| Time | Monday | | Tuesday | | Wednesday | | Thursday | | Friday | |
|---|---|---|---|---|---|---|---|---|---|---|
| 9:00-10:45 | Registration (from 8:30) and Welcome Session (9:30-10:00) | | Agents in Organisations: Autonomy, Regulation and Interaction | Argumentation for Agent Societies | Agent-Oriented Programming Languages | Multiagent Constraint Programming | Coordination of Multi-Robot Teams | Stability in Systems with Self-Interested Agents | Robots in Multiagent Systems Research | Dialectics in Multiagent Interaction |
| 11:15-13:00 | Introduction to Autonomous Agents and Multiagent Systems (10:00-11:15 and 11:45-13:00) | | Agent-Based Social Simulation | Temporal Constraint Methods for Autonomous Scheduling | Organisation and Environment Oriented Programming | Towards Industrial Application of Multiagent Systems | Agent Technologies for Energy Systems | Logics of Action and Agency | Robots in Multiagent Systems Research | Dialectics in Multiagent Interaction |
| 13:00-14:30 | Lunch | | Lunch | | Lunch | | Lunch | | Lunch | |
| 14:30-16:15 | Agents in Organisations: Autonomy, Regulation and Interaction | Argumentation for Agent Societies | Student Session | | Social event (TBA) | | Student Session | | Coordination of Multi-Robot Teams | Stability in Systems with Self-Interested Agents |
| 16:45-18:30 | Agent-Based Social Simulation | Temporal Constraint Methods for Autonomous Scheduling | Agent-Oriented Programming Languages | Multiagent Constraint Programming | | | Organisation and Environment Oriented Programming | Towards Industrial Application of Multiagent Systems | Agent Technologies for Energy Systems | Logics of Action and Agency |
| 18:30-19:30 (TBC) | | | Labs: Agent-Oriented Programming Languages | | | | Labs: Organisation and Environment Oriented Programming | | | |
| Evening | Welcome reception | | | | Gala dinner | | | | | |

# EASSS 2011 Tutorial's descriptions:

### Introduction to Autonomous Agents and Multiagent Systems

*Simon Parsons*

**Abstract:**

This lecture will provide a brief introduction to the field of autonomous agents and multiagent systems. Starting from the question "what is an agent?", the lecture will identify the major issues that have to be resolved in order to create both individual agents and multiagent systems. Each of these issues will be reviewed in terms of the requirements it places on an agent, important (partial) solutions that have been suggested, the state of the art, and what open questions remain.

**Tutor:**

Simon Parsons is a Professor of Computer Science at Brooklyn College, City University of New York (CUNY), where he is co-director of the Agents Lab and the director of the graduate program. he received his PhD in 1993 from the University of London, and took his first faculty job two years later. He worked at the University of London, the University of Liverpool and MIT before moving to CUNY in 2002. His research interests center on multiagent systems, including the areas of argumentation, agent interaction, and decision-making. He has published over 200 papers on these topics, and is the editor of the *Knowledge Engineering Review*. He has received multiple grants from the National Science Foundation, and other funding from the US Army Research Lab.

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### Agents in Organisations: Autonomy, Regulation and Interaction

*Frank Dignum, Huib Alderwereld, Virginia Dignum and Birna van Riemsdijk*

**Abstract:**

In recent years, social and organisational aspects of agency have become a major issue in MAS research. Recent applications of MAS on Web Services, Grid Computing, Gaming and Ubiquitous Computing enforce the need of using these aspects in order to ensure some social order within these systems. One of the ways to assure such a social order is through so-called *multiagent organisations*. In many situations, organisations are designed to facilitate and guide some desired specific global behaviour. One way to achieve this is by using the organisation as a design concept that guides the programming of the agents such that they have goals that achieve objectives of the organisation, they have constraints on their plans such that they follow organisational rules and they have protocols that allow them to communicate with the appropriate agents in the organisation. However, individual participants are assumed to be autonomous to decide on their participation in the organisation and they may behave in non-expected ways, i.e., they do not always have to behave in accordance with the rules of the organisation. Sometimes this may be because they prefer their own goals over organisational objectives, but this might also be caused by the fact that the agent has local knowledge that indicates that organisational objectives are better served by breaking some general rules. This kind of behaviour can only be generated if we represent the organisation explicitly and agents are able to reason about it. However, there is still a lack of a comprehensive methodology and framework for how to put these concepts in practice, i.e., how to program them. This tutorial aims at giving an answer to such questions.

