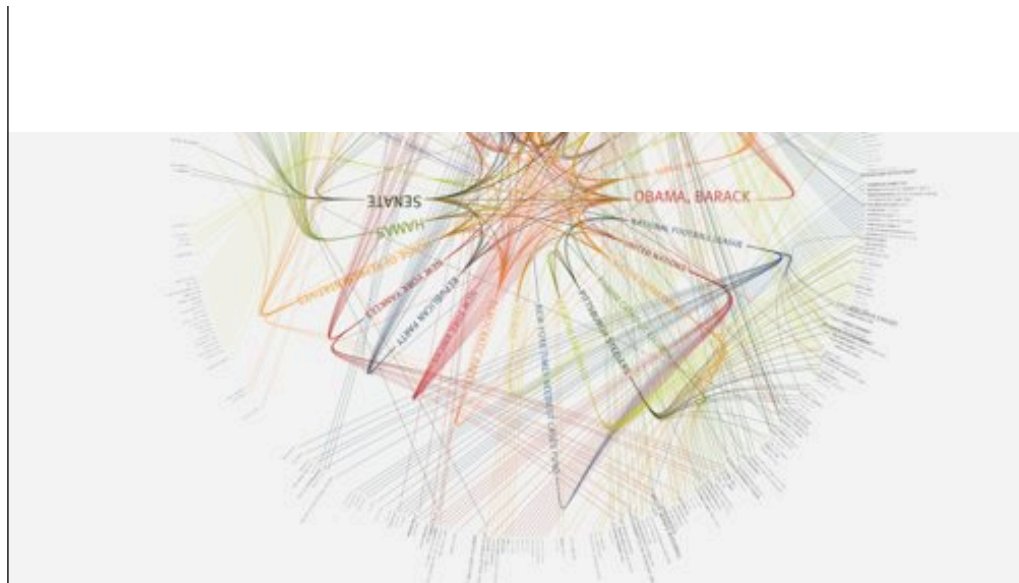




Thinking in networks: what it means for policy makers

Alberto Cottica, University of Alicante – Policy Making 2.0, June 2013



A network represents relationships across entities

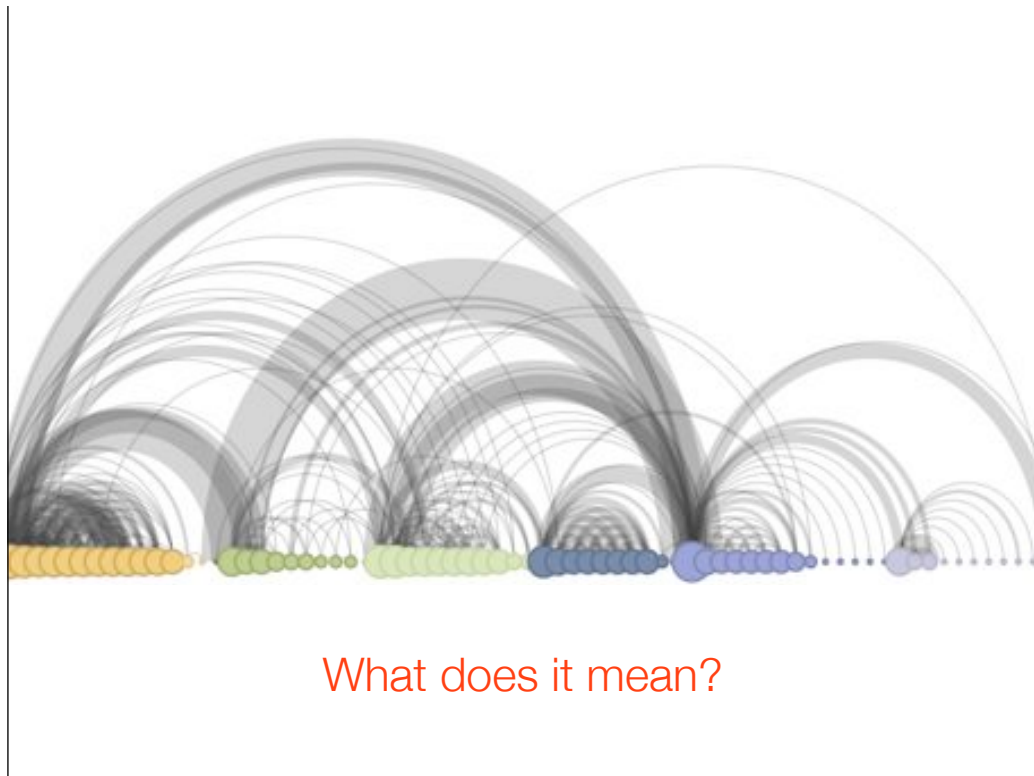
Networks are mathematical objects. They provide us with a rigorous way to think about relationships (represented by edges) across entities (represented by nodes). They are very general: you can use them to describe relationships of any kind across entities of any kind. And people do: they study networks of genes, where nodes represent genes and edges represent the same disease being encoded by two genes. Food chain networks, where two species (nodes) are connected by an edge when one feeds on the other. Ingredients in cooking, where two ingredients (nodes) are connected by an edge if they appear in one dish together. Blogging networks, where a blog (node) is connected by an edge to another if it links to it. And on it goes. There are airline networks to study logistics; power grid networks to understand baseload and cascading failures; both the Internet and the World Wide Web have well-studied network representations; financial networks to understand contagion from a few struggling banks to the rest of the financial system; there's even studies on networks of dolphins swimming together. A particularly important type of network for policy makers are social networks: these are networks in which nodes are people.



