Welcome to the 2017 CSSS

David Feldman
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1. Goals of CSSS
2. What are Complex Systems?(!)
3. Thoughts and Advice on CSSS
4. Interdisciplinary Communication
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Goals of the CSSS

1. Give students an introduction to some of the methods, tools, and concepts in Complex Systems
2. Give students experience working in diverse, interdisciplinary collaborations
3. Create an international, interdisciplinary network of complex systems scholars

Complex Systems: Qualities

It seems to me that Complex Systems share many of the following qualities:

- **Emergence**: Systems contain patterns not obviously part of the rules giving rise to them.
- **Interactions**: Components are not isolated
- Combine **order and disorder**
- **Heterogeneous**
- **Adaptive** or **dynamic**.

Complex Systems: Topics

What are some things that people think are complex systems?

- Economies, Ecosystems, Evolution, Cities
- Brain, Immune System, Microbiome, …

What types of questions do we ask?

- How does cooperation or complexity emerge?
- How does evolution or change occur?

Complex Systems = What Complex Systems people study?

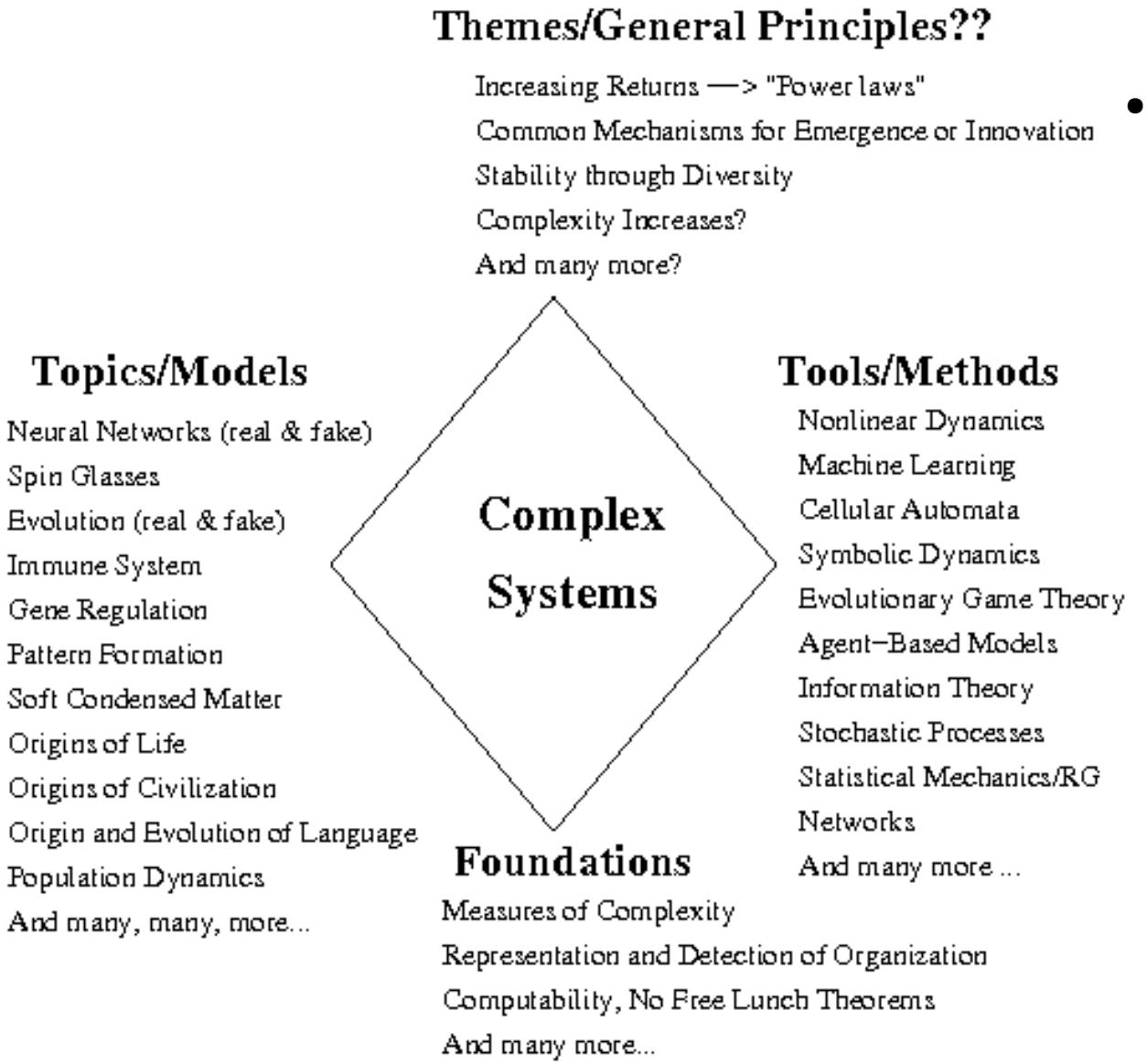
Complex Systems: Methods & Tools

- Agent-based Models, Complex Networks
- Information Theory, Dynamical Systems
- Computation Theory, Statistical Mechanics
- Statistics, Machine Learning, etc.

Complex Systems: Cultural Practice

- Aubin and Dahan-Delmedcio, write that dynamical systems is “a vast process of sociodisciplinary convergence and conceptual reconfiguration... [blurring] a number of old epistemological boundaries and conceptual oppositions hitherto seemingly irreducible such as order/disorder, random/nonrandom, simple/complex, local/global, stable/unstable, ...”