**Tutors:**

Frank Dignum is associate professor at the department of Information and Computing Sciences of Utrecht University. He got his PhD in 1989 from the Free University in Amsterdam. He set up

the CS department at the University of Swaziland, taught at the Technical University of Lisbon, has been assistant professor at the Technical University of Eindhoven before becoming associate professor in Utrecht. His main research is in social aspects of agent systems. He has written many papers about theoretical topics such as norms and agent communication, but also has written about practical issues of using agent systems. He has led many (European) projects in the area, has organised workshops and conferences and has given tutorials all over the world. He has given previous tutorials at EASSS on agent communication, electronic commerce and games and agents.

Huib Aldewereld is researcher at the Department of Information and Computing Sciences, Utrecht University. He got his PhD in 2007 from Utrecht University on the topic of norms and institutions for agent systems. He has since worked at Maastricht University and now again at Utrecht University as researcher in the fields of distributed plan diagnosis, organising webservice-based systems, and organisations for scheduling and planning.

Virginia Dignum is senior researcher and assistant professor at the Department of Technology, Policy and Management, Delft University of Technology. She got her PhD in 2004 from Utrecht University. Previously, she worked for more than 12 years in consultancy and system development in the areas of expert systems and knowledge management. Her research focuses on agent-based models of organisations, in particular on the dynamic aspects of organisations, and the applicability of agent organisations to support knowledge creation, sharing and representation in distributed environments. She has organised many international workshops, and was co-organiser of AAMAS-2005.

Birna van Riemsdijk is assistant professor in the Man-Machine Interaction group at Delft University of Technology. Until September 2008, she was a postdoc in the Programming and Software Engineering group at Ludwig-Maximilians-University in Munich, and she obtained her PhD in the Intelligent Systems group at Utrecht University. She has done research in the areas of agent programming and service-oriented systems, and is currently working on programming languages for organisation-aware agents, i.e., agents that can reason about the organisation in which they are participating. She is a member of the steering committee of the International Workshop on Declarative Agent Languages and Technologies (DALT), and has been a co-chair of this workshop several times. She is a PC member for numerous international workshops and conferences in the field of agent technology and intelligent systems.

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### Logics of Action and Agency

*Andreas Herzig and Emiliano Lorini*

**Abstract:**

Action and agency are fundamental concepts in multiagent systems, where one says that an individual $i$ is agentive for a certain outcome $\phi$ if $i$ has triggered an action that achieves $\phi$, whatever the other agents do. From these two concepts other concepts can be defined, such as the capability of an agent and of a coalition of agents to achieve some outcome. We will present three families of logics that allow us to reason about action and agency: (1) logics of programs and actions (Propositional Dynamic Logic PDL); (2) logics of ability (Pauly's Coalition Logic CL and Alur et al.'s Alternating-Time Temporal Logic ATL); (3) logics of agency (Belnap's logic of "seeing to it that" STIT and Kanger and Pörn's "bringing it about" logic). These families will be introduced and their relationship explained. We will also discuss the choices of the linguistic primitives and semantics, and present translations and computational properties.

**Tutors:**

Andreas Herzig is a research director at the French Centre National de Recherche Scientifique (CNRS) since 2004 and works at the Institut de Recherche en Informatique de Toulouse (IRIT). He

works on the logical analysis of multiagent systems, investigating key concepts in that domain such as action and agency, knowledge and belief, goals and intentions, emotions and trust. He has published papers on dynamic logic and dynamic epistemic logics and their application in reasoning about actions, on STIT logic and its relation with CL and ATL, on Cohen and Levesque's logic of intention, on the logic of emotions of the theory of Ortony, Clore and Collins, and on Castelfranchi and Falcone's theory of cognitive trust.
Emiliano Lorini is a full-time researcher at the French Centre National de Recherche Scientifique (CNRS) since 2009 and works at the Institut de Recherche en Informatique de Toulouse (IRIT). He focuses his research on the application of formal methods to modelling autonomous agents and multiagent systems. He has published several journal and conference papers on different topics in this area such as: BDI logic, game theory, logic of agency and cooperation, logic of collective attitudes (common belief, collective acceptance), deontic logic, theory of emotions, theory of trust and reputation, theory of institutions.