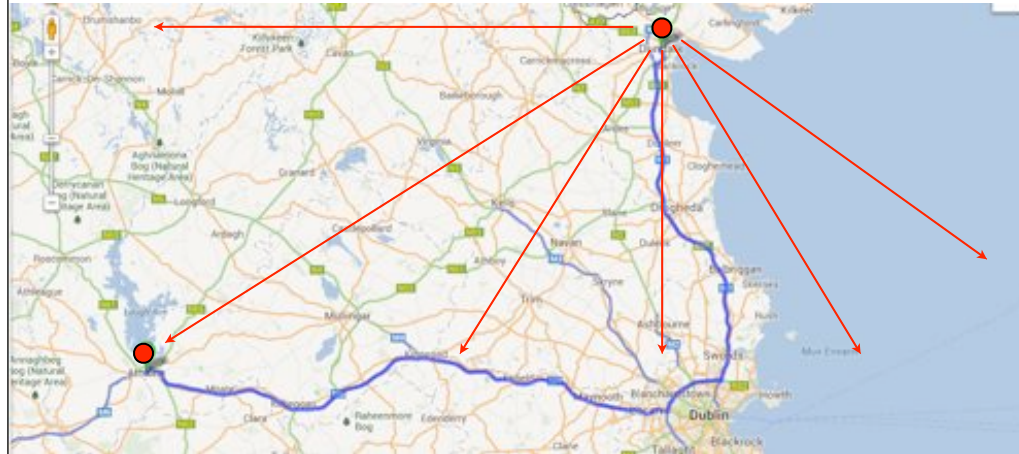
Behavioral change propagates by “contagion”

Social networks are a useful way to think about societies, the economies they support and policies enacted on them. Why? Well, because most policies are about affecting the behavior of agents one way or another. And it turns out behavioral patterns travel across social links. Among the early adopters of network models are epidemiologists. Think, say, of AIDS. You model your population as a social network: two people are connected if they are sexual partners. If you know who is a partner of whom, and the probability of being infected by sexual contacts, you can predict the pattern of the epidemics.

So far so good. But here’s the curveball: someone used the same model for obesity, and got a really good fit. If you have obese friends, your probability of being obese is significantly higher. Why is that? There is no obesity virus or bacterium that you can transmit through social contact. So they tried other theoretically non-contagious states. Smoking: good fit. Giving up smoking: good fit. Income: good fit. Unemployment: good fit. You get the idea. It looks like we are wired for imitation and sensitivity to social pressure, for good or bad.



