



On Norms, Punishment and Society

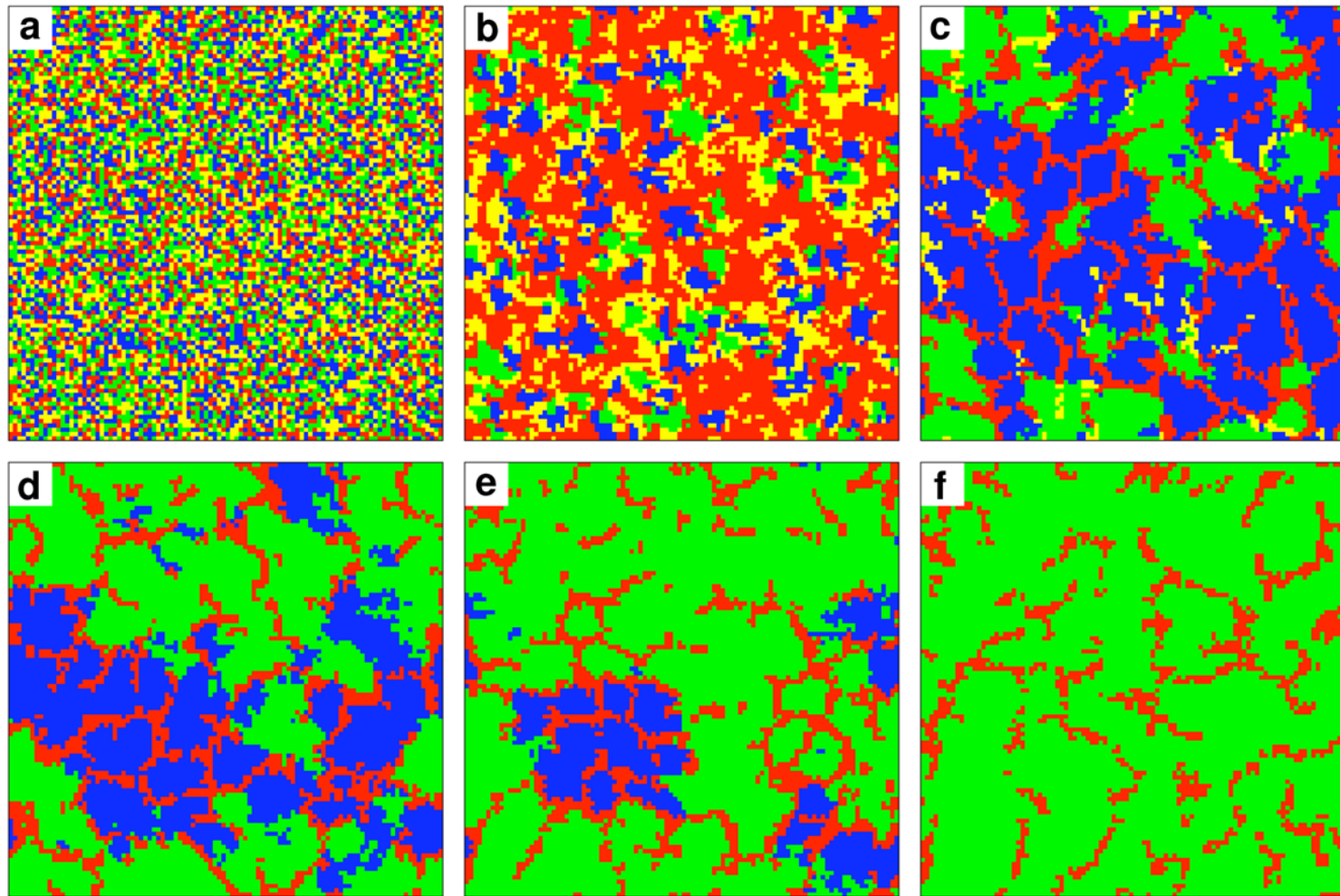
Dirk Helbing (ETH Zurich)

with Karl-Dieter Opp, Heiko Rauhut, Wenjian Yu, Matjaz
Perc, Attila Szolnoki, György Szabo, and Stefano Balietti

Global Warming and the Spreading of Costly Punishment

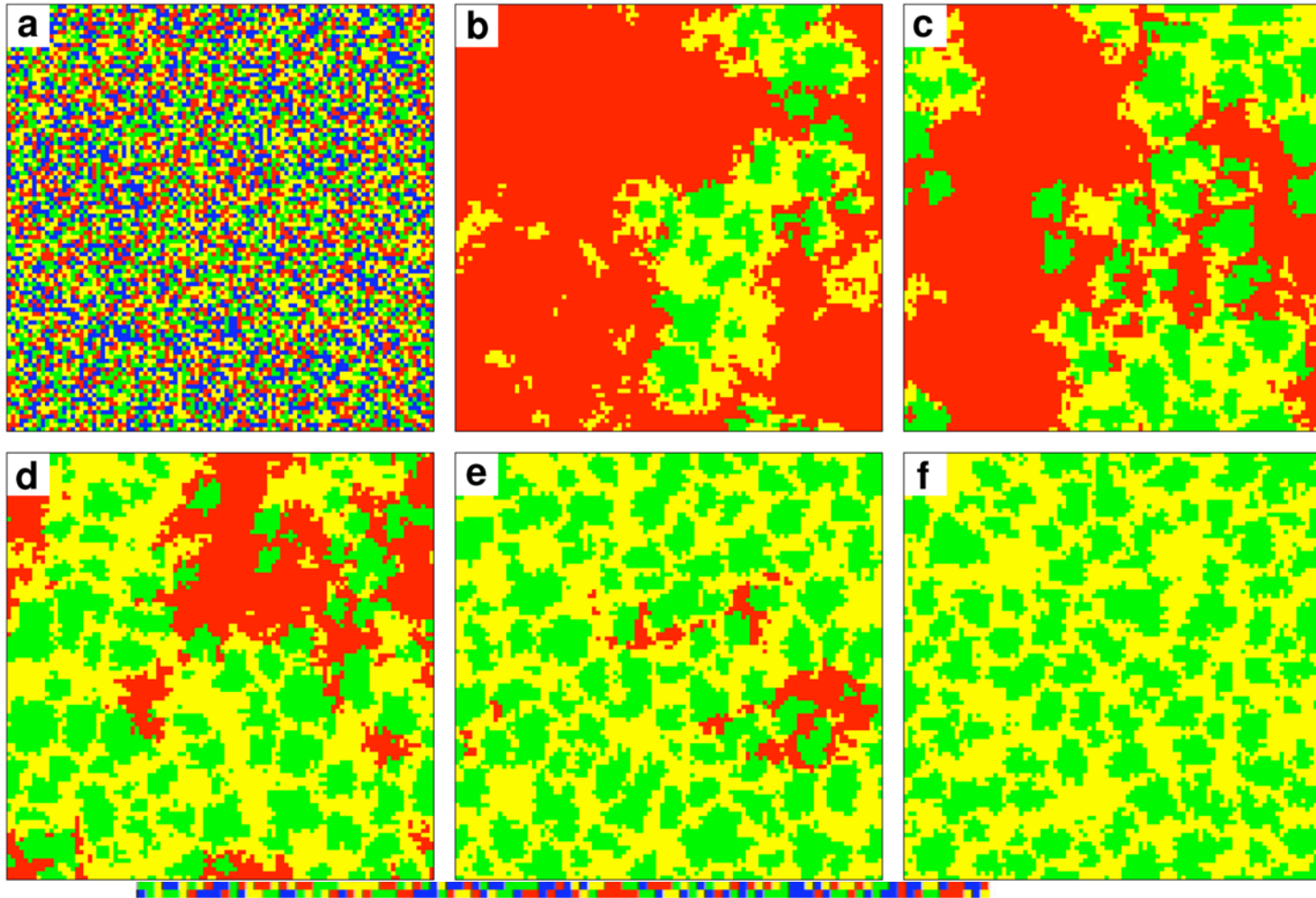
- Imagine that **cooperators (C)** correspond to countries trying to meet the CO₂ emission standards of the Kyoto protocol, and **“moralists” (M)** to cooperative countries that additionally enforce the standards by international pressure (e.g. embargoes). **Defectors (D)** would correspond to those countries ignoring the Kyoto protocol, and **“immoralists” (I)** to countries failing to meet the Kyoto standards, but nevertheless imposing pressure on other countries to fulfil them.
- For well-mixed interactions, **defectors will be the winners** of the evolutionary competition among the strategies, i.e. all countries would finally fail to meet the emission standards (**“tragedy of the commons”**). The reason is that **cooperators (“second-order free-riders”)** spread at the cost of moralists, while requiring them for **their own survival**.
(See the work of Milinski et al.!)