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### Dialectics in Multiagent Interaction

*Katarzyna Budzynska and Chris Reed*

**Abstract:**

This tutorial introduces the means by which knowledge structures are executed, created and navigated through processes of dialectical games between agents. In contrast to abstract argumentation systems, detailed structures of reasons, justifications and autonomously constructed proofs focus on the detailed internal composition of reasoning and represent a rapidly expanding area of research in ontology development, multiagent communication and automated reasoning. Their connection to dialogue is of crucial importance in the development of accounts of agent reasoning and agent interaction in both theory and practice. The tutorial begins by reviewing both foundations and recent results in both argumentation theory and rhetoric, and also computational models of argument in multiagent systems and AI more broadly, excluding the large body of work on abstract argumentation. For this, we will draw heavily on the recent COMMA conferences and the new *Journal of Argument & Computation*. The tutorial then develops more depth in understanding of the design, specification, implementation and verification of dialectics supported by examples from philosophy and computer science. The tutorial is also designed to have a strong element of practical work to give students a deeper understanding of the key concepts that are introduced. Finally, the tutorial examines in depth recent advances in theoretical and ontological accounts of the connection between dialogues and structured arguments. For this, the Argument Interchange Format will be used as a representational background and the tutorial will end by covering the very recent development of Inference Anchoring Theory for capturing the illocutionary connection between speech acts in dialogues and the knowledge structures that they yield.

**Tutors:**

Katarzyna Budzynska is an assistant professor in the Department of Logic at Cardinal Stefan Wyszynski University and in 2009-2010 was a visiting scholar in the Argumentation Research Group at the University of Dundee. Her research interests concentrate on the structure of communication (in particular, speech acts, argument-based communication) and the formal modelling of cognitive processes (in particular, with the use of modal systems such as epistemic or dynamic logic). She has cooperated with linguists, logicians and computer scientists in interdisciplinary projects on argumentation. The projects have delivered a logic-based verification tool for persuasive multiagent systems, Perseus, a tool for the analysis of argument structure, Araucaria-PL, and a Polish online corpus ArgDB-pl.

Chris Reed is Professor of Computer Science and Philosophy at the University of Dundee in Scotland, where he heads the Argumentation Research Group. He has been working at the overlap between argumentation theory and artificial intelligence for over a decade, and has over 100 peer-reviewed papers in the area. In 2000 he co-organised the Symposium on Argument and Computation which kick-started new collaborations and led to a book, Argumentation Machines. More recently he has also published a monograph on Argumentation Schemes with Cambridge. He has also been instrumental in the development of the Argument Interchange Format, an international standard for computational work in the area, and is a founding editor of the *Journal of Argument & Computation*.

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### Argumentation for Agent Societies

*Massimiliano Giacomin and Serena Villata*

**Abstract:**
The role of argumentation theory in supporting various forms of interaction among autonomous agents has been explicitly recognised in the literature. In argumentation theory, Dung's framework provides a general unifying view able to encompass most of the existing approaches to argumentation. This high level of generality is achieved by leaving unspecified the origin and the structure of arguments, and by modelling the interaction between them simply as a binary relation indicating that an argument attacks another one, making it possible to focus exclusively on semantics issues. In the first part of the tutorial, the proposals for a semantics that can be considered traditional (including stable, grounded and preferred semantics), all of them relying on the notion of admissibility, will be briefly reviewed and the relevant properties will be examined. The definition of some general principles for evaluating and comparing argumentation semantics will be also discussed, and a number of recent proposals will be introduced and evaluated with respect to such criteria. The aim of the second part of the tutorial is to introduce participants to the recent developments of the argumentation models for application in agent reasoning and communication. We will describe recent extensions to Dung's framework developed to facilitate flexible and adaptive agent reasoning over conflicting beliefs, goals, and decision making over action. In argumentation, conflict management is carried out by the formal process of defeat status computation. The tutorial will consider the generalisation of this process to a distributed multiagent setting.

