

# 09121 Abstracts Collection

## Normative Multi-Agent Systems

— Dagstuhl Seminar —

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**Abstract.** From 15.03. to 20.03.2009, the Dagstuhl Seminar 09121 “Normative Multi-Agent Systems ” was held in Schloss Dagstuhl – Leibniz Center for Informatics. During the seminar, several participants presented their current research, and ongoing work and open problems were discussed. Abstracts of the presentations given during the seminar as well as abstracts of seminar results and ideas are put together in this paper. The first section describes the seminar topics and goals in general. Links to extended abstracts or full papers are provided, if available.

**Keywords.** Similarity-based clustering and classification, metric adaptation and kernel design, learning on graphs, spatiotemporal data

## Robust Normative Systems

*Thomas Agotnes (Bergen University College, NO)*

Although normative systems, or social laws, have proved to be a highly influential approach to coordination in multi-agent systems, the issue of *compliance* to such normative systems remains problematic. In all real systems, it is possible that some members of an agent population will not comply with the rules of a normative system, even if it is in their interests to do so. It is therefore important to consider the extent to which a normative system is *robust*, i.e., the extent to which it remains effective even if some agents do not comply with it. We formalise and investigate three different notions of robustness and related decision problems.

We begin by considering sets of agents whose compliance is necessary and/or sufficient to guarantee the effectiveness of a normative system; we then consider quantitative approaches to robustness, where we try to identify the proportion

of an agent population that must comply in order to ensure success, and finally, we consider a more general approach, where we characterise the compliance conditions required for success as a logical formula.

*Keywords:* Normative systems, robustness, fault tolerance, complexity

*Joint work of:* Agotnes, Thomas; van der Hoek, Wiebe; Wooldridge, Michael

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1897>

## **What do Agent-Based and Equation-Based Modelling Tell us about Social Conventions?**

*Giulia Andrighetto (ISTC - CNR - Rome, IT)*

Ten years ago, during MABS'98, H. Van Dyke Parunak, Robert Savit and Rick L. Riolo discussed the similarities and differences between the Agent-Based Modelling (ABM) and the Equation-Based Modelling (EBM), developing criteria for selecting one or the other approach. The authors concluded that a distinction between them must be made case by case on the basis of practical considerations. In this work we will present and confront some simulation-based and analytical results on the emergence of steady states in a class of coordination games, the congestion games. In particular, our study focuses on the emergence of steady states in traffic-like interactions, drawing on Sen and Airiau's study of the emergence of the precedence rule. We show that, in contrast with Parunak-Savit-Riolo conclusions, in congestion games we should use an integrated approach, mixing the ABM and the EBM frameworks. A crucial feature concerns organization: simulation results are organized in some hierarchical structure since they are generated by our algorithms. For example, in our model, results incorporate peculiar symmetries: i.e. equivalent strategies cannot coexist, while non-equivalent ones can. We endeavor to explicate these symmetric results using EBM.

*Keywords:* Agent based modelling, conventions, equation based modelling

*Joint work of:* Andrighetto, Giulia; Cecconi, Federico; Campenni, Marco; Conte, Rosaria

## **Normal = Normative? The Role of Intelligent Agents in Norm Innovation**

*Giulia Andrighetto (ISTC - CNR - Rome, IT)*

In this paper the results of several agent-based simulations, aiming to test the role of normative beliefs in the emergence and innovation of social norms, are presented and discussed.

Rather than mere behavioral regularities, norms are here seen as behaviors spreading to the extent that and because the corresponding commands and beliefs do spread as well. On the grounds of such a view, the present work will endeavour to show that a sudden external constraint (e.g. a barrier preventing agents from moving among social settings) facilitates norm innovation: under such a condition, agents provided with a module for telling what a norm is can generate new (social) norms by forming new normative beliefs, irrespective of the most frequent actions.

*Keywords:* Norm emergence, agent based simulation

*Joint work of:* Andrighetto, Giulia; Cecconi, Federico; Campenni, Marco; Conte, Rosaria

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1898>

## Dynamic Context Logic and its Application to Norm

*Guillaume Aucher (University of Luxembourg, LU)*

Building on a simple modal logic of context, the paper presents a dynamic logic characterizing operations of contraction and expansion on theories.

