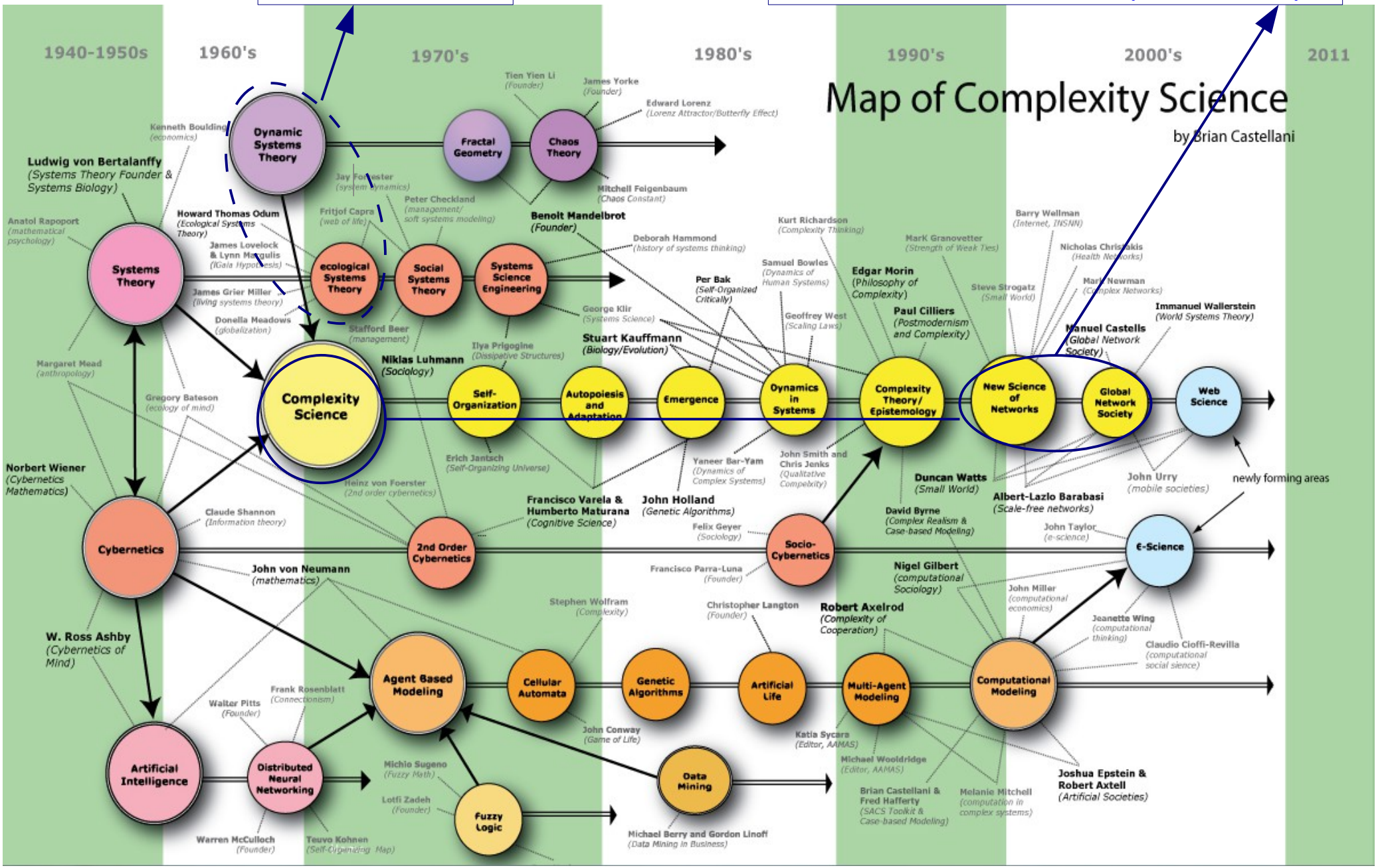
Webinar. *Anticipation and Complexity : Foreseeing a New Paradigm of Human Development*

Applying the Science of Networks to the Planetary Food Problématique

Raoul Weiler

1972 Limits to Growth

2012 Towards Grand Unified Theory for Sustainability



April 10, 2015

http://wikipedia.org/wiki/Complexity

RW. Blue lines are add-ons

Expectations of Sciences of Networks & Complexity for better understanding of actual problems, and in the search new paradigms or solutions ?