**Tutors:**

Massimiliano Giacomin is associate professor in Information Processing Systems at the Department of Information Engineering of the University of Brescia (Italy). He received the PhD degree in Information Engineering from the University of Brescia in 2002. He is author of more than 50 scientific papers in various fields of Artificial Intelligence, such as knowledge representation and automated reasoning (in particular, argumentation theory, fuzzy constraints, temporal reasoning), agents and multiagent systems. He served as a reviewer for various scientific journals and conferences, and was member of the program committee of several international conferences. In 2006, he won the "Marco Somalvico" Artificial Intelligence prize sponsored by the Italian Association for Artificial Intelligence (AI*IA) for significant results obtained in the field by a young Italian researcher.

Serena Villata is a research assistant at the Department of Computer Science of the University of Turin, where she obtained her PhD in 2010, with a thesis on argumentation theory, and in particular on the meta-argumentation methodology applied to problems from the field of multiagent systems. She has focused her research interests mainly on artificial intelligence, multiagent systems and argumentation theory, in particular on cooperation and norms, on

dialogue and ontologies. She was chair of the Student Session of the 12th European Agent Systems Summer School (EASSS-2010).

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### Stability in Systems with Self-Interested Agents

*Maria Polukarov*

**Abstract:**

Multiagent systems with self-interested agents are traditionally modelled as a non-cooperative games, where players strategically optimise their own utility functions. This tutorial will begin by briefly introducing students to some basic game-theoretic concepts, and will lead them to an understanding of what a stable outcome of a game is, and how agents can be made to achieve one. In particular, we will focus on the concept of a pure strategy Nash equilibrium (PSNE), in which each agent plays a certain strategy, and no one has an incentive to unilaterally change it. Such outcomes are highly desirable, since, from a system-wide perspective, they imply that a system has a deterministic stable state. This is necessary in a range of control problems where randomised strategies are not appropriate (e.g., in industrial processing or transport applications). Also, unlike mixed strategy and correlated equilibria, PSNE do not rely on the assumption that agents have the capacity to accurately randomise their actions according to an equilibrium prescription. We will introduce some important classes of non-cooperative games with pure strategy equilibria, putting the emphasis on computational aspects of achieving such stable outcomes (including centralised algorithms and natural decentralised dynamics). The main focus will be on congestion (potential) games and some of their recent generalisations. Finally, we will discuss how equilibrium dynamics traditionally studied in these settings can be applied in other domains (e.g., voting games).

**Tutor:**

Maria Polukarov is a lecturer in the School of Electronics and Computer Science of the University of Southampton, UK. She received her PhD in Operations Research from the Technion, the Israel Institute of Technology, in 2007. Her research interests lie at the border of operations research, computer science and economics, with an emphasis on algorithms, combinatorial optimisation, game theory, mechanism design and social choice theory. She is particularly interested in the recently developed area of Algorithmic Game Theory, which is connected to problems motivated by the Internet and other decentralised computer networks, and multiagent systems. Most of her work in the last few years has focused on optimisation problems and algorithmic questions that arise in this context, such as computation of equilibria, coalition formation, resource allocation or operational logistics solutions.

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### Multiagent Constraint Programming

*Boi Faltings, Thomas Léauté and Brammert Ottens*

**Abstract:**

Constraint Programming has been applied with great success to solve complex configuration and scheduling problems. Many of these problems also occur in settings involving multiple agents that each have information or control over different parts of the problem. This brings about issues of compatible problem modelling, elicitation of constraints and preferences, privacy, and incentives for collaboration. In this tutorial, we give an overview of work on constraint satisfaction and optimisation with multiple agents. We present the different types of algorithms for Distributed Constraint Optimisation (DCOP), focusing on the trade-offs between runtime, information exchange and memory requirements. We show how privacy constraints can

be satisfied through such distributed algorithms and multiparty computation. We give examples where multiagent constraint programming could be applied, and thus deduce a set of open issues.

