Global Participatory Computing for Our Complex World

FuturICT

www.futurict.eu

"How complexity science can shed light on massive open data"

Anna Carbone
FuturICT Coordination Team
Politecnico di Torino & ETH Zurich

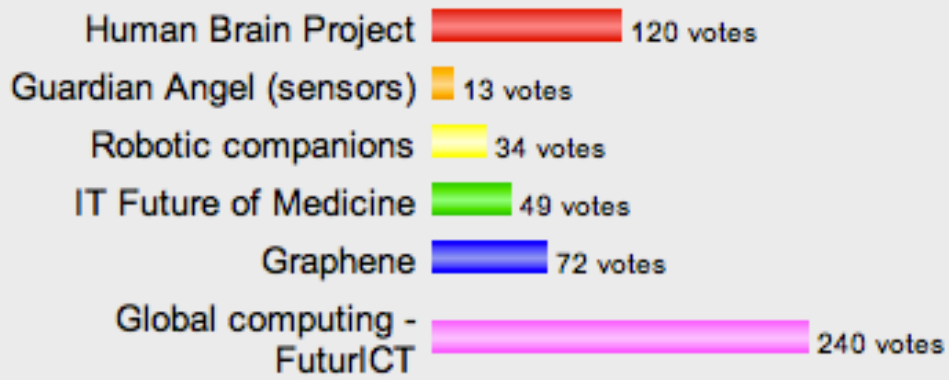
FET Flagship Poll “Next Big Future”

poll.pollhost.com/bmV4dGJpZ2Z1dHVyZQkxMzE2MTAxOTIzCUVFRUVFRQkwMDA

Type a question here to create your own free poll

Who will be the next president? ... Do you like my new haircut?

The EU will provide two projects out of 6 pilot projects with 1 billion euro from 2013-2022. Pick your favorites



Opportunities and Challenges of the Information Age

- Global ICT = most complex artifact
- Billions of interacting components
- Many autonomous decisions
- → Artificial social systems!
- Example: Computer-based automated financial trading

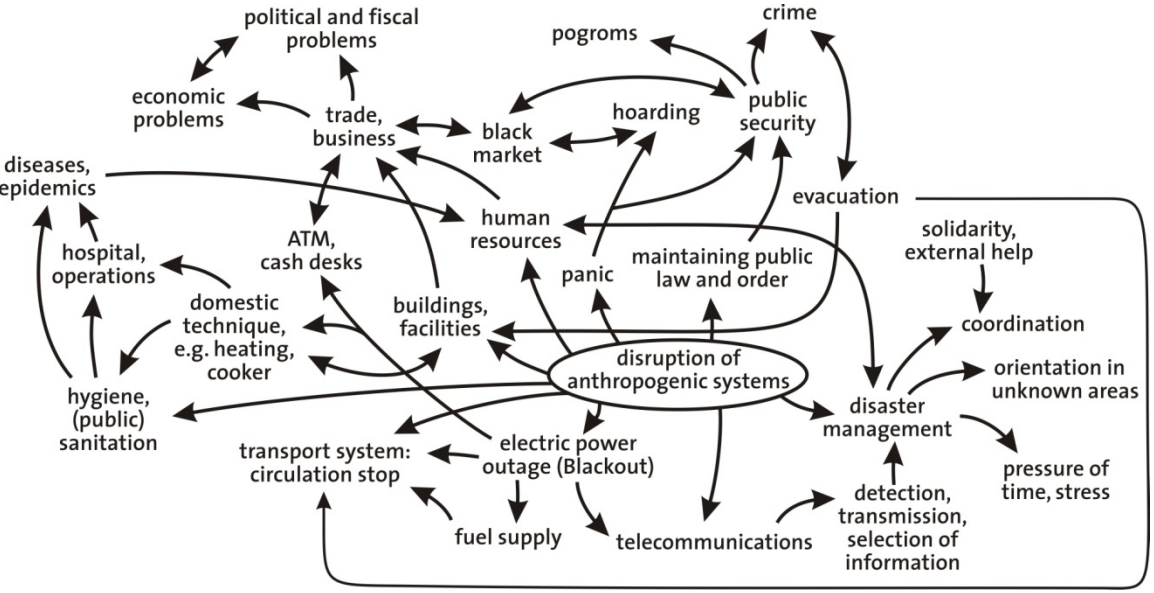
- Too much Data
- Too much Speed
- Too much Complexity

ICT is part of the problem, thus key to the solution! Need to understand socially interacting systems!

