might say “Don’t Panic!” These will be no more painful to use than most of the apps you download on your computer. And, both are free.
Reading loads are reduced on these weeks to allow time to play with the software. Basic models will be provided to study for these exercises.

Class Materials:
Texts:
Two textbooks are required and are available in the bookstore (also Amazon and probably numerous other places). In addition, both are on 2 hour reserve in the library.

Cases:
• The Beer Game – TFD Chapter 3
• Lockheed Tri-Star –Supplement (from Linstone)

Harvard Business cases are available here:
https://cb.hbsp.harvard.edu/cbmp/access/25467957
Note: you will need to register (if you haven’t prior) here:
https://cb.hbsp.harvard.edu/cbmp/register/ROLE_Student/18962027
I’ll provide more thorough instruction in a separate note.
  • Prediction markets at Google
  • The Hilton-ITT Wars
  • SAP AG: Orchestrating the Ecosystem
  • LinkedIn Corp., 2008

Videos:
I’ll assign videos as we go along.

Required articles (note these will be expanded as the course progresses):
These are all available via the PSU library. All articles links are available here (link)
  • Sterman, John, Learning from Evidence (Sterman2)

Valuable Supporting Readings/Resources:
    Available as an electronic resource from the PSU library, (CAGT)
• Burgelman, Robert, “Strategy is Destiny,” The Free Press, 2002. We will use a snippet from this book in one of our discussions.

I’ve become a pretty big fan of Amazon’s Kindle. You can get a basic Kindle for around $70. I have the paperwhite and do like that. Once you have it you could purchase Senge, Kahneman and both of Taleb’s books listed (Antifragile and The Black Swan) for just $39!

Valuable MOOCs (Massive Open Online Course):
- SFI: Introduction to Complexity, Melanie Mitchell
- Coursera: Model Thinking, Scott E. Page
- Coursera: Social Network Analysis, Lada Adamic

System Dynamic Model Libraries:
- Models from Sterman (Business Dynamics): http://www.mhhe.com/business/opsci/sterman/models.mhtml
- Tom Fiddam (Vensim): http://www.metasd.com/models/

**Student Deliverables/Grading:**

<table>
<thead>
<tr>
<th></th>
<th>Percentage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participation</td>
<td>10%</td>
<td>Contribute in classroom</td>
</tr>
<tr>
<td>Weekly online quiz</td>
<td>15%</td>
<td>Goal: keep up</td>
</tr>
<tr>
<td>Online midterm</td>
<td>20%</td>
<td>Multiple choice</td>
</tr>
<tr>
<td>Online final</td>
<td>30%</td>
<td>Multiple Choice</td>
</tr>
<tr>
<td>Class Project</td>
<td>25%</td>
<td>Presentation during finals time</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(15% presentation, 10% report)</td>
</tr>
</tbody>
</table>

**Office Hours:**
By arrangement and it’s generally best to be a phone or Skype discussion. I can have some short meetings before or after class. Just let me know beforehand.

**Other Items:**
Academic honesty per PSU policy