Cooperative communities emerge in transparent social networks

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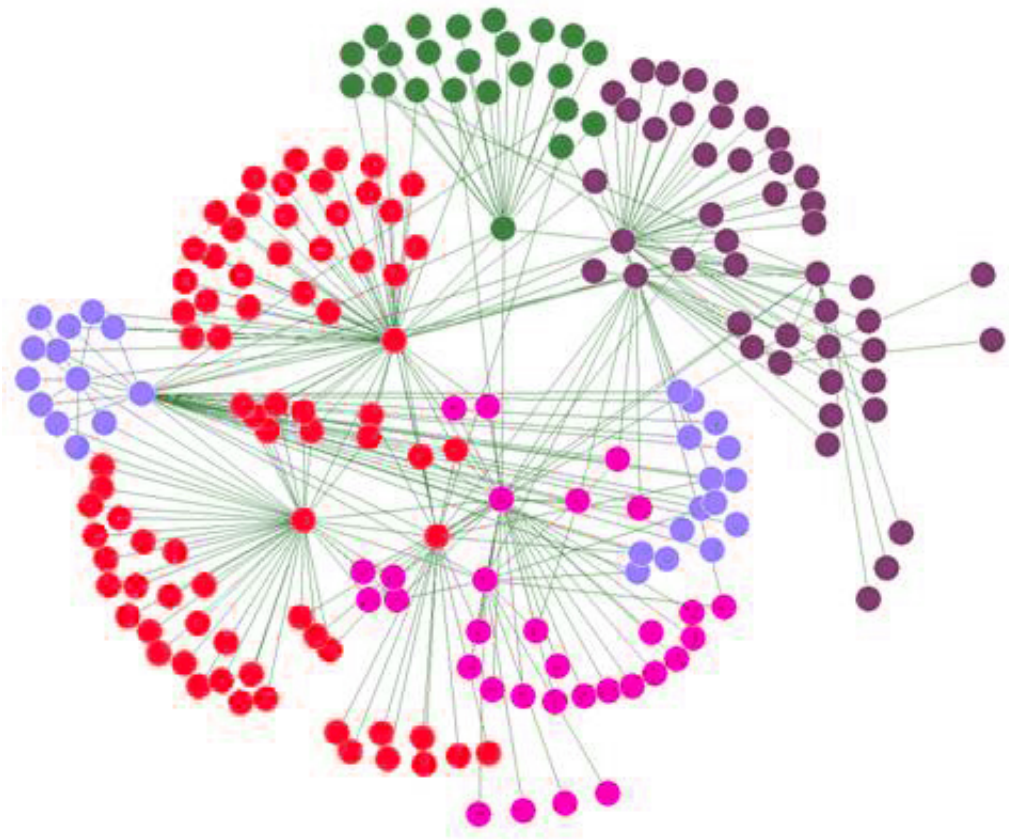

Social network diagram. Credit: Daniel Tenerife/Wikipedia

People in a society are bound together by a set of connections - a social network. Cooperation between people in the network is essential for societies to prosper, and the question of what drives the emergence and sustainability of cooperation is a fundamental one.

What we know about other people in a network informs how much we are willing to cooperate with them. By conducting a series of online experiments, researchers explored how two key areas of network knowledge effect cooperation in decision-making: what we know about the reputation and social connections of those around us.

In most social contexts, knowledge about others' reputation - what we know about their previous actions - is limited to those we have immediate connections with: friends, neighbours and so on.

But the new study shows that if the reputation of everyone in a network is completely transparent - made common knowledge and visible to all - rather than limited to the individuals who are directly connected, the level of cooperation across the overall network almost doubles. The network also becomes denser and more clustered (so your connections tend to be connected with each other).

The researchers also tested how transparency of social connections in the group influences cooperation. On its own, common knowledge of social connections had little impact on overall levels of cooperation.

However, when the researchers combined transparency of social connections with transparency of everyone's reputation, a community of the most cooperative formed. Members of the community actively removed links from less cooperative individuals and refused their proposals to reconnect.

Researchers found that belonging to the community of cooperators is profitable. Each interaction in the cooperative community is 23% more beneficial than the equivalent interaction in the less cooperative community.

The study is published today in the journal *PNAS*, and was conducted by

Cambridge and Oxford researchers.

"We show that knowing others' past actions is the key driver of a high contribution level. Additionally, knowing who is connected to whom matters for the distribution of contributions: it allows contributors to form their own community," said study author Dr Edoardo Gallo, from the Faculty of Economics and Queens' College at the University of Cambridge.

"This finding suggests that in a world where social information is more available, people may increasingly insulate themselves in communities with other like-minded individuals. In the case we examined, belonging to the community of contributors is highly beneficial," he said.

The research sheds light on the problem of 'public good' provision: what motivates people to make costly actions towards a good that benefits everyone, even those who do not contribute to it. Perhaps the most defining example of 'public good' in the modern era is the preservation of our environment.

Gallo, along with Oxford colleague Chang Yan, devised an online experiment involving people forming connections and playing a 'game' of public good provision, also popularly known as the Prisoner's Dilemma.

First, the participants in a group can freely form connections with each other which determine the network. After the network is formed, each individual decides whether to cooperate by contributing to a public good that only benefits their neighbours in the network.

Contributing benefits all the neighbours, but it is costly to the contributor. Not cooperating by not contributing, however, is costless.

The best possible outcome for the group is for everyone to contribute. However, each individual has an incentive not to contribute: they can gain the benefits from others' contributions without paying any cost themselves.

The researchers recruited 364 people from crowdsourcing platform Amazon Mechanical Turk to play several rounds of a network formation game followed by a public good game. They investigated four treatments that varied the amount of knowledge subjects have about the network and previous actions of others.

When the reputation (previous actions) of everyone in the network was rendered transparent, the overall levels of cooperation were almost twice as high as when only the previous actions of immediate connections were known.

When the social connections for the entire network were also revealed to all, the cooperators formed their own community, leaving those with a history of being uncooperative out in the cold.

Gallo points out that whether the community formation - the insulating and ostracizing - that occurred in the transparent network is a desirable outcome depends on the nature of the behaviour that leads to the separation.

"In the experiment, the 'good' cooperators ostracize the 'bad' defectors, but one can argue the defectors brought it on themselves with their actions. If the same pattern occurred because of another more neutral behaviour, like an accent when speaking a language, then the ostracization might be undesirable for society," Gallo said.

More information: The effects of reputational and social knowledge on cooperation, www.pnas.org/cgi/doi/10.1073/pnas.1415883112

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