How Second-Order Free-Riders Are Eliminated+Punishment Spreads



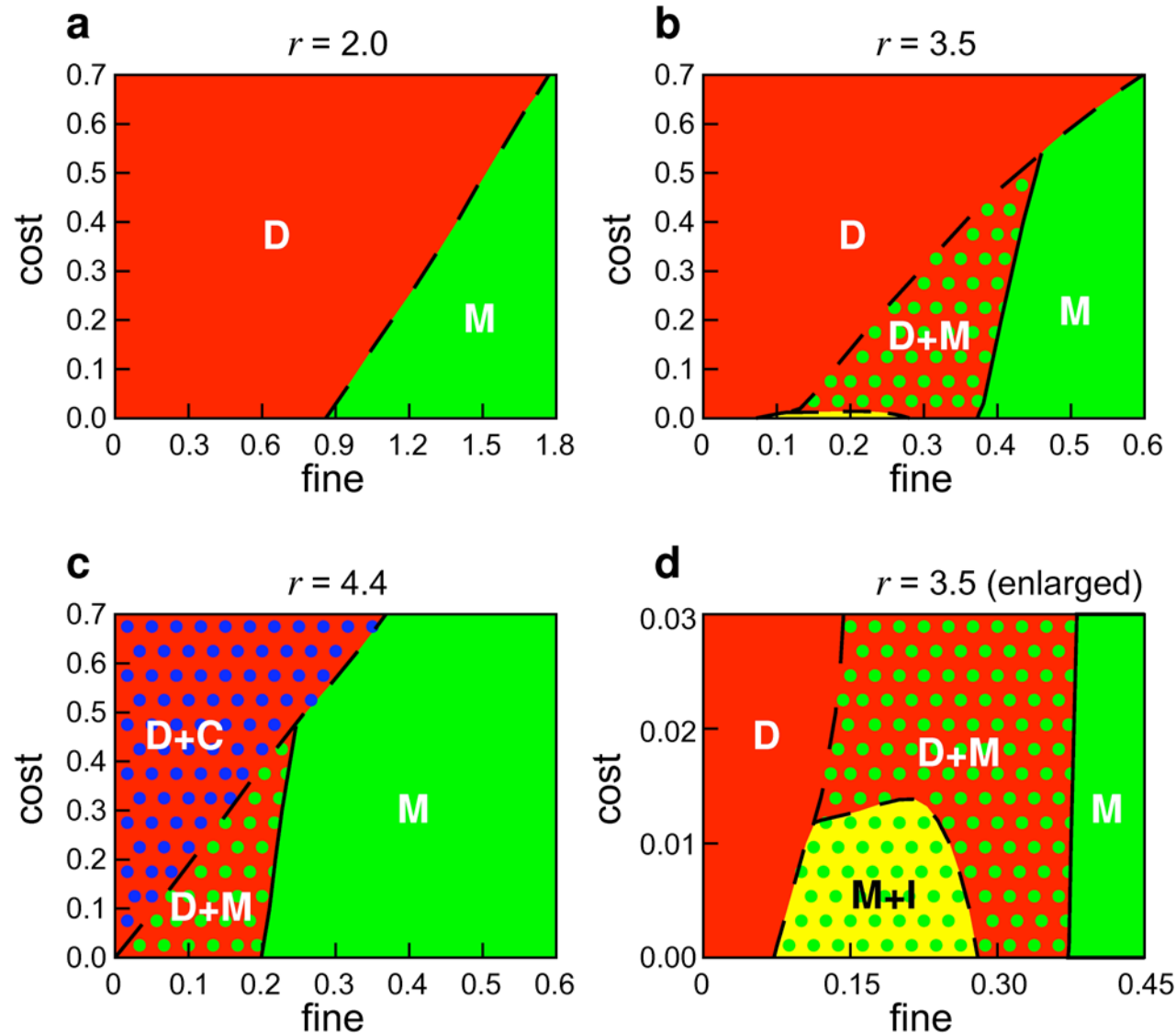
D = Defectors (Free-Riders), M = Moralists, I=Immoralists
C = Non-punishing Cooperators (Second-Order Free-Riders)

The “Unholy” Symbiosis of Moralists and Immoralists

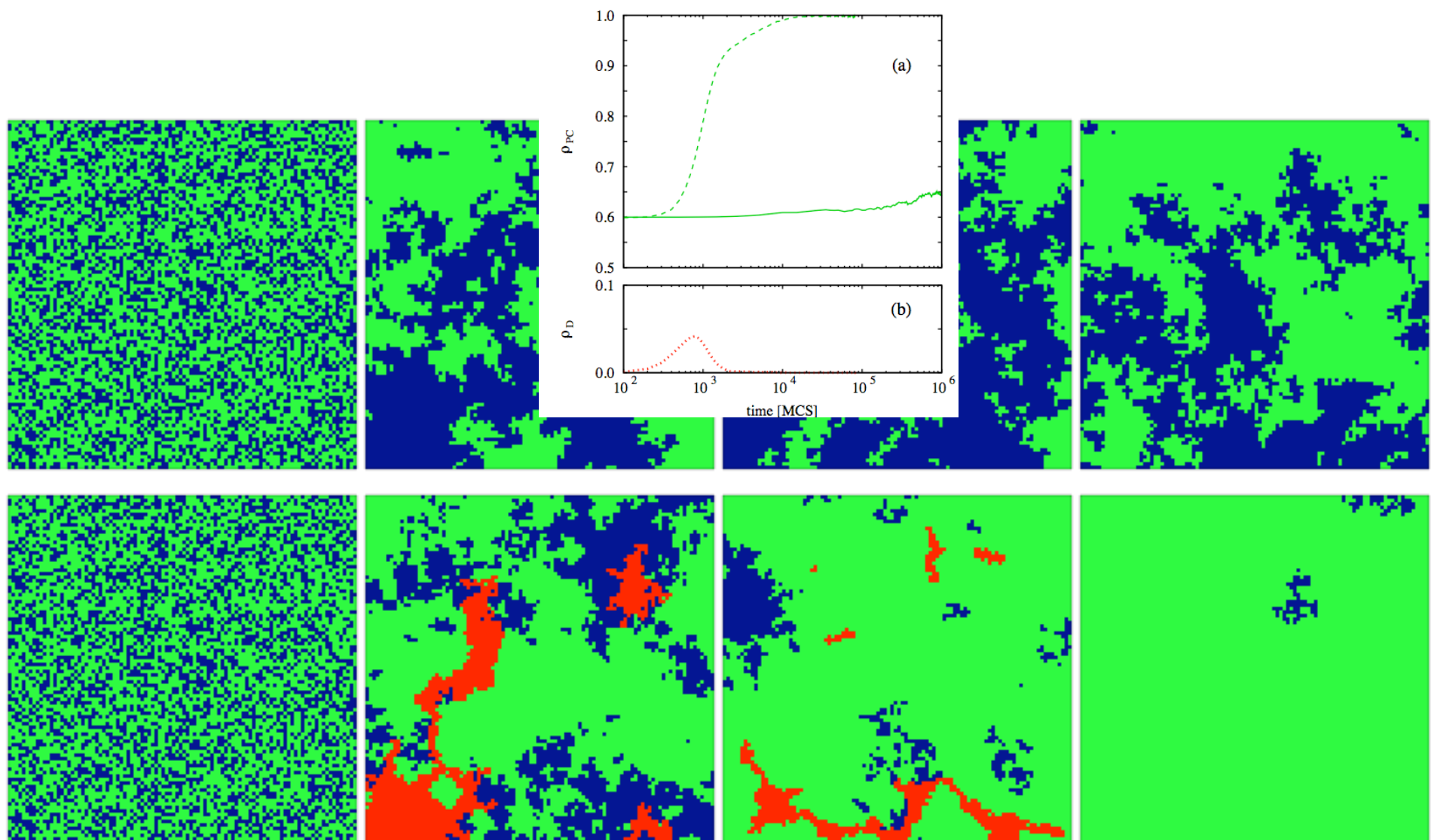


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Overcoming the Tragedy of the Commons by Spatial Interactions



