

Commenced Publication in 1973

Founding and Former Series Editors:

Gerhard Goos, Juris Hartmanis, and Jan van Leeuwen

Editorial Board Members

David Hutchison, UK

Josef Kittler, UK

Friedemann Mattern, Switzerland

Moni Naor, Israel

Bernhard Steffen, Germany

Doug Tygar, USA

Takeo Kanade, USA

Jon M. Kleinberg, USA

John C. Mitchell, USA

C. Pandu Rangan, India

Demetri Terzopoulos, USA

FoLLI Publications on Logic, Language and Information

Subline of Lectures Notes in Computer Science

Subline Editors-in-Chief

Valentin Goranko, *Stockholm University, Sweden*

Michael Moortgat, *Utrecht University, The Netherlands*

Subline Area Editors

Nick Bezhanishvili, *University of Amsterdam, The Netherlands*

Anuj Dawar, *University of Cambridge, UK*

Philippe de Groote, *Inria Nancy, France*

Gerhard Jäger, *University of Tübingen, Germany*

Fenrong Liu, *Tsinghua University, Beijing, China*

Eric Pacuit, *University of Maryland, USA*

Ruy de Queiroz, *Universidade Federal de Pernambuco, Brazil*

Ram Ramanujam, *Institute of Mathematical Sciences, Chennai, India*

More information about this series at <http://www.springer.com/series/7407>

Patrick Blackburn · Emiliano Lorini ·
Meiyun Guo (Eds.)

Logic, Rationality, and Interaction

7th International Workshop, LORI 2019
Chongqing, China, October 18–21, 2019
Proceedings

Editors

Patrick Blackburn
Roskilde University
Roskilde, Denmark

Emiliano Lorini
Université Paul Sabatier, IRIT-CNRS
Toulouse, France

Meiyun Guo
Southwest University
Chongqing, China

ISSN 0302-9743 ISSN 1611-3349 (electronic)

Lecture Notes in Computer Science

ISBN 978-3-662-60291-1 ISBN 978-3-662-60292-8 (eBook)

<https://doi.org/10.1007/978-3-662-60292-8>

LNCS Sublibrary: SL1 – Theoretical Computer Science and General Issues

© Springer-Verlag GmbH Germany, part of Springer Nature 2019

This work is subject to copyright. All rights are reserved by the Publisher, whether the whole or part of the material is concerned, specifically the rights of translation, reprinting, reuse of illustrations, recitation, broadcasting, reproduction on microfilms or in any other physical way, and transmission or information storage and retrieval, electronic adaptation, computer software, or by similar or dissimilar methodology now known or hereafter developed.

The use of general descriptive names, registered names, trademarks, service marks, etc. in this publication does not imply, even in the absence of a specific statement, that such names are exempt from the relevant protective laws and regulations and therefore free for general use.

The publisher, the authors and the editors are safe to assume that the advice and information in this book are believed to be true and accurate at the date of publication. Neither the publisher nor the authors or the editors give a warranty, expressed or implied, with respect to the material contained herein or for any errors or omissions that may have been made. The publisher remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

This Springer imprint is published by the registered company Springer-Verlag GmbH, DE part of Springer Nature.

The registered company address is: Heidelberger Platz 3, 14197 Berlin, Germany

Preface

This book contains the papers presented at the 7th International Workshop on Logic, Rationality, and Interaction (LORI-VII 2019), held during October 18–21, 2019, in Chongqing, China, and hosted by the Institute of Logic and Intelligence (ILI) of Southwest University.

As with previous LORI conferences, the focus of the workshop was on the following topics: Agency, Argumentation, and Agreement; Belief Revision and Belief Merging; Belief Representation, Cooperation, Decision Making, and Planning; Natural Language, Philosophy, and Philosophical Logic; and Strategic Reasoning. We received 56 full paper submissions and ended up selecting 33 of them (the authors of two accepted papers chose not to have them published here). The papers were selected on the basis of at least two blind reviews. We decided not to impose a long-paper/short-paper distinction, and to allow all authors 30 minutes of presentation time; this meant that we had to have a number of parallel sessions at the workshop.