Networking is Good … But Heterogeneities Promote Cascading Effects

- We now have a global exchange of people, money, goods, information, ideas…

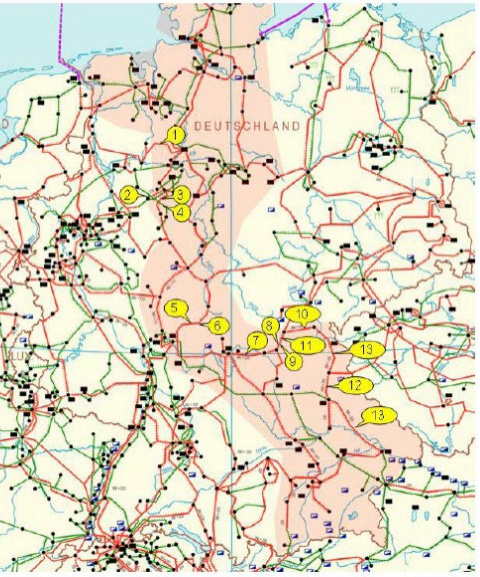
- Globalization and technological change have created a strongly coupled and interdependent world

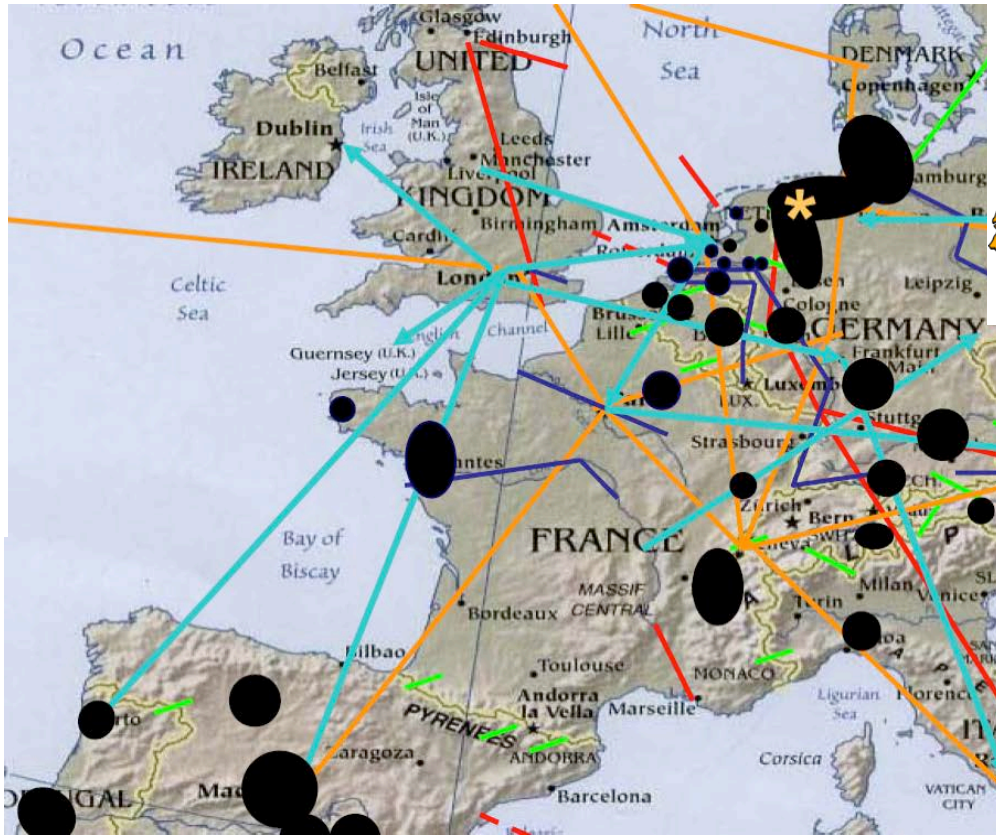


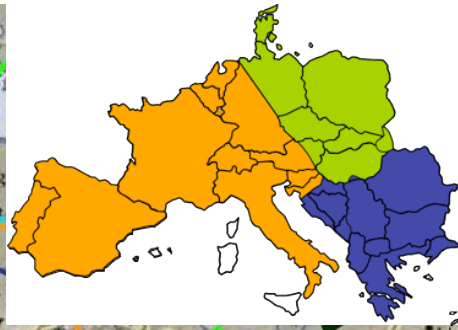