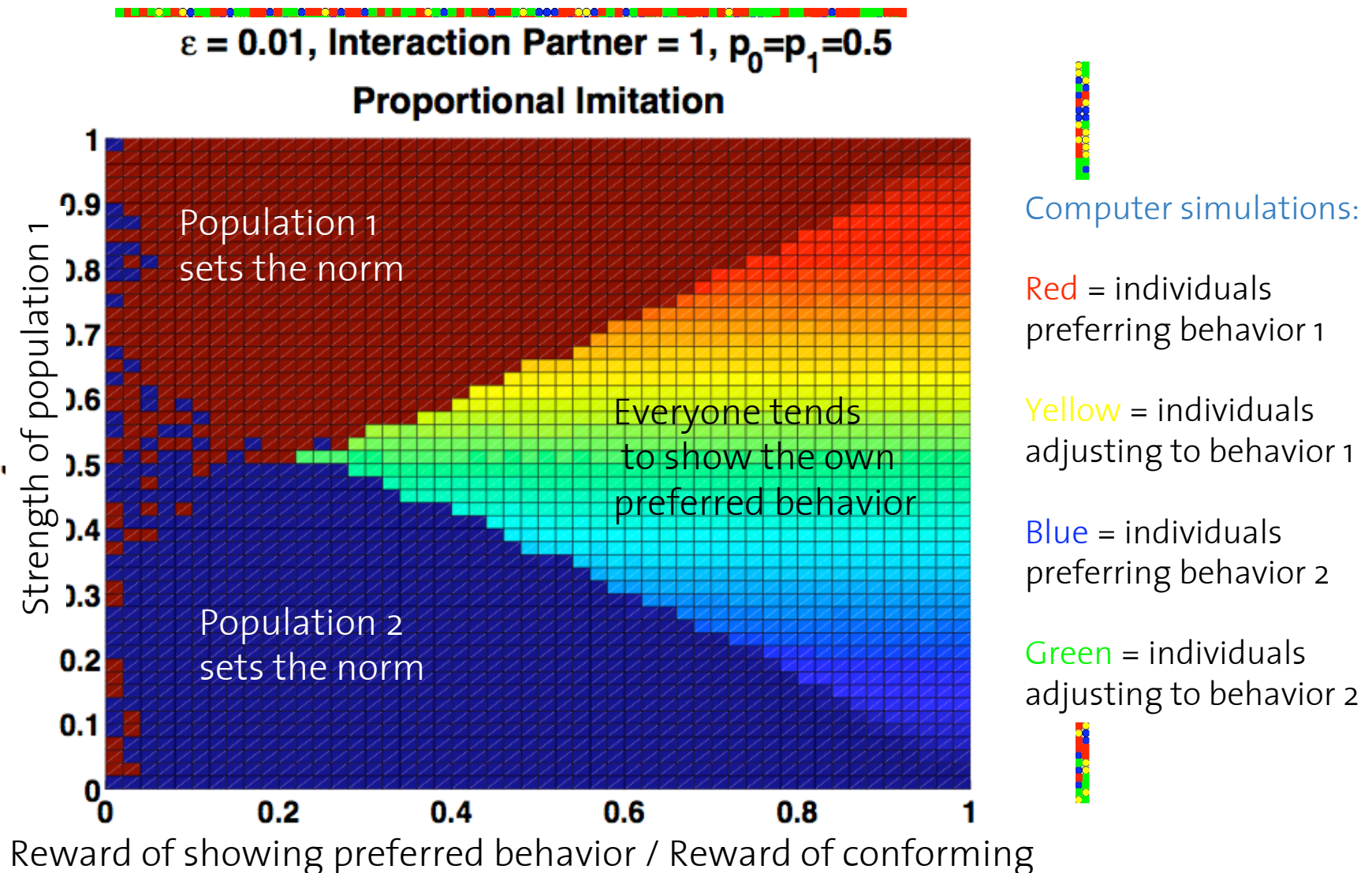
“Lucifer’s Positive Side Effects”



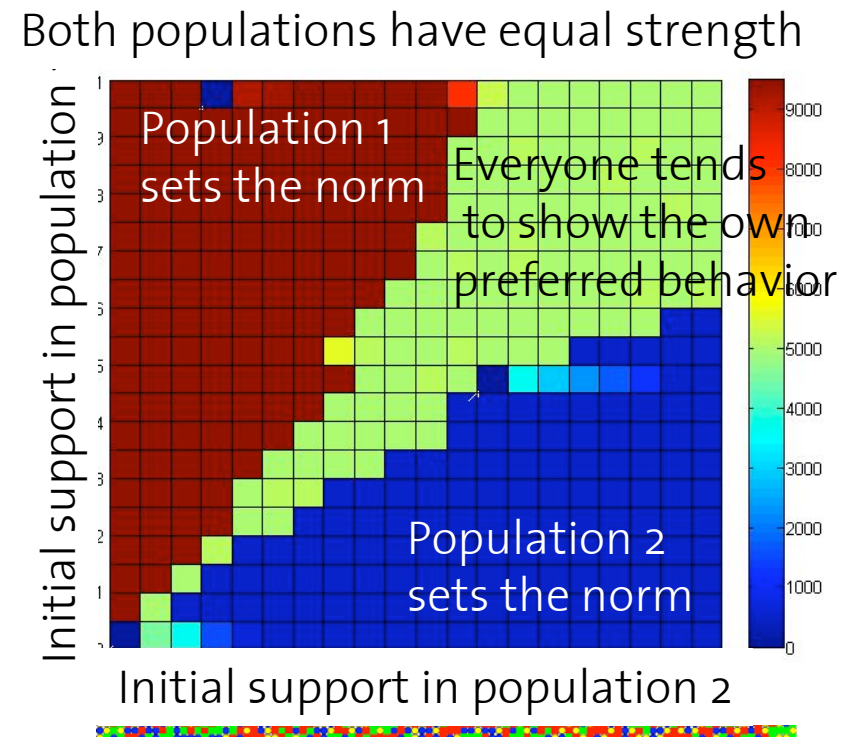
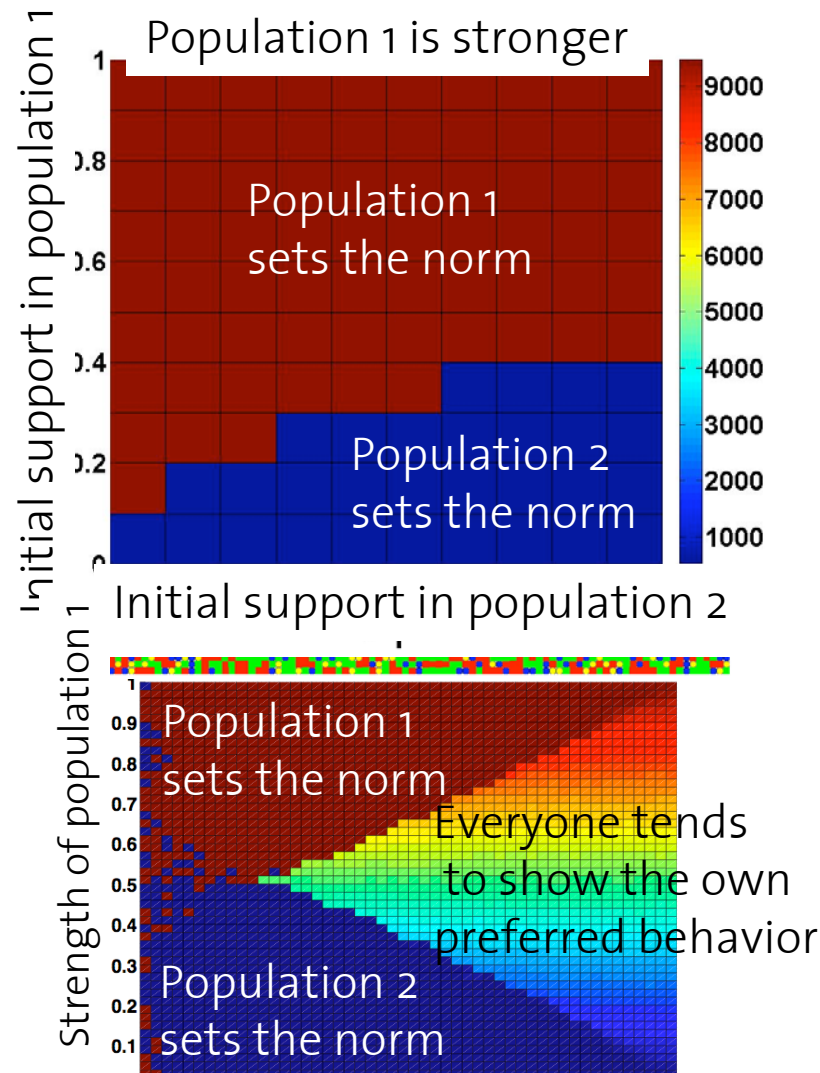
Social Norms: Some Stylized Facts

- Social norms make people follow certain **social rules**, often even if not observed by others (“internalized norms”). They are like a “**remote control**” that lets people satisfy other people’s expectations.
- They are the forces, which keep society together (**the “cement of society”**)
- It allows people to interact more smoothly (**the “grammar of society”**), makes interactions more predictable
- Social norms are formed, if individual behaviors have **externalities**
- The establishment and maintenance of norms often requires **sanctioning efforts** (deviations from the norm are punished)
- It can happen that **non-popular** or non-system-optimal norms are established
- Norms can have almost **any content**, but are largely **history-dependent**
- The typical situation is **local consensus, but global diversity**
- Norms can abruptly change from one area or group to another. The **separating borders may be quite sharp**

