



## Workshop: Rational Agency and Logic

- Date:** Friday 30 November 2018
- Venue:** Linnésalen, Kungl. Vetenskapsakademien,  
Lilla Frescativägen 4A, Stockholm
- Organizer:** The Swedish National Committee for Logic, Methodology,  
and Philosophy of Science.

The concept of rational agency is pervasive and very important in modern society and its study is a broadly interdisciplinary endeavor, bringing together humanities, social sciences, and economics (game theory). Rational agency has a range of diverse aspects, including beliefs, desires, intentions, cognition, knowledge and communication, norms, action and interaction, strategic abilities, cooperation and competition, etc. The scope and relevance of the study of rational agency and has been steadily expanding in the past few decades, also involving more technical disciplines such as computer science and artificial intelligence, where multi-agent systems of different kinds (e.g. robotic teams, computer and social networks, institutions, markets) have become a fundamental framework for modeling and analysis. The use of formal models and logic-based methods for analyzing rational agency has become increasingly popular and successful. This workshop brings together different perspectives and approaches to that study.

### Programme

- 09.30 Opening**
- 09.35 How do people reason when their opponent makes an apparently irrational first move in a centipede-like game?**  
*Rineke Verbrugge, University of Groningen, The Netherlands*
- 10.40 'Seeing to it that' logics of agency**  
*Marek Sergot, Imperial College London, UK*
- 11.45 Lunch break**
- 13.15 A Logic for Inductive Learning**  
*Alexandru Baltag, ILLC Amsterdam, The Netherlands*
- 14.20 Logic-based Strategic Reasoning in Social Context**  
*Valentin Goranko, Stockholm University, Sweden*
- 15.25 Coffee break**
- 15.45 The Creation and Change of Social Networks**  
*Sonja Smets, ILLC Amsterdam, The Netherlands*
- 16.50 End of workshop**

**Organizing committee:** Valentin Goranko, Dag Westerståhl (chair).

**Sponsors:** The Royal Swedish Academy of Sciences, the Department of Philosophy, Stockholm University.

**The event is free of charge and open to the public but registration is required. For more information and registration please visit: [www.kva.se/rationalagency](http://www.kva.se/rationalagency)**



## Abstracts

### **How do people reason when their opponent makes an apparently irrational first move in a centipede-like game?**

*Rineke Verbrugge, University of Groningen, The Netherlands*

Game theorists have proposed backward induction as the reasoning procedure that rational players follow in turn-taking games. An alternative is forward induction, in which a player rationalizes any previous apparently irrational move by the opponent.

Do people's choices in centipede-like turn-taking games fit better with backward or forward induction? In our experiments, participants played a turn-taking game against a computer, which was programmed to surprise the subject 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. Although in the aggregate, participants tend to favor the forward induction choice, their verbalized strategies usually depend on other features, such as risk aversion or cooperativeness.

### **'Seeing to it that' logics of agency**

*Marek Sergot, Imperial College London, UK*

'Stit' ('seeing to it that') logics deal with expressions of the form 'agent  $x$ , or group of agents  $G$ , sees to it that  $F$  is the case'. They have been studied extensively; there are many variations. They have also attracted some attention in computer science where they have been seen as a potentially valuable tool in the formal modelling of agent interaction. Their perceived advantages are that they provide an appropriate level of abstraction (who and what, rather than how), that they generalise naturally to talking about groups (sets) of agents, that they deal well with indeterminism, and that they provide a good account of agent responsibility, both in the sense of ' $x$  is the cause of  $F$ ' and ' $x$  ought to see to it that  $F$ '. Works in this area tend to be technical however; there are few examples of applications. I will present a series of examples to illustrate some fundamental limitations and try to identify (not always successfully) how the underlying assumptions might be adjusted in order to provide a more adequate representational formalism.



### **A Logic for Inductive Learning**

*Alexandru Baltag, ILLC Amsterdam, The Netherlands*

I present a simple logic for reasoning about the process of inductive learning from successive observations. This formalism combines ideas from Dynamic Epistemic Logics, Subset Space Logics, Formal Learning Theory, and the Topological approach to knowledge. Semantically, we take intersection spaces (a type of subset spaces that are closed under finite non-empty intersections), with points interpreted as possible worlds and neighborhoods interpreted as observations or “information states”, and enhance these structures with an AGM learner  $L$ , i.e. a function mapping every information state to a conjecture (representing the learner’s strongest belief in this state), that satisfies the AGM postulates for belief revision. At the syntactic level, we extend Subset Space Logic with dynamic observation modalities, as well as with a learning or “belief” operator. I give a complete axiomatization of this logic, study its expressivity and use it to characterize various notions of knowledge, belief, knowability and learnability. Time-permitting, I provide a topological characterization of inductive solvability of empirical problems, and use it to prove that AGM-style belief revision is “universal”: every inductively solvable problem can be solved by AGM learners. This talk is based on joint papers with Sonja Smets, Nina Gierasimczuk, Aybuke Ozgun and Ana Lucia Vargas.

### **Logic-based Strategic Reasoning in Social Context**

*Valentin Goranko, Stockholm University, Sweden*

Reasoning in social context has many important aspects, one of which is the reasoning about strategic abilities of individuals (agents) and groups (coalitions) of individuals to guarantee the achievement of their desired objectives. Various logical systems have been proposed for formalising and capturing such reasoning over the past 20 years, starting with Coalition Logic (CL) introduced and studied by Marc Pauly in the early 2000s. CL provides a natural, but somewhat one-sided perspective: the agents in the proponent coalition are viewed as acting in full cooperation with each other but in complete opposition to all agents outside of the coalition, which are treated as adversaries. The strategic interaction in real societies is much more complex, usually involving various patterns combining cooperation and competition. To capture these, more expressive and refined logical frameworks are needed. I will focus on the following two complementary leading ideas:

- i. Social friendliness: individuals and groups can aim to achieve their private goals while allowing for cooperation with the entire society.
- ii. Self-protection: individuals and groups can aim to cooperate with the society while simultaneously protecting their own private goals.

In this talk I will first present briefly Coalition Logic and then will introduce and discuss two more expressive and versatile logical systems, viz. the Socially Friendly Coalition Logic (SFCL) and the Group Protecting Coalition Logic (GPCL), respectively capturing the two ideas above. Finally, I will take a more general perspective, leading towards a unifying logic-based framework for strategic reasoning in social context.

This talk is based on a joint work with Sebastian Enqvist.



## **The Creation and Change of Social Networks**

*Sonja Smets, ILLC Amsterdam, The Netherlands*

Recently, epistemic-social phenomena have received more attention from the logic community, analyzing peer pressure, studying informational cascades, inspecting priority-based peer influence, modeling diffusion and prediction, and examining reflective social influence. In this presentation, I will contribute to this line of work and focus in particular on the logical features of social group creation. I pay attention to the mechanisms which indicate when agents can form a team based on the correspondence in their set of features (behavior, opinions, etc.). Our basic approach uses a semi-metric on the set of agents, which is used to construct a network topology. This structure is then extended with epistemic features to represent the agents' epistemic states, allowing us to explore group-creation alternatives where what matters is not only the agent's differences but also what they know about them. The logical settings in this work make use of the techniques of dynamic epistemic logic to represent group-creation actions, to define new languages in order to describe their effects, and to provide sound and complete axiom systems. This talk is based on recent joint work with Fernando Velazquez Quesada at the University of Amsterdam.