- **Social Networks e.g. Facebook, Twitter etc**

- **Political discourse remains linear**
- **Governance large organizations UN**

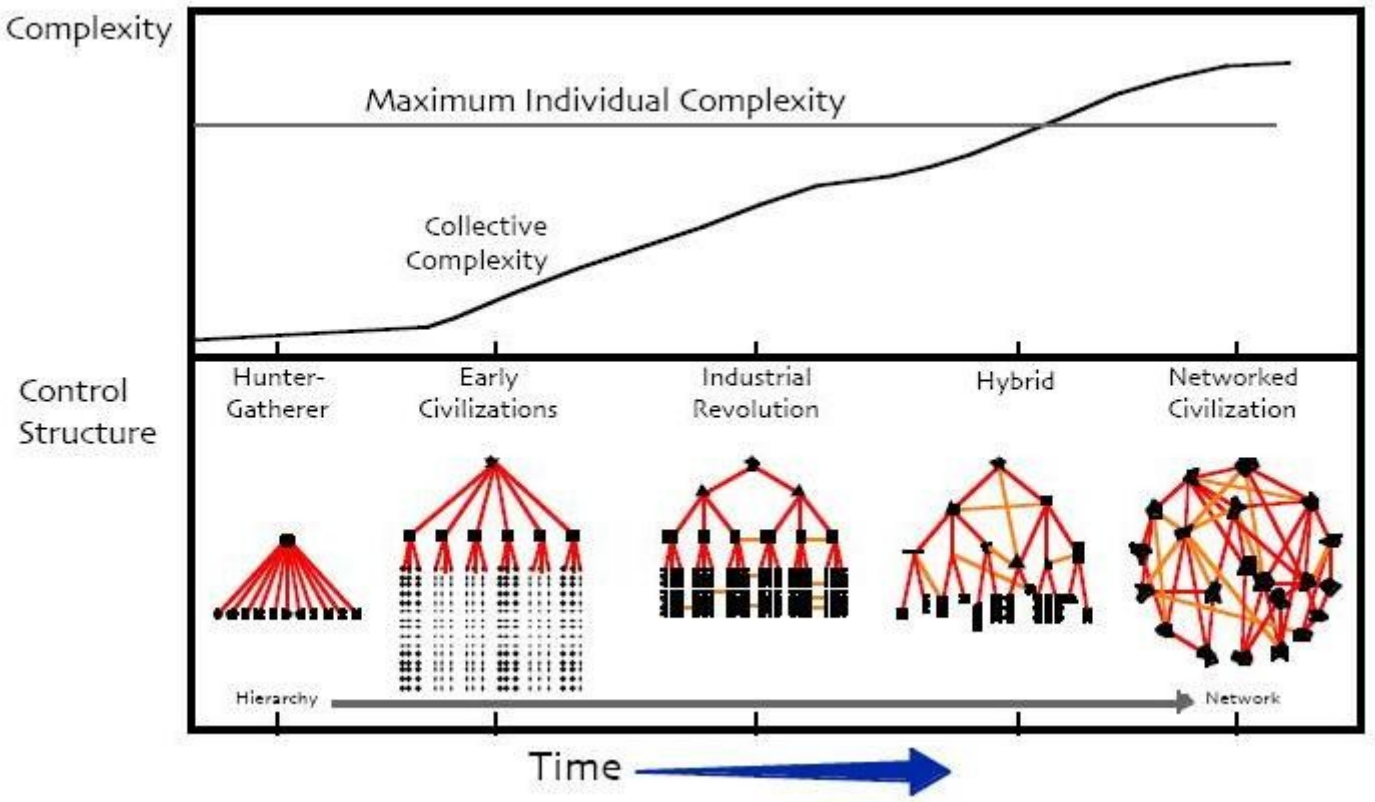
- **Finance & monetary systems/networks**

- **Climate Change challenges need new methodologies**
- **Planetary Resilience /Sustainability issues**

- **Planetary food analyses : Demography, Climate Change**

- **Brain Research**

Positioning of Network Science in Civilization : quite recent!!



