

Information Processing, Rational Belief Change and Social Interaction

Dagstuhl seminar 09351, August 23-27, 2009

Executive Summary

1. Motivation and Goals

The study of the formal aspects of information processing, belief formation and rational belief change is of central importance in a number of different fields. A new field of research, called Social Software, maintains that mathematical models developed to reason about the knowledge and beliefs of a group of agents can be used to deepen our understanding of social interaction and aid in the design of successful social institutions. Social Software is the formal study of social procedures focusing on three aspects: (1) the logical and algorithmic structure of social procedures (the main contributors to this area are computer scientists), (2) knowledge and information (the main contributors to this area are logicians and philosophers), and (3) incentives (the main contributors are game theorists and economists). Similarly, the most important question in Game Theory is how to rationally form a belief about other players' behavior and how to rationally revise those beliefs in light of observed actions. Traditionally Game Theory has relied mostly on probabilistic models of beliefs, although recent research has focused on qualitative aspects of belief change. A new branch of logic, called Dynamic Epistemic Logic, has emerged that investigates the epistemic foundations of game theory from the point of view of formal logic. There are various newly emerging links between the research areas mentioned above.

The purpose of the Workshop was to bring together researchers from all these different areas and to promote an exchange of ideas and cross-fertilization between different fields. These researchers normally do not meet together.

Two very successful workshops with similar objectives took place at Schloss Dagstuhl in August 2005 and August 2007 (Seminars 05321 and 07351). Researchers from different fields (logicians, computer scientists, philosophers and economists) participated in these workshops and the anonymous surveys collected at the end gave enthusiastic evaluations of the events.

2. Content of the Seminar

The initial research in belief revision came from the philosophical community, wherein belief change was generally studied from a normative point of view, providing axiomatic foundations about how rational agents should behave with respect to the information flux. Subsequently, computer scientists – especially in the artificial intelligence and the database communities – have been building on these results and relating them to computational systems. Belief change, as studied by computer scientists, not only pays attention to behavioral properties characterizing evolving databases or knowledge bases, but must also address computational issues such as how to represent beliefs states in a concise way and how to efficiently compute the revision of a belief state. More recently, the economics and game theory community, in particular the emerging field of cognitive economics, has become active in belief change research paying particular attention to the issue of rational agents' disposition to change their beliefs. Both computer scientists and game theorists have stressed the importance of going beyond the question of how to formally characterize the rationality of an agent's beliefs and turn to the issue of a rational strategy for responding to new information.

Another newly emerging link between different fields results from the recognition that beliefs, preferences, intention and behavior are all intimately connected. In artificial intelligence, the relatively recent emergence of the field of cognitive robotics has given impetus to research in belief change. Cognitive robotics is concerned with endowing artificial agents with cognitive functions that involve reasoning, for example, about goals, actions, the states of other agents, collaboration and negotiation, etc.; it is natural that this work would extend to the development of computational operators for belief change and the identification of issues arising from concrete, evolving sets of knowledge in a dynamic environment. Recent work in behavioral and experimental economics has highlighted the importance of perception of opponents' intention in explaining behavior in interactive situations. In game theory a new area of research has been dealing with the incentive to truthfully reveal private information and the strategic manipulation of other agents' beliefs. The new field of dynamic epistemic logic has focused on the process by which public information changes the interactive beliefs of a group of agents (in particular, what is commonly believed among them).

Given the commonality of interests among the different areas mentioned above and the difficulty of promoting interaction among researchers belonging to different disciplines, the Workshop represented a unique opportunity for the dissemination of ideas and provided impetus for interdisciplinary collaboration.

3. The participants

The seminar gathered 36 researchers from 16 countries:

Australia, Austria, Brazil, Canada, France, Germany,
Israel, Luxemburg, Portugal, South Africa, Spain,
Sweden, United Kingdom, The Netherlands, United
States, Venezuela

The participants come from computer science, philosophy, mathematics (formal logic) and economics. The different backgrounds of the researchers resulted in stimulating discussions on various issues.

4. The program

We organized the program so as to have rather homogeneous sessions, each session being focused on related issues.

