AI & Soc
DOI 10.1007/s00146-013-0529-0

ORIGINAL ARTICLE

An agent-based simulation for restricting exploitation in electronic societies through social mechanisms

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Received: 14 March 2013 / Accepted: 28 November 2013

Abstract One of the problems in artificial agent societies is the problem of non-cooperation, where individuals have motivations for not cooperating with others. An example of non-cooperation is the issue of freeriding, where some agents do not contribute to the welfare of the society but do consume valuable resources. New mechanisms for group self-organisation and management in multi-agent societies are presented and examined in a multi-agent societies where nodes of a P2P system are modelled as interacting agents belonging to different groups. The context of interaction between agents is the sharing of digital goods in electronic societies. We have simulated a decentralised P2P system which self-organises itself to avoid cooperative sharers being exploited by uncooperative free riders. Specifically, we illustrate how cooperative sharers and uncooperative free riders can be placed in different groups of an electronic society in a decentralised manner. Inspired by human society, we use social mechanisms such as tags, gossip and ostracism. Our aim here is to restrict exploitation or in other words restrict uncooperative behaviour by separating groups based on performance since it reduces the likelihood of bad agents exploiting the good agents in the better groups. The developed system shows promising results by encouraging sharers to move to better groups and also by restricting free riders without any centralised control, which makes these mechanisms appropriate for distributed policy governance. Our work offers new insights into policy mechanisms for regulation of distributed societies.

Keywords Policy mechanisms · Self-organising systems · Freeriding problem · Multi-agent systems

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1 Introduction

Human societies have long developed and evolved social mechanisms for facilitating cooperation among individual members and subgroups. The advent of dynamic societies of the technological world, in particular the large and rapidly changing electronic societies, call for the use of new mechanisms to facilitate cooperation among artificial agents that can be modelled after those employed in human societies.

One of the most persistent problems in peer-to-peer (P2P) networks is freeriding (Ramaswamy and Liu 2003; Feldman and Chuang 2005; Krishnan et al. 2004). There are published examples of centralised approaches in facilitating cooperation that employ centralised regulations to control freeriders (Esteva et al. 2004; Purvis et al. 2006). These researchers have used monitoring agents or governor agents to control agent behaviour. Even though centralised systems have several advantages, such as direct control and access, they have several limitations as well. They suffer from bottlenecks when the number of agents increases in the system. They are computationally expensive, because of the cost associated with avoiding performance bottlenecks, and they are prone to single-points-of-failure.

Published online: 22 December 2013