Y. Bar-Yam. ***Complexity Rising: From Human Beings to Human Civilization, a Complex Profile.***
In : Encyclopedia of Life support (EOLSS, Oxford, 2002)

Kinds of Networks

- **Technological networks**
  - **Internet**
  - **Telephone network**
  - **Power grid**
  - **Transportation networks**

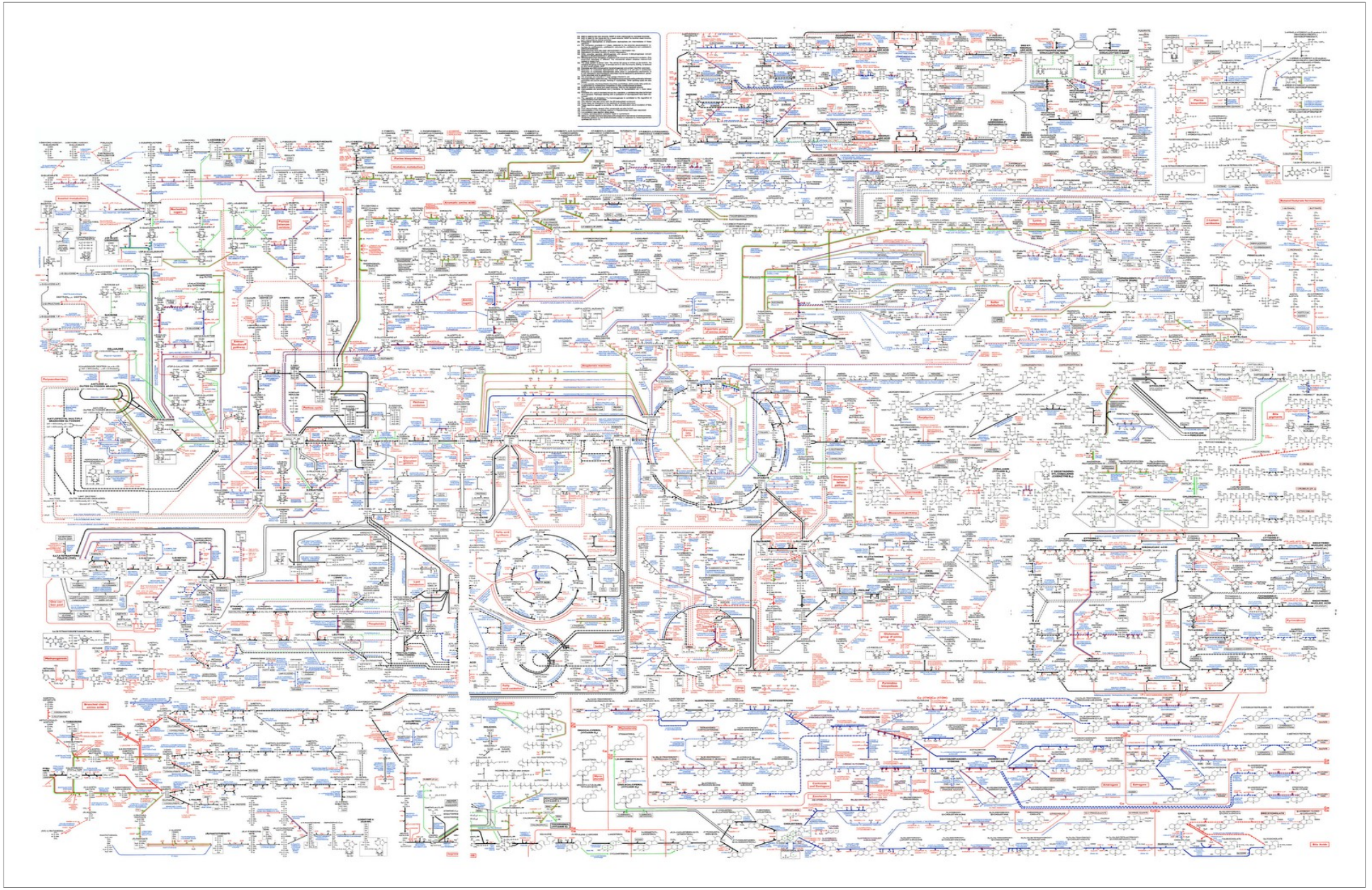
- **Social networks**
  - **Person relationships**
  - **Ego-centered networks**
  - **'Small world' networks**