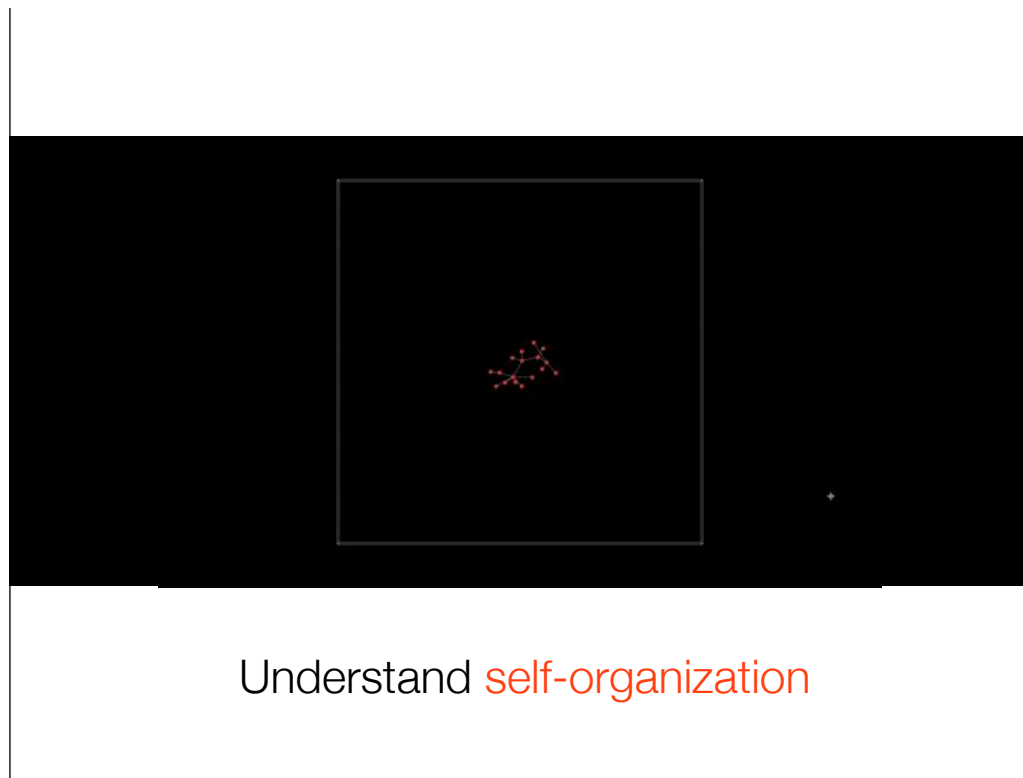
What does it mean?



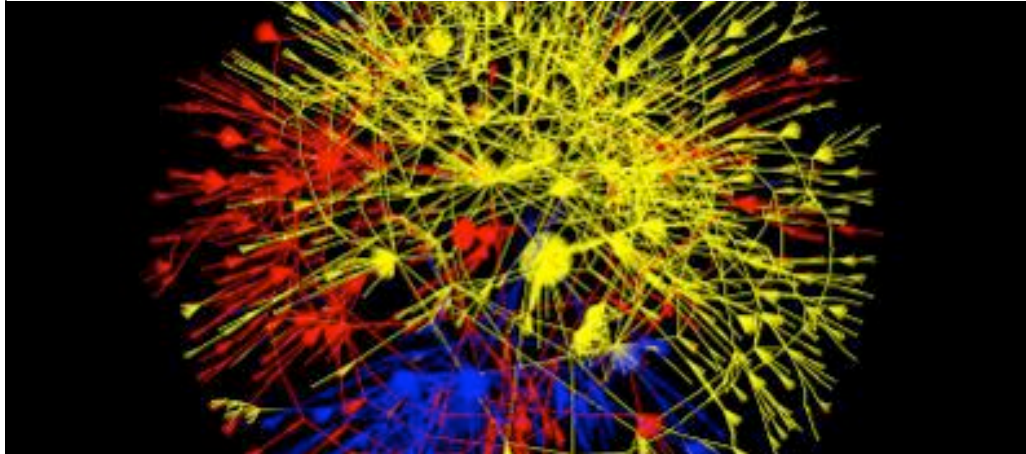
See and reuse the social infrastructure

So, thinking in networks means you train yourself to see social networks – patterns of social interaction across individuals – as a fundamental communication and coordination infrastructure underpinning society. Once you know it's there, you start thinking about policies in fundamentally different way: policy becomes a signal that travels through that network, whereas now we think of policies as a broadcast signal. Suppose you want to get a message from A to B. In a broadcast world, you just broadcast. It's a brute force approach: you just push out the signal in all directions, hoping there is no wall to block your signal.

