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Introduction to the Special Issue on Logic and the Foundations of Game and Decision Theory (LOFT12)

This special issue of *Studia Logica* contains a selection of papers presented at the 12*th Conference on Logic and the Foundations of Game and Decision Theory* (LOFT12), which took place in Maastricht (The Netherlands), July 20-22, 2016. While this special issue collects papers which are more focused on logic, a second set of papers—that have a more game-theoretic content—can be found in a special issue of the *B.E. Journal of Theoretical Economics*.

The LOFT conferences have spanned a period of 22 years: the first took place in 1994 in Marseille (France) and, since then, LOFT has become a regular bi-annual event.[1]

The LOFT conferences are interdisciplinary events that bring together researchers from a variety of fields: cognitive psychology, computer science and artificial intelligence, economics, game theory, linguistics, logic, mind sciences, philosophy and social choice. In its original conception, LOFT had as its central theme the application of logic, in particular modal epistemic logic, to foundational issues in the theory of games and individual decision-making. The LOFT initiative arose from the realization that the tools and methodology that were used in game theory were closely related to those used in other fields, notably computer science, logic and philosophy. Modal logic turned out to be the common language that made it possible to bring together different professional communities.

New and active areas of research have sprung from the interdisciplinary exposure provided by the LOFT events. Over time the scope of the LOFT

[1] The first conference was hosted by the Centre International de Recherches Mathematiques in Marseille (France), the next four took place at the International Centre for Economic Research in Torino (Italy), LOFT6 was hosted by the Graduate School of Management in Leipzig (Germany), LOFT7 took place at the University of Liverpool (United Kingdom), LOFT8 at the University of Amsterdam (The Netherlands), LOFT9 at the University of Toulouse (France), LOFT10 at the University of Sevilla (Spain) and LOFT11 at the University of Bergen (Norway).

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conferences has broadened to encompass a wider range of topics, while maintaining its focus on the general issue of rationality and agency. Topics that have fallen within the LOFT umbrella include epistemic and temporal logic, theories of information processing and belief revision, models of bounded rationality, non-monotonic reasoning, theories of learning and evolution, social choice theory, the theory of social networks, etc. A complete list of publications that have sprung from the past LOFT conferences is given in the References section at the end of this Introduction.

This special section consists of four articles, which are briefly summarized below.

The paper "The dynamics of epistemic attitudes in resource-bounded agents" by Philippe Balbiani, David Fernandez Duque and Emiliano Lorini presents some logics for reasoning about the formation of beliefs through perception or through inference in non-omniscient resource-bounded agents. The logic distinguishes the concept of explicit belief from the concept of background knowledge. This distinction is reflected in its formal semantics and axiomatics, by using a non-standard semantics putting together a neighbourhood semantics for explicit beliefs and relational semantics for background knowledge, and by allowing for specific axioms in the logic highlighting the relationship between the two concepts. Mental operations of perceptive type and inferential type, having effects on epistemic states of agents, are primitives in the object language of the logic. At the semantic level, they are modelled as special kinds of model-update operations, in the style of Dynamic Epistemic Logic. The paper presents results on axiomatisation, decidability and complexity for the logics.

In the paper "Dynamic epistemic logic of diffusion and prediction in social networks", Alexandru Baltag, Zoé Christoff, Rasmus Kraemmer Rendsvig and Sonja Smets present a logical approach to threshold models, used to study diffusion (of opinions, new technologies, infections, or behaviour) in social networks. Threshold models consist of a network graph of agents connected by a social relationship and a threshold value which regulates the diffusion process. Such models formalise the intuition that an individual's actions or opinions are influenced by the individuals around them. In the model, agents adopt a new behavior/product/opinion when the proportion of their neighbours who have already adopted it meets the threshold. Under this adoption policy, threshold models develop dynamically towards a guaranteed fixed point. The paper has two goals, the first of which is to propose logics for reasoning about threshold models and their dynamics. For this, the authors construct a minimal dynamic propositional logic to describe the threshold dynamics and show that the logic is sound and complete.

The second goal is to investigate how the agents' knowledge affects such dynamics. For this, the framework is extended with an epistemic dimension and the authors investigate how information about more distant neighbours' behaviour allows agents to anticipate changes in behaviour of their closer neighbours.

As the title suggests, in "Logics for moderate belief-disagreement between agents" Jia Chen and Tianqun Pan study the idea of moderate belief-disagreement from a logical perspective. Moderate disagreement means that some agent believes a certain proposition whereas another agent does not. It must be distinguished from strong disagreement, which is a situation where the first agent believes the proposition and the second agent believes its negation, and also from weak disagreement, which means that the first agent does not believe the proposition and the second agent does not believe its negation. The authors develop two logical systems for moderate belief-disagreement, and show that the first is sound and complete with respect to arbitrary frames, and that the second is sound and complete with respect to serial frames. At the end, the findings in the paper are compared to Aumann's famous paper on "agreeing to disagree".

In the paper "The monodic fragment of Propositional Term Modal Logic", R. Ramanujam and Anantha Padmanabha develop a logic related to Term Modal Logics (TML)—introduced by Fitting, Thalmann and Voronkov (2001)—in which modalities are indexed by terms, built on a generic first-order logic. The authors call their logic Propositional Term Modal Logic (PTML). While TML can be used to quantify over the set of agents, PTML is suitable for reasoning about systems of unboundedly many reasoners. The main problem investigated by the authors is decidability. They study the monodic fragment of propositional TML (the monodic fragment of a quantified logic is a syntactic restriction where one allows at most one free variable in the scope of any modal formula) and give a non-deterministic double exponential time algorithm to decide its satisfiability problem. The authors also provide an invariance characterisation of a particular notion of bisimulation introduced here for the logic PTML.

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Introduction to the Special Issue on Logic

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