Network infrastructures create pathways for disaster spreading!
Need adaptive decoupling strategies.

Cascading Effect and Blackout in the European Power Grid

Failure in the continental European electricity grid on November 4, 2006

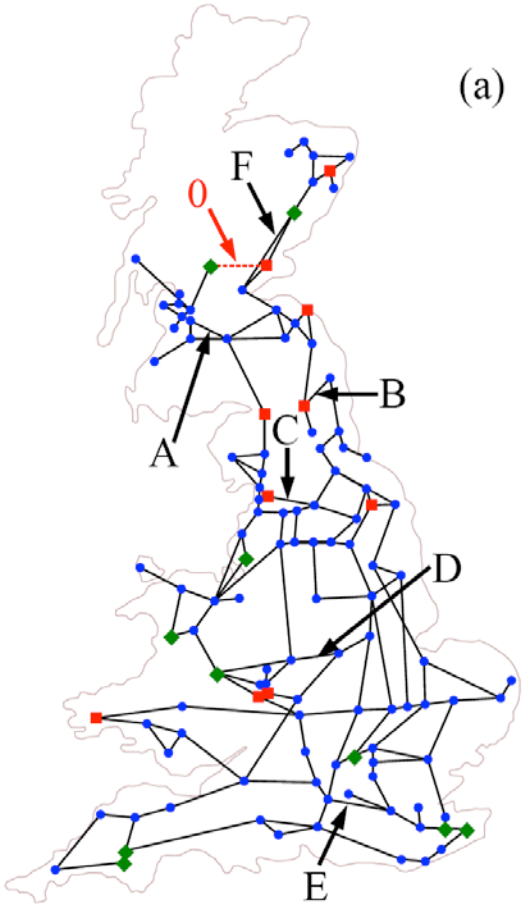






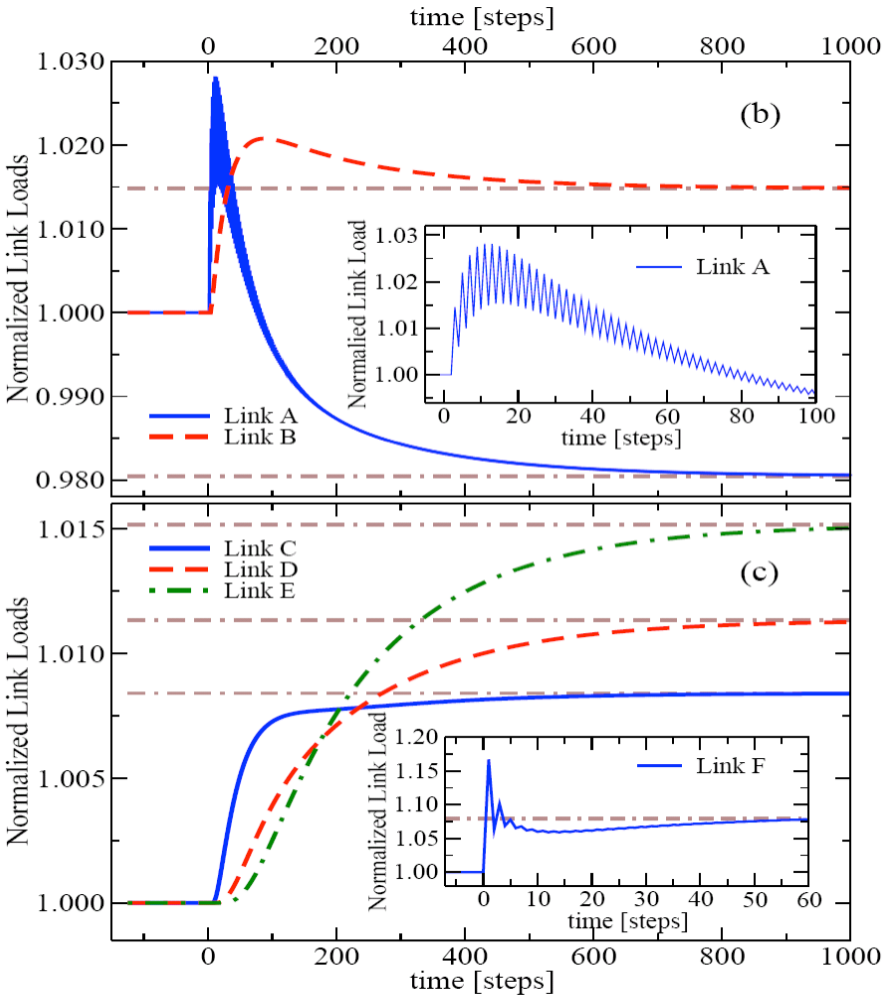
EU project IRRIIS: E. Liuf (2007) Critical Infrastructure protection, R&D view