**Tutors:**

Boi Faltings is a full professor of computer science at the Ecole Polytechnique Fédérale de Lausanne (EPFL), where he heads the Artificial Intelligence Laboratory. His main research contributions are in the area of qualitative and model-based reasoning, case-based reasoning, constraint programming, and distributed problem solving. He has co-founded 5 companies in e-commerce and computer security and acted as advisor to several other companies worldwide. He has published over 300 refereed papers and graduated over 25 PhD students, several of which have won national and international awards. His standing is recognised by regular membership in the program committees of the most selective conferences in the field, including IJCAI, AAAI and ECAI, as well as associate editor positions in the two most prestigious journals, the *Artificial Intelligence Journal* (2001-2008) and the *Journal of Artificial Intelligence Research* (2005-2007). Since 2002, he is a fellow of the European Coordinating Committee for Artificial Intelligence.

Thomas Léauté is a PhD student under the supervision of Boi Faltings at EPFL. He holds a double degree of Engineer from Ecole Centrale Paris and Master of Science in Aeronautics and Astronautics from MIT, where he wrote his Master's thesis entitled "Coordinating Agile Systems through the Model-Based Execution of Temporal Plans", under the supervision of Brian Williams. After a short industrial stint at the European Space Agency Center in Darmstadt, Germany, he joined the EPFL Artificial Intelligence Laboratory in 2006. His thesis work is on Distributed Constraint Optimisation, focusing on the two issues of providing strong privacy guarantees and reasoning under stochastic uncertainty. He is a principal developer for the FRODO platform.

Brammert Ottens is a PhD student under the supervision of Boi Faltings at EPFL. He holds a Master's degree in both Artificial Intelligence and Logic from the University of Amsterdam. Towards his degree in Artificial Intelligence he wrote a thesis entitled "A Logical Viewpoint on Mathematical Morphology" under the supervision of Marco Aiello. Towards his degree in Logic he wrote a thesis on "The Winner Determination Problem for Mixed Multi-Unit Combinatorial Auctions" under the guidance of Krzysztof Apt and Ulle Endriss. He currently works in the EPFL Artificial Intelligence Laboratory on Distributed Constraint Optimisation with a focus on agent autonomy. He also is a principal developer for the FRODO platform.

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## Temporal Constraint Methods for Autonomous Scheduling

*Cees Witteveen*

**Abstract:**

When several autonomous actors are involved in making a joint schedule for a set of tasks, they like to take into account their own objectives and resources. In order to prevent conflicts that might result from incompatible constraints imposed by these actors, coordination mechanisms have to be provided. After a general overview of coordination mechanisms and their properties, we discuss a coordination mechanism that ensures a conflict-free joint schedule and allows each actor to schedule its part of the task independently from the others. This mechanism ensures autonomous scheduling even when the original job specifies temporal dependencies between tasks allocated to different agents and can be used if communication between the agents during scheduling is impossible or unwanted. We introduce this method by first discussing the main features of temporal constraint networks such as Simple Temporal Networks to specify (distributed) task scheduling problems. Then we discuss temporal decoupling techniques in detail and discuss some quality measures for them, like the price of autonomy and the price of

flexibility. Finally, we discuss an application of this technique to the scheduling of ground handling service providers at airports.

**Tutor:**

Cees Witteveen studied psychology and mathematics at Utrecht University. Currently, he is a full professor in Algorithmics at the Faculty of Electrical Engineering, Mathematics and Computer Science of TU Delft. His research interests are the design, analysis and evaluation of coordination algorithms in distributed systems with autonomous actors. He has published more than 150 refereed papers and journal articles in this field. He has been project leader of more than 15 research projects (in cooperation with other universities as well as industry) on plan coordination in multiagent systems, plan diagnosis and incident management, hybrid computing, maintenance scheduling, and computational complexity.

