

Lecture Notes in Artificial Intelligence 2934

Edited by J. G. Carbonell and J. Siekmann

Subseries of Lecture Notes in Computer Science

Springer

Berlin

Heidelberg

New York

Hong Kong

London

Milan

Paris

Tokyo

Gabriela Lindemann Daniel Moldt
Mario Paolucci (Eds.)

Regulated Agent-Based Social Systems

First International Workshop, RASTA 2002
Bologna, Italy, July 16, 2002
Revised Selected and Invited Papers



Springer

Series Editors

Jaime G. Carbonell, Carnegie Mellon University, Pittsburgh, PA, USA
Jörg Siekmann, University of Saarland, Saarbrücken, Germany

Volume Editors

Gabriela Lindemann
Humboldt-Universität zu Berlin
Institut für Informatik, Lehrstuhl für Künstliche Intelligenz
Rudower Chaussee 25, 10099 Berlin, Germany
E-mail: lindeman@informatik.hu-berlin.de

Daniel Moldt
Universität Hamburg, Fachbereich Informatik
Vogt-Kölln-Straße 30, 22527 Hamburg, Germany
E-mail: moldt@informatik.uni-hamburg.de

Mario Paolucci
Consiglio Nazionale delle Ricerche, CNR
Viale Marx, 15, 00137 Rome, Italy
E-mail: paolucci@ip.rm.cnr.it

Cataloging-in-Publication Data applied for

A catalog record for this book is available from the Library of Congress.

Bibliographic information published by Die Deutsche Bibliothek
Die Deutsche Bibliothek lists this publication in the Deutsche Nationalbibliografie;
detailed bibliographic data is available in the Internet at <<http://dnb.ddb.de>>.

CR Subject Classification (1998): I.2.11, I.2, J.4, C.2.4, I.6

ISSN 0302-9743

ISBN 3-540-20923-9 Springer-Verlag Berlin Heidelberg New York

This work is subject to copyright. All rights are reserved, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, re-use of illustrations, recitation, broadcasting, reproduction on microfilms or in any other way, and storage in data banks. Duplication of this publication or parts thereof is permitted only under the provisions of the German Copyright Law of September 9, 1965, in its current version, and permission for use must always be obtained from Springer-Verlag. Violations are liable for prosecution under the German Copyright Law.

Springer-Verlag is a part of Springer Science+Business Media
springeronline.com

© Springer-Verlag Berlin Heidelberg 2004
Printed in Germany

Typesetting: Camera-ready by author, data conversion by PTP-Berlin, Protago-TeX-Production GmbH
Printed on acid-free paper SPIN: 10985007 06/3142 5 4 3 2 1 0

Preface

This volume presents selected, extended and reviewed versions of the papers presented at the 1st International Workshop on Regulated Agent Systems: Theory and Applications (RASTA 2002), a workshop co-located with the 1st International Joint Conference on Autonomous Agents and Multi-Agent Systems (AAMAS 2002), which was held in Bologna, Italy, in July, 2002. In addition, several new papers on the workshop theme appear here as the result of a further call for participation.

Agent-technology is the latest paradigm of software engineering methodology. The development of autonomous, mobile, and intelligent agents brings new challenges to the field. Agent technologies and multiagent systems are among the most vibrant and active research areas of computer science. At the same time commercial applications of agents are gaining attention. The construction of artificial (agent) societies leads to questions that already have been asked for human societies. Computer scientists have adopted terms like emerging behavior, self-organization, and evolutionary theory in an intuitive manner. Multiagent system researchers have started to develop agents with *social* abilities and complex *social* systems.

However, most of these systems lack the foundation of the *social sciences*. The intention of the RASTA workshop, and of this volume, is to bring together researchers from computer science as well as the social sciences who see their common interest in social theories for the construction and regulation of multi-agent systems.

A total of 17 papers appear in this volume, out of 31 papers submitted. They include nine papers presented in the workshop (whose preproceedings were published as *Communications Vol. 318 Mitteilung 318* of Hamburg University, Faculty of Informatics), as well as six new papers. In addition, an invited paper from Bruce Edmonds reflects some aspects of the lively discussions held during the workshop. The selection presented is divided into two major topics.