Possible Outcomes in the Two-Population Norms Game

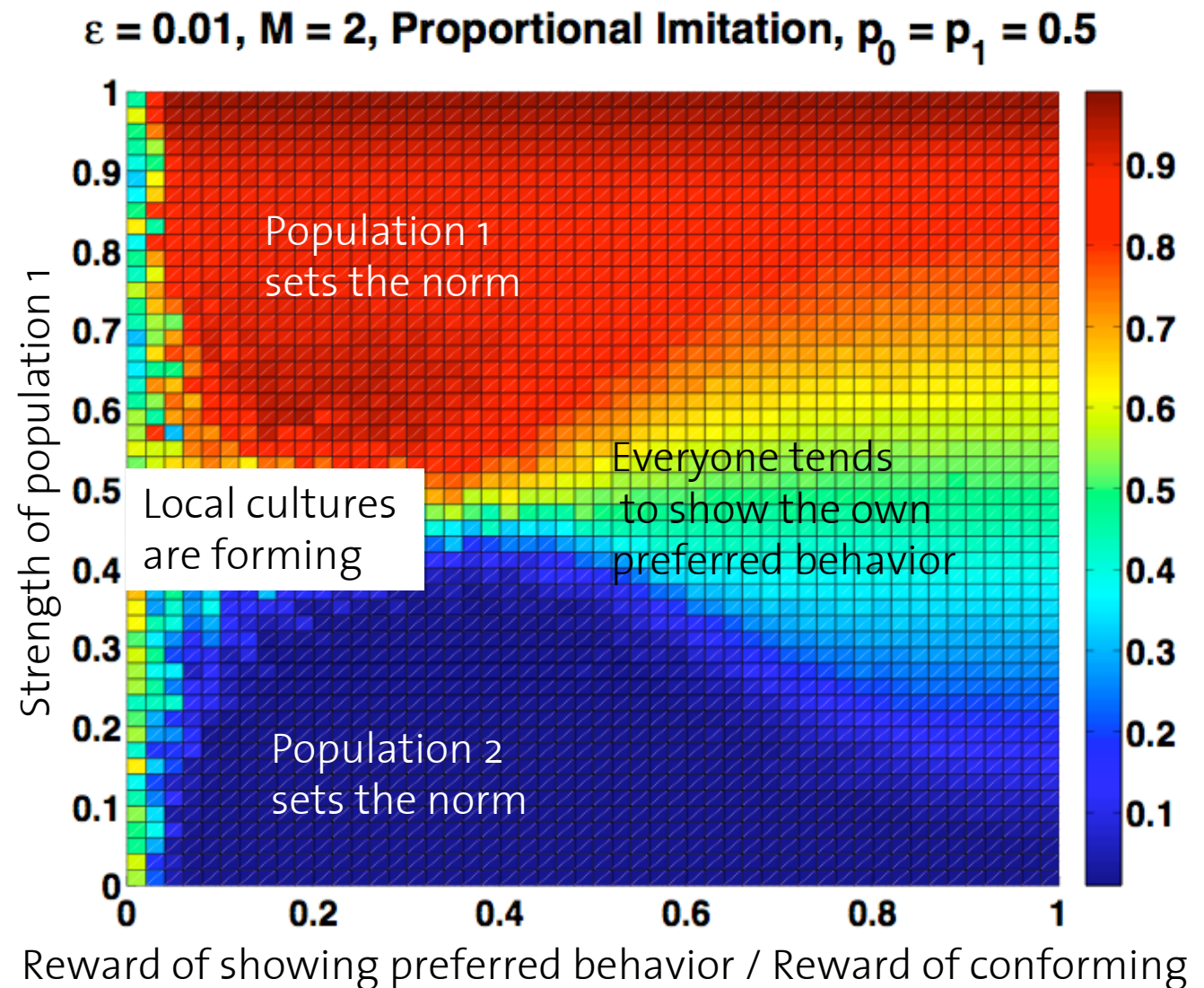
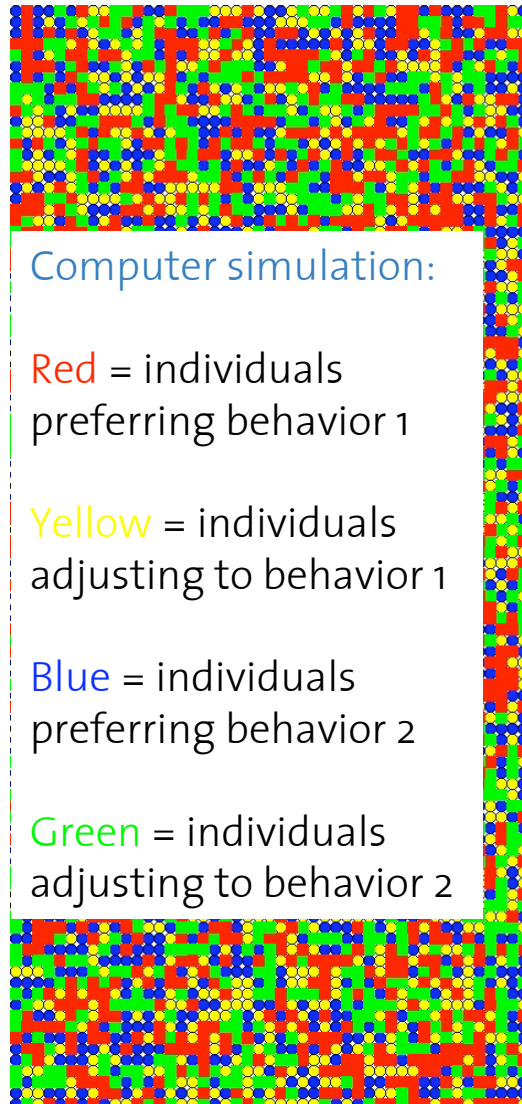


History/Path Dependence - The Initial Condition Matters

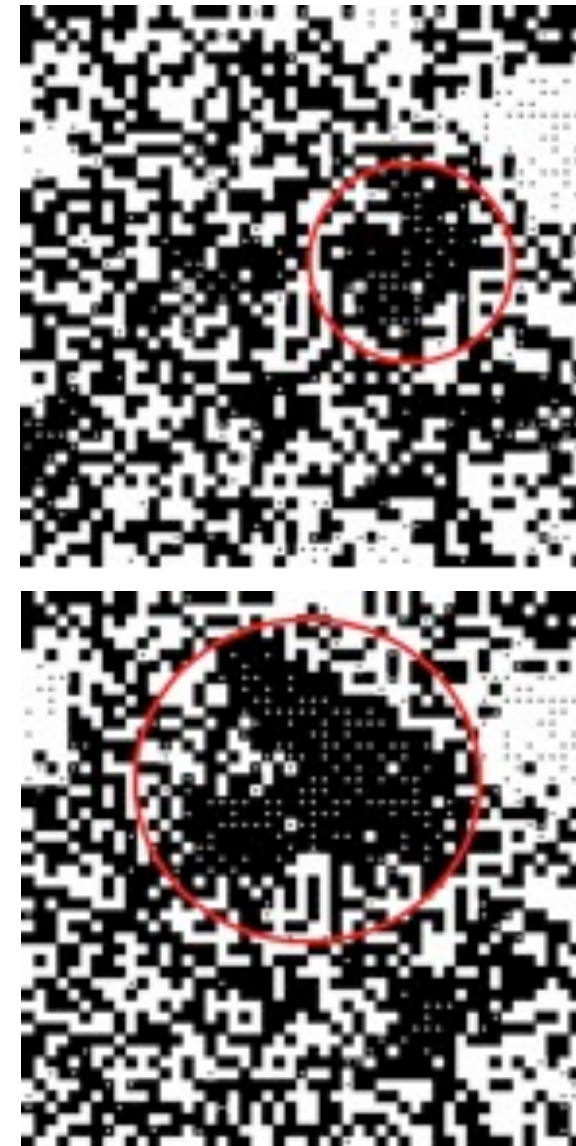
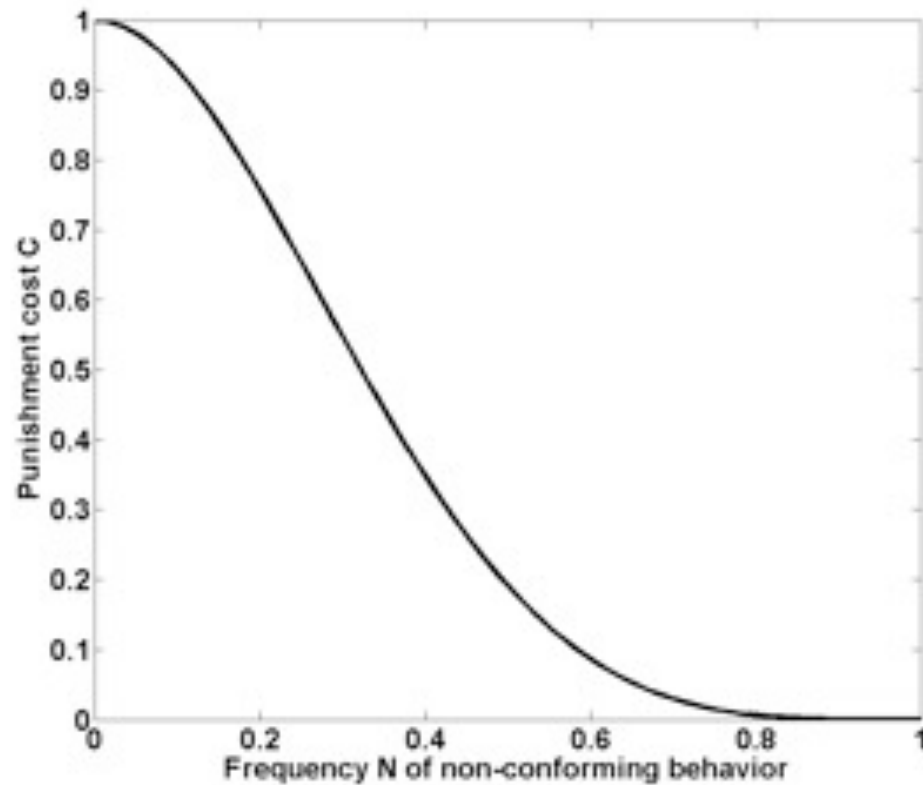


