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Games, Actions and Social Software

Multidisciplinary Aspects

Springer

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Foreword

Why do people stand in queues? I had the privilege and pleasure of spending a semester at NIAS[1], during which time I used to often take the bus at Leiden Centraal. While people would hang about in no particular order until the bus showed up, a queue would form as soon as the bus arrived, not necessarily in the order of people as they had arrived at the bus stop. Some who had arrived early might well be the tenth to get in, but nobody complained. There were occasions, such as the day of the Flower Parade in April, when there was a rush and no queues.

A queue is an example of a *social algorithm*, a method devised by society to solve one of its problems. Every society and culture evolves its own prioritization of problems and its own solutions. These solutions are largely efficacious, mostly self-enforced, and typically robust, though they are not guaranteed to work at all times. A fabric of interwoven social algorithms holds society together, and this is termed social software by the scholars who discuss a variety of related themes in this book.

The bold premise of the book is that there is a *logical* structure underlying social algorithms, one that is amenable to formal mathematical treatment and explication. The reasoning is game-theoretic in nature, involves epistemic attitudes of agents such as knowledge and belief, and has an elaborate relationship with structures of communication. The articles in this collection therefore cover a range of issues: rights and responsibilities of agents, intensional acts such as lying and truth telling, cooperation and competition, and the role of perception. They offer formal frameworks in which some aspect or other of social interaction and procedure is discussed.

Logic has traditionally been introspective, at home in the abstractions of notions like truth and consistency, shunning the messiness of interaction and communication, let alone human endeavors and social structure. The expansion of the logician's agenda to include these is a welcome step. Logic may not help in solving the burning problems of society, but is generally good at raising new and important questions. In the process of answering such questions, new insight emerges.

The fact that the ambience of NIAS is woven into this book makes it particularly special. NIAS is an idyll, offering a scholarly retreat for meditation, especially on society and culture. This book breathes the logician's language into that ethos, offering new variations on a theme that is old for NIAS.

[1] Netherlands Institute for Advanced Study in the Humanities and Social Sciences, Wassenaar (near Leiden)

I hope that not only logicians, but also social scientists and scholars in the humanities, will participate in the discussion that this book invites them to.

August 2011

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Preface

This is the second book that appears as a product of the multi-disciplinary project "Games, Action and Social Software," which was carried out at the Netherlands Institute for Advanced Study in the Humanities and Social Sciences (NIAS) in Wassenaar, from September 2006 through January 2007. This project brought together a group of creative researchers from philosophy, logic, computer science, cognitive science and economics, to investigate the logical, computational and strategic aspects of social mechanisms. The aim was to arrive at a multi-disciplinary perspective, and help create an active community with a more definite agenda. One of the deliverables of the project was to be an overview of this emerging new field, including an agenda for further research, with the contents of the book to be shaped by discussions and interaction at NIAS. This promise was fulfilled with *Discourses on Social Software*, that appeared in 2009 with Amsterdam University Press in the series *Texts in Logic and Games.*

Some research monographs were started by subgroups of fellows as part of the NIAS project. So far, *Teamwork in Multi-Agent Systems: A Formal Approach* by Barbara Dunin-Kęplicz and Rineke Verbrugge has appeared with Wiley and Sons in 2010.

The present volume collects a set of chapters presenting the research that the group of affiliated researchers carried out as part of the NIAS project, individually and in small interdisciplinary subgroups, during their stay at NIAS and afterwards. It has a more conventional flavor than the *Discourses on Social Software* volume. All authors of this book have been involved in the "Games, Action and Social Software" project. Five of them were project fellows staying at NIAS the full semester (Martin van Hees, Barbara Dunin-Kęplicz, Krister Segerberg, and ourselves), eight were guests for one or two months (Johan van Benthem, Nicola Dimitri, Hans van Ditmarsch, Keith Dowding, Peter Gärdenfors, Rohit Parikh, Marc Pauly, and Andrzej Szałas), and two were short-time visitors (Floor Sietsma and Yanjing Wang).

The book has three parts: I, II, and III. The first part deals with "Social Software and the Social Sciences." In Chap. 1, Rohit Parikh and Marc Pauly explain the general meaning of the concept of social software, with an emphasis on the aspects of logical structure, knowledge and incentives. They discuss an extensive example: a social mechanism for the distribution of housing at Stanford University.

Chapter 2, by Keith Dowding and Martin van Hees, draws a number of useful philosophical distinctions in the area of formal analysis of social mechanisms, focusing on the concepts of freedom, liberties and rights.

In the final chapter in this part, Chap. 3, Nicola Dimitri and Jan van Eijck investigate the intriguing phenomenon of time discounting: "A bird in the hand

is worth two in the bush," especially if you hold the bird in the hand *now*, and the promise of two in the bush is for *tomorrow*.

The second part of the book revolves around "Knowledge, Belief and Action." In the first chapter in this part, Chap. 4, Hans van Ditmarsch, Jan van Eijck, Floor Sietsma, and Yanjing Wang develop a formal logic of lying inspired by dynamic epistemic logic, concentrating on the effects of lies as communicative acts, and not modeling, say, the intentions of the liar. They apply their logical framework to lies in public discourse and finish by analyzing lying (or bluffing) in games like Liar's Dice, making use of a custom-made extension of the automated epistemic model checker DEMO.