We investigate the mathematical properties of the logic, and use it to develop an axiomatic and semantic analysis of norm change in normative systems. The proposed analysis advances the state of the art by providing a formal semantics of norm-change which, at the same time, takes into account several different aspects of the phenomenon, such as permission and obligation dynamics, as well as the dynamics of classificatory rules.

*Keywords:* Context logic, norm change, deontic logic

*Joint work of:* Aucher, Guillaume; Grossi, Davide; Herzig, Andreas; Lorini, Emiliano

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1900>

## A Taxonomy for Ensuring Institutional Compliance in Utility Computing

*Tina Balke (Universität Bayreuth, DE)*

With the ongoing evolution from closed to open distributed systems and the lifting of the assumption that agents acting in such a system do not pursue own goals and act in the best interest of the society, new problems arise. One of them is that compliance cannot be assumed necessarily and consequently trust issues arise. One way of tackling this problem is by regulating the behavior of the

agents with the help of institutions. However for institutions to function effectively their compliance needs to be ensured. Using a utility computing scenario as sample application, this paper presents a general applicable taxonomy for ensuring compliance that can be consulted for analyzing, comparing and developing enforcement strategies and hopefully will stimulate research in this area.

*Keywords:* Institutions, Compliance, Enforcement, Regimentation, Norms, Sanctions, Utility Computing

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1901>

## **Normative Systems in Computer Science - Ten Guidelines for Normative Multiagent Systems**

*Guido Boella (University of Torino, IT)*

In this paper we introduce and discuss ten guidelines for the use of normative systems in computer science. We adopt a multiagent systems perspective, because norms are used to coordinate, organize, guide, regulate or control interaction among distributed autonomous systems.

The first six guidelines are derived from the computer science literature.

From the so-called 'normchange' definition of the first workshop on normative multiagent systems in 2005 we derive the guidelines to motivate which definition of normative multiagent system is used, to make explicit why norms are a kind of (soft) constraints deserving special analysis, and to explain why and how norms can be changed at runtime. From the so-called 'mechanism design' definition of the second workshop on normative multiagent systems in 2007 we derive the guidelines to discuss the use and role of norms as a mechanism in a game-theoretic setting, clarify the role of norms in the multiagent system, and to relate the notion of "norm" to the legal, social, or moral literature. The remaining four guidelines follow from the philosophical literature: use norms also to resolve dilemmas, and in general to coordinate, organize, guide, regulate or control interaction among agents, distinguish norms from obligations, prohibitions and permissions, use the deontic paradoxes only to illustrate the normative multiagent system, and consider regulative norms in relation to other kinds of norms and other social-cognitive computer science concepts.

*Keywords:* Normative systems, Guidelines, Norms, Multiagent systems, Deontic logic

*Joint work of:* Boella, Guido; Pigozzi, Gabriella; van der Torre, Leendert

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1902>

## A Framework for Normative MultiAgent Organisations

*Olivier Boissier (Ecole des Mines - St. Etienne, FR)*

The social and organisational aspects of agency have led to a good amount of theoretical work in terms of formal models and theories. From these different works normative multiagent systems and multiagent organisations are particularly considered in this paper. Embodying such models and theories in the conception and engineering of proper infrastructures that achieve requirements of openness and adaptation, is still an open issue. In this direction, this paper presents and discusses a framework for normative multiagent organisations. Based on the Agents and Artifacts meta-model (A&A), it introduces organisational artifacts as first class entities to instrument the normative organisation for supporting agents activities within it.

*Keywords:* Normative system, organisation, artifacts, norm enforcement

*Joint work of:* Boissier, Olivier; Hübner, Jomi Fred

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1903>

## A Conviviality Measure for Early Requirement Phase

*Patrice Caire (University of Luxembourg, L)*

In this paper, we consider the design of convivial multi-agent systems. Conviviality has recently been proposed as a social concept to develop multi-agent systems. In this paper we introduce temporal dependence networks to model the evolution of dependence networks and conviviality over time, we introduce epistemic dependence networks to combine the viewpoints of stakeholders, and we introduce normative dependence networks to model the transformation of social dependencies by hiding power relations and social structures to facilitate social interactions. We show how to use these visual languages in design, and we illustrate the design method using an example on virtual children adoptions.

