

Introduction to the special issue

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This special issue of *Synthese* contains a selection of papers presented at the *11th Conference on Logic and the Foundations of the Theory of Games and Decisions* (LOFT11), which took place in Bergen (Norway), July 27–30, 2014.¹ LOFT11 marked 20 years of LOFT conferences: the first conference took place in 1994 in Marseille (France) and, since then, LOFT has become a regular bi-annual event.² 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

¹ Most of the papers in this special issue have a strong epistemological flavor. A second set of papers, with an emphasis on logic, can be found in a special issue of the *Journal of Logic and Computation*.

² The first conference was hosted by the Centre International de Recherches Mathématiques 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) and LOFT10 at the University of Sevilla (Spain).

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decision-making. Epistemic considerations have been central to game theory for a long time. The expression “interactive epistemology” has been used in the game-theory literature to refer to the analysis of strategic interaction based on an explicit modeling of the players’ beliefs about each other’s beliefs and rationality. The LOFT conferences 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 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, etc. A complete list of publications that have sprung from the past LOFT conferences is given in the References.

The paper “Paradoxes in social networks with multiple products” by Krzysztof Apt, Evangelos Markakis and Suni Simon deals with social networks. The paper uses a simple model of influence to show that paradoxes similar to Braess’ well known traffic congestion paradox can occur under relatively weak assumptions: more services or products becoming available might lead to a worse outcome for everybody in the network. Some other, related, paradoxes are demonstrated as well, based on both adding and removing products or services. Results include a characterisation of conditions for these paradoxes to arise.

In “Should Stackelberg mixed strategies be considered a separate solution concept?” Vincent Conitzer analyzes the solution concept of mixed strategies in Stackelberg games. Such games (in the two-player case) allow one of the players to act, that is, commit to a course of action, before the other player moves (Stackelberg competition), rather than the two players moving simultaneously (Cournot competition). Now it appears that finding optimal mixed strategies for a Stackelberg game in normal form, yields exactly the same as applying backward induction to a modified version of the game, in extensive form. This in principle raises the question whether it is worthwhile to study optimal mixed strategies in Stackelberg games. Conitzer answers this with a well-argued yes, which for the general case suggests that even if one solution concept for a specific kind of game is equivalent to another solution concept for a modified version of the game, this does not necessarily imply that the first concept is not an interesting one, and deserves study on its own.

In “Bargaining over a common categorisation” Marco LiCalzi and Nadia Maaghi appeal to the theory of conceptual spaces, developed by Gärdenfors (2000) as a way of modeling cognitive representations. Central to this theory is the claim that natural concepts can be associated with convex regions of a suitable space and that a conceptual space can be identified with a collection of convex regions. The paper explores how two agents, who initially differ in their understanding of a concept, can reach a common understanding as the outcome of a bargaining game. Agents exhibit stubbornness as they are reluctant to give up on their own categorization, but they are engaged in a dialectic process that must ultimately lead to a common categorization.

The common convex categorization emerges as the (unique) equilibrium of the game. The authors distinguish two cases, depending on whether the disagreement between the agents' individual spaces is focused or widespread. Under focused disagreement, the bargaining process has a zero-sum structure: agents' stubbornness leads to a unique equilibrium where each concedes as little as possible, and the agent who has a larger span of control over the process ends up being better off. Under widespread disagreement, the zero-sum structure disappears and each agent confronts a dilemma: holding on to one of her individual categories weakens her position on another one. At the unique equilibrium, these conflicting pressures force a retraction of consensus: two agents who individually agree on a region falling under the same category end up relabeling it in order to minimize conflict.

The paper "A minimal logic for interactive epistemology" by Emiliano Lorini employs formal logic to study the epistemic foundations of game-theoretic solution concepts. It defines a minimalistic modal logic that can be used to express qualitative statements about individual knowledge and belief, as well as different variants of group knowledge, such as common knowledge. In addition to demonstrating the use of the logic to reason about various solution concepts, the paper presents meta-logical results including axiomatic completeness and characterisations of computational complexity.