In addition, there were presentations by six keynote speakers:

Leila Amgoud	IRIT-CNRS, Toulouse University, France
Kevin Kelly	Carnegie Mellon University, USA
Rineke Verbrugge	University of Groningen, The Netherlands
Michael Wooldridge	University of Oxford, UK
Yanjing Wang	Peking University, China
Thomas Ågotnes	University of Bergen, Norway, and Southwest University, China

The LORI series dates back to August 2007, when the first meeting was held at Beijing Normal University. Since then, a meeting has been held every two years: for further information about the previous conferences, see www.golori.org. Here we will simply remark that over the past 12 years the LORI series has acted as a focus point for research in East Asia on the topics related to logic, rationality, and interaction, and has simultaneously succeeded in drawing scholars from out-side the region to interact and collaborate in this area. The “LORI-community” which has been built up in this way seems destined to become bigger, broader in scope, and to give rise to new and exciting research in the coming years.

As Organizing and Program Committee chairs we would like to thank all the members of the Program Committee for their hard work in a short space of time; the reviewing called forth intense and generous efforts, for which we are deeply grateful.

We are also grateful to Zuojun Xiong who handled the website practicalities and responded fast to our emails, and to Fenrong Liu, Johan van Benthem, and Jeremy Seligman whose timely advice, based on their experience with all the previous LORI conferences, helped us to keep things on track.

Finally, special thanks must also go to the School of Political Science and Public Administration at Southwest University and Institute of Logic and Intelligence (ILI) of Southwest University, China, for their sponsorship for the conference and for financially supporting the proceedings of LORI-VII 2019.

October 2019

Patrick Blackburn
Emiliano Lorini
Meiyun Guo

Organization

Organization Committee

Meiyun Guo (Chair)	Southwest University, China
Zhanglv Li	Southwest University, China
Junli Jiang	Southwest University, China
Zuojun Xiong	Southwest University, China

Program Committee Chairs

Patrick Blackburn	Roskilde University, Denmark
Emiliano Lorini	IRIT-CNRS, Université Paul Sabatier, France

Steering Committee

Johan van Benthem	University of Amsterdam, The Netherlands, Tsinghua University, China, and Stanford University, USA
Shier Ju	Sun Yat-sen University, China
Frank Veltman	University of Amsterdam, The Netherlands
Jialong Zhang	Chinese Academy of Social Sciences, China
Xiangdong He	Southwest University, China
Huaxin Huang	Zhejiang University, China
Wen-fang Wang	Yang Ming University, China
Tomoyuki Yamada	Hokkaido University, China

Scientific Secretaries

Fenrong Liu	Tsinghua University, China
Minghui Xiong	Sun Yat-sen University, China

Program Committee

Natasha Alechina	University of Nottingham, UK
Luciana Benotti	Universidad Nacional de Cordoba, Argentina
Thomas Bolander	Technical University of Denmark, Denmark
Nina Gierasimczuk	Technical University of Denmark, Denmark
Valentin Goranko	Stockholm University, Sweden
Davide Grossi	University of Groningen, The Netherlands
Andreas Herzig	CNRS, IRIT, University of Toulouse, France
Wesley Holliday	University of California Berkeley, USA
Jeff Horty	University of Maryland, USA

Thomas Icard	Stanford University, USA
Guifei Jiang	Nankai University, China
Fengkui Ju	Beijing Normal University, China
Kohei Kishida	Dalhousie University, Canada
Dominik Klein	University of Bamberg, Germany
Jérôme Lang	CNRS, LAMSADE, Université Paris-Dauphine, France
Hu Liu	Sun Yat-sen University, China
Guo Meiyun	South-West University, China
Sara Negri	University of Helsinki, Finland
Hiroakira Ono	JAIST, Japan
Eric Pacuit	University of Maryland, USA
Laurent Perrussel	IRIT, University of Toulouse, France
Gabriella Pigozzi	Université Paris-Dauphine, France
Soroush Rafiee Rad	University of Amsterdam, The Netherlands
Ram Ramanujam	The Institute of Mathematical Sciences, India
Olivier Roy	Universität Bayreuth, Germany
Katsuhiko Sano	Hokkaido University, Japan
François Schwarzentruher	École normale supérieure de Rennes, France
Jeremy Seligman	The University of Auckland, New Zealand
Sonja Smets	University of Amsterdam, The Netherlands
Kaile Su	Griffith University, Australia
Paolo Turrini	Imperial College London, UK
Hans van Ditmarsch	LORIA, CNRS, University of Lorraine, France
Robert van Rooij	University of Amsterdam, The Netherlands
Fernando R. Velázquez-Quesada	University of Amsterdam, The Netherlands
Gregory Wheeler	Frankfurt School of Finance & Management, Germany
Yi N. Wáng	Zhejiang University, China
Audrey Yap	University of Victoria, Australia
Junhua Yu	Tsinghua University, China
Dongmo Zhang	Western Sydney University, Australia
Thomas Ågotnes	University of Bergen, Norway

