Evolution of cooperation- and defection-networks in a multiplayer online game

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Introduction
The bottleneck in scientific approaches to quantification of human social dynamics is the availability and quality of data. We have compiled a unique dataset of a self-developed multiplayer online game played by over 300,000 users. In this game every player has to generate virtual income through economic activities to ‘survive’ and is engaged in several social activities. We have tracked every action of all players in the past 4 years.

Dataset
1,000 GB of log-files containing all actions and properties of 300,000 players over 1,200 days. Data includes social and economical parameters (e.g. number of friends or income of game money).

Network extraction
• Communication networks: Players can send messages to others
• Friend/Enemy networks: Players can mark others as friends or enemies

Aim
Establish a “laboratory” for socio-economical behavior.
• Measure structure and dynamics of friend (cooperator), enemy (defector), and communication networks
• Test social-dynamics hypotheses
• Compare findings with real-world data

Result I: Degree distribution
Degree distributions of enemy networks are well characterized by power-laws, not so for friend networks.

Result II: Network densification

Result III: Preferential attachment
Preferential attachment is a model of network growth generating power-law degree distributions. It assumes a preference of new nodes to link to popular existing nodes. The probability $\Pi(k)$ that a new node connects to an existing node with degree $k$ scales like $\Pi(k) \sim k^{-\alpha}$.

Result IV: Weak-ties hypothesis
We confirm the famous Weak-Ties Hypothesis [3] in communication networks.

Result V: Triad significance profiles
In directed networks there exist 16 isomorphism classes of 3-node subgraphs, called Triad types:

Conclusion
We measured properties of evolving social networks composed of interacting cooperators and defectors from a massive multiplayer online game. Significant differences between networks of cooperation and defection could be revealed. Our results are in good agreement with real-world data. We are able to conduct social science with a precision usually only achieved in the natural sciences.

References