*Keywords:* Multi-agent systems

*Joint work of:* Caire, Patrice; van der Torre, Leendert

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1899>

## A modal logic for reasoning on consistency and completeness of regulations

*Laurence Cholvy (ONERA - Toulouse Research Center, FR)*

In this paper, we deal with regulations that may exist in multi-agent systems in order to regulate agent behaviour and we discuss two properties of regulations, that is consistency and completeness.

After defining what consistency and completeness mean, we propose a way to consistently complete incomplete regulations. In this contribution, we extend previous works and we consider that regulations are expressed in a first order modal deontic logic.

*Keywords:* Regulations, consistency, completeness, deontic logic, default logic

*Joint work of:* Garion, Christophe; Roussel, Stéphanie; Cholvy, Laurence

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1904>

## **A categorization of simulation works on norms**

*Stephen Cranefield (University of Otago, NZ)*

In multi-agent systems, software agents are modelled to possess characteristics and behaviour borrowed from human societies. Norms are expectations of behaviours of the agents in a society. Norms can be established in a society in different ways. In human societies, there are several types of norms such as moral norms, social norms and legal norms (laws). In artificial agent societies, the designers can impose these norms on the agents. Being autonomous, agents might not always follow the norms. Monitoring and controlling mechanisms should be in place to enforce norms. As the agents are autonomous, they themselves can evolve new norms while adapting to changing needs. In order to design and develop robust artificial agent societies, it is important to understand different approaches proposed by researchers by which norms can spread and emerge within agent societies. This paper makes two contributions to the study of norms. Firstly, based on the simulation works on norms, we propose a life-cycle model for norms. Secondly, we discuss different mechanisms used by researchers to study norm creation, spreading, enforcement and emergence.

*Keywords:* Norms, creation, spreading, enforcement, emergence

*Joint work of:* Savarimuthu, Bastin Tony Roy; Cranefield, Stephen

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1905>

## **Monitoring Social Expectations in Second Life**

*Stephen Cranefield (University of Otago, NZ)*

Online virtual worlds such as Second Life provide a rich medium for unstructured human interaction in a shared simulated 3D environment. However, many human interactions take place in a structured social context where participants play particular roles and are subject to expectations governing their behaviour, and current virtual worlds do not provide any support for this type of interaction. There is therefore an opportunity to adapt the tools developed in the MAS

community for structured social interactions between software agents (inspired by human society) and adapt these for use with the computer-mediated human communication provided by virtual worlds. This paper describes the application of one such tool for use with Second Life. A model checker for online monitoring of social expectations defined in temporal logic has been integrated with Second Life, allowing users to be notified when their expectations of others have been fulfilled or violated. Avatar actions in the virtual world are detected by a script, encoded as propositions and sent to the model checker, along with the social expectation rules to be monitored. Notifications of expectation fulfilment and violation are returned to the script to be displayed to the user. This utility of this tool is reliant on the ability of the Linden scripting language (LSL) to detect events of significance in the application domain, and a discussion is presented on how a range of monitored structured social scenarios could be realised despite the limitations of LSL.

*Keywords:* Virtual worlds, Second Life, social expectations

*Joint work of:* Cranefield, Stephen; Li, Guannan

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1906>

## Normative Multi-Agent Programs and Their Logics

*Mehdi Dastani (Utrecht University, NL)*

Multi-agent systems are viewed as consisting of individual agents whose behaviors are regulated by an organization artefact. This paper presents a simplified version of a programming language that is designed to implement norm-based artefacts. Such artefacts are specified in terms of norms being enforced by monitoring, regimenting and sanctioning mechanisms. The syntax and operational semantics of the programming language are introduced and discussed. A logic is presented that can be used to specify and verify properties of programs developed in this language.

*Keywords:* Normative Multi-Agent Systems, Programming Multi-Agent Systems

*Joint work of:* Dastani, Mehdi; Grossi, Davide; Meyer, John-Jules; Tinnemeier, Nick

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1907>

## A Meta-model for the Specification of Artificial Institutions using the Event Calculus

*Nicoletta Fornara (University of Lugano, CH)*

The specification of open interaction systems, which may be dynamically entered and left by autonomous agents, is widely recognized to be a crucial issue in the development of distributed applications on the internet.