Topic A – *Social Theory for Agent Technology (Socionics)*

The wide range of social theories offers many different solutions to problems found in complex (computer) systems. Which theories, and how and when to apply them is a major challenge. In developing agents and multiagent systems computer scientists have used sociological terms like negotiation, interaction, contracts, agreement, organization, cohesion, social order, and collaboration. Meanwhile an interdisciplinary area called socionics, the bridge between sociology and computer science, is beginning to establish itself. The realization that the behavior of societies cannot fully be explained by macrotheories only, and the progress made in agent technology have opened the way to new models of societies in which both macrotheories and microtheories are incorporated. The development

of the socionics research area and the increased interest in the dynamics of the behavior of agents in hybrid organizations requires the investigation of new modelling concepts like roles, groups, social intelligence, emotions, beliefs, desires, and intentions.

Topic B – *Norms and Institutions in MAS*

Multiagent systems are increasingly being considered a viable technological basis for implementing complex, open systems such as electronic marketplaces, virtual enterprises, political coalition support systems, etc. The design of open systems in such domains poses a number of difficult challenges, including the need to cope with unreliable communication and network infrastructures, the need to address incompatible assumptions and limited trust among independently developed agents, and the necessity to detect and respond to systemic failures.

Human organizations and societies have successfully coped with similar problems of coordination, cooperation, etc., in short, with the challenge of social order, mainly by developing norms and conventions, that is, specifications of behavior that all society members are expected to conform to, and that undergo efficient forms of decentralized control. In most societies, norms are backed by a variety of social institutions that enforce law and order (e.g., courts, police), monitor for and respond to emergencies (e.g. ambulance service), prevent and recover from unanticipated disasters (e.g., coast guard, firefighters), etc. In that way, civilized societies allow citizens to utilize relatively simple and efficient rules of behavior, offloading the prevention and recovery of many problem types to social institutions that can handle them efficiently and effectively by virtue of their economies of scale and widely accepted legitimacy. Successful civil societies have thus achieved a division of labor between individuals and institutions that decreases the “barriers to survival” for each citizen, while helping to increase the welfare of the society as a whole.

Several researchers have recognized that the design of open multiagent systems can benefit from abstractions analogous to those employed by our robust and relatively successful societies and organizations. There is a growing body of work that touches upon the concepts of norms and institutions in the context of multiagent systems.

July 2003

Daniel Moldt
Gabriela Lindemann
Mario Paolucci

Organization

The International Workshop on Regulated Agent-Based Social Systems: Theories and Applications (RASTA 2002) was organized by: *the Institute of Cognitive Sciences and Technologies* - CNR, Italy; *MIT Sloan School of Management*, USA; *AI Lab of the Department of Computer Sciences*, Humboldt University, Berlin; and *the Theoretical Foundations of Computer Science Group*, University of Hamburg.

Workshop Chairs

Daniel Moldt
Gabriela Lindemann
Mario Paolucci
Bin Yu

Organizing Committee

Rosaria Conte
Chris Dellarocas
Henry A. Kautz
Gabriela Lindemann
Daniel Moldt
Mario Paolucci
Munindar P. Singh
Bin Yu

Program Committee

Andreas Abecker	Fiorella De Rosis
Karl Aberer	Chris Dellarocas
Mark S. Ackerman	Frank Dignum
Sven Brückner	Peter Dittrich
Kathleen Carley	Rino Falcone
Jose Carmo	David Hales
Enhong Chen	Andrea Hollingshead
Helder Coelho	Michael Huhns
Rosaria Conte	Andrew Jones
Noshir Contractor	Catholijn Jonker
Raymond D'Amore	Henry A. Kautz
Kerstin Dautenhahn	Stefan Kirn