The speakers for the **first day (Monday, August 24)** were:

Didier Dubois (Paul Sabatier University, Toulouse, France)
Meta-epistemic logic: A simple modal logic for reasoning
about revealed beliefs

Hans van Ditmarsch (University of Sevilla, Spain)
Awareness and forgetting of facts and agents

Thomas Meyer (Meraka Institute, Pretoria, South Africa)
Next steps in propositional Horn contraction

Alexander Bochman (Holon Institute of Technology, Israel)
The statics of rule update

Andres Perea (Maastricht University, The Netherlands)
Belief in the Opponents' Future Rationality

Emiliano Lorini (IRIT, Toulouse, France)
A Modal Logic of Epistemic Games

Giacomo Bonanno (University of California, Davis, USA)
Revealed preference, iterated belief revision and solutions
of dynamic games

Burkhard Schipper, (University of California, Davis, USA)
How Mindless is Standard Economics Really?

Ramon Pino-Perez (Universidad de Los Andes, Mérida, Venezuela)
Distances, structured profiles and Arrow's Theorem

The speakers for the **second day (Tuesday, August 25)** were:

Mauricio Reis (University of Madeira Funchal, Portugal)

On the Semantics of Multiple Contraction

Abhaya Nayak (Macquarie University, Sydney, Australia)

Two Approaches to Iterated Belief Contraction

Renata Wasserman (University of São Paulo, Brazil)

Inclusion and Recovery in Belief Base Dynamics

James Delgrande (Simon Fraser University, Canada)

Revising with Several Formulas

Gabriele Kern-Isberner (University of Dortmund, Germany)

(Iterated) Revision and Update, Revisited

John Cantwell (Stockholm University, Sweden),

A semantics for conditional assertions

Hans Rott (Regensburg University, Germany)

The Ramsey Test for Conditionals and Iterated Theory Change

Sébastien Konieczny (Université d'Artois-Lens, France)

Improvement Operators

Gerhard Brewka (University of Leipzig, Germany)

Argumentation Context Systems: A Framework for Abstract Group Argumentation

Stefan Woltran (Vienna University of Technology, Austria)

Belief Revision with Bounded Treewidth

The speakers for the **third day (Wednesday, August 26)** were:

Daniel Eckert (University of Graz, Austria)

Systematic judgment aggregators: An algebraic connection between social and logical structure"

Guillaume Aucher (Luxemburg University, Luxemburg)

BMS revisited

Andreas Herzig (IRIT, Toulouse, France)

Speech acts as announcements

Jan Broersen (University of Utrecht, The Netherlands)

Modeling the Agency in Epistemic Product Update

Leon van der Torre (Luxemburg University, Luxemburg)
Contracting norms

The speakers for the **fourth day (Thursday, August 27)** were:

Henri Prade, (Paul Sabatier University, Toulouse, France)
Similarity-based enlarging of statements for coping with
inconsistency. Part 1: Motivations and general principle

Steven Schockaert (Paul Sabatier University, Toulouse, France)
Similarity-based enlarging of statements for coping with
inconsistency. Part 2: Merging multiple source information

Guillermo Simari (Universidad Nacional del Sur, Argentina)
Argument Theory Change

Mathijs de Boer (Luxemburg University, Luxemburg)
A First Glimpse at Trust Revision

Jérôme Lang (University Paris-Dauphine, France),
Preference change triggered by belief change: a principled
approach

Isaac Levi (Columbia University, USA)
Gambling With Truth

Besides the formal talks, which were attended by all the participants, there were several discussions and active interactions among small groups of participants throughout the duration of the Workshop.

5. Conclusion

We saw the Dagstuhl Workshop as providing a forum where researchers in three broad areas (philosophy and logic, artificial intelligence and computer science, and economics and game theory) could address highly related (in some cases, the same) problems, in which work in one area could benefit research in another.

We found the Workshop successful, especially on the following two achievements: first, the seminar made participants aware of a commonality of interests across different disciplines; second, it suggested new directions for research that will probably be taken up by researchers in the next couple of years.

The organizers:

Giacomo Bonanno (University of California, USA)
James Delgrande (Simon Fraser University, Canada)
Hans Rott (Regensburg University, Germany)