The specification of such systems involves two main problems: the first is the definition of a standard way of specifying a communication language for the interacting agents and the context of the interaction; the second, which derives from the assumption of the agents' autonomy, is finding a way to regulate interactions so that agents may have reliable expectations on the future development of the system. A possible approach to solve those problems consists in modeling the interaction systems as a set of artificial institutions. In this chapter we address this issue by formally defining, in the Event Calculus, a repertoire of abstract concepts (like commitment, institutional power, role, norm) that can be used to specify artificial institutions. We then show how, starting from the formal specification of a system and using a suitable tool, it is possible to simulate and monitor the system's evolution through automatic deduction.

*Keywords:* Artificial Institutions, Open Interaction Systems, Norms, Commitment, Power, Event Calculus

*Joint work of:* Fornara, Nicoletta; Colombetti, Marco

## Designing Ontologies for NMAS: Some Patterns

*Aldo Gangemi (ISTC - CNR - Rome, IT)*

This paper presents a more comprehensive approach to deal with NMAS ontology specification in a computational environment. Such approach employs semantic web languages such as OWL, RIF, SPARQL, etc., and complies to the eXtreme Design paradigm, which is a method to build an ontology by exploiting user requirements (in the form of competency questions,) and reusable ontology design patterns for both ontology building and evaluation.

The patterns presented here are partly extracted from the ODP community portal, and those that are closely related to the NMAS domain are extracted from the NIC ontology, as well as other, related ones. Some recipes are presented which allow different reasoning styles on NMAS entities (DL classification, subsumption and realization, constructive query answering, rule engines, etc.), and a ranking of the recipes is provided.

The ultimate suggestion is to attach an ontology reasoning component to NMAS, which can be leveraged to perform typical reasoning tasks on the NMAS domain, while leaving NMAS to work on such normalized knowledge, and to concentrate on typical NMAS functionalities, such as dynamics of NMAS worlds.

A proposal to share modelling practices for NMAS on the ODP community portal is also briefly sketched.

*Keywords:* NMAS ontologies, Ontology design patterns, Collaborative design



## FSL – Fibred Security Language

*Valerio Genovese (University of Torino, IT)*

We develop a fibred security language capable to express statements of the form

$$\{x\}\varphi(x) \textbf{ says } \psi$$

where  $\{x\}\varphi(x)$  is the set of all  $x$  that satisfy  $\varphi$  and  $\psi$  is any formula.  $\varphi$  and  $\psi$  may share several free variables.

For example, we can express the following: "A member  $m$  of the Program Committee can not accept a paper  $P_1$  in which one of its authors says that he has published a paper with him after 2007"

$$\neg(\{m\}[PC(m) \wedge \{y\}author\_of(y, P_1) \textbf{ says } \exists p(paper(p) \wedge author\_of(m, p) \wedge author\_of(y, p) \wedge year(p) \geq 2007)] \textbf{ says } accept(P_1))$$

*Keywords:* Access Control, Trust Management, Fibring Logics

*Joint work of:* Genovese, Valerio; Boella, Guido; Gabbay, Dov M.; van der Torre, Leendert

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1908>

## How Do Agents Comply with Norms?

*Guido Governatori (NICTA Queensland Research Laboratory, AU)*

The import of the notion of institution in the design of MASs requires to develop formal and efficient methods for modeling the interaction between agents' behaviour and normative systems. This paper discusses how to check whether agents' behaviour is compliant with the rules regulating them. The key point of our approach is that compliance is a relationship between two sets of specifications: the specifications for executing a process and the specifications regulating it. We propose a logic-based formalism for describing both the semantics of normative specifications and the semantics of compliance checking procedures.

*Keywords:* Compliance, agents, violations, norms

*Joint work of:* Governatori, Guido; Rotolo, Antonino

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1909>

## A note on brute vs. institutional facts

*Davide Grossi (University of Amsterdam, NL)*

The paper investigates the famous Searlean distinction between "brute" and "institutional" concepts from a logical point of view.

We show how the partitioning of the non-logical alphabet-e.g., into "brute" and "institutional" atoms-gives rise to interesting modal properties. A modal logic, called UpTo-logic, is introduced and investigated which formalizes the notion of (propositional) logical equivalence up to a given signature.

*Keywords:* Modal logic, brute and institutional facts

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1910>

## **On dissemination mechanism of corporate social responsibility (CSR): Analysis with agent simulation**

*Takashi Hashimoto (JAIST - Ishikawa, JP)*

Corporate Social Responsibility (CSR), such as pro-environmental behaviour and fair trade, is a kind of normative behaviour by private companies to provide a quasi-public good. We study dissemination mechanism of CSR with a multi-agent model in which corporation agents and consumer agents interact with each other. We show that the mechanism to disseminate CSR is a positive feedback between the corporations popularity seeking behaviour and the consumer social learning in which CSR-seeking preference is evaluated according to both the local average of the preferences of surrounding consumers and the global average of the investment in CSR by all corporations. We also discuss an institutional design to establish CSR from an objectionable social state.