Additional Reviewers

Carlos Areces
Ryuta Arisaka
Fausto Barbero
Tristan Charrier
Zoé Christoff
Tiziano Dalmonte
Liangda Fang
Rustam Galimullin
Malvin Gatteringer
Sujata Ghosh
Marianna Girlando
Umberto Grandi
Zhe Lin
Andrés Occhipinti Liberman
Alessandra Marra

Karl Nygren
Anantha Padmanabha
Carlo Proietti
Arthur Queffelec
Rasmus K. Rendsvig
Chenwei Shi
Xin Sun
Apostolos Tzimoulis
Jonni Virtema
Ren-June Wang
Yanjing Wang
Kun Xing
Zuojun Xiong
Aybüke Özgün

Abstract of Invited Talks

The Dynamics of Group Knowledge and Belief

Thomas Ågotnes

University of Bergen/Southwest University
Thomas.Agotnes@uib.no

Principles of reasoning about group knowledge and belief have received attention over the past decade, in particular in the context of reasoning about the dynamics of interaction. In the talk I will review some of this work, hopefully provide some new insights, and pose some open problems. I will focus on formalisations in modal logic.

What we mean when we say that a group knows something can be radically different depending on context. Well-known notions of group knowledge that have been proposed in the literature include general knowledge (everybody-knows), distributed knowledge, common knowledge, relativised common knowledge. What group belief is, however, is murkier. Applying the same definitions to belief, group belief is not actually always belief. The existence of group belief depends on the particular properties one assumes of belief, and I will map out different possible notions of group belief under different notions of belief. I will also discuss intermediate notions of group belief between distributed and common belief.

Moving to dynamics, we first look at the consequences of adding new group knowledge operators to dynamic epistemic logics such as public announcement logic and action model logic. The relationship between distributed and common knowledge has been of special interest in the dynamic setting, an intuitive idea being that distributed knowledge is potential common knowledge. However this idea is clearly false: it is possible to have distributed knowledge of a Moore-like sentence, which can never even become individual knowledge. I will discuss a dynamic operator that exactly captures what is true after the group have shared all their information with each other; this is what we call resolving distributed knowledge. Intuitions about group knowledge, such as the one just mentioned, are often related to group ability; which states of knowledge a group can make come about. I will thus discuss group knowledge first in the context of general group ability operators such as those found in Alternating-time Temporal Logic and Coalition Logic, and then circle back to dynamic epistemic logics again and discuss cases where ability means ability to achieve some state of knowledge by using public announcements. I will have something to say about how all these different static and dynamic takes on group knowledge and belief are tied together.

Argument-Based Paraconsistent Logics

Leila Amgoud

CNRS

`Leila.Amgoud@irit.fr`

Handling inconsistency in propositional knowledge bases (KBs) has been studied in AI for a long time. Several two-level logics have been defined: They start with classical propositional logic and define on top of it a non-monotonic logic that infers non-trivial conclusions from an inconsistent KB. There are at least two families of such logics: coherence-based and argument-based logics. The former compute the set of all maximal (for set inclusion) consistent subbases (MCSs) of a KB, and then they apply an inference mechanism for drawing consequences from the MCSs. Argument-based logics follow another process. They justify every candidate consequence of a KB by arguments, generated using the classical consequence relation, then they identify possible conflicts between arguments, evaluate arguments using a formal method, called semantics, and finally keep among the candidate consequences those that are supported by “strong” arguments.

In this talk, I present three families of argument-based logics that use respectively on extension semantics, ranking semantics, and gradual semantics in the evaluation step. I discuss the properties of those logics, and compare them with coherence-based logics.

Realism, Simplicity, and Topology

Kevin Kelly

Carnegie Mellon University
kk3n@andrew.cmu.edu

This is joint work with Hanti Lin, University of California, Davis and Konstantin Genin, University of Toronto.

Scientific realists assure us that simpler theories are better-confirmed by simple data and are, therefore, more worthy of belief. Scientific anti-realists respond that the data might look simple for eternity if the complex theory is true, in which case the realist's assurance would lead to eternal error. We show that the realist's position follows from a learning-theoretic argument for Ockham's razor. The argument is based on the interaction of two topologies on possible worlds: the realist topology of arbitrary similarity in reality, and the empirical topology of arbitrary empirical similarity. The former pertains to the ends of inquiry, and the latter characterizes the means.