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## Agent-Oriented Programming Languages

*Mehdi Dastani and João Leite*

**Abstract:**

With the significant advances in the area of autonomous agents and multiagent systems in the last few years, promising technologies have emerged as a sensible alternative for the development and engineering of multiagent systems. The result is a variety of programming languages, execution platforms, and tools that facilitate the development and engineering of multiagent systems. This tutorial will give a broad overview of the programming languages, techniques, and tools that are currently available to support the effective implementation of multiagent systems, and participants will learn and practice some basic skills in developing multiagent systems. Topics to be covered include a very brief presentation of how agent-oriented software engineering methodologies can be related to agent-oriented programming languages; an overview of the research agenda in programming languages for multiagent systems; description and discussion of various well-known agent languages such as 2APL, 2OPL, Jason, GOAL, Jadex, Jade, Jack and Minerva; and some typical agent-based applications. This tutorial will be prepared for beginners in the area of agent-oriented programming, but requires some basic notions of BDI agents and logic programming. A hands-on approach will be used to allow participants practice basic skills to implement a multiagent system by means of a well-structured exercise.

**Tutors:**

Mehdi Dastani is a lecturer in computer science at Utrecht University. He is working in the area of multiagent systems and multiagent programming and has published many papers on these subjects. He has been involved in the design, development, and extensions of BOID, 3APL, 2APL, and 2APL languages which can support the implementation of multiagent systems. He has given many courses on these subjects, among which Intelligent Information Agents, Multiagent Systems, and Multiagent Programming. He is a member of the steering committee of ProMAS (The International Workshop on Programming Multi-Agent Systems: Languages and Tools). He is PC member of various international conferences and workshops such as AAMAS, IJCAI, ECAI, JELIA, and MATES. He has edited, together with the ProMAS organisers, two books on Programming Multi-Agent Systems published by Springer.

João Leite is Assistant Professor at the Computer Science Department at the New University of Lisbon. His research interests focus on Knowledge Representation and Non-Monotonic Reasoning with Logic Programming for Multiagent Systems. He has been involved in the design of several extensions of Answer Set Programming for Agent Systems, such as EVOLP, DLP, MDLP and KABUL, and the logic programming based agent architecture Minerva. He has co-organised several editions of the CLIMA, LADS and DALT workshops, he was conference chair of the Ninth

International Conference on Logics in Artificial Intelligence (JELIA-2004), held in Lisbon, and he was organiser of EASSS-2008, held in Caparica, Portugal in May 2008. He has authored one book, edited several books published by Springer and three journal special issues, and co-authored more than 60 scientific papers published internationally.

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### Organisation and Environment Oriented Programming

*Jomi Hübner and Alessandro Ricci*

**Abstract:**

The aim of this practical tutorial is to teach the basic aspects of Multiagent Systems (MAS) programming using an holistic/systemic approach, focusing on two of the four main design and programming dimensions of MAS, namely the environment dimension and the organisation dimension. To this end, we will combine state-of-the-art technologies and platforms. Moise, and CArtAgO will be used as examples of platforms to show the concepts in practice. The course will introduce the relevant techniques and then provide a lab session for students to have hands-on experience of fully-fledged MAS programming, developing a simple case study by integrating and combining environment and organisation oriented programming technologies with agent-oriented technologies.

**Tutors:**

Jomi Hübner is an Associate Professor at University of Santa Catarina (Brazil). His research interests are MAS organisation and tools to develop BDI-based systems. The main projects he is co-developing are MOISE+ (an organisational model and infrastructure), Jason (an interpreter of a language for BDI agents), and ForTrust (a model for agent reputation). He organised the Iberoamerican Workshop on Multi-Agent Systems, held in IBERAMIA-2006, COIN-2008, held with AAMAS-2008, and LADS-2010, held with MALLOW-2010. He has served on the programme committees of major conferences and workshops in multiagent systems and more generally in artificial intelligence, including AAMAS, EUMAS, ProMAS, COIN, AT2AI, LADS, SBIA, RFIA, APLSA and SEAS.

Alessandro Ricci is a research associate at DEIS (Department of Electronics, Informatics and Systems), Alma Mater Studiorum / Università di Bologna and a lecturer at the Second Faculty of Engineering, located in Cesena. After working on coordination models and infrastructures for multiagent systems, his main research activities currently concern multiagent oriented programming, environment-oriented programming and agent-oriented computing, investigating agents and MAS as a paradigm for general-purpose computer programming and software engineering. He has been co-organiser of several international events, including AT2AI-6 (Sixth International Workshop "From Agent Theory to Agent Implementation"), at AAMAS-2008, ProMAS-2007 (International Workshop on Programming Multi-Agent Systems) at AAMAS-2007, the Special Track of Coordination Models, Languages and Applications at the SAC ACM Conference 2007, and ESAW-2006 (International Workshop on Engineering Societies in the Agents World).

