Computer, Social, and Neural Networks

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We address the question of why it seems to be so hard to achieve *cooperative action* in networks and suggest that there are some fundamental reasons. We define a network as a group of purposeful individuals with *limited communication*. The individuals could be computers, people, neurons, etc. The important point is that each individual has internal state that is not available to the others. For our purposes a nuclear family, professional sports team, or work group is not best treated as a network because, within its sphere of action, it functions more like a fully communicating unit.

There is compelling evidence from many fields that it is very hard to achieve *coherent planning and action* from networks. Large groups can exhibit mass behavior like voting or rioting, but this is quite different. In computing, there is still essentially no parallel computation in tasks that require coordinated non-uniform action. Many systems can work in parallel on a search or other map-reduce tasks, but not on problems that involve communicating control between processors. There are even some relevant theorems.

In computational neuroscience, it is increasingly clear that the brain relies on sparse representations, where the crucial information is carried by the activity of a small number of neurons. Holographic models, where a concept is represented by a pattern over the whole collection of neurons, have been known for decades to be inadequate. For one thing, how would this distributed information get transmitted from one modality (e.g. vision) to another (say motor action). There is rich interconnection in the brain, but it is organized into specialized interacting networks with relatively sparse links to other networks. The vast majority of neural connections are local.

All of the existing data suggests that social networks also require considerable structure in order to execute coherent plans and actions. For example, kibbutzim and other communes allocate responsibility and decision making to individuals. Obviously enough, there are huge net-mediated social networks. Most of these, like Facebook, etc. have no system goals or behavior. An interesting example of a very large network that does have concrete goals is Moveon (and similar political action sites). These function by offering fixed choices to their members, selected by a small coordinating group. They will sometimes openly solicit input, but again it is centrally filtered.

Everyone has experienced the death of an open discussion group from uncontrolled flame wars. At a basic level, multi-way broadcast is not an efficient communication method for networks of even moderate size. Any other form of interaction involves some filtering of communication. Aside from random filtering, which makes no sense, any form of limiting communication introduces some non-democratic control.

So, an interim conclusion is that any large complex system must be hierarchical. There is apparently a folk term "iron law of hierarchy" in some social science circles. The open-source software world is often cited as being built on a successful goal-driven democratic networks. This has been extensively studied and shown to be quite hierarchical, although again open to suggestions. And Wikipedia, which does not entail coordinated action, still has had to introduce hierarchy and control.

Inherent hierarchy does not, of course, require that the structure of the network and particularly the role of individuals within it needs to remain fixed. These are questions of power and control, which are terribly

important, but separate from the question of how to achieve democratic cooperation on a particular task or agenda.

Democratic Deliberation and Action

It would be great if someone could show how to achieve democratic planning and acting in large groups, but we do know that smaller groups can be effective, when they work together directly.
There are many examples of this across cultures from traditional villages to clubs to boards of directors. Could networked software provide support for democratic action to moderate sized groups that are not able to meet physically? If so, this would greatly increase the potential scope of community action.

When we first looked into this some years ago, we were amazed to find essentially nothing suitable. There are many CSCW tools, but none that are focused on democratic production. There are also myriad tools for group discussion, but none that support the group planning and carrying out actions. More background information can be found on the CoPE web site:
http://cope.icsi.Berkeley.edu.

Our own efforts to produce and deploy such a platform are discussed in a paper by Santi Caballe at this conference. The short form is that it is technically feasible to build software that supports democratic deliberation and action, there are two huge barriers to success. The first is the standard problem of acceptance; the system needs to usable by non-wizards but we still don't know how to introduce it to groups which may not even exist yet. The second problem is more technical; the system is inherently web based which makes it a point of vulnerability. The constant hacker war leads to continual change in the software base and has added an unavoidable maintenance burden that is unsustainable. This suggest a fundamental problem for community based software.

References

Caballe, Santi and Jerome Feldman, CoLPE: Communities of Learning Practice Environment
these proceedings.

Weber, Steven, *The Success of Open Source*, 2004 Harvard University Press.