Beijing CSSS 2007

Summary and Closing Thoughts

3 August 2007

David Feldman

Week I

1. **Dave Feldman:** Tools and Foundations in Complex Systems: Chaos, Information Theory, Computation Theory, Measures of Complexity.
2. **John Pepper:** Agent-Based Models, Evolutionary Theory.
3. **Henry Wright:** Foragers and the Emergence of Agriculture, Villages and the Emergence of Tribal Alliance Systems, Raising Civilizations.
4. **Jon Wilkins:** Coalescence, Evolutionary Landscapes, Genomic Imprinting, and Approximate Bayesian Computation.

(15 lectures)

Week II

1. **Lee Altenberg:** Overview of Evolutionary Computation, Spectral Analysis of Evolutionary Dynamics, Higher Order Evolutionary Phenomena.
2. **Emily Burkhead:** Introduction to Discrete Dynamical Systems, Symbolic Dynamics, A Symbolics Dynamics View of Cellular Automata.
3. **Dan Hruschka:** Models of Cultural Diversity, Simple Models of Social Learning.
4. **Hao Bai-Lin:** Coarse-graining, Symbolic Description, and Complexity; Factorizable language: Examples from Biology.
5. **Van Savage:** Scaling and Power Laws with a Case Study in Biological Allometry, Biological Scaling Theory and Effects on Populations, Scaling Tumor Growth and Sleep Times.
6. **Weixia (Bonnie) Huang:** Introduction to Network Workbench.

(11 lectures)

Week III

1. **James Glazier:** Developmental Biology, Computational Modeling, and CompuCell3D.
2. **Han Jing:** The Collective Behavior of Multi-Agent Systems, I and II.
3. **Han Zhangang:** Agent Based Model of the Division of Labor.
4. **Jia Qing-Shan (Samuel)** Ordinal Optimization: Soft Optimization for Hard Problems.
5. **Raissa D'souza:** Understanding Networks: Theory and Application. I–III.

(12 lectures)

Week IV

1. **Chen Xiaosong:** Introduction to the Institute of Theoretical Physics of the Chinese Academy of Sciences.
2. **Jin Xiaoyi:** Introduction to Population Dynamics in China.
3. **Marc Feldman:** Rural-urban Migration in China Social Networks, Human History Seen through the Genes.
4. **Eric Smith:** Origins of Life.
5. **Chris Wood:** Imaging Brain Structure and Function: Prospects and Progress, Research at the Santa Fe Institute.

(8 lectures)

Also ...

1. **Student Workshops**.
2. **Group Agent-Based Model Experiment**.
3. Presentation on **tips for giving research presentations**.
4. A **Mandarin** lesson for the foreigners, and an **English** clinic for many of the Chinese.
5. **Many announcements** from Dave, Will, and other staff.
6. **Scavenger hunt** to the Summer Palace.
7. **Many trips** to the forbidden city, the Great Wall, etc.
8. **Many meals** in Beijing restaurants.
9. Numerous **dancing** lessons and expeditions.

Some Descriptive Statistics

1. **46 lectures**
2. This corresponds to **2.4 days**
3. Approximately **1100 slides**, all of which Li Li and the ITP staff helped to photocopy.
4. Let us assume that the entropy per word of written English is around 1 bit per symbol.
5. Then, assuming 25 words per slide, and 4.5 symbols per word, the lectures have transmitted at least **100,000 bits** or **100 kb**.
6. You are now joining a select group of over **2000 CSSS alumni**.

Goals of the CSSS

1. **Complex Systems Content:** Provide a foundation in some of the central tools and themes in the study of complex systems and introduce students to some current areas of application and advanced topics.
2. **Interdisciplinary, Collaborative Research:** Give students hands-on experience and develop skills for working in in collaborative groups that span disciplines.
3. **International Collaboration:** Give students experience and develop skills for working in international research collaborations.

Whether or not we've met these goals is ultimately up to you to decide.

Thoughts on Models

- I believe it is extremely valuable to try and answer a question different ways.
- Too often math classes teach us to solve problems that have already been posed.
- This is the case for any class whose title is a method.
- As many others have said, be careful about the assumptions hidden in models.
- **When we use models, they use us back.**

Thoughts on Projects

- In terms of the goals of the CSSS, the *process* of doing the projects is at least as important as the *product*.
- Collaboration can be hard, and interdisciplinary and international work can present additional challenges.
- Over the next few days, I'd encourage you to reflect on the process of doing your projects.
  - What worked well in your collaboration and what didn't?
  - What role(s) did you play in your group?
  - What could you have done differently?
  - What did you enjoy the most? The least?

Some Other Thoughts and Advice, Big and Small

- Keep in touch with CSSS colleagues after the school ends.
- If you have some good photos of the CSSS, please share them on the wiki or elsewhere.
- Most people I know who are excellent researchers:
  - Know more than they have to know
  - Are good at both math/theory and computation.
- Review literature thoroughly. Use the science citation index and google scholar. Interdisciplinarity is no excuse for sloppiness.
- Interdisciplinary is good, but it's a means, not an end.

Questions

- Try not to lose your passion for big questions
  - If you pursue a career in academia, you will be pressured to pursue traditional, safe problems.
  - You will also be pressured to chose a discipline.
  - It is wise to give in to this pressure, but try to do so in a way that lets you keep working on risky, interdisciplinary, BIG problems.
- The hard part of scholarship is posing big, beautiful questions.
- The role of theory is often to pose questions, not to answer them.
- I hope you leave the CSSS with more and better questions than you started with.
- There are (few) set paths for interdisciplinary work.
- *Caminante, no hay camino. Se hace camino al andar.* (Searcher, there is no road. We make the road by walking.) –Antonio Machado.

Will Tracy