Cybersecurity seen through a chaotic lens

What is the problem and why is it important?

- **Security cannot be engineered into an interconnected and constantly changing cyberworld without leveraging the social and behavioral sciences**
  - We will never understand the problem space well enough and fast enough to design effective and sustainable solutions.
    - Unknown interactions among actors
    - Constant adaptation
  - Recent research has shown misalignment of incentives
    - Can be economic, power, autonomy, reputation, …
  - Network effects at multiple levels
  - Scaling

Recent motivating examples

- Emergence of ransomware economy
- Trolls, fake news, and botnets in social media
- Data breaches enabled by new business models
- Wikileaks and Snowden

Why is this difficult to do?

- Conflicting incentives
- Many integrated layers of software
  - Controlled by multiple stakeholders
  - Lack of transparencyand clear lines of responsibility
  - Interactions lead to vulernerabilites
- New business models

Why is progress possible now?

- Relevant Social Science Theories/Models
  - Prospect Theory
  - Over-determination Theory
- AI, machine learning and related methods are maturing and accepted approaches
- Availability of large data sets
- More receptive audience
  - Institutions and individuals recognize their exposure
- New modeling and simulation methods
  - E.g. empirical agent-based models

What are barriers to success?

- Forming interdisciplinary research teams
- Funding the basic research that is required
  - Jonathan Phautz, DARPA
  - Doug Maughn DHS/HSARPA
  - Ed Palozol, Army Research Office
- Finding appropriate datasets
- Identifying and addressing assumptions from all fields

Example Research Questions

- How does defense in depth fail and why?
- Study moving target taking behavior into account
- Studying the incentive system of ransomware
- How can we disincentivize fake news and trolling?
- How can we address social media problems while preserving free speech?
- Understand how to get these systems to develop their own defense systems
- Infrastructure should encourage everyone to innovate their own defense systems