In Chap. 5, Krister Segerberg discusses belief revision in the context of dynamic doxastic logic, which contains for each Boolean formula φ a propositional operator $[*\varphi]$ standing for "after the agent has come to believe that φ and revised his beliefs accordingly it is the case that." Segerberg provides a sketch of the resulting rich logical landscape.

The final chapter in Part II, Chap. 6, is a logical analysis of the concept of a strategy in various kinds of games, by Johan van Benthem. Van Benthem develops a plea for treating strategies as first-class citizens in explicit strategy logics, instead of hiding them under existential quantifiers saying that "players have a strategy." This chapter is an updated and revised version of a paper that has circulated in manuscript form for about five years and has already sparked a number of ongoing research projects.

The third and final part of the book discusses "Perception, Communication and Cooperation." In Chap. 7, Jan van Eijck discusses perception in update logic, and presents a logic of change and perception. The next chapter of the book, Chap. 8 by Barbara Dunin-Kęplicz and Andrzej Szałas, is a plea for a more realistic treatment of the notion of similarity, to take account of vagueness and lack of precision in perception. The authors present a framework that remains close to standard multimodal approaches, and show how it can be applied in multi-agent environments. Next, in Chap. 9, Peter Gärdenfors discusses the role of cognition and communication in cooperation. Step by step, the chapter moves through the stages of evolution studied by evolutionary biologists, and shows that different forms of cooperation can arise at different stages of evolution where they are enabled by higher and higher levels of cognition and more and more possibilities of communication. The description culminates with the pinnacle of cooperation, fully fledged teamwork. Thus, the book gently segues into the closing chapter. In the final chapter, Barbara Dunin-Kęplicz and Rineke Verbrugge present a logic of teamwork capturing the strong types of teamwork that can occur in human teams or among software agents, based on collective intentions and collective commitments, and open to the needs of re-planning teamwork in dynamic environments.

Most of the chapters contained in this volume went through several rounds of different updates. For each chapter, the date of the first version sent to the editors appears below. We would like to thank all authors for their thorough revisions and expansions.

Part I Social Software and the Social Sciences
Chapter 1 Rohit Parikh and Marc Pauly:
What Is Social Software?
First version received June 14, 2007.
Chapter 2 Keith Dowding and Martin van Hees:
Freedom, Rights and Social Software.
First version received May 7, 2007.
Chapter 3 Nicola Dimitri and Jan van Eijck:
Time Discounting and Time Consistency.
First version (by Nicola Dimitri) received August 28, 2007.
Part II Knowledge, Belief and Action
Chapter 4 Hans van Ditmarsch, Jan van Eijck, Floor Sietsma and Yanjing Wang:
On the Logic of Lying.
First version received on August 16, 2007.
Chapter 5 Krister Segerberg:
Strategies for Belief Revision.
First version received April 20, 2007.
Chapter 6 Johan van Benthem:
In Praise of Strategies.
First version received May 15, 2007.
Part III Perception, Communication and Cooperation
Chapter 7 Jan van Eijck:
Perception and Change in Update Logic.
First version received July 13, 2010.
Chapter 8 Barbara Dunin-Kęplicz and Andrzej Szałas:
Agents in Approximate Environments.
First version received November 9, 2007.
Chapter 9 Peter Gärdenfors:
The Cognitive and Communicative Demands of Cooperation.
First version received January 29, 2007.
Chapter 10 Barbara Dunin-Kęplicz and Rineke Verbrugge:
A Logical View on Teamwork.
First version received January 16, 2007.

We are grateful to the NIAS staff, in particular to NIAS rector Wim Blockmans and to NIAS head of research planning and support Jos Hooghuis, for their open-mindedness in welcoming our rather unusual project team at NIAS, and for making us feel genuinely at home. The project received much practical and financial support from NIAS, for which we would like to express our thanks in the name of all fellows and guests of the theme group.

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and Computer Science (CWI) for allowing Jan van Eijck to take part in the NIAS project.

The Lorentz Center in Leiden provided a generous grant, supporting the workshop at which many lectures leading to chapters in this book took place. The relaxed atmosphere and the unique facilities at the Lorentz Centre fostered lively discussions during the workshop on Games, Action and Social Software. We would like to thank Martje Kruk, Wim van Saarloos, Gerda Filippo and Henriette Jensenius for their enthusiastic and highly professional support.

This volume has found a good home in the FoLLI series of Springer *Lecture Notes in Computer Science*. We would like to thank series editor Eric Pacuit for his immediate enthusiasm and Ursula Barth for her practical support.

In the process of making this book, we received invaluable support from a number of anonymous referees, who helped us with detailed reports and useful suggestions, sometimes even on several versions of a chapter. Thank you ever so much for enabling a great improvement in the quality of the book as a whole. We as editors-cum-authors even had to keep some of the names of the referees anonymous from one another, but you know who you are!

Autumn 2011

Jan van Eijck
Rineke Verbrugge

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