Reasoning in Dynamic Games: From Rationality to Rationalization

Rineke Verbrugge

Department of Artificial Intelligence, Bernoulli Institute,
University of Groningen
L.C.Verbrugge@rug.nl

Game theorists have proposed backward induction as the reasoning procedure that rational players follow in dynamic games, on the basis of their collective belief that all participating players are rational. An alternative reasoning procedure is forward induction, in which a player rationalizes any previous apparently irrational move by the opponent. Do people's choices in centipede-like dynamic games fit better with backward or forward induction?

In our experiments (with Sujata Ghosh, Aviad Heifetz, and Harmen de Weerd), participants played a centipede-like game called Marble Drop. The computer opponent was programmed to surprise the participant by deviating often from its backward induction strategy at the beginning of the game. Participants had been told that the computer was optimizing against some belief about the participant's future strategy.

In the aggregate, participants tended to favor the forward induction choice. However, their verbalized strategies usually depended on other features, such as risk aversion, trust or cooperativeness. In a follow-up experiment we compared participants from India, Israel and The Netherlands in the Marble Drop game, with surprising results.

Understanding Equilibrium Properties of Multi-agent Systems

Michael Wooldridge

University of Oxford

michael.wooldridge@cs.ox.ac.uk

Over a twenty minute period on the afternoon 6 May 2010, the Dow Jones industrial average collapsed, at one point wiping a trillion dollars off the value of the US markets. Remarkably, the market recovered in a similarly short period of time, to nearly its position before the collapse. While the precise causes of the so-called “Flash Crash” are complex and controversial, the Flash Crash was only possible because modern international markets are multi-agent systems, in which high frequency trading agents autonomously buy and sell on timescales that are so small that they are far beyond human comprehension or control. There is no reason to believe that the 2010 Flash Crash was an isolated event: and the next one could be even bigger, with potentially devastating global consequences. The 2010 Flash Crash provides a stark illustration of something we have long known: that systems composed of large numbers of multiple interacting components can be subject to rapid, unpredictable swings in behaviour. We urgently need to develop the theory and tools to understand such multi-agent system dynamics.

In this talk, I will present two very different approaches to this problem.

The first views a multi-agent system as a game, in the sense of game theory, with decision-makers interacting strategically in pursuit of their goals. I describe a model we have developed in which players in such a game act in pursuit of temporal logic goals. In such a setting, the key decision problems relate to the properties of a system that hold under the assumption that players choose strategies in (Nash) equilibrium. I conclude by describing a tool, developed by DPhil student Muhammed Najib, through which we can automatically analyse the properties of such equilibria.

The second approach takes a very different approach, in which we use agent-based financial models, involving very large numbers of agents, to understand specifically the factors that can contribute to Flash Crash events, and in particular the phenomenon of “contagion”, where stress on one asset leads to other assets being stressed.

This talk will report joint work with Ani Calinescu, Julian Gutierrez, Paul Harrenstein, Muhammed Najib, James Paulin, and Giuseppe Perelli.

Beyond Knowing that: A New Generation of Epistemic Logics

Yanjing Wang

Peking University
wangyanjing@gmail.com

Epistemic logic is a major field of philosophical logic studying reasoning patterns about knowledge and belief. Despite its various applications in epistemology, theoretical computer science, AI, and game theory, the technical developments in the field have been mainly focusing on the propositional part, i.e., the propositional modal logics of “knowing that”. However, knowledge is also expressed in everyday life by “knowing whether”, “knowing what”, “knowing how”, “knowing why” and so on (know-wh hereafter). Recent years witnessed a growing interest in new epistemic logics of know-wh motivated by questions in philosophy, AI and linguistics. The new epistemic modalities introduced in those logics usually share, in their semantics, the general schema of ‘exists x \Box phi’ (where \Box is a box-modality), e.g., knowing how to achieve phi roughly means that there exists a way such that you know that it is a way to make sure that phi. Therefore they are natural fragments of first-order modal logic. The new axioms of those logics intuitively capture the essential interactions of know-that and other know-wh operators, and the resulting logics are non-normal but decidable.

In this talk, I will first explain the core ideas behind this new research program with some examples, and then propose a more general framework inspired by the concrete know-wh logics, which leads to the discovery of new decidable fragments of first-order modal logic.