But if you know the network structure you can do it in a much more efficient way. Suppose that point A is Dundalk and point B is Athlone: if you know the road network you'll go through Dublin rather than walking across the countryside in a straight line.



With networks, it is surprisingly easy to get interesting behavior out of very simple models. You are looking at a model of preferential attachment. Just assume a network grows. Nodes come online and they have one edge to invest. They will connect to another node at random, but the probability of connecting to any node will depend on the number of links that the node already has. Which makes sense: suppose this is a social network, you might care about making sure you are friends with the person that knows everybody, and might give you access to more people. Granovetter has shown decades ago that people find jobs through weak social ties, acquaintances rather than family or friends. This simple model generates an outcome that mimics very well that of real-life social networks. Thinking in networks trains you to look at highly organized social systems without necessarily postulating a social planner, or a leader or something like that. By implication, it teaches you humility: you learn that peer-to-peer social interaction, left to its own devices, can generate sophisticated structure. Sometimes you might not need policy at all!



What do we gain?



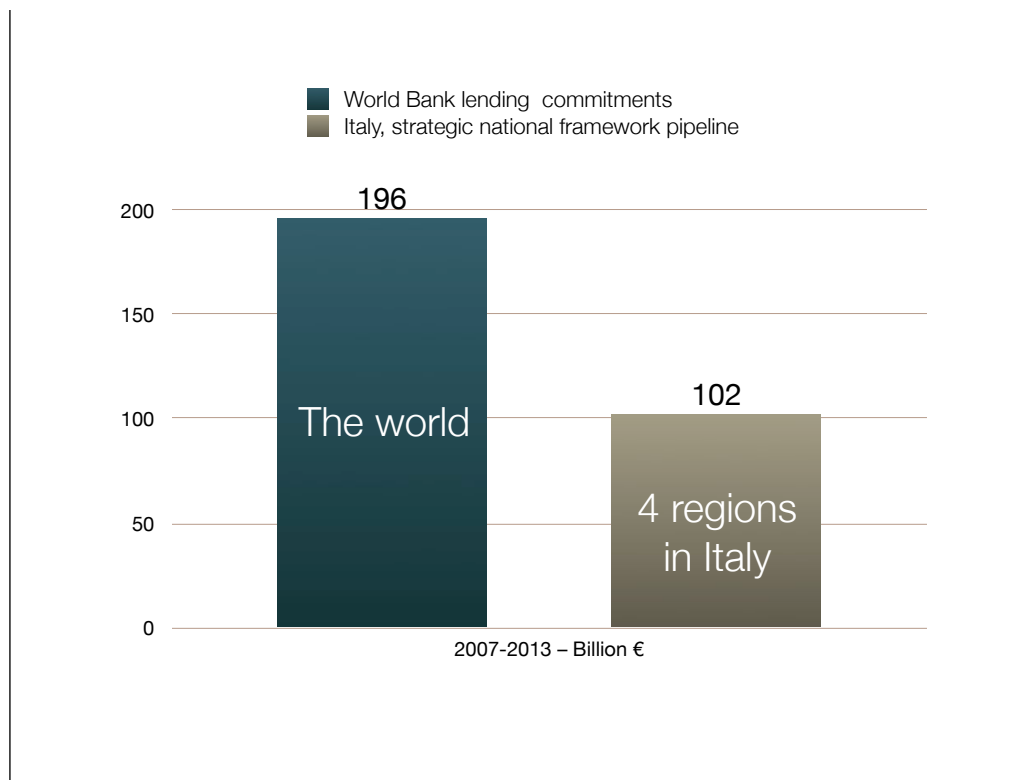
Impact: the right tool for the job

Impact is an obvious one. You get more bang for your buck: you are trying to fight aids by focusing on the few network hubs, people with very many sexual partners, and going graphic on them rather than putting up vague posters in schools and community centers.

