



Image by Vitit Kantabutra

# Introduction to DynCoopNet: What's in a name?

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## Outline

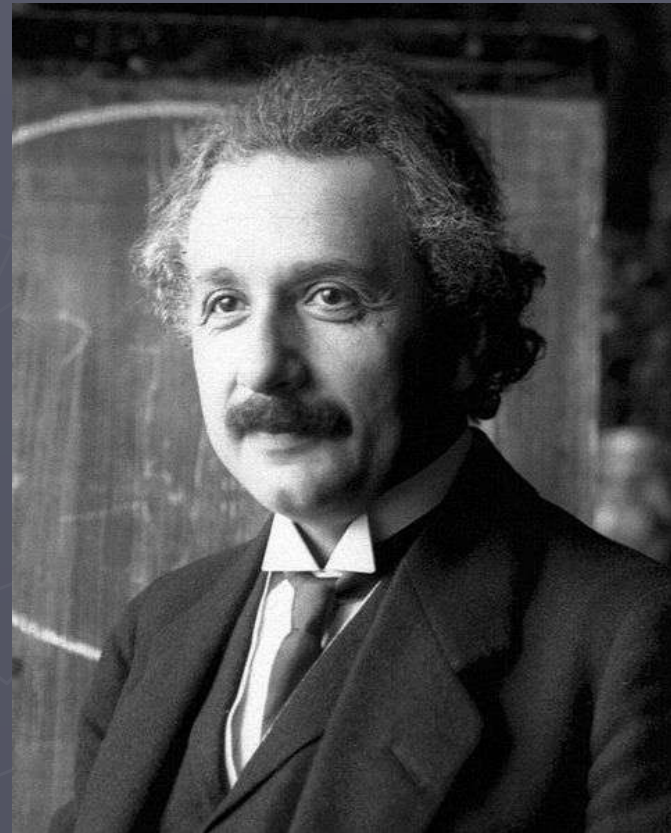
# Dynamic Complexity of Cooperation-Based Self-Organizing Commercial Networks in the First Global Age

- ❑ Geographically-Integrated History
- ❑ Narrative Knowledge
  - ❑ Narrative as a distinct and valuable source of knowledge
- ❑ Dynamics GIS
  - ❑ Activities, Events, Processes
- ❑ Implications for cooperation research
- ❑ Complex, Dynamic, Nonlinear Systems
  - ❑ System more than sum of its parts
  - ❑ Stability and Phase Transitions
  - ❑ Limited prediction
- ❑ Self-Organizing Social Networks
- ❑ SNA & Evolutionary Game Theory
- ❑ The World is Fuzzy
- ❑ Overview



**“Problems cannot be solved  
by the same level of thinking  
that created them.”**

Attributed to ...  
Albert Einstein, Nobel Prize, 1921



# Geographically-Integrated History

As a research and teaching discipline, *Geographically-Integrated History* is founded on the idea that (1) the understanding of historical processes requires an integration the natural, social, and cultural environments on the basis of place, space, and time and (2) accomplishing this integration poses a challenge that can be met with modern information management, especially GIS, and visualization techniques.

Transforming disciplines





# Geographically-Integrated History Paradigm Hallmarks

- 1) The history of any place is shaped by the way the place is connected to other places and by the changes in these connections over time.
- 2) Historical periods are complex, dynamic, nonlinear systems, which are spatially large, and in more recent centuries, global in extension, and which sometimes become unstable, leading to a phase transition, bifurcation, and the organization of new systems.
- 3) Within such systems, people and places are connected by self-organizing networks, which are the sources of innovation and the emergence of new forms.





# **Important implication for cooperation research?**

**We focus on the First Global Age, 1400-1800, as a system. Because there was a phase transition at the end of this period, historians can say something important about strategic interactions in this human system, which cannot be dealt with well by research on contemporary scenarios.**



# Narrative Knowledge

**Narrative as a distinct and  
valuable source of knowledge**

# Dynamics GIS

(May Yuan 2008)

- ▶ Need more complicated narratives
- ▶ Activities, Events, Processes
- ▶ Coupled Natural & Human Systems