Contents

On the Right Path: A Modal Logic for Supervised Learning.	1
<i>Alexandru Baltag, Dazhu Li, and Mina Young Pedersen</i>	
Elementary Iterated Revision and the Levi Identity	15
<i>Jake Chandler and Richard Booth</i>	
Undefinability in Inquisitive Logic with Tensor	29
<i>Ivano Ciardelli and Fausto Barbero</i>	
Minimal-Change Counterfactuals in Intuitionistic Logic	43
<i>Ivano Ciardelli and Xinghan Liu</i>	
Consolidation of Belief in Two Logics of Evidence.	57
<i>Yuri David Santos</i>	
From Classical to Non-monotonic Deontic Logic Using ASPIC ⁺	71
<i>Huimin Dong, Beishui Liao, Réka Markovich, and Leendert van der Torre</i>	
A Discrete Representation of Lattice Frames.	86
<i>Ivo Düntsch and Ewa Orłowska</i>	
Group Announcement Logic with Distributed Knowledge	98
<i>Rustam Galimullin, Thomas Ågotnes, and Natasha Alechina</i>	
Towards a Logic for Conditional Local Strategic Reasoning.	112
<i>Valentin Goranko and Fengkui Ju</i>	
Multi-agent Knowing How via Multi-step Plans: A Dynamic Epistemic Planning Based Approach	126
<i>YanJun Li and Yanjing Wang</i>	
The Sequent Systems and Algebraic Semantics of Intuitionistic Tense Logics	140
<i>Kaiyang Lin and Zhe Lin</i>	
Weakly Aggregative Modal Logic: Characterization and Interpolation	153
<i>Jixin Liu, Yanjing Wang, and Yifeng Ding</i>	
Dynamic Term-Modal Logic for Epistemic Social Network Dynamics	168
<i>Andrés Occhipinti Liberman and Rasmus K. Rendsvig</i>	

Analyzing Echo Chambers: A Logic of Strong and Weak Ties	183
<i>Mina Young Pedersen, Sonja Smets, and Thomas Ågones</i>	
Public Group Announcements and Trust in Doxastic Logic	199
<i>Elise Perrotin, Rustam Galimullin, Quentin Canu, and Natasha Alechina</i>	
Bipolar Argumentation Frameworks, Modal Logic and Semantic Paradoxes.	214
<i>Carlo Proietti, Davide Grossi, Sonja Smets, and Fernando R. Velázquez-Quesada</i>	
Improving Judgment Reliability in Social Networks via Jury Theorems	230
<i>Paolo Galeazzi, Rasmus K. Rendsvig, and Marija Slavkovik</i>	
Term-Sequence-Modal Logics.	244
<i>Takahiro Sawasaki, Katsuhiko Sano, and Tomoyuki Yamada</i>	
A Logical and Empirical Study of Right-Nested Counterfactuals.	259
<i>Katrin Schulz, Sonja Smets, Fernando R. Velázquez-Quesada, and Kaibo Xie</i>	
First Degree Entailment with Group Attitudes and Information Updates	273
<i>Igor Sedlár, Vít Punčochář, and Andrew Tedder</i>	
Knowledge in Topological Argumentation Models	286
<i>Chenwei Shi</i>	
Towards a Logical Formalisation of Theory of Mind: A Study on False Belief Tasks	297
<i>Anthia Solaki and Fernando R. Velázquez-Quesada</i>	
A Two-Layer Partition Awareness Structure	313
<i>Pengfei Song and Wei Xiong</i>	
First-Order Intuitionistic Epistemic Logic	326
<i>Youan Su and Katsuhiko Sano</i>	
A Neutral Temporal Deontic STIT Logic	340
<i>Kees van Berkel and Tim Lyon</i>	
Evaluating Networks of Arguments: A Case Study in Mīmāṃsā Dialectics	355
<i>Kees van Berkel, Agata Ciabattoni, Elisa Freschi, and Sanjay Modgil</i>	
Who Should Be My Friends? Social Balance from the Perspective of Game Theory	370
<i>Wiebe van der Hoek, Louwe B. Kuijer, and Yi N. Wang</i>	

Epistemic Logic with Partial Dependency Operator	385
<i>Xinyu Wang</i>	
Knowledge-Now and Knowledge-All.	399
<i>Xinyu Wang and Yanjing Wang</i>	
A Logic of Knowing How with Skippable Plans.	413
<i>Xun Wang</i>	
A Dynamic Hybrid Logic for Followership	425
<i>Zuojun Xiong and Meiyun Guo</i>	
Author Index	441