*Keywords:* CSR (corporate social responsibility), Quasi-public good, Institutional design, Positive Feedback, Multi-agent simulation

*Joint work of:* Hashimoto, Takashi; Shinohara, Naoto; Egashira, Susumu

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1911>

## **Coherence-Driven Argumentation to Norm Consensus**

*Sindhu Joseph (IIIA - CSIC - Barcelona, ES)*

In this paper coherence-based models are proposed as an alternative to logic-based BDI and argumentation models for the reasoning of normative agents. A model is provided for how two coherence-based agents can deliberate on how to regulate a domain of interest. First a deductive coherence model presented, in which the coherence values are derived from the deduction relation of an underlying logic; this makes it possible to identify the reasons for why a proposition is accepted or rejected. Then it is shown how coherence-driven agents can generate candidate norms for deliberation, after which a dialogue protocol for such deliberations is proposed. The resulting model is compared to current logic-based argumentation systems for deliberation over action.

*Keywords:* Deductive coherence, norm deliberation, normative agents, argumentation

*Joint work of:* Joseph, Sindhu; Prakken, Henry

## **Dynamics of acceptances in institutional contexts: a modal logic account**

*Emiliano Lorini (Université Paul Sabatier (IRIT) - Toulouse, FR)*

We continue the work initiated in (Lorini et al. 2009; Lorini & Longin 2008), where the acceptance logic, a logic for modeling individual and collective acceptances was introduced. Here, we extend acceptance logic by two kinds of dynamic modal operators. The first kind consists of public announcements in institutional contexts. The second kind consists of acceptance shiftings: certain agents shift (change) their acceptances in order to accept a certain proposition qua members of a given institution. We show that the resulting logic has a complete axiomatisation in terms of reduction axioms for both dynamic operators

*Keywords:* Acceptance, institutions

## **Argumentation based Resolution of Conflicts Between Desires and Normative Goals**

*Sanjay Modgil (King's College - London, GB)*

Norms represent what ought to be done, and their fulfillment can be seen as benefiting the overall system, society or organisation. However, individual agent goals (desire) may conflict with system norms. If a decision to comply with a norm is determined exclusively by an agent or, conversely, if norms are rigidly enforced, then system performance may be degraded, and individual agent goals may be inappropriately obstructed. To prevent such deleterious effects we propose a general framework for argumentation-based resolution of conflicts amongst desires and norms. In this framework, arguments for and against compliance are arguments justifying rewards, respectively punishments, exacted by ‘enforcing’ agents. The arguments are evaluated in a recent extension to Dung’s abstract argumentation framework, in order that the agents can engage in metalevel argumentation as to whether the rewards and punishments have the required motivational force. We provide an example instantiation of the framework based on a logic programming formalism.

*Keywords:* Argumentation, Norms, Desires, Conflicts

*Joint work of:* Modgil, Sanjay; Luck, Michael

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1912>

## Partially Observable Markov Decision Processes with Behavioral Norms

*Matthias Nickles (University of Bath, GB)*

This extended abstract discusses various approaches to the constraining of Partially Observable Markov Decision Processes (POMDPs) using social norms and logical assertions in a dynamic logic framework. Whereas the exploitation of synergies among formal logic on the one hand and stochastic approaches and machine learning on the other is gaining significantly increasing interest since several years, most of the respective approaches fall into the category of relational learning in the widest sense, including inductive (stochastic) logic programming. In contrast, the use of formal knowledge (including knowledge about social norms) for the provision of hard constraints and prior knowledge for some stochastic learning or modeling task is much less frequently approached. Although we do not propose directly implementable technical solutions, it is hoped that this work is a useful contribution to a discussion about the usefulness and feasibility of approaches from norm research and formal logic in the context of stochastic behavioral models, and vice versa.