- I think the same could be said of Complex Systems
- What has developed is a common vocabulary, set of questions, and cultural/epistemological values.

A Possibly Useful Diagram



- Based on Fig 1 of Shalizi, pp. 33-114 in Deisboeck and Kresh (eds.), Complex Systems Science in Biomedicine (New York: Springer-Verlag, 2006); http://arxiv.org/abs/nlin.AO/0307015

Some Broad Questions

- Are there general principles of complex systems?
- Are there tools and methods that unite complex systems?
- What is the nature of a “solution” to a problem in complex systems?
- Are there cultural practices and norms common across complex systems scientists?
- Etc...

History

- SFI has held the CSSS in Santa Fe since 1988
- We have also held several schools in China, India, and Chile.
- I attended the CSSS in 1996 and lectured at (04-09) and co-directed (06-09) the China CSSS.
- Since 1998 I have been on the faculty at College of the Atlantic teaching physics and math.

A bit about you

- You come from 24 different countries.
- About half are not native speakers of English.

Now that you're here...

- It's normal to be "weird" and interdisciplinary.
- You won't be asked "But is that physics?" (or biology, economics, etc.)

Thoughts on the Lectures

- There will be times when the lectures seem too slow, and times when they seem too fast.
- This is the nature of interdisciplinary work.
- Please ask questions during the lectures.
- Be critical but generous.
- Slides from all lectures will be posted on the wiki.
- Let’s work to minimize electronic distractions.

Thoughts on the Projects

- Group projects in teams of 3-8
- You'll give a presentation and write a paper
- The process of the project is at least as important as the product
- Take risks. Experiment.
- Not all projects will work out. That's good.
- Cat will provide additional details this afternoon.