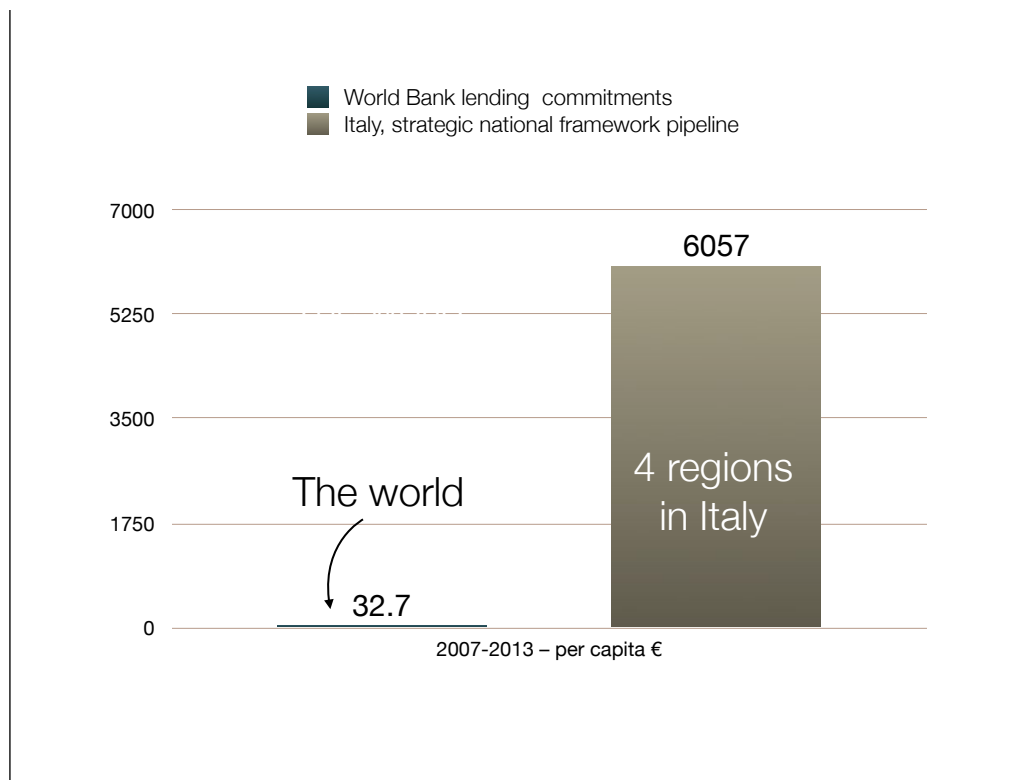


Iatrogenics: harm done by the healer

As our societies get ever more complex, they get ever more difficult to second guess. There is a real risk of what Nassim Taleb calls iatrogenics, harm done by the healer.



One of my favorite examples of that is with public spending. In my country, Italy, we have a situation. The north of the country is well-developed, with quite a strong manufacturing economy, whereas its south is lagging behind. This is a high political priority, and for at least fifty years we have thrown money and brains at it.



That means people in that part of Italy, per capita, see a substantial pot of money – 200 times their counterparts in the rest of the world.

“Everyone was talking about
public sector tenders.”

– Tiago Dias Miranda in southern Italy, 2013

The result of this situation: smart, entrepreneurial young people in Italy’s Mezzogiorno are talking about public sector tenders. They know all the acronyms of European programs. And why not? Though most of the money ends up with networks of incumbents, even the crumbs can be quite a big payoff. But of course, in development terms, this is just a distraction: as they write funding applications, they are not starting companies, or leaving the country, or squatting buildings; they are not engaging in collective, trial-and-error discovery of the paths that lead to the healing of the economy. And in fact, the economy does not heal. The government means mostly well, but the amount of damage inflicted is terrifying. Thinking in networks helps in two ways: first, it teaches you a healthy respect for self-organizing social phenomena; second, it encourages deploying narrowcast, minimal intervention rather than broadcast heavy one.