*Keywords:* Norms, Partially Observable Markov Decision Processes, Deontic Logic, Propositional Dynamic Logic

*Joint work of:* Nickles, Matthias; Rettinger, Achim

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1913>

## An essay on msic-systems

*Jan Odelstad (University of Gävle, SE)*

A theory of many-sorted implicative conceptual systems (abbreviated msic-systems) is outlined. Examples of msic-systems include legal systems, normative systems, systems of rules and instructions, and systems expressing policies and various kinds of scientific theories. In computer science, msic-systems can be used in, for instance, legal information systems, decision support systems, and multi-agent systems. In this essay, msic-systems are approached from a logical and algebraic perspective aiming at clarifying their structure and developing effective methods for representing them. Of special interest are the most narrow links or joinings between different strata in a system, that is between subsystems of different sorts of concepts, and the intermediate concepts intervening between such strata. Special emphasis is put on normative systems, and the role that intermediate concepts play in such systems, with an eye on knowledge representation issues. In this essay, normative concepts are constructed out of descriptive concepts using operators based on the Kanger-Lindahl theory of normative positions. An abstract architecture for a norm-regulated multi-agent system is suggested, containing a scheme for how normative positions will restrict the set of actions that the agents are permitted to choose from.

*Keywords:* Concept formation, Intermediary, Intermediate concept, Legal concept, Normative system, Normative position, Norm-regulated system, Agent architecture

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1914>

## **Distrust is not Always the Complement of Trust (Position Paper)**

*Celia Costa Pereira (University of Milan, IT)*

We believe that distrust can be as important as trust when agents are making a decision. An agent may not trust a source because of lack of positive evidence, but this does not necessarily mean the agent distrusts the source. Trust and distrust have to be considered as two separate concepts which can coexist.

We are aware that an adequate way to take this fact into account is by considering explicitly not only the agent's degree of trust in a source but also its independent degree of distrust. Explicitly taking distrust into account allows us to mark a clear difference between the distinct notions of negative trust and insufficient trust. More precisely, it is possible, unlike in approaches where only trust is explicitly accounted for, to "weigh" differently information from helpful, malicious, unknown, or neutral sources.

*Keywords:* Trust, Distrust, Decision Making

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1915>

## **Early requirements engineering for e-customs decision support: Assessing overlap in mental models**

*Yao-Hua Tan (VU University Amsterdam, NL)*

Developing decision support systems is a complex process. It involves stakeholders with diverging interpretations of the task and domain. In this paper, we propose to use ontology mapping to make a detailed analysis of the overlaps and differences between mental models of stakeholders. The technique is applied to an extensive case study about EU customs regulations. Companies which can demonstrate to be 'in control' of the safety and security in the supply chain, may become 'Authorized Economic Operator' (AEO), and avoid inspections by customs. We focus on a decision support tool, AEO Digiscan, developed to assist companies with an AEO self-assessment. We compared the mental models of customs officials, with mental models of the developers of the tool. The results highlight important differences in the interpretation of the new regulations, which will lead to adaptations of the tool.

*Keywords:* E-government, shared mental models, decision support systems

*Joint work of:* Burgemeestre, Brigitte; Liu, Jianwei; Hulstijn, Joris; Tan, Yao-Hua

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1916>

## **Reflection and Norms: Towards a Model for Dynamic Adaptation for MAS**

*Ingo Timm (Goethe-Universität Frankfurt am Main, DE)*

The design of self-organizing systems and particular multiagent systems (MAS) is a non trivial task. On the one hand the particular system should show a dynamic behavior according to its environment, to gain a central advantage of distributed systems, on the other hand it has to act on behalf of its user and the final results have to possess acceptable quality. Especially the quality of the overall system's behavior can become a critical issue, if the subsystems have their own objectives they have to optimize. In this paper we present a methodology that can be integrated into MAS for adapting their behavior allowing local optimization while respecting an acceptable level of the system's global goals.

*Keywords:* Balancing autonomy, multiagent simulation, manufacturing

*Joint work of:* Timm, Ingo J.; Lattner, Andreas D.; Schumann, Rene

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1917>

## **Modeling and Validating Norms**

*Viviane Torres da Silva (University of Rio de Janeiro, BR)*

Norms describe the permissions, prohibitions and obligations of agents in multiagent systems in order to regulate their behavior. In this paper we propose a normative modeling language that makes possible the modeling of norms motivating the modeling of such norms together with the non-normative part of the system. In addition, we also propose a mechanism to validate the norms at design time, i.e., to check if the norms respect the constraints defined by the language and also their possible conflicts.