Reward of showing preferred behavior / Reward of conforming

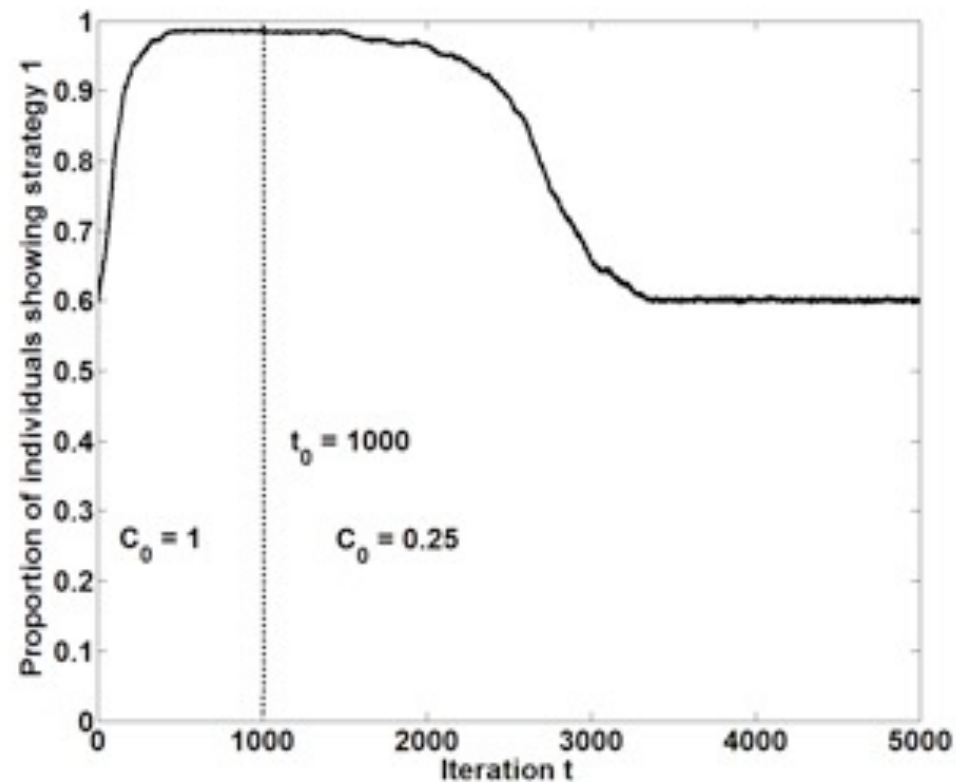
Possible Outcomes in the Norms Game with Local Interactions