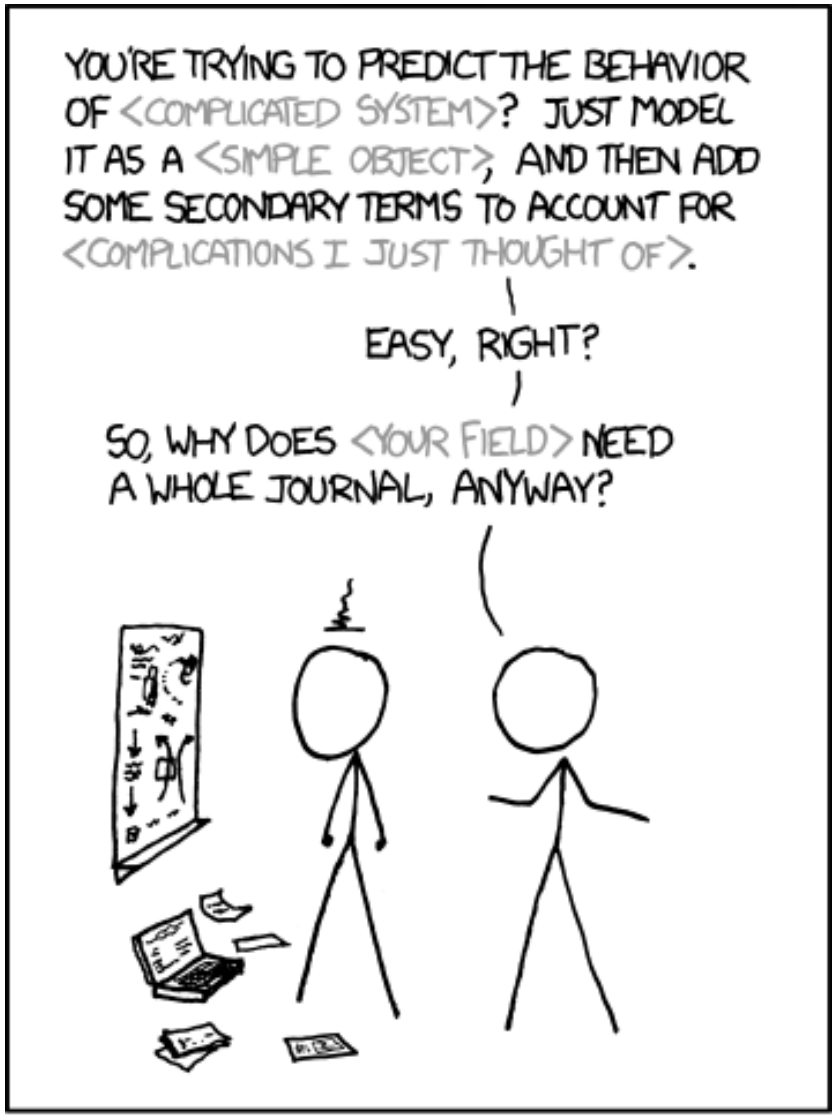
Other Thoughts

- Engage. Be present. Connect.
- Explore. Self organize.
- Take care of yourself. Sleep. Recharge.
- Pace yourself. It can be a long month.
- Don’t spend too much energy worrying about the definition of complexity or complex systems.

Interdisciplinary Collaboration

- Hard
- Important
- Rewarding

Disciplinary Humility



- Physicists: Don't do this.
- Disciplines should not be placed in a hierarchy.
- We all have something to learn from each other.
- https://xkcd.com/793/

Communication Patterns

Creating a space where all can contribute and flourish takes attention and care:

- Step up, step back
- Be mindful of gendered communication patterns
- Use “I” statements
- Gently lean into discomfort
- Communication and collaboration is an active, shared responsibility

Conclusion

- Dive in to this amazing opportunity.
- Take care of yourselves and each other.
- We have a great staff. We’re here to help.
- We have a great line-up of faculty.
- It’s going to be an awesome month.

Readings

- Richard Levins, “Why Programs Fail,” *Monthly Review.* 61(10), 2010. https://monthlyreview.org/2010/03/01/why-programs-fail/
- Clay Shirky, Why I Just Asked my Students to Put their Laptops Away. Medium.com. September 2014. https://medium.com/@cshirky/why-i-just-asked-my-students-to-put-their-laptops-away-7f5f7c50f368
- Aubin, David, and Amy Dahan Dalmedico. "Writing the history of dynamical systems and chaos: longue durée and revolution, disciplines and cultures." Historia mathematica 29.3 (2002): 273-339.