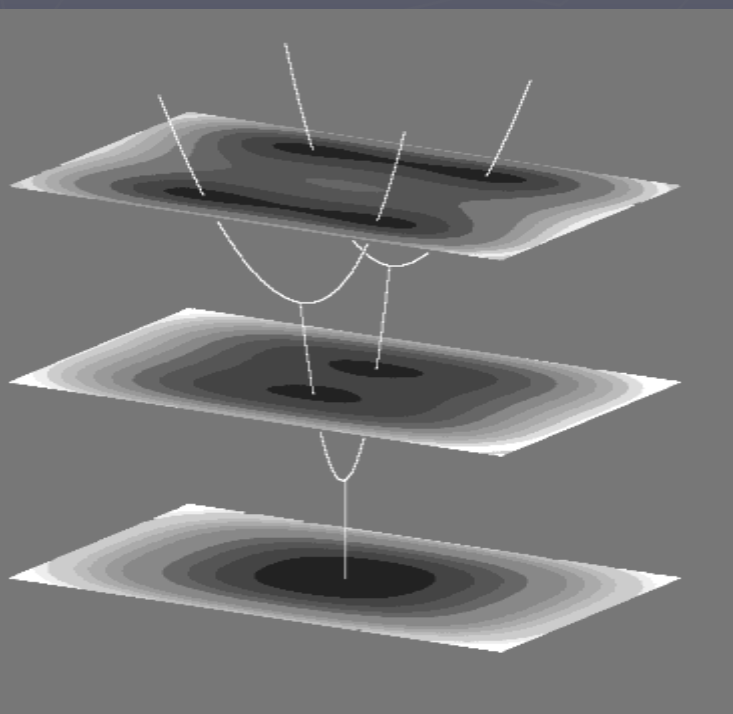


# Complex, Dynamic, Nonlinear System: more than the sum of its parts



# Nature of a complex, dynamic, nonlinear system

Image from Tõnu Puu (2003: chapter 12)



- ▶ Lots of variables
- ▶ A few variables (perhaps only one), stable but near instability, maintain the stability of the system
- ▶ Variables to instability, system to instability, chaos, and bifurcation
- ▶ Different values & perspectives so that those of new system have difficulty understanding the former one (teleology: “early modern”)

# Limited Predictability

Ransom E. Olds, first production Oldsmobile, 1903





# Self-Organizing Social Networks

- ▶ Polymorphous network domains & fluid social identity
- ▶ Self-organization & emergence
- ▶ Sources of creativity and innovation
- ▶ Network disruption & more robust networks (the local to the global)
- ▶ Cascade of innovations





# Why important?

## ► Historic periods & models

- Complex, dynamic, nonlinear system (limited predictability)
- Multiple networks of different types, connected only at particular nodes; shape identity
- Disruptions, robustness & unpredictable cascades (the stuff of **narrative**)
- The local to the global
- “Control” variables to instability
- Phase transition



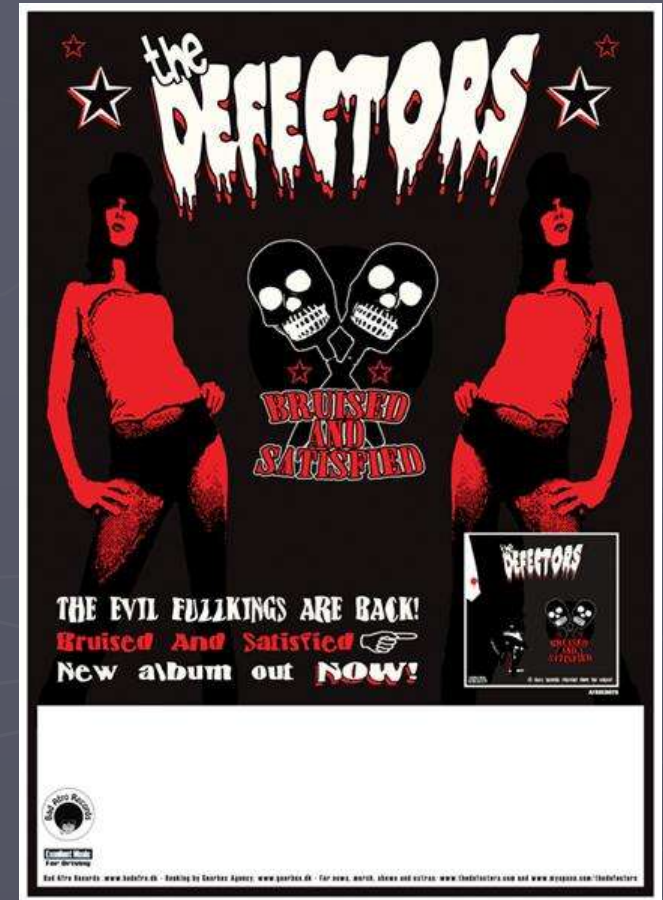
# Social Network Analysis (SNA) & Evolutionary Game Theory