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### Agent-Based Social Simulation

*Frédéric Amblard*

**Abstract:**

The tutorial will introduce first the main concepts used for classical modelling and simulation and the related methodology. Then, based on concrete examples, we will present the agent-based approach and the important differences between this approach and the classical

modelling and simulation perspectives. We will then present recent tools developed to deal with agent-based simulation (either for participative modelling or for experimental designs). The tutorial will use specifically models on opinion dynamics and social network evolution as examples to illustrate the concepts and approach.

**Tutors:**

Frédéric Amblard is a lecturer at the Social Sciences University Toulouse 1 and researcher at the IRIT Laboratory for Computer Sciences in the Cooperative Multiagent Systems (SMAC) team. He defended his PhD thesis in 2003 at the Cemagref research institute working on tools and methodologies to understand agent-based simulations with applications to opinion dynamics. He then obtained a postdoc position at the Theoretical Physics Laboratory of the ENS Ulm working on community detection in social networks, and later was recruited in Toulouse. His main research interests are the use of agent-based social simulation for the modelling of social networks dynamics and evolution, and he is also involved in several projects on the use of simulation for the integrated assessment of public policies, in particular for water management.

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### Robots in Multiagent Systems Research

*Elizabeth Sklar and Simon Parsons*

**Abstract:**

Robots have always been prototypical agents. They are situated in the physical world and have all the classic problems of noisy sensors and imprecise actuators. However, until recently, to be a robotics researcher you had to be a "real" engineer with an advanced degree in electrical and/or mechanical engineering and a big lab filled with computers, soldering irons, a drill press and a lathe. Today, you only have to be an eight-year-old child with a PC and a penchant for playing with LEGO. Just as the trend in computer hardware has evolved over the last 50 years from immense machines that took up entire rooms to powerful microprocessors that literally fit in the palm of your hand, robots have gotten smaller, faster and cheaper. Through off-the-shelf robot kits, like the LEGO Mindstorms or the Surveyor SRV-1, agent researchers today have access to robotic hardware much more easily than in the past. This tutorial describes the use of robotics kits for multiagent systems research. The tutorial includes a review of current such applications, instruction and hands-on experiences for attendees, and details of the presenters' usage of robot kits in their own research.

**Tutors:**

Elizabeth Sklar is an Associate Professor of Computer Science at Brooklyn College, City University of New York (CUNY), where she is co-director of the Agents Lab. She received her PhD in Computer Science from Brandeis University in 2000, and taught at Boston College and Columbia University before coming to CUNY. Her research interests include multiagent simulation, human/multi-robot teams, interactive learning systems, and educational robotics. She has published nearly 100 papers on these topics, and has received multiple grants from the National Science Foundation. She regularly serves on program and organising committees for international conferences in the areas of artificial intelligence and agent-based systems.

Simon Parsons is a Professor of Computer Science at Brooklyn College, City University of New York (CUNY), where he is co-director of the Agents Lab and the director of the graduate program. He received his PhD in 1993 from the University of London, and took his first faculty job two years later. He worked at the University of London, the University of Liverpool and MIT before moving to CUNY in 2002. His research interests center on multiagent systems, including the areas of argumentation, agent interaction, and decision-making. He has published over 200 papers on these topics, and is the editor of the *Knowledge Engineering Review*. He has received

multiple grants from the National Science Foundation, and other funding from the US Army Research Lab.

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## Coordination of Multi-Robot Teams

*Luís Paulo Reis and Nuno Lau*

**Abstract:**

Robotics is one of the most important applications fields of agent technology. The dynamic and unforeseen nature of most robotics environments, especially for teams of mobile robots, has fostered the use of agent-based architectures for the development of multi-robot teams. This tutorial will focus on the development of coordination techniques that enable teams of robots to accomplish complex tasks in dynamic environments. Specifically, the tutorial will address the structure of the coordination model, communication between the robotic agents, cooperative sensor fusion, reactivity and deliberation, and flexible plans/setplay execution and monitoring. The tutorial will emphasise cooperative robotics and its application in the RoboCup domain, but general coordination frameworks and applications will also be addressed.