- **Networks of information**
  - **WWW**
  - **Citation networks [academic, biography, patents]**

- **Biological networks**
  - **Biochemical networks : Metabolic**
    Protein-protein interaction
    Genetic regulatory networks
  - **Neural networks**
  - **Ecological networks : Food webs**

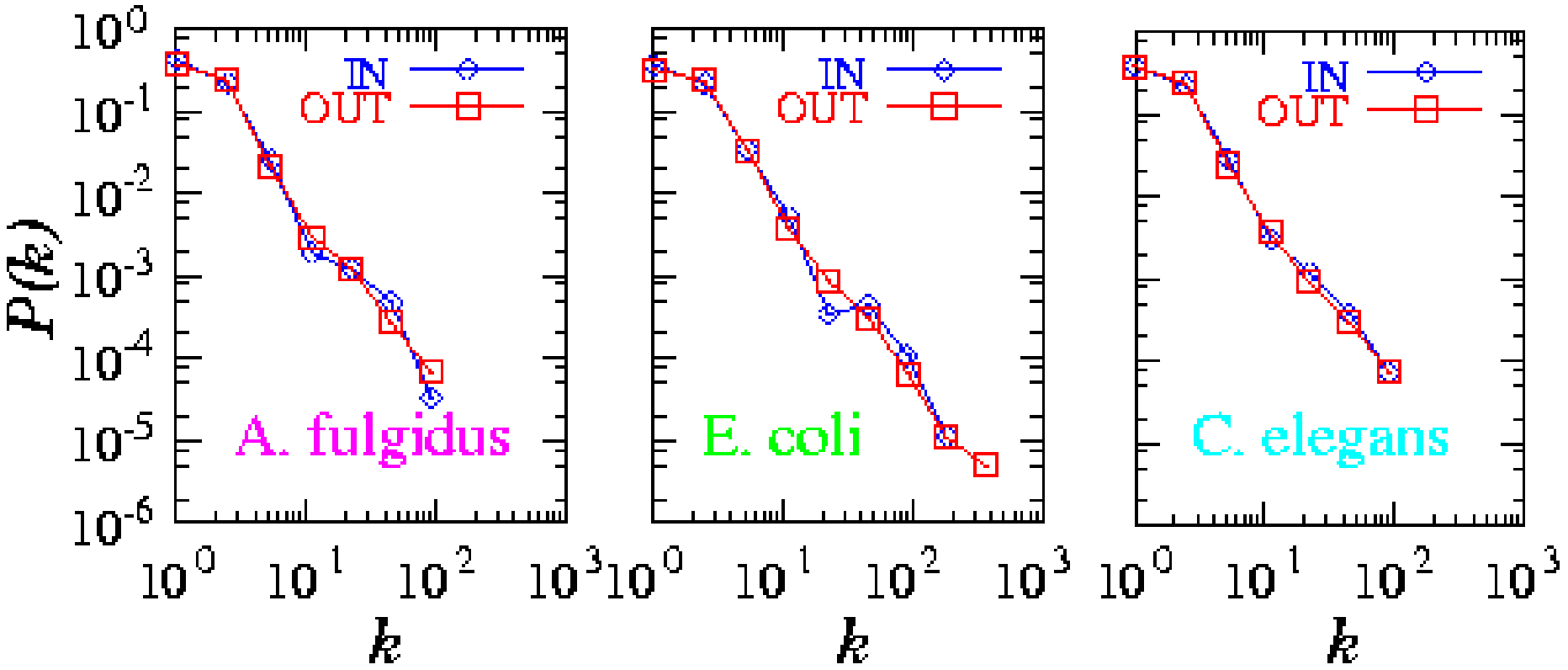
Knowledge & Social Networks. [26th Jan 2015 Internet Governance in 2015]