- ▶ SNA and graphs
- ▶ Use evolutionary game theory results to explore strategic interaction in social networks
- ▶ Permits analysis of interplay of social norms, the integration into models of “gene-culture” coevolution, and the development of narrative knowledge (Gintis, *Bounds of reason*, 2009)



# Individual Intentions & Strategic Interaction

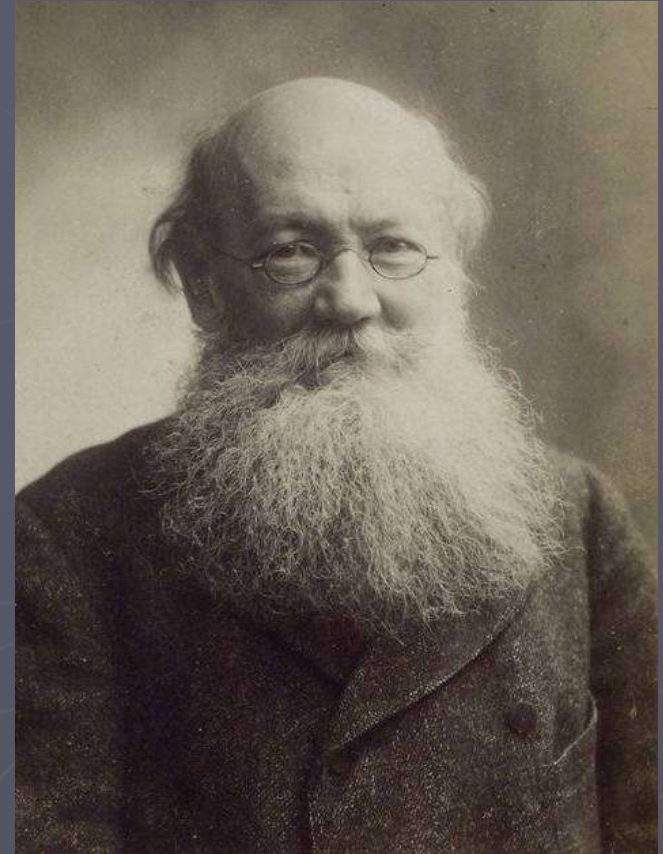
- ▶ Examine the role of individual intentions within strategic interactions, variables highlighted by historical narratives (Lehmann, Foster, Borenstein & Feldman 2008 *TEE*)
- ▶ Narrating disruptions & catalog of possible interactions as basis for models and theories





# New Models & Theories

- ▶ Game theory models lack generality, for the details of dynamics and interactions modify results in a qualitative manner (Roca, Cuesta & Sánchez 2009 *Phy Life Rev*)
- ▶ “New Models; New Theories” (Sánchez 2009 TECT IIASA)
- ▶ Nonlinear dynamics, social network analysis, and emergence and evolution of cooperation from environment of seemingly endemic violence



Petr Kropotkin, *Mutual Aid: A Factor in Evolution* (1902)



# The World Is Fuzzy!



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# Inherent Complexity of Reality

- ▶ Because of their complexity, “humanistic systems” (human-centered ones) cannot be modeled in the way we model “mechanistic systems”.
- ▶ Still, based upon documents and data, the “domain” expert (animal ecologist, geographer, historian) may have a sense of “rules” that govern the system behavior and the meanings of natural language expressions such as “Amy is young” or “The level of trust is very strong”.



# Lotfi A. Zadeh, "fuzzy logic"

"I think it is better to be visible and provocative than to be bland."





# Overview

- ✓ Complex system
- ✓ Nonlinear dynamics (limited predictability)
- ✓ Narrative Knowledge
- ✓ Dynamics GIS
- ✓ Social networks (fluid self-identity, multilevel)
- ✓ Disruptions, robustness, & cascades (connects local action to global system)
- ✓ Evolutionary Game Theory
- ✓ Fuzzy logic (historic information & data management)

“Dead reckoning”



Follow Jack into an unknown sea?



# Too futuristic?



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# Albert and Jack



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# Thank you for listening

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