Outbreak of a Social Norm by Adaptive Group Pressure

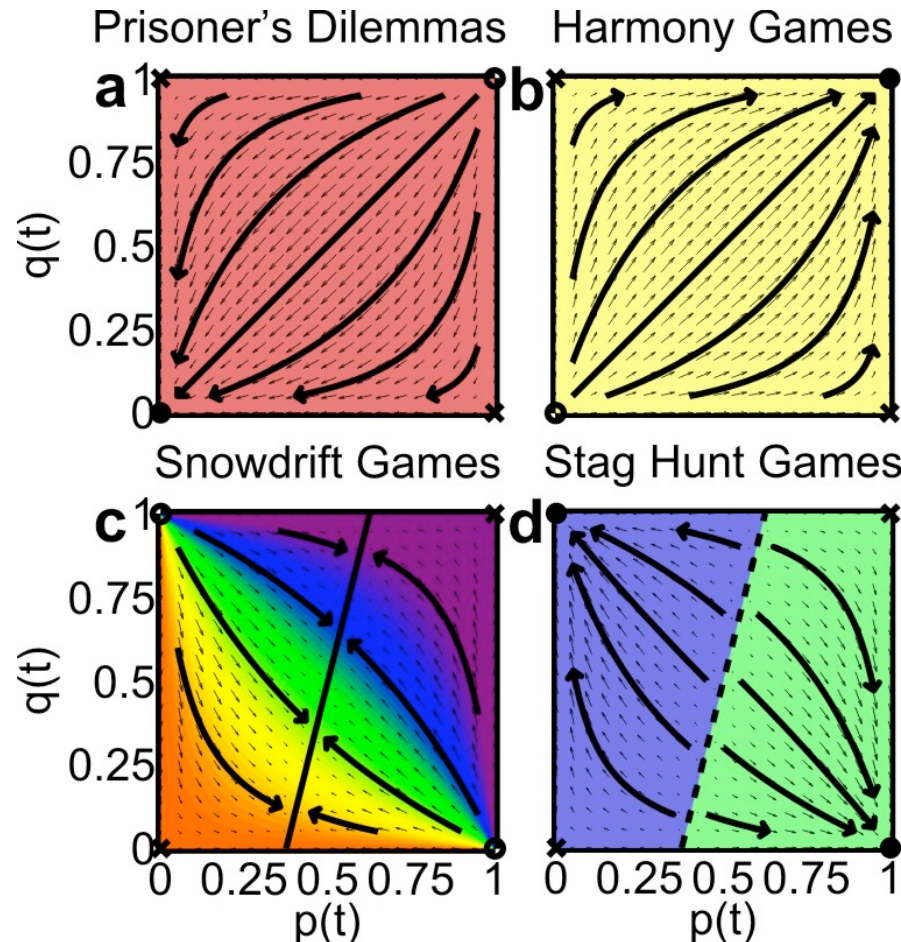


Persistence of Social Norms



Two Populations with Incompatible Interests

Breakdown
of cooperation



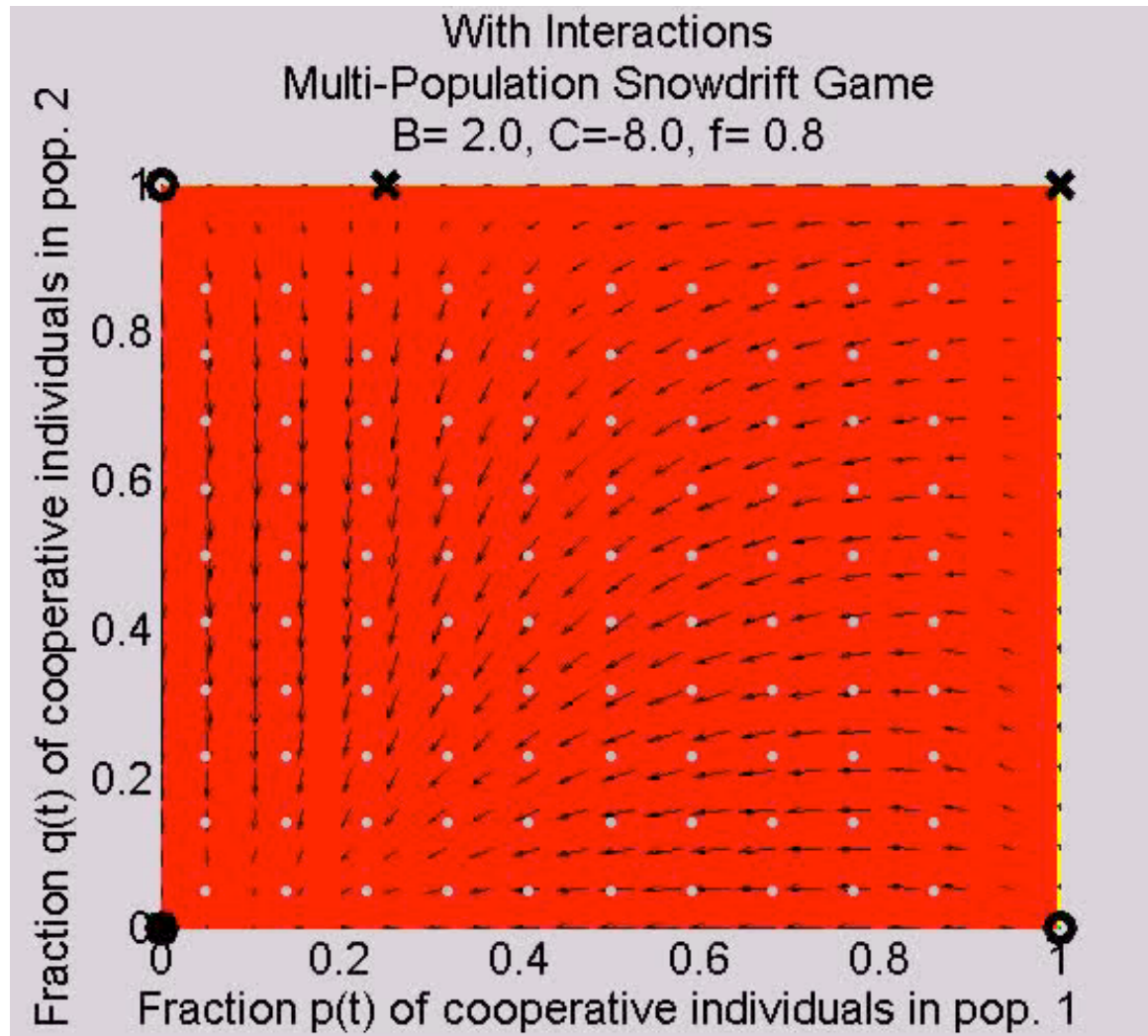
Formation of
subcultures

Conflict/no
agreement

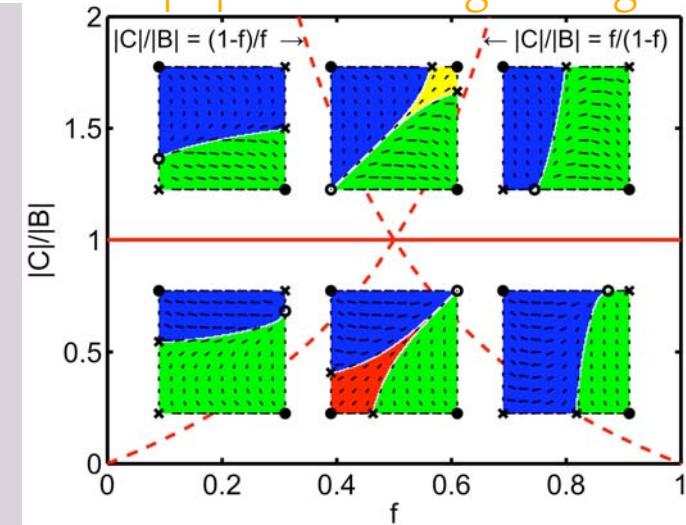
Formation of shared
behavioral norms

Only in the Stag Hunt Game we find that both populations tend to use the same behavioral strategy, i.e. **a behavioral norm evolves!** The norm-creating mechanism is also important for the **evolution of language.**

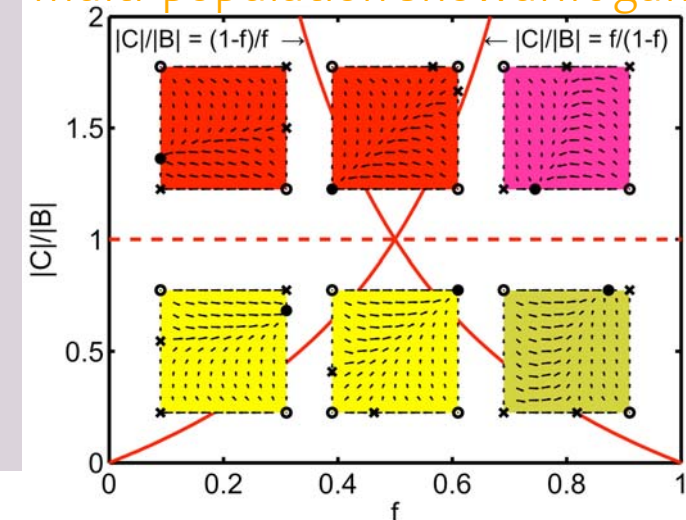
Relevance of the Payoff Parameters and Power



multi-population stag hunt game

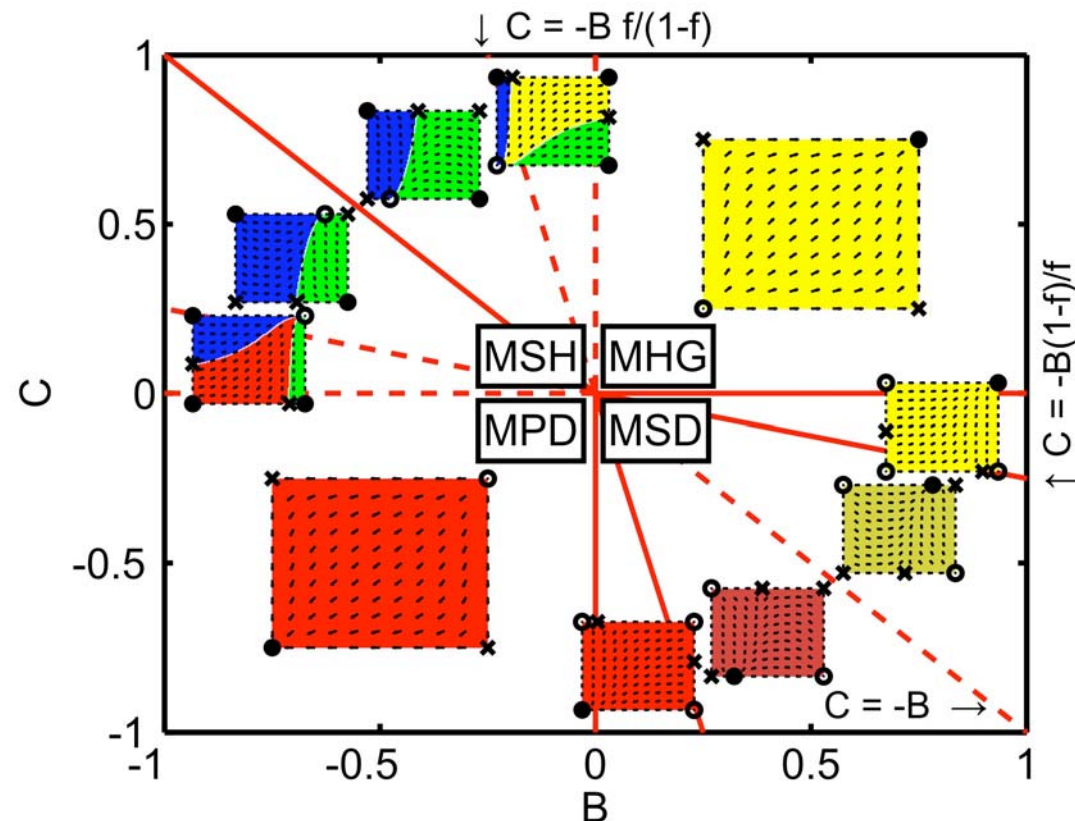


multi-population snowdrift game



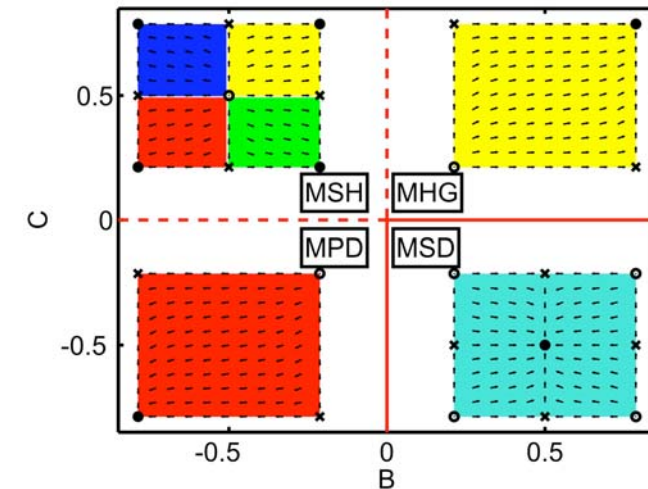
Summary of System Dynamics in Multi-Population Games

with interactions and self-interactions

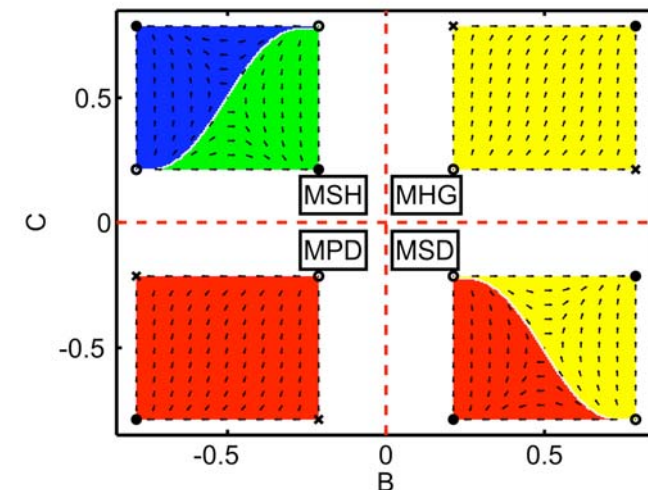


MSH = multi-population stag hunt game
 MPD = multi-population prisoner's dilemma
 MHG = multi-population harmony game
 MSD = multi-population snowdrift game