VIII Organization

Victor Lesser
Ioan Alfred Letia
Henry Lieberman
Gabriela Lindemann
Jiming Liu
Steve Marsh
Mark Maybury
Ivica Mitrovic
Daniel Moldt
Bonnie Nardi
Hiroaki Ogata
Sascha Ossowski
Pietro Panzarasa
Mario Paolucci
Mirko Petric
Paolo Petta
Michael Prietula

Juan Antonio Rodriguez-Aguilar
Giovanni Sartor
Bernd Schmidt
Ingo Schulz-Schaeffer
Bart Selman
Carles Sierra
Munindar P. Singh
Sorin Solomon
Katia Sycara
Ingo Timm
Inga Tomic-Koludrovic
Adeline Uhrmacher
Thomas Uthmann
Leon Van der Torre
Harko Verhagen
Pinar Yolum
Bin Yu

Referees (*not included in the Program Committee*)

Luis Antunes
Joscha Bach
Francois Bousquet
Jan Broersen
Marc Esteva
Eduardo Fermé
Guido Fioretti
David Hales
Xiaolong Jin

Michael Köhler
Maria Miceli
Dagmar Monett
Tim Norman
Alexander Osherenko
Giovanni Pezzulo
Heiko Rölke
Martijn Schut
Luca Tummolini

Table of Contents

Invited Paper

How Formal Logic Can Fail to Be Useful for Modelling or Designing MAS	1
<i>Bruce Edmonds</i>	

Topic A: Social Theory for Agent Technology

Communicational Patterns as Basis of Organizational Structures	16
<i>Steffen Albrecht, Maren Lübcke</i>	
On How to Conduct Experimental Research with Self-Motivated Agents.....	31
<i>Luis Antunes, Helder Coelho</i>	
Cognitive Identity and Social Reflexivity of the Industrial District Firms. Going Beyond the “Complexity Effect” with Agent-Based Simulations	48
<i>Riccardo Boero, Marco Castellani, Flaminio Squazzoni</i>	
The MAS-SOC Approach to Multi-agent Based Simulation	70
<i>Rafael H. Bordini, Fabio Y. Okuyama, Denise de Oliveira, Guilherme Drehmer, Romulo C. Krafta</i>	
Organisation Modelling for the Dynamics of Complex Biological Processes	92
<i>Tibor Bosse, Catholijn M. Jonker, Jan Treur</i>	
Communication without Agents? From Agent-Oriented to Communication-Oriented Modeling	113
<i>Thomas Malsch, Christoph Schlieder</i>	
Modeling Product Awareness Rates and Market Shares	134
<i>Filippo Neri</i>	
Metanarratives and Believable Behavior of Autonomous Agents	145
<i>Mirko Petric, Inga Tomic-Koludrovic, Ivica Mitrovic</i>	
FORM – A Sociologically Founded Framework for Designing Self-Organization of Multiagent Systems	156
<i>Michael Schillo, Klaus Fischer, Bettina Fley, Michael Florian, Frank Hillebrandt, Daniela Spresny</i>	

Social Organization in a Software Agent Community with a Non-zero-Sum Game Interaction Model	176
<i>Matti A. Vanninen, John R. Rose</i>	

Emotion: Theoretical Investigations and Implications for Artificial Social Aggregates	189
<i>Christian von Scheve, Daniel Moldt</i>	

Topic B: Norms and Institutions in MAS

What Is a Normative Goal? Towards Goal-Based Normative Agent Architectures	210
<i>Mehdi Dastani, Leendert van der Torre</i>	

Searching for a Soulmate – Searching for Tag-Similar Partners Evolves and Supports Specialization in Groups	228
<i>David Hales</i>	

Norms and Their Role in a Model of Electronic Institution	240
<i>Ioan Alfred Letia, Wamberto W. Vasconcelos</i>	

A Model of Normative Multi-agent Systems and Dynamic Relationships	259
<i>Fabiola López y López, Michael Luck</i>	

Integration of Generic Motivations in Social Hybrid Agents	281
<i>Fenintsoa Andriamasinoro, Remy Courdier</i>	

Author Index	301
---------------------------	-----