**Tutors:**

Luís Paulo Reis is an Assistant Professor and a member of the Directive Board of the Artificial Intelligence and Computer Science Lab at the University of Porto, Portugal. He received his Electrical Engineering and MSc degrees from the University of Porto in 1993 and 1995, and a PhD in Artificial Intelligence at the same University in 2003. HE is one of the team leaders of the FC Portugal team that has been three times World Champion at RoboCup (simulation leagues). He was also a member of the 5DPO Small-Size and Middle-Size League teams, which were three times European Champions at RoboCup. His research interests include Intelligent Robotics, Artificial Intelligence, Multiagent Systems (MAS), Coordination in MAS and Intelligent Simulation. He is the author of more than one hundred publications in international conferences and journals and has supervised 5 PhD theses and more than 50 MSc thesis to completion, and is currently supervising 15 PhD theses.

Nuno Lau is an Assistant Professor at Aveiro University, Portugal. He received his Electrical Engineering Degree from Oporto University in 1993, a DEA degree in Biomedical Engineering from Claude Bernard University, Lyon, France in 1994 and the PhD from Aveiro University in 2003. He is one of the team leaders of FC Portugal team that has been three times World Champion at RoboCup (simulation leagues). He is also a member of the CAMBADA Middle-Size League team which has also been RoboCup World Champion. His research interests include Intelligent Robotics, Artificial Intelligence, Multiagent Systems and Simulation. He has given courses on Distributed Artificial Intelligence, Intelligent Robotics, Computer Architecture, Programming, etc. He is the author of more than seventy publications in international conferences and journals.

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## Agent Technologies for Energy Systems

*Alex Rogers*

**Abstract:**

Mitigating the worst effects of global climate change, and ensuring energy security in the face of dwindling oil and gas reserves, requires a radical change in the way in which energy is generated, distributed and consumed. Addressing this challenge requires future energy systems (such as smart electricity grids) to be capable of autonomously and intelligently configuring themselves to make the most efficient use of available resources while satisfying the diverse

preferences and constraints of the system's participants. These requirements naturally lend themselves to a multiagent systems methodology, and thus, this tutorial will introduce the challenges posed by this important and exciting application domain, and discuss how agent technologies, such as coalition formation, distributed constraint optimisation, mechanism design and game theory, and agent-based simulation might be used to address them.

**Tutor:**

Alex Rogers is a Reader in the School of Electronics and Computer Science at the University of Southampton in the UK. His research seeks to develop and apply agent-based algorithms and mechanisms for the control of decentralised systems, particularly decentralised information systems such as sensor networks and future energy networks such as the smart grid. He is the principal and co-investigator of projects totalling over £7M in these areas, and he is the organiser of the AAMAS Workshop on Agent Technologies for Energy Systems.

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### Towards Industrial Application of Multiagent Systems

*Michal Pechoucek*

**Abstract:**

This application-oriented tutorial will provide an introduction to the world of multiagent applications and various known cases of industrial deployment. We will systematically analyse the potential of the functionality and capability supported by multiagent systems research and agent-based computing such as multiagent planning, distributed resource allocation, diagnosis and multiagent learning, trust and reputation systems, or multiagent programming with respect to applicability in industrial practice. This analysis will be documented via existing multiagent applications in the areas of logistics, manufacturing, air traffic, and power engineering. Special attention will be devoted to the concept of multiagent simulation as an enabler of early adoption of the listed multiagent concepts. We will discuss the particular challenges such as scalability, fidelity and mixed simulation. Detailed technical demonstration of multiagent applications developed at the Agent Technology Center will be provided.

**Tutor:**

Michal Pechoucek is a full professor in cybernetics (equivalent to computer science) at the Czech Technical University (CTU), Vice-Chairman of the Department of Cybernetics, and Head of the Agent Technology Center, which he has been continuously building since 2000. His research interests lie mainly in the fields of multiagent simulation and modelling, coordination, multiagent planning and applications of agent-based computing to security-related applications, UAV robotic coordination, air-traffic control and mixed-mode urban traffic applications.