Elias Tsakas' aim in his contribution "Correlated-belief equilibrium" is to fill a gap in the literature on solution concepts for strategic-form (or normal-form) games with complete information. Tsakas introduces a new solution concept, "correlated-belief equilibrium" (CBE) and studies its properties. A CBE is a profile of (possibly mixed) strategies having the property that, for each player i , there exists a correlated belief in her opponents' actions such that (i) its marginal on each opponent j 's set of actions corresponds to j 's mixed strategy in the profile (that is, i 's belief correctly predicts j 's randomized choice), and (ii) player i 's mixed strategy in the profile is a best response to the belief. Thus CBE captures the notion of rational behavior under correct marginal beliefs (CMB) but not necessarily independent beliefs (IB). Thus, CBE refines correlated rationalizability, which requires neither CMB nor IB, and generalizes Nash equilibrium, which corresponds to rational behavior under both CMB and IB. Furthermore, CBE and Nash equilibria coincide in two player games and also when only pure strategies are considered. Tsakas also relates CBE to correlated equilibrium by proving that for every CBE there exists some subjective correlated equilibrium that induces the CBE. Finally, the author also provides sufficient epistemic conditions for CBE by generalizing the epistemic sufficiency results by Aumann and Brandenburger (1995) and Borelli (2009) for Nash equilibria.

The paper "Partial-order Boolean games: informational independence in a logic-based model of strategic interaction" by Michael Wooldridge, Julian Gutierrez and Julian Bradfield suggests an extension of the notion of Boolean game studied in the literature. Boolean games are simultaneous games where each player chooses an assignment of truth values for the set of variables under her control. With each player is associated a formula over the entire set of variables (that is, the variables she controls together with the variables controlled by the other players) and the player's goal is to make that formula true. The authors generalize the notion of Boolean game by enriching it with a dependency graph which allows a player to be informed of the value assigned by another player to a variable x before assigning a value to the vari-

able y under her control. They call these more general games “partial-order Boolean games.” The authors study the properties of partial-order Boolean games and show that, while some problems associated with the more general games have the same complexity as the conventional Boolean games, for others the complexity increases dramatically.

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References

- [1] Bacharach, M. and P. Mongin (Eds.), special issue of *Theory and Decision* (LOFT1), Vol. 37, 1994.
- [2] Bacharach, M. L.-A. Gérard-Varet, P. Mongin and H. Shin (Eds.), *Epistemic logic and the theory of games and decisions* (LOFT1), Kluwer Academic, 1997.
- [3] Bonanno, G., M. Kaneko and P. Mongin (Eds.), two special issues of *Mathematical Social Sciences* (LOFT2), Vols. 36 and 38, 1998.
- [4] Bonanno, G. and W. van der Hoek (Eds.), two special issues of *Bulletin of Economic Research* (LOFT4), Vol. 53, 2001 and Vol. 54, 2002.
- [5] Bonanno, G. and W. van der Hoek (Eds.), special issue of *Research in Economics* (LOFT5), Vol. 57, 2003.
- [6] Bonanno, G. (Ed.), special issue of *Knowledge, Rationality and Action* (part of *Synthese*; LOFT6), Vol. 147, 2005.
- [7] Bonanno, G., W. van der Hoek and M. Wooldridge (Eds.), *Logic and the foundations of game and decision theory* (LOFT7), Vol. 3 of *Texts in Logic and Games*, Amsterdam University Press, 2008.
- [8] Bonanno, G., W. van der Hoek and B. Löwe (Eds.), *Logic and the foundations of game and decision theory* (LOFT 8), Vol. 6006 of *Lecture notes in artificial intelligence*, Springer, 2010.
- [9] Bonanno, G., A. Herzig, J. Lang and W. van der Hoek (Eds.), special issue of the *Journal of Applied Non-Classical Logics* (LOFT9), Vol. 21, 2011.
- [10] Bonanno, G., A. Herzig, J. Lang and W. van der Hoek (Eds.), special issue of the *International Journal of Game Theory* (LOFT9), Vol. 42, 2013.
- [11] Bonanno, G., H. van Ditmarsch and W. van der Hoek (Eds.), special issue of the *Journal of Philosophical Logic* (LOFT10), Vol. 42, 2013.
- [12] Bonanno, G., H. van Ditmarsch and W. van der Hoek (Eds.), special issue of the *International Game Theory Review* (LOFT10), Vol. 16, 2014.