Graph representing the metadata of thousands of archive documents, documenting the social network of hundreds of League of Nations personals. Published in: Grandjean, Martin (2014). "La connaissance est un réseau". Les Cahiers du Numérique 10 (3): 37-54.



http://biochemicalpathwayswallchart.blogspot.be/2010/10/roche-biochemical-pathways-wall-chart.html

Metabolic network



Organisms from all three domains of life are **scale-free** networks!

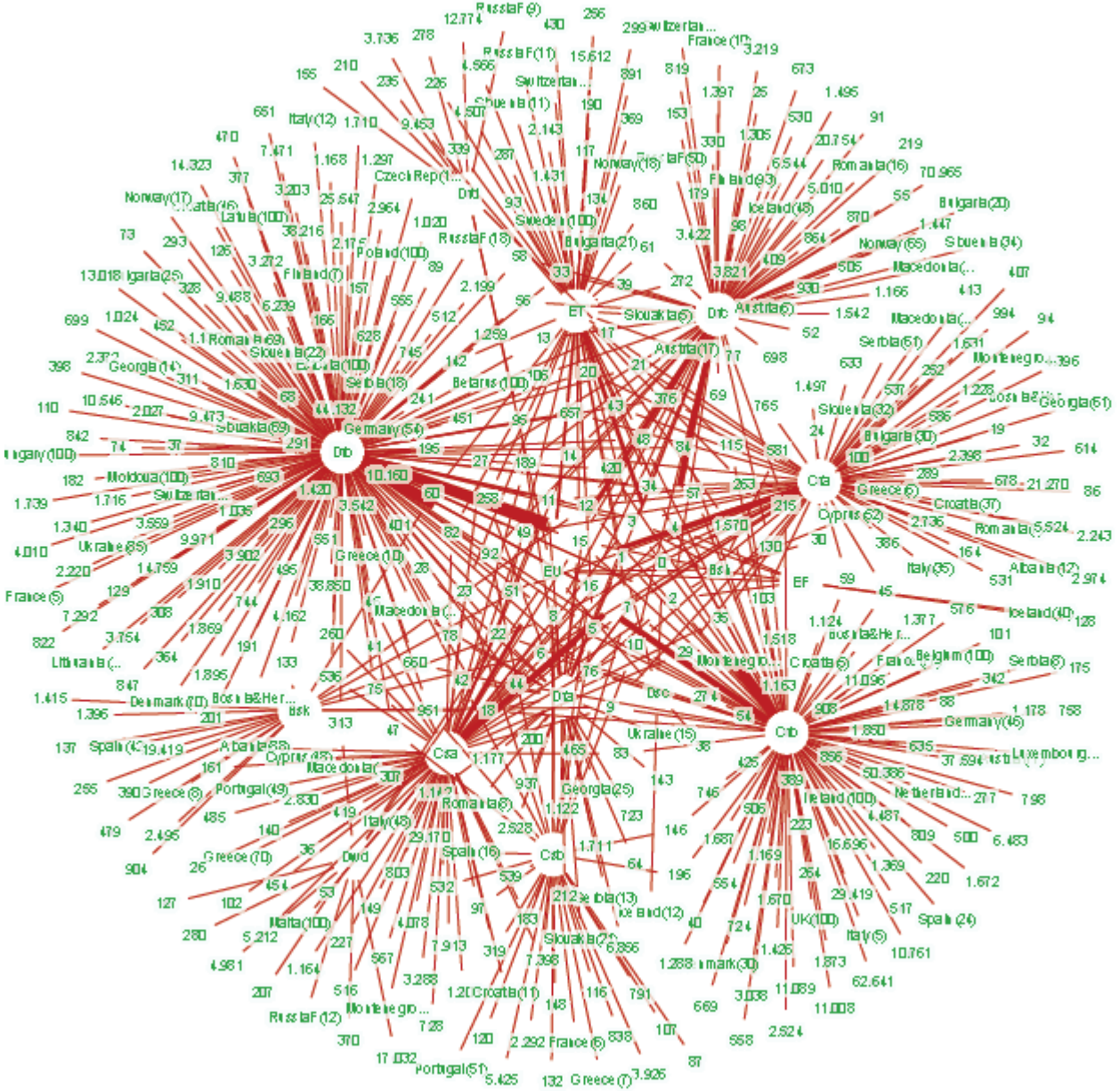
H. Jeong, B. Tombor, R. Albert, Z.N. Oltvai, and A.L. Barabasi, *Nature*, 407 651 (2000)