Vulnerability of Power Grids to Cascade Failures



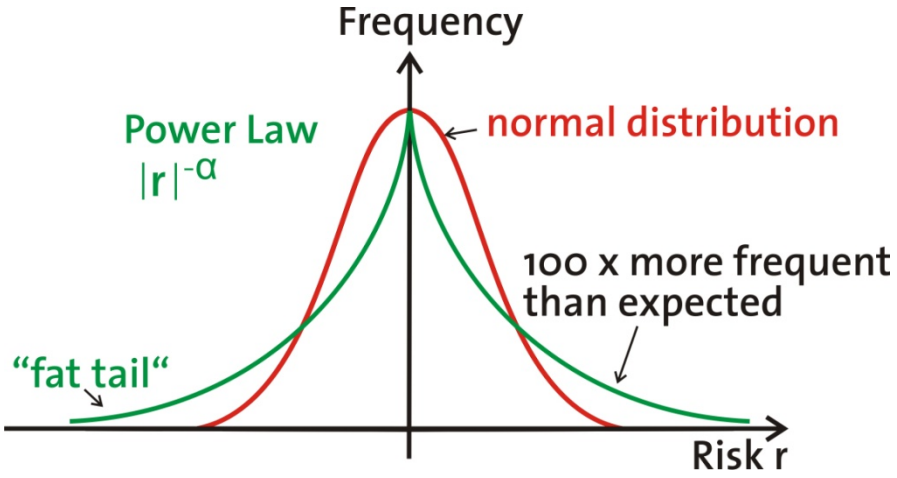
UK high voltage power grid topology (300-400 kV)

Transformation of electrical grids towards distributed power generation increases instability



Strongly Coupled Complex Systems Feature:

1. Faster dynamics
2. Increased frequency of extreme events – can have any size
3. Self-organization dominates system dynamics
4. Emergent and counterintuitive system behavior, unwanted feedback, cascade and side effects
5. Predictability goes down
6. External control is difficult
7. Larger vulnerability



Change of perspective (from a component- to an interaction-oriented view) will reveal new solutions!

Need a science of multi-level complex systems!

Today Need: New Science to Fill Knowledge Gaps

Our world is globalized and interconnected: a Global Systems Science to understand this complex system is still lacking:

1. Practically relevant Complex Systems Science
2. Data Science
3. Integrated Systems Design to manage complexity (e.g. financial architecture or open platforms promoting responsible use)
4. Systemic Risk Science
5. Many trained experts to solve problems.

The way forward…

- Linking Open Data and the FuturICT project would create great synergy effects.
- Access to institutional databases becomes more valuable, if the content and meaning of data is determined by science and the media, and made available to the public.
- By combining data with theories (to gain an explanatory understanding), Open Data can impact economy, science, technology and society at large.
- Connections between the OpenData and FuturICT communities will accelerate progress.