without interactions



without self-interactions



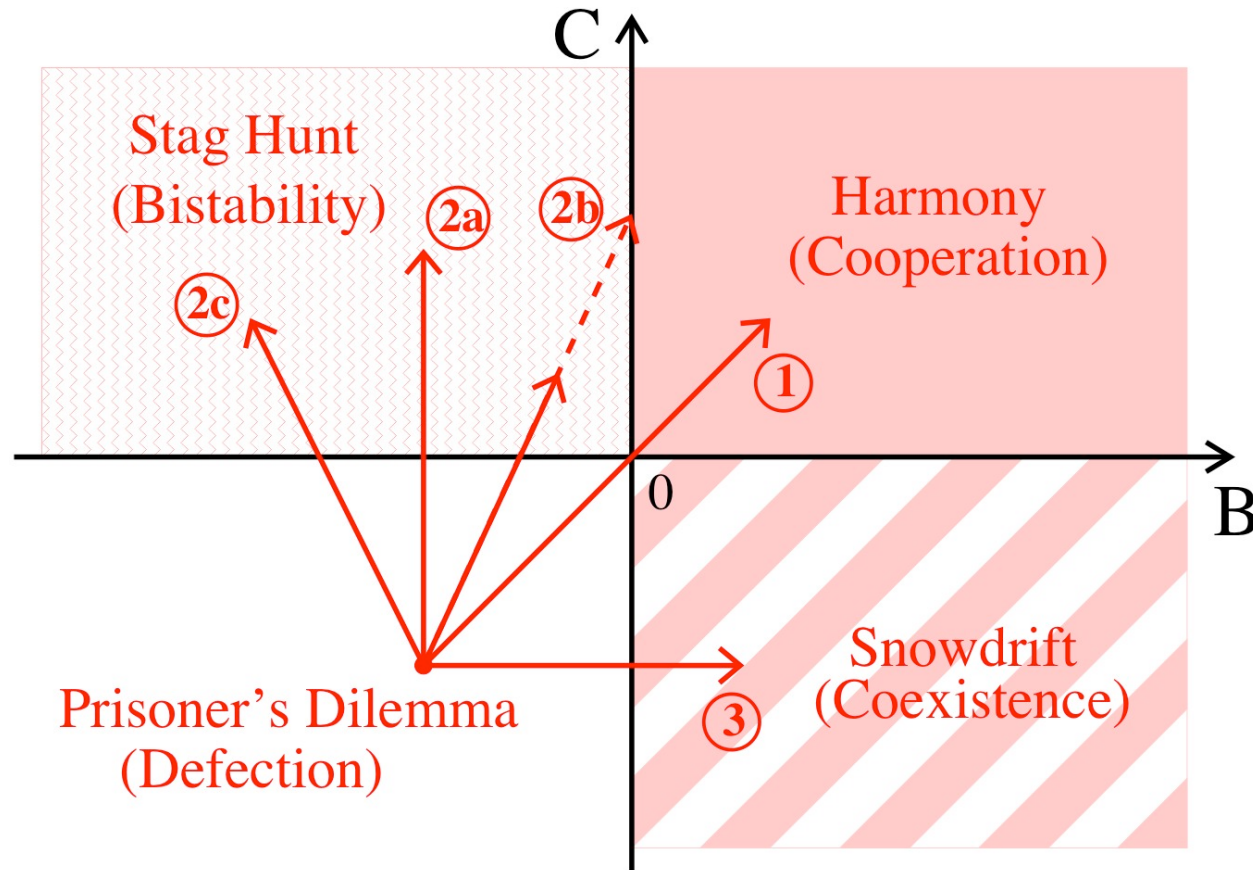
Fundamental Mechanisms Supporting Cooperation or Norms

- Genetic inheritance (B)
- Repeated interaction (S)
- Abstaining/volunteering (S)
- Reputation, signaling (S)
- Spatial interactions, clustering, agglomeration and segregation (B/S)
- Friendship formation, network effects (S)
- Group selection (B/S)
- Costly punishment, group pressure (S)
- Strong reciprocity (B/S)
- Mobility (B/S)
- Inequality, heterogeneity (B/S)
- Noise, errors, mutation (B/S)

B = Biological mechanism
S = Social mechanism

The representative agent /
mean field approach
is misleading

How to Transform the Prisoner's Dilemma into Other Games



Route 1: Kin selection, 3: Network interactions (don't support norms)

2a: Direct reciprocity, 2b: Indirect reciprocity, 2c: Punishment (support norms)

The FuturICT Knowledge Accelerator

Unleashing the Power of Information for a Sustainable Future

Dirk Helbing, with the support of >300 scientists from all over the World



We have explored the universe, and have sent men to the moon. It turns out, however, that our current knowledge of society is too limited to efficiently tackle the global challenges of humanity in the 21st century. Thus, it's time to pay attention to our Earth and create an ICT Flagship to explore social life and everything it relates to.



Challenges Humanity is Facing in the 21st Century

Lee C. Bollinger, president of Columbia University, formulated the issue as follows: “The forces affecting societies around the world ... are powerful and novel. The spread of global market systems ... are ... reshaping our world ..., raising profound questions. These questions call for the kinds of analyses and understandings that academic institutions are uniquely capable of providing. Too many policy failures are fundamentally failures of knowledge.”



1. Financial and economic crisis
2. Debts and inflation
3. Stability of the European Union
4. Corruption
5. Organized crime, hooliganism
6. Extremism, terrorism, war
7. Epidemics (SARS, H1N1 pandemic)
8. Security and cyber risks
9. Migration and integration
10. Environmental change

The Top 10 Socio-Economic Problems and their Reasons

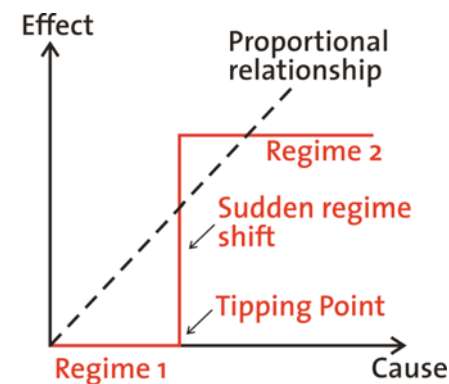
Problems:

1. Demographic change, migration
2. Financial and economic stability
3. Social, economic and political inclusion, integration
4. Public health
5. Balance of power and conflict
6. Corruption and crime
7. Collective social behavior
8. Institutional design
9. Sustainable use of resources
10. Reliability of critical infrastructures

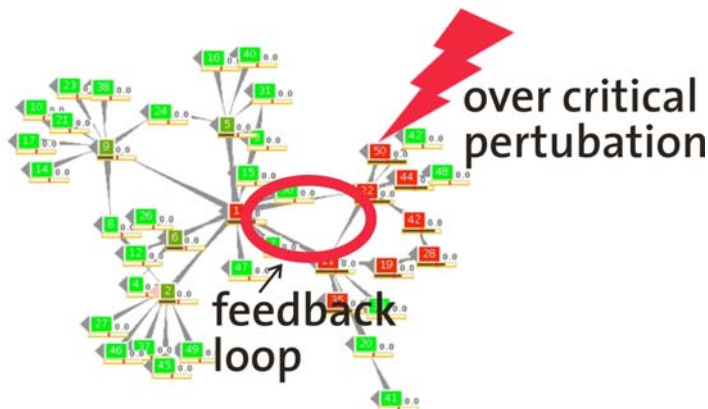


Reasons:

1. Interdependency, interconnectivity
2. Socio-economic, ecological, and technological complexity
3. Self-organization, emergence, chaos
4. Limits of predictability and control



Cascade failures/
avalanche effects:
Epidemic spreading,
congestion spreading,
failure of interbank
market, breakdown
of former GDR



5. Lack of quantitative models
6. (Due to) Lack of data
7. Lack of computational power
8. Lack of systemic predictions
9. Lack of tested alternatives
10. Systemic risks

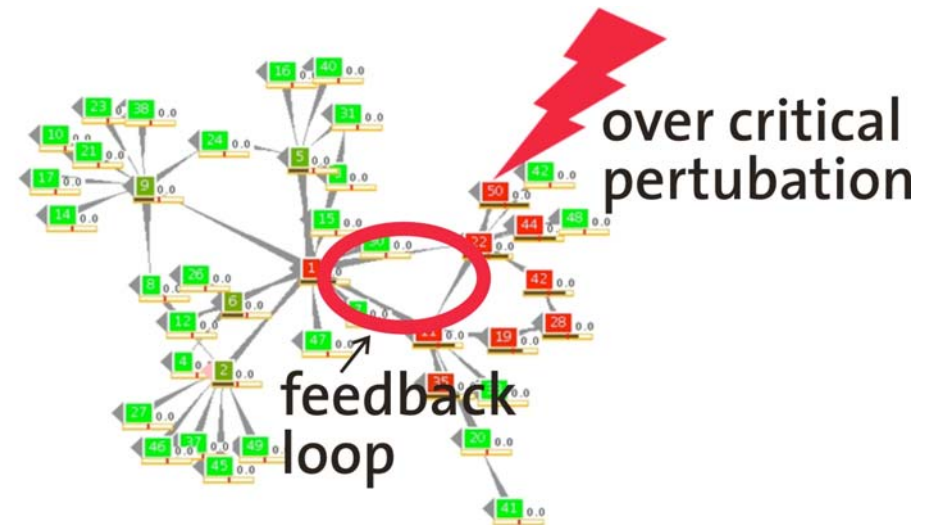
This is
about to
change!