FOOD PRODUCTION Analysis.

Network for the Climate Zones of the European Continent (EUR)

for crops = wheat, rice, maize.

Gephi software [open source]. 493 nodes and 679 edges (links).



Adjacency Matrix. Dendrogram

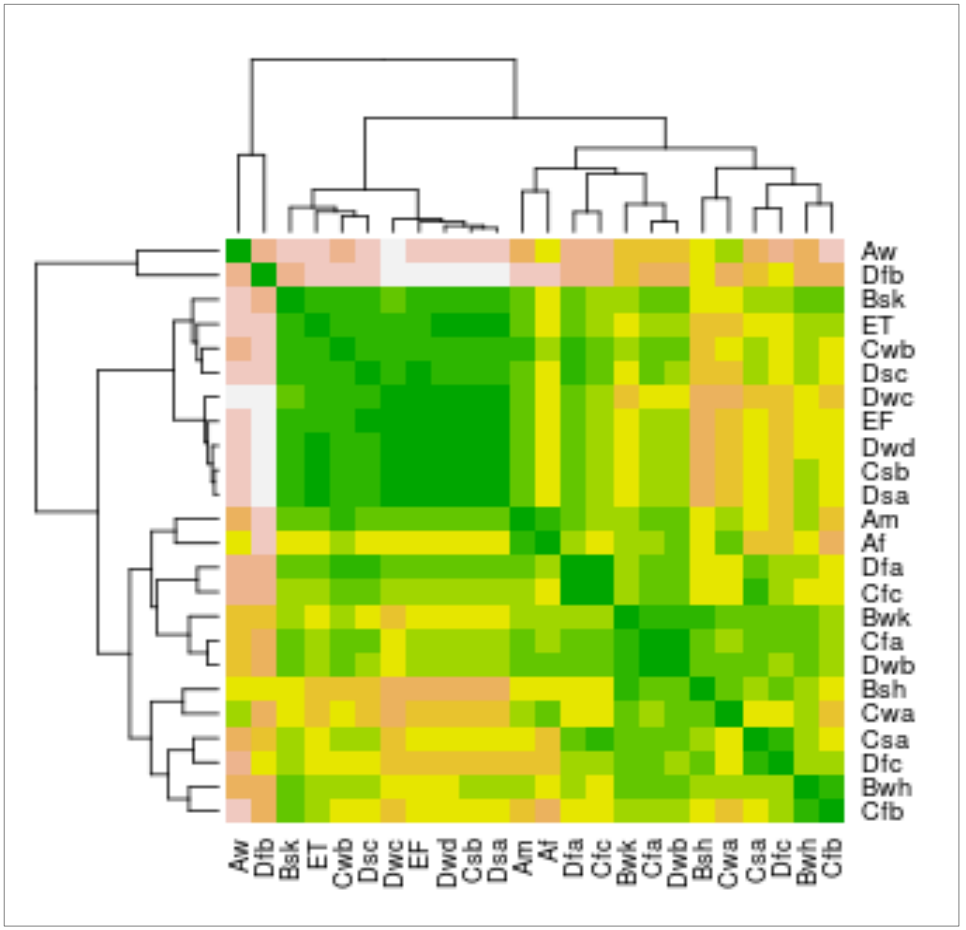
Crops production

C1 : Af Am Bwk Cfa Cfc Dfa Dwb

C2 : Aw Dfb

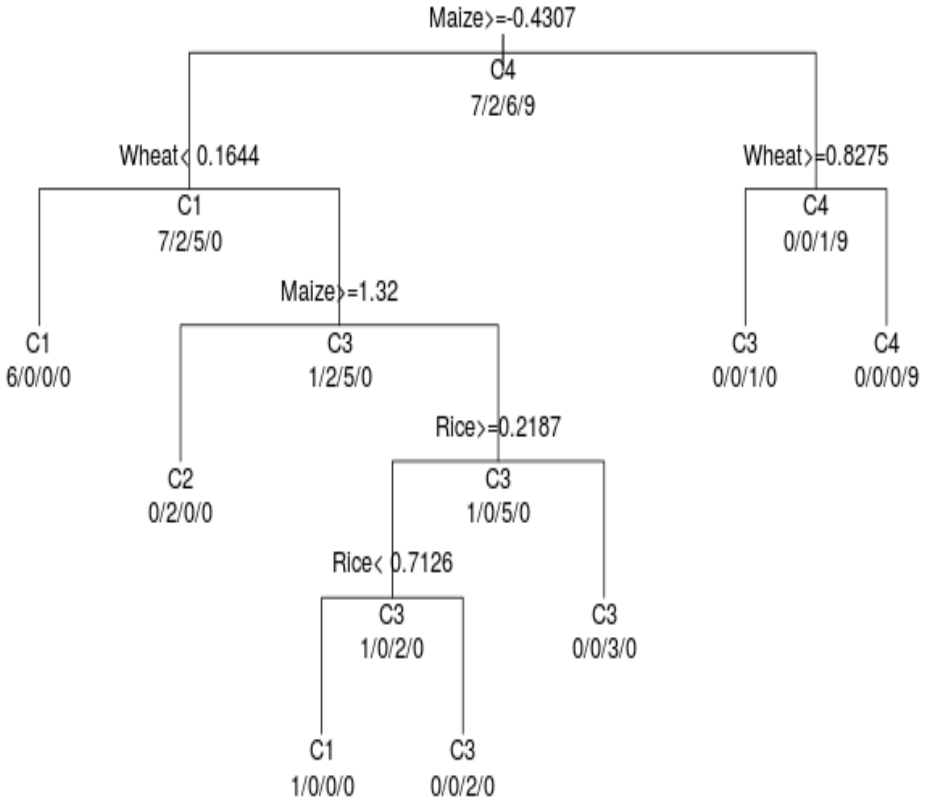
C3 : Bsh Bwh Cfb Csa Cwa Dfc

C4 : Bsk Csb Cwb Dsa Dsc Dwc Dwd EF ET



Hierarchical cluster structure

Crops production



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M.E.J. Newman. ***Networks. An Introduction.*** **Oxford Univ. Press, 2010**

Albert-Laszlo Barabasi & Eric Bonabeau. ***Scale-Free Networks.*** **Scientific American, May 2003**

OECD. ***Report on Applications of Complex Science for Public Policy : New tools for finding unanticipated Consequences and Unrealized Opportunities.*** **September 2009**

Gérard Weisbuch & Sorin Solomon. ***Tackling Complexity in Science. General Integration of the Aplication of Complexity in Science.*** **EC, 2007**