Photo: [write_adam](#)

“Too big to know”

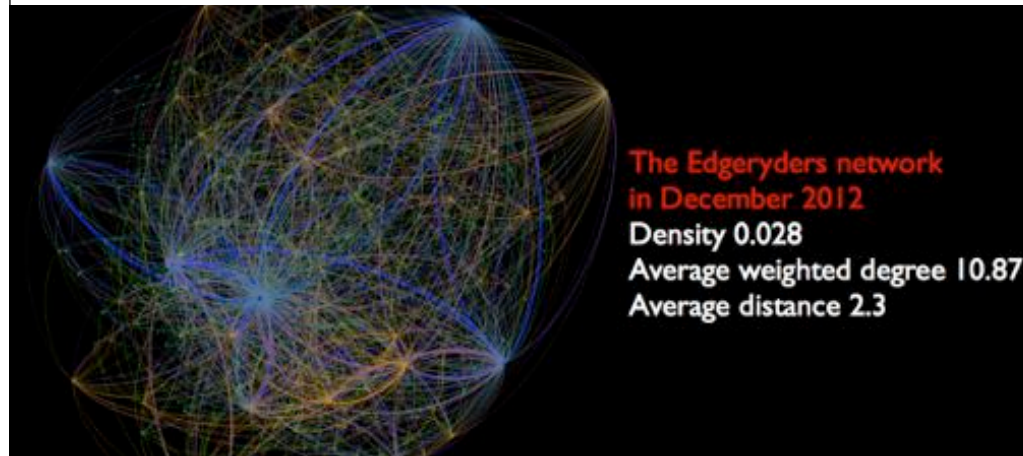
In the age of big data, it's paradoxically getting increasingly difficult to take responsibility for decisions made on the basis of evidence. Why? Because evidence is difficult to interpret. Take machine learning: we get our result by evolving algorithms to make decisions, then feed them unfathomable quantities of data. Even the people who trained the algorithms have trouble interpreting what they do: for most senior decision makers it is unrealistic to take courses in linear algebra and data science just to hack apart a result. A few months ago it turned out that an influential paper by Carmen Reinhart and Kenneth Rogoff, observing a tendency to sovereign default in states with a debt/GDP ratio over 90%, had an Excel error. Network modeling is relatively intuitive, in the sense that you can get quite far on simple, intuitive models.



Compassion: it's not you, it's system dynamics

Remember the preferential attachment model? We simulated the existence of superstars starting from identical nodes. Superstars are desirable in many network, because they result in a topology called scale-free. One of its properties is that propagating information across the network can be done very efficiently thanks to the “hubs” with many links, connecting everyone with everyone else. But this efficiency property at the system level comes at a price: high inequality at the node level. And this inequality seems unfair: most superstars acquire their status by being born early, or getting a lucky break early on. The system dynamics does the rest.

Most network models assume identical nodes: network math makes you very aware that your special position in society can be explained as a function of variables you have no control on. This challenges the “underserving poor” rhetoric and leads to empathy for the people who get pushed to the left of the degree distribution, that might well be as smart as some of the superstars or better.



Measure: quantify online social interaction

Social media are a game changer in this space. Because of the technology we use to support it, online social interaction leaves traces encoded in databases. You can then mine those databases to rebuild the graph of social interaction. This is what Google and Facebook are doing. They care about the contagion dimension of consumption, and microtargeting, say, luxury watches ads to the people with the highest probability of buying luxury watches based on what their friends do (by the way, compare the cost-effectiveness of this with that of a TV campaign on AIDS prevention). But we can use them to map the transmission of other behavioral change signals.

This opens up interesting scenarios. In my own work, I study online conversation in participatory processes, and try to figure out how to diagnose its health by looking at the shape of the interaction networks. Our ultimate goal is to drive participation processes – where, by definition, we have zero command and control over individual participants – by taking advantage of the influence on individual participants of the global networks characteristics. On the latter, whoever is running the participatory exercise typically does have some control: for example, you can make the network more dense by exposing participants to a feed of content generated by people they are not connected with.

So, what do you think?