New ICT for Socio-Economic-Ecological Reality Mining + Simulation

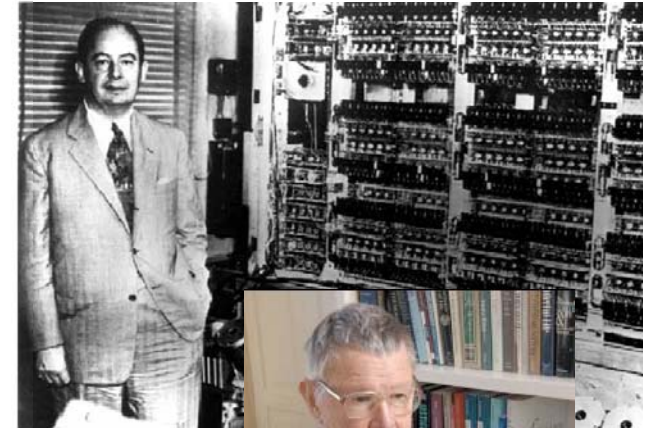
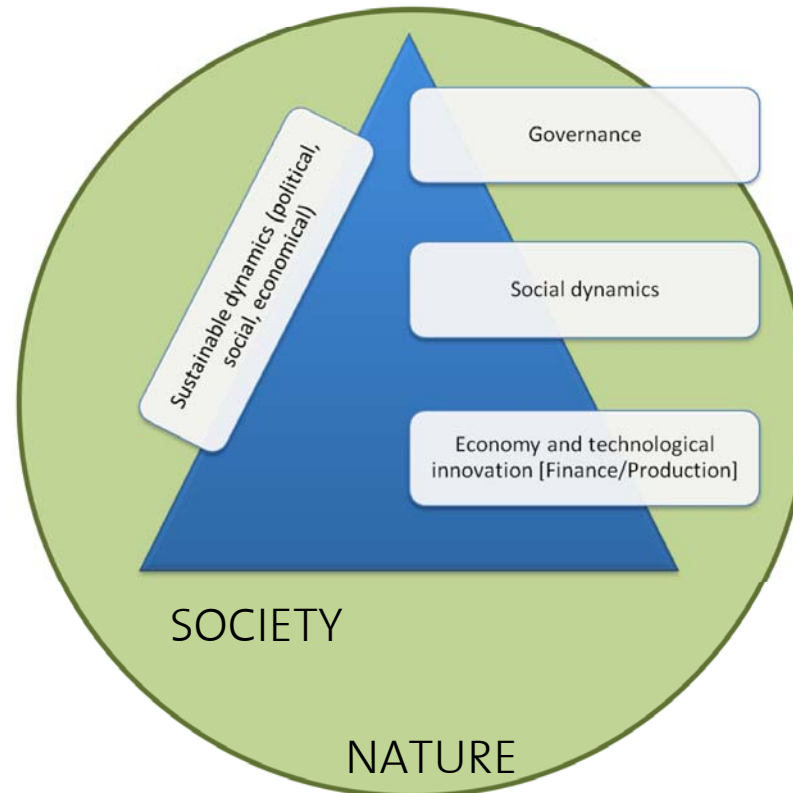
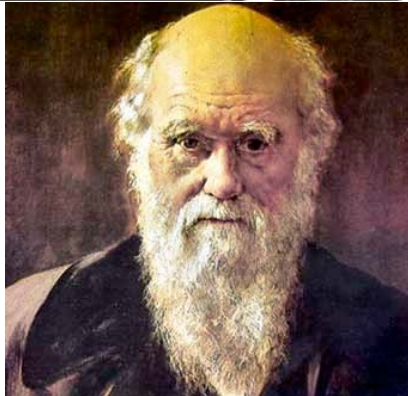
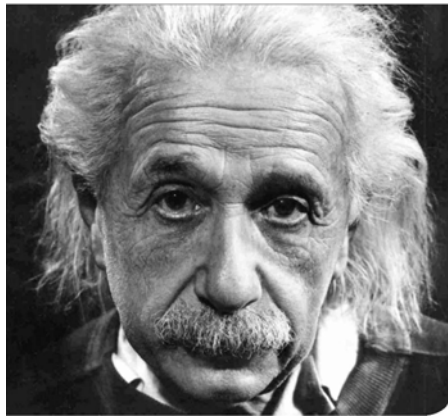


Cascade Spreading and Systemic Crises

- Network interactions are ubiquitous
 - **Feedback loops**, circuli vitiosi
 - Unwanted side effects
- **Systemic malfunctions**, whenever the system state changes beyond a **critical threshold** („tipping point“)
- Often caused by massive cascading effects („domino effects“, „avalanche effects“)
- Triggered by overcritical perturbation or coincidence of failures
- **Examples:** Epidemic spreading, failure of interbank market, congestion spreading, blackout of electrical power system

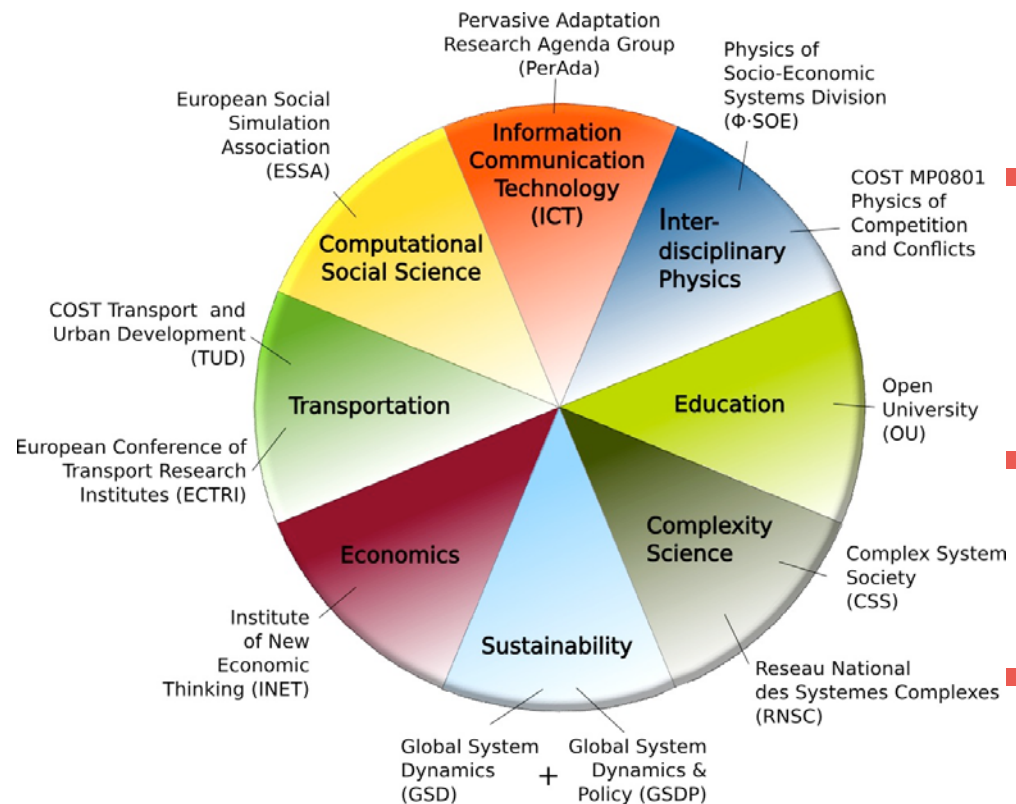


The Need of A Knowledge Accelerator



We need to create a **techno-socio-economic-ecological knowledge accelerator** - a kind of multi-disciplinary Apollo project that uses current and future ICT developments to address the challenges of humanity, involving natural scientists and engineers

Plausibility of FuturICT



- Europe has reached leadership in social modeling and simulation, but strong competitors are trying to take over. The project is in the best public interest, meets Europe's Vision 2020.
- Many preparatory **Networks of Excellence and Coordination Actions**: Exystence, Giacs, Once-CS, ASSYST, PANORAMA/PerAda, ...
- EU projects on **techno-social systems**: Qlectives, Cyberemotions, Epiwork, Socionical
- **Various Integrated Projects and STREPS**: EURACE, EMIL, PERPLEXUS, PATRES, MMCOMNET, EVERGROW, DELIS, EC-AGENTS, PACE, CREEN, IRRIIS...
- **Information Science**: HITIME, VIVO, GAPMINDER, GLOBALHUBS, CREEN...

Overview of FuturICT's Living Earth Platform Concept



Data collector



Testing of alternative solutions



Decision arena

Meltdown modelling



Crisis observatory



European-scale,
multi-disciplinary
effort is needed!



Political decision-making

**Thank you
for your interest!**

Any questions?