*Keywords:* Norm, modeling, validation, conflict, metamodel

*Joint work of:* Torres da Silva, Viviane; Braga, Christiano

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1918>

## A convention or (tacit) agreement betwixt us

*Luca Tummolini (ISTC - CNR - Rome, IT)*

The aim of this paper is to show that conventions are sources of tacit agreements. Such agreements are tacit in the sense that they are implicated by what the agents do (or forbear to do) though without that any communication between them be necessary. Conventions are sources of tacit agreements under two substantial assumptions: (1) that there is a salient interpretation, in some contexts, of every-one's silence as confirmatory of the others' expectations, and (2) that the agents share a value of not hostility. To characterize the normativity of agreements the Principle of Reliability is introduced.

*Keywords:* Agreement, convention, norm, pragmatics

*Joint work of:* Andrighetto, Giulia; Tummolini, Luca; Castelfranchi, Cristiano; Conte, Rosaria

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1919>

## Contract Formation through Preemptive Normative Conflict Resolution

*Wamberto Vasconcelos (University of Aberdeen, GB)*

We explore a rule-based formalisation for contracts: the rules capture conditional norms, that is, they describe situations arising during the enactment of a multi-agent system, and norms that arise from these situations. However, such rules may establish conflicting norms, that is, norms which simultaneously prohibit and oblige (or prohibit and permit) agents to perform particular actions. We propose to use a mechanism to detect and resolve normative conflicts in a preemptive fashion: these mechanisms are used to analyse a contract and suggest "amendments" to the clauses of the contract. These amendments narrow down the scope of influence of norms and avoid normative conflicts. Agents propose rules and their amendments, leading to a contract in which no conflicts may arise.

*Keywords:* Normative Conflict, Contracts

*Joint work of:* Vasconcelos, Wamberto; Norman, Timothy J.

*Full Paper:* <http://drops.dagstuhl.de/opus/volltexte/2009/1920>

## Massively multiple online role playing games as normative multiagent systems

*Harko Verhagen (Stockholm University, SE)*

The latest advancements in computer games offer a domain of human and artificial agent behaviour well suited for analysis and development based on normative multi agent systems research. One of the most influential gaming trends today, Massively Multi Online Role Playing Games (MMORPG), poses new questions about the interaction between the players in the game. If we model the players and groups of players in these games as multiagent systems with the possibility to create norms and sanction norm violations we have to create a way to describe the different kind of norms that may appear in these situations. Certain situations in MMORPG are subject to discussions about how norms are created and propagated in a group, one such example involves the sleeper in the game Everquest, from Sony Online Entertainment (SOE). The Sleeper was at first designed to be unkillable, but after some events and some considerations from SOE the sleeper was finally killed. The most interesting aspect of the story about the sleeper is how we can interpret the norms being created in this example. We propose a framework to analyse the norms involved in the interaction between players and groups in MMORPG. We argue that our model adds complexity where we find earlier norm typologies lacking some descriptive power of this phenomenon, and we can even describe and understand the confusing event with the sleeper in Everquest.

*Keywords:* Norms, MMORPG

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## NorMAS-RE: a Normative Multiagent Approach to Requirements Engineering

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In this paper we present a new model, called NorMAS-RE, for the requirements analysis of a system. NorMAS-RE is a new model based on the multiagent systems paradigm with the aim to support the requirements analysis phase of systems design. This model offers a structured approach to requirements analysis, based on conceptual models defined following a visual modeling language, called dependence networks. The main elements of this visual language are the agents with their goals, capabilities and facts, similarly to the TROPOS methodology [10]. The normative component is present both in the ontology and in the conceptual metamodel, associating agents to roles they play inside the systems and a set of goals, capabilities and facts proper of these roles. This improvement



allows to define different types of dependence networks, called dynamic dependence networks and conditional dependence networks, representing the different phases of the requirements analysis of the system. This paper presents a requirements analysis model based on normative concepts such as obligation and institution.

The NorMAS-RE model is a model of semiformal specification featured by an ontology, a meta-model, a graphical notation and a set of constraints. Our model, moreover, allows the definition of the notion of coalition for the different kinds of network. We present our model using the scenario of virtual organizations based on a Grid network.

*Keywords:* Conditional dependence networks, obligations, sanctions, contrary to duty, requirements analysis

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